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Rockwell International

Collins instruction book

HF-380 Transceiver

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AC-2832 Transceiver-to-Coupler Control Cable	523-0772591

Collins Telecommunications Products Division
Defense Electronics Operations
Rockwell International
Cedar Rapids, Iowa 52498

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Caution

The material in this manual is subject to change. Before attempting any maintenance operation on the equipment covered in this manual, verify that you have a complete and up-to-date publication applicable to your equipment.

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introduction

DESIGN FEATURES

The HF-380 Transceiver is an all solid-state transceiver that transmits in SSB or CW from 1.6 to 29.999 99 MHz. The transceiver receives in SSB, CW, or AM modes with frequency coverage from 0.5 to 29.999 99 MHz. Transmit output power is 90 watts pep, minimum, with automatic protective turndown for high average power, excessive vswr, or overtemperature conditions.

The transceiver is designed for fixed-station use with 115/230-V, 50- to 60-Hz power. An accessory power cable is available to permit using a 12- to 15-V dc source for standby or emergency operation.

An associated CU-380 Antenna Coupler provides automatic antenna matching capability for the transceiver to allow operation using an 8-foot whip (4 to 30 MHz), 16-foot whip (3 to 30 MHz), 32-foot (2 to 30 MHz), and 50- and 100-foot long wire (2 to 30 MHz) antennas.

SERVICE BULLETINS/SERVICE INFORMATION LETTERS

All HF-380 Transceiver service bulletins (SB) and service information letters (SIL) incorporated in this instruction book are listed below. Applicable service bulletins and/or service information letters released after printing, but prior to shipment, of the instruction book are inserted in the front of the instruction book.

Note

Service bulletins are numbered in sequence for the life of the equipment. Service information letters are numbered in sequence starting at 1 for each calendar year.

TPA-2174-017

HF-380 Transceiver

SB/SIL	DESCRIPTION	ISSUE DATE
SB 1	Allows either a low- or high-impedance mic to be used. Mic gain is increased by 18 dB. A greater range of adjustment for VOX is provided. Minimum VOX delay time is decreased to less than 50 ms to allow faster semibreak in CW operation. Preemphasis to VOX preamplification is added to improve SSB VOX operation. Line audio (600-Ω) output level is increased to ensure at least -10-dBm output. Changes are to receiver-exciter circuit card A3 (638-6908-001).	8-1-80
SB 2	Improves transmitter spectral purity when operating on a frequency ending in 257 kHz (ie, 14 257 kHz). This modification to synthesizer A5A1 (638-6916-001, -002) ensures that transmitter spurious output will be within the -50-dB specification limit.	8-1-80
SB 3	Eliminates potential frequency warble that may occur at certain frequencies. Modifies synthesizer variable reference frequency loop A5A2 (638-6920-001) to increase rf input levels to compensate for integrated circuits at the low end of their specified parameters.	8-19-80
SB 4	Eliminates possible tuning dial drive drag when turned in a clockwise direction or when initially turned on. Replaces optical encoder (229-9702-010).	8-15-80
SB 5	Eliminates possible resistance tapers on the audio and rf gain (AF RF GAIN) potentiometer. Replaces AF RF GAIN potentiometer R5 (376-0276-050).	9-1-80
SB 6	Corrects a transmit hum caused by a ground loop between the front panel and the receiver-exciter circuit card ground plane. Replaces mic jack J2 with a jack that has insulated sleeve contact.	12-15-80
SB 7 and Rev 1	Prevents excessive emi (rcvr birdies) and eliminates electronic tuning backlash. Modifies control card A8 (638-6929-001-002) and synthesizer compartment.	12-22-80 Rev 8-1-81
SB 8 and Rev 1	Prevents the meter from pegging when AGC is switched on; reduces the popping noise during AGC attack; and changes the rf gain function to allow the AGC threshold to be preset. Modifies receiver-exciter A3 (638-6908-002).	12-22-80 Rev 1 10-1-82
SB 9 and Rev 1	Eliminates power amplifier oscillations and adjusts circuit gain. Modifies power amplifier/heat sink assembly A1 (634-8481-003) and power amplifier circuit card A1A1 (638-6775-001).	1-2-81 Rev 1 10-1-82
SIL 1-81	Describes method for providing a mute function for an external receiver.	3-1-81
SIL 2-81	Describes a method of connecting S-line 312B-4 and 312B-5 phone patches to the transceiver.	8-1-81
SB 10	Replaces a ROM on control A8 to provide eleven new frequency memories. These memories are addressed with the AC-3803 Control Interface and a key pad. A frequency change of more than 10 kHz or a frequency change made by the key pad will generate a strobe pulse which is detected by the CU-380 Antenna Coupler. The antenna coupler will then tune upon receipt of a key pulse.	10-1-82
SB 11	Improves audio response of the receiver by adding an electronic low-pass filter A15 with a 3-kHz cut-off point to reduce high frequency noise.	3-15-82
SB 12	Increases rise and decay time of CW envelope from 1 ms to 4 ms to eliminate any key clicks that might be generated in straight on-off switching.	10-1-82
SB 13	Improves the performance of the automatic gain control (AGC) by changing AGC time constants. The attack time is lengthened to a nominal 12 ms, the fast release time is reduced to a nominal 400 ms, and the slow release hang time is made longer but the discharge time after hand is shortened.	10-1-82
SB 14	Extends the frequency range of the mic preamplifier to ensure proper audio frequency response in transmit.	10-1-82

SB/SIL	DESCRIPTION	ISSUE DATE
SB 15	The addition of a choke on the directional coupler circuit card A2A2 provides an antenna static discharge path which reduces the possible loss of directional coupler diodes in the field.	10-1-82
SB 16	Reduces the synthesizer 500-Hz sidebands to prevent frequency warble at certain frequencies.	10-1-82
SB 17	This modification is necessary if the transceiver is to be used with the CU-380 Antenna Coupler. This change enables proper operation of the tune function and creates a system key line.	10-1-82
SB 18	Eliminates the 2-ms rf power burst which occurs when the transceiver is unkeyed. It also increases the delay time to a nominal 20 ms between keying and the transceiver and the start of rf output. This allows more time for an external linear amplifier tr relay to switch into transmit before rf is present.	10-1-82

HF-380 Transceiver

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description

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description

1. GENERAL

The HF-380 Transceiver, 622-3580-001, is a fully synthesized, all solid-state transceiver that transmits in SSB or CW from 1.6 to 29.999 99 MHz and receives in SSB, CW or AM modes from 0.5 to 29.999 99 MHz. A phase-locked loop synthesizer tunes in 10-Hz increments either manually or with optional remote keypad control. Split vfo function is standard, as is the digital frequency display driven directly by a microprocessor. A complete line of operating accessories and options are available for use with the transceiver.

Warning

This transceiver, when transmitting into an antenna either directly or through an associated linear power amplifier and/or an antenna coupler, may produce an electromagnetic field near the antenna that is in excess of the Occupational Safety and Health Administration (OSHA) maximum recommended limits.

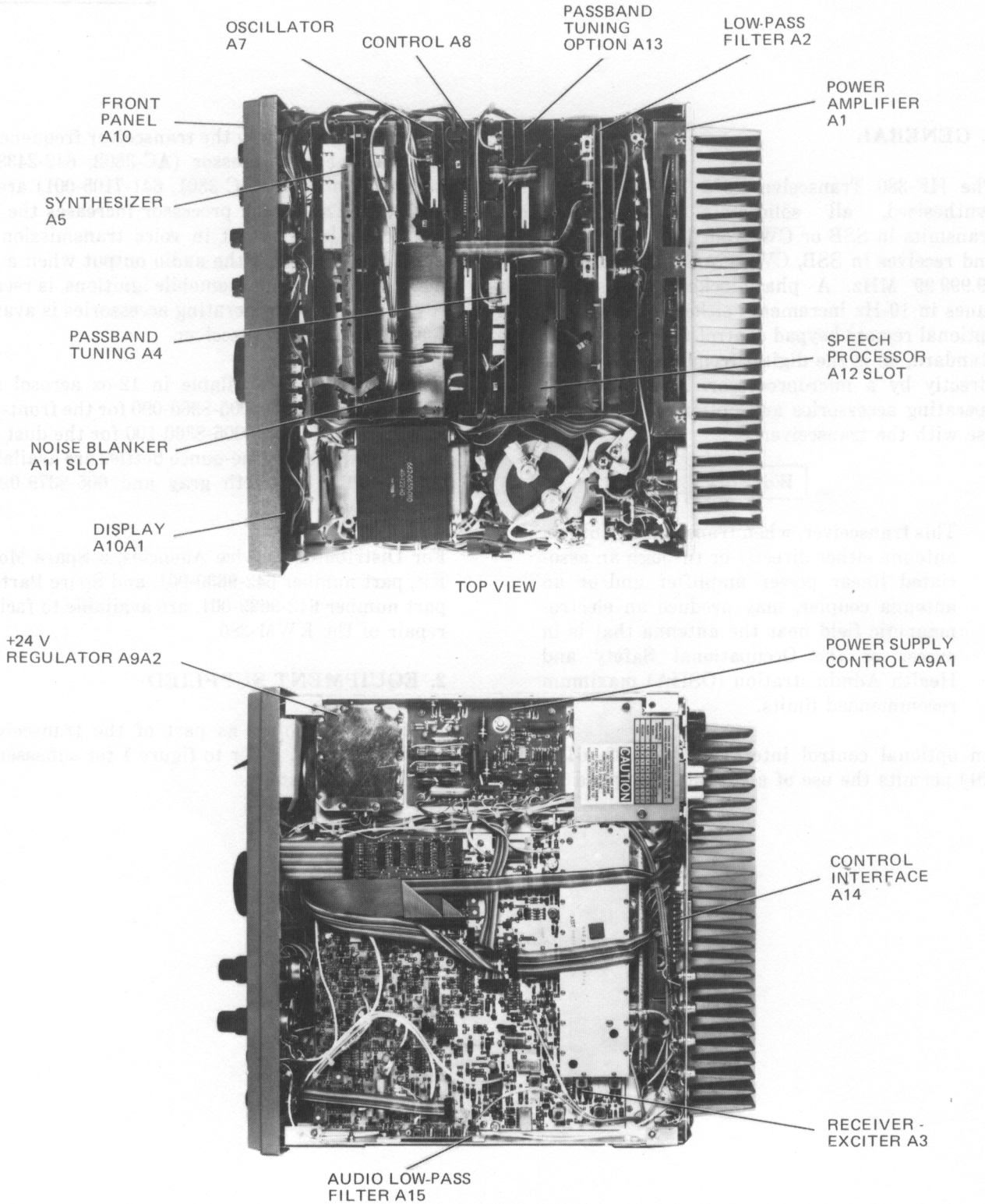
An optional control interface (AC-3803, 641-7150-001) permits the use of a customer-supplied remote keypad for controlling the transceiver frequency. An optional speech processor (AC-3802, 642-2438-001) and noise blanker (AC-3801, 641-7105-001) are also available. The speech processor increases the average power level output in voice transmission. The noise blanker quiets the audio output when a noise pulse, such as from automobile ignitions, is received. A complete line of operating accessories is available for use with the transceiver.

Touchup paint is available in 12-oz aerosol spray cans as part number 005-8360-090 for the front-panel earth gray color and 005-8360-100 for the dust cover earth brown color. One-ounce bottles are available as 005-8379-010 for earth gray and 005-8379-020 for earth brown.

For Distributor/Service Agencies, a Spare Modules Kit, part number 642-9630-001, and Spare Parts Kit, part number 642-9629-001, are available to facilitate repair of the KWM-380.

2. EQUIPMENT SUPPLIED

Equipment supplied as part of the transceiver is listed in table 1. Refer to figure 1 for subassembly/circuit card location.



Circuit Card/Subassembly Location
Figure 1

Table 1. Equipment Supplied Configuration.

CIRCUIT CARD/SUBASSEMBLY		DESCRIPTION/FUNCTION
TITLE	COLLINS PART NUMBER	
Power amplifier A1	634-8481-003	Wideband amplifier that produces 90 watts pep minimum output
Receiver-exciter A3	638-6908-002	The exciter provides 100-milliwatt rf power to power amplifier, and the receiver is a double-conversion superheterodyne type.
Chassis A9	641-7103-001	Provides mounting for circuit cards.
Power supply control A9A1	638-6825-001	Contains the +5, +9- and +14-V dc regulators.
+24-V regulator A9A2	638-6275-002	Generates +24 V dc from a +14-V dc input.
Front Panel A10	641-7104-001	All controls for normal operation are located on the front panel of the transceiver.
Display A10A1	638-6931-001	Decodes the frequency data and displays the data on 7-segment displays.
Synthesizer A5	641-7099-002, -003	Develops variable frequencies for injection into receiver-exciter.
Oscillator A7	638-6918-001	Develops 39.6-MHz, 455-kHz, and 454.2-kHz signals for synthesizer and receiver-exciter circuits.
Control A8	638-6929-003, -004, -006	Microprocessor control to develop control signals for transceiver operation.
Passband tuning A4	638-6912-002, -003	Adjusts positions of the received if signal within the passband of the selected bandwidth filter.
Passband tuning option A13	638-6914-002	Provides mounts and interface for optional filters.
Low-pass filter A2	641-7132-001	Relay selectable low-pass filters to cover frequencies in amateur radio service bands.
Audio low-pass filter A15	646-5802-001	Electronic audio low-pass filter to reduce high frequency noise.

3. ASSOCIATED EQUIPMENT

Equipment required to operate the transceiver is listed in table 2. Detailed information on the CU-380 Antenna Coupler is contained in the CU-380 Antenna Coupler instruction book. Detailed information on the optional kits is contained in the kits section of this instruction book.

Table 2. Associated Equipment.

EQUIPMENT	TYPE	FUNCTION	CHARACTERISTICS
Antenna	Various 100-watt capability	Transmits or transmits/receives	Less than 3:1 vswr
Antenna coupler	CU-380 or equivalent	Automatically matches antenna to pa output	Provides 50-ohms input impedance with 2:1 vswr maximum when tuned
Microphone	Collins SM-280 or equivalent	Keys and modulates transmitter	Low-impedance dynamic cardioid
CW key	Collins AC-2827 or equivalent	Keys transmitter for CW operation	Hand-operated CW key

4. ACCESSORIES

Accessories available for the transceiver are listed in table 3.

Table 3. Accessories.

EQUIPMENT	PART NUMBER	FUNCTION	CHARACTERISTICS
AC-3801 Noise Blanker A11	641-7105-001 (kit) and 641-7146-001 (assembly)	Quiets audio output when a noise pulse, such as from automobile ignitions, is received	Refer to options section.
AC-3802 Speech Processor A12	642-2438-001 (kit) and 638-6933-001 (circuit card)	Increases the average power level output (talk-power) in SSB transmission	Refer to options section.
AC-3803 Control Interface A14	641-7150-001 (kit) and 638-6910-001 (circuit card)	Allows use of external keypad for frequency control	Refer to options section.
AC-3805 or AC-3805A Keypad	651-7412-001 651-7412-002	Facilitates the selection, storage and recall of up to 11 transceiver operating frequencies	Refer to options section.
AC-3809 Interface Adapater	651-7700-001	Allows use of external keypad for frequency control	Refer to options section.
AC-3810 360-Hz CW Filter	642-2439-001	Provides 360-Hz bandwidth for receiver	Refer to options section.
AC-3811 140-Hz CW Filter	642-2440-001	Provides 140-Hz bandwidth for receiver	Refer to options section.
AC-3812 1.7-kHz Narrow Sideband Filter	642-2441-001	Provides 1.7-kHz bandwidth for receiver	Refer to options section.
AC-3813 6.0-kHz AM Filter	642-2442-001	Provides 6.0-kHz bandwidth for receiver	Refer to options section.
AC-3814 3.0-kHz Wide SB/Data Filter	651-7410-001	Provides 3.0-kHz bandwidth for receiver	Refer to options section.
AC-3821, AC-3822, or AC-3823 Transceiver-to-Coupler RF Cable	651-7768-XXX 651-7769-XXX 651-7700-XXX	Used as interconnect between transceiver antenna coupler	Refer to options section.
AC-2801 Rack Mount	622-3537-001	Provides mounting capability for transceiver into standard 483-mm (19-in) rack	Refer to options section.
AC-2808 Blower	622-3547-001	Enables operation at continuous 100-watt power output	Refer to options section.
AC-2810 or AC-2811 Vertical Antenna	622-3553-001 622-3554-001	Transmits or transmits/receives	Refer to options section.
AC-2812 or AC-2813 Dipole Antenna	622-3555-001 622-3556-001	Used to construct resonant dipole antennas	Refer to options section.
AC-2814 or AC-2815 Long-Wire Antenna	622-3557-001 622-3558-001	Used to make long-wire antennas for use at frequencies from 1.6 to 30 MHz	Refer to options section.

Table 3. Accessories (Cont).

EQUIPMENT	PART NUMBER	FUNCTION	CHARACTERISTICS
AC-2818 Lightning Arrester	622-3561-001	Discharges to ground high-voltage current surges on the inner conductor of attached coax cables	Refer to options section.
AC-2819 Grounding	622-3562-001	Used to make electrical ground to earth	Refer to options section.
AC-2820 Ground Radial	622-3563-001	Used to make electrical ground plane for use with a vertical antenna	Refer to options section.
AC-2821 DC Power Cable	622-3564-001	Enables transceiver emergency operation with 12-V battery	Refer to options section.
AC-2827 CW Key	634-8545-001	Keys transmitter for CW operation	Hand-operated CW key.
AC-2828 Foot Switch	634-8546-001	Keys transmitter	Refer to options section.
AC-2829 Standard Headphones	622-3571-001	Monitors transmit audio	Standard headphones with 600-ohm impedance; has sound-blocking earmuffs
AC-2830 Headphones	622-3572-001	Monitors transmit audio	Lightweight headphones with 500-ohm impedance; has comfort-designed earpieces
AC-2832 Transceiver-to-Coupler Control Cable	651-7638-XXX	Cable for control signals from transceiver to antenna coupler	Refer to options section.
MM-280 Handheld Microphone	020-0260-010	Keys and modulates transmitter	Handheld dynamic omnidirectional microphone with low impedance; has push-to-talk switch; color, black
MM-281 Handheld Microphone	020-0260-020	Keys and modulates transmitter	Handheld dynamic microphone with low impedance and noise-cancelling characteristics; has push-to-talk switch; color, black
SM-280 Desktop Microphone	020-0261-010	Keys and modulates transmitter	Desktop dynamic microphone with low impedance and cardioid sound pattern; has push-to-talk bar; color, black

5. OPTIONS

Accessory kits (options) available for the transceiver are listed in table 4. Detailed information of the kits is contained in the options section of this instruction book.

Table 4. Kits.

KIT	PART NUMBER
AC-3801 Noise Blanker	641-7105-001
AC-3802 Speech Processor	642-2438-001
AC-3803 Control Interface	641-7150-001
Key Pads	
AC-3805	651-7412-001
AC-3805A	651-7412-002
AC-3809 Interface Adapter	651-7700-001
Filters	
AC-3810	642-2439-001
AC-3811	642-2440-001
AC-3812	642-2441-001
AC-3813	642-2442-001
AC-3814	651-7610-001
Transceiver-to-Coupler RF Cable	
AC-3821	651-7768-XXX
AC-3822	651-7769-XXX
AC-3823	651-7770-XXX
AC-2801 Rack Mount	622-3537-001
AC-2808 Blower	622-3547-001
Vertical Antenna	
AC-2810	622-3553-001
AC-2811	622-3554-001
Dipole Antenna	
AC-2812	622-3555-001
AC-2813	622-3556-001
Long-Wire Antenna	
AC-2814	622-3557-001
AC-2815	622-3558-001
AC-2818 Lightning Arrester	622-3561-001
AC-2819 Grounding	622-3562-001
AC-2820 Ground Radial	622-3563-001
AC-2821 DC Power Cable	622-3564-001
AC-2828 Foot Switch	634-8546-001
AC-2832 Transceiver-to-Coupler Control Cable	651-7638-XXX

6. EQUIPMENT SPECIFICATIONS

Table 5 lists electrical, environmental, and physical specifications of the transceiver.

Table 5. Equipment Specifications.

CHARACTERISTIC	SPECIFICATION
Physical	
Size	394 mm (15.5 in) wide; 190 mm (7.5 in) high, including 25 mm (1 in) feet; 457 mm (18.0 in) deep
Weight	21.8 kg (48 lb), max
Environmental	
Operating temperature	0 to 50 °C (32 to 122 °F)
Operating humidity	0 to 90% relative humidity
Operating altitude	0 to 3049 m (0 to 10 000 ft)
Vibration	2 g's, 10 to 33 Hz
Electrical	
Primary power	Strappable for: 105, 115, 125/210, 220, 230, 240, 250 V ±5%, 50 to 60 Hz; or 12 to 15 V dc, negative ground: 120 watts max in receive, 600 watts max in transmit
Receiver	
Frequency	0.5 to 29.999 99 MHz, tunable in 10-Hz steps
Modes	USB, LSB, AM, and CW
Sensitivity (using "soft" μV measurement)	0.5 μV or better for 10 dB (s+n)/n, 2.0 to 30.0 MHz, SSB and CW; 1.0 μV or better for 1.8 to 2.0 MHz
Selectivity (3-dB bandwidth)	Selectable: 8 kHz *1.7 kHz *6 kHz *360 Hz 2.1 kHz *140 Hz *Optional filters
If and image rejection	Greater than 60 dB
Intermodulation distortion	-50 dB or better for two signals of -10 dB mW each, 20 kHz apart
AGC	Audio output variation not more than 8 dB for 4-μV to 200-mV open circuit rf input variation
Audio output	Not less than 3 W into 4-ohm load, at 1 kHz, at not more than 10% total harmonic distortion Line audio output not less than -10 dB mW nominal into 600 ohms Frequency response: 300 to 2400 Hz with not more than 5-dB variation

Table 5. Equipment Specifications (Cont).

CHARACTERISTIC	SPECIFICATION
Transmitter	
Frequency	1.6 to 29.999 99 MHz, tunable in 10-Hz steps
Modes	USB, LSB, and CW (RTTY by AFSK on LSB)
Output power	90 W pep, min (100 W, nominal) In CW or RTTY: 50% duty cycle; key down 15 minutes, max. Automatic turndown to 50 W after 10 seconds. With optional blower kit installed, power is 100 W average, 50% duty cycle, key down 1 hour max at 25 °C; 30 minutes max at 50 °C for all modes.
Unwanted signal suppression	
Carrier	-50 dB or better
Undesired sideband, 1-kHz ref	-55 dB or better
Harmonics (all)	-40 dB or better
Mixer products	-50 dB or better
Third order distortion	25 dB below each tone of 2-tone test
Synthesizer accuracy and stability	Accuracy within +5 Hz after 10 minutes warmup when 39.6-MHz and 455-kHz oscillators are set to within ±3 Hz Stability within ±150 Hz over temperature range of 0 to 50 °C (32 to 122 °F) if oscillators set within 10 Hz at 25 °C (77 °F)
Antenna impedance	50 ohms, nonreactive. (Full transmitter power output with vswr of 2:1 or less. Automatic power output turndown with vswr greater than 2:1.)
Audio inputs	
Microphone	Low or high impedance, dynamic; 3.3-kilohm nominal impedance
Line	600 ohm, unbalanced; 40-mV input sufficient for full rf power output

HF-380 Transceiver

Rockwell International

installation

Collins Telecommunications Products Division

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installation

1. GENERAL

Because of the uniqueness of each individual radio installation, the installation information for the HF-380 Transceiver found here is limited in scope.

Warning

This transceiver, when transmitting into an antenna either directly or through an associated antenna coupler and/or power amplifier, may produce an electromagnetic field near the antenna that is in excess of the Occupational Safety and Health Administration (OSHA) maximum recommended limits.

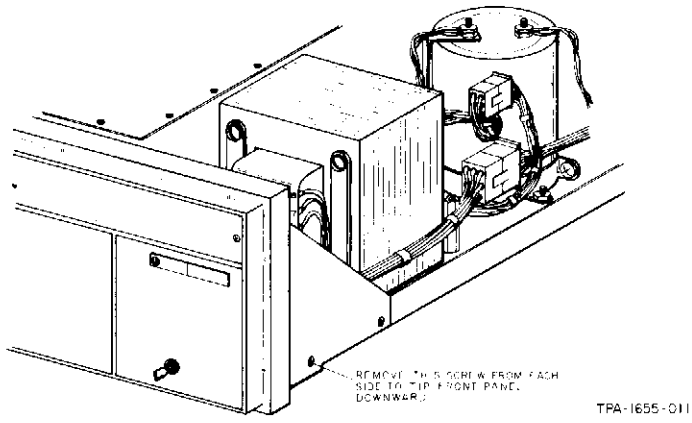
2. UNPACKING

The transceiver may be shipped in two separate cartons, depending on the shipping carrier's requirements. One contains the power transformer, the other contains the transceiver. After carefully unpacking the cartons, check to be sure no shipping damage is evident. Should any damage be apparent, save the cartons and notify the delivery carrier immediately to file claim for damage.

3. POWER TRANSFORMER INSTALLATION

If the power transformer has been shipped separately, it can be quickly installed in five steps. A 9.53-mm (3/8-in) open-end wrench, #12 (3/8-in) nutdriver, and a Phillips screwdriver are the only tools needed. Refer to figure 1.

a. Using the screwdriver, remove four screws from the bottom of the transceiver (near the rubber feet at each corner), set transceiver on its side with speaker up, and slide the dust cover off over the heat sink.
b. Remove the front one of the two Phillips-head screws securing the front panel braces to the sides of the chassis and tilt the panel forward.
c. Turn the transformer so terminals 1 through 8 face the front panel. With the nutdriver, remove the four hexposts and lockwashers from the chassis mounting studs in the right front corner of the chassis and set the transformer over the studs.
d. Using the wrench and nutdriver, secure the transformer to the studs with the four lockwashers and hexposts.
e. Electrically connect the transformer to the transceiver with the two attached polarized connectors. Reattach the front panel, then replace the dust cover. Be careful when replacing the dust cover to avoid pinching or dislodging cables.



Power Transformer Installation
Figure 1

4. PREINSTALLATION CHECK/REQUIREMENTS

4.1 Operating Location

The normal operating location should be chosen so the transceiver is away from heat vents and normal airflow around it is unobstructed. Do not lay objects on top or against the sides. It is especially important that the heat sink have a free flow of air about it. An automatic turndown circuit will reduce the rf output power if the heat sink overheats. This is for self-protection of the power amplifier output stages.

The AC-2808 Blower Kit is available for attaching to the heat sink. This blower supplies cooling air to permit normal operation in close quarters or high-duty cycle operation.

4.2 Antennas

The antenna is one of the most important parts in the performance of any radio communications system. System performance is directly related to the efficiency of the antenna. Because each individual installation has unique characteristics, various types of antennas, their characteristics, and installation information cannot be covered in this manual. A number of excellent reference works on antennas are available.

The transceiver is designed to operate into a nonreactive rf load of 50 ohms. Impedance mismatches producing vswr's lower than 2:1 are acceptable. For vswr's 2:1 or greater, the transceiver power amplifier output is automatically reduced in proportion to the reflected power.

The associated CU-380 Antenna Coupler provides the capability for the transceiver to operate with antennas that present impedance mismatches of greater than 2:1 vswr over all frequencies.

4.3 Grounding

The importance of a good ground system cannot be overemphasized. All units of the system should have ground interconnections through heavy wire (#12 AWG or larger) or ground strap (6-mm (1/4-in) wide or larger) between ground lugs. Use as short a length of ground wire or braid as practical between units or external ground.

4.4 Primary Power Requirements

The transceiver will operate from 50- to 60-Hz ac voltages and 12 to 15 volts dc for back-up emergency power.

4.4.1 AC Voltage Operation

The transceiver will operate from various 50- to 60-Hz voltages, depending on internal strapping connections. As shipped from the factory, the transceiver is strapped for 115-V operation.

Determine the average ac voltage at the primary power outlet where the transceiver is to be used. If the primary power is other than 115 V ac, remove the chassis dust cover and locate the protective cover plate near the left rear corner as viewed with chassis upside down.

Warning

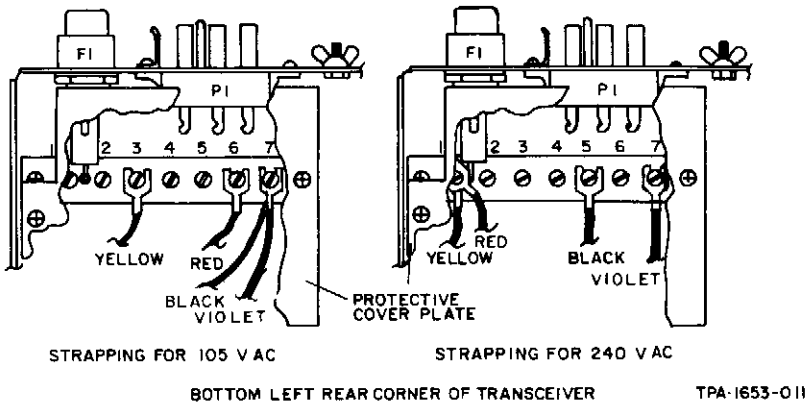
Do not attempt to change voltage strapping while primary power is applied. Electrical shock will occur. Disconnect the primary power cable from the power source or the transceiver first.

Remove the cover plate and refer to table 1 to make the connections indicated for the voltage nearest the primary power output voltage. If the outlet voltage is approximately halfway between two voltages listed, strap terminal board TB1 for the lower voltage.

Figure 2 illustrates terminal board TB1 correctly strapped for 105- or 240-V ac primary power outlet voltage.

Table 1. TB1 Strapping.

WIRE	PRIMARY POWER OUTLET VOLTAGE							
	105	115	125	210	220	230	240	250
	TERMINAL BOARD TB1 TERMINALS							
BLACK	7	7	7	6	6	5	5	4
YELLOW	3	2	1	3	2	2	1	1
RED	6	5	4	3	2	2	1	1



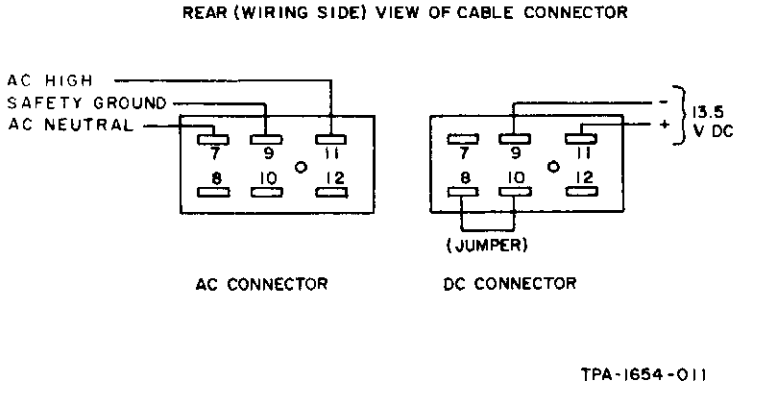
TB1 Strapping for 105 Volts or 240 Volts
Figure 2

4.4.2 DC Voltage Operation

The transceiver will also accept 12 to 15 volts dc for backup emergency power. The primary power connector must be strapped as shown in figure 3. Power requirements are nominally 3 A in receive and 20 A in transmit.

4.4.3 Transceiver Connectors Signal Parameters

Table 2 lists the signal parameters for all front and rear connectors except the primary and rf power. Refer to figure 4 for connectors location.



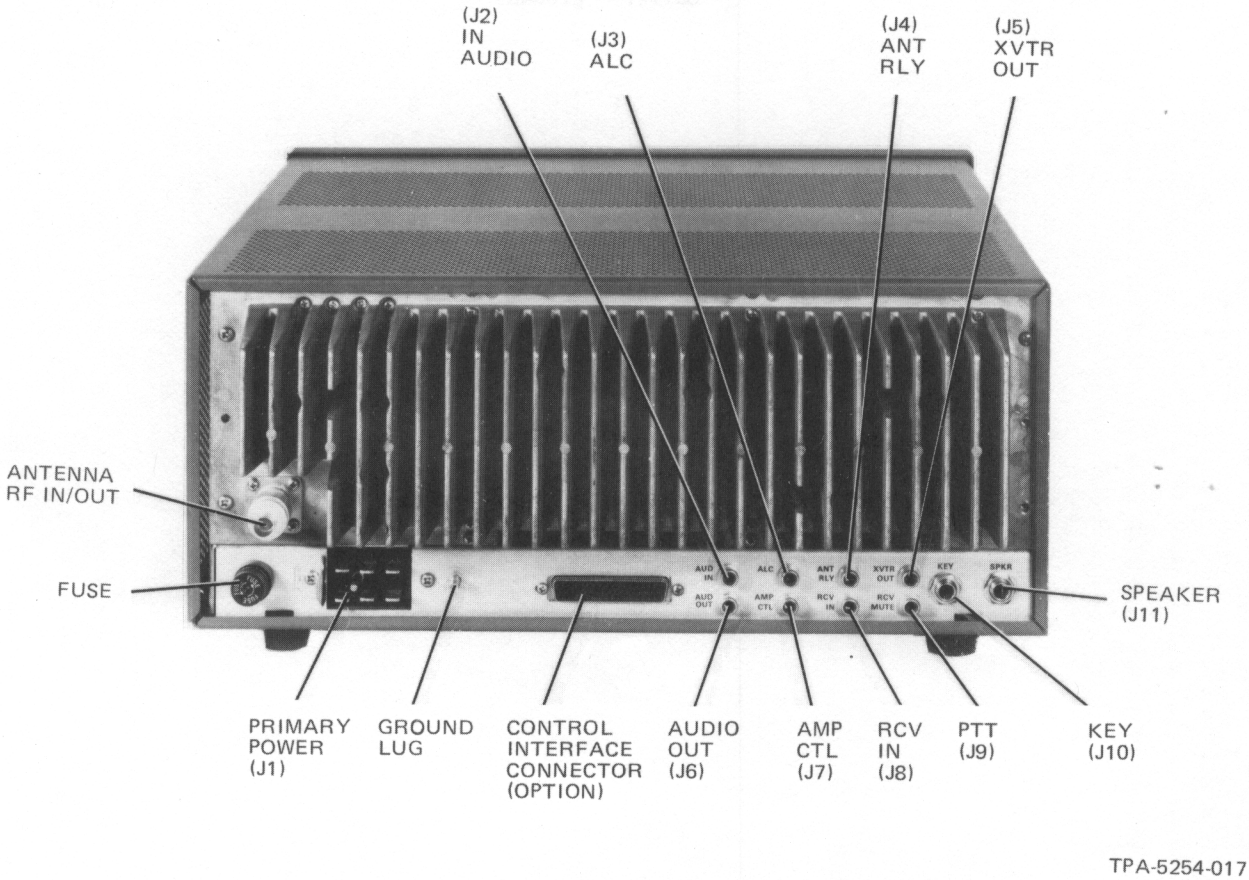
Power Connector Strapping for AC or DC Operation
Figure 3

Table 2. Connectors With Signal Parameters.

ITEM	FUNCTION
Front panel	
PHONES (mates with PJ-055)	Output jack for low-impedance (4- to 8-Ω) headphones. Connecting phones inhibits speaker and SPKR (on rear panel) outputs. Tip -- receiver audio; 4- to 8-Ω impedance, up to 3-W output Barrel -- ground
MIC (mates with PJ-068)	Input jack for high- or low-impedance, dynamic microphone. Jack is also wired for ptt signal. Tip -- ptt line; ground to transmit Ring -- microphone audio; high- or low-impedance input, approx 5 mV in for full-power output Barrel -- common ground
Rear panel	
Antenna (mates with PL-259)	Rf connector (type S0-239 with Teflon insert) for coaxial cable connection to antenna linear amplifier, or antenna coupler
Fuse	Primary power fuse (8 A for 110 V, 4 A for 220 V)
J1	Primary power connector
Ground	Stud for earth-ground connection
AUD IN (J2) (mates with phono plug)	Input for 600-ohm, unbalanced line audio: 40-mV input produces 100-W rf output
ALC (J3) (mates with phono plug)	Negative ALC input signal from external power amplifier
ANT RLY (J4) (mates with phono plug)	Receive contacts of internal antenna transfer ***Caution*** Do not connect linear amplifier control to J4. Damage to the receiver may result. External receiver may be connected to J4. (Jumpered to RCV IN (J8) if separate receive antenna not used. Cut internal jumper if separate antenna used.)
XVTR OUT (J5) (mates with phono plug)	Exciter output signal for use with transmitting converter. Level adjusted by MIC/CARRIER control. Approximately 200-mW (100-mW, min) output from exciter into 50-ohm load. (To obtain output, connect this line to dc ground through a 1-mH rf choke.)
AUD OUT (J6) (mates with phono plug)	Output for 600-ohm, unbalanced line audio; -10 dB mW at AGC threshold. Level is independent of audio gain control.
AMP CTL (J7) (mates with phono plug)	Relay contacts for tr-switching external power amplifier. Normally open relay contacts; contacts grounded in transmit. 2 A, 28 V dc or 0.75 A, 115 V ac capacity

Table 2. Connectors With Signal Parameters (Cont).

ITEM	FUNCTION
RCV IN (J8) (mates with phono plug)	Receiver front end signal input. Bypasses antenna transfer relay and transmit low-pass filters. (Jumpered to ANT RLY (J4) if separate receive antenna not used. Cut internal jumper if separate antenna used.)
PTT (J9) (mates with phono plug)	Push-to-talk switch input. Ground to command transmit operation. (Line is connected to +5 V through 10-kΩ resistor.)
KEY (J10) (mates with PJ-055)	CW key input. (Line is connected to +5 V through 10-kΩ resistor.) Tip -- keying line; ground to transmit Barrel -- ground
SPKR (J11) (mates with PJ-055)	Output for 4- to 8-ohm speaker. Disconnects internal speaker when external speaker connected. (Inhibited when headphones connected to PHONES jack on front panel.) Tip -- receiver audio; 4- to 8-Ω impedance, up to 4-W output Barrel -- ground



Transceiver Connectors
Figure 4

5. INSTALLATION PROCEDURES

Perform the procedures in paragraphs 2 through 4. Figures 5 and 6 show typical hookups for the transceiver and transceiver with typical 1-kW linear power amplifier. Refer to table 2, the appropriate typical hookup, and the outline and mounting dimensions diagram, and connect the components. Installation kit, part number 641-7181, provides the connectors to mate with the transceiver and fuses for input voltage lines and for the power supply control A9A1 +14-V dc outputs. Figure 7 is the outline and mounting dimensions diagram.

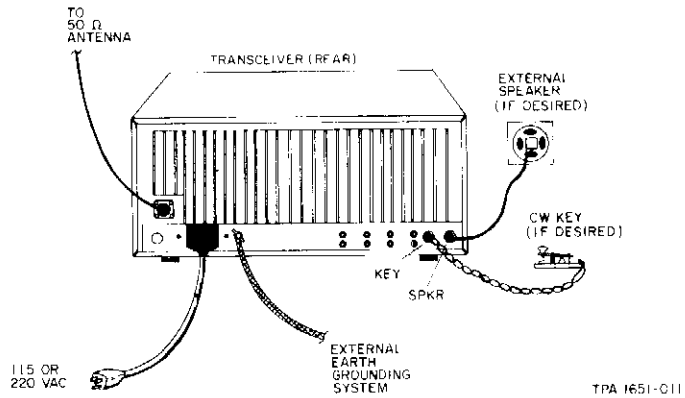
For phone patch interconnections, 600-Ω audio input (J2), ptt (J9), and 4- to 8-Ω speaker output (J11) connectors are available on the transceiver rear panel. Refer to the phone patch manufacturer's instructions for interconnect information.

Connect the transceiver ground lug on the rear to a good earth or water-pipe ground.

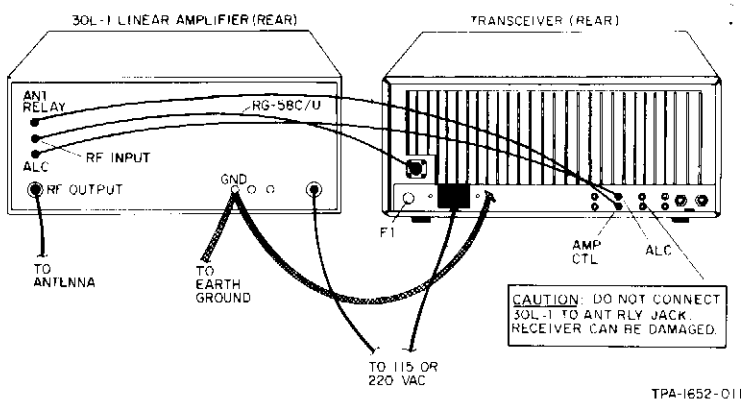
Before using a water-pipe ground, check to make sure that no plastic, rubber, or other such insulating sections will interrupt the electrical continuity to ground. Install a jumper around any insulating sections found. Use heavy copper wire or ground braid and metal pipe clamps.

6. POSTINSTALLATION PROCEDURES

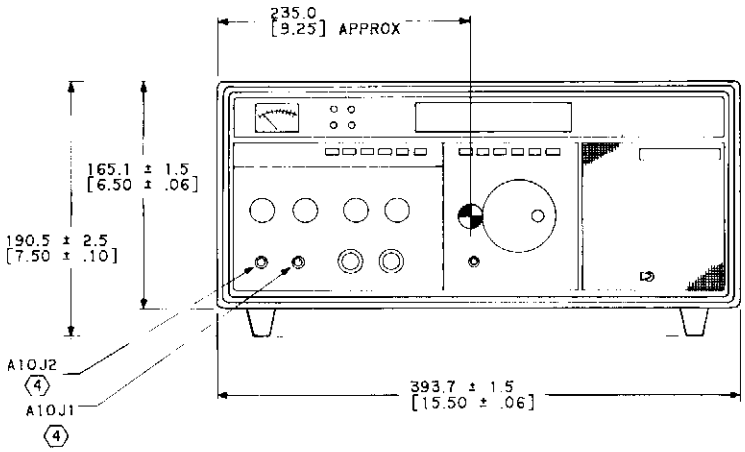
Perform operating procedures as outlined in the operation section.



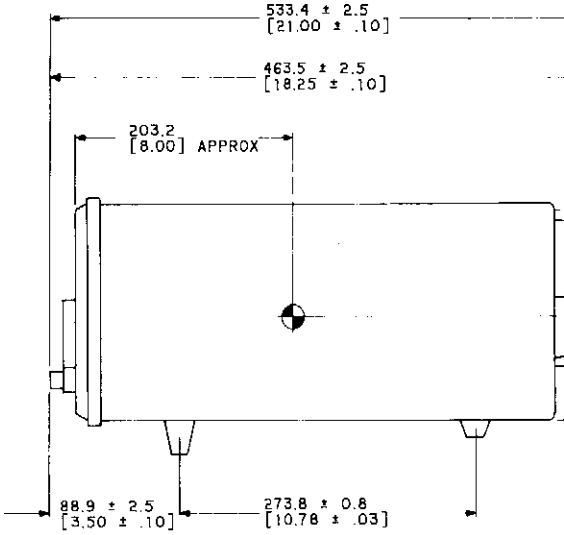
Transceiver Installation Connections
Figure 5



Transceiver and Linear Power Amplifier Installation Connections
Figure 6



FRONT VIEW

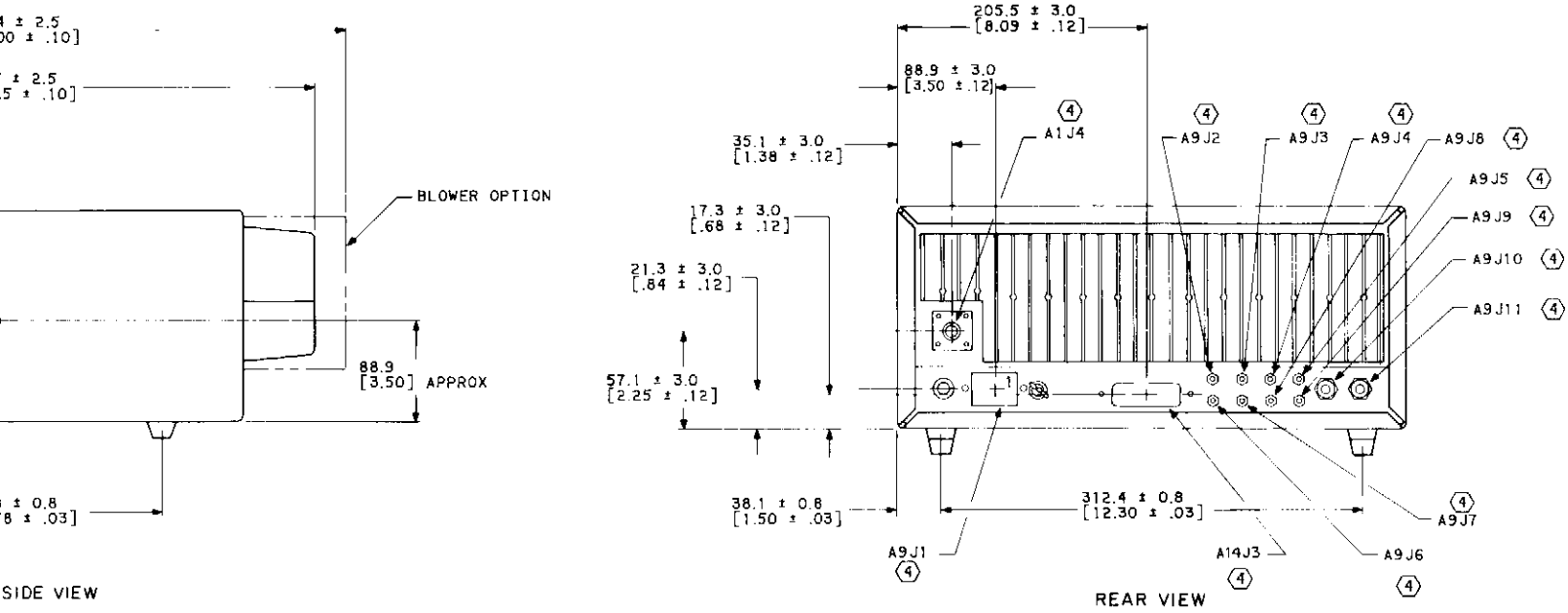


SIDE VIEW

NOTES:

1. DIMENSIONS ARE MILLIMETRES [INCHES].
2. WEIGHT: 21.8 ± 0.5 kg [48.0±1.0 LB].
3. ◓ DENOTES CENTER OF GRAVITY.
4. CONNECTOR CHART

REF DES	CHASSIS SCREENING	COMPANY PART NO	VENDOR NAME	VENDOR PART N
A9J1	J1	365-0068-020	TRW CINCH	P-406
A14J3	REMOTE CONTROL	371-0386-080	ITT CANNON	DBU-2
A9J2	AUD IN	360-0148-000	SWITCHCRAFT	350 I
A9J3	ALC	360-0148-000	SWITCHCRAFT	350 I
A9J4	ANT RLY	360-0148-000	SWITCHCRAFT	350 I
A9J5	XVTR OUT	360-0148-000	SWITCHCRAFT	350 I
A9J6	AUD OUT	360-0148-000	SWITCHCRAFT	350 I
A9J7	AMP CTL	360-0148-000	SWITCHCRAFT	350 I
A9J8	RCV IN	360-0148-000	SWITCHCRAFT	350 I
A9J9	PTT	360-0148-000	SWITCHCRAFT	350 I
A9J10	KEY	358-0014-000	QPL	M641/
A9J11	SPKR	360-0136-000	SWITCHCRAFT	13E
A10J2	MIC	358-1050-000	QPL	M641/
A10J1	PHONES	360-0136-000	SWITCHCRAFT	13E
A1J4	NONE	357-9005-000	AMPHENOL	83-79



	VENDOR NAME	VENDOR PART NO	COMPANY MATING PART NO	VENDOR NAME	VENDOR PART NO
	TRW CINCH	P-406-AB	365-0068-010	TRW CINCH	S-406-CCT
	ITT CANNON	DBU-25SBF	371-0170-000	TRW CINCH	DBM-25P
	SWITCHCRAFT	350 IFP	361-0062-000	SWITCHCRAFT	350 IMC
	SWITCHCRAFT	350 IFP	361-0062-000	SWITCHCRAFT	350 IMC
	SWITCHCRAFT	350 IFP	361-0062-000	SWITCHCRAFT	350 IMC
	SWITCHCRAFT	350 IFP	361-0062-000	SWITCHCRAFT	350 IMC
	SWITCHCRAFT	350 IFP	361-0062-000	SWITCHCRAFT	350 IMC
	SWITCHCRAFT	350 IFP	361-0062-000	SWITCHCRAFT	350 IMC
	SWITCHCRAFT	350 IFP	361-0062-000	SWITCHCRAFT	350 IMC
	SWITCHCRAFT	350 IFP	361-0062-000	SWITCHCRAFT	350 IMC
	QPL	M641/12-1	361-0018-000	QPL	PJ-055B
	SWITCHCRAFT	13E	361-1040-000	MALLORY	75
	QPL	M641/5-1	361-0001-000	QPL	PJ-068
	SWITCHCRAFT	13E	361-1040-000	MALLORY	75
	AMPHENOL	83-798	357-9014-000	AMPHENOL	83-822

TPA-5305-014

Transceiver Outline and Mounting Dimensions
Figure 7

HF-380 Transceiver

Rockwell International

operation

Collins Telecommunications Products Division

Printed in USA

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1 August 1982

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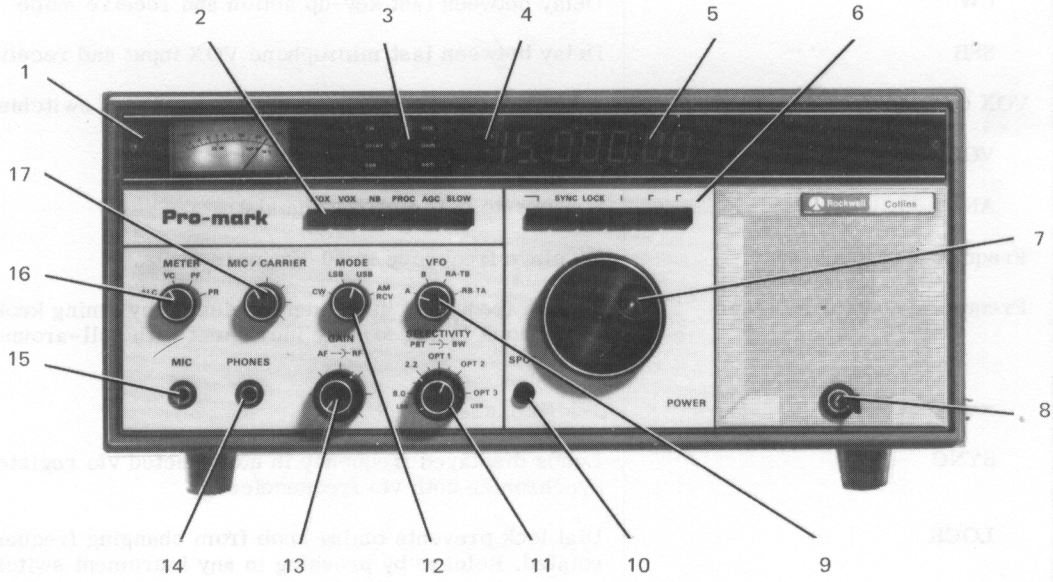
1. GENERAL

Operation of the HF-380 Transceiver is controlled by the front-panel controls and indicators. Connectors (jacks) on the front panel and rear panel provide necessry interface for transceiver operation.

When the optional AC-3803 Control Interface is installed, a remote key pad control may be used for keying in, storing, and recalling up to 11 frequencies.

2. CONTROLS AND INDICATORS

The functions of the controls and indicators on the transceiver front panel are described in table 1. Figure 1 illustrates the location of the controls and indicators.



TPA-5253-017

Controls and Indicators
Figure 1

Table 1. Controls and Indicators.

INDEX NO	CONTROL OR INDICATOR	FUNCTION
1	Meter	In receive, indicates relative signal strength in "S" units. (Rf input of 100 μV "hard" (50 μV "soft") gives S9 indication.) In transmit, indicates signal selected by METER switch.
2	Function switches	Selects related function when switch is in position.
	MOX	Manually-operated receive-to-transmit switching. Places transceiver in transmit when pressed in.
	VOX	Voice-operated receive-to-transmit switching. Ptt switching also operable.
	NB	Noise blanker.
	PROC	Speech processor
	AGC	Automatic gain control (Switch must be in in position to enable AGC function.)
	SLOW	Selects slow AGC action in in position; fast AGC when out. (AGC switch must be in in position for fast/slow action to be enabled.)
3	VOX DELAY	Adjustments for transmit-to-receive switching time delay.
	CW	Delay between last key-up action and receive mode
	SSB	Delay between last microphone VOX input and receive mode
4	VOX GAIN	Adjusts levels at which receive-to-transmit switching occurs.
	VOX	Voice or line audio input signals
	ANTI	Speaker-to-microphone signals
5	Frequency readout	Displays frequency in 10-Hz increments.
6	Frequency control switches	Selects frequency increments selected by tuning knob. Continuous tuning for any increment with roll-around at end limits.
	⌐‾‾‾

Table 1. Controls and Indicators (Cont).

INDEX NO	CONTROL OR INDICATOR	FUNCTION
8	POWER switch	Controls primary power input.
9	VFO	Selects frequency-storage register.
	A	A register. Transmit and receive on same frequency.
	B	B register. Transmit and receive on same frequency.
	RA-TB	Receive on A register frequency, transmit on B register frequency.
	RB-TA	Receive on B register frequency, transmit on A register frequency.
10	SPOT	In CW mode only, enables 800-Hz tone to which received CW tone is matched to spot transmitted frequency to exact received frequency.
11	SELECTIVITY	Controls selectivity of receiver.
	PBT (small knob)	Passband tuning. Used to selecte USB, LSB, or CW during receive mode. Continuously varies position of passband (bandwidth selected by BW control) within 8-kHz passband of first if filter.
	BW (large knob)	Selects filter bandwidth.
	8.0	8.0-kHz filter (for AM, also selects optional 6-kHz AM filter if installed).
	2.2	2.2-kHz filter (for normal SSB)
	OPT 1, 2, 3	Three positions for optional filters.
12	MODE	Selects mode of transmit operation.
	CW	Continuous wave
	USB	Upper sideband } Receive sideband determined by setting of PBT control.
	LSB	Lower sideband }
	AM RCV	Amplitude modulation, in receive only. Transmitter does not operate in AM mode.
13	GAIN	Adjusts gain of receiver circuits.
	AF (small knob)	Af amplifier gain
	RF (large knob)	Rf amplifier gain
14	PHONES (mates with PJ-055)	Output jack for low-impedance (4- to 8-Ω) headphones. Connecting phones inhibits speaker and SPKR :(on rear panel) outputs. Tip--receiver audio; 4- to 8-Ω impedance, up to 3-W output Barrel--ground

Table 1. Controls and Indicators (Cont).

INDEX NO	CONTROL OR INDICATOR	FUNCTION
15	MIC (mates with PJ-068)	Input jack for low or high impedance, dynamic microphone. Jack is also wired for ptt signal. Tip --ptt line; ground to transmit Ring-- microphone audio; 3.3-kΩ nominal input impedance, approximately 5 mV in for full power output Barrel-common ground
16	METER (switch)	Selects signal applied to meter during transmit.
	ALC	Transmitter automatic level control voltage
	VC	Collector voltage for final amplifier stage
	PF	Forward rf power sampled at amplifier output
	PR	Reflected rf power sampled at amplifier output
17	MIC/CARRIER	In sideband operation, adjusts microphone amplifier gain. In CW operation, adjusts rf carrier level.

3. OPERATING PROCEDURES

3.1 Preoperational Check

a. Check that all interconnect cables are properly connected to the transceiver.
b. If the blower kit is installed, ensure blower intake is unobstructed.

3.2 Frequency Selection

The large tuning knob and row of switches immediately above it control transceiver frequency selection. When power is applied to the transceiver, the frequency is automatically set to 15.000 00 MHz. Frequency data is not retained in the vfo registers when power is turned off.

There is no need for bandswitch since selection of the MHz tuning increment permits tuning from 0 to 29 MHz in three turns of the knob. This rate is effective for the MHz digits only. Selecting other increments automatically switches the tuning rate to 200 steps per turn. For example, selecting the 100-Hz increment gives 20 kHz per revolution of the tuning knob.

When a switch is depressed to select a frequency increment to be changed, that and all higher increments will change as the tuning knob rotates. For example, if the 100-Hz increment is selected, the 10-Hz digit remains where last set. Rotating the tuning knob clockwise causes the 100-Hz digits to increment up through 9, index the 1-kHz digit by one, and roll around to 0 to continue incrementing toward 9 again. Counterclockwise rotation causes the frequency to decrement in a similar fashion.

Once a chosen frequency is selected, pressing the LOCK switch to the in position electronically disables the tuning knob operation. In LOCK, rotation of the tuning knob has no effect on the frequency. To restore tuning control of the knob, press any tuning increment switch to return the LOCK switch to the out position.

The SYNC switch is momentary and when depressed, will load the displayed frequency value from the operating vfo register into the register that is not being displayed. For example, if using register B, depressing SYNC will lead the same frequency into register A. The frequency in register B can then be changed without affecting the stored value in register A.

The A and B vfo registers may contain any two frequencies. Split-frequency operation is achieved by selecting RA-TB or RB-TA. With RA-TB chosen, the transceiver will receive on the frequency in the A

register and transmit on the frequency in the B register. The frequency display shows the receive frequency when receiving and the transmit frequency when transmitting.

The vfo registers can be set up for split-frequency operation on any two frequencies, even within separate bands.

In CW operation, the SPOT switch enables an 800-Hz tone that is applied to the receiver audio output. By tuning the received signal so the CW audio frequency matches the 800-Hz SPOT frequency, the receiver frequency will be matched with the transmitted frequency.

3.3 Function Selection

Depressing the MOX or VOX switch selects manual- or voice-operated keying, respectively. The rear panel PTT jack (J9), when grounded, will key the transmitter regardless of MOX or VOX selection.

When pressed to the in position, the MOX switch keeps the transceiver continuously keyed. For normal transmit-receive operation, the MOX switch must be out. With MOX and VOX both out, the transceiver is keyed with the microphone ptt switch. Selecting VOX enables voice keying in sideband or CW keying in CW.

The AGC function can be enabled by depressing the AGC switch. The out position inhibits AGC operation. Release time of the AGC is controlled by the SLOW switch. The in position selects a slow release time. This is normally used in SSB operation. Fast AGC release, the switch out position, is more useful for CW reception.

The optional noise blanker and speech processor circuits, when installed, are selected by depressing the respective NB or PROC switch to the in position. The noise blanker reduces or eliminates pulse-type noise, such as from automobile ignition systems, from the receiver audio output. The speech processor increases the ratio of average to peak power in the rf output signal. This increases talk power and may be desired in DX operation.

The DELAY controls adjust the time the transceiver is held in the transmit mode after the voice input or CW keying signal is removed. Clockwise adjustment of either control increases the delay between the last input of automatic transmit-to-receive switching. Independently set these controls as desired for the preferred delay times.

3.4 Gain Controls

The GAIN controls adjust the sensitivity to microphone input signals from the operator (VOX) or from the receiver speaker (ANTI-VOX). Set the VOX GAIN so the normal voice level used during transmitting keeps the receiver keyed. A level too high may cause background noises to key the transmitter while a level too low will require a loud voice input to the microphone for keying. In CW, advance VOX GAIN until an rf output is obtained when the transceiver is keyed in the VOX mode. Set the ANTI-VOX GAIN to the minimum gain (ccw) level that prevents the microphone pickup of the speaker output from tripping the VOX circuit.

3.5 Selectivity

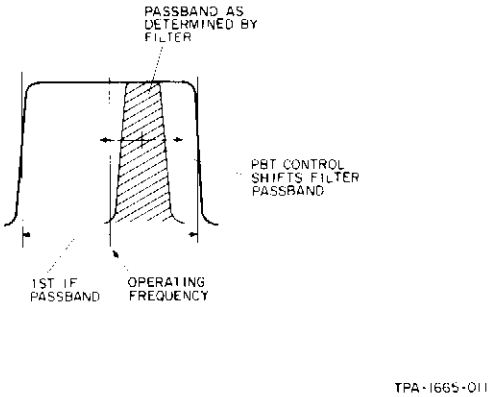
The large (rear) BW switch controls the receive bandwidth by selecting any one of the installed filters. Filter installation information is given in the maintenance section. The 6-kHz AM filter (AC-8313) is particularly recommended for critical AM listening.

The small (front) PBT control positions the passband of the selected filter within the 8-kHz passband of the receiver first if and is used to select the desired sideband in receive. For RTTY, position the pointer near LSB (left-most position); and for USB, between OPT 2 and OPT 3.

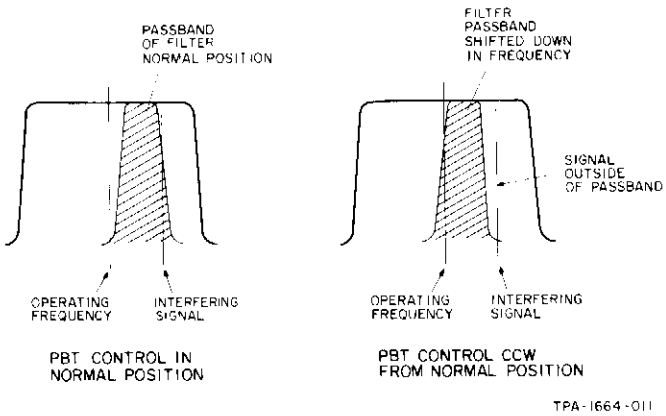
Note

The MODE switch does not determine which sideband is received. It only selects the desired transmit passband.

The PBT control can shift the position of the receive selectivity by adjusting the passband above or below the normal frequency position. In either USB or LSB, rotating the control toward the vertical (OPT 1) position lowers the audio frequency passband. This produces a lower audio tone. Figure 2 illustrates this. Figure 3 illustrates how the passband can be tuned away from an interfering signal to put the signal outside the passband and eliminate the interference.



Filter Passband Positioning with PBT Control
Figure 2



Passband Tuning to Eliminate Interfering Signal
Figure 3

3.6 MIC/CARRIER Control

The MIC/CARRIER control adjusts the audio modulation level or the CW carrier level to control the rf output power. For voice operation, set the METER switch to ALC. Key the transmitter and speak into the microphone or say "Ahhhh" in a normal operating-voice level while adjusting the MIC/CARRIER control until the meter indicates S5 to S9 on the S-unit scale. A more counterclockwise position of the control will give less than this full-power output setting.

DO NOT EXCEED S9 ALC indication or distortion may be generated. Normal power output is 100 watts pep. In voice operation, this will produce an average power output of 15 to 25 watts on an average power wattmeter. Speech processing will increase this average by several dB.

For CW operation, set the METER switch to ALC. Key the transmitter and adjust the MIC/CARRIER control clockwise until the meter indicates S5 to S9. A more counterclockwise position of the control will give less than this full-power setting.

3.7 Operations

Adjustments of the transceiver controls will vary with individual operators. The following setups give initial control settings for each mode of operation. After setting up the transceiver, the controls may be adjusted as desired during operation. If a linear power amplifier or antenna coupler is used with the transceiver, tune the amplifier or antenna coupler by using the CW MODE of the transceiver. Since the CW key line is closed circuit, a key is not necessary. If a key is used, it must be closed in VOX or MOX. Simply depress VOX or MOX for transmit enable.

The rf input to the amplifier/coupler is controlled with the MIC/CARRIER control. This control should be slowly adjusted from minimum power (full counterclockwise position) upward to an output level adequate for tuning the amplifier/coupler. There is a short lag between control adjustment and rf output level change. Use caution to not overdrive the power amplifier. For RTTY operation, the modem output (to the transceiver line audio input, J2) must be AFSK; FSK will not work.

3.7.1 CW Operation

a. Set the POWER switch to ON.
b. Set the MODE switch to CW position.
c. Set the VFO switch to A or B positions.
d. Adjust RF and AF GAIN controls to desired levels.
e. Set the SELECTIVITY BW switch to desired bandwidth position.
f. Set the SELECTIVITY PBT control to midrange (vertical position).
g. Select unused frequency near desired operating frequency.
h. Set METER switch to ALC position.
i. Key transceiver and adjust MIC/CARRIER switch for S5 to S9 ALC indication on meter.

Note

VOX GAIN must be set to high enough level to trigger the VOX circuit.

j. Release the key and tune to operating frequency.

3.7.2 SSB Operation

a. Set the POWER switch to ON.
b. Set the MODE switch to LSB or USB, as desired for band of operation.
c. Set the VFO switch to A or B position.
d. Adjust RF and AF GAIN controls to desired levels.
e. Set the SELECTIVITY BW switch to 2.2 position (2.2-kHz bandwidth).
f. Set the SELECTIVITY PBT control to between 8.0 and 2.2 (for LSB) or OPT 2 and OPT 3 (for USB).
g. Select unused frequency near desired operating frequency.
h. Set METER switch to ALC position.
i. Depress the VOX function pushbutton if ptt operation is not desired.
j. Key transceiver and speak into microphone while adjusting MIC/CARRIER control to power output level desired (normally to level where meter indicates S5 to S9 on S-unit scale). Do not exceed S9.
k. Unkey and tune to operating frequency.

3.7.3 RTTY Operation

a. Ensure microphone is disconnected from transceiver.
b. Connect AFSK RTTY signal to AUD IN.
c. Set the POWER switch to ON.
d. Set the MODE switch to LSB position.
e. Set VFO switch to A or B position.
f. Adjust RF and AF GAIN controls to desired levels.
g. Select desired bandwidth filter for receive using SELECTIVITY BW switch. (Transmit automatically selects 2.2-kHz filter).
h. Set SELECTIVITY PBT control to second index mark to left of top center.
i. Set METER switch to ALC position.
j. Select unused frequency near desired operating frequency.
k. Depress the MOX function pushbutton (transceiver keys).
l. Adjust MIC/CARRIER control to ALC indication between S5 to S9.
m. Depress MOX function pushbutton to release key (unkeyed position).

Note

VOX may be used if AFSK modem mutes tone during receive.

n. Tune to operating frequency.

3.7.4 AM Operation (Receive Only)

a. Set the POWER switch to ON.
b. Set the MODE switch to AM position.
c. Set the VFO switch to A or B position.
d. Adjust RF and AF GAIN controls to desired levels.
e. Set the SELECTIVITY BW switch to 8.0 (8.0-kHz bandwidth). The operational AC-8313 6-kHz filter is recommended for optimum AM reception.
f. Set the SELECTIVITY PBT control to midrange (vertical position).
g. Tune to desired frequency.

HF-380 Transceiver

Rockwell International

theory

Collins Telecommunications Products Division

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1 August 1982

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1. GENERAL

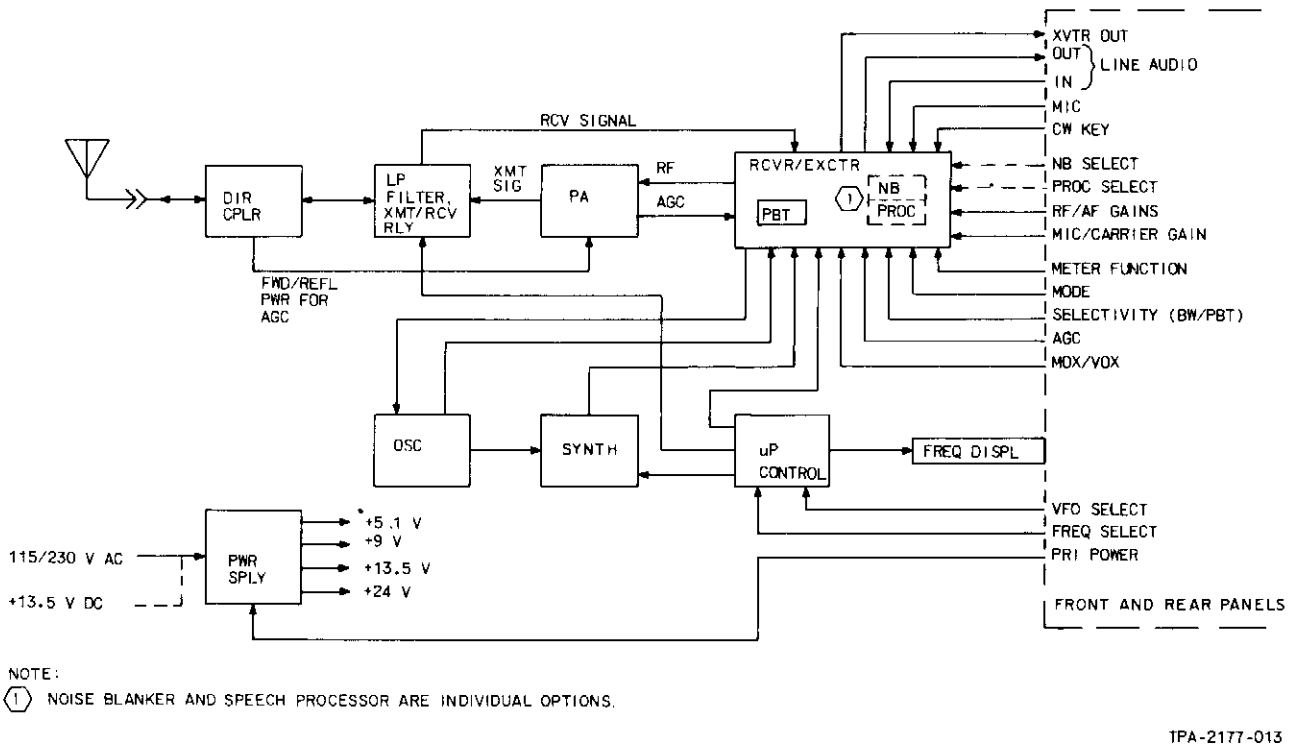
This section contains information describing the operating principles of the HF-380 Transceiver on a functional level. Operating principles of the plug-in circuit cards/subassemblies are described only to the level necessary to make the overall description meaningful. Specific operating principles of the circuit cards/subassemblies are presented in the individual circuit card instruction sections of this instruction book.

2. THEORY

2.1 Overall Unit

The transceiver is a double-conversion superheterodyne receiver and single-sideband transmitter. The transceiver operates on either sideband for voice transmission. CW transmission is generated by keying a carrier oscillator. For RTTY transmission, an external AFSK modem is required to generate audio signals for modulation on LSB. The receiver has a product detector for SSB and an envelope detector for AM reception. Transmission by AM is not possible with the transceiver. Figure 1 is a simplified block diagram of the transceiver.

Rf frequencies for the receiver-exciter circuits are synthesized by a 3-loop phase-locked loop synthesizer that is tunable in 10-Hz steps. A control-temperature oven oscillator develops the 39.6-MHz and 4.55-MHz signals for use in the synthesizer and receiver-exciter, while a standard crystal oscillator develops the 454.2-kHz signal used in the receiver-exciter. The 4.55-MHz output is divided by 10 to get



NOTE:
(1) NOISE BLANKER AND SPEECH PROCESSOR ARE INDIVIDUAL OPTIONS.

1PA-2177-013

Transceiver, Simplified Block Diagram
Figure 1

the 455-kHz output. Inputs from the front-panel frequency-selection controls are applied to a microprocessor. The microprocessor outputs are frequency data to the synthesizer, control signals to the low-pass filter assembly and receiver-exciter, and operating frequency data to the front-panel frequency display.

Receiver selectivity is controlled by switch-selectable bandwidth filters and a variable if circuit. The filters and variable if circuit make up the passband tuning (PBT) subassembly. An optional noise blanker, connected into the receiver circuit just before the second receiver mixer, blanks ignition-noise-type pulses from the received signal. An optional speech processor, connected into the exciter circuit after the microphone preamplifier, compresses audio signal peaks to permit using higher average power level audio signals for modulating the exciter.

The exciter output is applied to the power amplifier. The power amplifier is a broadband type that does not require tuning. From the foward and reflected power analogs, the power amplifier develops an ALC signal that is applied to the exciter. This ALC signal controls the exciter gain to prevent overdriving the power amplifier. A thermistor-controlled circuit keeps the power amplifier output reduced to a safe level if overheating occurs.

The power amplifier output is applied, through a tr relay, to the low-pass filter assembly. (In receive, the tr relay directs the receive signals to the receiver circuits.) A control signal from the microprocessor automatically selects the appropriate low-pass filter for the frequency of transmission. If the receive frequency is in a different band from the transmit frequency, the microprocessor automatically switches the appropriate filters in and out of the rf path as the transceiver is switched from receive to transmit and back. A directional coupler measures the forward and reflected rf power signals. The results are coupled back to the power amplifier ALC circuits. An ALC signal from an external linear power amplifier may also be applied to the transceiver power amplifier for ALC control of the exciter.

All power for the circuits is developed from the power supply. The supply operates from 115 or 230 volts (nominal), 50 to 60 Hz; or from 12 to 15 V dc for standby or emergency operation. A thermal switch, located on the power amplifier heat sink, turns off the power supply output if heat from the series-pass power transistors or power amplifier output transistor becomes excessive.

2.2 RF System (Refer to figure 2)

2.2.1 Transmit

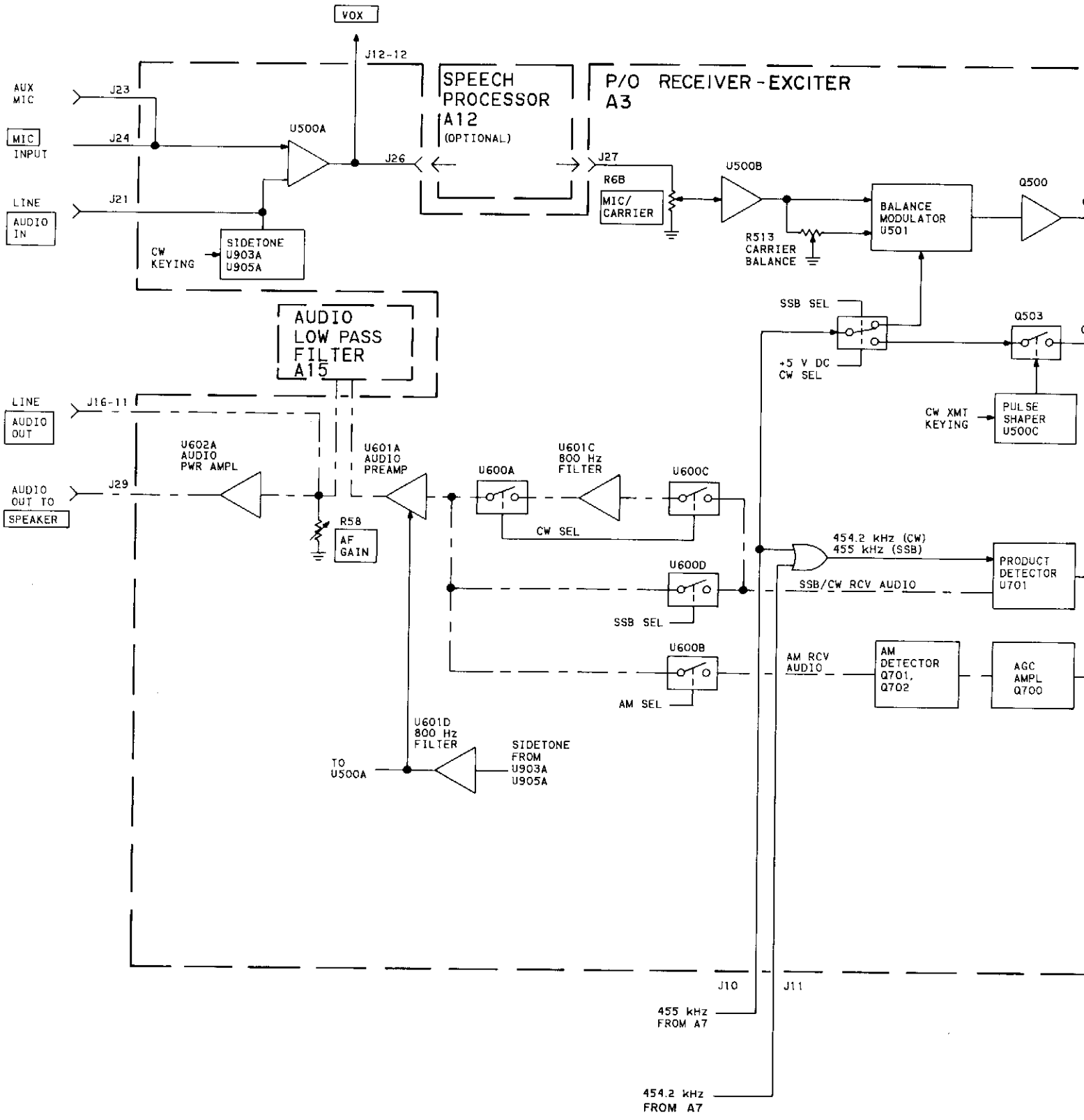
The transmit rf signal path starts at microphone preamplifier U500A. The audio input to U500A is either through J24 (microphone) or J21 (line audio). The third input to U500A is from sidetone generator U903A/U905G. The sidetone signal, normally generated during CW keying, is nominally an 800-Hz tone. If a fault occurs during transceiver tuning or if the phase-locked loop in the synthesizer fails to lock on, the 800-Hz sidetone is turned on and off at a 10-Hz rate, resulting in a rapid beeping audio output from the transceiver.

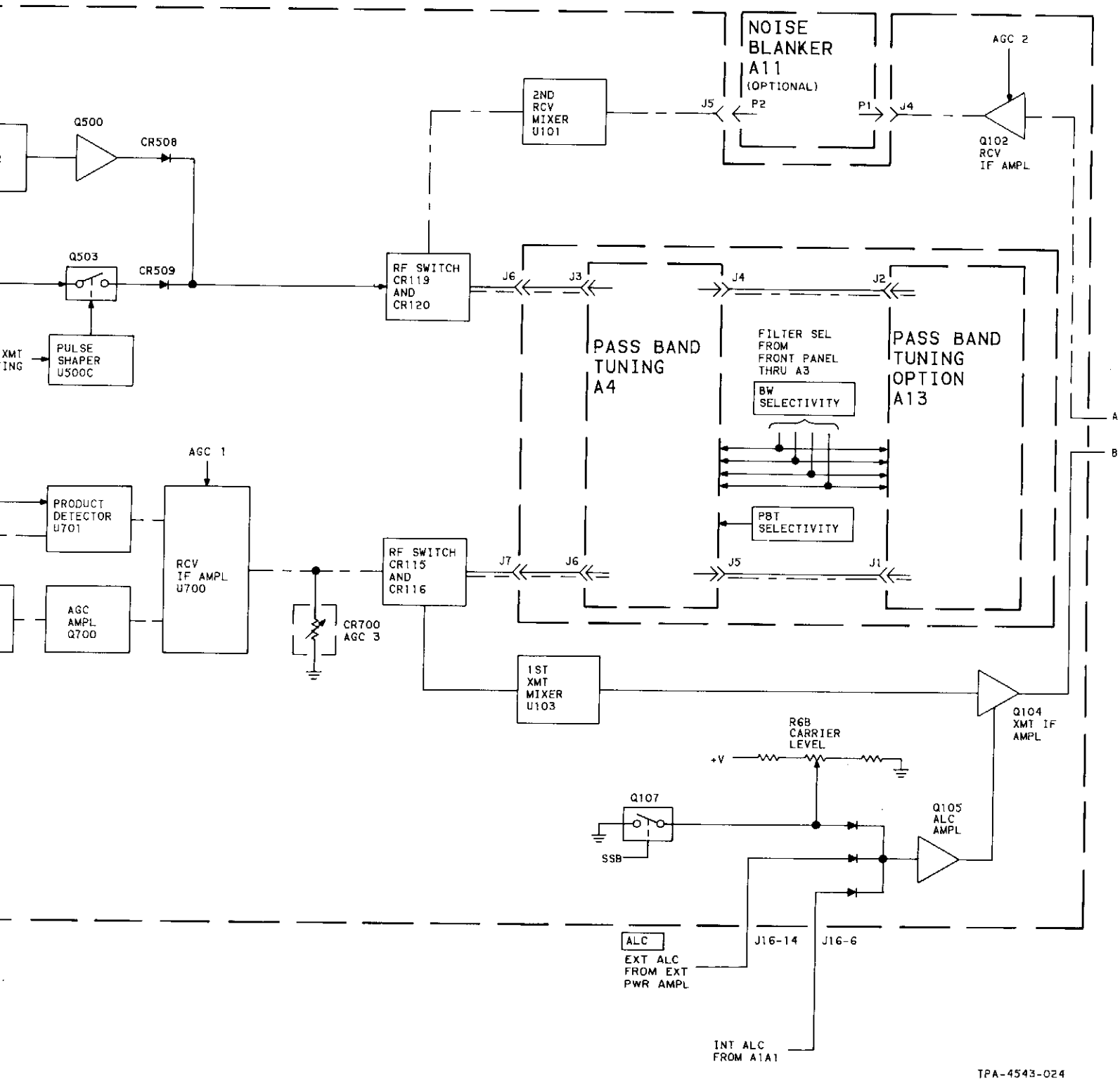
The output of U500A is applied to the VOX circuit and to MIC/CARRIER potentiometer R6B. The audio tapped from R6B, amplified by amplifier U500A, is applied to balance modulator U501. The audio input to U501 modulates the 455-kHz signal in sideband mode. R513 (carrier balance) is adjusted for minimum rf carrier output from the exciter with no audio input. If the operating mode selected is CW, the 455-kHz signal is not applied to U501, therefore, no output is produced.

In the sideband mode, the balanced modulator output is a double sideband signal applied to amplifier Q500. The amplifier output is applied, through forward-biased CR508 (in sideband), to the passband tuning assembly through rf switch (CR119 and CR120). If the transceiver is operating in CW, the SSB logic signal is not aplied to CR508, and +5-V CW select is applied to CR509 through switch Q503.

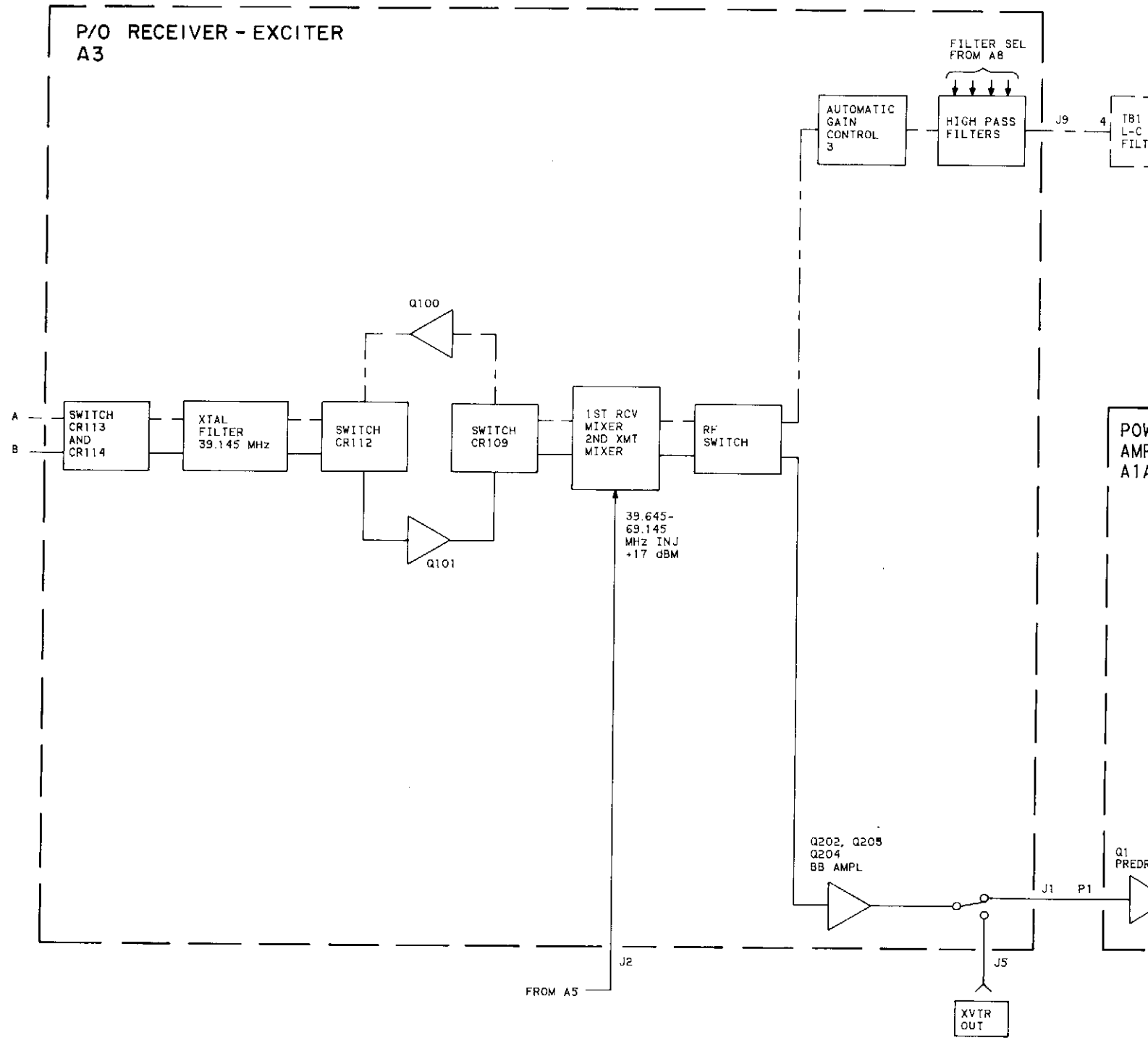
Absence of the SSB logic signal keeps any output from Q500 being applied to other circuits. The +5-V CW logic signal forward biases CR509 to permit the output of Q503 to be applied to the passband tuning assembly.

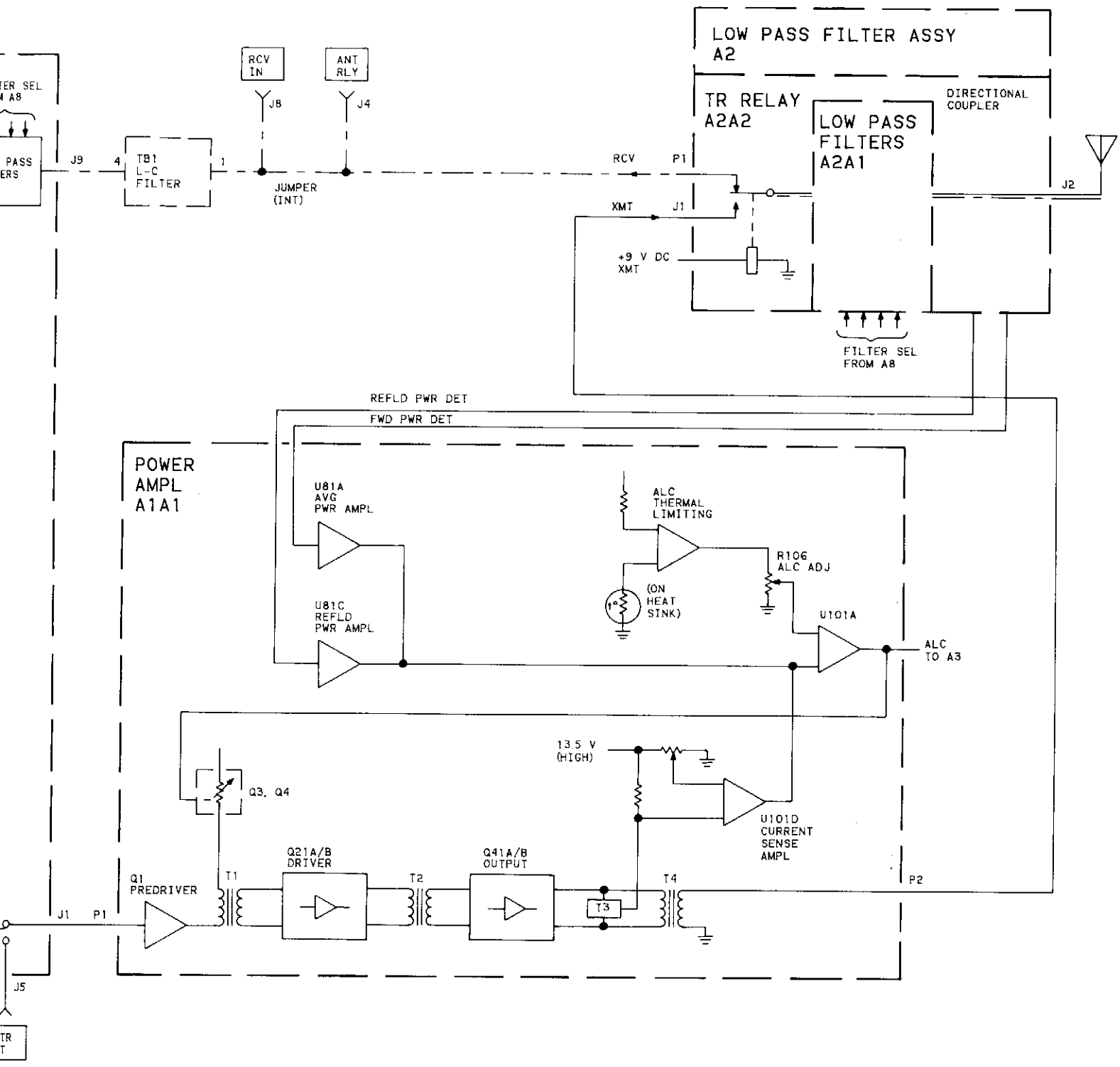
The audio modulated 455-kHz input to passband tuning assembly A4 is automatically positioned to the proper location within the filter passband of the mode selected by a mode-selected preset voltage. The filtered output of A4 is switches to first transmit mixer U103 through CR119. The 455-kHz signal is mixed with a 39.6-MHz input from oscillator A7. The resultant 39.145-MHz output of U103 is applied to transmit if amplifier Q104. Amplifier Q104 is the ALC and carrier level control point for the transmit signal. In sideband, the internal ALC from power


VOX
J12-12
SPEECH PROCESSOR A12 (OPTIONAL)
P/O RECEIVER-EXCITER A3
AUX MIC
J23
MIC INPUT
J24
U500A
J26
J27
R6B
MIC/ CARRIER
U500B
Q500
LINE AUDIO IN
J21
CW KEYING
SIDETONE U903A U905A
R513 CARRIER BALANCE
BALANCE MODULATOR U501
SSB SEL
Q503
+5 V DC CW SEL
CW XMT KEYING
PULSE SHAPER U500C
AUDIO LOW PASS FILTER A15
LINE AUDIO OUT
J16-11
U602A AUDIO PWR AMPL
U601A AUDIO PREAMP
U600A
U601C 800 Hz FILTER
U600C
AUDIO OUT TO SPEAKER
J29
R58
AF GAIN
CW SEL
454.2 kHz (CW) 455 kHz (SSB)
PRODUCT DETECTOR U701
U600D
SSB/CW RCV AUDIO
SSB SEL
U600B
AM RCV AUDIO
AM DETECTOR Q701, Q702
AGC AMPL Q700
AM SEL
U601D 800 Hz FILTER
TO U500A
SIDETONE FROM U903A U905A
J10
J11
455 kHz FROM A7
454.2 kHz FROM A7



RF System, Functional Block Diagram
Figure 2 (Sheet 1 of 2)


P/O RECEIVER - EXCITER
A3
FILTER SEL
FROM A8
AUTOMATIC
GAIN
CONTROL
3
HIGH PASS
FILTERS
J9
4
TB1
L-C
FILT
Q100
A
B
SWITCH
CR113
AND
CR114
XTAL
FILTER
39.145 MHz
SWITCH
CR112
SWITCH
CR109
1ST RCV
MIXER
2ND XMT
MIXER
RF
SWITCH
Q101
39.645-
69.145
MHz INJ
+17 dBM
POW
AMP
A1A
Q202, Q205
Q204
BB AMPL
J1
P1
Q1
PREDR
J2
FROM A5
J5
XVTR
OUT



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RF System, Functional Block Diagram
Figure 2 (Sheet 2)

amplifier A1A1 or external ALC from an external power amplifier controls the output level of Q104. In CW, the output of Q104 is level-controlled by the front panel MIC/CARRIER control R6B. The output of Q104 is applied to crystal filter FL1A/B through diode CR113. The crystal filter has an 8-kHz passband centered on 39.145 MHz. The crystal-controlled output of FL1A/B, applied through forward-biased CR112, is amplified by Q101 to compensate for the filter insertion loss. The output of Q101 switched through CR109 is applied to second transmit mixer U100.The 39.145-MHz input to U100 is mixed with a variable local oscillator input from synthesizer A5. This variable local oscillator input (39.645- to 69.145-MHz, depending upon the selected operating frequency of the transceiver) results in a difference frequency output that is the operating frequency of the transceiver.

The output of U100 is diode-switched to broadband amplifier, Q202 and Q204. The broadband amplifier develops approximately 23 dB of gain for a maximum exciter output of 100-mW rf. Relay K200 is normally deenergized, thereby directing the exciter output to power amplifier A1A1.

When the exciter output is used to drive a transverter, the transceiver rear panel J5 connector is connected to ground through a 1-mH rf choke. With the connector grounded for dc but not for rf, relay K200 energizes.

The 100-mW rf signal is applied to predriver Q1 in power amplifier A1A1. Power amplifier A1A1 produces an rf output of 90 watts pep minimum from a 100-milliwatt nominal input. The amplifier is protected from high vswr, excessive output power, and thermal overheating by an ALC circuit. ALC amplifier U101A inputs are from average power amplifier U81A, which monitors the forward power detected by directional coupler A2A2; reflected power amplifier U81C, which monitors the reflected power detected by directional coupler A2A2; current sense amplifier U101D, which monitors the output of drivers Q41A/Q41B; and ALC thermal limiting amplifier, which monitors a thermistor detecting temperature from the heatsink. The ALC output from U101A is applied to receiver-exciter A3 at J16-6. This signal controls the level of the transmit if signal, thereby controlling the exciter output. If a malfunction occurs and the exciter output increases beyond normal, the U101A output increases. When the U101A output reaches approximately +3.2 volts, transistors Q3 and Q4 conduct, lowering the output of predriver Q1. This provides fail-safe operation for the transceiver.

The rf output coupled from transformer T4 is applied to tr relay A2A2K1. When in transmit, the relay is energized, thereby applying the transmit rf signal to one of five control card-selected low-pass filters in low-pass filter A2A1 or one of four control card selected filters in the low-pass filter A2A3. The filtered rf signal is routed through the directional coupler to A2J2 for application to an antenna.

2.2.2 Receive

The receiver rf signal path starts at jack A2J2, or at RCV IN jack J8 if a separate antenna is used for receive. The ANT RLY jack J4 provides for connecting the receive input to another receiver.

Note

Refer to installation section for receive connection information.

LC filter TB1 provides first image rejection for the received signal, and also provides filtering so the local oscillator signal will not feed through to the antenna.

The high-pass filters consist of a 0.5- to 1.6-MHz rolloff filter that attenuates signals in the 0.5- to 1.6-MHz broadcast band and three selectable high-pass filters selected depending on band of operation. The filtered rf receive input is applied to an automatic gain control circuit to control rf signal strength.

The receive rf signal is applied to first receive mixer U100 through rf switch CR107. The receive rf is mixed with the variable injection frequency (39.645 to 69.145 MHz) to generate the first if frequency of 39.145 MHz. The first if is diode-switched through CR109 to amplifier Q100. Amplifier Q100 provides approximately 14 dB of gain. This amplified if is diode-switched through CR111 to crystal filter FL1A/B. The filtered if is applied to receive if amplifier Q102. Amplifier Q102 provides approximately 24 dB of gain when the input is below the AGC 2 threshold level. The amplified if from Q102 is applied to second receive mixer, U101, directly or through optional noise blanker A11.

The noise blanker reduces spike-type noise in the if signal.

The second receive mixer, U101, mixes the 39.145 MHz if with a fixed local oscillator frequency (39.6 MHz) to produce the 455-kHz if signal. The 455-kHz if signal is diode-switched through rf switch CR115 to passband tuning assembly A4 and passband tuning option A13.

The SELECTIVITY BW front panel switch is used to select any one of the installed filters for the receive bandwidth. The SELECTIVITY PBT front panel control positions the passband of the selected filter within the 8-kHz passband of the receiver first if, and is used to select the desired sideband in receive.

The receive output of A4 and A13 is diode-switched through CR120 to receive if amplifier U700. Pin diode CR700, controlled by AGC 3 voltage is at the input of U700 for gain control. The AGC 1 input also provides control of the if input. The output of U700 is split, with a portion going to product detector U701, for SSB/CW modes, and a portion being applied to AGC amplifier Q700, for AM mode.

The AGC amplifier output is applied to Q400 for generation of the AGC signal, and to AM detector Q701 and Q702 for detection of the received audio. If AM mode is selected, switch U600B is closed, resulting in the AM receive audio being applied to audio preamplifier U601A. Product detector U701 receives a 455-kHz bfo input in sideband or a 454.2-kHz bfo input in CW. The product detector output is an audio signal corresponding to the received sideband or CW signal. The audio output is switched through switch U600D in sideband or U600C in CW. In sideband, the audio is applied directly to audio preamplifier U601A, and in CW the audio is filtered by U601C before it is applied through U600A to audio preamplifier U601A. The output of U601A is present at the AUDIO OUT line, goes through audio LPF module, and is applied to front panel AF GAIN control R5B. The AF GAIN control potentiometer adjusts the audio signal to amplifier U602A. Amplifier U602A drives the speaker or headphones.

When in CW mode, a sidetone signal is generated, filtered by U601D, and then amplified, resulting in an approximate 800-Hz tone when the key is down.

2.3 Frequency Generation (Refer to figure 3)

Oscillator A7, synthesizer A5, and control A8 constitute the frequency generation circuits within the transceiver. Oscillator A7 contains a control-temperature oven oscillator which develops the 39.6-MHz and 4.55-MHz signals, and a standard crystal oscillator to generate the 454.2-kHz signal. Only the 39.6-MHz output is adjustable over a limited frequency range. The 4.55-MHz output is divided by 10 to get the 455-kHz output.

Synthesizer A5 consists of three phase-locked loops contained on variable reference frequency loop A5A2 and output loop A5A1. External signals input to the synthesizer are the 39.6-MHz output from A7; frequency data, clock, and strobe from control A8; and dc voltages for component operation.

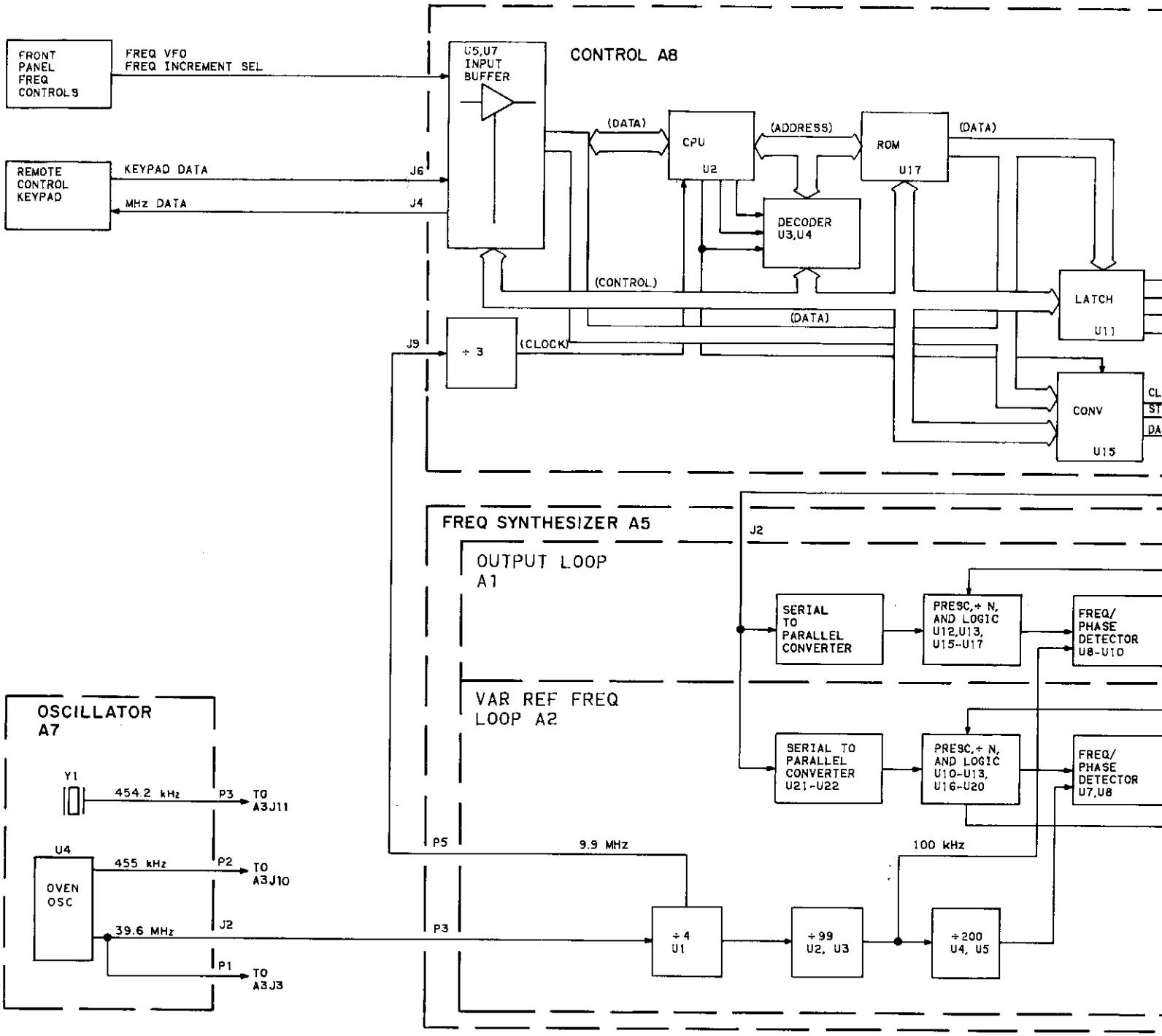
The 39.6 MHz is divided by four, producing a 9.9-MHz output. The 9.9-MHz output is applied to control A8 to use as a clock signal. The 9.9 MHz is divided by 99 to produce a 100-kHz signal for use by the synthesizer loop 2 reference frequency, and the 100-kHz signal is divided by 200 to produce a 500-Hz signal used for the variable reference loop reference frequency.

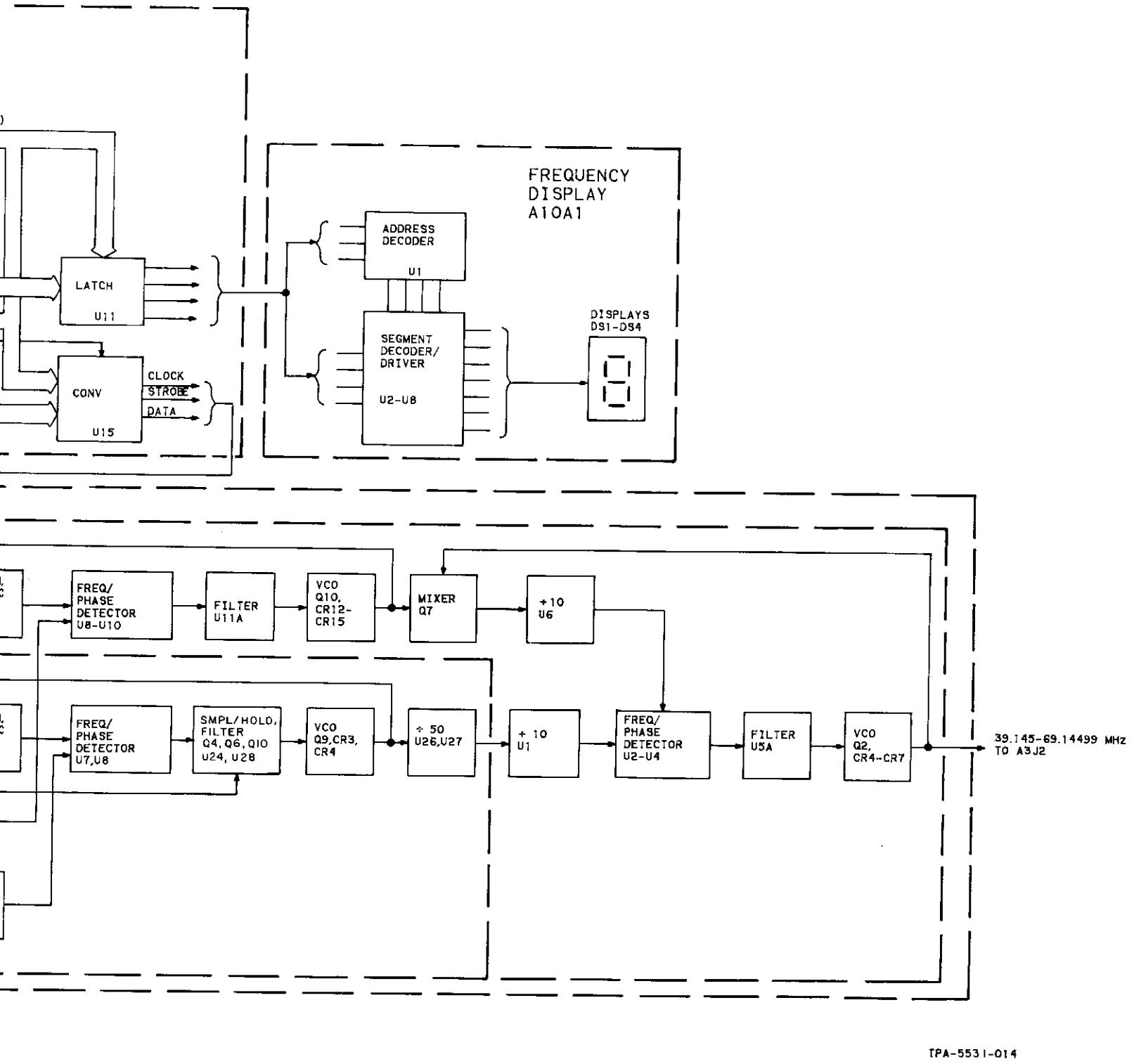
The frequency data, clock, and strobe from control A8 determine the frequency output to the receiver-exciter at A5A1P1.

The synthesizer contains three loops to get 10-Hz frequency increments. Loop 1 develops the 39.145- to 69.145-MHz signal used in the receiver-exciter as a local oscillator variable injection frequency. The loop 2 output is used as a mixing frequency with the loop 1 vco output. The variable reference frequency loop output is used as the reference frequency for loop 1.

Loop 2 frequency is controlled by the 1's and 10's MHz frequency data. This data is loaded into serial-to-parallel decoders, then applied to the ÷N divider. Frequency data inputs to the divider determine the division ratio, N. The ratio is the number by which the vco frequency is divided to equal, when locked, the 100-kHz reference frequency input to the frequency/phase detector. Before a locked condition is obtained, the difference between the divided-down vco output and the reference frequency causes the error voltage that drives the vco frequency to a value that nulls the error. At the frequency, the divided-down vco output is 100 kHz-the detector reference frequency. The vco output, proportional in frequency to the selected 1's to 10's MHz frequency digits, is applied to the loop 1 mixer.

The variable reference frequency loop is controlled by the 100's kHz through 10's Hz frequency data. Frequency data is loaded into serial-to-parallel decoders, then applied to the variable reference loop-N divider. Operation of the variable reference loop is


FRONT PANEL FREQ CONTROLS
FREQ VFO
FREQ INCREMENT SEL
REMOTE CONTROL KEYPAD
KEYPAD DATA
MHz DATA
J6
J4
U5,U7 INPUT BUFFER
CONTROL A8
(DATA)
CPU U2
(ADDRESS)
ROM U17
(DATA)
DECODER U3,U4
(CONTROL)
LATCH U11
(DATA)
J9
÷ 3
(CLOCK)
CONV U15
CL
ST
DA
FREQ SYNTHESIZER A5
J2
OUTPUT LOOP A1
SERIAL TO PARALLEL CONVERTER
PRESC,÷ N, AND LOGIC U12,U13, U15-U17
FREQ/ PHASE DETECTOR U8-U10
VAR REF FREQ LOOP A2
SERIAL TO PARALLEL CONVERTER U21-U22
PRESC,÷ N, AND LOGIC U10-U13, U16-U20
FREQ/ PHASE DETECTOR U7,U8
OSCILLATOR A7
Y1
454.2 kHz
P3
TO A3J11
U4
OVEN OSC
455 kHz
P2
TO A3J10
39.6 MHz
J2
P1
TO A3J3
P5
9.9 MHz
P3
÷ 4 U1
÷ 99 U2, U3
100 kHz
÷ 200 U4, U5



Frequency Generation, Block Diagram
Figure 3

similar to that of loop 2. The divided-down vco output is compared with a 500-Hz reference frequency input. Any difference causes an error voltage that shifts the vco to the correct frequency. The variable reference loop vco output is the reference frequency input to loop 1.

The loop 1 circuit is somewhat different from the other two. The ÷N ratio for loop 1 is fixed, but the vco output is mixed with the loop 2 vco output that is varied with the selected operating frequency. The loop 1 reference frequency is variable also, and depends on the selected operating frequency. Frequency error detection and correction voltage generation is the same as for the other two loops.

2.4 Power Supply (Refer to schematic in diagrams section and figure 4)

2.4.1 Primary Power Input

The ac input, applied to transformer T1, is strapped according to the voltage level to cover a range of 105 to 125 or 210 to 250 V.

The ac power supply can be bypassed for dc power use. This requires a power plug wired with a jumper between pin 8 and pin 10, +14 V applied to pin 11, and ground to pin 9. When wired this way, dc power is applied directly to the +14-V output, bypassing transformer T1 and the series pass transistors Q1, Q2, and Q3.

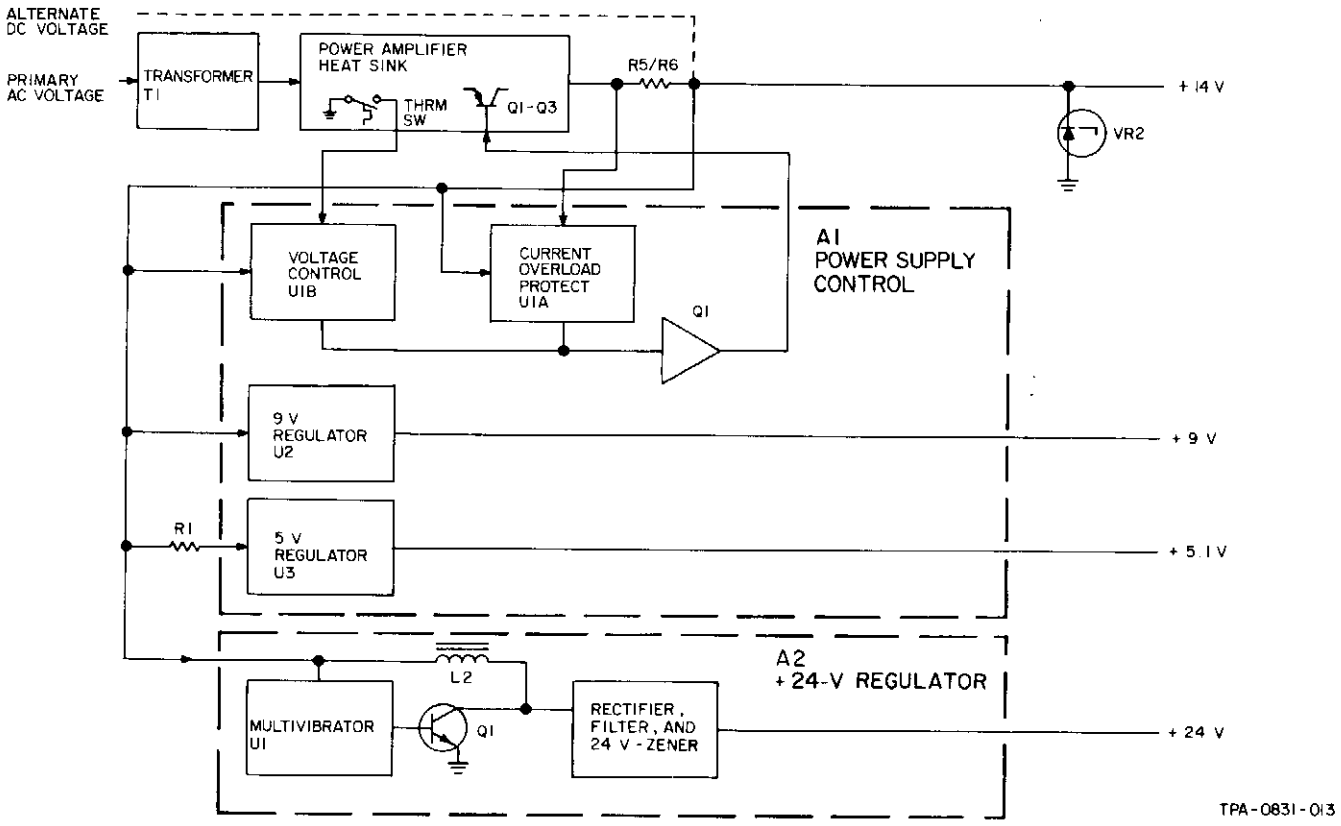
Caution

The jumper must not be present on the ac power plug.

Series pass transistor Q1 through Q3 and related components regulate the rectified ac to +14 V. The regulator circuit for Q1 through Q3 is on subassembly A2A1, along with the 9- and 5-V regulators.

2.4.2 +14-V Regulator

Comparator U1A and related components are current overload protection. Comparator U1A compares the voltage across R5/R6 (a result of the power supply output current) with the voltage at the junction



Power Supply, Block Diagram
Figure 4

of R16 and R30. The output of U1A, along with that from U1B, biases A2A1Q1, the control transistor for the series pass transistors. Resistor R16 adjusts the voltage comparison reference level to set the current protection level.

Comparator U1B and related components develop the voltage control for the +14-V output. Comparator U1B compares a voltage from the +14-V output with a reference voltage developed by VR1. The voltage control level is adjusted by R23. The output of U1B supplies a bias voltage to Q1. An overheat condition, sensed by thermal switch S1 on the heat sink, will cause the U1B output to turn off Q1, turning off the series pass transistors.

Zener VR2 is a transient absorber and reverse dc input power protector.

2.4.3 +5- and +9-V Regulators

Regulators U2 and U3 and related components develop +5- and +9-V outputs, respectively. Resistor R1 drops the voltage for the input of the +5-V regulator. The output voltage levels of U2 and U3 are adjusted by R12 and R14, respectively.

2.4.4 +24-V Regulator (Subassembly A9A2)

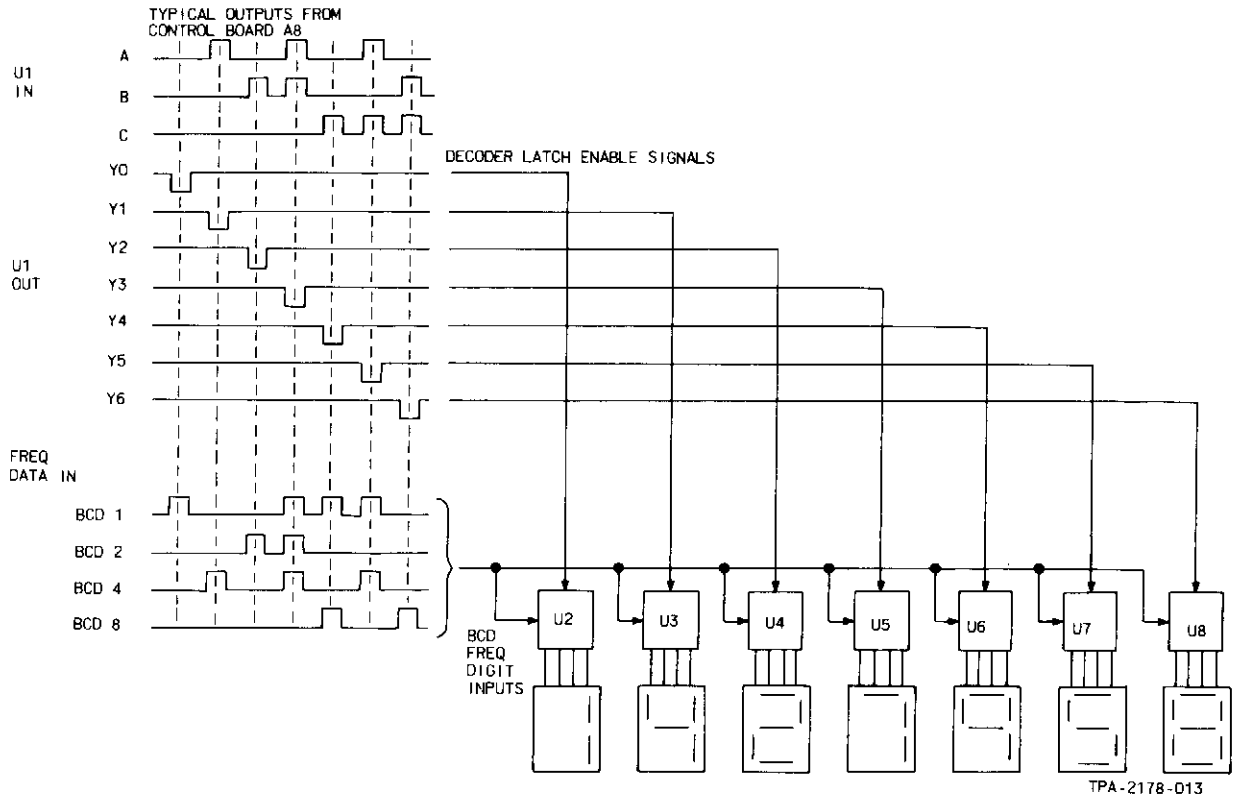
The +24-V switching circuit boosts the +14-V input to a +24-V output. Voltage step-up occurs as Q1 switches the current through L2. When Q1 is off, the collapsing field about L2 causes the voltage boost. Astable multivibrator U1 switches Q1. The switching frequency is determined by C2, R1, R2, and R3, with R3 an adjustment for the frequency and consequently the resulting regulator output voltage.

The voltage from L2 is rectified, filtered, and applied to VR3 for regulation to +24 V. Filter C5, C6, L3 suppresses noise caused by the switching.

2.5 Display Card A10A1 (Refer to schematic in diagrams section)

The display card receives frequency data from the control card, decodes the data, and displays the frequency value on 7-segment readouts. Inputs from J1-5, -7, and -9 are applied to U1. From these bcd inputs, U1 develops sequential logic 0's at its seven outputs. These logic 0's are latch enable signals for decoder/drivers U2 through U8. When a latch enable is logic 0, bcd frequency data at the applicable decoder/driver input is transferred in, decoded to 7-segment format, and latched to the output until the next logic 0 latch enable signal. Input frequency data to the decoder/drivers is from the control card, in parallel format, through J1-4, -6, -8, and -10.

Figure 5 is a simplified diagram showing latch enable signal development from the U1 inputs, corresponding decoding of the bcd inputs to the decoder/drivers, and resulting frequency digit displays at the 7-segment readouts.



Display Circuit Logic and Block Diagram
Figure 5

HF-380 Transceiver

Rockwell International

maintenance

Collins Telecommunications Products Division

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1. GENERAL

This section provides instructions for testing and maintaining the HF-380 Transceiver. Testing and troubleshooting procedures provide a means to make a rapid evaluation of essential equipment operational characteristics to determine if performance is satisfactory. If the transceiver fails to meet a performance standard, review the symptoms and the operating conditions under which they occurred to isolate a faulty module or chassis-mounted component, or determine if adjustment is necessary. Individual circuit card/subassembly instructions in the instructions sections contain testing and troubleshooting procedures to isolate faults to a specific circuit or individual component.

Warning

This device contains a radio frequency transmitter which, when operated into an antenna, may produce electromagnetic fields in close proximity to the antenna that are in excess of Occupational Safety and Health Administration (OSHA) recommended maximum limits.

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be utilized to prevent equipment damage. Refer to paragraph 6 before performing maintenance on the equipment.

2. TEST EQUIPMENT AND TOOLS

Table 1 lists the test equipment required to perform the tests and adjustments. Included in table 1 are tools necessary for circuit card repair. A suggested type is given; however, that specific equipment is not required. Any that meets or exceeds the illustrated minimum specifications is acceptable for use.

Table 1. Test Equipment and Tools.

ITEM	MINIMUM SPECIFICATIONS	REPRESENTATIVE TYPE
Flux		Kester 1544
Solder	0.5-mm (0.020-in) diameter, 63/37 rosin flux core	
Solvent	Freon	Freon TMC
Soldering iron	40 W, 1.5875-mm (1/16-in) tip	
Solder sucker	Plunger-type	
Needle-nose pliers		
Small brush		
Pipe cleaners		
Diagonal cutters		
Electrician's scissors		

Table 1. Test Equipment and Tools (Cont).

ITEM	MINIMUM SPECIFICATIONS	REPRESENTATIVE TYPE
Nonmagnetic tweezers		
HumiSeal 1B31 coating		
Adhesive		Dow Corning RTV-3140
60-dB attenuator (or two 30-dB attenuators)	60 dB, 200 W, 50 ohm, 1.6 to 30 MHz	Sierra Electric 662A-30 (2 required)
Frequency counter	1.6 to 30 MHz, ±1-Hz accuracy	Fluke 1910A
CW key	Continuously-closed switch provision	AC-2827
Rf wattmeter	0 to 150 watts	Bird 43 with 250 H element
Rf load	150 watts continuous, 50 ohms	Bird 8135
Microphone	Dynamic type, low impedance; push-to-talk switch	MM-280 or MM-281
Signal generator	0.5 to 99.3 MHz, 0- to 1000-μV output; 400-Hz 30%-modulated AM and CW outputs	Hewlett-Packard 8640B (2 required)
Rf fuseholder	50-ohm coaxial rf fuse element, 1/16 A	Hewlett-Packard 11509A with 2110-0026 fuse element
6-dB attenuator	50-ohm, 6-dB, 2-watt	Weinschel 1A6 (2 required)
Distortion analyzer	Distortion levels, in dB mW, of +20 to -40; frequency range of 400 to 1500 Hz.	Hewlett-Packard 331A
Pulse generator	50-Hz rate, 1-μs-wide pulses of 1- to 5-volt amplitude	Interstate Electronics P22
Dc voltmeter	0 to ±25 V dc	Fluke 8000A
Headphones	8 to 600	AC-2829 or AC-2830
Rf voltmeter	0 to 3 V; 1 to 30 MHz	Boonton 92C with 50-Ω probe
Dc ammeter	0 to 35 A dc	Yew 2051
High-power rheostat	0.25 to 3 Ω, 0 to 35 A	Rex Rheostat
Dc power supply	0 to 20 V dc, 1 A	Hewlett-Packard 6264B (2 required)
Dc power supply	+13.5 V, 0 to 25 A	Sorensen SRL-20-25
Vector impedance meter	Phase angles to ±10°, impedance to 70 ohms	Hewlett Packard 4815A
Audio oscillator	300-3000 Hz, 0 to 50 mV	Hewlett Packard 200AB

Table 1. Test Equipment and Tools (Cont).

ITEM	MINIMUM SPECIFICATIONS	REPRESENTATIVE TYPE
Oscilloscope	5 mV to 2 V/div vertical; 1 μs/div horizontal; 1-MHz bandwidth	Tektronix 455
Spectrum analyzer		Hewlett-Packard 141T
Rf plug-in		Hewlett-Packard 8553B
If plug-in		Hewlett-Packard 8552B
Variable signal sampler		Bird 4273-020
Power divider		Weinschel 1506A
Rf load	150 W rf, 50-ohm, 2 to 30 MHz	Bird 8329
Power meter	88 watts at 30 MHz	Hewlett-Packard 432B
Rf source	100-watt, 30-MHz	HF-380
Coax jumper		Pn 634-8283-011
20-dB attenuator		Weinschel 9214
Remove keypad (used only if AC-3803 is installed)	2-out-of-8 connected to common, 16 keys. Refer to AC-3803 Control Interface instructions for pad and pin arrangements.	

3. TESTING AND TROUBLESHOOTING

3.1 General

The following paragraphs contain information on test setups, performance testing, and troubleshooting.

The minimum performance tests in table 2 provide an operational test on the transceiver. The test and troubleshooting procedures in tables 3 and 4 determine the overall operational quality of the transceiver. The tests in table 2 should be performed upon receipt of the equipment or anytime degradation of performance is suspected. The tests in tables 3 and 4 provide procedures to determine faulty functional areas/components within the transceiver.

3.2 Test Setup

Turn on primary power to the test equipment. Do not turn on power to the transceiver until instructed to do so in the procedures.

Connect the equipment as instructed in the procedures for each test.

3.3 Testing and Troubleshooting Procedures

The testing and troubleshooting procedures listed in tables 2, 3, and 4 may be performed in any sequence, but the steps within each test must be performed in sequence. Each test may be performed as an individual test or as part of an overall system test. For any test that does not meet or exceed the requirements of the NORMAL INDICATION column, follow the directions of the IF INDICATION IS ABNORMAL column.

Table 2. Minimum Performance Test.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	***Caution*** During receive tests, do not key transceiver by switching in MOX or by any other keying means while signal generator is connected to transceiver rf connector. Keep MIC/CARRIER control turned to maximum ccw position. a. Connect signal generator to transceiver rf connector through rf fuseholder and 6-dB attenuator. b. Connect distortion analyzer to AUD OUT connector on transceiver rear panel. Connect 600-Ω, 1/2-W resistor from AUD OUT center conductor to ground. c. Set BW SELECTIVITY switch to 2.2 and rotate PBT SELECTIVITY control to align with OPT 2 position (for USB reception). Set RF GAIN control to max cw position. Set MIC/CARRIER control to max ccw position. Turn on transceiver power.		
2. Receive	a. Tune transceiver to any frequency greater than 1.600 00 MHz. Tune signal generator to 1 kHz higher than transceiver frequency and set output level to 1 μV. ***Note*** All rf signal levels given at the generator output. Rf to the transceiver is attenuated 6 dB. b. Observe distortion analyzer and make minor signal generator frequency adjustments to obtain best signal-to-noise ratio. Note ratio.	10 dB or better for any frequency greater than 1.6 MHz	Refer to table 3.
(Cont)	c. Rotate PBT SELECTIVITY control to align with 2.2 position (for LSB reception) and tune signal generator to 1 kHz lower than transceiver frequency. d. Repeat test 2.b to measure LSB snr. e. Rotate PBT SELECTIVITY control to align with OPT 1 position (for CW reception) and tune signal generator to transceiver frequency.	Same as test 2.b.	Same as test 2.b.

Table 2. Minimum Performance Test (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	f. Listen to speaker output. (Adjust RF GAIN control to desired level.)	800-Hz tone (Any variation from 800 Hz will be caused by mismatch between signal generator and transceiver frequency.)	Refer to table 3.
	g. Depress SPOT pushbutton and listen to speaker output. Release SPOT pushbutton.	800-Hz tone in addition to tone heard in step f. (If signal generator and transceiver are on identical frequencies, both tones should be 800 Hz.)	Refer to table 2 test 5.d., and figure 1.
	h. Switch BW SELECTIVITY switch through all positions having installed filters. Note speaker output.	Signal present for each installed-filter position.	Refer to table 3.
	i. Adjust signal generator output for 3-μV, 1-kHz, 80% AM modulation. Set MODE to AM RCV, BW SELECTIVITY switch to 8.0, and PBT SELECTIVITY control to align with OPT 1 position. Note speaker output.	1-kHz AM signal is heard.	Refer to table 3.
3. Frequency control switches	a. Depress each of the tuning increment switches (⌐, ⌊ , ⌐, ⌐) and rotate tuning knob to step associated display digits through entire range.	Digits increase in value with cw rotation of tuning knob and decrease in value with ccw rotation through entire range of associated display digits.	Refer to table 3.
	b. Depress LOCK switch and rotate tuning knob. Note display.	Display digits do not change as knob is rotated.	Check LOCK switch A10S6C.
	c. Release LOCK switch (to out position) by pressing in any of the tuning increment switches.		
4. VFO control switches	a. Set VFO switch to A. Note displayed frequency and depress SYNC switch.		
	b. Set VFO switch to B and note displayed frequency.	Displayed frequency is same as that noted for VFO A.	Check VFO select switch A10S3 and receiver-exciter A3.
(Cont)	c. Rotate tuning knob to change frequency of VFO B. Note frequency.		

Table 2. Minimum Performance Test (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	d. Set VFO switch to A and note displayed frequency.	Displayed frequency is same as that previously noted for VFO A.	Same as test 4.b.
	e. Set VFO switch to RA-TB and note displayed frequency.	Displayed frequency doesn't change.	Same as test 4.d.
	f. Set VFO switch to RB-TA and note displayed frequency.	Displayed frequency is same as that noted in step c.	Same as test 4.d.
5. Transmit	a. Disconnect attenuator and signal generator from rf connector. Connect power meter and dummy load to rf connector.		
	b. Set MIC/CARRIER control to max ccw position. Set MODE switch to CW, VFO switch to A, and tune to any frequency within the Amateur Radio Service bands. Switch in MOX and rotate MIC/CARRIER control cw to max position while observing power meter.	In max ccw position of MIC/CARRIER control, power output is zero. Increasing control position cw increases power output to 90 watts or greater. Power automatically reduces to approximately 60 watts after about 10 seconds if optional AC-2808 Blower is not installed.	Refer to table 3.
	c. Rotate METER switch through all positions and note readings.		Same as test 5.b.
	(1) ALC	Upscale	
	(2) VC	Approximately 14-V	
	(3) PF	Same as power meter readings	
	(4) PR	0	
	d. Note speaker output.	800 Hz (Sidetone frequency may be internally adjusted over limited frequency range.)	Adjust A3R616 sidetone level for proper frequency. Refer to figure 1.
(Cont)	e. Note displayed frequency, then depress SYNC switch. (Frequency will be stored in VFO B.) Tune to different frequency within Amateur Radio Service band. (This is new VFO A frequency.)		

Table 2. Minimum Performance Test (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	f. Set VFO to RA-TB and note frequency display.	VFO B frequency	Check VFO select switch A10S3 and receiver-exciter A3.
	g. Switch out MOX and note frequency display.	VFO A frequency	Same as test 5.f.
	h. Set VFO to RB-TA and note frequency display.	VFO B frequency	Same as test 5.f.
	i. Switch in MOX and note frequency display.	VFO A frequency	Check MOX function switch A10S7 and receiver-exciter A3.
	j. Switch out MOX.		
	k. Connect CW key to KEY jack and switch in VOX. Set CW DELAY control to max ccw position. Momentarily close CW key and note power meter. *Note* VOX GAIN control must be increased to position where continuous rf output is developed when key is closed.	Meter indicates rf output while key is closed and no rf when key is open.	Refer to table 3.
	l. Set CW DELAY control to max cw position. Momentarily close CW key and note power meter. (After test, readjust CW DELAY control for delay desired.)	Meter indicates rf output while key is closed. For approximately 3 seconds after key is opened, the radio remains in transmit, then switches to receive.	Same as test 5.k.
	m. Disconnect CW key. Connect microphone to MIC jack. Set METER switch to ALC and MODE switch to USB. Set MIC/CARRIER control to max ccw position.		
	n. Whistle steady tone into microphone while adjusting MIC/CARRIER control cw to obtain ALC reading of approximately S9. Note rf output at this meter indication.	80 to 100 W	Same as test 5.k.
(Cont)	o. Switch MODE switch to LSB and repeat steps m and n to check lower sideband operation.	80 to 100 W	Same as test 5.k.

Table 2. Minimum Performance Test (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	p. Set SSB DELAY control to max ccw position. Speak into microphone to key transmitter. Stop speaking and note time required for transceiver to switch back to receive.	Delay of not over 0.5 second	Same as test 5.k.
	q. Set SSB DELAY control to max cw position. Speak into microphone to key transmitter. Stop speaking and note time required for transceiver to switch back to receive. (After test, readjust SSB DELAY control for delay desired.)	Approximately 3 seconds	Same as test 5.k.
	r. Disconnect dummy load and power meter. Connect 60-dB power attenuator to rf connector and frequency meter to attenuator.		
	s. Switch in MOX. Note transceiver frequency and frequency counter displays.	Both frequencies are the same.	Check MOX function switch A10S7 and receiver-exciter A3.

Table 3. Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Initial setup	a. Remove dust cover from transceiver.		
	b. Connect transceiver to primary power source.		
	c. Turn on power switch.		
2. Power supply	a. Measure voltage between A9A1TP5 (+) and gnd (-).	+15 to +20 V, unregulated	Refer to table 4.
	b. Measure voltage between A9A1TP3 or TP6 (+) and gnd (-).	+14 ±0.7 V	Adjust A9A1R23; refer to table 4.
	c. Measure voltage between A9A1TP2 (+) and gnd (-).	+9 ±0.1 V	Adjust A9A1R12; refer to table 4.
	d. Measure voltage between A9A1TP1 (+) and gnd (-).	+5.1 ±0.05 V	Adjust A9A1R14; refer to table 4.
	e. Measure voltage between feedthrough capacitor A9A2C5 (+) and gnd (-). (+ term has bypass cap.)	+24.5 +2.8, -3 V	Adjust A9A2R3; refer to table 4.
3. Oscillator A7	a. Using high-impedance probe on rf voltmeter, measure signal level at A7P1.	400 mV rms, or greater	Refer to paragraph 4.2; if ineffective, then refer to oscillator A7 instructions.
	b. Connect frequency counter to A7P1 and measure frequency.	39.600 00 MHz ±5 Hz	Refer to oscillator A7 instructions.
	c. Disconnect A7P2 from A3J10. Connect rf voltmeter through 50-Ω adapter to A7P2. Depress SPOT pushbutton and measure signal level. Release SPOT pushbutton.	10 mV rms or greater	Refer to oscillator A7 instructions.
	d. Connect frequency counter to A7P2. Depress SPOT pushbutton. Release SPOT pushbutton.	455 kHz ±15 Hz	Refer to oscillator A7 instructions.
	e. Reconnect A7P2 to A3J10.		
	f. Connect rf voltmeter through 50-Ω adapter to A7P3. Depress SPOT pushbutton and measure signal level. Release SPOT pushbutton.	30 mV rms or greater	Refer to oscillator A7 instructions.
	g. Connect frequency counter to A7P3.	454.2 kHz ±200 Hz	Refer to oscillator instructions.
	h. Reconnect A7P3 to A3J11.		
4. Synthesizer A5	a. Set transceiver frequency to 15.000 00 MHz.		
(Cont)	b. Disconnect A5A1P1 from A3J2. Connect rf voltmeter through 50-Ω adapter to A5A1P1. Measure signal level.	+17 dB mW or greater	Refer to synthesizer A5 instructions.

Table 3. Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	c. Connect frequency counter to A5A1P1 and measure frequency.	54.144 99 MHz ±3 Hz	Refer to synthesizer A5 instructions.
	d. Reconnect A5A1P1 to A3J2.		
	e. Momentarily ground A5A2TP2. Measure voltage between A5A2J1-6 (U6A-6) and gnd (-).	Rapid beeping in speaker. Logic 0 at A5A2J1-6 (U6A-6).	Refer to synthesizer A5 instructions and check loss-of-lock signal.
	f. Remove ground from A5A2TP2.		
5. Audio outputs	***Caution*** Do not key transceiver by switching in MOX or by any other keying means while signal generator is connected to transceiver rf connector.		
	a. Connect signal generator to transceiver rf connector through rf fuseholder and 6-dB attenuator.		
	b. Connect 600-Ω, 1/2-W resistor between transceiver AUD OUT connector and ground, and also connect distortion analyzer to AUD OUT connector.		
	c. Set transceiver switches/controls as follows: MODE: USB VFO: A AF GAIN: As desired RF GAIN: Max cw BW: 2.2 PBT: OPT 2 AGC: Off-switch out NB: Off-switch out MOX: Off-switch out VOX: Off-switch out PROC: Off-switch out POWER: On Tuning: 15.000 00		
(Cont)	d. Adjust signal generator for 15.001-MHz, 10-μV output. Adjust AF GAIN control and note speaker output.	Approx 1-kHz tone heard with level adjustable by AF GAIN control.	Refer to receiver-exciter A3 instructions.

Table 3. Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	e. Connect headphones to front panel PHONES jack, then to rear panel SPKR jack. Adjust AF GAIN control for each connection and note headphones output.	Approx 1-kHz tone heard with level adjustable by AF GAIN control.	Refer to receiver-exciter A3 instructions.
	f. Set reference level on distortion analyzer, then note signal level output and vary AF GAIN control, then RF GAIN control.	Level does not change with AF GAIN but does with RF GAIN adjustments.	Refer to receiver-exciter A3 instructions.
6. Sensitivity	a. Set RF GAIN control to max cw, AF GAIN control as desired, and signal generator output to 1 μV.		
	b. Tune transceiver and signal generator to MHz frequencies indicated and measure (s+n)/n ratio on distortion analyzer each time. Slightly tune signal generator frequency for best ratio.	10 dB or better for each frequency	Refer to receiver-exciter A3 instructions.
	TRANSCEIVER / SIGNAL GENERATOR 1.995 / 1.996 3.999 / 4.000 9.999 / 10.000 19.999 / 20.000 29.699 / 29.700		
7. Image rejection	a. Tune transceiver to 21.000 00 MHz and signal generator to 21.001 MHz. Record distortion analyzer audio voltmeter reading.		
	b. Tune signal generator to 20.089 MHz and increase output level until audio output to voltmeter is same as recorded in test 7.a.		
	c. Note increase in signal generator output level from 1 μV.	Not less than 70 dB	Refer to receiver-exciter A3 instructions.
	d. Adjust signal generator for 21.001 MHz and 1-μV output. Record distortion analyzer audio voltmeter reading.		
	e. Tune signal generator to 99.289 MHz and increase output level until audio output to voltmeter is same as in test 7.d.		
	f. Note increase in signal generator output level from 1 μV.	Not less than 80 dB	Refer to receiver-exciter A3 instructions.

Table 3. Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. Ultimate (s+n)/n	a. Tune transceiver to 21.000 00 MHz and switch in AGC.		
	b. Adjust signal generator for 21.000 80-MHz, 200-mV output.		
	c. Set MODE switch to CW. Press in SPOT pushbutton and slightly adjust signal generator frequency to match 800-Hz SPOT tone.		
	d. Note (s+n)/n on distortion analyzer.	30 dB or better	Refer to receiver-exciter A3 instructions.
9. Passband tuning	a. Tune transceiver and signal generator to 21.000 00 MHz. Set MODE switch to CW and PBT SELECTIVITY control to OPT 1 position.		
	b. Switch BW SELECTIVITY switch to each position that has filter installed. Note speaker output.	800-Hz tone (received CW signal) for each BW position having filter installed	Refer to passband tuning A4 and passband tuning option A13 instructions.
10. Output power	a. Disconnect any equipment from transceiver rf connector.		
	b. Connect wattmeter and dummy load (Bird 813T).		
	c. Tune transceiver to 1.999 00 MHz and select CW mode. Set MIC/CARRIER control to max cw position.		
	d. Note time and switch in MOX. Measure output power. After power decreases to approximately 50 watts, note time.	Full power is not less than 90 watts. Reduced power occurs in 20 ±10 seconds.	Adjust PA ALC pot for 100 watts. If ineffective, refer to power amplifier A1A1 and receiver-exciter A3 instructions.
	e. Switch out MOX, tune transceiver to listed frequency, switch in MOX, and measure full-power output. Continue for all frequencies listed, switching out MOX before changing frequencies. 3.999 MHz 7.299 MHz 14.349 MHz 21.449 MHz 29.699 MHz	Full power is not less than 90 watts for any frequency.	Refer to power amplifier A1A1 and receiver-exciter A3 instructions.

Table 3. Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
11. Output level control	a. Switch out MOX and set MIC/CARRIER control to max ccw position.		
	b. Switch in MOX and, while observing power meter, rotate MIC/CARRIER control to max cw position.	Output power increases smoothly from 0 to not less than 90 watts.	Refer to receiver-exciter A3 instructions.
12. Modulation	a. Switch out MOX. Rotate MIC/CARRIER control to max ccw position. Set MODE switch to USB.		
	b. Connect audio signal generator to AUD IN jack. Adjust for 1000-Hz, 40-mV input to transceiver.		
	c. Switch in MOX and, while observing power meter, rotate MIC/CARRIER control to max cw position.	Output power increases smoothly from 0 to not less than 90 watts.	Refer to receiver-exciter A3 instructions.
	d. Switch out MOX. Disconnect audio signal generator.		
13. VOX	a. Connect microphone to MIC jack. Switch in VOX.		
	b. Observe power meter and speak into microphone.	Output power varies with voice input.	Refer to receiver-exciter A3 instructions.
	c. Rotate VOX GAIN control counterclockwise. Speak into microphone in voice loud enough to cause output power indication on power meter.	Note that louder voice level is required to switch in VOX.	Refer to receiver-exciter A3 instructions.
	d. Readjust VOX GAIN control to desired level. Rotate SSB DELAY control to near max ccw position.		
	e. Speak into microphone to switch transceiver to transmit, then note time required for switching back to receive.		
	f. Rotate SSB DELAY control clockwise. Speak into microphone to cause switching to transmit, then note time required for switching back to receive.	Delay between stopping speaking and switching to receive is longer than in test 13.f.	Refer to receiver-exciter A3 instructions.
(Cont)	g. Readjust SSB DELAY control for desired delay time. Rotate ANTI GAIN control to max ccw position. Increase AF GAIN control to near volume used for normal reception.		

Table 3. Testing and Troubleshooting Procedures (Cont).

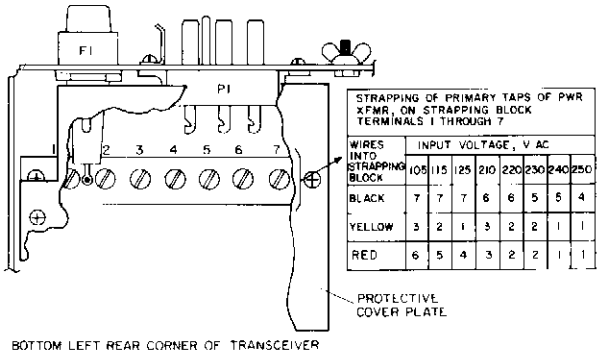
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
13. (Cont)	h. Hold microphone to within approximately 10 cm (4 in) of speaker. Note power meter.	Transceiver switches between transmit and receive, as indicated by fluctuating power meter indication.	Same as test 13.f.
	i. Adjust ANTI GAIN control until transceiver just stops switching between receive and transmit.		
	Note All options may not be installed in the transceiver. Perform only those tests relating to the installed options.		
14. Noise blanker option	***Caution*** During this test, do not key the transceiver. The test equipment could be damaged by an rf output.		
	a. Connect pulse generator and signal generator in parallel through rf fuseholder and 6-dB attenuator to transceiver rf connector.		
	b. Adjust pulse generator for output of 1 to 5 V, 1-μs-wide pulses, minimum rise and fall time, at 50-Hz rate.		
	c. Adjust signal generator for 14.001-MHz, 2-μV output.		
	d. Position transceiver PBT switch to OPT 2 and BW SELECTIVITY switch to 2.2. Set RF GAIN control to max cw and AF GAIN control to near midrange (or to a comfortable listening level). Switch out NB. Turn on power and make sure transceiver is tuned to 14.000 MHz.		
	e. Listen to audio output and switch in NB.	Noise pulses heard until NB switched in; then pulses, if heard, are at reduced level.	Refer to noise blanker A11 instructions.
	f. Turn off and disconnect equipment.		
15. Speech processor option	a. Connect dummy load to transceiver rf connector and microphone to MIC jack.		
	b. Tune transceiver to 14.300 00 set MODE switch to USB, METER switch to ALC, and switch out PROC and switch in MOX.		
(Cont)			

Table 3. Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
15. (Cont)	c. Speak into microphone in normal operating voice and adjust MIC/CARRIER control for S7 to S9 indication on meter. d. Switch in PROC. e. Speak into microphone with same voice level as before and note LED peak indicator on speech processor A12. f. Switch out MOX. g. Turn off and disconnect equipment.	Indicator just flashes on voice peaks.	Refer to speech processor A12 instructions.

Table 4. Power Supply and Frequency Display, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Initial setup	a. Before connecting primary power, check strapping and fuse F1 for correct values. (Refer to schematic diagram and figure below.) Restrap and refuse, if necessary, for bench primary power.		
	b. Connect wattmeter and dummy load to rf output connector J4. Connect CW key and select CW mode.		
	c. Connect and turn on primary power.		
2. +17-V output	a. Measure voltage between A9A1 pin 20 (TP5) and gnd (-).	+15 to +20 V unregulated	Check A9T1, C1, CR1/CR2, and A9F2.
3. +14-V output	a. Measure voltage between A9A1 pin 11 (TP6 (end of R24 nearest C14) and gnd (-)).	+14.5 ±0.25 V	Adjust A9A1R23 (volt adjust). If adjustments ineffective for low voltage, slowly adjust A9A1R16 (current limit) approx 1/8 turn cw. If R16 ineffective, check A9A1C4, A9A1VR2, A9A1U1B, and A9A1Q1.
	b. Connect high-power rheostat and 0- to 30-A ammeter in series. Set rheostat to maximum resistance.		
	c. Connect rheostat and ammeter between C4 (+ terminal) and chassis ground for power supply load.		
	d. Set A9A1R16 to maximum cw position.		
	e. Adjust rheostat for approx 31 A on ammeter, and set A9A1R16 for 30 A on ammeter.		If A9A1R16 adjustments ineffective, check A9A1U1A.



STRAPPING OF PRIMARY TAPS OF PWR XFMR, ON STRAPPING BLOCK TERMINALS 1 THROUGH 7

WIRES INTO STRAPPING BLOCK	INPUT VOLTAGE, V AC							
	105	115	125	210	220	230	240	250
BLACK	7	7	7	6	6	5	5	4
YELLOW	3	2	1	3	2	2	1	1
RED	6	5	4	3	2	2	1	1

Table 4. Power Supply and Frequency Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. +9.0-V output	a. Measure voltage between A9A1 TP2 and gnd (-).	+9.0 ±0.1-V	Adjust A9A1R12. If adjustment ineffective, check A9A1U2.
5. +5.1-V output	a. Measure voltage between A9A1 TP1 and gnd (-).	+5.1 ±0.05-V	Adjust A9A1R14. If adjustment ineffective, check A9A1U3 and A9A1VR1.
	b. On front panel A10, adjacent to display card A10A1, measure voltage between PIN 2 and gnd (-).	+5.0 ±0.2-V	Check A10U1.
	c. On card cage, adjacent to A9C1, measure voltage between A9U1-2 and gnd (-).	+5.0 ±0.2-V	Check A9U1.
6. +24-V output	Measure voltage between feedthrough A9A2C5 and gnd (-).	+24 ±2-V	Adjust A9A2R3 for 33.5 ±2 V at A9A2-TP1. Check A9A2U1, A9A2Q2, and A9A2VR2.
7. Frequency display	a. Disconnect A3J1 from power amplifier A1A1P1. Connect 6-dB attenuator and frequency counter to A3J1.		
	b. Turn on transceiver and press in MOX switch.		
	c. Using frequency control switches and tuning knob, step transceiver through entire frequency range, observing display and frequency counter. *Note* Pressing in ⌈⌈ frequency control switches and rotating tuning knob five turns enables every 100's- and 10's-Hz digit, respectively. Pressing in ⌈ frequency control switch and rotating tuning knob five turns enables every kHz digit. Pressing in ⌉ frequency control switch and rotating tuning knob three times enables every MHz digit.	Transceiver and frequency counter displays indicate same frequency for 10's-Hz and higher digits.	If transceiver display is different from frequency counter display or if transceiver display digit is faulty, the input digit is faulty; input fixed logic levels on ADRS and BCD input lines on display A10A1 and check suspected component. Replace component not giving proper output.
(Cont)			

Table 4. Power Supply and Frequency Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont) (Cont)			***Note*** Logic 1 is +5-V from a power supply applied through 10-kΩ resistor to each SEG input and through 390-Ω resistor to each ADRS input requiring logic 1 for test. Logic 0 is applied by directly grounding each input requiring logic 0 for test. ***Note*** An ADRS input must be provided to check an associated driver and display digit with SEG inputs. Refer to following list and apply indicated ADRS inputs to enable selected driver and digit. Then apply indicated SEG inputs to enable various numbers.

Table 4. Power Supply and Frequency Display, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL

7. (Cont)

DIGIT ENABLED	ADRS (BCD 4 J1-5,	2 -7,	1 -9	OUTPUT LOGIC FROM U1-PIN NO
10's MHz (DS1A)	0	0	0	15 = 1, others = 0
1's MHz (DS1B)	0	0	1	14 = 1, others = 0
0.1's MHz (DS2)	0	1	0	13 = 1, others = 0
10's kHz (DS3A)	0	1	1	12 = 1, others = 0
1's kHz (DS3B)	1	0	0	11 = 1, others = 0
0.1's kHz (DS4A)	1	0	1	11 = 1, others = 0
10's Hz (DS4B)	1	1	0	9 = 1, others = 0

NUMBER DISPLAYED	SEG (BCD 8 J1-8,	4 -10,	2 -4,	1) -6
0	0	0	0	0
*1	0	0	0	1
*2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
Display blanked	1	0 thru	1	0
	1	1	1	1

*10's MHz digit displays 1 or 2 only

d. Switch out MOX. Turn off transceiver power. Reconnect A1A1P1 to A3J1.

4. ADJUSTMENTS

4.1 Receiver-Exciter Sidetone and Spot Potentiometer Adjustments

Refer to figure 1 for locations of sidetone frequency and level, and spot tone level potentiometers. These potentiometers may be adjusted to the level or frequency desired by the operator.

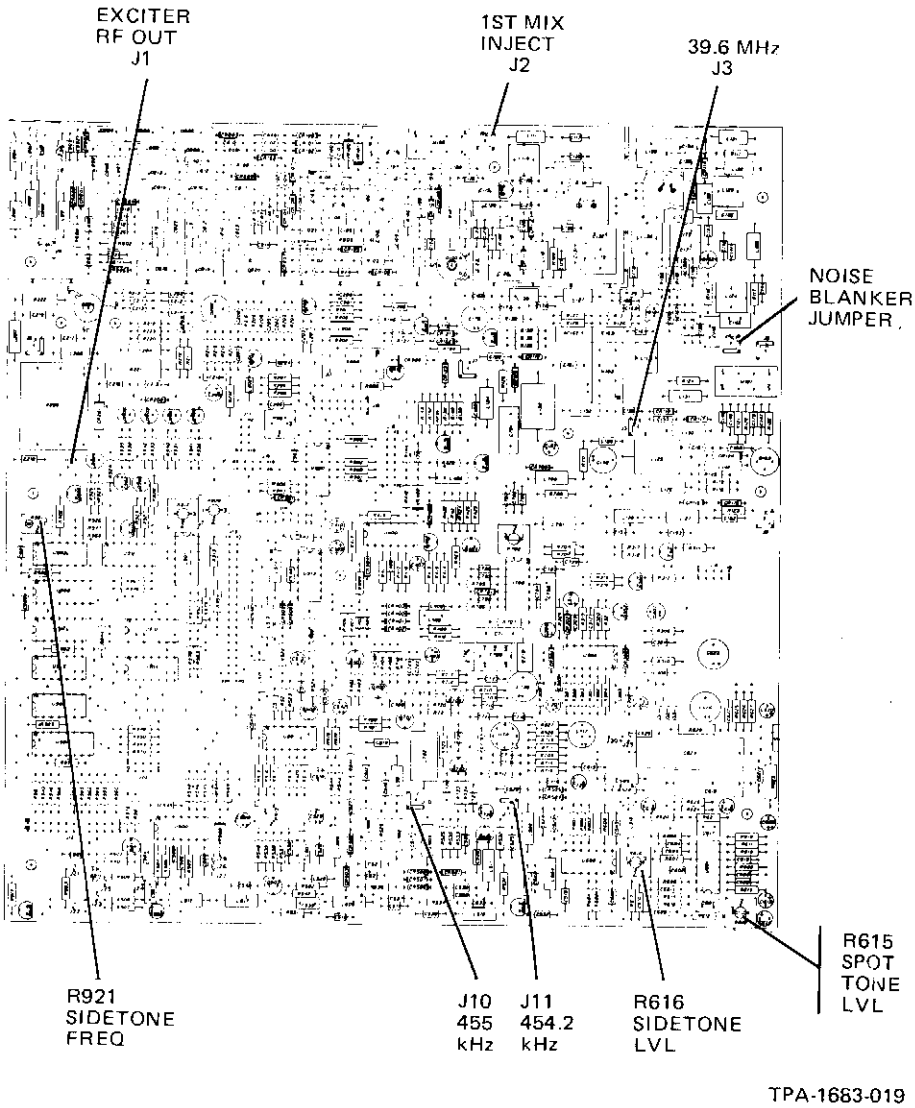
Caution

Do not make any other adjustments on the receiver-exciter board without the instructions and test equipment setup given in the receiver-exciter instruction section tables 1 and 2.

4.2 39.6-MHz and 455-kHz Oscillator Adjustments

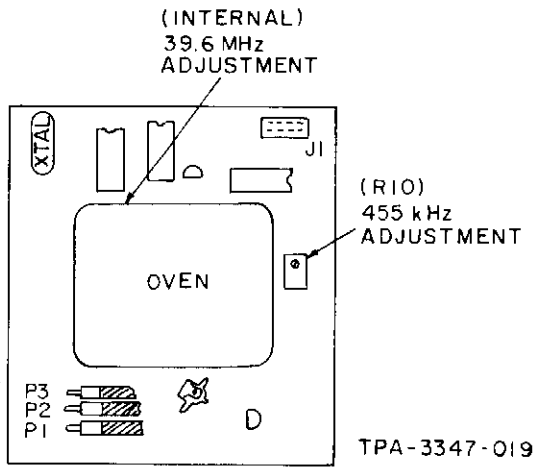
The oscillator frequencies are adjustable over a limited range. The oscillators do not normally need adjustment; however, trimmer capacitors are readily accessible if adjustment is required. No test equipment is required.

The test for off-frequency operation and corrective adjustment procedures are as follows:



Receiver-Exciter Connectors and Adjustments Locations
Figure 1

a. Set mode to USB.
b. Set BW to 8.0 and PBT to vertical (OPT 1) position.
c. Tune to radio station WWV at 15.000 00 MHz.
d. Adjust dial frequency for exact zero-beat of station.
e. Note dial frequency offset, if any.
f. Repeat operation for 10.000 00 MHz and 5.000 00 MHz, noting frequency offset.
g. If frequency offset is the same for each frequency, the 455-kHz oscillator needs adjusting. If offsets differ, the 39.6-MHz oscillator needs adjusting.
h. To adjust either oscillator, remove unit dust cover and card cage cover. Lift oscillator A7 part way out of cage. Tune WWV at 15.000 00 MHz. Set dial frequency to 15.000 00 MHz. Adjust the appropriate control for zero beat. (Refer to figure 2 for adjustment locations.)
i. Recheck frequency offsets, as above. If both oscillators are off frequency, these steps may have to be repeated several times. Replace the oscillator and covers when adjustments are completed.



Oscillator A7 Frequency Adjustment Locations
Figure 2

5. DISASSEMBLY/ASSEMBLY

Procedures for removing or replacing circuit cards/assemblies and chassis mounted components are obvious after mechanical inspection. Refer to parts list for location information.

5.1 Replaceable Fuses and Lamps

a. There are two fuses required for primary power A9F1 and A9F2. A9F1 is located on the rear panel and may be fused for 115 VAC (8 AMP) or 230 VAC (4 AMP). A9F2 is located under the power strapping cover plate. To replace A9F2, remove dust cover and power strapping cover plate. A9F2 is a 30A fuse for dc operation.
b. There are two fuses, A9A1F1 and A9A1F2, located on the power supply control card. Both are easily accessible once the dust cover is removed; both are 2 A.
c. The panel meter lamps are located at the top rear of the meter on the top rear of the A10 front panel assembly. The lamps used are type 7373, 100 mA, 14 V.

6. REPAIR

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be utilized to prevent equipment damage. Refer to paragraph 6.2, Electrostatic Discharge Sensitive Devices Precautions, before performing maintenance on the equipment.

6.1 General

Use standard shop repair practices to remove and replace chassis-mounted components or subassemblies. Make adequate notes to enable restoration of wire location and lead dress to original positions.

Caution

Avoid use of excessive heat when soldering to solid state devices or the circuit board. Otherwise, the devices may be damaged or the copper circuit foil may lift from the board.

Use standard solid state device and circuit card repair techniques to remove and replace components on the circuit cards. The following paragraphs provide special information for handling ESDS devices, and for removing and replacing postcoating on circuit cards.

6.2 Electrostatic Discharge Sensitive Devices Precautions

A static charge is produced by friction between, and separation of, dissimilar materials. Potentials of 1 to 20 kilovolts are commonly generated on the human

body or insulated surfaces. Voltages of this magnitude can produce both immediate and latent failure in electrostatic discharge sensitive (ESDS) devices.

Note

Dry weather (relative humidity less than 30 percent) multiplies the accumulation of static charges on a surface. In a low-humidity environment, the handling procedures specified are of greater importance and should be adhered to without exception.

6.2.1 Handling of ESDS Devices

Caution

Do not use nylon or other synthetic material gloves when handling ESDS devices. Excessive static can build up on this type of material. Handle ESDS devices by their case whenever possible. Avoid touching the leads or contacts even though grounded.

The transport of ESDS devices at the component level requires that all device leads be effectively shorted together. This can be accomplished by one of the following methods.

a. Insert device in high-density conductive foam.
b. Insert device in aluminum foil-lined individual packages.
c. Insert device in a dual-in-line carrier tube made of aluminum or specially coated plastic (must be labeled as static charge dissipative).

The label shown below shall be shown on all individual part containers:

Caution

This component can be damaged by static electricity. Special handling methods and materials must be utilized.

Antistatic protection is required for ESDS devices from the time they are received until they are terminated in a protective subassembly. If ESDS devices are in subassemblies that do not provide adequate ESDS device protection, they are still vulnerable to static damage.

The transport of circuit board or module subassemblies containing ESDS devices requires that contact with exposed subassemblies be prevented. Conductive plastic bags, not clear polyvinyl, are well suited to this purpose. After the subassembly containing ESDS devices is installed in the top level unit, normal ESDS devices handling is adequate.

6.2.2 Storage of ESDS Devices

The methods of handling described in paragraph 6.2.1 are acceptable methods of storage.

6.2.3 Testing of Subassemblies Containing ESDS Devices

Observe the following precautions when testing any subassembly containing ESDS devices.

a. Remove power from test fixtures of equipment before inserting/removing any ESDS device or subassembly containing an ESDS device.
b. Ground all test equipment.
c. Apply dc source power to ESDS device or subassembly containing an ESDS device before applying any signal voltages.
d. Remove signal voltages from ESDS device or subassembly containing an ESDS device before removing dc source power.
e. Do not make dielectric strength or insulation resistance checks for any ESDS device or subassembly containing an ESDS device.

6.2.4 Replacement of ESDS Devices

Caution

Protective carriers for ESDS devices should be placed on grounded conductive work-station surfaces.

It is recommended that an ionized air blower be used in the work area where personnel are handling ESDS devices and that personnel work in the path of the ionized air. The blower should be operated for 3 minutes before handling an ESDS device so that residual static charges may be removed. In lieu of an ionized air blower, a grounded wrist strap in contact with bare skin can be used.

Warning

If a grounded wrist strap is used, take all necessary precautions to make sure the wrist strap and/or ground lead cannot make contact with any voltage sources in the area of the work station.

Obseve the following precautins when replacing an ESDS device.

a. Ground soldering iron tips, special tools, and handtools.
b. Use only uninsulated metal handtools. Place all handtools on conductive work-station surface when they are not in use.
c. Keep leads of ESDS devices in contact with conductive material, except when being installed, to avoid buildup of static charge.
d. Do not install (insert) or remove ESDS devices from circuits with power on. Transient voltages may cause damage.
e. Connect all unused input leads of ESDS device to circuit ground or ESDS device supply, whichever is applicable for logic circuit involved.

HF-380 Receiver-Transmitter

Rockwell International

parts list

Collins Telecommunications Products Division

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1 August 1982

list of illustrations

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2	Chassis A9	10
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4	24-Volt Regulator A9A2	19
5	Front Panel A10	21
6	Display A10A1	25

1. INTRODUCTION

1.1 General

The purpose of this parts list is for identification, requisition and issuance of parts.

Parts listed meet critical equipment design specification requirements. Use only part numbers specified in this parts list for replacement of parts.

1.2 Group Assembly Parts List

FIG-ITEM Column — Digits preceding the dash refer to figure numbers. Digits following the dash are item numbers assigned in sequence to correspond with item numbers on the illustrations.

PART NO Column — Listed are MIL standard, vendor, or Collins part numbers. Collins part numbering system consists of 10 digits as follows: a 3-digit family number, a 4-digit serial number, and a 3-digit dash number.

INDENT Column — Items are coded 1, 2, 3, etc, to indicate the relationship to the next higher assembly.

DESCRIPTION Column — Listed are the noun name, modifier, descriptive information, federal manufacturer's code, reference designation, attaching part (AP), reference to other figures, and effectivities.

Attaching parts are identified by (AP) following the part or parts they attach.

Effectivities are identified by the following methods: MCN (Manufacturer Control Number) 101 and up; CI (Configuration Identifier) 5-digit number; REV (Revision Identifier) dash (—) denotes original, letter A first change, letter B second change, etc. One of the above identifiers is listed on each chassis and/or replaceable assembly. Service Bulletins are identified by SB 1, SB 2, etc.

UNITS PER ASSY Column — Quantities specified are per item number. Letters AR denote the selection of parts as required. Letters REF refer to an assembly completely assembled on a preceding figure and illustration.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

1.3 Numerical Index

PART NUMBER Column — Part numbers are listed in alphanumeric sequence.

FIG-ITEM Column — Digits preceding the dash refer to figure numbers. Digits following the dash are item numbers.

TTL REQ Column — Listed is the total quantity of parts or assemblies covered in the Group Assembly Parts List.

1.4 Reference Designation Index

REFERENCE DESIGNATION Column — Reference designations are listed in alphanumeric sequence.

FIG-ITEM Column — Digits preceding the dash refer to figure numbers. Digits following the dash are item numbers.

PART NUMBER Column — Part numbers listed are for items that have reference designations assigned.

1.5 How To Use This Parts List

To locate a part number if the assembly in which the part is used is known, turn to the List of Illustrations and find the page number for the assembly in which the part is used. Locate the part and its index number on the illustration and find the index number on the Group Assembly Parts List page to determine its description and part number.

To locate the illustration for a part if the reference designation is known, refer to the Reference Designation Index and find the symbol; turn to the Group Assembly Parts List and find the figure and index number indicated in the index.

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All supporting parts list illustrations that contain ESDS items are shown with the following symbol.

1.6 Manufacturer's Code, Name, and Address

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
A1704	MC DIVISION ELECTRONIC INSTRUMENT AND SPECIALTIES CORP 42 PLEASANT ST STONEHAM MA 02180
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
00853	SANGAMO WESTON INC SANGAMO CAPACITOR DIV SANGAMO RD P O BOX 128 PICKENS SC 29671
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
05277	WESTINGHOUSE ELECTRIC CORP SEMICONDUCTOR DIV HILLS ST YOUNGWOOD PA 15697
05464	INDUSTRIAL ELECTRONIC ENGINEERS INC 7720 LEMONA AVE VAN NUYS CA 91405
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV SUB OF SCHLUMBERGER LTD NORTH AMERICAN SALES MAIL STOP 14-1053 401 ELLIS ST P O DRAWER 7284 MOUNTAIN VIEW CA 94042
07388	TOROTEL PRODUCTS INC 13402 S 71 HWY GRANDVIEW MO 64030
11237	CTS KEENE INC 3230 RIVERSIDE P O BOX 1977 PASO ROBLES CA 93446
11700	JB ELECTRONIC TRANSFORMERS INC 2300 W ARMITAGE AVE CHICAGO IL 60647
12954	SIEMENS CORP COMPONENTS GROUP 8700 E THOMAS RD P O BOX 1390 SCOTTSDALE AZ 85252
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
14099	SEMTECH CORP 652 MITCHELL ROAD NEWBURY PARK CA 91320
14433	ITT SEMICONDUCTOR DIV WEST PALM BEACH FL
15686	DISC INSTRUMENTS INC 102 E BAKER ST COSTA MESA CA 92626
24226	GOWANDA ELECTRONICS CORP NO 1 INDUSTRIAL PL GOWANDA NY 14070
24444	GENERAL SEMICONDUCTOR INDUSTRIES INC 2001 W 10TH PLACE P O BOX 3078 TEMPE AZ 85281
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
27193	EATON CORP SPECIALTY PRODUCTS OPERATIONS 4201 N 27TH ST MILWAUKEE WI 53216

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
31918	ITT SCHADOW INC 8081 WALLACE RD EDEN PRAIRIE MN 55343
32171	MODUTEC INC 18 MARSHALL ST NORWALK CT 06854
33095	SPECTRUM CONTROL INC 8061 AVONIA RD FAIRVIEW PA 16415
34263	CTS OF BROWNSVILLE INC 1100 ROOSEVELT ST BROWNSVILLE TX 78520
49671	RCA CORP 30 ROCKEFELLER PLAZA NEW YORK NY 10020
49956	RAYTHEON CO EXECUTIVE OFFICES 141 SPRING ST LEXINGTON MA 02173
50508	MAGNETIC COMPONENTS INC 9520 AINSLIE ST SCHILLER PARK IL 60176
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
55009	ELMO SEMICONDUCTOR CORP 5300 SANTA MONICA BLVD LOS ANGELES CA 90029
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
71400	MCGRAW-EDISON CO BUSSMANN MFG DIV 502 EARTH CITY PLAZA P O BOX 14460 ST LOUIS MO 63178
71450	CTS CORP 905 N WEST BLVD ELKHART IN 46514
71468	ITT CANNON ELECTRIC DIV OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORP 10550 TALBERT AVE P O BOX 8040 FOUNTAIN VALLEY CA 92708
71590	GLOBE-UNION INC CENTRALAB ELECTRONICS DIV HWY 20 W P O BOX 858 FORT DODGE IA 50501
71744	GENERAL INSTRUMENT CORP LAMP DIV 4433 N RAVENS WOOD AVE CHICAGO IL 60640
71785	TRW INC TRW CINCH CONNECTORS DIV 1501 MORSE AVE ELK GROVE VILLAGE IL 60007
75915	LITTELFUSE INC 800 E NORTHWEST HWY DES PLAINES IL 60016
76854	OAK SWITCH SYSTEMS INC SUB OF OAK TECHNOLOGY INC 100 S MAIN ST P O BOX 517 CRYSTAL LAKE IL 60014
77250	ALLIED PRODUCTS CORP PHEOLL MFG CO DIV 5700 W ROOSEVELT RD CHICAGO IL 60650
78488	STACKPOLE CARBON CO ST MARYS PA 15857
81349	MILITARY SPECIFICATIONS
82389	SWITCHCRAFT INC SUB OF RAYTHEON CO 5555 N ELSTRON AVE CHICAGO IL 60630
86797	ROGAN CORP 3455 WOODHEAD DR NORTHBROOK IL 60062
91637	DALE ELECTRONICS INC P O BOX 609 COLUMBUS NE 68601
96214	TEXAS INSTRUMENTS INC EQUIPMENT GROUP 13500 N CENTRAL EXPY P O BOX 226015 DALLAS TX 75266
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544
99392	MEPCO/ELECTRA INC ROXBORO DIV INDUSTRIAL DR P O BOX 1223 ROXBORO NC 27573

1.7 Reference Designation Prefixes

The following prefixes have been assigned in this manual:

PREFIX	UNIT PART NUMBER	FIG-ITEM
A9	641-7103-001	2
A9A1	638-6825-001	3

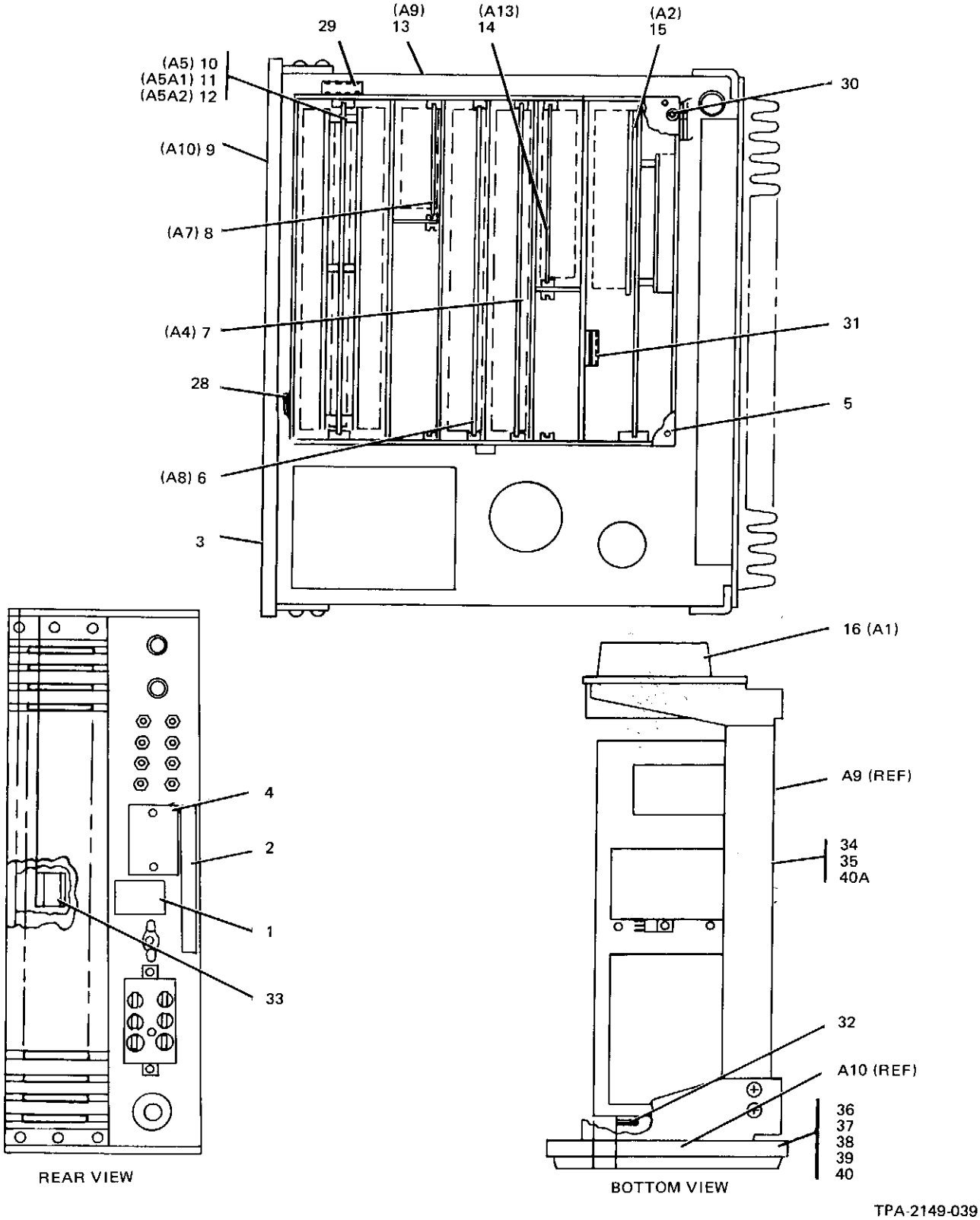
PREFIX	UNIT PART NUMBER	FIG-ITEM
A9A2	638-6275-001	4
A9A2	638-6275-002	4
A10	641-7104-001	5
A10A1	638-6931-001	6

1.8 Configuration Identifiers

The following CI's/REV LTR's were used in compiling data for this manual:

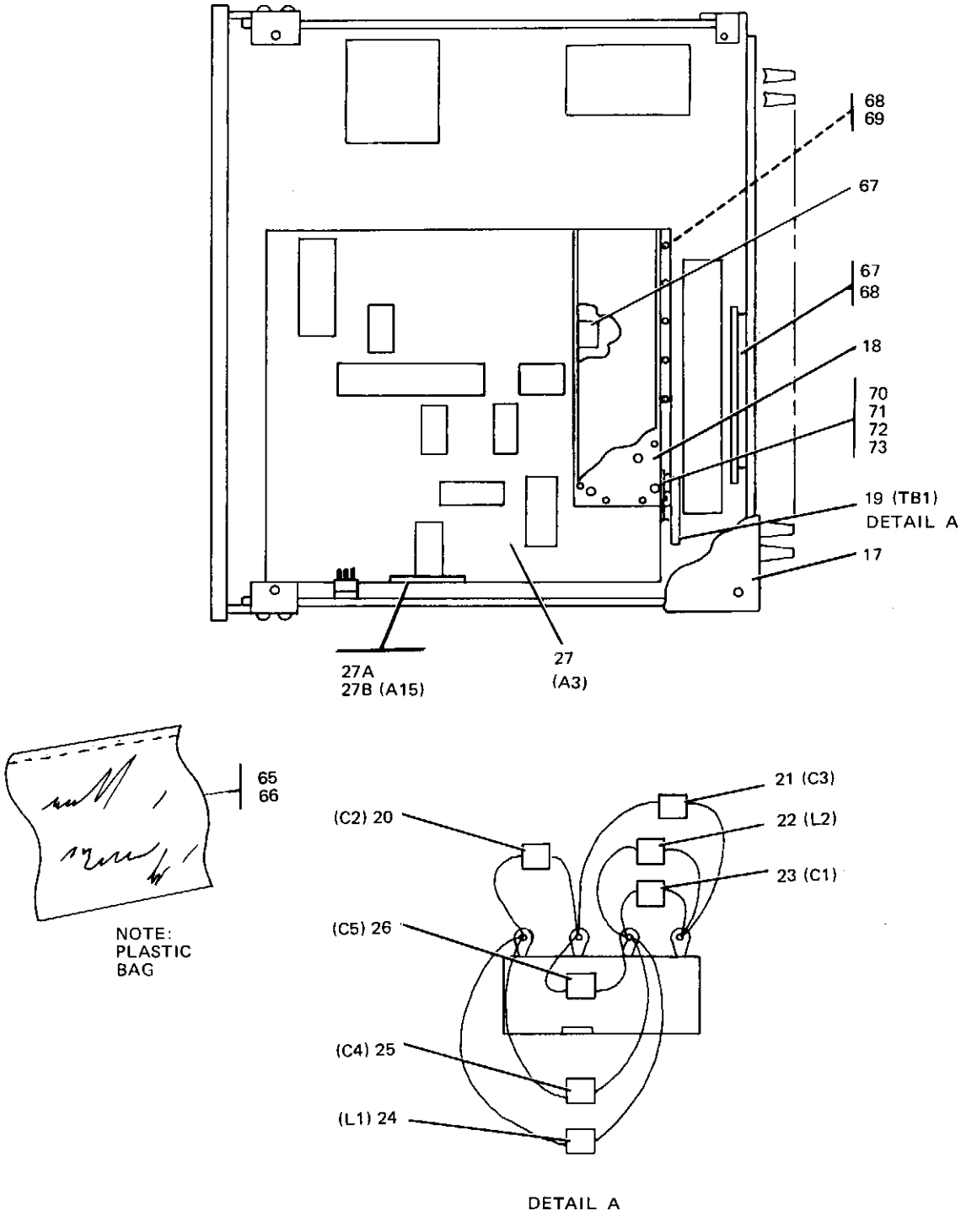
CI/ REV LTR	UNIT PART NUMBER	FIG-ITEM
M	641-7103-001	2
K	638-6825-001	3
G	638-6275-001	4
G	638-6275-002	4
N	641-7104-001	5
G	638-6931-001	6

2. GROUP ASSEMBLY PARTS LIST



HF-380 Receiver-Transmitter
Figure 1 (Sheet 1 of 3)

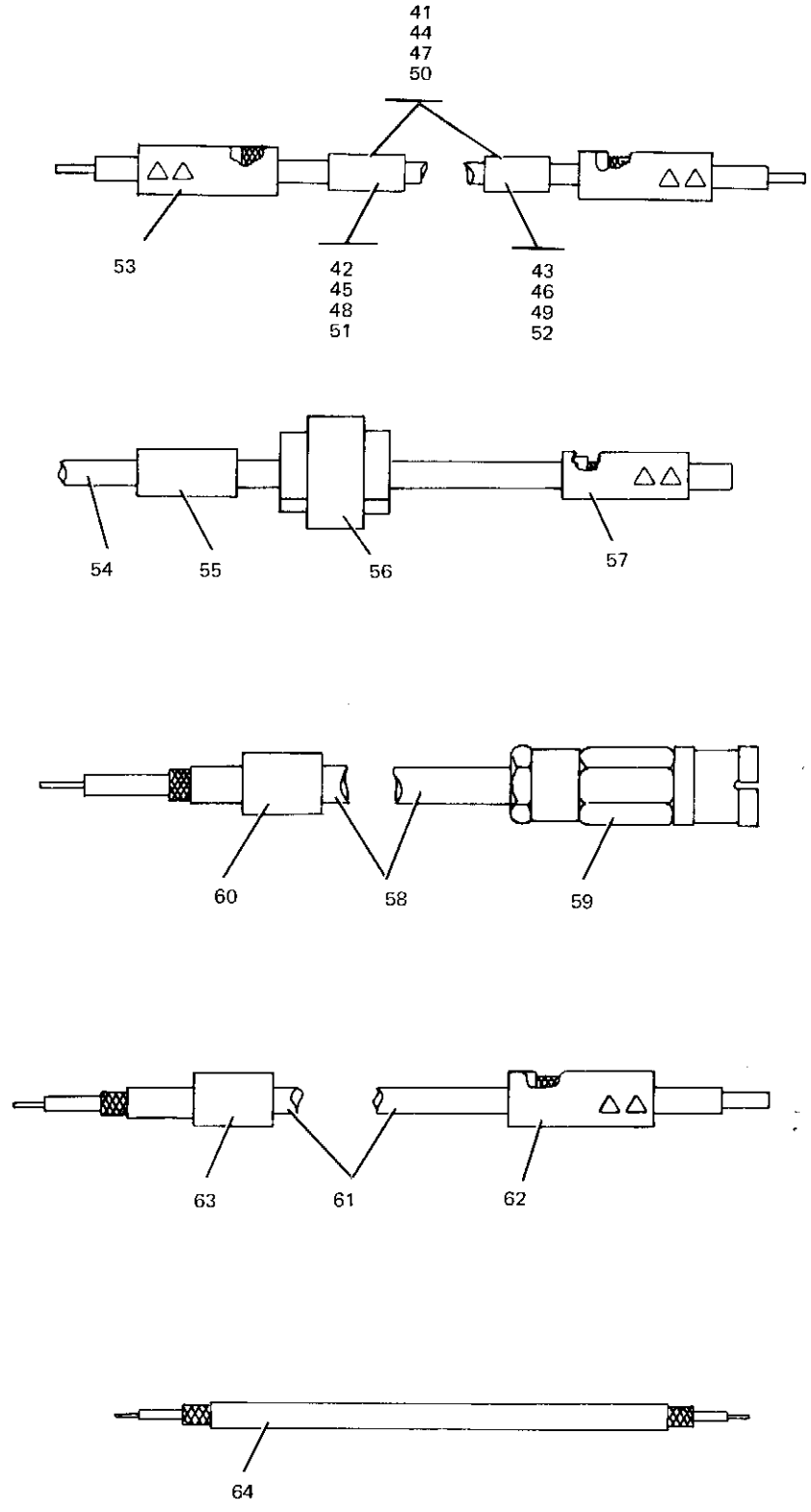
GROUP ASSEMBLY PARTS LIST



TPA-2149-039

HF-380 Receiver-Transmitter
Figure 1 (Sheet 2)

GROUP ASSEMBLY PARTS LIST



TPA-2149-039

HF-380 Receiver-Transmitter
Figure 1 (Sheet 3)

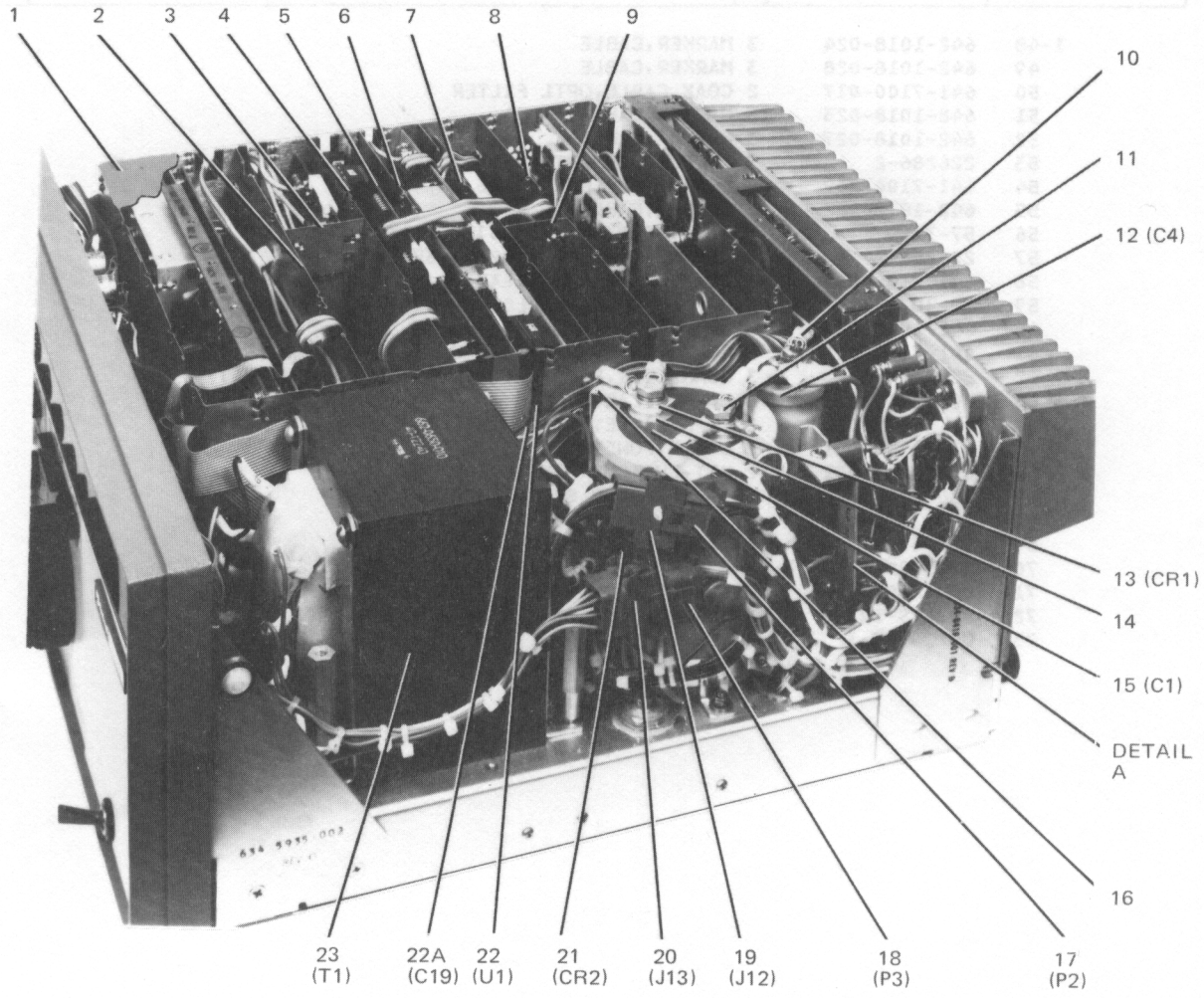
GROUP ASSEMBLY PARTS LIST

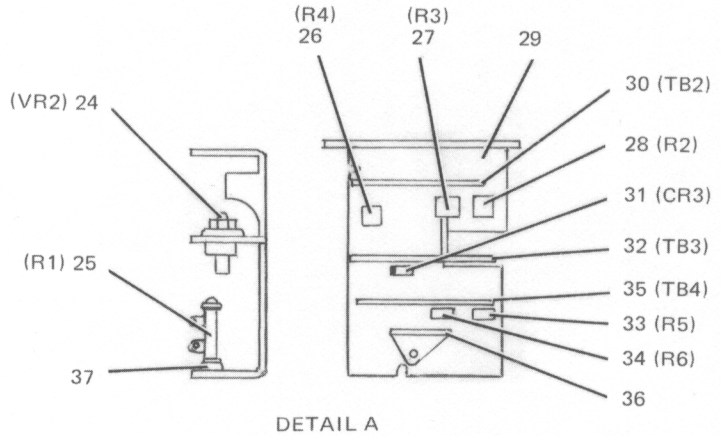
FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
1-	622-3580-001	1	RECEIVER- TRANSMITTER HF-380	1	
1	641-3700-001	2	PLATE,MOD	1	
2	642-0028-000	2	PLATE,IDENT	1	
3	641-7115-001	2	INSERT,IDENT	1	
4	634-5903-003	2	PLATE,COVER (EFF TO REV LTR L)	1	
5	641-7097-001	2	COVER,CARD CAGE	1	
6	638-6929-002	2	CONTROL A8 (EFF TO REV LTR L)	1	
6	638-6929-004	2	CONTROL A8 (EFF REV LTR L)	1	
7	638-6912-002	2	PASS BAND TUNING A4	1	
8	638-6918-001	2	OSCILLATOR A7	1	
9	641-7104-001	2	FRONT PANEL A10 (SEE FIG 5)	1	
10	641-7099-001	2	SYNTHESIZER A5	1	
10	641-7099-002	2	SYNTHESIZER A5	1	
11	638-6916-002	3	OUTPUT LOOP A5A1	1	
12	638-6920-001	3	VARIABLE LOOP A5A2	1	
13	641-7103-001	2	CHASSIS A9 (SEE FIG 2)	1	
14	638-6914-002	2	PASS BAND TUNING A13	1	
15	641-7132-001	2	LOW PASS FILTER A2	1	
16	634-8481-003	2	POWER AMPLIFIER A1	1	
17	634-5943-001	2	COVER ASSY, STATIONARY	1	
18	641-7140-001	2	SHIELD,COVER	1	
19	332-14-04-022	2	TERMINAL BOARD (71785) 306-9032-000 TB1	1	
20	CM04ED330J03	2	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 500V (81349) 912-3848-000 C2	1	
21	CM04ED820J03	2	CAPACITOR,FXD MICA DIEL, 82PF, 5%, 500V (81349) 912-3873-000 C3	1	
22	MS75083-06	2	COIL,RF 0.27UH (96906) 240-2016-000 L2	1	
23	CM04ED330J03	2	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 500V (81349) 912-3848-000 C1	1	
24	MS18130-1	2	COIL,RF 0.15UH (96906) 240-1562-000 L1	1	
25	CM04FD101J03	2	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V (81349) 912-3879-000 C4	1	
26	CM05FD151J03	2	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V (81349) 912-2828-000 C5	1	
27	638-6908-002	2	RECEIVER/EXCITER A3	1	
27A	646-5802-001	2	AUDIO LOW PASS FILTER A15	1	
27B	647-2924-001	2	BRACKET, MOUNTING	1	
	P313-0140-000	2	NUT,PLAIN,HEX NP BRS, 6-32 (77250) 313-0140-000 (AP)	1	
	MS35338-98	2	WASHER,SPRING CD PL BRZ, 0.141 ID X 0.250 OD (96906) 310-0096-000 (AP)	1	
	MS51957-28	2	SCREW,MACH SST, 6-32 X 3/8 (96906) 343-0169-000 (AP)	1	
	MS51957-26	2	SCREW,MACH SST, 6-32 X 1/4 (96906) 343-0167-000 (AP)	1	
28	641-7166-001	2	CABLE,CARD GAGE (NON-REPAIRABLE ITEM)	1	
29	641-7167-001	2	CABLE,SMO (NON-REPAIRABLE ITEM)	1	
30	641-7173-001	2	CABLE,BAND PASS TUNING (NON-REPAIRABLE ITEM)	1	
31	641-7169-001	2	CABLE,LOW PASS FILTER (NON-REPAIRABLE ITEM)	1	
32	641-7168-001	2	CABLE,CONTROL DISPLAY (NON-REPAIRABLE ITEM)	1	
33	641-7170-001	2	CABLE,REAR PANEL (NON-REPAIRABLE ITEM)	1	
34	641-7123-001	2	CABLE,SPECIAL PURPOSE	1	
35	641-7123-002	2	CABLE,SPECIAL PURPOSE	1	
36	641-7123-003	2	CABLE,SPECIAL PURPOSE	1	
37	641-7123-004	2	CABLE,SPECIAL PURPOSE	1	
38	641-7123-005	2	CABLE,SPECIAL PURPOSE	1	
39	641-7123-006	2	CABLE,SPECIAL PURPOSE	1	
40	641-7123-007	2	CABLE,SPECIAL PURPOSE	1	
40A	641-7123-008	2	CABLE,SPECIAL PURPOSE	1	
41	641-7100-001	2	COAX CABLE,BAND PASS FILTER	1	
42	642-1018-023	3	MARKER,CABLE	1	
43	642-1018-019	3	MARKER,CABLE	1	
44	641-7100-002	2	COAX CABLE, BAND PASS FILTER	1	
45	642-1018-026	3	MARKER,CABLE	1	
46	642-1018-020	3	MARKER,CABLE	1	
47	641-7100-008	2	COAX CABLE,OPTL FILTER	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
1-48	642-1018-024	3	MARKER,CABLE	1	
49	642-1018-028	3	MARKER,CABLE	1	
50	641-7100-017	2	COAX CABLE,OPTL FILTER	1	
51	642-1018-025	3	MARKER,CABLE	1	
52	642-1018-027	3	MARKER,CABLE	1	
53	226286-2	3	CONNECTOR,RCPT (00779) 357-0067-010	8	
54	641-7100-007	2	COAX CABLE,RCV IN/RE	1	
55	642-1018-022	3	MARKER,CABLE	1	
56	57-1559	3	CORE,FERRITE (78488) 288-1337-050	1	
57	226286-2	3	CONNECTOR,RCPT (00779) 357-0067-010	1	
58	641-7100-014	2	COAX CABLE,ANT RELAY NO.2	1	
59	52-307-3188	3	CONNECTOR,PLUG ELEC (98291) 357-7207-010	1	
60	642-1018-030	3	MARKER CABLE	1	
61	641-7100-015	2	COAX CABLE, XVERTER/RE	1	
62	52-307-3188	3	CONNECTOR,PLUG ELEC (98291) 357-7207-010	1	
63	642-1018-021	3	MARKER,CABLE	1	
64	641-7100-016	2	COAX CABLE,RCV IN/ANT FILTER	1	
65	634-8498-001	2	CABLE,POWER	1	
66	641-7181-001	2	KIT,CUSTOMER INSTL	1	
67	280-2745-020	2	LABEL,PRESS SENS (ESDS) (12998)	1	
68	280-3821-020	2	LABEL,PRESS SENS (12998)	1	
69	280-3821-010	2	LABEL,PRESS SENS (12998)	1	
70	M24308/26-1	2	SCREW,ASMBLD CLIP (81349) 371-0062-000	1	
71	DBM-25P	2	CONNECTOR,RCPT ELEC (71468) 371-0170-000	1	
72	D20419-18	2	SCREW LOCK ASSY (71468) 371-0040-020	1	
73	DB110963-3	2	SHELL,JUNCTION (71468) 371-0392-030	1	

GROUP ASSEMBLY PARTS LIST



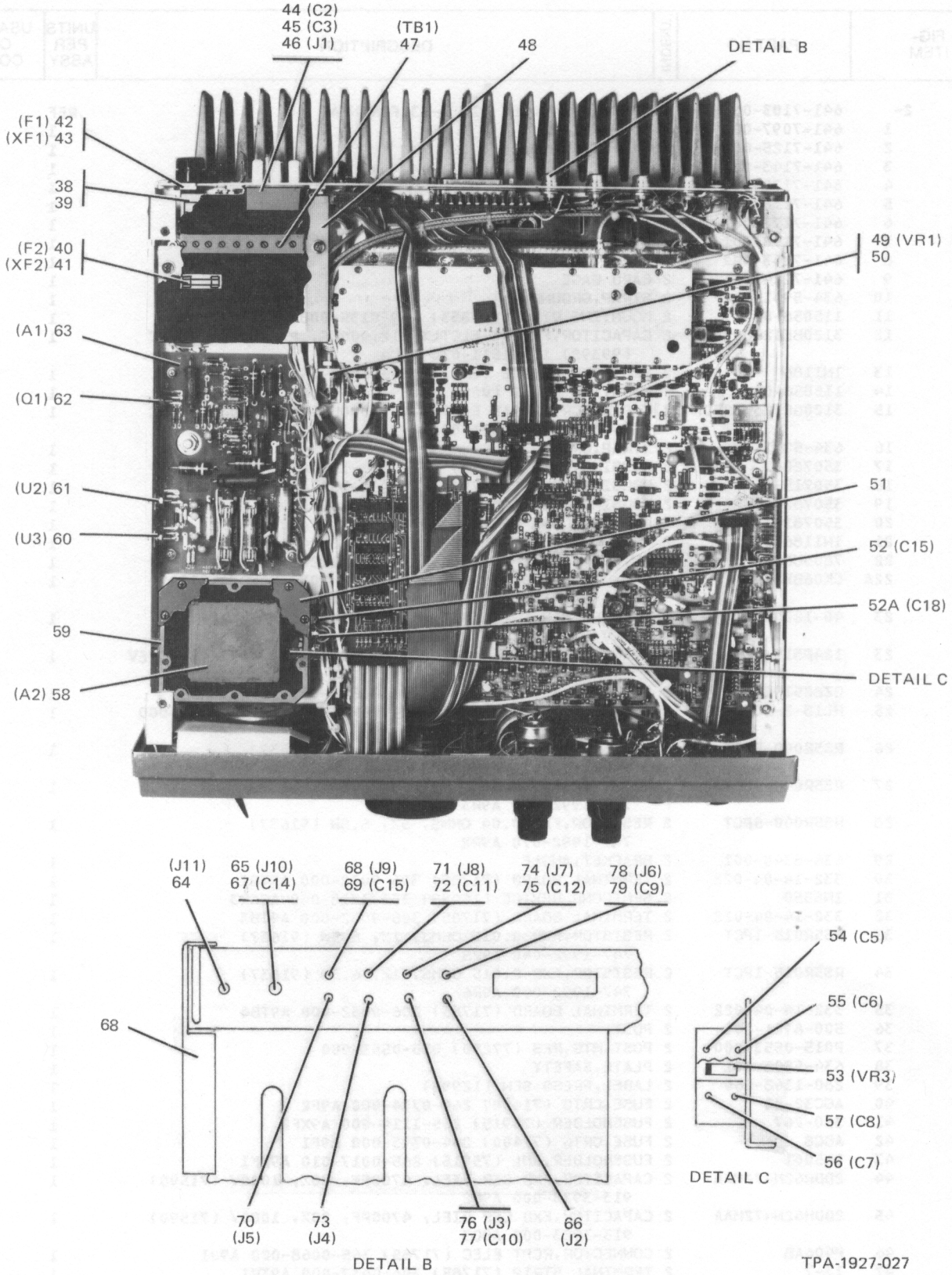


DETAIL A

TPA-1927-027

Chassis A9
Figure 2 (Sheet 1 of 2)

GROUP ASSEMBLY PARTS LIST



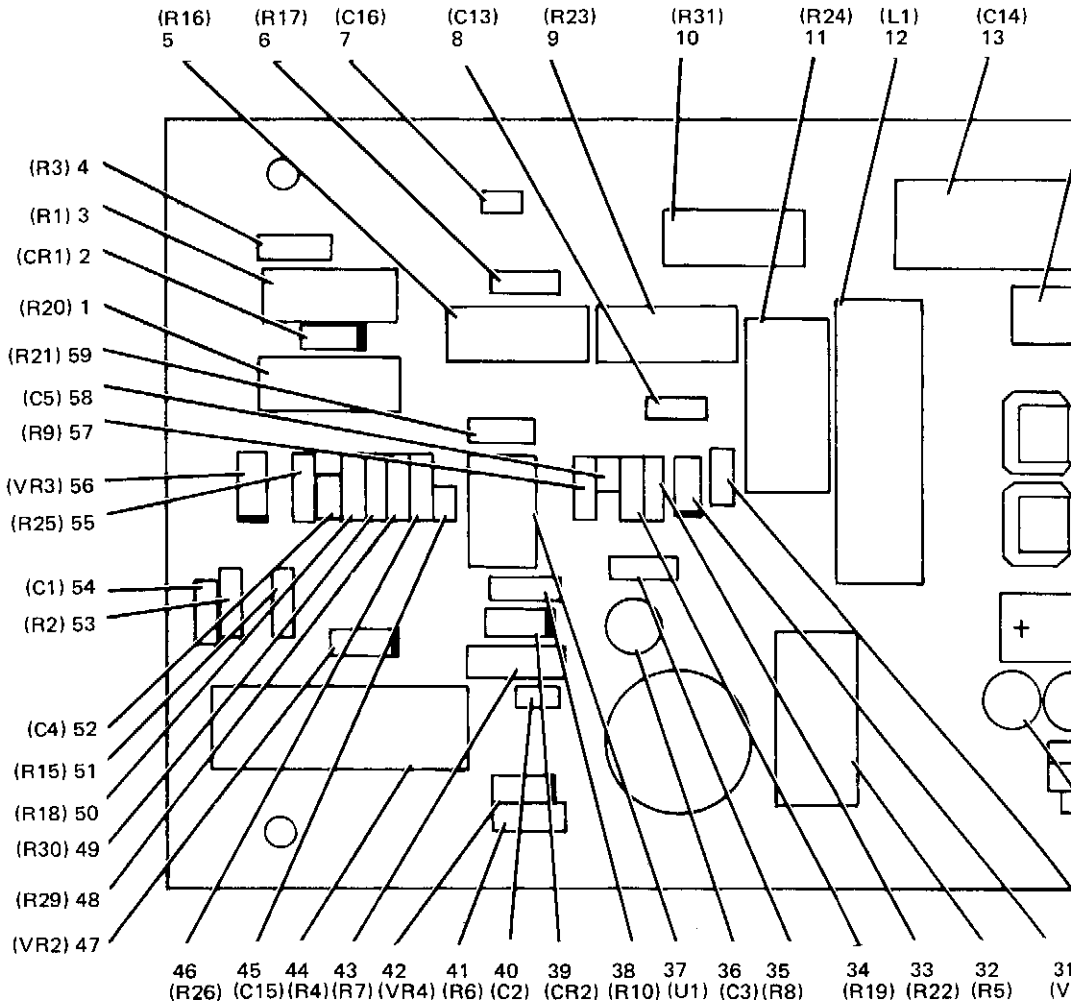
Chassis A9
Figure 2 (Sheet 2)

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
2-	641-7103-001	1	CHASSIS A9 (SEE FIG 1-13 FOR NHA)	REF	
1	641-7097-002	2	COVER, CARD	1	
2	641-7125-001	2	PARTITION-NO.1	1	
3	641-7143-001	2	PARTITION	1	
4	641-7175-001	2	PARTITION-NO.2	1	
5	641-7176-001	2	PARTITION-NO.3	1	
6	641-7177-001	2	PARTITION-NO.4	1	
7	641-7178-001	2	PARTITION-NO.5	1	
8	641-7143-002	2	PARTITION	1	
9	641-7124-001	2	CARD GAGE	1	
10	634-5941-002	2	STRAP,GROUND	1	
11	115058-06	2	MOUNTING RINGS (00853) 139-0135-000	1	
12	3120BE123U025BP	2	CAPACITOR,FXD AL ELCTLT, 12,000UF, P75%M10%, 25VDC (99392) 183-1511-010 A9C4	1	
13	1N1186	2	SEMICOND DEVICE (05277) 353-6478-040 A9CR1	1	
14	115058-01	2	MOUNTING RINGS (00853) 139-0139-000	1	
15	3120GE723U025DP	2	CAPACITOR,FXD AL ELCTLT, 72,000UF, P75%M10%, 25VDC (99392) 183-1511-030 A9C1	1	
16	634-5941-001	2	STRAP,GROUND	1	
17	350720-1	2	HOUSING,CONN (00779) 372-0064-150 A9P2	1	
18	350715-1	2	HOUSING,CONN (00779) 372-0064-130 A9P3	1	
19	350782-1	2	HOUSING,CONN (00779) 372-0064-160 A9J12	1	
20	350781-1	2	HOUSING,CONN (00779) 372-0064-140 A9J13	1	
21	1N1186	2	SEMICOND DEVICE (05277) 353-6478-040 A9CR2	1	
22	7805UC	2	INTEGRATED CIRCUIT (07263) 351-1120-010 A9U1	1	
22A	CK06BX334K	2	CAPACITOR,FXD CER DIEL, 0.33UF, 10%, 50VDC (81349) 913-5019-500 A9C19 (EFF REV LTR H)	1	
23	40-12240	2	TRANSFORMER,PWR (50508) 662-0650-010 A9T1 (EFF TO REV LTR J)	1	
23	124P315	2	TRANSFORMER,POWER (11700) 662-0650-020 A9T1 (EFF REV LTR J)	1	
24	GZ82519E	2	SEMICOND DEVICE (24444) 353-0325-010 A9VR2	1	
25	HL15-3-50HMS5PCT	2	RESISTOR,FXD 3.5 OHMS, 5%, 14W (91637) 747-0715-000 A9R1	1	
26	RS5R040-5PCT	2	RESISTOR,FXD 0.04 OHMS, 5%, 6.5W (91637) 747-1992-070 A9R4	1	
27	RS5R040-5PCT	2	RESISTOR,FXD 0.04 OHMS, 5%, 6.5W (91637) 747-1992-070 A9R3	1	
28	RS5R040-5PCT	2	RESISTOR,FXD 0.04 OHMS, 5%, 6.5W (91637) 747-1992-070 A9R2	1	
29	634-8340-001	2	BRACKET,ANGLE	1	
30	332-14-04-022	2	TERMINAL BOARD (71785) 306-9032-000 A9TB2	1	
31	1N5550	2	SEMICOND DEVICE (14099) 353-3718-040 A9CR3	1	
32	332-14-04-022	2	TERMINAL BOARD (71785) 306-9032-000 A9TB3	1	
33	RS5R015-1PCT	2	RESISTOR,FXD 0.015 OHMS, 1%, 6.5W (91637) 747-1992-040 A9R5	1	
34	RS5R015-1PCT	2	RESISTOR,FXD 0.015 OHMS, 1%, 6.5W (91637) 747-1992-040 A9R6	1	
35	332-14-04-022	2	TERMINAL BOARD (71785) 306-9032-000 A9TB4	1	
36	500-8921-001	2	POST	1	
37	P015-0553-000	2	POST,MTG,RES (77250) 015-0553-000	1	
38	634-5908-001	2	PLATE,SAFETY	1	
39	280-1368-560	2	LABEL,PRESS SEN (12998)	1	
40	AGC32-30	2	FUSE,CRTG (71400) 264-0734-000 A9F2	1	
41	350-267	2	FUSEHOLDER (75915) 265-1114-000 A9XF2	1	
42	ABC8	2	FUSE,CRTG (71400) 264-0395-000 A9F1	1	
43	345001	2	FUSEHOLDER,PNL (75915) 265-0017-010 A9XF1	1	
44	2DDH62N472MAA	2	CAPACITOR,FXD CER DIEL, 4700PF, 20%, 1000V (71590) 913-3923-000 A9C2	1	
45	2DDH62N472MAA	2	CAPACITOR,FXD CER DIEL, 4700PF, 20%, 1000V (71590) 913-3923-000 A9C3	1	
46	P406AB	2	CONNECTOR,RCPT ELEC (71785) 365-0068-020 A9J1	1	
47	17-7	2	TERMINAL STRIP (71785) 306-0037-000 A9TB1	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
2-48	540-9221-003	2	POST,ELEC-MECH	2	
49	1N3998RA	2	SEMICOND DEVICE (04713) 353-3648-040 A9VR1	1	
50	634-8281-001	2	BRACKET,DIODE	1	
51	634-5955-001	2	COVER,CHASSIS	1	
52	199D474X0035AB1	2	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V (56289) 184-9102-330 A9C15	1	
52A	CK06BX334K	2	CAPACITOR,FXD CER DIEL, 0.33UF, 10%, 50VDC (81349) 913-5019-500 A9C18 (EFF REV LTR H)	1	
53	1N5359B	2	SEMICOND DEVICE (04713) 353-6550-270 A9VR3	1	
54	54-794-010-102P	2	CAPACITOR,FXD CER DIEL, 1000PF, GMV, 500V (33095) 913-1298-020 A9C5	1	
55	54-794-010-102P	2	CAPACITOR,FXD CER DIEL, 1000PF, GMV, 500V (33095) 913-1298-020 A9C6	1	
56	54-794-010-102P	2	CAPACITOR,FXD CER DIEL, 1000PF, GMV, 500V (33095) 913-1298-020 A9C7	1	
57	54-794-010-102P	2	CAPACITOR,FXD CER DIEL, 1000PF, GMV, 500V (33095) 913-1298-020 A9C8	1	
58	638-6275-001	2	24 VOLT REGULATOR A9A2 (EFF TO REV LTR G)(SEE FIG 4)	1	
58	638-6275-002	2	24 VOLT REGULATOR A9A2 (EFF REV LTR G)(SEE FIG 4)	1	
59	634-5952-001	2	CHASSIS	1	
60	LM317T	2	INTEGRATED CIRCUIT (27014) 351-1271-010 A9U3	1	
61	LM317T	2	INTEGRATED CIRCUIT (27014) 351-1271-010 A9U2	1	
62	TIP31A	2	TRANSISTOR (49671) 352-1156-010 A9Q1	1	
63	638-6825-001	2	POWER SUPPLY CONTROL A9A1 (SEE FIG 3)	1	
64	13E	2	JACK,TEL (82389) 360-0136-000 A9J11	1	
65	M641-12-1	2	JACK,TEL (81349) 358-0014-000 A9J10	1	
66	3501FP	2	PHONO-JACK (82389) 360-0148-000 A9J2	8	
67	292CY5U103D8050	2	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V (56289) 913-3331-020 A9C14	1	
68	3501FP	2	PHONO-JACK (82389) 360-0148-000 A9J9	1	
69	292CY5U103D8050	2	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V (56289) 913-3331-020 A9C13	1	
70	3501FP	2	PHONO-JACK (82389) 360-0148-000 A9J5	1	
71	3501FP	2	PHONO-JACK (82389) 360-0148-000 A9J8	1	
72	292CY5U102D8050	2	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V (56289) 913-3331-010 A9C11	1	
73	3501FP	2	PHONO-JACK (82389) 360-0148-000 A9J4	1	
74	3501FP	2	PHONO-JACK (82389) 360-0148-000 A9J7	1	
75	CK63AW103M	2	CAPACITOR,FXD CER DIEL, 10000PF, 20%, 500V (81349) 913-1188-000 A9C12	1	
76	3501FP	2	PHONO-JACK (82389) 360-0148-000 A9J3	1	
77	292CY5U103D8050	2	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V (56289) 913-3331-020 A9C10	1	
78	3501FP	2	PHONO-JACK (82389) 360-0148-000 A9J6	1	
79	292CY5U102D8050	2	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V (56289) 913-3331-010 A9C9	1	
80	641-7162-001	2	CABLE, POWER SUPPLY	1	
81	641-7120-001	2	CHASSIS	1	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(R17) 6
(C16) 7
(C13) 8
(R23) 9
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(R24) 11
(L1) 12
(C14) 13
(R3) 4
(R1) 3
(CR1) 2
(R20) 1
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(C5) 58
(R9) 57
(VR3) 56
(R25) 55
(C1) 54
(R2) 53
(C4) 52
(R15) 51
(R18) 50
(R30) 49
(R29) 48
(VR2) 47
46 (R26)
45 (C15)
44 (R4)
43 (R7)
42 (VR4)
41 (R6)
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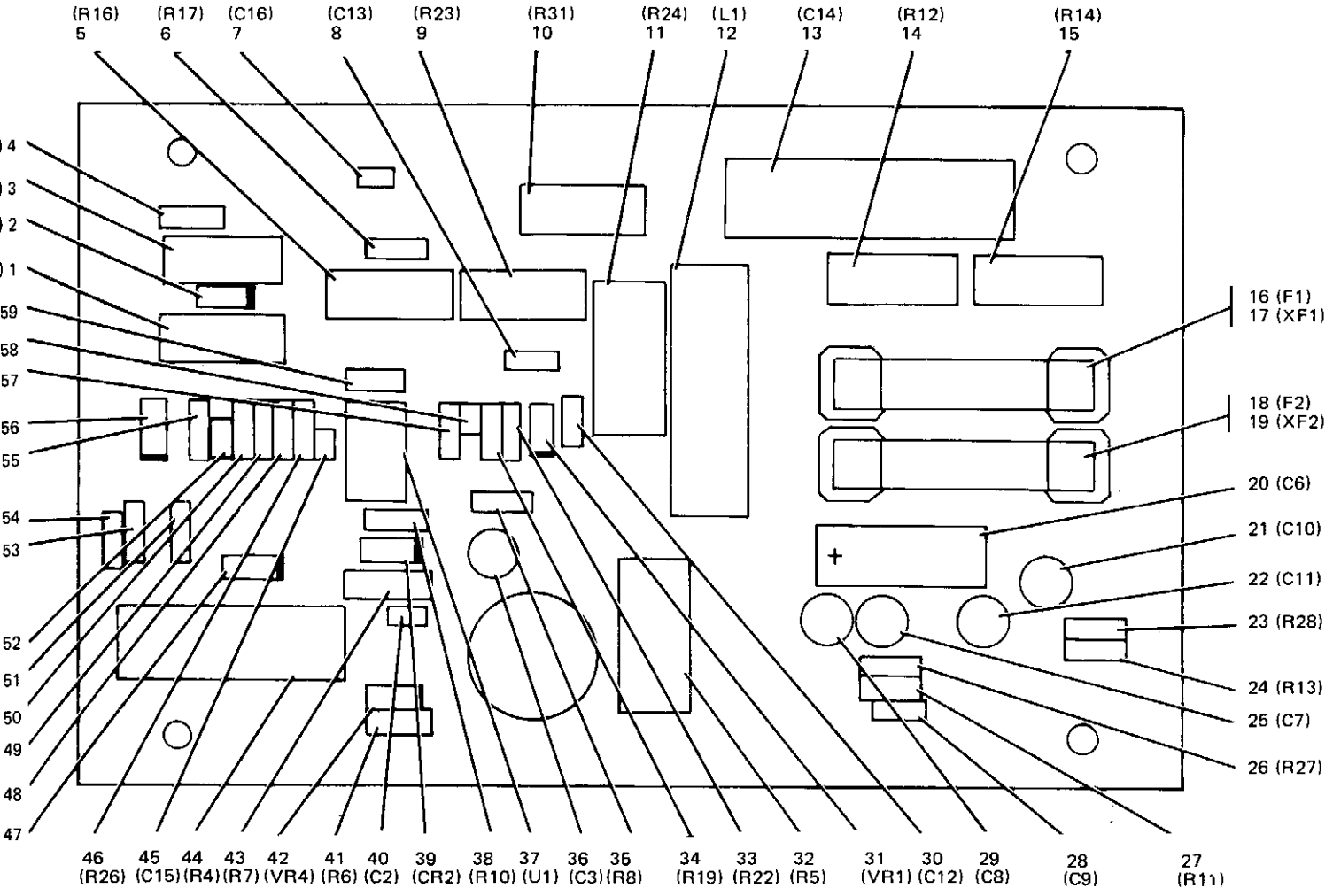
GROUP ASSEMBLY PARTS LIST



TPA-5233-019

Power Supply Control, Circuit Card A9A1
Figure 3

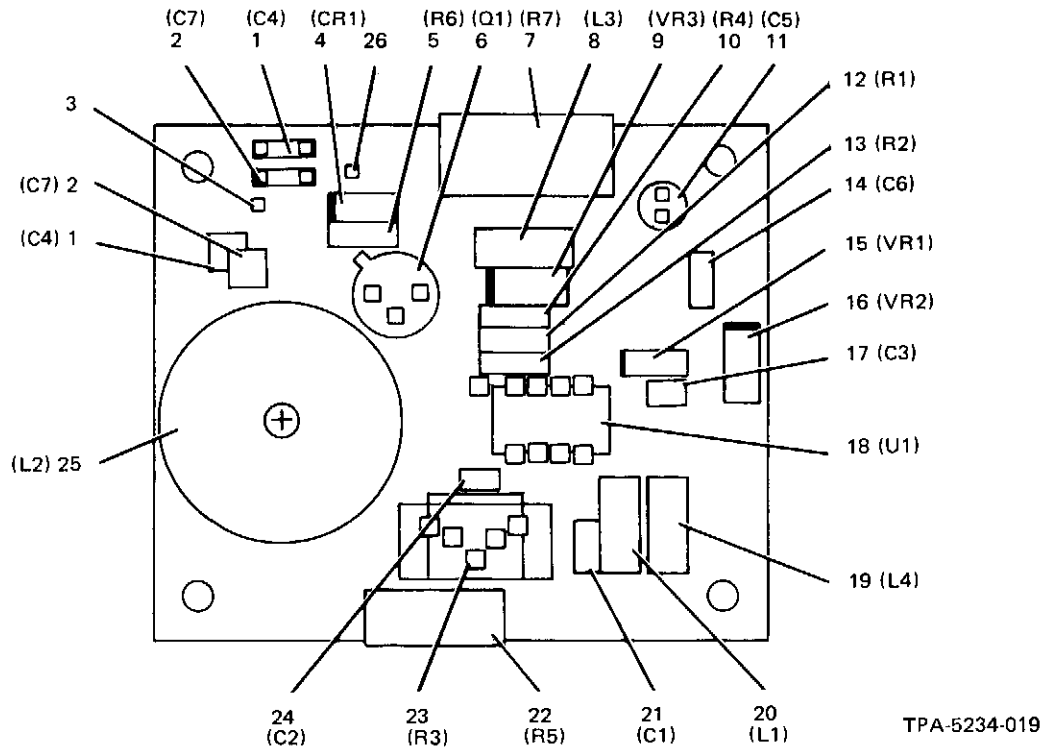
GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
3-	638-6825-001	1	POWER SUPPLY CONTROL A9A1 (SEE FIG 2-63 FOR NHA)	REF	
1	RCR32G152KS	2	RESISTOR,FXD CMPSN, 1.5K, 10%, 1W (81349) 745-3359-000 A9A1R20	1	
2	1N4002	2	SEMICOND DEVICE (14433) 353-6442-020 A9A1CR1	1	
3	RW69V821	2	RESISTOR,FXD WW, 820.0 OHMS, 5%, 3W (81349) 747-5358-000 A9A1R1	1	
4	RCR07G471KS	2	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W (81349) 745-0737-000 A9A1R3	1	
5	X201R251B	2	RESISTOR,VAR 250 OHMS, 30%, 0.25 TO 0 W (71450) 376-0274-020 A9A1R16 (EFF TO REV LTR J)	1	
5	101T500R0	2	RESISTOR,VAR 500 OHMS, 20%, 1/2W (91637) 382-0038-030 A9A1R16 (EFF REV LTR J)	1	
6	RN55D1401F	2	RESISTOR,FXD FILM, 1.40K, 1%, 1/8W (81349) 705-1003-000 A9A1R17	1	
7	292CX7R102M050B	2	CAPACITOR,FXD CER DIEL, 0.001UF, P80%M20%, 50VDC (56289) 913-3331-010 A9A1C16	1	
8	292CY5U104Z050C	2	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC (56289) 913-3331-030 A9A1C13	1	
9	X201R102B	2	RESISTOR,VAR 1K, 30%, 0.25 TO 0 W (71450) 376-0274-040 A9A1R23 (EFF TO REV LTR J)	1	
9	101T10000	2	RESISTOR,VAR 1K, 20%, 1/2W (91637) 382-0038-040 A9A1R23 (EFF REV LTR J)	1	
10	RW69V1R5	2	RESISTOR,FXD WW, 1.5 OHMS, 5%, 3W (81349) 747-5363-000 A9A1R31	1	
11	RCR42G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 2W (81349) 745-5628-000 A9A1R24	1	
12	240-0879-010	2	COIL,RF 12UH (24226) A9A1L1	1	
13	500D337G025DF5	2	CAPACITOR,FXD AL ELCTLT, 330UF, P75%M10%, 25V (56289) 183-1510-070 A9A1C14	1	
14	X201R251B	2	RESISTOR,VAR 250 OHMS, 30%, 0.25 TO 0 W (71450) 376-0274-020 A9A1R12 (EFF TO REV LTR J)	1	
14	101T200R0	2	RESISTOR,VAR 200 OHMS, 20%, 1/2W (91637) 382-0038-020 A9A1R12 (EFF REV LTR J)	1	
15	X201R251B	2	RESISTOR,VAR 250 OHMS, 30%, 0.25 TO 0 W (71450) 376-0274-020 A9A1R14 (EFF TO REV LTR J)	1	
15	101T200R0	2	RESISTOR,VAR 200 OHMS, 20%, 1/2W (91637) 382-0038-020 A9A1R14 (EFF REV LTR J)	1	
16	AGC250-2	2	FUSE,CARTRIDGE (71400) 264-0723-000 A9A1F1	1	
17	102071	2	CLIP,ELEC (75915) 265-1041-010 XF1 (EFF REV LTR J)	1	
18	AGC250-2	2	FUSE,CARTRIDGE (71400) 264-0723-000 A9A1F2	1	
19	102071	2	CLIP,ELEC (75915) 265-1041-010 XF2 (EFF REV LTR J)	1	
20	500D336G025BB5	2	CAPACITOR,FXD AL ELCTLT, 33UF, P75%M10%, 25V (56289) 183-1510-020 A9A1C6	1	
21	199D475X0035DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V (56289) 184-9102-390 A9A1C10	1	
22	199D475X0035DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V (56289) 184-9102-390 A9A1C11	1	
23	RN55D7500F	2	RESISTOR,FXD FILM, 750 OHMS, 1%, 1/8W (81349) 705-0990-000 A9A1R28	1	
24	RN55D2870F	2	RESISTOR,FXD FILM, 287 OHMS, 1%, 1/8W (81349) 705-0970-000 A9A1R13	1	
25	199D475X0035DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V (56289) 184-9102-390 A9A1C7	1	
26	RN55D7500F	2	RESISTOR,FXD FILM, 750 OHMS, 1%, 1/8W (81349) 705-0990-000 A9A1R27	1	
27	RN55D1400F	2	RESISTOR,FXD FILM, 140 OHMS, 1%, 1/8W (81349) 705-0955-000 A9A1R11	1	
28	292CY5U104Z050C	2	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC (56289) 913-3331-030 A9A1C9	1	
29	199D475X0035DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V (56289) 184-9102-390 A9A1C8	1	
30	292CY5U104Z050C	2	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC (56289) 913-3331-030 A9A1C12	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
3-31	1N821A	2	SEMICOND DEVICE (12954) 353-3261-000 A9A1VR1	1	
32	RCR42G150KS	2	RESISTOR,FXD CMPSN, 15 OHMS, 10%, 2W (81349) 745-5575-000 A9A1R5	1	
33	RN55D3831F	2	RESISTOR,FXD FILM, 3.83K, 1%, 1/8W (81349) 705-1024-000 A9A1R22	1	
34	RN55D5621F	2	RESISTOR,FXD FILM, 5.62K, 1%, 1/8W (81349) 705-1032-000 A9A1R19	1	
35	RCR07G104KS	2	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W (81349) 745-0821-000 A9A1R8	1	
36	199D475X0035DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V (56289) 184-9102-390 A9A1C3	1	
37	MLM358U	2	INTEGRATED CIRCUIT OP AMP (04713) 351-1211-040 A9A1U1	1	
38	RCR07G101KS	2	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W (81349) 745-0713-000 A9A1R10	1	
39	1N4002	2	SEMICOND DEVICE (14433) 353-6442-020 A9A1CR2	1	
40	292CX7R102M050B	2	CAPACITOR,FXD CER DIEL, 0.001UF, P80%M20%, 50VDC (56289) 913-3331-010 A9A1C2	1	
41	RCR07G103KS	2	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W (81349) 745-0785-000 A9A1R6	1	
42	1N4617	2	SEMICOND DEVICE (04713) 353-3591-410 A9A1VR4	1	
43	RCR20G222KS	2	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/2W (81349) 745-1366-000 A9A1R7	1	
44	RW67V470	2	RESISTOR,FXD WW, 47 OHMS, 5%, 6.5W (81349) 747-5493-000 A9A1R4	1	
45	292CY5U103Z050B	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC (56289) 913-3331-020 A9A1C15	1	
46	RN55D1401F	2	RESISTOR,FXD FILM, 1.40K, 1%, 1/8W (81349) 705-1003-000 A9A1R26	1	
47	1N4750A	2	SEMICOND DEVICE (04713) 353-6481-450 A9A1VR2	1	
48	RN55D6811F	2	RESISTOR,FXD FILM, 6.81K, 1%, 1/8W (81349) 705-1036-000 A9A1R29	1	
49	RN55D6811F	2	RESISTOR,FXD FILM, 6.81K, 1%, 1/8W (81349) 705-1036-000 A9A1R30	1	
50	RCR07G105KS	2	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W (81349) 745-0857-000 A9A1R18	1	
51	RN55D2490F	2	RESISTOR,FXD FILM, 249 OHMS, 1%, 1/8W (81349) 705-0967-000 A9A1R15	1	
52	292CX7R102M050B	2	CAPACITOR,FXD CER DIEL, 0.001UF, P80%M20%, 50VDC (56289) 913-3331-010 A9A1C4	1	
53	705-0701-000	2	RESISTOR,FXD FILM, 680 OHMS, 1%, 750V (96214) A9A1R2	1	
54	292CY5U104Z050C	2	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC (56289) 913-3331-030 A9A1C1	1	
55	RCR07G101KS	2	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W (81349) 745-0713-000 A9A1R25	1	
56	1N4104	2	SEMICOND DEVICE (04713) 353-3591-060 A9A1VR3	1	
57	RCR07G102KS	2	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W (81349) 745-0749-000 A9A1R9	1	
58	292CY5U103Z050B	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC (56289) 913-3331-020 A9A1C5	1	
59	RN55D3013F	2	RESISTOR,FXD FILM, 301K, 1%, 1/8W (81349) 705-1115-000 A9A1R21 (EFF TO REV LTR J)	1	
59	RN60D3833F	2	RESISTOR,FXD FILM, 383K, 1%, 1/4W (81349) 705-6720-000 A9A1R21 (EFF REV LTR J)	1	

GROUP ASSEMBLY PARTS LIST



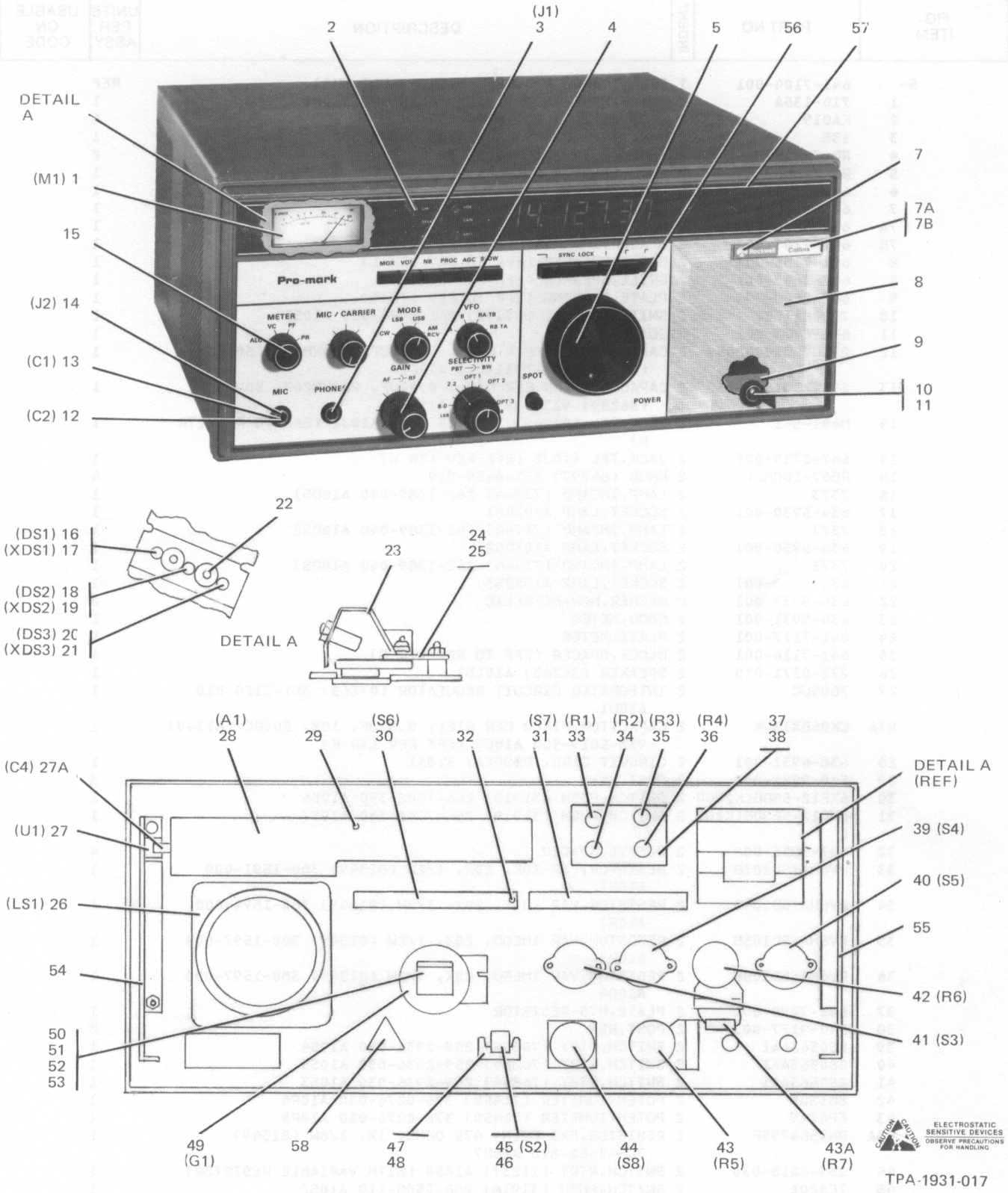
24-Volt Regulator A9A2
Figure 4

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
4-	638-6275-001	1	24 VOLT REGULATOR A9A2 (SEE FIG 2-58 FOR NHA)	REF	A
	638-6275-002	1	24 VOLT REGULATOR A9A2 (SEE FIG 2-58 FOR NHA)	REF	B
1	199D155X0050CE3	2	CAPACITOR,FXD TNTLM ELCTLT, 1.5UF, 20%, 50V (56289) 184-9102-960 A9A2C4 (EFF TO REV LTR F)	1	A
1	CK06BX105K	2	CAPACITOR,FXD CER DIEL, 1UF, 10%, 50VDC (81349) 913-5019-560 A9A2C4 (EFF REV LTR F)	1	A
1	CK06BX105K	2	CAPACITOR,FXD CER DIEL, 1UF, 10%, 50VDC (81349) 913-5019-560 A9A2C4	1	B
2	199D155X0050CE3	2	CAPACITOR,FXD TNTLM ELCTLT, 1.5UF, 20%, 50V (56289) 184-9102-960 A9A2C7 (EFF TO REV LTR F)	1	A
2	CK06BX105K	2	CAPACITOR,FXD CER DIEL, 1UF, 10%, 50VDC (81349) 913-5019-560 A9A2C7 (EFF REV LTR F)	1	A
2	CK06BX105K	2	CAPACITOR,FXD CER DIEL, 1UF, 10%, 50VDC (81349) 913-5019-560 A9A2C7	1	B
3	CAS01SP100-230-430	2	CONNECTOR,HDR (52072) 372-2656-130	2	B
4	SC5615	2	SEMICOND DEVICE (14099) 353-6496-020 A9A2CR1	1	
5	RCR07G101KS	2	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W (81349) 745-0713-000 A9A2R6	1	
6	2N2219A	2	TRANSISTOR (49956) 352-0661-010 A9A2Q1	1	
7	RCR42G181KS	2	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 2W (81349) 745-5621-000 A9A2R7	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
4-8	MS75089-15	2	COIL,RF 220UH (96906) 240-2715-410 A9A2L3	1	
9	1N5363B	2	SEMICOND DEVICE (04713) 353-6550-310 A9A2VR3	1	B
10	RCR07G222KS	2	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W (81349) 745-0761-000 A9A2R4	1	
11	199D475X0035DB1	2	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V (56289) 184-9102-390 A9A2C5	1	
12	RN55D2741F	2	RESISTOR,FXD FILM, 2.74K, 1%, 1/8W (81349) 705-1017-000 A9A2R1	1	
13	RCR07G102KS	2	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W (81349) 745-0749-000 A9A2R2	1	
14	292CY5U104Z050C	2	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC (56289) 913-3331-030 A9A2C6	1	
15	1N821A	2	SEMICOND DEVICE (12954) 353-3261-000 A9A2VR1	1	
16	1N5359B	2	SEMICOND DEVICE (04713) 353-6550-270 A9A2VR2	1	B
17	292CY5U103Z050B	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC (56289) 913-3331-020 A9A2C3	1	
18	LM555CN	2	INTEGRATED CIRCUIT TIMER (27014) 351-1137-020 A9A2U1	1	
19	MS75089-3	2	COIL,RF 22UH (96906) 240-2715-290 A9A2L4	1	
20	MS75089-3	2	COIL,RF 22UH (96906) 240-2715-290 A9A2L1	1	
21	292CY5U104Z050C	2	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC (56289) 913-3331-030 A9A2C1	1	
22	RCR32G561KS	2	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1W (81349) 745-3342-000 A9A2R5	1	
23	X201R252B	2	RESISTOR,VAR 2.5K, 30%, 0.25 TO 0 W (71450) 376-0274-050 A9A2R3	1	A
23	101T20000	2	RESISTOR,VAR 2K, 20%, 1/2W (91637) 382-0038-050 A9A2R3	1	B
24	CK05BX103K	2	CAPACITOR,FXD CER DIEL, 0.01UF, 10%, 100VDC (81349) 913-5019-200 A9A2C2	1	
25	12375B	2	COIL,RF 10MH (07388) 240-0261-000 A9A2L2	1	
	MS51957-30	2	SCREW,MACH SST, 6-32 X 1/2 (96906) 343-0171-000 (AP)	1	
26	2-332070-3	2	JACK-TIP (00779) 360-0079-120 A9A2TP1	1	A

GROUP ASSEMBLY PARTS LIST



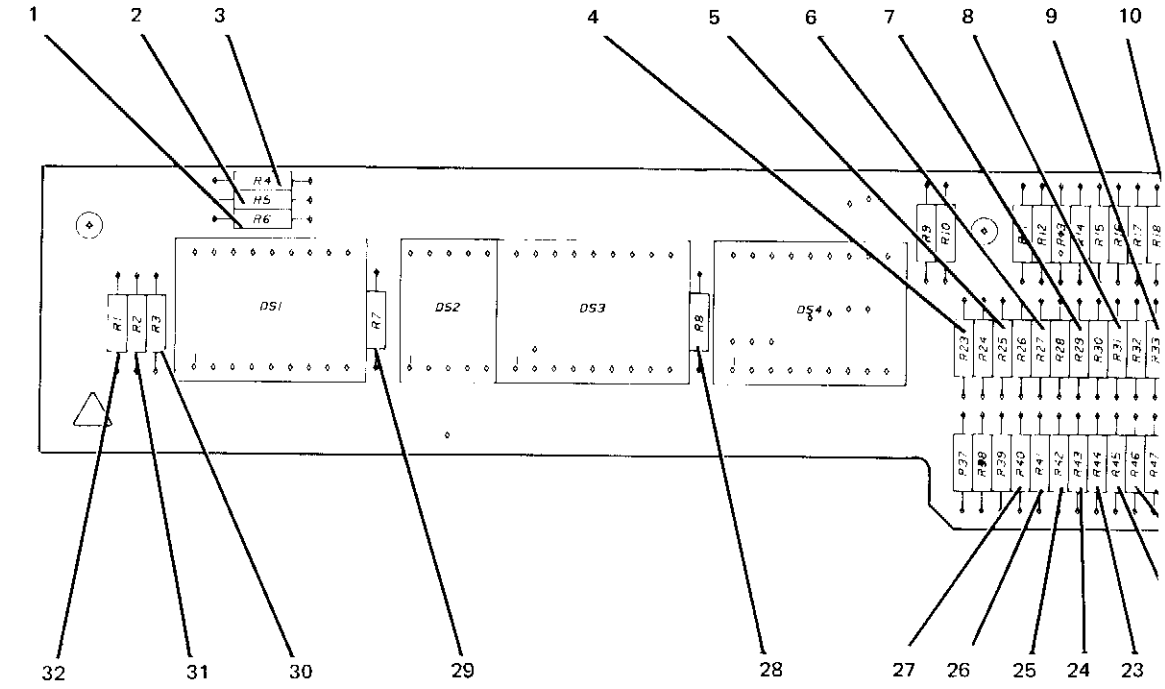
Front Panel A10
Figure 5

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
5-	641-7104-001	1	FRONT PANEL A10 (SEE FIG 1-9 FOR NHA)	REF	
1	710-135A	2	METER,PANEL (32171) 450-0158-020 A10M1	1	
2	KA019	2	KNOB (A1704) 281-0160-000	4	
3	13E	2	JACK,TEL (82389) 360-0136-000 A10J1	1	
4	RB67-2AP1M	2	KNOB (86797) 281-0659-040	2	
5	RB67-5MX5PC	2	KNOB (86797) 281-0659-020	1	
6	641-7101-001	2	LENS,WINDOW	1	
7	623-9008-001	2	INSERT,HOUSEMARK	1	
7A	632-5234-001	2	HOLDER,INDENT	1	
7B	641-7109-001	2	SPACER,INDENT (EFF TO REV LTR L)	1	
8	641-7155-001	2	GRILL,SPEAKER (EFF TO REV LTR L)	1	
8	647-2843-001	2	GRILL,SPEAKER (EFF REV LTR L)	1	
9	642-2520-001	2	PLATE,SPACING (EFF TO REV LTR L)	1	
10	7360K11C27	2	SWITCH,TOGGLE (27193) 266-5424-010 A10S1	1	
11	641-6773-001	2	GUARD,SAFETY	1	
12	292CY5U102D8050	2	CAPACITOR,FXD CER DIEL, 0.001UF, P80%M20%, 50VDC (56289) 913-3331-010 A10C2	1	
13	292CY5U103D8050	2	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC (56289) 913-3331-020 A10C1	1	
14	M641-5-1	2	JACK,TEL (81349) 358-1050-000 A10J2 (EFF TO REV LTR H)	1	
14	647-2739-001	2	JACK,TEL A10J2 (EFF REV LTR H)	1	
15	RB67-1DCMXL	2	KNOB (86797) 281-0659-010	4	
16	7373	2	LAMP,INCAND (71744) 262-1389-040 A10DS1	1	
17	634-5930-001	2	SOCKET,LAMP A10XDS1	1	
18	7373	2	LAMP,INCAND (71744) 262-1389-040 A10DS2	1	
19	634-5930-001	2	SOCKET,LAMP A10XDS2	1	
20	7373	2	LAMP,INCAND (71744) 262-1389-040 A10DS3	1	
21	634-5930-001	2	SOCKET,LAMP A10XDS3	1	
22	634-8939-001	2	WASHER,NON-METALLIC	2	
23	634-5931-001	2	HOOD,METER	1	
24	641-7117-001	2	PLATE,METER	1	
25	641-7116-001	2	BLOCK,SPACER (EFF TO REV LTR G)	1	
26	271-0271-010	2	SPEAKER (34263) A10LS1	1	
27	7805UC	2	INTEGRATED CIRCUIT REGULATOR (07263) 351-1120-010 A10U1	1	
27A	CK06BX334K	2	CAPACITOR,FIXED CER DIEL, 0.33UF, 10%, 50VDC (81349) 913-5019-500 A10C4 (EFF REV LTR K)	1	
28	638-6931-001	2	CIRCUIT CARD, DISPLAY A10A1	1	
29	540-9041-003	2	POST,HEX	3	
30	6XF12-5SDBLK2UGR	2	SWITCH,PUSH (31918) 266-7508-350 A10S6	1	
31	6XF12-5FSDBLK2UE E	2	SWITCH,PUSH (31918) 266-7508-340 A10S7	1	
32	541-5955-002	2	SLEEVE,SPACER	4	
33	RV6NAYSD103B	2	RESISTOR,VAR 10K, 20%, 1/2W (81349) 380-1591-000 A10R1	1	
34	RV6NAYSD104B	2	RESISTOR,VAR 100K, 20%, 1/2W (81349) 380-1594-000 A10R2	1	
35	RV6NAYSD105B	2	RESISTOR,VAR 1MEGO, 20%, 1/2W (81349) 380-1597-000 A10R3	1	
36	RV6NAYSD105B	2	RESISTOR,VAR 1MEGO, 20%, 1/2W (81349) 380-1597-000 A10R4	1	
37	641-7098-001	2	PLATE,MTG-RESISTOR	1	
38	540-9177-003	2	POST,HEX	2	
39	280563AA1	2	SWITCH,RTRY (76854) 259-2936-030 A10S4	1	
40	280563AA1	2	SWITCH,RTRY (76854) 259-2936-030 A10S5	1	
41	280563AA1	2	SWITCH,RTRY (76854) 259-2936-030 A10S3	1	
42	EB1309	2	POTENTIOMETER (71450) 376-0276-030 A10R6	1	
43	FF6719	2	POTENTIOMETER (71450) 376-0276-050 A10R5	1	
43A	RN55D4750F	2	RESISTOR,FXD FILM, 475 OHMS, 1%, 1/8W (81349) 705-3600-810 A10R7	1	
44	259-8018-030	2	SWITCH,RTRY (11237) A10S8 (WITH VARIABLE RESISTOR)	1	
45	1FA20A	2	SWITCH,PUSH (31918) 266-7508-110 A10S2	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
5-46	FGBLACK	2	BUTTON,SW (31918) 266-7508-130	1	
47	01-0003-00	2	SWITCH,PUSH (31918) 266-7508-120	1	
48	540-5955-002	2	SLEEVE,SPACER	1	
49	PC66D200-5	2	ENCODER,SHAFT (15686) 229-9702-010 A10G1	1	
50	641-7160-001	2	CABLE,FRONT PANEL NO.1	1	
51	641-7161-001	2	CABLE,FRONT PANEL NO.2	1	
52	641-7164-001	2	CABLE,BOX	1	
53	641-7165-001	2	CABLE,FRONT PANEL NO.3	1	
54	634-5935-002	2	BRACKET,PANEL	1	
55	634-5935-001	2	BRACKET,PANEL	1	
56	641-7114-001	2	PANEL,FRONT	1	
57	641-7119-001	2	PANEL,FRONT	1	
58	280-2745-020	2	LABEL,PRESS SENS (ESDS) (12998) (EFF REV LTR M)	1	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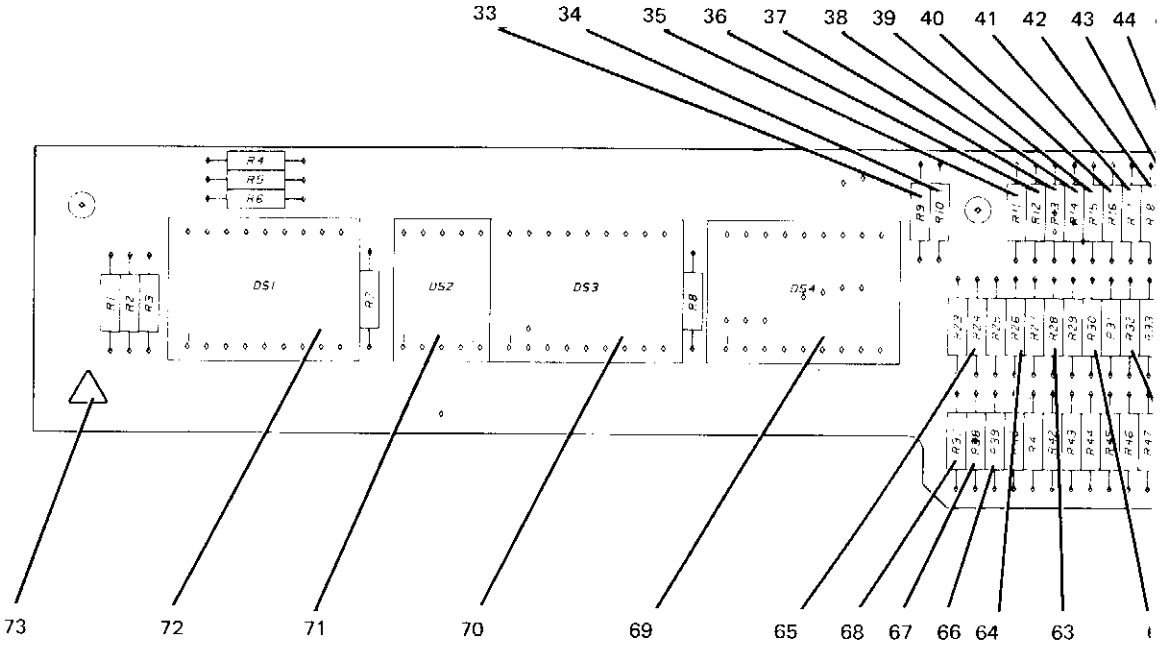
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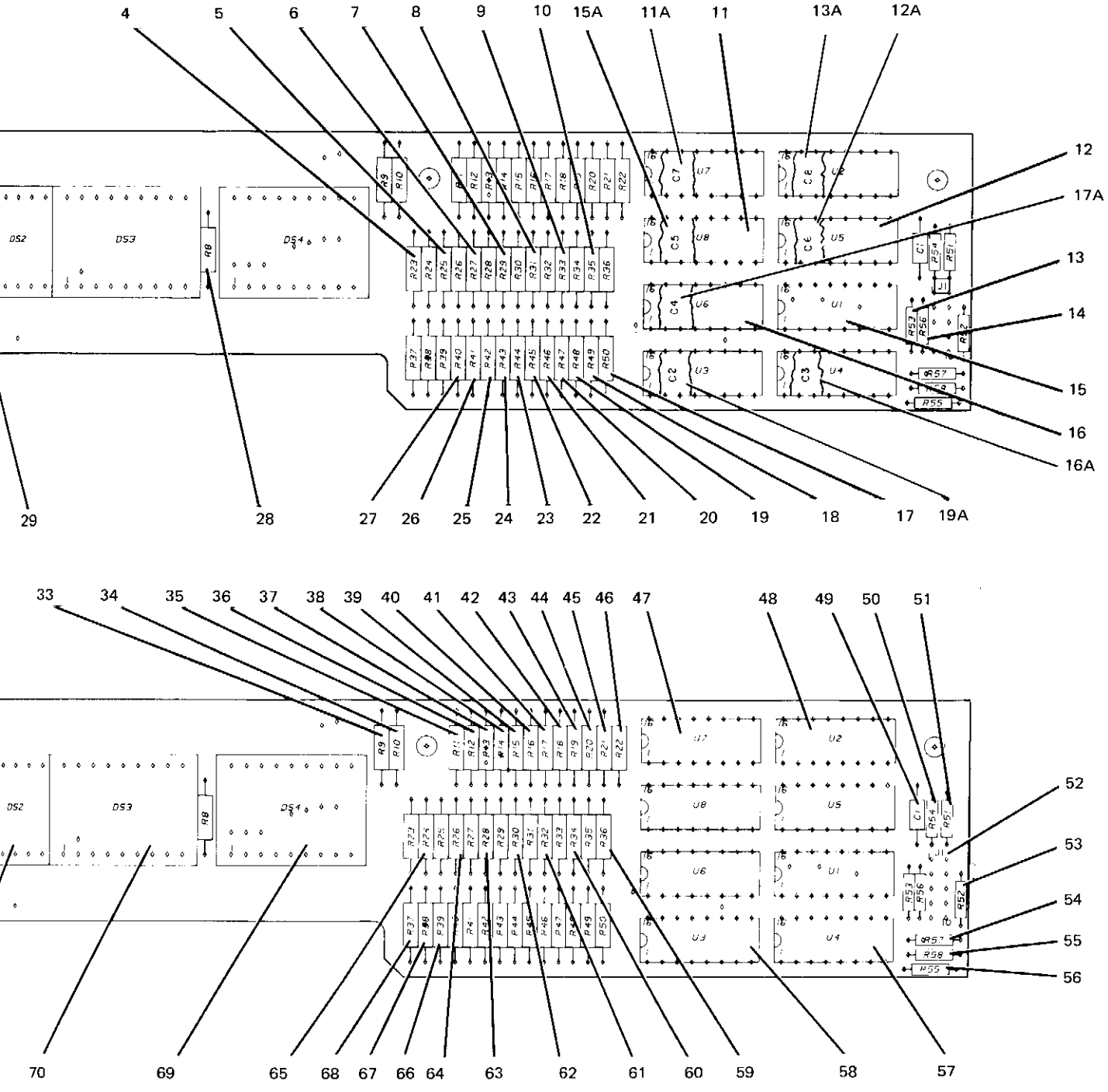
638-6931-001

GROUP ASSEMBLY PARTS LIST



Display A10A1
Figure 6

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
6-	638-6931-001	1	DISPLAY A10A1 (SEE FIG 5-28 FOR NHA)	REF	
1	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10R6	1	
2	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10R5	1	
3	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10R4	1	
4	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10R23	1	
5	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R25	1	
6	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R27	1	
7	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R29	1	
8	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R31	1	
9	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R33	1	
10	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R35	1	
11	8804-020	2	INTEGRATED CIRCUIT LOGIC GATE (ESDS) (55009) 351-8804-020 A10A1U8	1	
11A	CK05BX471K	2	CAPACITOR,FIXED CER DIEL, 470PF, 10%, 200V (81349) 913-4014-000 A10A1C7	1	
12	8804-020	2	INTEGRATED CIRCUIT LOGIC GATE (ESDS) (55009) 351-8804-020 A10A1U5	1	
12A	CK05BX471K	2	CAPACITOR,FIXED CER DIEL, 470PF, 10%, 200V (81349) 913-4014-000 A10A1C6	1	
13	RCR05G104KS	2	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W (81349) 745-2413-000 A10A1R53	1	
13A	CK05BX471K	2	CAPACITOR,FIXED CER DIEL, 470PF, 10%, 200V (81349) 913-4014-000 A10A1C8	1	
14	RCR05G103KS	2	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W (81349) 745-2377-000 A10A1R56	1	
15	SN74LS138N	2	INTEGRATED CIRCUIT DECODER (04713) 351-1526-030 A10A1U1	1	
15A	CK05BX471K	2	CAPACITOR,FIXED CER DIEL, 470PF, 10%, 200V (81349) 913-4014-000 A10A1C5	1	
16	8804-020	2	INTEGRATED CIRCUIT LOGIC GATE (ESDS) (55009) 351-8804-020 A10A1U6	1	
16A	CK05BX471K	2	CAPACITOR,FIXED CER DIEL, 470PF, 10%, 200V (81349) 913-4014-000 A10A1C3	1	
17	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R50	1	
17A	CK05BX471K	2	CAPACITOR,FIXED CER DIEL, 470PF, 10%, 200V (81349) 913-4014-000 A10A1C4	1	
18	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R49	1	
19	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R48	1	
19A	CK05BX471K	2	CAPACITOR,FIXED CER DIEL, 470PF, 10%, 200V (81349) 913-4014-000 A10A1C2	1	
20	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R47	1	
21	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R46	1	
22	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R45	1	
23	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R44	1	
24	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R43	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
6-25	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R42	1	
26	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R41	1	
27	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R40	1	
28	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R8	1	
29	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R7	1	
30	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R3	1	
31	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R2	1	
32	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R1	1	
33	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R9	1	
34	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R10	1	
35	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R11	1	
36	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R12	1	
37	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R13	1	
38	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R14	1	
39	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R15	1	
40	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R16	1	
41	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R17	1	
42	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R18	1	
43	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R19	1	
44	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R20	1	
45	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R21	1	
46	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R22	1	
47	8804-020	2	INTEGRATED CIRCUIT LOGIC GATE (ESDS) (55009) 351-8804-020 A10A1U7	1	
48	8804-020	2	INTEGRATED CIRCUIT LOGIC GATE (ESDS) (55009) 351-8804-020 A10A1U2	1	
49	292CY5U104Z050C	2	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC (56289) 913-3331-030 A10A1C1	1	
50	RCR05G104KS	2	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W (81349) 745-2413-000 A10A1R54	1	
51	RCR05G104KS	2	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W (81349) 745-2413-000 A10A1R51	1	
52	CAD10SP100-230-430	2	CONNECTOR,HDR (52072) 372-2656-100 A10A1J1	1	
53	RCR05G104KS	2	RESISTOR,FXD CMPSN, 100K, 10%, 1/8W (81349) 745-2413-000 A10A1R52	1	
54	RCR05G103KS	2	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W (81349) 745-2377-000 A10A1R57	1	
55	RCR05G103KS	2	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W (81349) 745-2377-000 A10A1R58	1	

GROUP ASSEMBLY PARTS LIST

FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
6-56	RCR05G103KS	2	RESISTOR,FXD CMPSN, 10K, 10%, 1/8W (81349) 745-2377-000 A10A1R55	1	
57	8804-020	2	INTEGRATED CIRCUIT LOGIC GATE (ESDS) (55009) 351-8804-020 A10A1U4	1	
58	8804-020	2	INTEGRATED CIRCUIT LOGIC GATE (ESDS) (55009) 351-8804-020 A10A1U3	1	
59	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R36	1	
60	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R34	1	
61	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R32	1	
62	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R30	1	
63	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R28	1	
64	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R26	1	
65	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R24	1	
66	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R39	1	
67	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R38	1	
68	RCR07G271KS	2	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W (81349) 745-0728-000 A10A1R37	1	
69	LR2664E	2	DISPLAY,LED (05464) 262-1485-020 A10A1DS4	1	
70	LR2664E	2	DISPLAY,LED (05464) 262-1485-020 A10A1DS3	1	
71	LR2668E	2	DISPLAY,LED (05464) 262-1485-030 A10A1DS2	1	
72	LR2664E	2	DISPLAY,LED (05464) 262-1485-020 A10A1DS1	1	
73	280-2745-040	2	LABEL,PRESS SENS (ESDS) (12998)	1	

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AGC250-2	3-16	
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AGC32-30	2-40	1
CAD10SP100-230-4	6-52	1
30		
CA501SP100-230-4	4-3	2
30		
CK05BX103K	4-24	1
CK05BX471K	6-11A	
	6-12A	
	6-13A	
	6-15A	
	6-16A	
	6-17A	
	6-19A	7
CK06BX105K	4-1	
	4-1	
	4-2	
	4-2	4
CK06BX334K	2-22A	
	2-52A	
	5-27A	3
CK63AW103M	2-75	1
CM04ED330J03	1-20	
	1-23	2
CM04ED820J03	1-21	1
CM04FD101J03	1-25	1
CM05FD151J03	1-26	1
DBM-25P	1-71	1
DB110963-3	1-73	1
D20419-18	1-72	1
EB1309	5-42	1
FF6719	5-43	1
FGBLACK	5-46	1
GZ82519E	2-24	1
HL15-3-50HMS5PCT	2-25	1
KA019	5-2	4
LM317T	2-60	
	2-61	2
LM555CN	4-18	1
LR2664E	6-69	
	6-70	
	6-72	3
LR2668E	6-71	1
MLM358U	3-37	1
MS18130-1	1-24	1
MS35338-98	1-27B	1
MS51957-26	1-27B	1
MS51957-28	1-27B	1
MS51957-30	4-25	1
MS75083-06	1-22	1
MS75089-15	4-8	1
MS75089-3	4-19	
	4-20	2
M24308/26-1	1-70	1

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M641-12-1	2-65	1
M641-5-1	5-14	1
PC66D200-5	5-49	1
P015-0553-000	2-37	1
P313-0140-000	1-27B	1
P406AB	2-46	1
RB67-1DCMXL	5-15	4
RB67-2API M	5-4	2
RB67-5MXSPC	5-5	1
RCR05G103KS	6-14	
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RCR05G104KS	6-13	
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RCR07G101KS	3-38	
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RCR07G102KS	3-57	
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RCR07G103KS	3-41	1
RCR07G104KS	3-35	1
RCR07G105KS	3-50	1
RCR07G222KS	4-10	1
RCR07G271KS	6-1	
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RCR07G471KS	3-4	1
RCR20G222KS	3-43	1
RCR32G152KS	3-1	1
RCR32G561KS	4-22	1
RCR42G150KS	3-32	1
RCR42G181KS	4-7	1
RCR42G271KS	3-11	1
RN55D1400F	3-27	1
RN55D1401F	3-6	
	3-46	2
RN55D2490F	3-51	1
RN55D2741F	4-12	1
RN55D2870F	3-24	1
RN55D3013F	3-59	1
RN55D3831F	3-33	1
RN55D4750F	5-43A	1
RN55D5621F	3-34	1
RN55D6811F	3-48	
	3-49	2
RN55D7500F	3-23	
	3-26	2
RN60D3833F	3-59	1
RS5R015-1PCT	2-33	
	2-34	2
RS5R040-5PCT	2-26	
	2-27	
	2-28	3
RV6NAYSD103B	5-33	1
RV6NAYSD104B	5-34	1
RV6NAYSD105B	5-35	
	5-36	2
RW67V470	3-44	1
RW69V1R5	3-10	1
RW69V821	3-3	1
SC5615	4-4	1
SN74LS138N	6-15	1
TIP31A	2-62	1
X201R102B	3-9	1
X201R251B	3-5	
	3-14	
	3-15	3
X201R252B	4-23	1
01-0003-00	5-47	1

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015-0553-000	2-37	1
1FA20A	5-45	1
1N1186	2-13	
	2-21	2
1N3998RA	2-49	1
1N4002	3-2	
	3-39	2
1N4104	3-56	1
1N4617	3-42	1
1N4750A	3-47	1
1N5359B	2-53	
	4-16	2
1N5363B	4-9	1
1N5550	2-31	1
1N821A	3-31	
	4-15	2
101T10000	3-9	1
101T200R0	3-14	
	3-15	2
101T20000	4-23	1
101T500R0	3-5	1
102071	3-17	
	3-19	2
115058-01	2-14	1
115058-06	2-11	1
12375B	4-25	1
124P315	2-23	1
13E	2-64	
	5-3	2
139-0135-000	2-11	1
139-0139-000	2-14	1
17-7	2-47	1
183-1510-020	3-20	1
183-1510-070	3-13	1
183-1511-010	2-12	1
183-1511-030	2-15	1
184-9102-330	2-52	1
184-9102-390	3-21	
	3-22	
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	4-11	6
184-9102-960	4-1	
	4-2	2
199D155X0050CE3	4-1	
	4-2	2
199D474X0035AB1	2-52	1
199D475X0035DB1	3-21	
	3-22	
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	4-11	6
2-332070-3	4-26	1
2DDH62N472MAA	2-44	
	2-45	2
2N2219A	4-6	1
226286-2	1-53	
	1-57	9
229-9702-010	5-49	1
240-0261-000	4-25	1
240-0879-010	3-12	1

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240-2016-000	1-22	1
240-2715-290	4-19	
	4-20	2
240-2715-410	4-8	1
259-2936-030	5-39	
	5-40	
	5-41	3
259-8018-030	5-44	1
262-1389-040	5-16	
	5-18	
	5-20	3
262-1485-020	6-69	
	6-70	
	6-72	3
262-1485-030	6-71	1
264-0395-000	2-42	1
264-0723-000	3-16	
	3-18	2
264-0734-000	2-40	1
265-0017-010	2-43	1
265-1041-010	3-17	
	3-19	2
265-1114-000	2-41	1
266-5424-010	5-10	1
266-7508-110	5-45	1
266-7508-120	5-47	1
266-7508-130	5-46	1
266-7508-340	5-31	1
266-7508-350	5-30	1
271-0271-010	5-26	1
280-1368-560	2-39	1
280-2745-020	1-67	
	5-58	2
280-2745-040	6-73	1
280-3821-010	1-69	1
280-3821-020	1-68	1
280563AA1	5-39	
	5-40	
	5-41	3
281-0160-000	5-2	4
281-0659-010	5-15	4
281-0659-020	5-5	1
281-0659-040	5-4	2
288-1337-050	1-56	1
292CX7R102M050B	3-7	
	3-40	
	3-52	3
292CY5U102D8050	2-72	
	2-79	
	5-12	3
292CY5U103D8050	2-67	
	2-69	
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292CY5U103Z050B	3-45	
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292CY5U104Z050C	3-8	
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292CY5U104Z050C	4-21	
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306-0037-000	2-47	1
306-9032-000	1-19	
	2-30	
	2-32	
	2-35	4
310-0096-000	1-27B	1
3120BE123U025BP	2-12	1
3120GE723U025DP	2-15	1
313-0140-000	1-27B	1
332-14-04-022	1-19	
	2-30	
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	2-35	4
343-0167-000	1-27B	1
343-0169-000	1-27B	1
343-0171-000	4-25	1
345001	2-43	1
350-267	2-41	1
3501FP	2-66	
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	2-78	15
350715-1	2-18	1
350720-1	2-17	1
350781-1	2-20	1
350782-1	2-19	1
351-1120-010	2-22	
	5-27	2
351-1137-020	4-18	1
351-1211-040	3-37	1
351-1271-010	2-60	
	2-61	2
351-1526-030	6-15	1
351-8804-020	6-11	
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352-0661-010	4-6	1
352-1156-010	2-62	1
353-0325-010	2-24	1
353-3261-000	3-31	
	4-15	2
353-3591-060	3-56	1
353-3591-410	3-42	1
353-3648-040	2-49	1
353-3718-040	2-31	1
353-6442-020	3-2	
	3-39	2
353-6478-040	2-13	
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353-6481-450	3-47	1
353-6496-020	4-4	1
353-6550-270	2-53	
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357-7207-010	1-59	
	1-62	2
358-0014-000	2-65	1
358-1050-000	5-14	1
360-0079-120	4-26	1
360-0136-000	2-64	
	5-3	2
360-0148-000	2-66	
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	2-78	15
365-0068-020	2-46	1
371-0040-020	1-72	1
371-0062-000	1-70	1
371-0170-000	1-71	1
371-0392-030	1-73	1
372-0064-130	2-18	1
372-0064-140	2-20	1
372-0064-150	2-17	1
372-0064-160	2-19	1
372-2656-100	6-52	1
372-2656-130	4-3	2
376-0274-020	3-5	
	3-14	
	3-15	3
376-0274-040	3-9	1
376-0274-050	4-23	1
376-0276-030	5-42	1
376-0276-050	5-43	1
380-1591-000	5-33	1
380-1594-000	5-34	1
380-1597-000	5-35	
	5-36	2
382-0038-020	3-14	
	3-15	2
382-0038-030	3-5	1
382-0038-040	3-9	1
382-0038-050	4-23	1
40-12240	2-23	1
450-0158-020	5-1	1
500-8921-001	2-36	1
500D336G025BB5	3-20	1
500D337G025DF5	3-13	1
52-307-3188	1-59	
	1-62	2
54-794-010-102P	2-54	
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	2-57	4
540-5955-002	5-48	1
540-9041-003	5-29	3
540-9177-003	5-38	2
540-9221-003	2-48	2
541-5955-002	5-32	4
57-1559	1-56	1
6XF12-5FSDBLK2UE	5-31	1
E		
6XF12-5SDBLK2UGR	5-30	1
622-3580-001	1-	1
623-9008-001	5-7	1
632-5234-001	5-7A	1
634-5903-003	1-4	1
634-5908-001	2-38	1
634-5930-001	5-17	
	5-19	
	5-21	3
634-5931-001	5-23	1
634-5935-001	5-55	1
634-5935-002	5-54	1
634-5941-001	2-16	1
634-5941-002	2-10	1
634-5943-001	1-17	1
634-5952-001	2-59	1
634-5955-001	2-51	1
634-8281-001	2-50	1
634-8340-001	2-29	1
634-8481-003	1-16	1
634-8498-001	1-65	1
634-8939-001	5-22	2
638-6275-001	2-58	1
	4-	REF
638-6275-002	2-58	1
	4-	REF
638-6825-001	2-63	1
	3-	REF
638-6908-002	1-27	1
638-6912-002	1-7	1
638-6914-002	1-14	1
638-6916-002	1-11	1
638-6918-001	1-8	1
638-6920-001	1-12	1
638-6929-002	1-6	1
638-6929-004	1-6	1
638-6931-001	5-28	1
	6-	REF
641-3700-001	1-1	1
641-6773-001	5-11	1
641-7097-001	1-5	1
641-7097-002	2-1	1
641-7098-001	5-37	1
641-7099-001	1-10	1
641-7099-002	1-10	1
641-7100-001	1-41	1
641-7100-002	1-44	1
641-7100-007	1-54	1
641-7100-008	1-47	1
641-7100-014	1-58	1
641-7100-015	1-61	1
641-7100-016	1-64	1
641-7100-017	1-50	1
641-7101-001	5-6	1
641-7103-001	1-13	1
	2-	REF
641-7104-001	1-9	1
	5-	REF
641-7109-001	5-7B	1
641-7114-001	5-56	1
641-7115-001	1-3	1

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641-7119-001	5-57	1
641-7120-001	2-81	1
641-7123-001	1-34	1
641-7123-002	1-35	1
641-7123-003	1-36	1
641-7123-004	1-37	1
641-7123-005	1-38	1
641-7123-006	1-39	1
641-7123-007	1-40	1
641-7123-008	1-40A	1
641-7124-001	2-9	1
641-7125-001	2-2	1
641-7132-001	1-15	1
641-7140-001	1-18	1
641-7143-001	2-3	1
641-7143-002	2-8	1
641-7155-001	5-8	1
641-7160-001	5-50	1
641-7161-001	5-51	1
641-7162-001	2-80	1
641-7164-001	5-52	1
641-7165-001	5-53	1
641-7166-001	1-28	1
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641-7168-001	1-32	1
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641-7175-001	2-4	1
641-7176-001	2-5	1
641-7177-001	2-6	1
641-7178-001	2-7	1
641-7181-001	1-66	1
642-0028-000	1-2	1
642-1018-019	1-43	1
642-1018-020	1-46	1
642-1018-021	1-63	1
642-1018-022	1-55	1
642-1018-023	1-42	1
642-1018-024	1-48	1
642-1018-025	1-51	1
642-1018-026	1-45	1
642-1018-027	1-52	1
642-1018-028	1-49	1
642-1018-030	1-60	1
642-2520-001	5-9	1
646-5802-001	1-27A	1
647-2739-001	5-14	1
647-2843-001	5-8	1
647-2924-001	1-27B	1
662-0650-010	2-23	1
662-0650-020	2-23	1
705-0701-000	3-53	1
705-0955-000	3-27	1
705-0967-000	3-51	1
705-0970-000	3-24	1
705-0990-000	3-23	
	3-26	2
705-1003-000	3-6	
	3-46	2
705-1017-000	4-12	1
705-1024-000	3-33	1
705-1032-000	3-34	1
705-1036-000	3-48	
	3-49	2
705-1115-000	3-59	1
705-3600-810	5-43A	1
705-6720-000	3-59	1
710-135A	5-1	1
7360K11C27	5-10	1
7373	5-16	
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	5-20	3
745-0713-000	3-38	
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	4-5	3
745-0728-000	6-1	
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745-0749-000	3-57	
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745-0761-000	4-10	1
745-0785-000	3-41	1
745-0821-000	3-35	1
745-0857-000	3-50	1
745-1366-000	3-43	1
745-2377-000	6-14	
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745-2413-000	6-13	
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745-3342-000	4-22	1
745-3359-000	3-1	1
745-5575-000	3-32	1
745-5621-000	4-7	1
745-5628-000	3-11	1
747-0715-000	2-25	1
747-1992-040	2-33	
	2-34	2
747-1992-070	2-26	
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	2-28	3
747-5358-000	3-3	1
747-5363-000	3-10	1
747-5493-000	3-44	1
7805UC	2-22	
	5-27	2
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	6-12	
	6-16	
	6-47	
	6-48	
	6-57	
	6-58	7
912-2828-000	1-26	1
912-3848-000	1-20	
	1-23	2
912-3873-000	1-21	1
912-3879-000	1-25	1
913-1188-000	2-75	1
913-1298-020	2-54	
	2-55	
	2-56	
	2-57	4
913-3331-010	2-72	
	2-79	
	3-7	
	3-40	
	3-52	
	5-12	6
913-3331-020	2-67	
	2-69	
	2-77	
	3-45	
	3-58	
	4-17	
913-3331-020	5-13	7
913-3331-030	3-8	
	3-28	
	3-30	
	3-54	
	4-14	
	4-21	
	6-49	7
913-3923-000	2-44	
	2-45	2
913-4014-000	6-11A	
	6-12A	
	6-13A	
	6-15A	
	6-16A	
	6-17A	
	6-19A	7
913-5019-200	4-24	1
913-5019-500	2-22A	
	2-52A	
	5-27A	3
913-5019-560	4-1	
	4-1	
	4-2	
	4-2	4

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REFERENCE DESIGNATION	FIG-ITEM	PART NUMBER
A1	1-16	634-8481-003
A10	1-9	641-7104-001
A10	5-	641-7104-001
A10A1	5-28	638-6931-001
A10A1	6-	638-6931-001
A10A1C1	6-49	292CY5U104Z050C
A10A1C2	6-19A	CK05BX471K
A10A1C3	6-16A	CK05BX471K
A10A1C4	6-17A	CK05BX471K
A10A1C5	6-15A	CK05BX471K
A10A1C6	6-12A	CK05BX471K
A10A1C7	6-11A	CK05BX471K
A10A1C8	6-13A	CK05BX471K
A10A1DS1	6-72	LR2664E
A10A1DS2	6-71	LR2668E
A10A1DS3	6-70	LR2664E
A10A1DS4	6-69	LR2664E
A10A1J1	6-52	CAD10SP100-230-430
A10A1R1	6-32	RCR07G271KS
A10A1R10	6-34	RCR07G271KS
A10A1R11	6-35	RCR07G271KS
A10A1R12	6-36	RCR07G271KS
A10A1R13	6-37	RCR07G271KS
A10A1R14	6-38	RCR07G271KS
A10A1R15	6-39	RCR07G271KS
A10A1R16	6-40	RCR07G271KS
A10A1R17	6-41	RCR07G271KS
A10A1R18	6-42	RCR07G271KS
A10A1R19	6-43	RCR07G271KS
A10A1R2	6-31	RCR07G271KS
A10A1R20	6-44	RCR07G271KS
A10A1R21	6-45	RCR07G271KS
A10A1R22	6-46	RCR07G271KS
A10A1R24	6-65	RCR07G271KS
A10A1R25	6-5	RCR07G271KS
A10A1R26	6-64	RCR07G271KS
A10A1R27	6-6	RCR07G271KS
A10A1R28	6-63	RCR07G271KS
A10A1R29	6-7	RCR07G271KS
A10A1R3	6-30	RCR07G271KS
A10A1R30	6-62	RCR07G271KS
A10A1R31	6-8	RCR07G271KS
A10A1R32	6-61	RCR07G271KS
A10A1R33	6-9	RCR07G271KS
A10A1R34	6-60	RCR07G271KS
A10A1R35	6-10	RCR07G271KS
A10A1R36	6-59	RCR07G271KS
A10A1R37	6-68	RCR07G271KS
A10A1R38	6-67	RCR07G271KS
A10A1R39	6-66	RCR07G271KS
A10A1R40	6-27	RCR07G271KS
A10A1R41	6-26	RCR07G271KS
A10A1R42	6-25	RCR07G271KS
A10A1R43	6-24	RCR07G271KS
A10A1R44	6-23	RCR07G271KS
A10A1R45	6-22	RCR07G271KS
A10A1R46	6-21	RCR07G271KS
A10A1R47	6-20	RCR07G271KS
A10A1R48	6-19	RCR07G271KS
A10A1R49	6-18	RCR07G271KS
A10A1R50	6-17	RCR07G271KS
A10A1R51	6-51	RCR05G104KS
A10A1R52	6-53	RCR05G104KS
A10A1R53	6-13	RCR05G104KS
A10A1R54	6-50	RCR05G104KS
A10A1R55	6-56	RCR05G103KS
A10A1R56	6-14	RCR05G103KS
A10A1R57	6-54	RCR05G103KS
A10A1R58	6-55	RCR05G103KS
A10A1R7	6-29	RCR07G271KS
A10A1R8	6-28	RCR07G271KS
A10A1R9	6-33	RCR07G271KS
A10A1U1	6-15	SN74LS138N
A10A1U2	6-48	8804-020
A10A1U3	6-58	8804-020
A10A1U4	6-57	8804-020
A10A1U5	6-12	8804-020
A10A1U6	6-16	8804-020
A10A1U7	6-47	8804-020
A10A1U8	6-11	8804-020
A10C1	5-13	292CY5U103D8050
A10C2	5-12	292CY5U102D8050
A10C4	5-27A	CK06BX334K
A10DS1	5-16	7373
A10DS2	5-18	7373
A10DS3	5-20	7373
A10G1	5-49	PC66D200-5
A10J1	5-3	13E
A10J2	5-14	M641-5-1
A10J2	5-14	647-2739-001
A10LS1	5-26	271-0271-010
A10M1	5-1	710-135A
A10R1	5-33	RV6NAYSD103B
A10R2	5-34	RV6NAYSD104B
A10R23	6-4	RCR07G271KS
A10R3	5-35	RV6NAYSD105B
A10R4	5-36	RV6NAYSD105B
A10R4	6-3	RCR07G271KS
A10R5	5-43	FF6719
A10R5	6-2	RCR07G271KS
A10R6	5-42	EB1309
A10R6	6-1	RCR07G271KS
A10R7	5-43A	RN55D4750F
A10S1	5-10	7360K11C27
A10S2	5-45	1FA20A
A10S3	5-41	280563AA1
A10S4	5-39	280563AA1
A10S5	5-40	280563AA1
A10S6	5-30	6XF12-5SDBLK2UGR
A10S7	5-31	6XF12-5FSDBLK2UE

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A10S8	5-44	259-8018-030
A10U1	5-27	7805UC
A10XDS1	5-17	634-5930-001
A10XDS2	5-19	634-5930-001
A10XDS3	5-21	634-5930-001
A13	1-14	638-6914-002
A15	1-27A	646-5802-001
A2	1-15	641-7132-001
A3	1-27	638-6908-002
A4	1-7	638-6912-002
A5	1-10	641-7099-001
A5	1-10	641-7099-002
A5A1	1-11	638-6916-002
A5A2	1-12	638-6920-001
A7	1-8	638-6918-001
A8	1-6	638-6929-002
A8	1-6	638-6929-004
A9	1-13	641-7103-001
A9	2-	641-7103-001
A9A1	2-63	638-6825-001
A9A1	3-	638-6825-001
A9A1CR1	3-2	1N4002
A9A1CR2	3-39	1N4002
A9A1C1	3-54	292CY5U104Z050C
A9A1C10	3-21	199D475X0035DB1
A9A1C11	3-22	199D475X0035DB1
A9A1C12	3-30	292CY5U104Z050C
A9A1C13	3-8	292CY5U104Z050C
A9A1C14	3-13	500D337G025DF5
A9A1C15	3-45	292CY5U103Z050B
A9A1C16	3-7	292CX7R102M050B
A9A1C2	3-40	292CX7R102M050B
A9A1C3	3-36	199D475X0035DB1
A9A1C4	3-52	292CX7R102M050B
A9A1C5	3-58	292CY5U103Z050B
A9A1C6	3-20	500D336G025BB5
A9A1C7	3-25	199D475X0035DB1
A9A1C8	3-29	199D475X0035DB1
A9A1C9	3-28	292CY5U104Z050C
A9A1F1	3-16	AGC250-2
A9A1F2	3-18	AGC250-2
A9A1L1	3-12	240-0879-010
A9A1R1	3-3	RW69V821
A9A1R10	3-38	RCR07G101KS
A9A1R11	3-27	RN55D1400F
A9A1R12	3-14	X201R251B
A9A1R12	3-14	101T200R0
A9A1R13	3-24	RN55D2870F
A9A1R14	3-15	X201R251B
A9A1R14	3-15	101T200R0
A9A1R15	3-51	RN55D2490F
A9A1R16	3-5	X201R251B
A9A1R16	3-5	101T500R0
A9A1R17	3-6	RN55D1401F
A9A1R18	3-50	RCR07G105KS
A9A1R19	3-34	RN55D5621F
A9A1R2	3-53	705-0701-000
A9A1R20	3-1	RCR32G152KS
A9A1R21	3-59	RN55D3013F
A9A1R21	3-59	RN60D3833F
A9A1R22	3-33	RN55D3831F
A9A1R23	3-9	X201R102B
A9A1R23	3-9	101T10000
A9A1R24	3-11	RCR42G271KS
A9A1R25	3-55	RCR07G101KS
A9A1R26	3-46	RN55D1401F
A9A1R27	3-26	RN55D7500F
A9A1R28	3-23	RN55D7500F
A9A1R29	3-48	RN55D6811F
A9A1R3	3-4	RCR07G471KS
A9A1R30	3-49	RN55D6811F
A9A1R31	3-10	RW69V1R5
A9A1R4	3-44	RW67V470
A9A1R5	3-32	RCR42G150KS
A9A1R6	3-41	RCR07G103KS
A9A1R7	3-43	RCR20G222KS
A9A1R8	3-35	RCR07G104KS
A9A1R9	3-57	RCR07G102KS
A9A1U1	3-37	MLM358U
A9A1VR1	3-31	1N821A
A9A1VR2	3-47	1N4750A
A9A1VR3	3-56	1N4104
A9A1VR4	3-42	1N4617
A9A2	2-58	638-6275-001
A9A2	2-58	638-6275-002
A9A2	4-	638-6275-001
A9A2	4-	638-6275-002
A9A2CR1	4-4	SC5615
A9A2C1	4-21	292CY5U104Z050C
A9A2C2	4-24	CK05BX103K
A9A2C3	4-17	292CY5U103Z050B
A9A2C4	4-1	199D155X0050CE3
A9A2C4	4-1	CK06BX105K
A9A2C4	4-1	CK06BX105K
A9A2C5	4-11	199D475X0035DB1
A9A2C6	4-14	292CY5U104Z050C
A9A2C7	4-2	199D155X0050CE3
A9A2C7	4-2	CK06BX105K
A9A2C7	4-2	CK06BX105K
A9A2L1	4-20	MS75089-3
A9A2L2	4-25	12375B
A9A2L3	4-8	MS75089-15
A9A2L4	4-19	MS75089-3
A9A2Q1	4-6	2N2219A
A9A2R1	4-12	RN55D2741F
A9A2R2	4-13	RCR07G102KS
A9A2R3	4-23	X201R252B
A9A2R3	4-23	101T20000
A9A2R4	4-10	RCR07G222KS
A9A2R5	4-22	RCR32G561KS
A9A2R6	4-5	RCR07G101KS
A9A2R7	4-7	RCR42G181KS
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A9A2U1	4-18	LM555CN
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A9A2VR2	4-16	1N5359B
A9A2VR3	4-9	1N5363B
A9CR1	2-13	1N1186
A9CR2	2-21	1N1186
A9CR3	2-31	1N5550
A9C1	2-15	3120GE723U0250P
A9C10	2-77	292CY5U103D8050
A9C11	2-72	292CY5U102D8050
A9C12	2-75	CK63AW103M
A9C13	2-69	292CY5U103D8050
A9C14	2-67	292CY5U103D8050

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A9C15	2-52	199D474X0035AB1			
A9C18	2-52A	CK06BX334K			
A9C19	2-22A	CK06BX334K			
A9C2	2-44	2DDH62N472MAA			
A9C3	2-45	2DDH62N472MAA			
A9C4	2-12	3120BE123U025BP			
A9C5	2-54	54-794-010-102P			
A9C6	2-55	54-794-010-102P			
A9C7	2-56	54-794-010-102P			
A9C8	2-57	54-794-010-102P			
A9C9	2-79	292CY5U102D8050			
A9F1	2-42	ABC8			
A9F2	2-40	AGC32-30			
A9J1	2-46	P406AB			
A9J10	2-65	M641-12-1			
A9J11	2-64	13E			
A9J12	2-19	350782-1			
A9J13	2-20	350781-1			
A9J2	2-66	3501FP			
A9J3	2-76	3501FP			
A9J4	2-73	3501FP			
A9J5	2-70	3501FP			
A9J6	2-78	3501FP			
A9J7	2-74	3501FP			
A9J8	2-71	3501FP			
A9J9	2-68	3501FP			
A9P2	2-17	350720-1			
A9P3	2-18	350715-1			
A9Q1	2-62	TIP31A			
A9R1	2-25	HL15-3-50HMS5PCT			
A9R2	2-28	RS5R040-5PCT			
A9R3	2-27	RS5R040-5PCT			
A9R4	2-26	RS5R040-5PCT			
A9R5	2-33	RS5R015-1PCT			
A9R6	2-34	RS5R015-1PCT			
A9TB1	2-47	17-7			
A9TB2	2-30	332-14-04-022			
A9TB3	2-32	332-14-04-022			
A9TB4	2-35	332-14-04-022			
A9T1	2-23	40-12240			
A9T1	2-23	124P315			
A9U1	2-22	7805UC			
A9U2	2-61	LM317T			
A9U3	2-60	LM317T			
A9VR1	2-49	1N3998RA			
A9VR2	2-24	GZ82519E			
A9VR3	2-53	1N5359B			
A9XF1	2-43	345001			
A9XF2	2-41	350-267			
C1	1-23	CM04ED330J03			
C2	1-20	CM04ED330J03			
C3	1-21	CM04ED820J03			
C4	1-25	CM04FD101J03			
C5	1-26	CM05FD151J03			
L1	1-24	MS18130-1			
L2	1-22	MS75083-06			
TB1	1-19	332-14-04-022			
XF1	3-17	102071			
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HF-380 Transceiver

Rockwell International

diagrams

Collins Telecommunications Products Division

Printed in USA

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1. CONFIGURATION STATUS CONTROL

Collins Telecommunications Products Division of Rockwell International uses a 2-character (maximum) alphabetic identifier for configuration identification. The alphabetic identifier is preceded by the letters REV (revision) and starts with — (dash) if no changes have been made. The first change is identified as A, the second as B, continuing through Z to AA, AB, and ultimately to ZZ.

Note

The alphabetic identifier is not a serial number; therefore, many units or subassemblies may exist with the same identifier.

Incorporation of design changes in a unit or subassembly that has been returned to Collins for repair or has been removed from the company's finished goods inventory is defined as rework. At the time of rework, the unit or subassembly is marked again to reflect the design level to which it is being upgraded. This is done by leaving the original marking and adding the letters RWK (rework) followed by the alphabetic identifier of the latest change incorporated in the rework. For example, unit one may be marked REV B-RWK F and unit two may be marked REV F. A reworked unit may not contain all design changes made prior to the reworked alphabetic identifier, but does contain all changes required to make unit operation identical to a newly manufactured unit having the same alphabetic identifier. Therefore, a unit reworked to a specific alphabetic identifier may not have the exact components and/or the same physical appearance as a newly manufactured unit having the same alphabetic identifier.

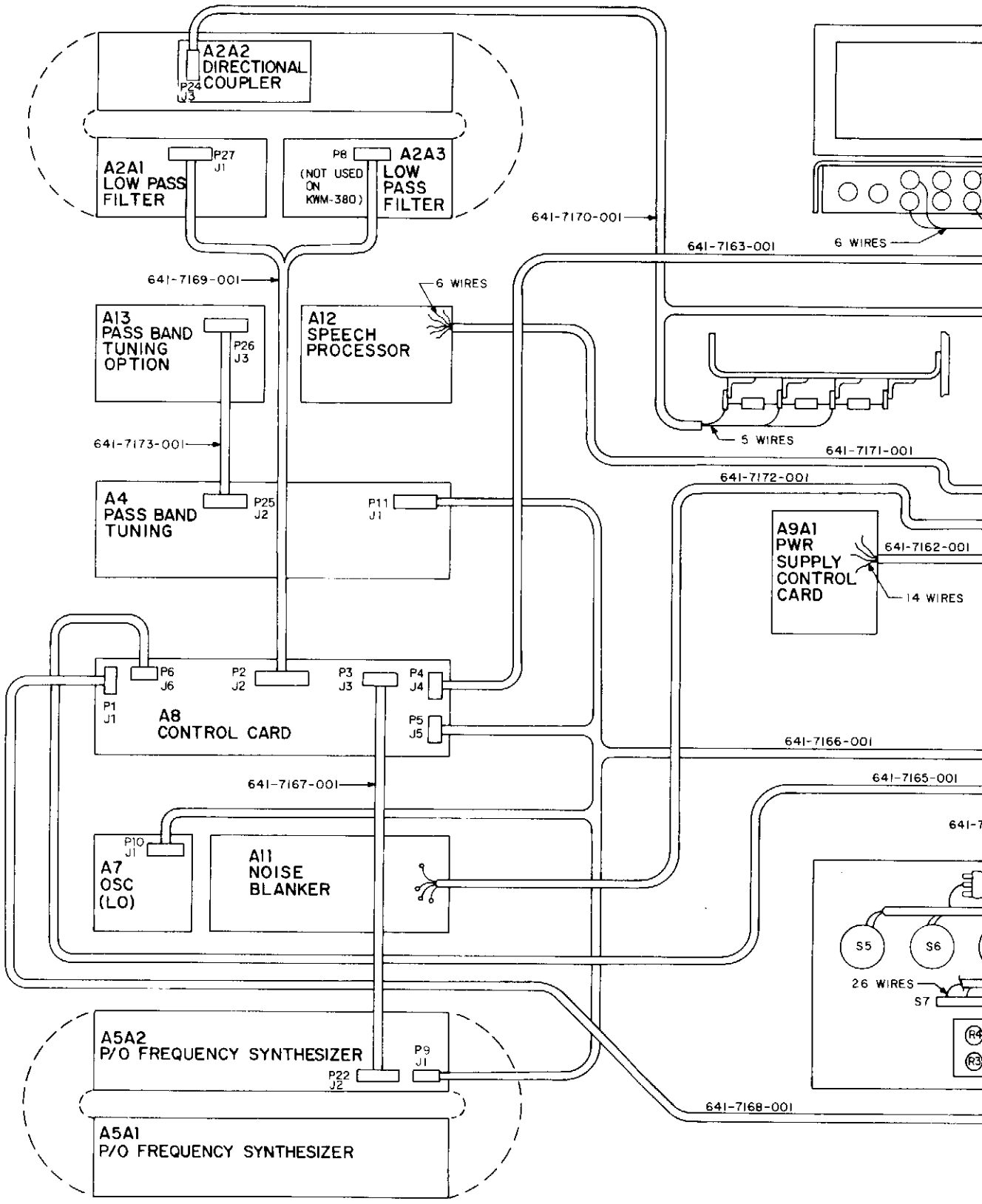
Only alphabetic identifiers that result in schematic changes are covered in this section. Therefore, if a unit or subassembly has an alphabetic identifier that falls between identifiers on the schematic changes page, or after the last identifier on the schematic changes page up to and including the latest effectivity listed below, the electrical configuration is represented by the earlier alphabetic identifier listed on the schematic changes page.

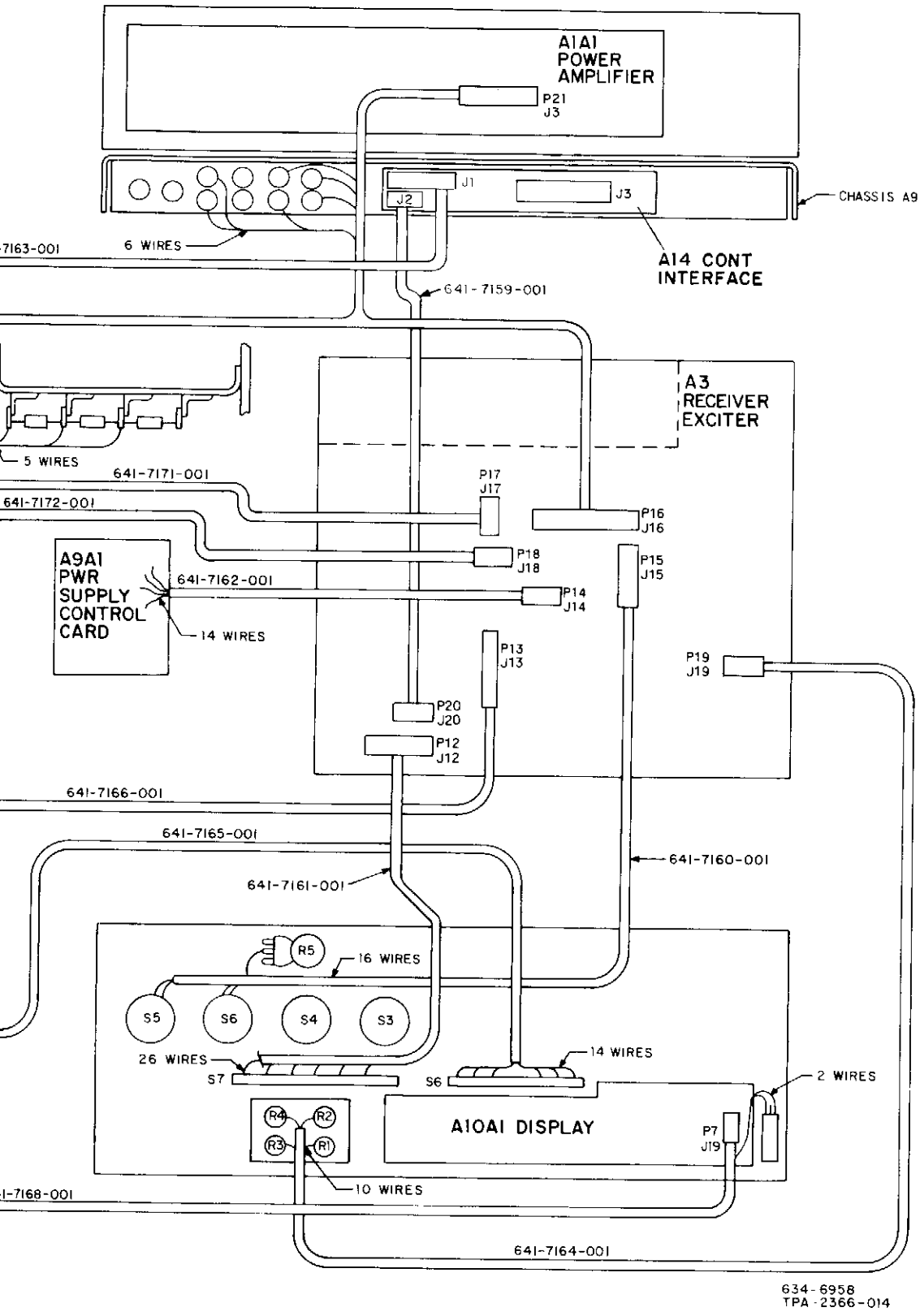
2. CONFIGURATION EFFECTIVITY

Refer to the schematic changes page preceding each subassembly schematic for any changes that may have occurred and the corresponding alphabetic identifier covering each change.

Listed below are the units/subassemblies with the latest alphabetic identifier covered by this document.

UNIT/SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
HF-380 Transceiver	638-3580-001	REV N
Chassis A9	641-7103-001	REV L
Power Supply Control A9A1	638-6825-001	REV J
+24-Volt Regulator A9A2	638-6275-001	REV G
Front Panel A10	641-7104-001	REV N
Display A10A1	638-6931-001	REV F

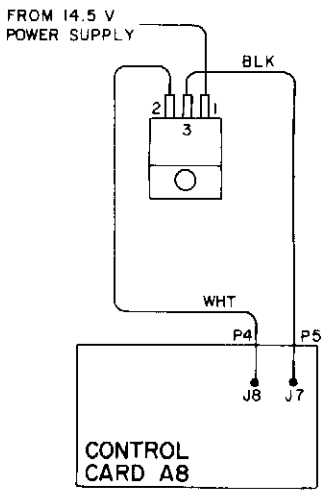

A2A2
DIRECTIONAL
COUPLER
P24
J3
A2A1
LOW PASS
FILTER
P27
J1
P8
(NOT USED
ON
KWM-380)
A2A3
LOW
PASS
FILTER
641-7170-001
641-7163-001
6 WIRES
641-7169-001
6 WIRES
A13
PASS BAND
TUNING
OPTION
P26
J3
A12
SPEECH
PROCESSOR
5 WIRES
641-7171-001
641-7173-001
641-7172-001
A4
PASS BAND
TUNING
P25
J2
P11
J1
A9A1
PWR
SUPPLY
CONTROL
CARD
641-7162-001
14 WIRES
P6
J6
P2
J2
P3
J3
P4
J4
P1
J1
A8
CONTROL CARD
P5
J5
641-7166-001
641-7167-001
641-7165-001
P10
J1
A7
OSC
(LO)
A11
NOISE
BLANKER
S5
S6
26 WIRES
S7
A5A2
P/O FREQUENCY SYNTHESIZER
P9
J1
P22
J2
641-7168-001
A5A1
P/O FREQUENCY SYNTHESIZER



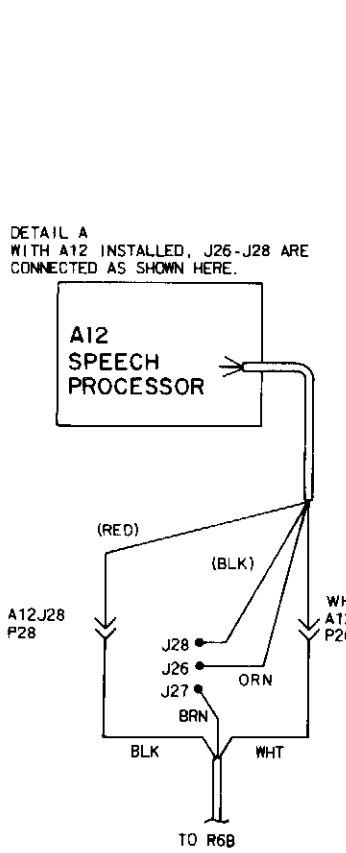
NOTE:

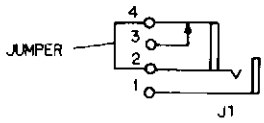
REFER TO PARTS LOCATION DIAGRAMS FOR CONNECTOR PIN LOCATIONS.

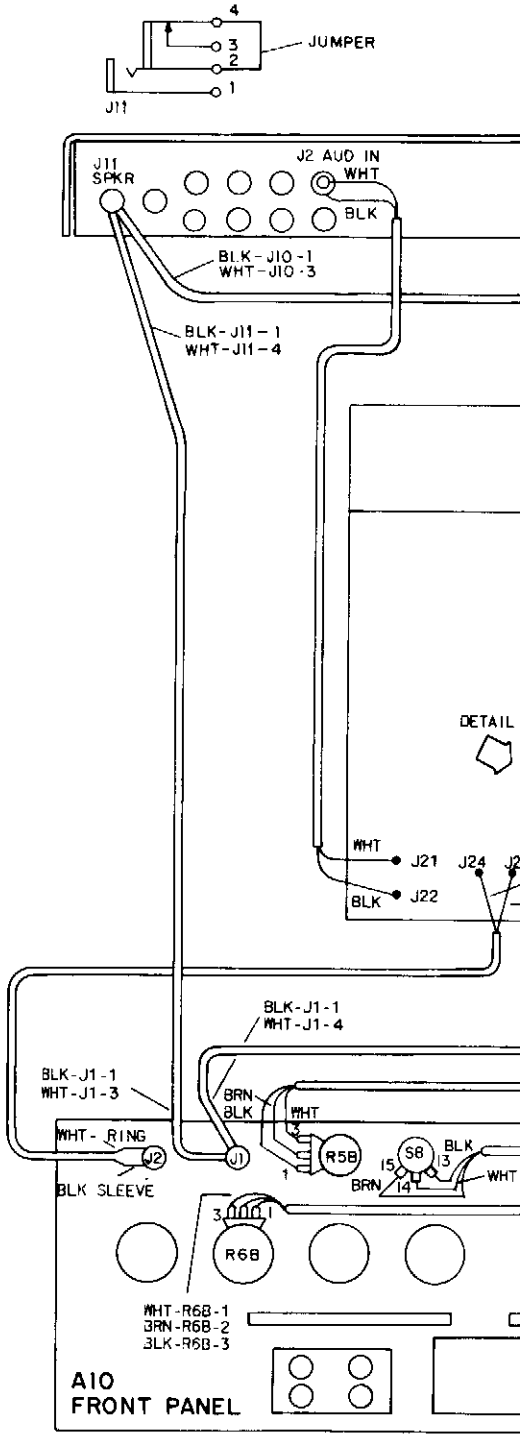
Ribbon Cable Wiring Diagram
Figure 1

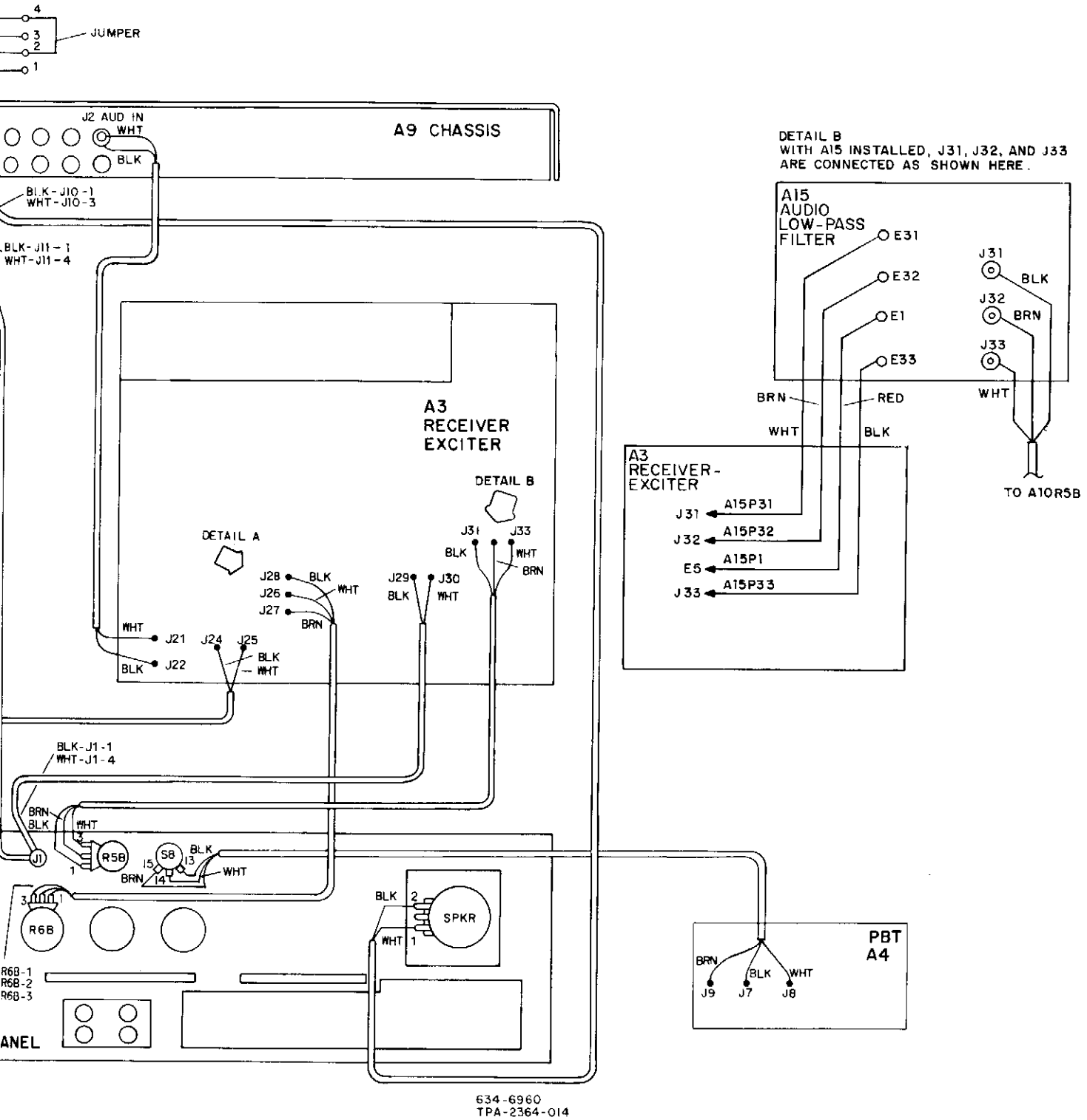


MISCELLANEOUS WIRING

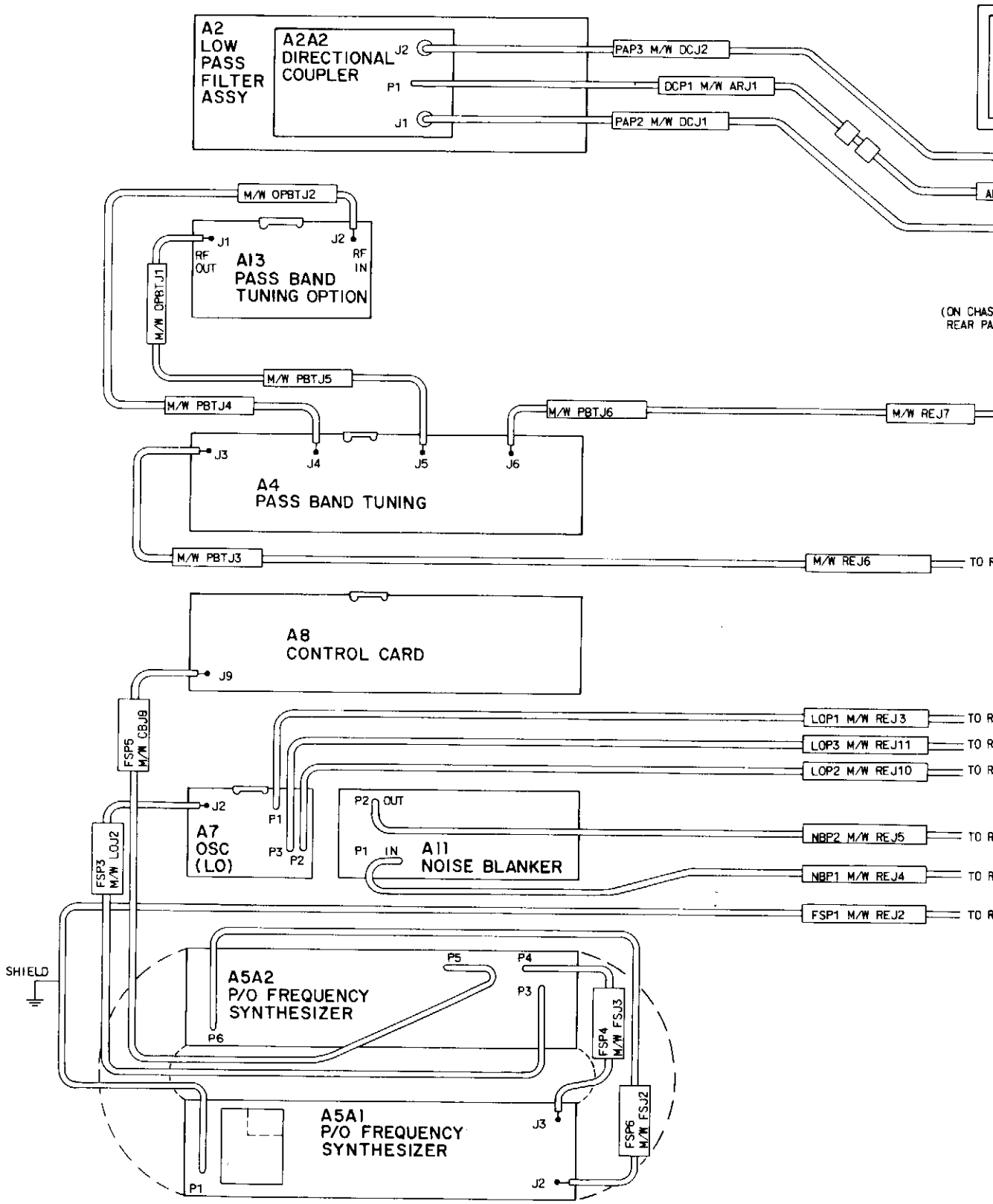


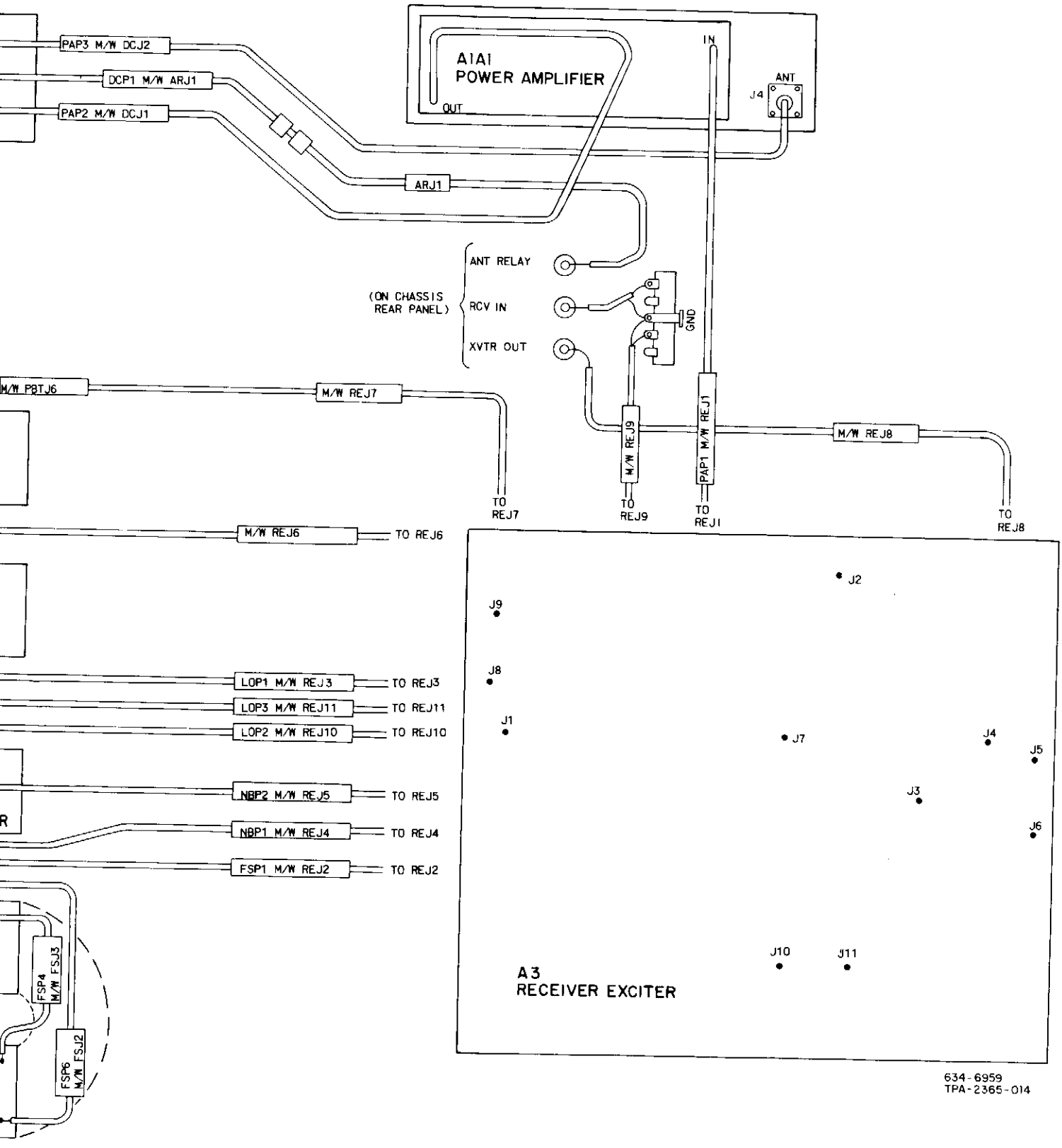




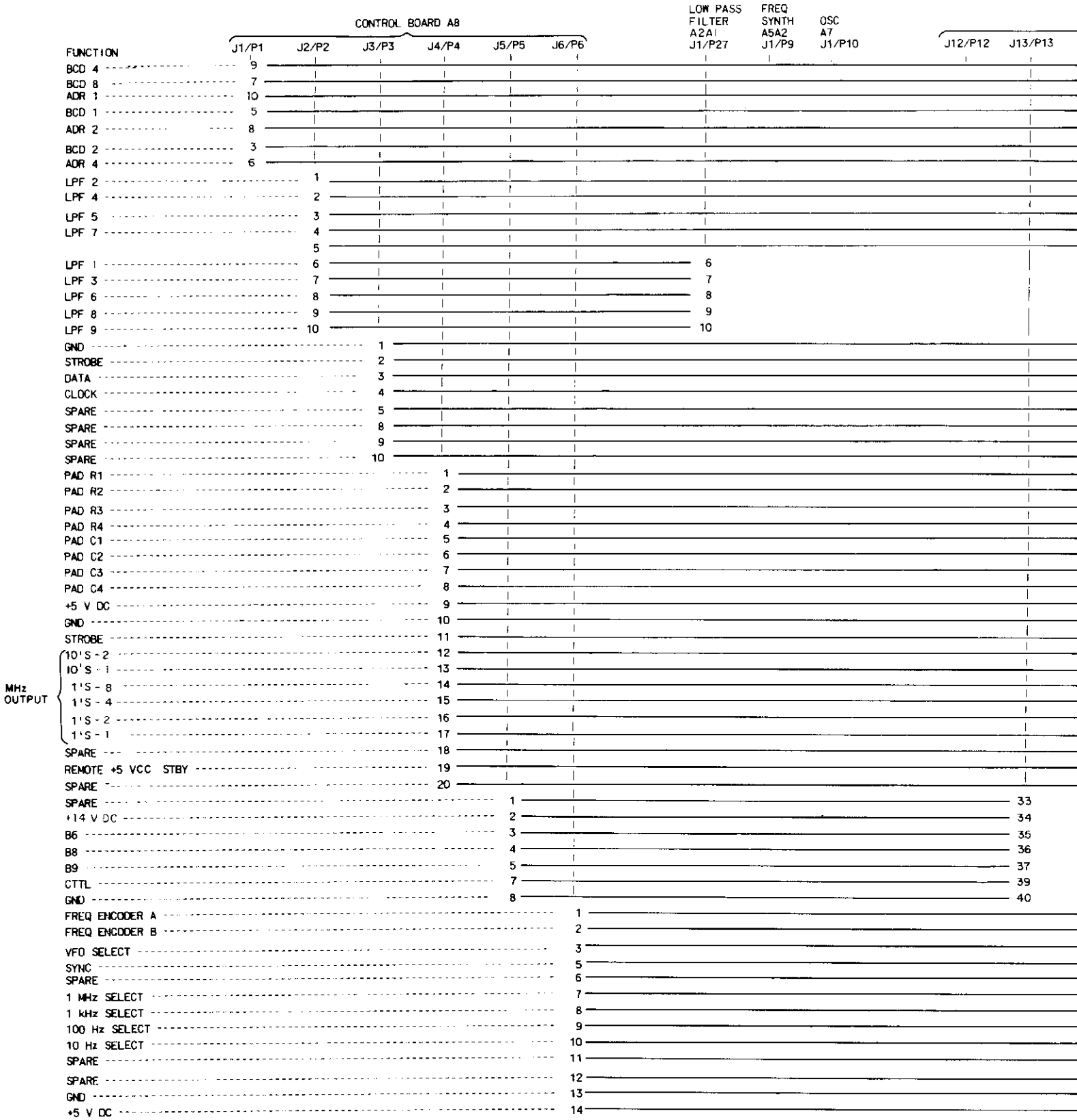


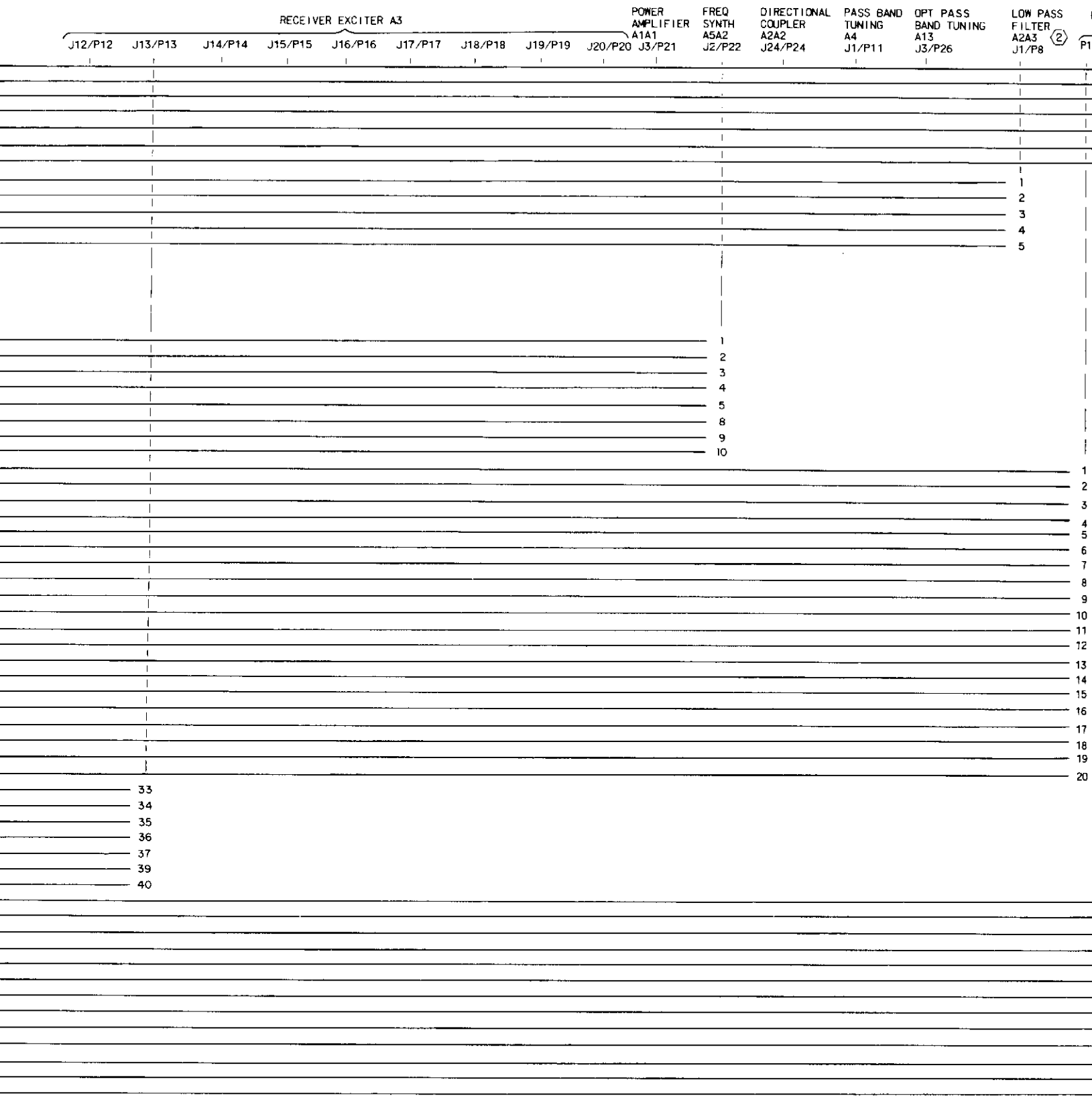
Shielded Wire Wiring Diagram
Figure 2

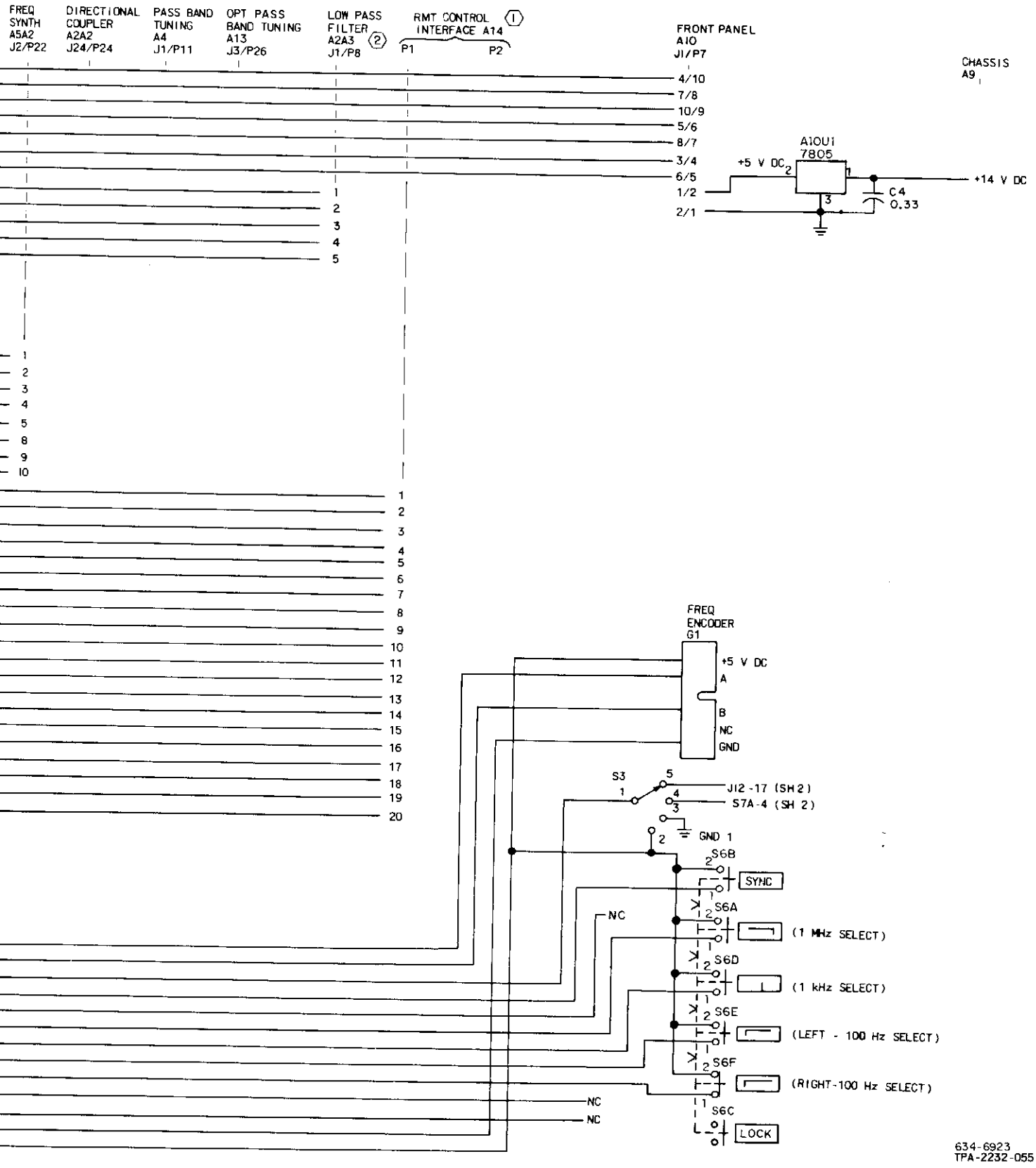

A2
LOW
PASS
FILTER
ASSY
A2A2
DIRECTIONAL
COUPLER
J2
P1
J1
PAP3 M/W DCJ2
DCP1 M/W ARJ1
PAP2 M/W DCJ1
M/W OPBTJ2
J1
J2
RF
OUT
RF
IN
A13
PASS BAND
TUNING OPTION
M/W OPBTJ1
M/W PBTJ5
M/W PBTJ4
M/W PBTJ6
M/W REJ7
J3
J4
J5
J6
A4
PASS BAND TUNING
M/W PBTJ3
M/W REJ6
A8
CONTROL CARD
J9
FSP5
M/W CBJ9
LOP1 M/W REJ3
LOP3 M/W REJ11
LOP2 M/W REJ10
J2
P1
P3
P2
A7
OSC
(LO)
P2
OUT
P1
IN
A11
NOISE BLANKER
NBP2 M/W REJ5
NBP1 M/W REJ4
FSP3
M/W LOJ2
FSP1 M/W REJ2
SHIELD
A5A2
P/O FREQUENCY
SYNTHESIZER
P5
P4
P3
P6
FSP4
M/W FSJ3
A5A1
P/O FREQUENCY
SYNTHESIZER
J3
FSP6
M/W FSJ2
P1
J2



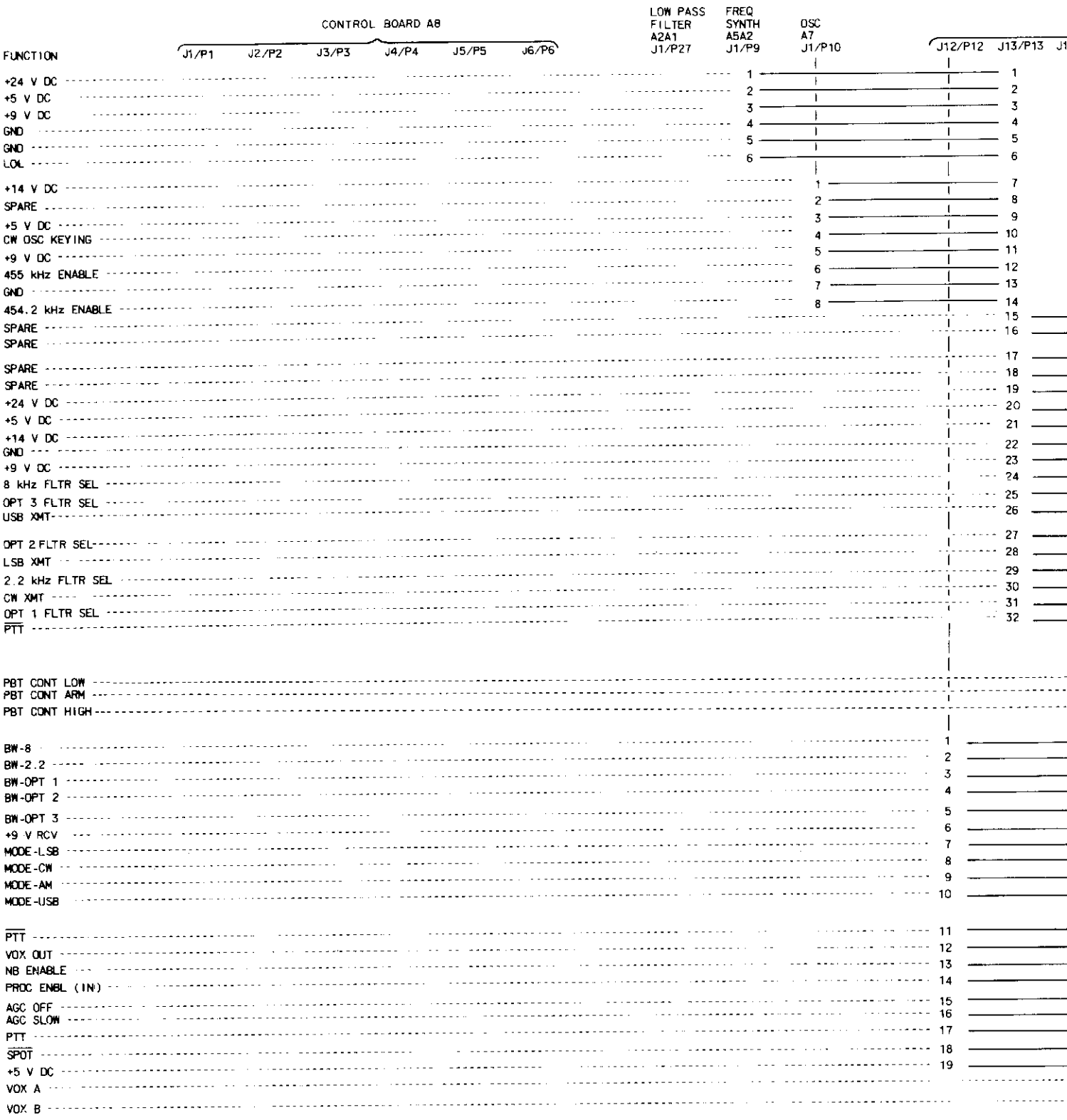
Coax Cable Wiring Diagram
Figure 3

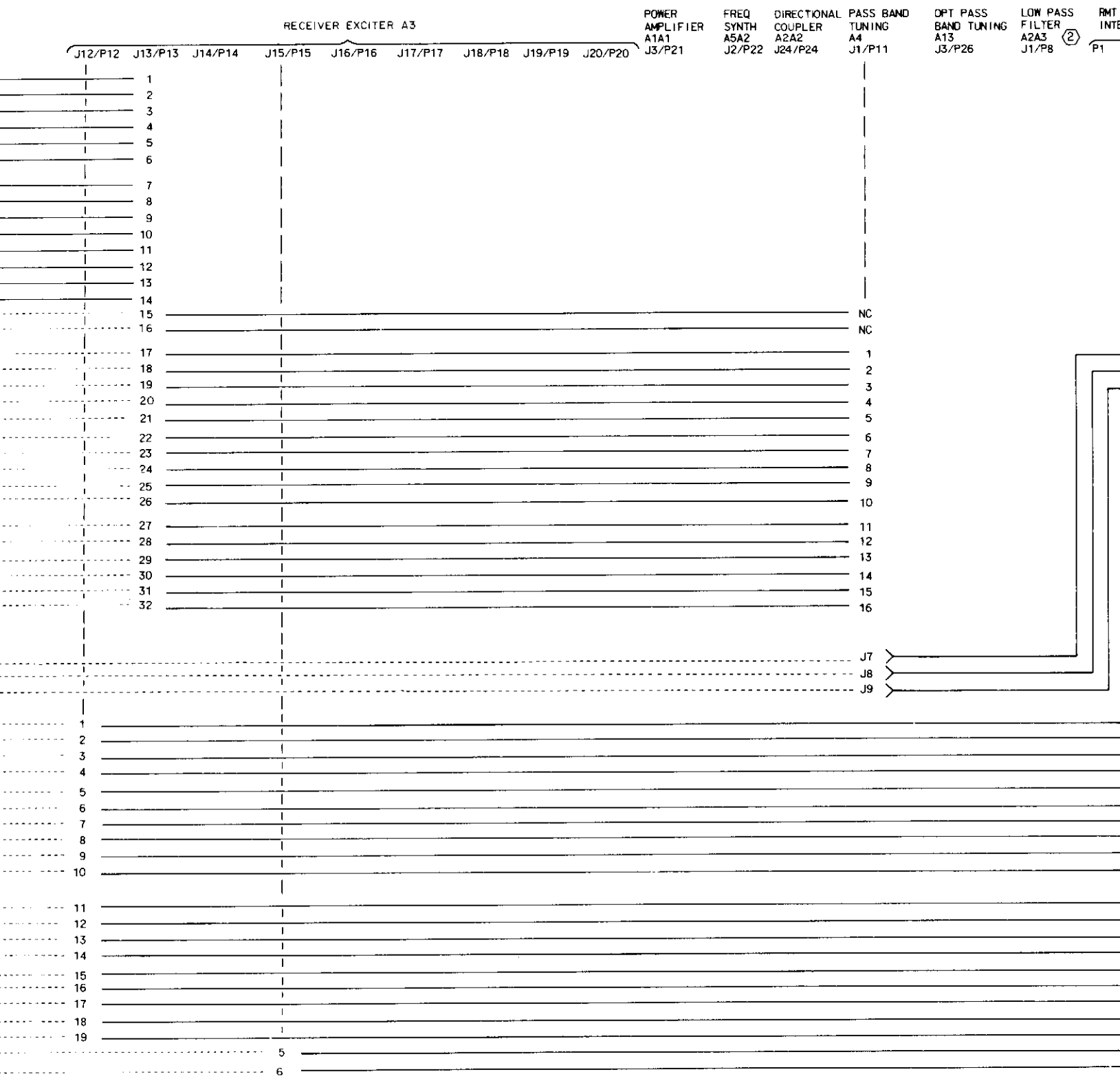

CONTROL BOARD A8
J1/P1
J2/P2
J3/P3
J4/P4
J5/P5
J6/P6
LOW PASS FILTER A2A1 J1/P27
FREQ SYNTH A5A2 J1/P9
OSC A7 J1/P10
J12/P12
J13/P13
FUNCTION
BCD 4
BCD 8
ADR 1
BCD 1
ADR 2
BCD 2
ADR 4
LPF 2
LPF 4
LPF 5
LPF 7
LPF 1
LPF 3
LPF 6
LPF 8
LPF 9
GND
STROBE
DATA
CLOCK
SPARE
SPARE
SPARE
SPARE
PAD R1
PAD R2
PAD R3
PAD R4
PAD C1
PAD C2
PAD C3
PAD C4
+5 V DC
GND
STROBE
10'S - 2
10'S - 1
1'S - 8
1'S - 4
1'S - 2
1'S - 1
MHz OUTPUT
SPARE
REMOTE +5 VCC STBY
SPARE
SPARE
+14 V DC
B6
B8
B9
CTTL
GND
FREQ ENCODER A
FREQ ENCODER B
VFO SELECT
SYNC
SPARE
1 MHz SELECT
1 kHz SELECT
100 Hz SELECT
10 Hz SELECT
SPARE
SPARE
GND
+5 V DC

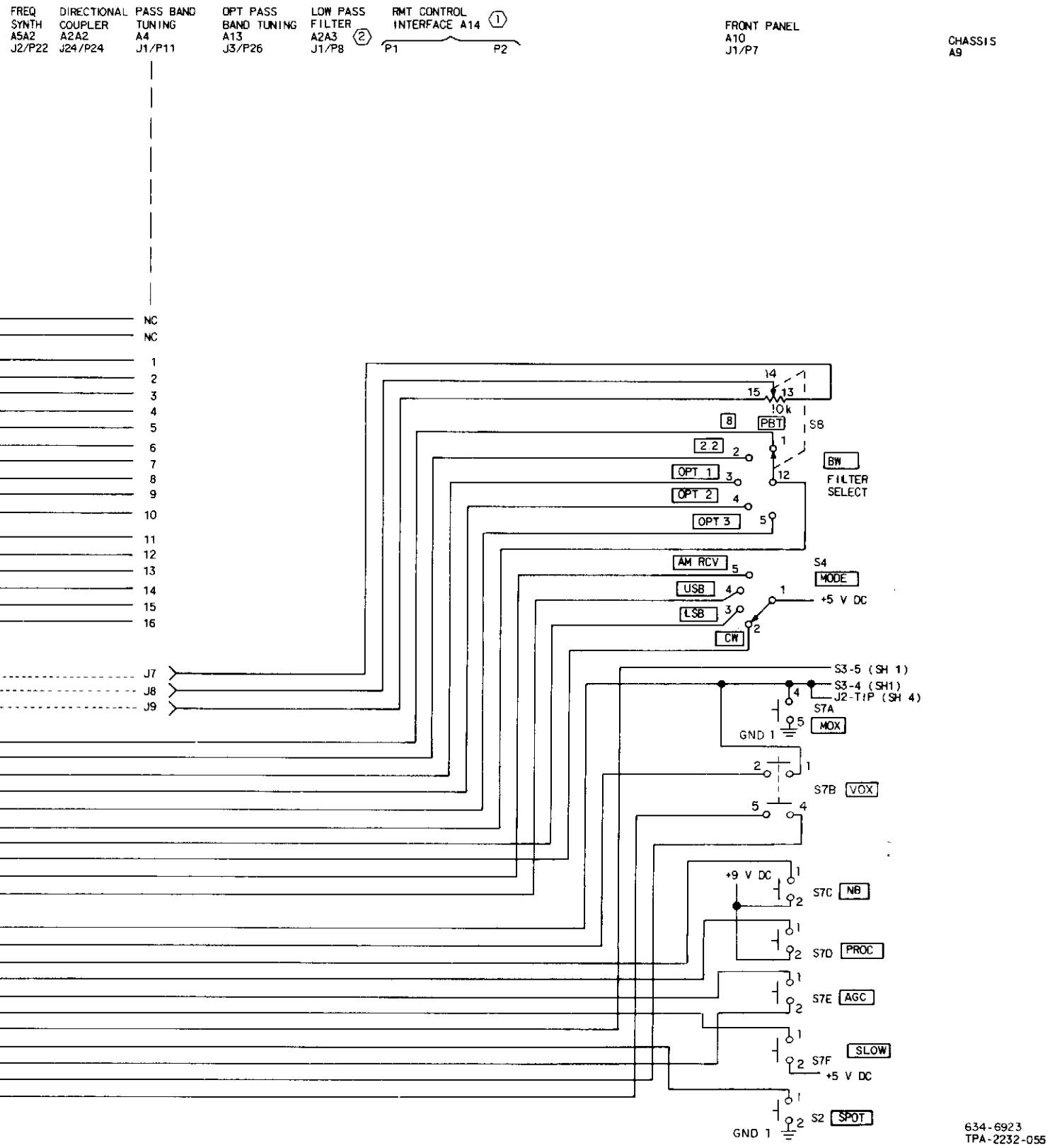

RECEIVER EXCITER A3
J12/P12
J13/P13
J14/P14
J15/P15
J16/P16
J17/P17
J18/P18
J19/P19
J20/P20
POWER AMPLIFIER A1A1 J3/P21
FREQ SYNTH A5A2 J2/P22
DIRECTIONAL COUPLER A2A2 J24/P24
PASS BAND TUNING A4 J1/P11
OPT PASS BAND TUNING A13 J3/P26
LOW PASS FILTER A2A3 J1/P8
2
P1
1
2
3
4
5
1
2
3
4
5
8
9
10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
33
34
35
36
37
39
40



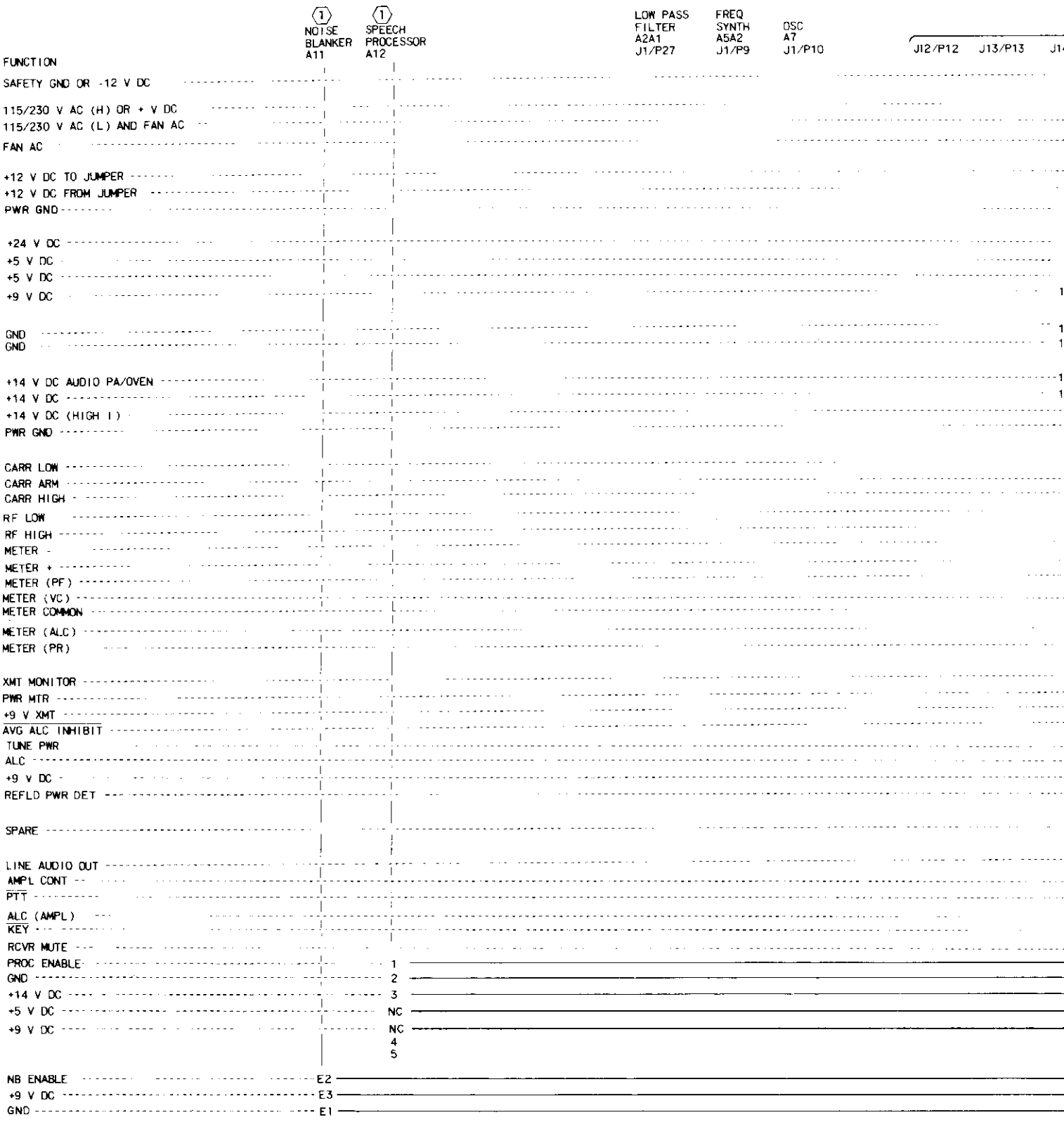
Transceiver, Interconnect Diagram
Figure 4 (Sheet 1 of 5)

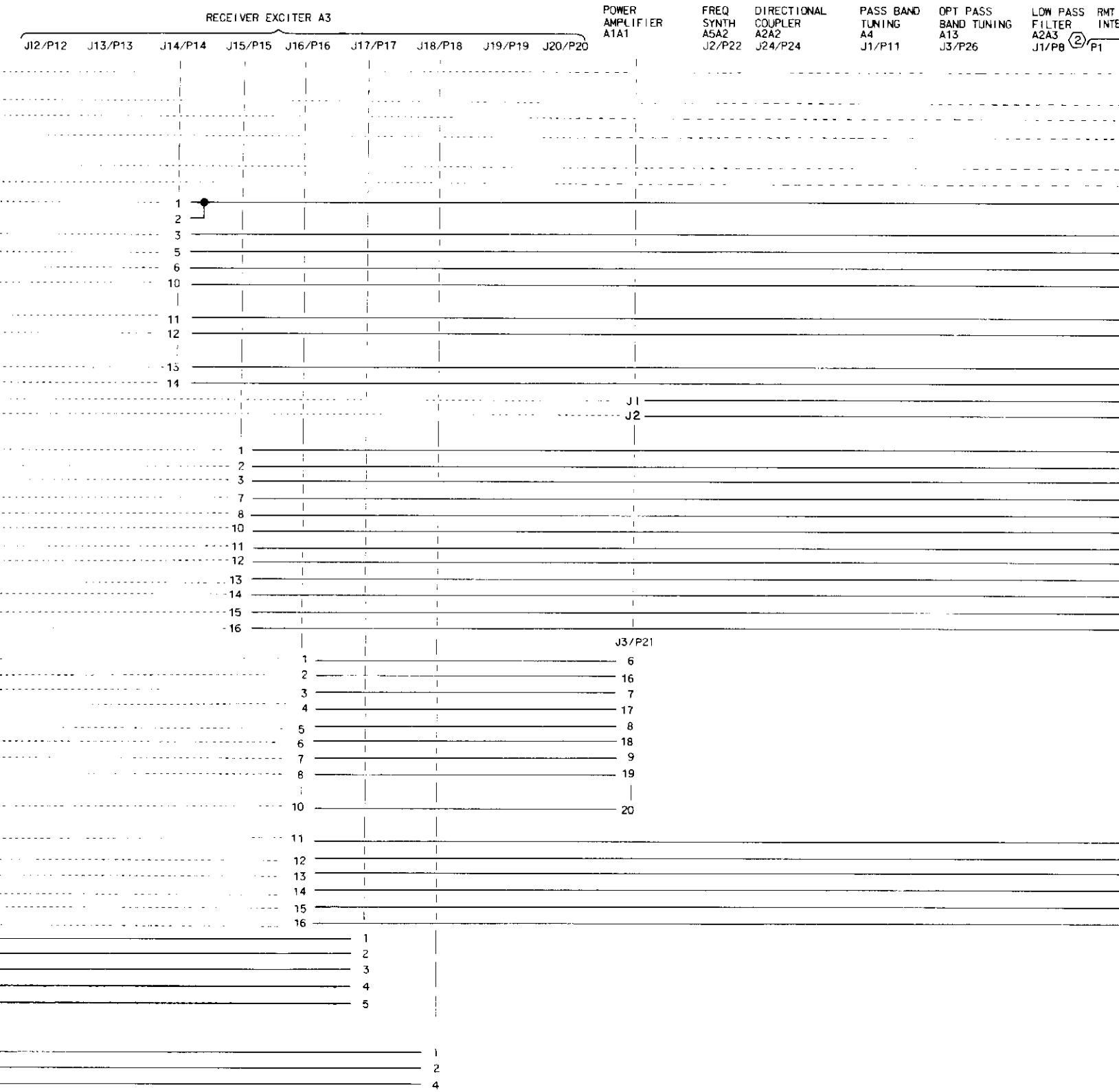

CONTROL BOARD A8
J1/P1
J2/P2
J3/P3
J4/P4
J5/P5
J6/P6
FUNCTION
LOW PASS FILTER A2A1 J1/P27
FREQ SYNTH A5A2 J1/P9
OSC A7 J1/P10
J12/P12
J13/P13
+24 V DC
+5 V DC
+9 V DC
GND
GND
LOL
+14 V DC
SPARE
+5 V DC
CW OSC KEYING
+9 V DC
455 kHz ENABLE
GND
454.2 kHz ENABLE
SPARE
SPARE
SPARE
SPARE
+24 V DC
+5 V DC
+14 V DC
GND
+9 V DC
8 kHz FLTR SEL
OPT 3 FLTR SEL
USB XMT
OPT 2 FLTR SEL
LSB XMT
2.2 kHz FLTR SEL
CW XMT
OPT 1 FLTR SEL
PTT
PBT CONT LOW
PBT CONT ARM
PBT CONT HIGH
BW-8
BW-2.2
BW-OPT 1
BW-OPT 2
BW-OPT 3
+9 V RCV
MODE-LSB
MODE-CW
MODE-AM
MODE-USB
PTT
VOX OUT
NB ENABLE
PROC ENBL (IN)
AGC OFF
AGC SLOW
PTT
SPOT
+5 V DC
VOX A
VOX B

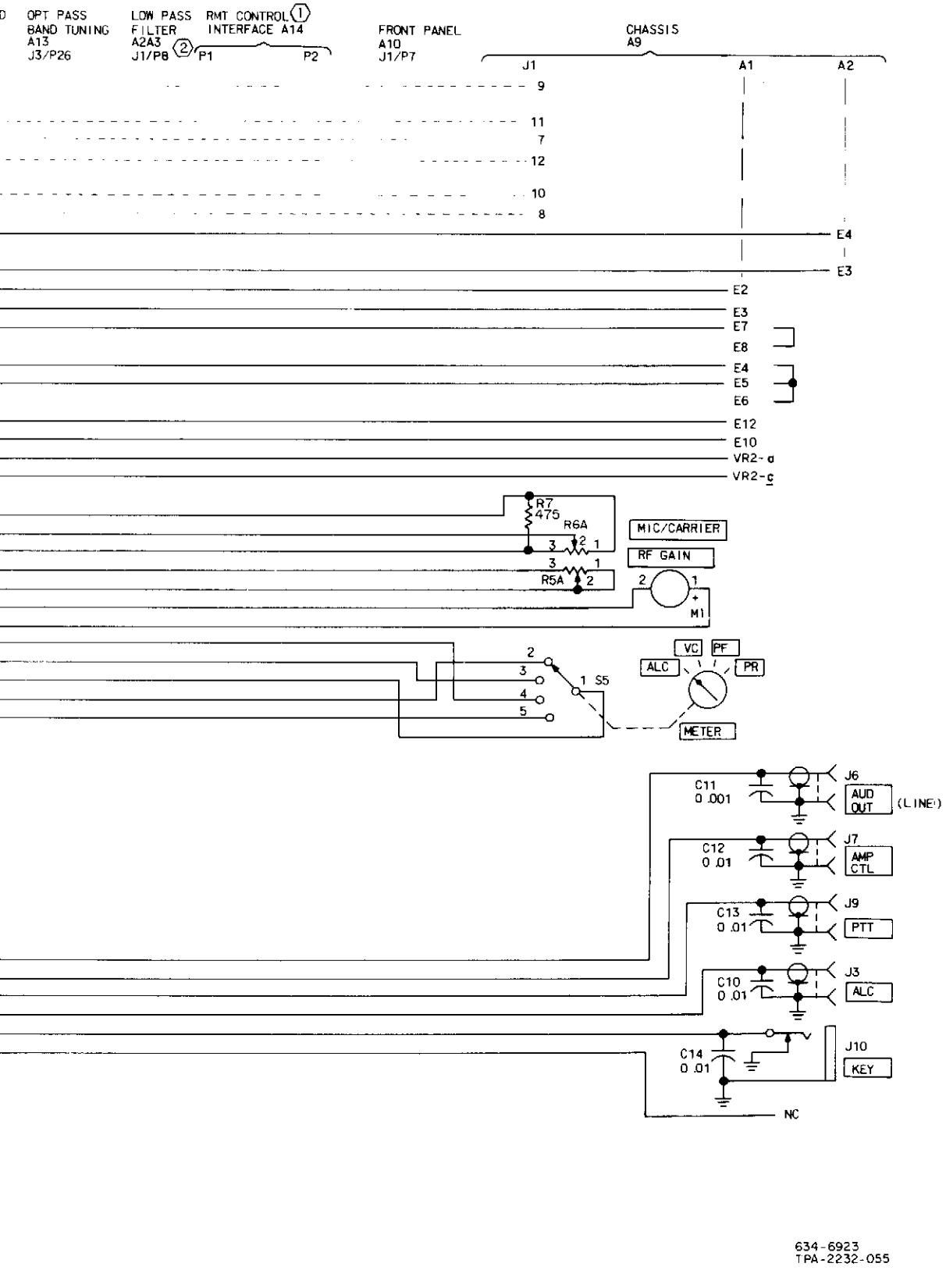

RECEIVER EXCITER A3
J12/P12
J13/P13
J14/P14
J15/P15
J16/P16
J17/P17
J18/P18
J19/P19
J20/P20
POWER AMPLIFIER A1A1 J3/P21
FREQ SYNTH A5A2 J2/P22
DIRECTIONAL COUPLER A2A2 J24/P24
PASS BAND TUNING A4 J1/P11
OPT PASS BAND TUNING A13 J3/P26
LOW PASS FILTER A2A3 J1/P8
2
P1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
NC
NC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
J7
J8
J9
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
5
6



Transceiver, Interconnect Diagram
Figure 4 (Sheet 2)


NOISE BLANKER A11
SPEECH PROCESSOR A12
LOW PASS FILTER A2A1 J1/P27
FREQ SYNTH A5A2 J1/P9
OSC A7 J1/P10
J12/P12
J13/P13
FUNCTION
SAFETY GND OR -12 V DC
115/230 V AC (H) OR + V DC
115/230 V AC (L) AND FAN AC
FAN AC
+12 V DC TO JUMPER
+12 V DC FROM JUMPER
PWR GND
+24 V DC
+5 V DC
+5 V DC
+9 V DC
GND
GND
+14 V DC AUDIO PA/OVEN
+14 V DC
+14 V DC (HIGH I)
PWR GND
CARR LOW
CARR ARM
CARR HIGH
RF LOW
RF HIGH
METER -
METER +
METER (PF)
METER (VC)
METER COMMON
METER (ALC)
METER (PR)
XMT MONITOR
PWR MTR
+9 V XMT
AVG ALC INHIBIT
TUNE PWR
ALC
+9 V DC
REFLD PWR DET
SPARE
LINE AUDIO OUT
AMPL CONT
PTT
ALC (AMPL)
KEY
RCVR MUTE
PROC ENABLE
GND
+14 V DC
+5 V DC
+9 V DC
1
2
3
NC
NC
4
5
NB ENABLE
+9 V DC
GND
E2
E3
E1


RECEIVER EXCITER A3
J12/P12
J13/P13
J14/P14
J15/P15
J16/P16
J17/P17
J18/P18
J19/P19
J20/P20
POWER AMPLIFIER A1A1
FREQ SYNTH A5A2 J2/P22
DIRECTIONAL COUPLER A2A2 J24/P24
PASS BAND TUNING A4 J1/P11
OPT PASS BAND TUNING A13 J3/P26
LOW PASS FILTER A2A3 J1/P8
2
P1
RMT INTE
1
2
3
5
6
10
11
12
13
14
J1
J2
1
2
3
7
8
10
11
12
13
14
15
16
J3/P21
1
2
3
4
5
6
7
8
10
11
12
13
14
15
16
6
16
7
17
8
18
9
19
20
1
2
3
4
5
1
2
4



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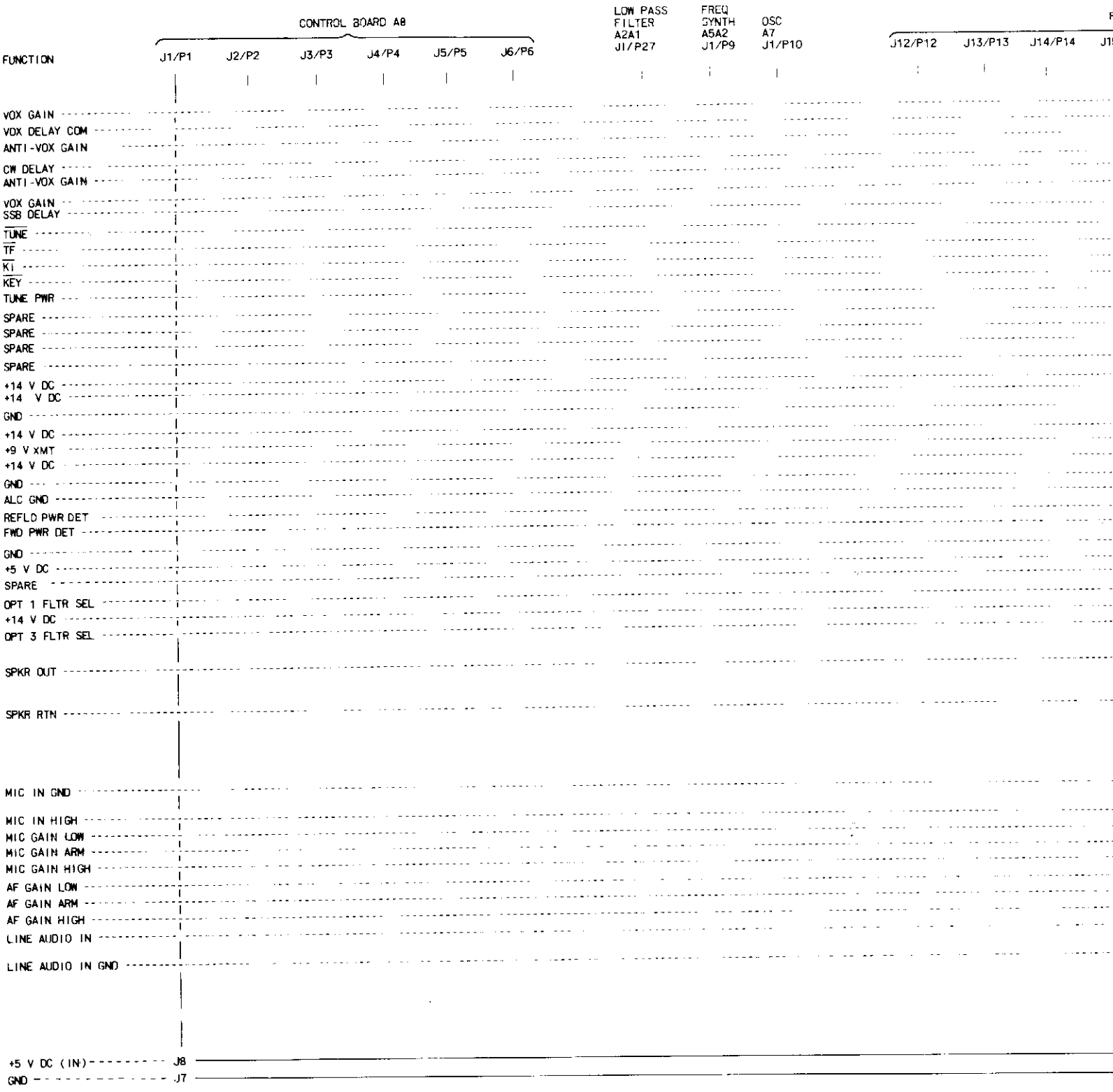
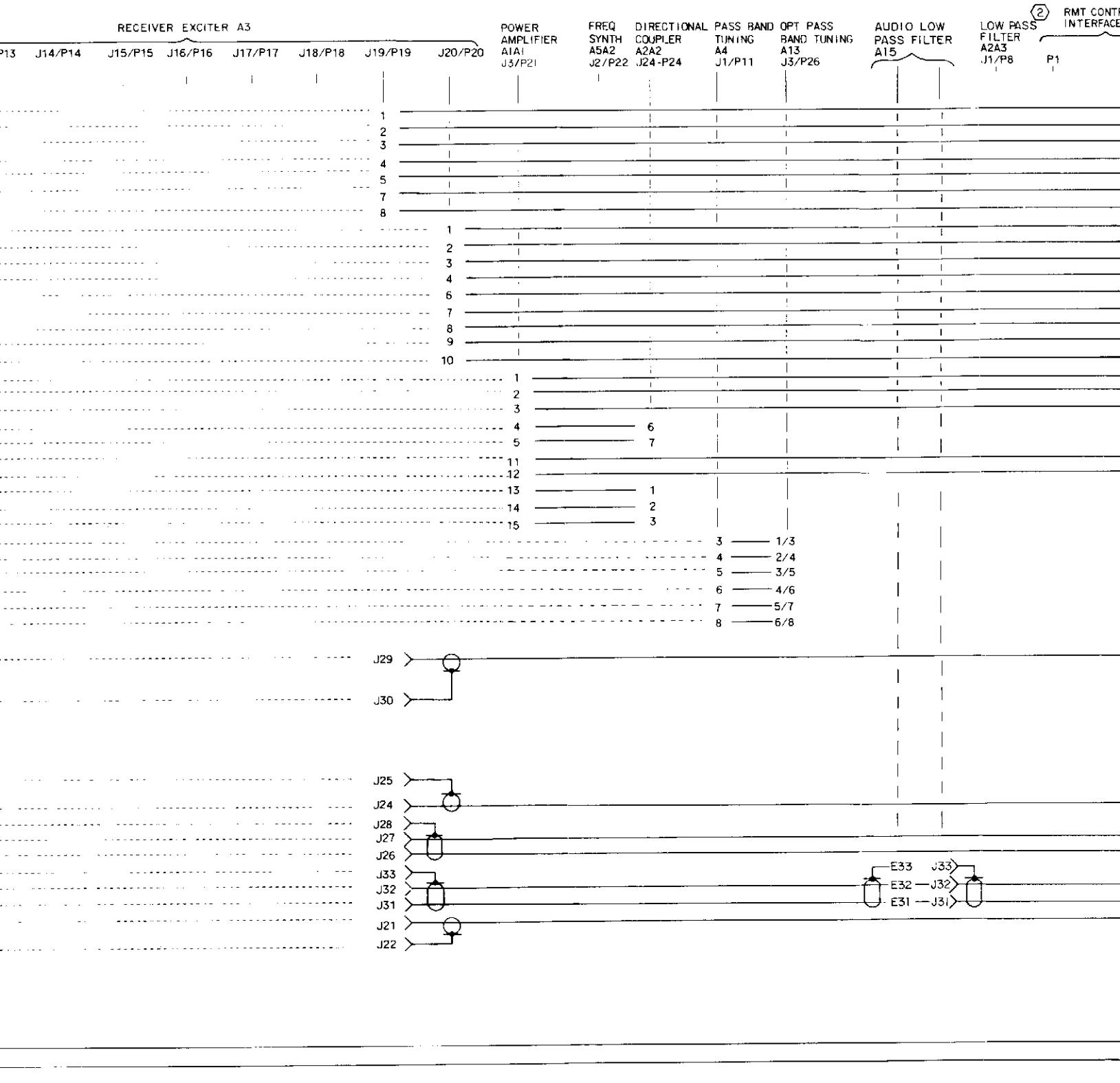
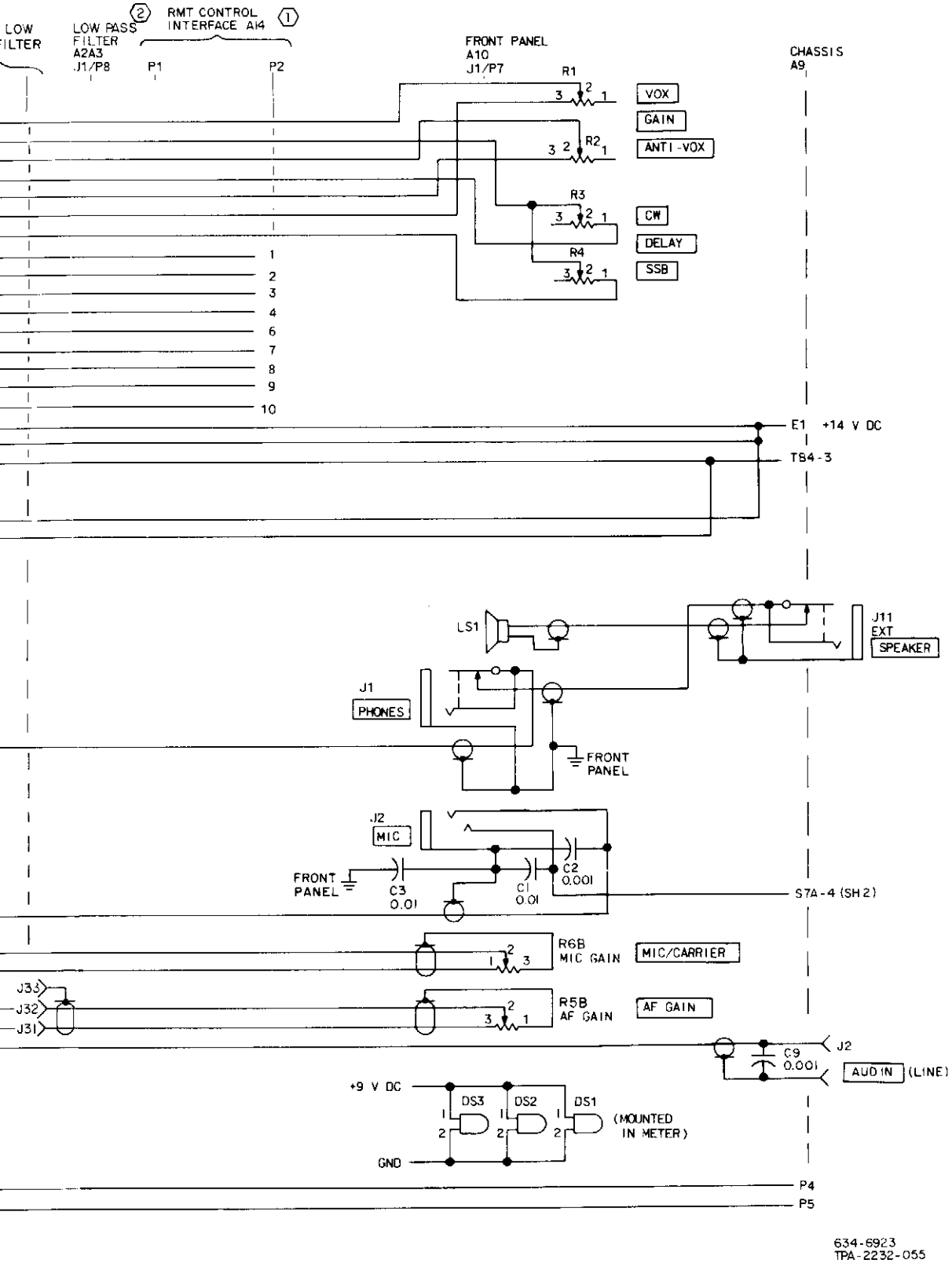
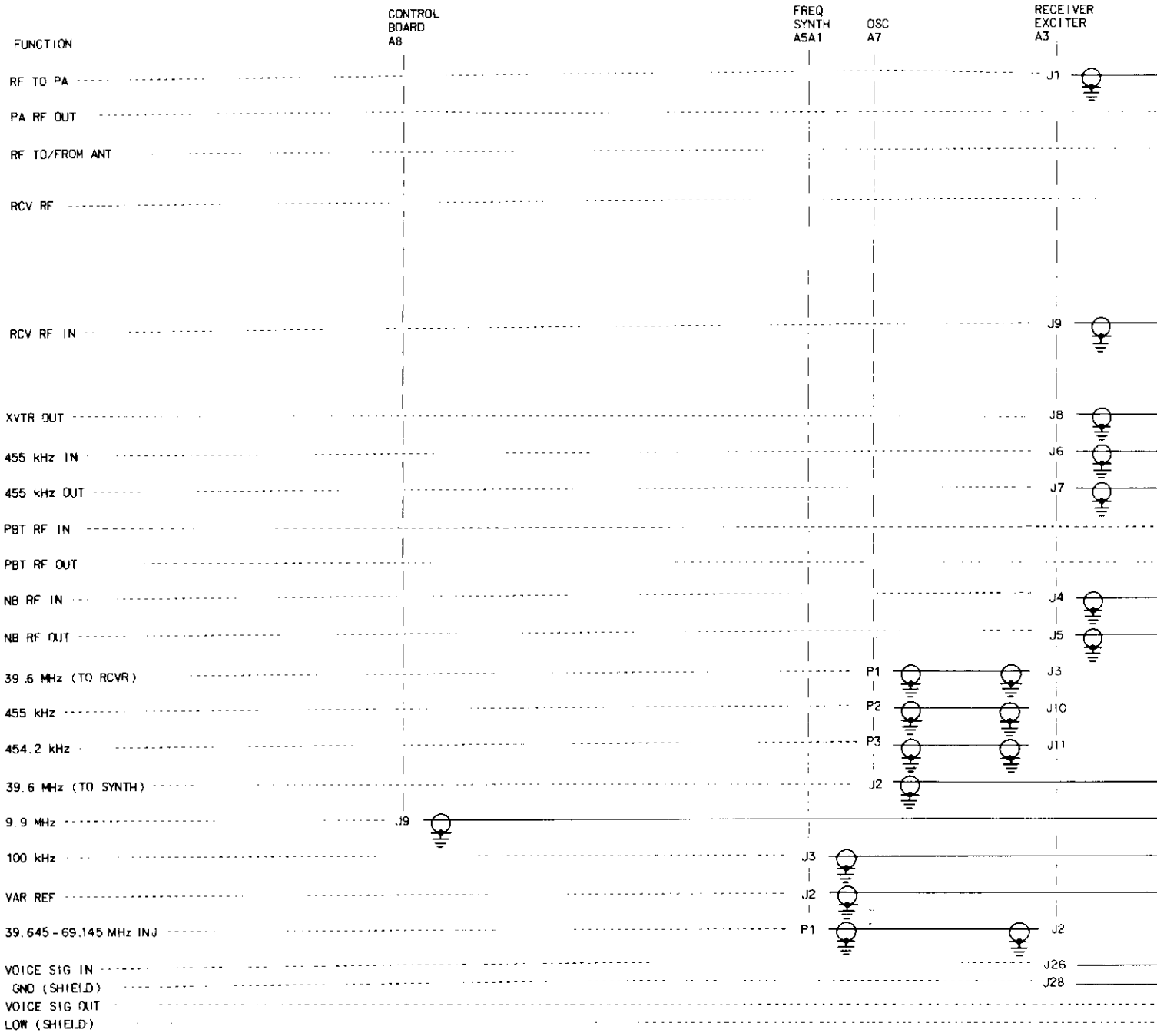
Transceiver, Interconnect Diagram
Figure 4 (Sheet 3)

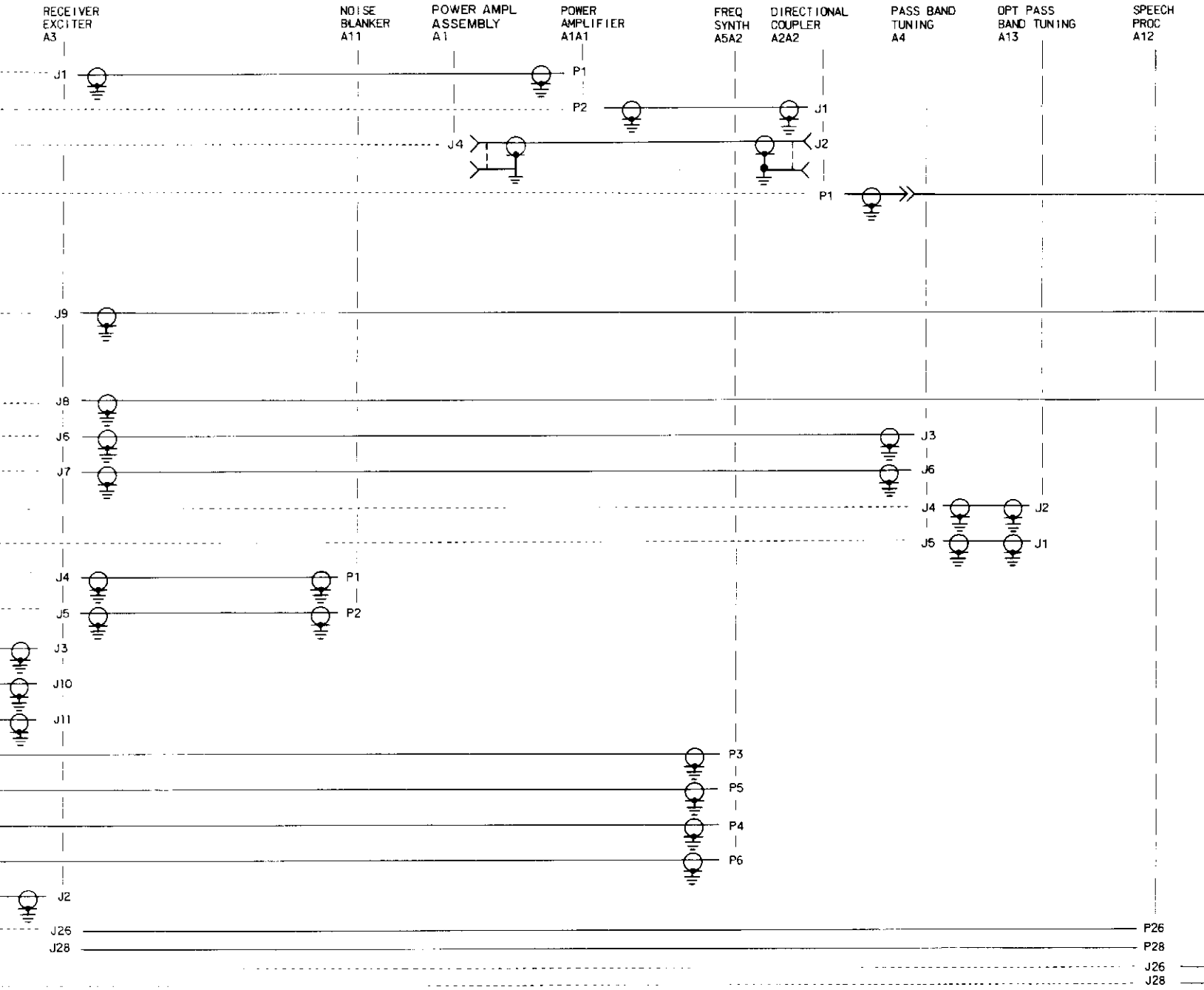

CONTROL BOARD A8
J1/P1
J2/P2
J3/P3
J4/P4
J5/P5
J6/P6
LOW PASS FILTER A2A1 J1/P27
FREQ SYNTH A5A2 J1/P9
OSC A7 J1/P10
J12/P12
J13/P13
J14/P14
FUNCTION
VOX GAIN
VOX DELAY COM
ANTI-VOX GAIN
CW DELAY
ANTI-VOX GAIN
VOX GAIN
SSB DELAY
TUNE
TF
KI
KEY
TUNE PWR
SPARE
SPARE
SPARE
SPARE
+14 V DC
+14 V DC
GND
+14 V DC
+9 V XMT
+14 V DC
GND
ALC GND
REFLD PWR DET
FWD PWR DET
GND
+5 V DC
SPARE
OPT 1 FLTR SEL
+14 V DC
OPT 3 FLTR SEL
SPKR OUT
SPKR RTN
MIC IN GND
MIC IN HIGH
MIC GAIN LOW
MIC GAIN ARM
MIC GAIN HIGH
AF GAIN LOW
AF GAIN ARM
AF GAIN HIGH
LINE AUDIO IN
LINE AUDIO IN GND
+5 V DC (IN)
J8
GND
J7


RECEIVER EXCITER A3
J13
J14/P14
J15/P15
J16/P16
J17/P17
J18/P18
J19/P19
J20/P20
POWER AMPLIFIER A1A1 J3/P21
FREQ SYNTH A5A2 J2/P22
DIRECTIONAL COUPLER A2A2 J24-P24
PASS BAND TUNING A4 J1/P11
OPT PASS BAND TUNING A13 J3/P26
AUDIO LOW PASS FILTER A15
LOW PASS FILTER A2A3 J1/P8
2
RMT CONTI INTERFACE
P1
1
2
3
4
5
7
8
1
2
3
4
6
7
8
9
10
1
2
3
4
5
11
12
13
14
15
6
7
1
2
3
3 1/3
4 2/4
5 3/5
6 4/6
7 5/7
8 6/8
J29
J30
J25
J24
J28
J27
J26
J33
J32
J31
J21
J22
E33 J33
E32 J32
E31 J31



Transceiver, Interconnect Diagram
Figure 4 (Sheet 4)


FUNCTION
CONTROL BOARD A8
FREQ SYNTH A5A1
OSC A7
RECEIVER EXCITER A3
RF TO PA
PA RF OUT
RF TO/FROM ANT
RCV RF
RCV RF IN
XVTR OUT
455 kHz IN
455 kHz OUT
PBT RF IN
PBT RF OUT
NB RF IN
NB RF OUT
39.6 MHz (TO RCVR)
455 kHz
454.2 kHz
39.6 MHz (TO SYNTH)
9.9 MHz
100 kHz
VAR REF
39.645 - 69.145 MHz INJ
VOICE SIG IN
GND (SHIELD)
VOICE SIG OUT
LOW (SHIELD)
J1
J9
J8
J6
J7
J4
J5
P1
P2
P3
J2
J3
J10
J11
J9
J3
J2
P1
J2
J26
J28



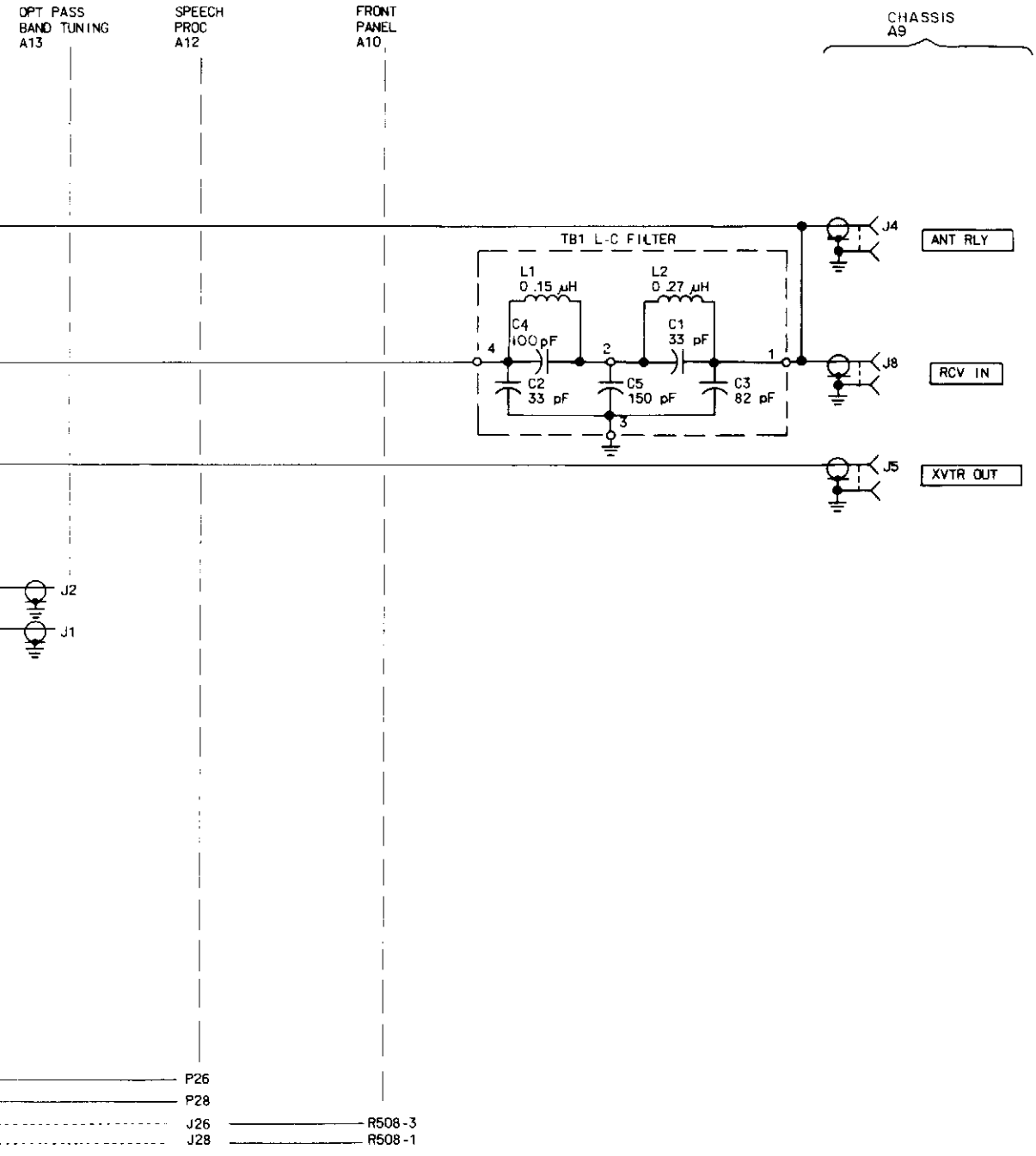
NOTES:

(1) OPTION

(2) NOT USED IN KWM-380

(3) UNLESS OTHERWISE SPECIFIED; CAPACITANCE VALUES ARE IN MICROFARADS

(4) PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER AND OR ASSEMBLY DESIGNATION.



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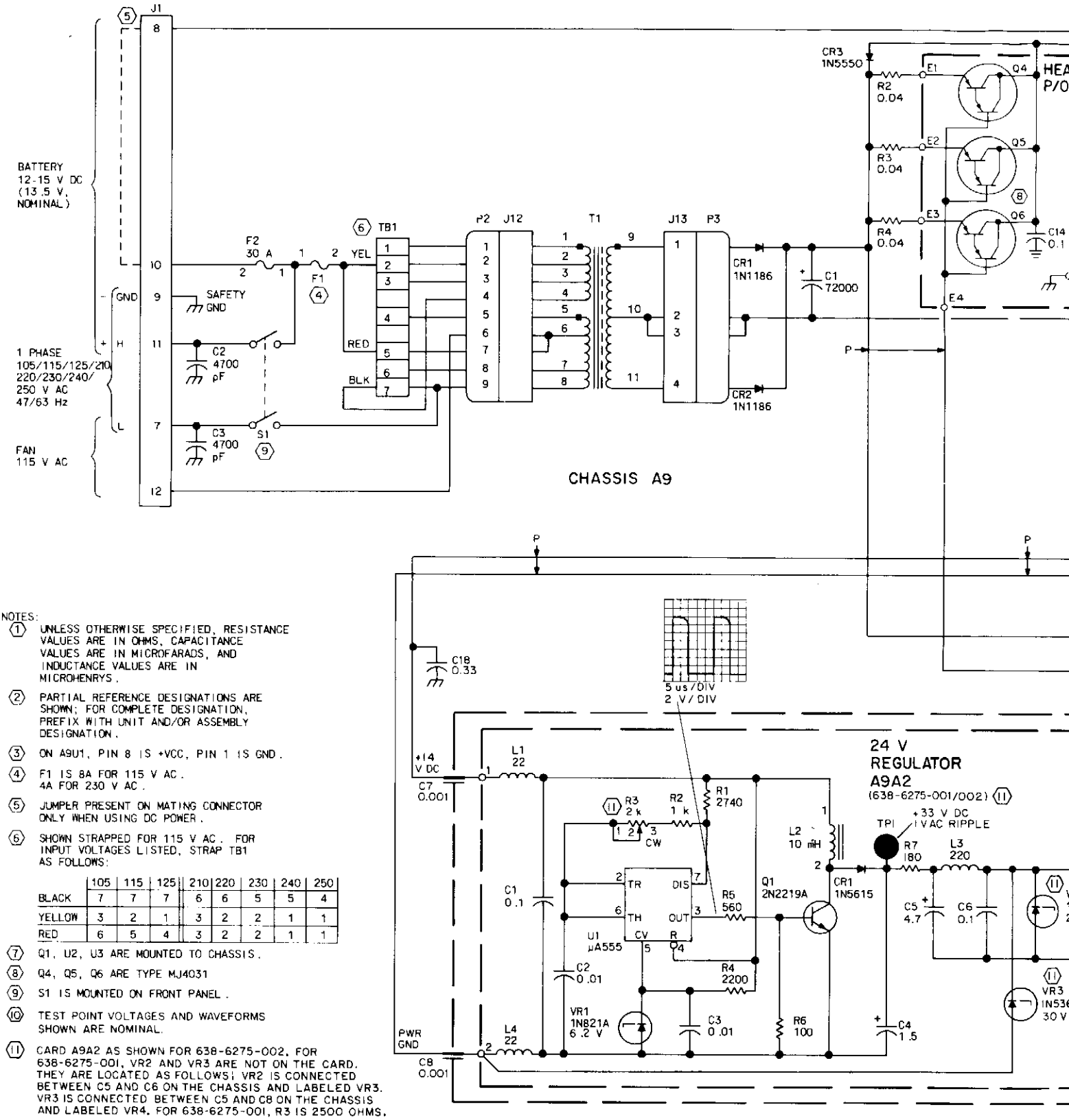
Transceiver, Interconnect Diagram
Figure 4 (Sheet 5)



NOTES:

(1) UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRYS.

(2) PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

(3) ON A9U1, PIN 8 IS +VCC, PIN 1 IS GND.

(4) F1 IS 8A FOR 115 V AC. 4A FOR 230 V AC.

(5) JUMPER PRESENT ON MATING CONNECTOR ONLY WHEN USING DC POWER.

(6) SHOWN STRAPPED FOR 115 V AC. FOR INPUT VOLTAGES LISTED, STRAP TB1 AS FOLLOWS:

	105	115	125	210	220	230	240	250
BLACK	7	7	7	6	6	5	5	4
YELLOW	3	2	1	3	2	2	1	1
RED	6	5	4	3	2	2	1	1

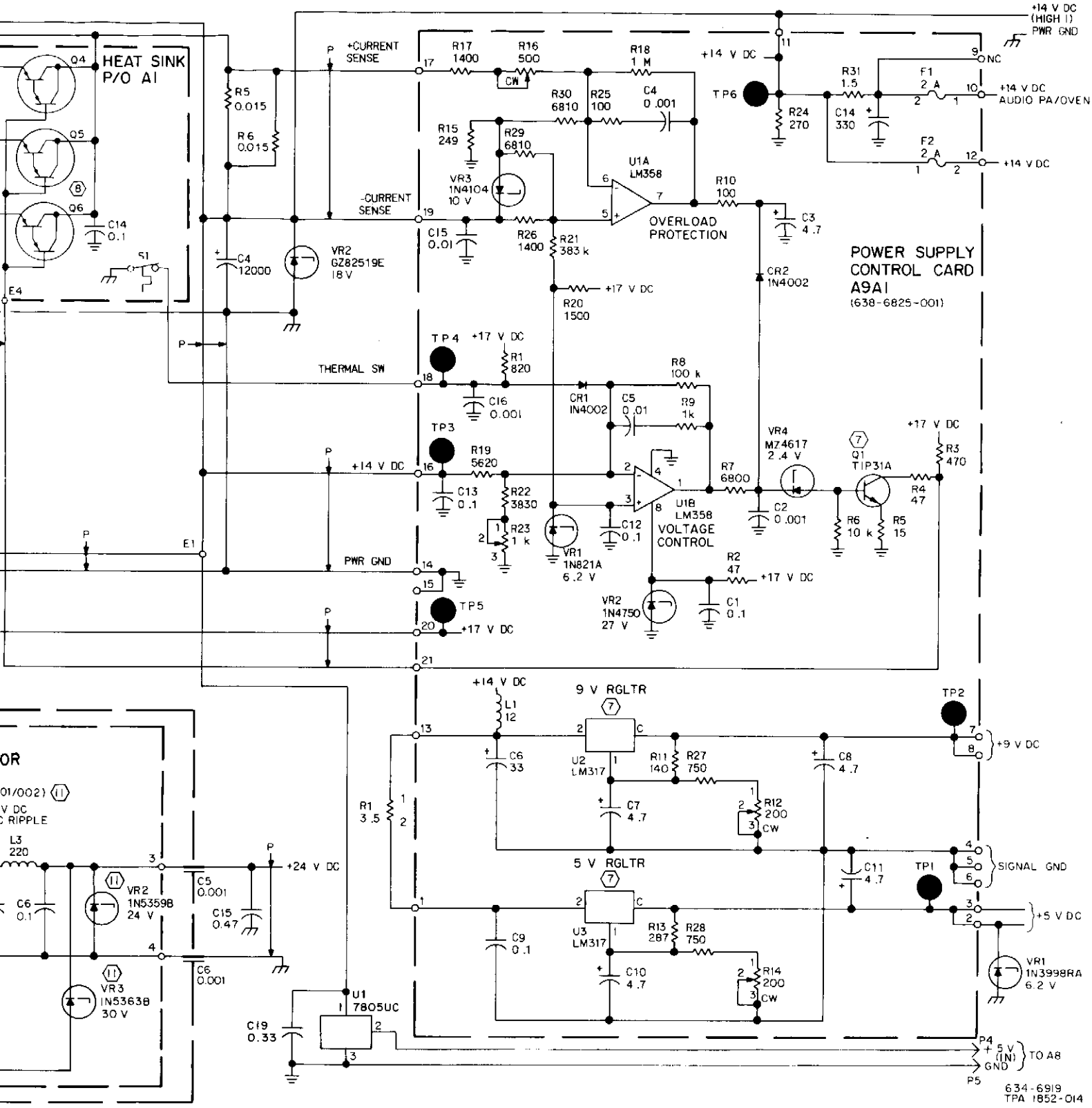
(7) Q1, U2, U3 ARE MOUNTED TO CHASSIS.

(8) Q4, Q5, Q6 ARE TYPE MJ4031

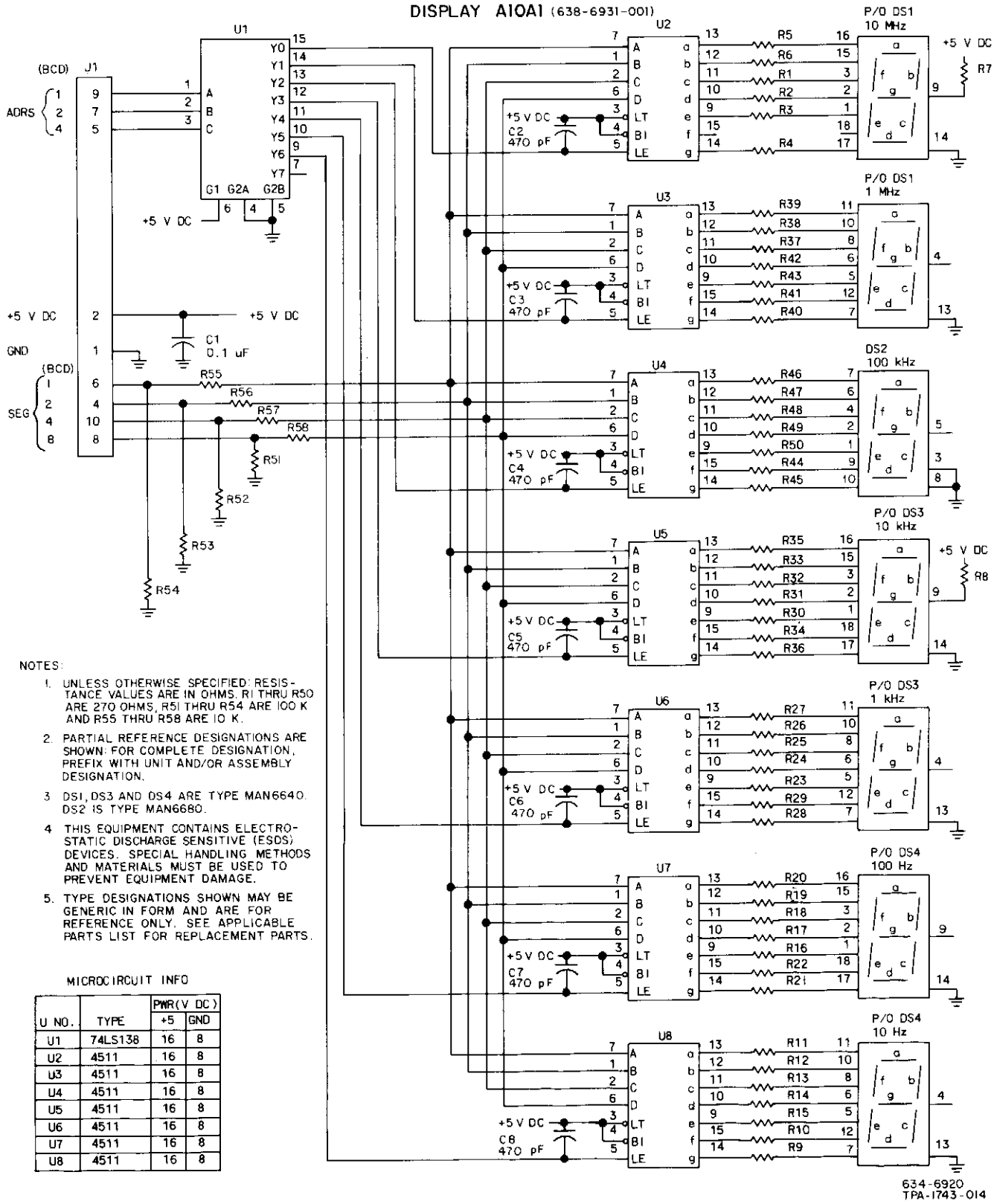
(9) S1 IS MOUNTED ON FRONT PANEL.

(10) TEST POINT VOLTAGES AND WAVEFORMS SHOWN ARE NOMINAL.

(11) CARD A9A2 AS SHOWN FOR 638-6275-002. FOR 638-6275-001, VR2 AND VR3 ARE NOT ON THE CARD. THEY ARE LOCATED AS FOLLOWS: VR2 IS CONNECTED BETWEEN C5 AND C6 ON THE CHASSIS AND LABELED VR3. VR3 IS CONNECTED BETWEEN C5 AND C8 ON THE CHASSIS AND LABELED VR4. FOR 638-6275-001, R3 IS 2500 OHMS.



Power Supply, Schematic Diagram
Figure 5



NOTES:

1. UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS. R1 THRU R50 ARE 270 OHMS, R51 THRU R54 ARE 100 K AND R55 THRU R58 ARE 10 K.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
3. DS1, DS3 AND DS4 ARE TYPE MAN6640. DS2 IS TYPE MAN6680.
4. THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.
5. TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

MICROCIRCUIT INFO

U NO.	TYPE	PWR(V DC) +5	PWR(V DC) GND
U1	74LS138	16	8
U2	4511	16	8
U3	4511	16	8
U4	4511	16	8
U5	4511	16	8
U6	4511	16	8
U7	4511	16	8
U8	4511	16	8

Display A10A1, Schematic Diagram
Figure 6

Rockwell International

Power Amplifier (634-8481-003)

instructions

Collins Telecommunications Products Division

Printed in USA

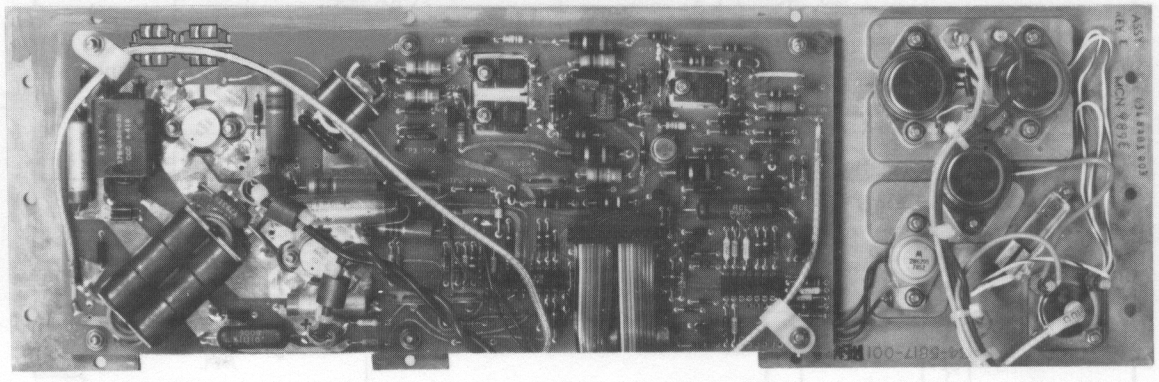
523-0771739-001211
1 August 1982

1. DESCRIPTION

Power Amplifier (634-8481-003), as shown in figure 1, produces an rf output of 90 watts pep minimum from a 100-milliwatt nominal input. The amplifier is protected from high vswr, excessive output power, and thermal overheating by an ALC circuit. The five rf transistors of the amplifier and final amplifier bias regulator transistor are in thermal contact with the heat sink.

Warning

This device contains a radio frequency transmitter which, when operated into an antenna, may produce electromagnetic fields in close proximity to the antenna that are in excess of Occupational Safety and Health Administration (OSHA) recommended maximum limits.



TPA-5269-017

Power Amplifier
Figure 1

2. PRINCIPLES OF OPERATION (Refer to block diagram, figure 2, and schematic diagram, figure 4)

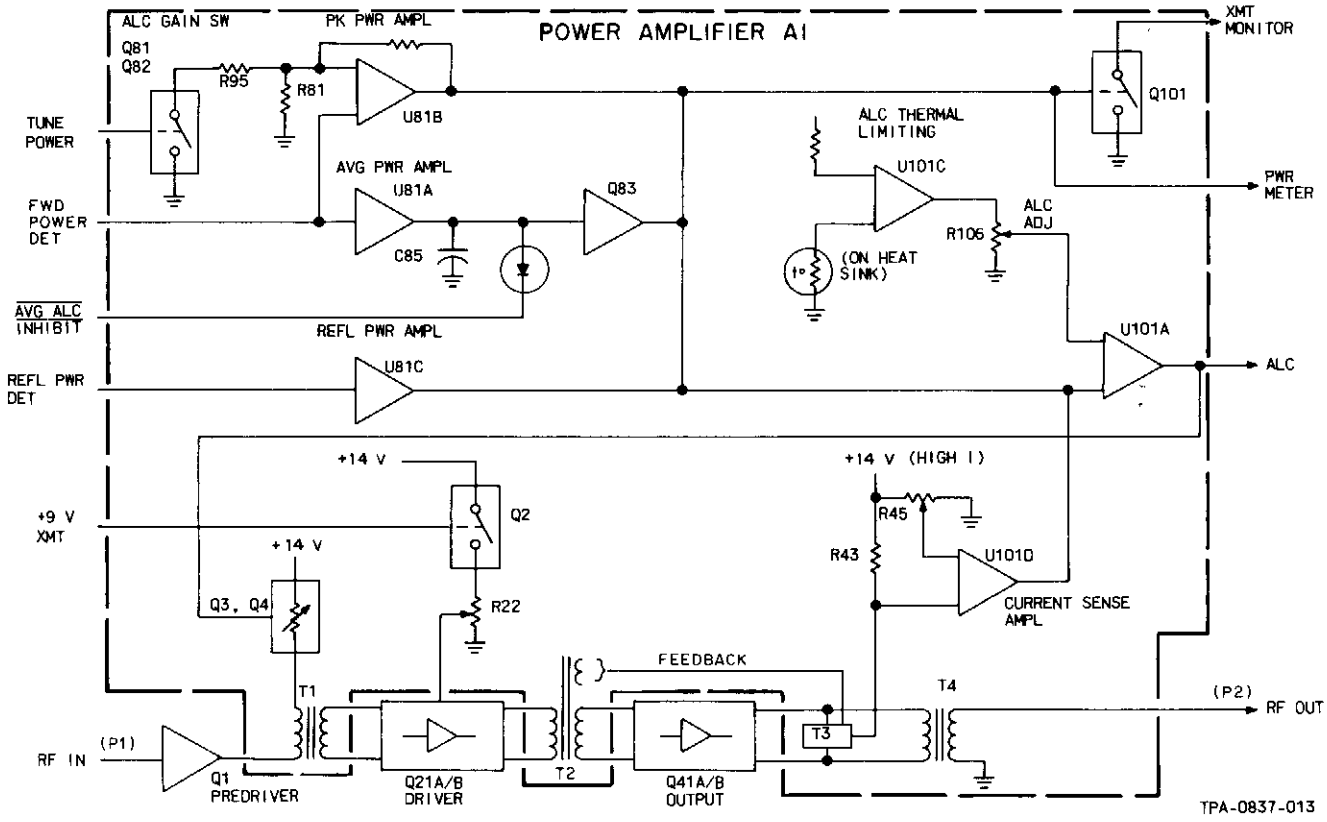
An automatic level controlled 10- to 100-mW rf signal (depending on frequency and ALC signal level) is input from the receiver-exciter to predriver amplifier Q1. When the transmitter is keyed, A1Q2 is turned on by the +9-V XMT voltage. This lets +14 V be applied to bias networks A1R21/R22/CR1 and A1U101B. The amplified output from Q1 is applied to the driver stage, Q21A/B. Here, it is further amplified and applied to the final amplifier stage, Q41A/B. The predriver operates as a class A amplifier; the driver and final stages operate class AB.

The output from Q41A/B is coupled across A1T4 at a nominal 50-ohm output impedance. Transformer A1T3 provides a dc path for the Q41A/B collectors while keeping rf from the power supply.

Idle collector current for the drivers is set by A1R22 to be approximately 250 mA, measured at 27 to 29 mV dc across A1R28 at TP2 and TP3. Idle collector current for the final amplifiers is set by A1R63 to be 200 mA, measured in the +14-V dc high-current input line.

The ALC signal is derived from four sources: peak amplifier output, average amplifier output, reflected power, and final amplifier stage collector current. A temperature-sensing input from the heat sink will cause the ALC to limit the power amplifier output to lower levels if the heat-sink temperature exceeds 90 °C. The composite ALC signal is output from A1U101A.

The ALC signal normally controls the exciter gain. If a malfunction occurs and the exciter output increases beyond normal, the A1U101A output will increase. When the output voltage reaches approximately +3.2 V, zener A1VR1 will conduct. This causes A1Q3 to begin conducting, reducing current through A1Q4. Since A1Q4 regulates the collector current of predriver Q1, the ALC signal will control the gain of the power amplifier directly. This is for fail-safe operation.



Power Amplifier, Block Diagram
Figure 2

The forward power detected signal is input to A1U81A, the average amplifier power sensor. The long time constant of capacitor A1C85 and A1R89 causes the output of A1U81A to average the pa forward power output analog. When in CW or RTTY mode, the average power output is limited to 60 watts by the AVG ALC INHIBIT signal input to Q83. The amplifier will operate at full power for approximately 10 to 30 seconds before the ALC automatically reduces the power to a 60-watt average. For test purposes, or for continuous full-power operation with the AC-2808 Blower installed, the AVG ALC INHIBIT signal can be grounded. This keeps the ALC from reducing average power.

The forward power detected signal is also input to A1U81B, the peak amplifier power sensor. The normal gain of A1U81B can be changed to decrease the pa output to approximately 20 watts. A logic 0 on the tune power input will do this. With tune power at logic 0, ALC gain switch A1Q81 is off and A1Q82 conducts to parallel A1R95 with A1R81. This increases the gain of ALC amplifier A1U81B. With increased gain, A1U81B requires a lower value of the forward power detected input signal to develop the normal ALC signal at A1J3-18. The output from A1U81B is applied to the ALC summing point, power meter, and transmit monitor switch A1Q101. The transmit monitor signal goes to logic 0 when the pa output is greater than approximately 50 watts.

The reflected power detected voltage is monitored by A1U81C and applied to the ALC summing junction. Current sense amplifier A1U101D compares the voltage at A1R43 (due to the collector currents of Q41A/B) with a reference voltage. The reference voltage is set by A4R45 to cause ALC current limiting when the +14-V dc high-current input reaches 23 amperes.

The current sense amplifier, peak power amplifier, average power amplifier, and reflected power amplifier outputs are all applied to the ALC summing junction at the noninverting input of A1U101A. This signal is compared to the ALC reference voltage from A1R106. The ALC threshold is adjusted for nominal output from A1U101A of 1.5 V with 100 watts of rf output power.

The voltage across A1R106 is developed by A1U101C, a thermal sense circuit controlled by thermistor RT101. (The thermistor is in contact with the heat sink.) Overheating causes the ALC to reduce the pa output power to a safe level, usually about 18 watts, to avoid damage.

3. TESTING/TROUBLESHOOTING PROCEDURES

Warning

This device contains a radio frequency transmitter which, when operated into an antenna, may produce electromagnetic fields in close proximity to the antenna that are in excess of Occupational Safety and Health Administration (OSHA) recommended maximum limits.

Caution

Do not operate the power amplifier subassembly alone (without the directional coupler) without a 50-ohm load attached. Amplifier components may be damaged.

Do not overdrive the power amplifier. This can cause excessive heating and destruction of bypass capacitors.

A performance test for the power amplifier is given in table 2. In addition to the required performance criteria, troubleshooting comments are given.

It is assumed that the repair technician is trained in solid-state circuit troubleshooting and repair techniques, and is familiar with the test equipment to be used. Step-by-step operating procedures are not given in the tests and not all possible troubleshooting information can be listed. The tests in table 2 must be performed in sequence.

Testing and troubleshooting of the power amplifier requires the power amplifier be installed in the transceiver.

3.1 Test Equipment Required

Table 1 lists the equipment required to perform the tests. A suggested type is given; however, that specific equipment is not required. Any that meets or exceeds the indicated minimum specifications is acceptable for use.

3.2 Performance Test

The following test procedures measure the performance of the power amplifier. After being repaired, repeat the numbered test where repair was performed to verify that no further malfunctions exist.

Table 1. Test Equipment Required.

ITEM	USED FOR	SUGGESTED TYPE	MINIMUM SPECIFICATIONS
Signal generator (2 required)	Rf input to power amplifier	Hewlett-Packard 8640B	1.6 to 30 MHz, 0- to 3-V rf output
Wattmeter	Measuring power output	Bird 43 with 250H element	0 to 120 W
Rf load	Terminating amplifier rf output	Bird 8135	50 ohms; 150 watts, continuous; 1.6 to 30 MHz
CW key	Keying transceiver to enable power amplifier	AC-2827	Continuously-closed switch provision
Dc voltmeter	Measuring amplifier voltages	Fluke 8000A	0 to 30 V; provision for isolating from ground
Dc power supply	Supplying high current for current limit test	Sorensen SRL-20-25	0 to 25 A, 13.5 V
Dc ammeter	Measuring amplifier high-current input	Yew 2051	0 to 250 mA, 0 to 25 A
Dc power supply	Biasing transmit monitor circuit	Hewlett-Packard 6264B	9 V, 10 mA
Spectrum analyzer	Measuring intermodulation distortion	Hewlett-Packard 141T	
Rf plug-in		Hewlett-Packard 8553B	
If plug-in		Hewlett-Packard 8552B	
Variable signal sampler	Connection of spectrum analyzer	Bird 4273-020	
Power divider	Connecting 2 signal generators as two-tone source	Weinschel 1506A	
6-dB attenuators (2 required)	Pad signal generator outputs	Weinschel 1A6	
20-dB attenuator	Pad signal sampler to spectrum analyzer	Weinschel 9214	

3.2.1 Preliminary Setup

Do not apply power to the equipment until instructed to do so in the procedures. Do not connect power with power switches turned on.

Connect the equipment as instructed in the procedures for each test.

3.2.2 Test Procedures

Perform the tests as given in table 2.

Table 2. Power Amplifier Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	a. Disconnect heat sink from chassis mounting brackets and tilt heat sink back. Remove cover from power amplifier.		
	b. Connect dc ammeter (0- to 250-mA and 0- to 25-A ranges) in +14-V dc high-current line at A1J2.		
	c. Connect wattmeter and dummy load to transceiver rf output connector.		
	d. Disconnect rf input connector A1P1 from A3J1 and connect to signal generator rf output.		
	e. Set signal generator frequency to 7.150 MHz and rf out to off until further instructed in procedures.		
	f. Turn on transceiver.		
	g. Tune transceiver to 7.150 MHz. Do not key transmitter until instructed in procedures.		
2. Idle currents	a. Measure +14-V high-current level (Q41A/B idle current) on ammeter.	10 mA, maximum	Check Q41A/B.
	b. Measure dc voltage at A1TP1 (Q1 idle current).	835 ±85 mV dc	Check Q1, A1Q3, and A1Q4.
	c. Switch in MOX to key transmitter and measure +14-V high-current level. Switch out MOX.	200 ±10 mA	Adjust A1R63 as required. Check A1Q2, A1U101B, and Q61.
	d. Connect voltmeter (must not be grounded) across A1TP2 and A1TP3. Switch in MOX and measure voltage. Switch out MOX.	+28 ±1.0 mV dc	Adjust A1R22 as required. Check Q21A/B.
3. ALC threhold	*Note* The following test requires transmitter be keyed and driven to 110-W output, and measurement/adjustment made. To prevent excessive heating, do not leave transmitter keyed longer than one minute.		
	a. Inhibit average power ALC by grounding A1J3-17 or by jumpering ALC INHIBIT terminals on the receiver-exciter.		
	b. Turn on signal generator rf output. Switch in MOX and carefully increase signal generator output level to obtain 110- ±3-W rf power output at J2 on		
(Cont)			

Table 2. Power Amplifier Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	low-pass filter. Measure ALC voltage at A1J3-18.	+1.0 ±0.3 V	Adjust A1R106 as required. Check A1U101A, A1U101C, and A1U81B.
	Switch out MOX.		
4. Current limit ALC	***Caution***		
	In performing this test, do not overdrive the power amplifier. Excessive heating and component damage can result.		
	a. Turn off transceiver POWER switch. Disconnect A1J1 and J2 from +14-V high current input.		
	b. Disconnect A1P2 from low-pass filter and short P2. Connect voltmeter to ALC output A1J3-18.		
	c. Connect A1J1 and J2 to power supply adjusted for +14 V and current limited for 26 A. Include ammeter in circuit for measuring input current.		
	d. Reduce signal generator output level to near zero. Turn on transceiver power.		
	Caution		
	Step e must be performed in approx 15 seconds to prevent output transistors from overheating. If RT101 in the ALC thermal limiting circuit (A1U101C) is overheated, the current limit ALC (A1U101D) adjustment will be in error.		
	e. While watching high-current ammeter, switch in MOX and increase signal generator output level until current is 24 ±0.5 A. Let current stabilize approx two seconds; then measure ALC voltage (A1J3-18).	+1.0 to +2.0 V dc	Adjust A1R45 as necessary.
	f. Switch out MOX. Turn off transceiver power. Remove short from A1P2 and reconnect P2 to low-pass filter. Disconnect power supply and reconnect A1J1 and J2 to transceiver. Turn on power.		
5. Gain/frequency	Perform following steps at 3.99, 7.29, 14.34, and 29.69 MHz:		
(Cont)	a. Set signal generator to frequency and 0-V rf output.		

Table 2. Power Amplifier Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	b. Tune transceiver to proper frequency.		
	c. Switch in MOX and increase signal generator output to produce 100-W output from transmitter.		
	d. Note rf input voltage to amplifier from signal generator.	0.6 to 2.3 V rf (as indicated on signal generator)	Check Q1, Q21A/B, and Q41A/B for low gain.
	e. Switch out MOX.		
6. Tune power	a. Set signal generator and transceiver frequency to 3.9 MHz.		
	b. Ground A1J3-8.		
	c. Switch in MOX and adjust signal generator output level for 20- to 30-W transmitter output.		
	d. Measure ALC voltage at A1J3-18 or J16-6.	+1.5 ±0.5 V	Check A1Q81, A1Q82, A1U81B, A1U101A, A1Q3 and A1Q4.
	e. Switch out MOX and remove ground from A1J3-8.		
7. Average power ALC	a. Remove ground from A1J3-17 or remove jumper from between ALC INHIBIT terminals on receiver-exciter, installed in step 3.a.		
	b. Set signal generator output to 1.5 V; switch in MOX and note time required for transmitter to go to reduced power.	10 to 30 seconds (rf output should be 50 to 60 W)	Check A1U81A, A1C85, and A1Q83.
	Note If AC-2808 Blower has been installed, ALC INHIBIT signal has been disabled and amplifier will not automatically reduce power output level.		
8. Intermodulation distortion	a. Inhibit average power ALC by grounding A1J3-17 or by jumpering ALC INHIBIT terminals on the receiver-exciter.		
	b. Connect spectrum analyzer to rf output through variable signal sampler and 20-dB attenuator.		
	c. Connect second signal generator to rf input through power divider. Insert 6-dB of attenuation in rf output of signal generators.		
(Cont)			

Table 2. Power Amplifier Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	d. Tune transceiver to 22 MHz. Drive power amplifier with single tone at 22 MHz to obtain 95 ±1-watt output. Adjust ALC REF adjust A1R106 to obtain 1.0 ±0.3-V dc ALC output measured at A1J3-18.		
	e. Remove ground from A1J3-17 or remove jumper from between ALC INHIBIT terminals on receiver-exciter.		
	f. Drive power amplifier from two-tone source with equal tones spaced 600 ±100 Hz at frequencies listed below to obtain ALC voltage of 1.0 ±0.3 V dc measured at A1J3-18.	3rd and 5th order products NLT -25 dB below either tone	Check Q41A/B and associated circuit.
	g. Switch out MOX; turn off power; and disconnect test equipment.		

4. REPAIR

Repair of the power amplifier is accomplished using standard maintenance and circuit card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

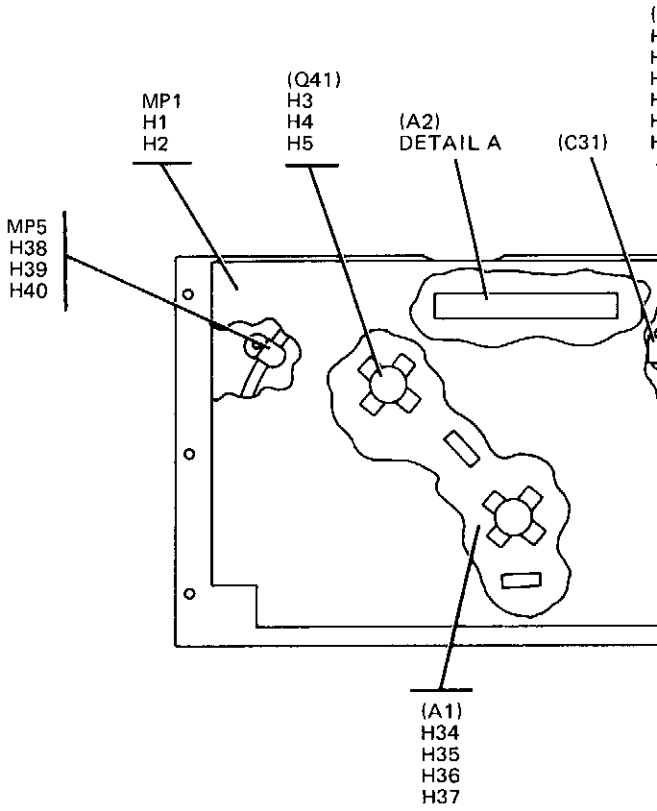
Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00853	SANGAMO WESTON INC SANGAMO CAPACITOR DIV SANGAMO RD P O BOX 128 PICKENS SC 29671
01121	ALLEN-BRADLEY CO 1201 SOUTH 2ND ST MILWAUKEE WI 53204
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
08289	BLINN DELBERT CO INC THE 1678 E MISSION BLVD P O BOX 2007 POMONA CA 91766
13103	THERMALLOY CO INC 2021 W VALLEY VIEW LANE P O BOX 340839 DALLAS TX 75234
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
14433	ITT SEMICONDUCTOR DIV WEST PALM BEACH FL
16037	SPRUCE PINE MICA CO INC P O BOX 219 SPRUCE PINE NC 28777
20462	PREM ENTERPRISES INC 3519 N CHAPEL HILL MC HENRY IL 60050
29990	AMERICAN TECHNICAL CERAMICS DIVISION OF PHASE INDUSTRIES 1 NORDEN LANE HUNTINGTON STATION NY 11746
31433	UNION CARBIDE CORP ELECTRONICS DIV HWY 276 SE P O BOX 5928 GREENVILLE SC 29606
34335	ADVANCED MICRO DEVICES 901 THOMPSON PL SUNNYVALE CA 94086
44094	NORTHERN ELECTRIC CO 5224 N KEDZIE AVE CHICAGO IL 60625
49956	RAYTHEON CO EXECUTIVE OFFICES 141 SPRING ST LEXINGTON MA 02173
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
55943	AMRAD CORP 349 BONHAM ST P O BOX 876 PARIS TX 75460
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
57582	KAHGAN ELECTRONICS CORP 556 PENINSULA BLVD HEMPSTEAD NY 11550
71279	CAMBRIDGE THERMIONIC CORP 445 CONCORD AVE CAMBRIDGE MA 02138
71450	CTS CORP 905 N WEST BLVD ELKHART IN 46514
77147	PATTON-MACGUYER CO DIV OF AVID CORP 17 VIRGINIA AVE PROVIDENCE RI 02905
77250	ALLIED PRODUCTS CORP PHEOLL MFG CO DIV 5700 W ROOSEVELT RD CHICAGO IL 60650
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIVISION ST CHARLES ROAD ELGIN IL 60120
79807	WROUGHT WASHER MFG INC 2100 S BAY ST MILWAUKEE WI 53207
80031	MEPCO/ELECTRA INC 22 COLUMBIA RD MORRISTOWN NJ 07960
80205	NATIONAL AEROSPACE STANDARD
81349	MILITARY SPECIFICATIONS
91637	DALE ELECTRONICS INC P O BOX 609 COLUMBUS NE 68601
96906	MILITARY STANDARD
99800	AMERICAN PRECISION INDUSTRIES INC DELEVAN DIV 270 QUAKER RD EAST AURORA NY 14052

5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Power Amplifier	634-8481-003	REV J
Circuit Card A1	638-6775-001	REV R
Electronics Components Assembly A2	647-2781-001	REV A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H3
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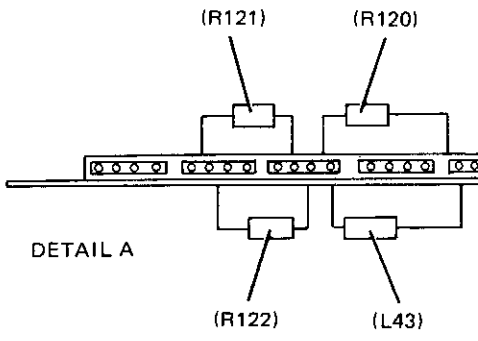
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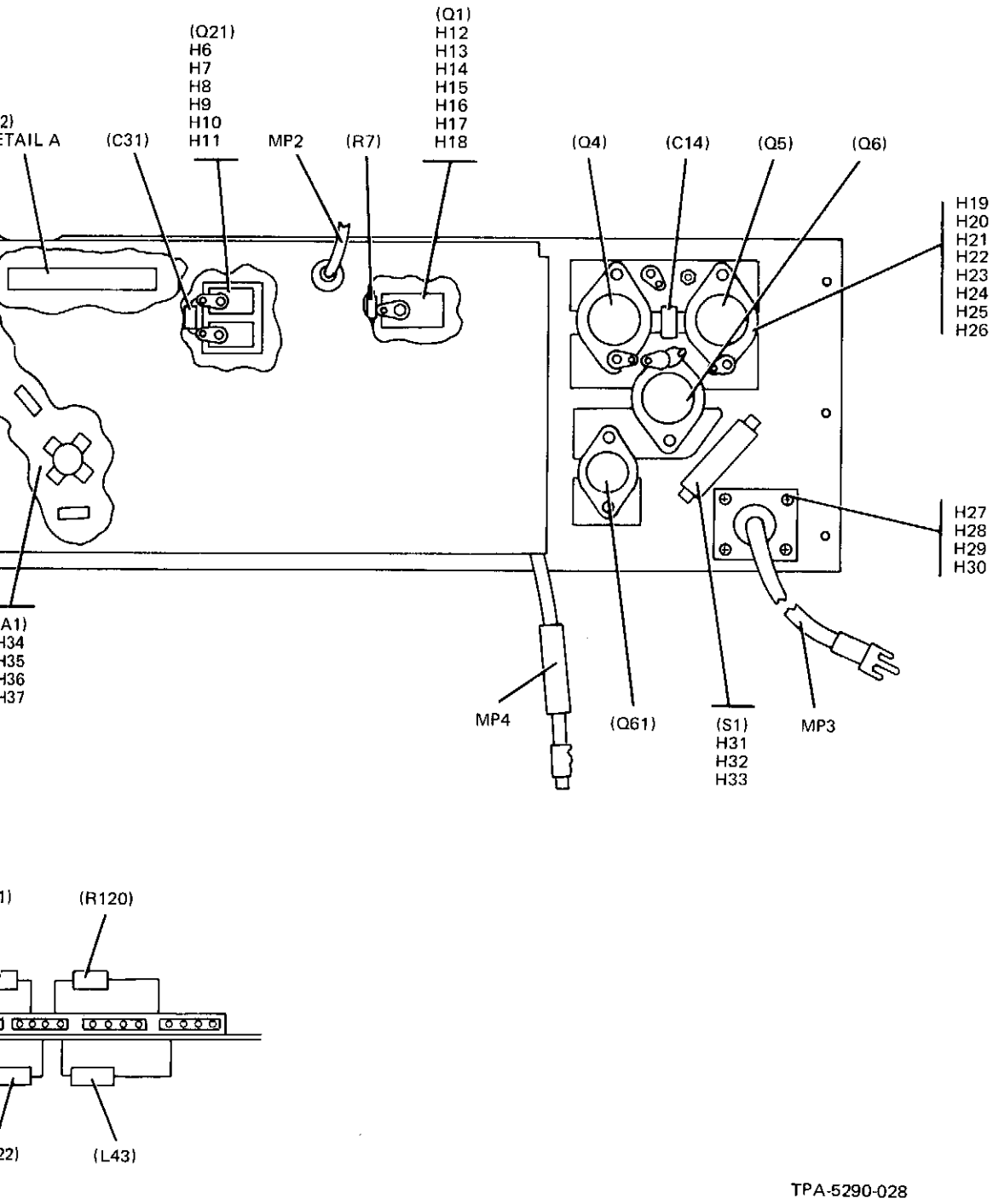
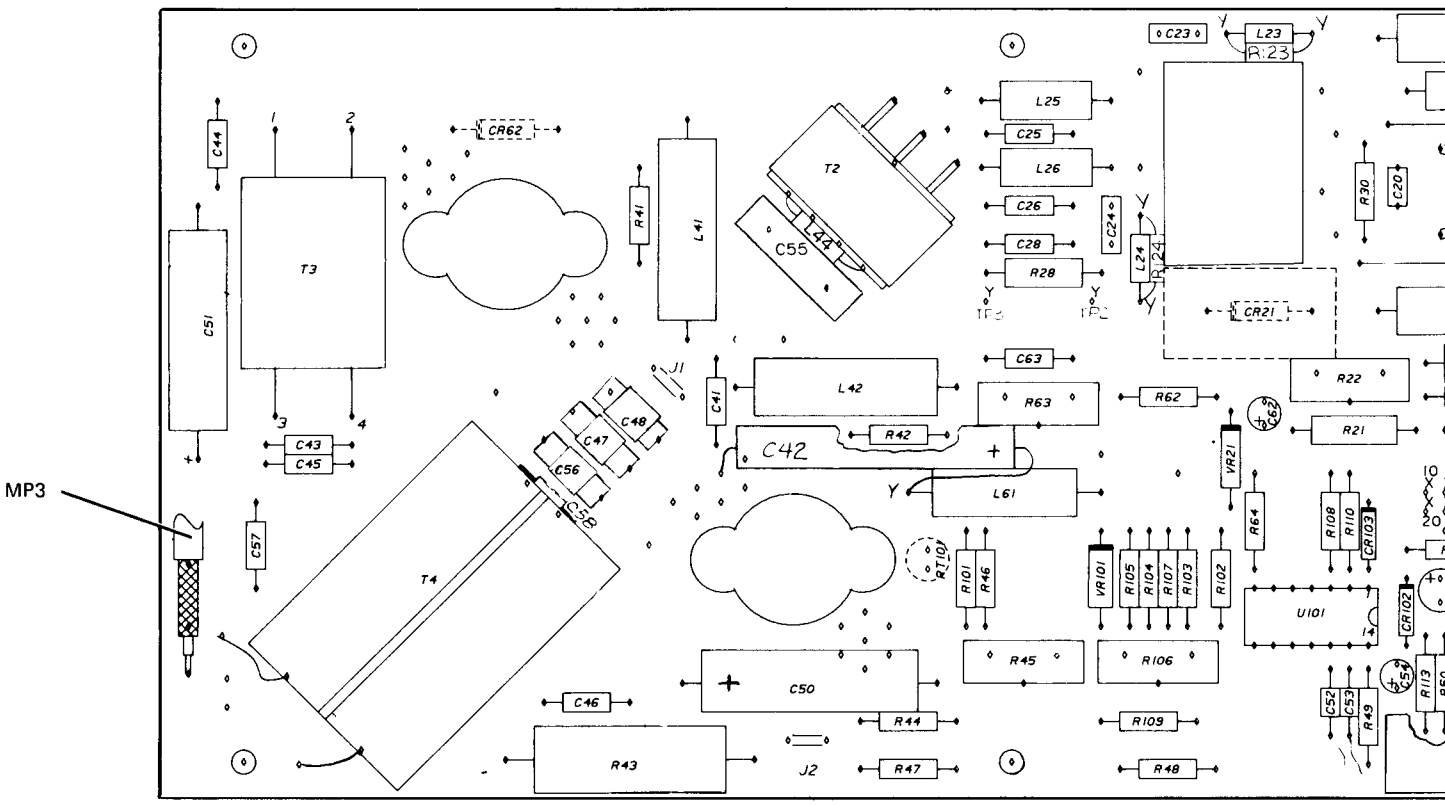


TPA-5290-028

Power Amplifier, Parts Location
Figure 3 (Sheet 1 of 3)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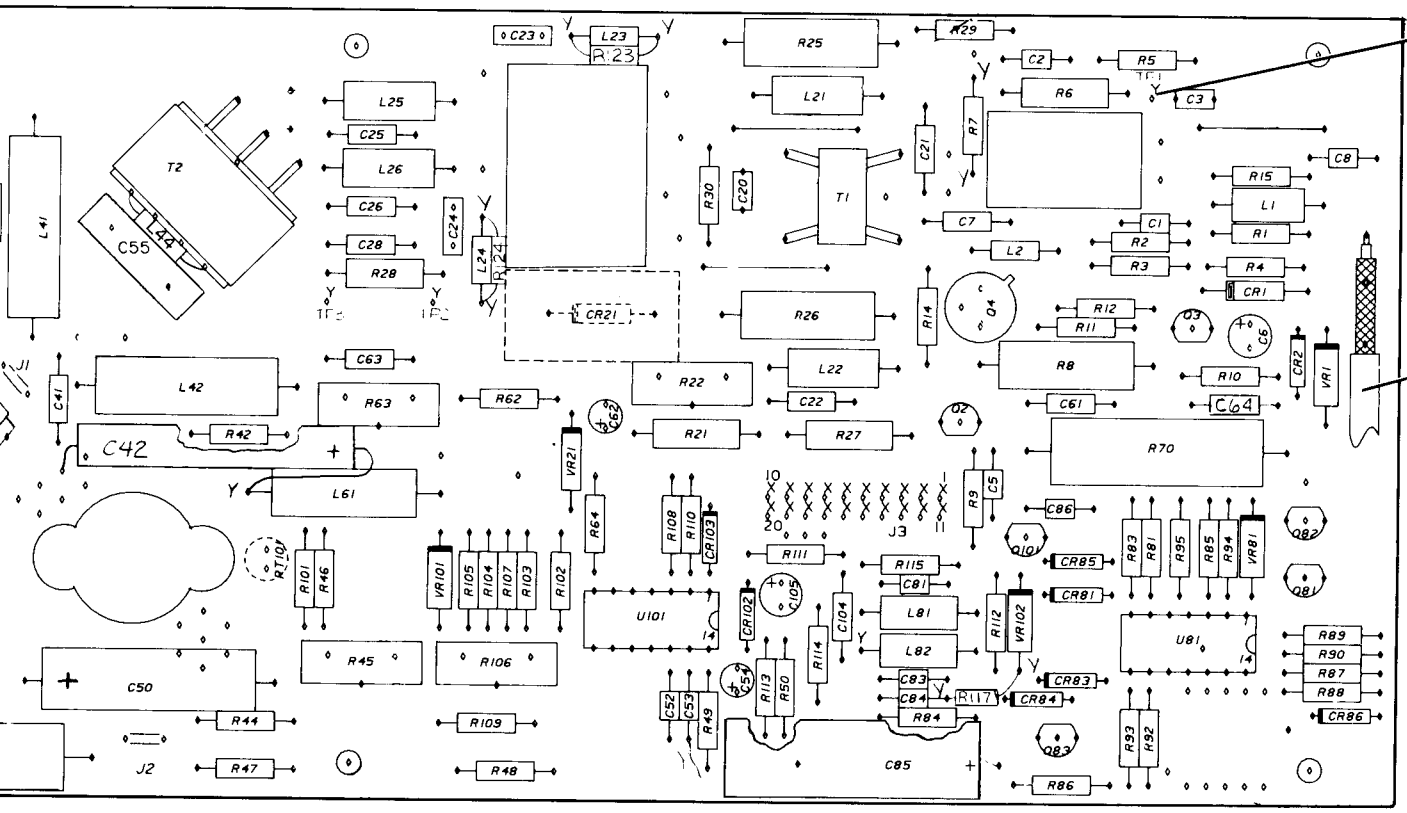
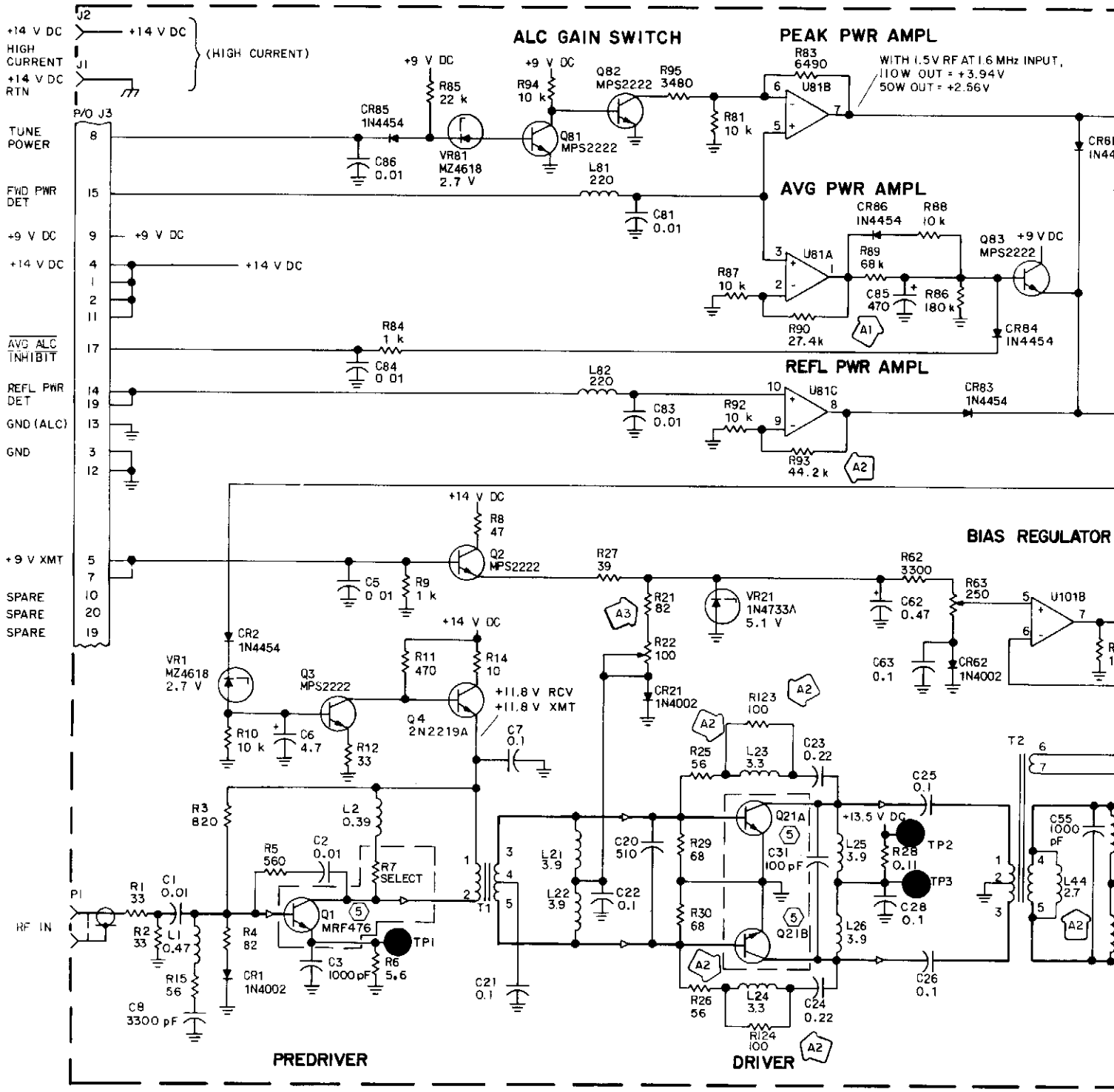


638-6775-001

TPA-5290-028

Power Amplifier, Parts Location
Figure 3 (Sheet 3)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PEAK PWR AMPL
AVG PWR AMPL
REFL PWR AMPL
BIAS REGULATOR
PREDRIVER
DRIVER
+14 V DC
HIGH CURRENT
+14 V DC RTN
(HIGH CURRENT)
J2
J1
P/O J3
TUNE POWER
FWD PWR DET
+9 V DC
+14 V DC
AVG ALC INHIBIT
REFL PWR DET
GND (ALC)
GND
+9 V XMT
SPARE
SPARE
SPARE
WITH 1.5 V RF AT 1.6 MHz INPUT,
1 OW OUT = +3.94 V
50W OUT = +2.56 V
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+11.8 V XMT
+13.5 V DC
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TP2
TP3
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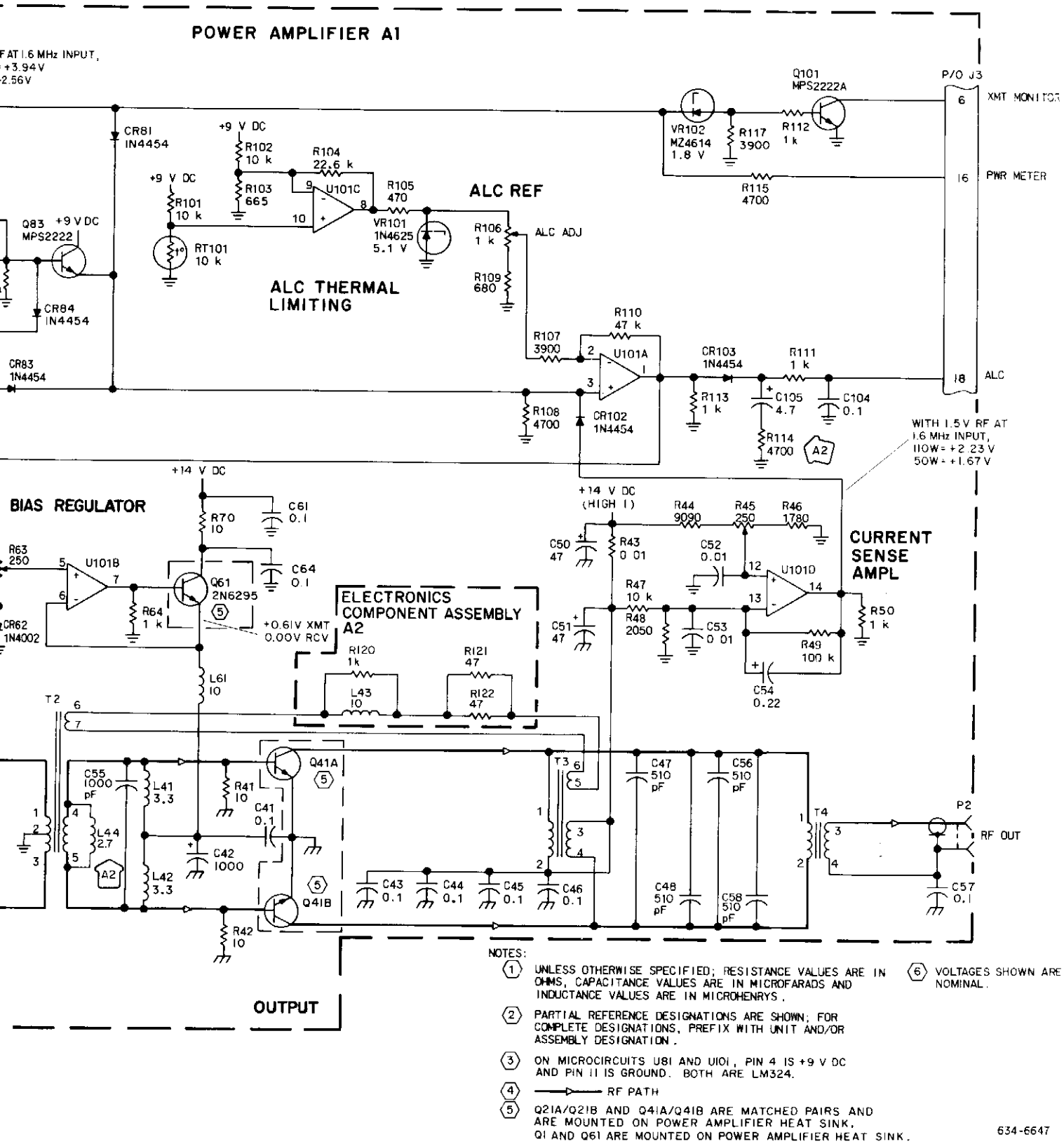


NOTES:

1. UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATIONS, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
3. ON MICROCIRCUITS U8I AND U10I, PIN 4 IS +9 V DC AND PIN 11 IS GROUND. BOTH ARE LM324.
4. ——▷—— RF PATH
5. Q2IA/Q2IB AND Q4IA/Q4IB ARE MATCHED PAIRS AND ARE MOUNTED ON POWER AMPLIFIER HEAT SINK. QI AND Q6I ARE MOUNTED ON POWER AMPLIFIER HEAT SINK.
6. VOLTAGES SHOWN ARE NOMINAL.

634-6647

Power Amplifier, Schematic Diagram
Figure 4

Low-Pass Filter (641-7132-001)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0772530-001211
1 August 1982

1. DESCRIPTION

Low-Pass Filter (641-7132-001), figure 1, consists of low-pass filter A1, 638-6900-001, directional coupler A2, 638-6788-001, and low-pass filter A3, 638-6904-001. The directional coupler has an antenna transfer relay and forward and reflected power detectors. The filter circuit cards have relay-selected filters covering frequencies from 1.6 to 29.9999 MHz.

2. PRINCIPLES OF OPERATION (Refer to schematic diagram, figure 3)

2.1 Low Pass Filters A1 and A3

The filters on the A1 and A3 assemblies are dual pi-section low-pass types. The high-frequency rolloff begins at the upper frequency of the band covered by the respective filter. The rf path through an individual filter is switched by a relay at each end of the filter. On A1, logic 0 band enable signal, developed by the control card, energizes the two relays associated with the band containing the frequency. On A3, a logic 1 band enable signal from the control card switches on a transistor to energize the two relays associated with the band containing the frequency. The energized relays switch in the fiter covering the operating frequency.

2.2 Directional Coupler A2

The directional coupler develops analog voltages of the forward and reverse rf power to the antenna. These signals are used in the power amplifier control circuits to generate ALC. Relay K1 switches the rf path between the power amplifier output and the receiver input connectors. The relay is energized by the +9 V XMT signal during transmit.

Rf current through T1 produces voltages across R1 and R2 that are proportional to the rf line current. Voltages are produced across the C1/L1/C3 and C2/L2/C4 series networks that are proportional to the rf line current. The voltage at R2 is added to that developed across C4. The combined voltage is rectified and filtered by CR2, L4, and C6, then applied to the power amplifier as the forward power analog voltage. The reflected power analog voltage applied to the power amplifier is developed similarly by R1, CR1, C3, L3, and C5. Capacitors C1 and C2 are adjusted to balance the voltages due to the sampled rf line voltage with those due to the sampled rf line current.

3. TESTING/TROUBLESHOOTING PROCEDURES

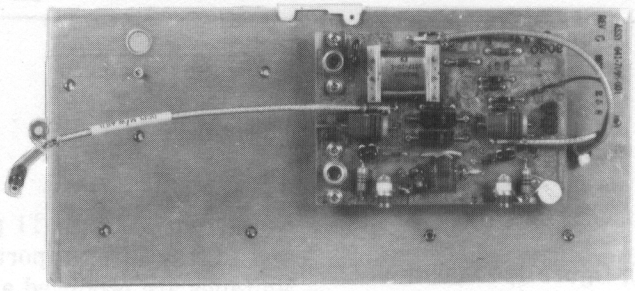
Performance tests for the low-pass filter are given in tables 2 and 3. In addition to the required performance criteria, troubleshooting comments are given.

It is assumed that the repair technician is trained in solid-state circuit troubleshooting and repair techniques, and is familiar with the test equipment to be used. Step-by-step operating procedures may not be given in all tests and not all possible troubleshooting information can be listed.

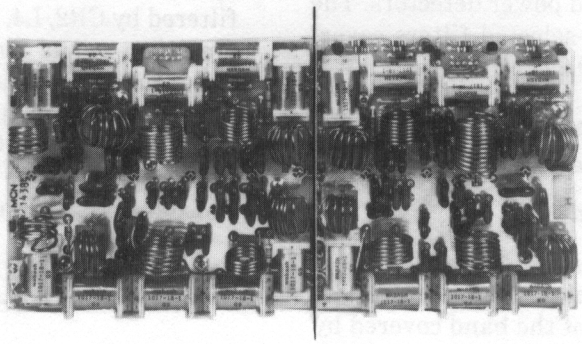
Testing and troubleshooting of the low-pass filter requires the low-pass filter be installed in the transceiver.

3.1 Test Equipment Required

Table 1 lists the equipment required to perform the tests. A suggested type is given; however, if that specific equipment is not available, any that meets or



A2



A1 A3

TPA-5794-017

Low-Pass Filter Assembly
Figure 1

exceeds the indicated minimum specifications is acceptable for use.

3.2 Performance Test

The following test procedures measure the performance of the low-pass filter. After being repaired, repeat the numbered test where repair was performed to verify that no further malfunctions exist.

3.2.1 Preliminary Setup

Be certain no power is applied to the equipment until instructed to do so in the procedures. Do not connect power with power switches turned on.

Connect the equipment as instructed in the procedures for each test.

3.2.2 Test Procedures

Perform the tests as given in tables 2 and 3.

Table 1. Test Equipment Required.

ITEM	USED FOR	SUGGESTED TYPE	MINIMUM SPECIFICATIONS
Rf load	Terminating filter output	Bird 8135	150-W rf, 50-ohm, 2 to 30 MHz
Vector impedance meter	Measuring phase angle and impedance of filters	Hewlett-Packard 4815A	Phase angles to ±10°, impedance to 70 ohms
Rf signal generator	Applying rf signals to filters	Hewlett-Packard 8640B	3 to 40 MHz, 2-V rf output, 50-ohm
Rf voltmeter	Measuring rf voltage at filters	Boonton 92C	0 to 0.1 V rf
Coax jumper (A2 P2 to A2P3)	Bypassing low-pass filter	P/N 634-8283-011	
Rf load	Terminating directional coupler transmit output	Bird 8329	150-W rf, 50-ohm, 2 to 30 MHz
Power meter	Measuring rf power output	HP 432B	88 watts at 30 MHz
Rf source	Supplying 100-watt rf input	KWM 380	100-watt, 30-MHz
12-volt power supply	Applying +9 V dc to directional coupler	HP 721A	+9 V dc
Digital voltmeter	Detector output measurements	HP 8000A	0 to 5 V dc

Table 2. Low-Pass Filter A1 Testing and Troubleshooting Procedures.

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>NORMAL INDICATION</th><th>IF INDICATION IS ABNORMAL</th></tr>
<tr><td>1. Test setup</td><td>a. Disconnect coax from receiver-exciter J1 to power amplifier (to keep rf from power amplifier).

b. Connect 50-ohm load (Bird 8135) to A2J2.

c. Connect vector impedance meter to A2J1. (Use probe-to-BNC adapter, then BNC-to-phono connector adapter for short as possible connection.)

d. Turn on transceiver.</td><td></td><td></td></tr>
<tr><td>2. Filter tuning impedance measurement</td><td>a. Key transceiver (press in MOX switch) and perform following steps for each filter in A1.

(1) Select transceiver frequency falling within band of filter being tested.

<table><tr><th>FILTER</th><th>DIAL FREQ</th></tr><tr><td>A2 L11/L12</td><td>1.95</td></tr><tr><td>A3 L11/L12</td><td>2.50</td></tr><tr><td>A2 L21/L22</td><td>3.55</td></tr><tr><td>A3 L21/L22</td><td>4.50</td></tr><tr><td>A3 L31/L32</td><td>6.00</td></tr><tr><td>A2 L31/L32</td><td>7.15</td></tr><tr><td>A3 L41/L42</td><td>12.00</td></tr><tr><td>A2 L41/L42</td><td>14.15</td></tr><tr><td>A2 L51/L52</td><td>29.00</td></tr></table>
(2) Slowly sweep meter frequency across filter band while noting input impedance and maximum phase angle for each filter.

<table><tr><th>FREQ RANGE (MHz)</th><th>FILTER</th></tr><tr><td>1.6-2</td><td>A1 L11/L12</td></tr><tr><td>2-3</td><td>A3 L11/L12</td></tr><tr><td>3-4</td><td>L1 L21/L22</td></tr><tr><td>4-5</td><td>A3 L21/L22</td></tr><tr><td>5-7</td><td>A3 L31/L32</td></tr><tr><td>7-10</td><td>A1 L31/L32</td></tr><tr><td>10-14</td><td>A3 L41/L42</td></tr><tr><td>14-20</td><td>A1 L41/L42</td></tr><tr><td>20-30</td><td>A1 L51/L52</td></tr></table></td><td>Maximum phase angle, θ, for any filter is ±10°.

Impedance, Ω, as indicated for max phase deviation.

<table><tr><th>IF PHASE IS NMT</th><th>IMPEDANCE RANGE IS</th></tr><tr><td>±10°</td><td>46-55</td></tr><tr><td>±8°</td><td>44-57</td></tr><tr><td>±6°</td><td>43-58</td></tr><tr><td>±4°</td><td>42-59</td></tr><tr><td>±2°</td><td>42-60</td></tr></table></td><td>If not within specified limits, increase output coil spacing to set to maximum allowable positive value at high end of band. Adjust input coil for middle and low end of band. Repeat step (2) to recheck measurement.</td></tr>
<tr><td>3. Stop band attenuation

(Cont)</td><td>b. Unkey transmitter and disconnect vector impedance meter and 50-ohm load.

a. Connect rf signal generator to A2J1. Adjust generator output for 1.0-V. Maintain this level throughout test.

b. Connect rf voltmeter to A2J2 (or transceiver rf connector J4).</td><td></td><td></td></tr>
</table>

Table 2. Low-Pass Filter A1 Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	c. Tune transceiver to frequency falling within band of filter being tested. d. Key transceiver e. Set signal generator output to frequency indicated and measure rf voltage. Repeat for all filters. FILTER (MHz) / DIAL FREQ / SIG GEN FREQ (MHz) 1.6-2 / 1.9 / 3.2 2-3 / 2.5 / 4.0 3-4 / 3.5 / 6.0 4-5 / 4.5 / 8.0 5-7 / 6.0 / 10.0 7-10 / 8.0 / 14.0 10-14 / 12.0 / 20.0 14-20 / 15.0 / 28.0 20-30 / 28.0 / 40.0 f. Unkey transceiver. Disconnect signal generator, voltmeter, and load. Reconnect coax between power amplifier P1 and receiver-exciter J1.	Rf voltage through filter is not more than 0.056-V.	Check for correct component values and possible coil damage.

Table 3. Directional Coupler A2 Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Null	Note Because of the unlikelihood of a fault in the directional coupler, this circuit need not be tested unless a malfunction is suspected. In normal operation, for 100-watt rf output, forward power detected output is +2.2 ±0.2-V dc and reflected power detected output is 0.0 V dc.		
	a. Remove assembly A2 from transceiver.		
	b. Temporarily connect coax jumper between P2 and P3 on A2.		
	c. Connect 50-ohm load to (Bird 8135) A2J2.		
	d. Connect 30-MHz, 100-watt output source to A2P1. Turn on source.		
	e. Using digital voltmeter measure dc voltage at:		
	A2J3-2	Not more than +0.1-V dc	Adjust A2C1 for null, not more than +0.1-V dc.
	A2J3-3	+2.2 ±0.2-V dc	Adjust A2C2 for correct voltage.
	f. Turn off rf source. Connect source to A2J2 and load to A2P1. Turn on source.		
	g. Using digital voltmeter, measure dc voltage at:		
	A2J3-2	+2.2 ±0.2-V dc	Adjust A2C1 for correct voltage.
	A2J3-3	Not more than +0.1-V dc	Adjust A2C2 for null, not more than +0.1-V dc
	h. Turn off rf source.		
2. Output	a. Connect 50-ohm load (Bird 8329) in parallel with 50-ohm load (Bird 8135) connected to A2J2. Connect power meter to 50-ohm load (Bird 8329).		
	Note Keep coax lengths between each rf load and A2J2 as short as possible. Load impedance at A2J2 as measured by vector impedance meter should be 25 ±10 ohms at 0 +10° phase angle at 30 MHz.		
(Cont)			

Table 3. Directional Coupler A2 Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	b. Turn on rf power source. Adjust rf power source for a reading of 44 watts on the power meter. *Note* Power meter reading equals 1/2 directional coupler output power.		
	c. Using digital voltmeter, measure dc voltage at:		
	A2J3-2	0.45 to 0.7-V dc	Check reflected power detector circuit.
	A2J3-3	2.3 to 2.7-V dc	Check forward power detector circuit.
	d. Turn off rf power source and disconnect test equipment.		
3. Tr relay	a. Connect rf voltmeter to receive rf input A2P1.		
	b. Connect signal generator to A2J2. Set signal generator to 1 V rf at 2 MHz.	Voltmeter indicates 1.0 ±0.2-V rms	Check A2K1.
	c. Momentarily connect +9-V dc input to A2J3-7 (+9 V XMT).	Voltmeter indicates 0 V rms	Check A2K1 and associated circuit.
	d. Disconnect test equipment.		
4. Coax inter lock	a. Enable transmit input (pin 7).	Forward power analog (pin 3) output is less than 50 mV dc when rf input (J1) is grounded and greater than 2.5 V dc when J1 is open.	
	b. Check for dc continuity to ground from J2 center conductor.		

4. REPAIR

Repair of the low-pass filter is accomplished using standard maintenance and circuit card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All parts list illustrations containing ESDS items are shown with the following symbol:

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification. Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

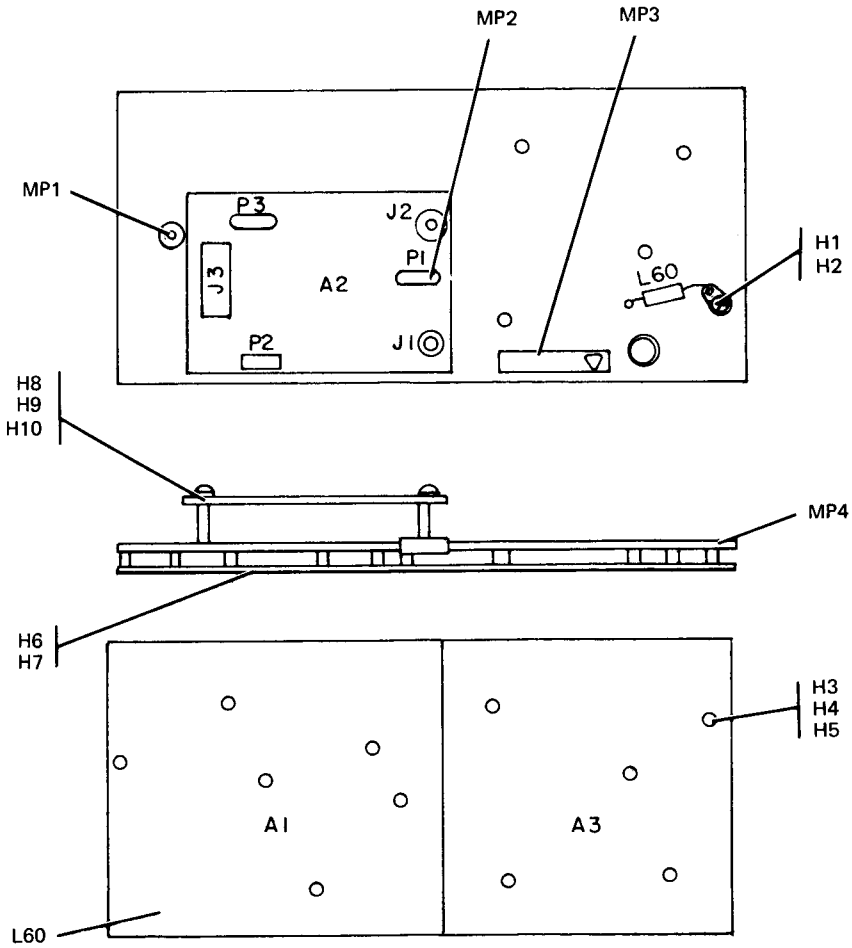
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
02113	COILCRAFT INC 1102 SILVER LAKE RD CARY IL 60013
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
18542	WABASH RELAY AND ELECTRONICS DIV WABASH INC 1ST AND WEBSTER STS P O BOX 708 WABASH IN 46992

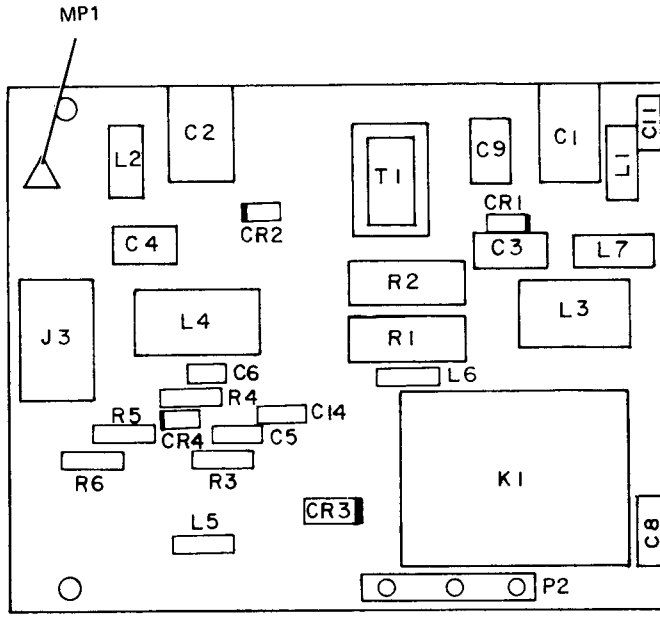
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
20462	PREM ENTERPRISES INC 3519 N CHAPEL HILL MC HENRY IL 60050
25184	PRECISION RUBBER PRODUCTS CORP HARTMAN DRIVE LEBANON TN 37087
28480	HEWLETT-PACKARD CO CORPORATE HQ 3000 HANOVER ST PALO ALTO CA 94304
31433	UNION CARBIDE CORP ELECTRONICS DIV HWY 276 SE P O BOX 5928 GREENVILLE SC 29606
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP P O BOX 7600 LAUTER AVE FLORENCE SC 29501
77250	ALLIED PRODUCTS CORP PHEOLL MFG CO DIV 5700 W ROOSEVELT RD CHICAGO IL 60650
81349	MILITARY SPECIFICATIONS
82389	SWITCHCRAFT INC SUB OF RAYTHEON CO 5555 N ELSTRON AVE CHICAGO IL 60630
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

5.3 Equipment Covered

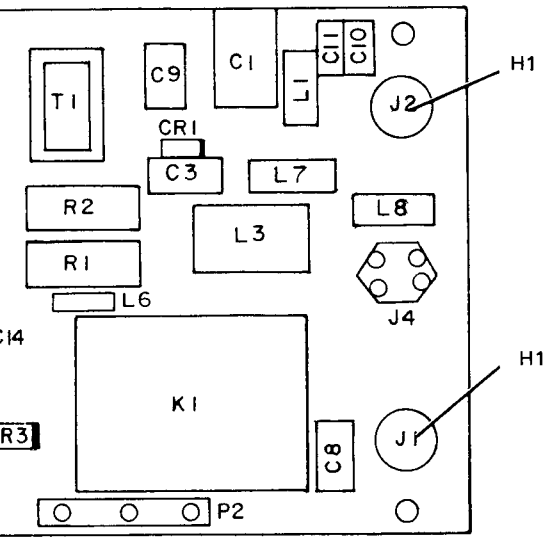
Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Low-Pass Filter	641-7132-001	REV D
Low-Pass Filter Circuit Card	638-6904-001	REV J
Standard Low-Pass Filter Circuit Card	638-6900-001	REV F
Directional Coupler	638-6788-001	REV N





638-6788-001
A2



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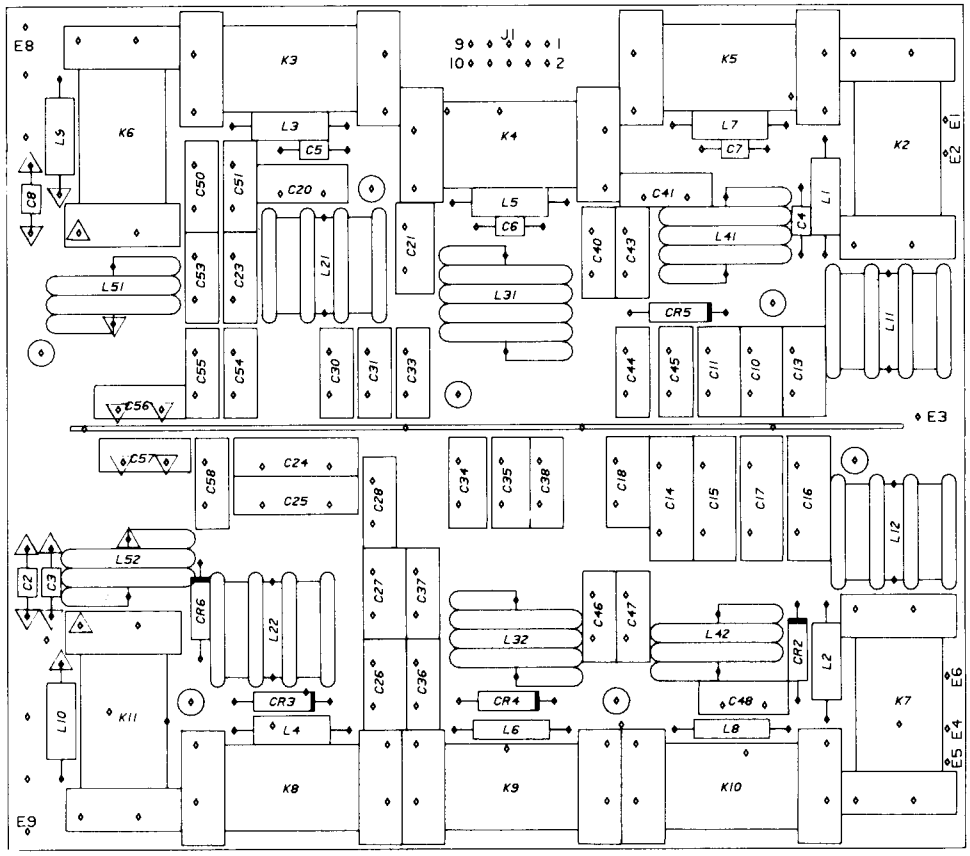
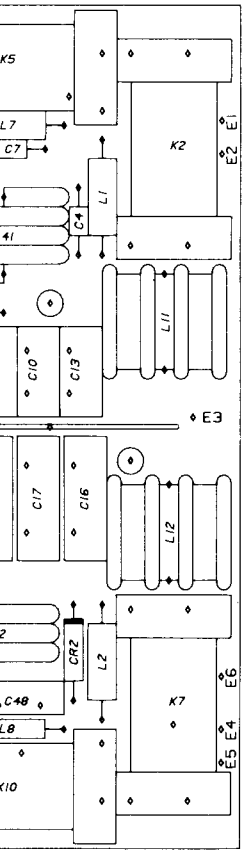
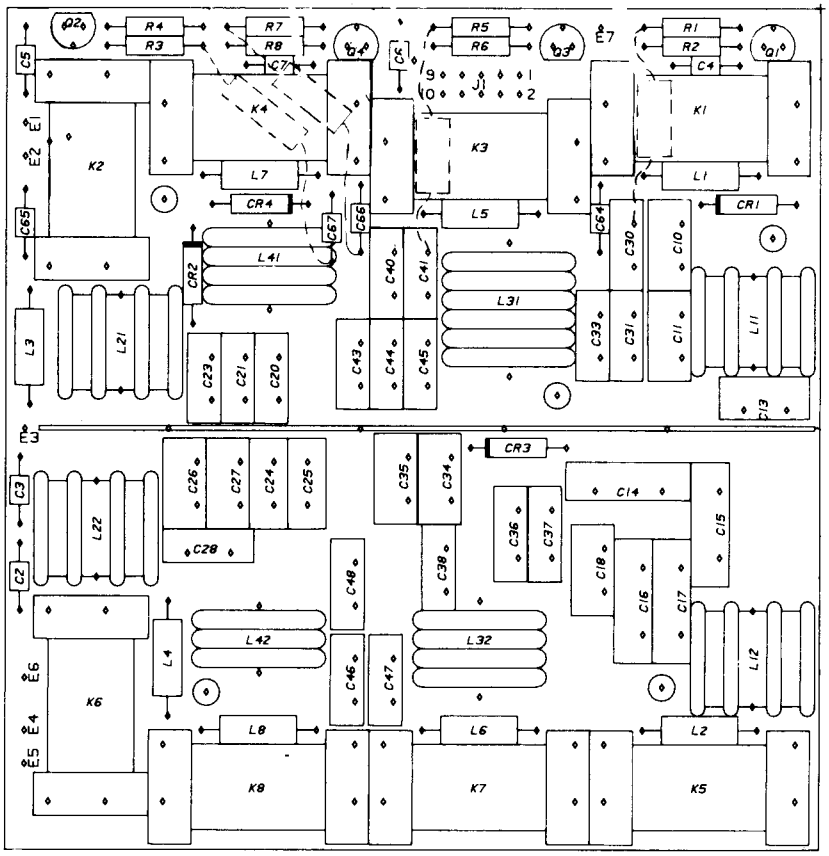


638-6900-001
A1





638-6904-001
A3

CAUTION CAUTION
ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

TPA-5535-018

Low-Pass Filter, Parts Location
Figure 2 (Sheet 1 of 2)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	SMR CODE
	LOW PASS FILTER	641-7132-001				
H1	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 1)	310-0279-000		96906	MS35338-135	
H2	NUT,PLAIN,HEX SST, 4-40 (QTY 1)	313-0132-000		77250	P313-0132-000	
H3	SCREW,MACH STL, 4-40 X 1/2 (QTY 1)	343-0137-000		96906	MS51957-17	
H4	WASHER,FLAT CRES, 0.125ID X 0.250 OD	310-0779-030		96906	MS15795-803	
H5	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 5)	310-0279-000		96906	MS35338-135	
H6	SCREW,MACH SST, 4-40 X 5/16 (QTY 11)	343-0134-000		96906	MS51957-14	
H7	WASHER,FLAT CRES, 0.125ID X 0.250 OD (QTY 7)	310-0779-030		96906	MS15795-803	
H8	SCREW,MACH STL, 4-40 X 1/2 (QTY 5)	343-0137-000		96906	MS51957-17	
H9	WASHER,FLAT CRES, 0.125ID X 0.250 OD (QTY 5)	310-0779-030		96906	MS15795-803	
H10	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 5)	310-0279-000		96906	MS35338-135	
L60	COIL,RF 2200UH	240-2715-530		96906	MS75089-27	
MP1	GROMMET,RUBBER	201-0001-000		96906	MS35489-4	
MP2	CABLE	641-7100-013			641-7100-013	
MP3	LABEL,PRESS SENS (ESDS)	280-2745-020		12998	280-2745-020	
MP4	MOUNT,FILTER	641-7130-001				
A2A3	LOW PASS FILTER- OPT	638-6904-001				
A2A1	LOW PASS FILTER	638-6900-001				
A2A2	DIRECTIONAL COUPLER	638-6788-001			638-6788-001	
A2A3	LOW PASS FILTER CIRCUIT CARD	638-6904-001				
CR1-CR4	SEMICOND DEVICE	353-6442-020		04713	1N4002	
C1	NOT USED					
C2-C7	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050	
C8,C9	NOT USED					
C10	CAPACITOR,FXD MICA DIEL, 430PF, 5%, 500V	912-2861-000		72136	DM15F431J300WV4CR	
C11	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-2858-000		81349	CM05FD391J03	
C12	NOT USED					
C13	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 500V	912-2846-000		81349	CM05FD271J03	
C14,C15	CAPACITOR,FXD MICA DIEL, 680PF, 5%, 500V	912-2989-000		81349	CM06FD681J03	
C16	CAPACITOR,FXD MICA DIEL, 510PF, 5%, 500V	912-2980-000		81349	CM06FD511J03	
C17	CAPACITOR,FXD MICA DIEL, 470PF, 5%, 500V	912-2974-000		81349	CM06FD471J03	
C18	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 500V	912-2852-000		81349	CM05FD331J03	
C19	NOT USED					
C20,C21	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-2840-000		81349	CM05FD221J03	
C22	NOT USED					
C23	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-000		81349	CM05FD151J03	
C24,C25	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-2858-000		81349	CM05FD391J03	
C26,C27	CAPACITOR,FXD MICA DIEL, 240PF, 5%, 500V	912-2843-000		81349	CM05FD241J03	
C28	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-000		81349	CM05FD151J03	
C29	NOT USED					
C30,C31	CAPACITOR,FXD MICA DIEL, 120PF, 5%, 500V	912-2822-000		81349	CM05FD121J03	
C32	NOT USED					
C33	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-2816-000		81349	CM05FD101J03	
C34,C35	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 500V	912-2846-000		81349	CM05FD271J03	
C36	CAPACITOR,FXD MICA DIEL, 200PF, 5%, 500V	912-2837-000		81349	CM05FD201J03	
C37	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 500V	912-2834-000		81349	CM05FD181J03	
C38	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-2816-000		81349	CM05FD101J03	
C39	NOT USED					
C40,C41	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-2804-000		81349	CM05ED680J03	
C42	NOT USED					
C43	CAPACITOR,FXD MICA DIEL, 43PF, 5%, 500V	912-2789-000		81349	CM05ED430J03	
C44	CAPACITOR,FXD MICA DIEL, 130PF, 5%, 500V	912-2825-000		81349	CM05FD131J03	
C45	CAPACITOR,FXD MICA DIEL, 120PF, 5%, 500V	912-2822-000		81349	CM05FD121J03	
C46	CAPACITOR,FXD MICA DIEL, 91PF, 5%, 500V	912-2813-000		81349	CM05FD910J03	
C47	CAPACITOR,FXD MICA DIEL, 82PF, 5%, 500V	912-2810-000		81349	CM05ED820J03	
C48	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 500V	912-2798-000		81349	CM05ED560J03	
C49-C63	NOT USED					
C64-C67	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050	
C68	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050	
C69	NOT USED					
C70	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050	
C71	NOT USED					
C72	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050	
C73	NOT USED					
C74	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050	
J1	CONNECTOR,HDR	372-2656-100		52072	CAD10SP100-230-430	
K1-K8	RELAY,REED,RF	410-0585-010		18542	1017-18-1	
L1-L8	COIL,RF 47UH	240-2043-000		96906	MS75085-03	
L9,L10	NOT USED					
L11	COIL,RF 2.9UH	278-0449-050		20462	278-0449-050	
L12	COIL,RF 1.6UH	278-0449-060		20462	278-0449-060	
L13-L20	NOT USED					
L21	COIL,RF 1.7UH	278-0449-070		20462	278-0449-070	
L22	COIL,RF 0.95UH	278-0449-080		20462	278-0449-080	
L23-L30	NOT USED					
L31	AIR WND, 11 1/2 TURNS	278-0846-450		02113	278-0846-450	
L32	AIR WND, 7 1/2 TURNS	278-0846-460		02113	278-0846-460	
L33-L40	NOT USED					
L41	COIL,RF AIR WND, 6 TURNS	278-0846-470		02113	278-0846-470	
L42	COIL,RF AIR WND, 5 TURNS	278-0846-480		02113	278-0846-480	
Q1-Q4	TRANSISTOR	352-5035-010		04713	MPSA14	
R1	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS	
R2	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS	
R3	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS	
R4	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS	
R5	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS	
R6	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS	
R7	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS	

PARTS LIST (Co

REF DES	DESCRIPTION	COLL PART NUM
R8	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-
	STANDARD LOW PASS FILTER CIRCUIT CARD	638-
CR1	NOT USED	
CR2-CR6	SEMICOND DEVICE	353-
C1	NOT USED	
C2-C8	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-
C9	NOT USED	
C10	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 500V	912-
C11	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-
C12	NOT USED	
C13	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-
C14	CAPACITOR,FXD MICA DIEL, 1000PF, 5%, 500V	912-
C15,C16	CAPACITOR,FXD MICA DIEL, 820PF, 5%, 500V	912-
C17	CAPACITOR,FXD MICA DIEL, 510PF, 5%, 500V	912-
C18	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 500V	912-
C19	NOT USED	
C20,C21	CAPACITOR,FXD MICA DIEL, 240PF, 5%, 500V	912-
C22	NOT USED	
C23	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 500V	912-
C24	CAPACITOR,FXD MICA DIEL, 470PF, 5%, 500V	912-
C25	CAPACITOR,FXD MICA DIEL, 430PF, 5%, 500V	912-
C26	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 500V	912-
C27	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 500V	912-
C28	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-
C29	CAPACITOR,FXD MICA DIEL, 91PF, 5%, 500V	912-
C30-C32	NOT USED	
C33	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-
C34,C35	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 500V	912-
C36,C37	CAPACITOR,FXD MICA DIEL, 130PF, 5%, 500V	912-
C38	CAPACITOR,FXD MICA DIEL, 75PF, 5%, 500V	912-
C39	NOT USED	
C40	CAPACITOR,FXD MICA DIEL, 43PF, 5%, 500V	912-
C41	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V (A2)	912-
C41	CAPACITOR,FXD MICA DIEL, 36PF, 5%, 500V	912-
C42	NOT USED	
C43	CAPACITOR,FXD MICA DIEL, 36PF, 5%, 500V (A2)	912-
C43	CAPACITOR,FXD MICA DIEL, 39PF, 5%, 500V	912-
C44	CAPACITOR,FXD MICA DIEL, 82PF, 5%, 500V	912-
C45	CAPACITOR,FXD MICA DIEL, 91PF, 5%, 500V	912-
C46	CAPACITOR,FXD MICA DIEL, 62PF, 5%, 500V (A1)	912-
C46	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-
C47	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-
C48	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 500V	912-
C49	NOT USED	
C50,C51	CAPACITOR,FXD MICA DIEL, 30PF, 5%, 500V (A1)	912-
C50,C51	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 500V	912-
C52	NOT USED	
C53	CAPACITOR,FXD MICA DIEL, 22PF, 5%, 500V	912-
C54	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 500V (A1)	912-
C54	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-
C55	CAPACITOR,FXD MICA DIEL, 62PF, 5%, 500V	912-
C56	CAPACITOR,FXD MICA DIEL, 39PF, 5%, 500V	912-
C57	CAPACITOR,FXD MICA DIEL, 43PF, 5%, 500V	912-
C58	CAPACITOR,FXD MICA DIEL, 22PF, 5%, 500V (A1)	912-
C58	CAPACITOR,FXD MICA DIEL, 27PF, 5%, 500V	912-
J1	CONNECTOR,HDR	372-
K1	NOT USED	
K2-K11	RELAY,REED,RF	410-
L1-L10	COIL,RF 47UH	240-
L11	COIL,RF 3.8UH	278-
L12	COIL,RF 2.2UH	278-
L13-L20	NOT USED	
L21	COIL,RF 2.0UH	278-
L22	COIL,RF 1.05UH	278-
L23-L30	NOT USED	
L31	COIL,RF AIR WND, 8 1/2 TURNS	278-
L32	COIL,RF AIR WND, 6 TURNS	278-
L33-L40	NOT USED	
L41	COIL,RF AIR WND, 5 1/2 TURNS	278-
L42	AIR WND, 4 TURNS	278-
L43-L50	NOT USED	
L51	AIR WND, 4 TURNS	278-
L52	AIR WND, 3 1/2 TURNS	278-
	DIRECTIONAL COUPLER CIRCUIT CARD	638-
CR1,CR2	SEMICOND DEVICE	353-
CR3	SEMICOND DEVICE	353-
CR4	SEMICOND DEVICE (A1)	353-
C1,C2	CAPACITOR,VAR AIR DIEL, 0.8 TO 10PF, 250V	922-
C3,C4	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 300V	912-
C5,C6	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-
C7	NOT USED	
C8,C9	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-
C10,C11	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC (A1)	913-
C12,C13	NOT USED	
C14	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC (A1)	913-

PARTS LIST (Cont)

	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	SMR CODE
%, 1/4W	745-0821-000		81349	RCR07G104KS	
CARD	638-6900-001				
	353-6442-020		04713	1N4002	
20%P80%,50V	913-3331-020		56289	292CY5U103D8050	
5%, 500V	912-2855-000		81349	CM05FD361J03	
5%, 500V	912-2858-000		81349	CM05FD391J03	
5%, 500V	912-2858-000		81349	CM05FD391J03	
5%, 500V	912-3001-000		81349	CM06FD102J03	
5%, 500V	912-2995-000		81349	CM06FD821J03	
5%, 500V	912-2980-000		81349	CM06FD511J03	
5%, 500V	912-2855-000		81349	CM05FD361J03	
5%, 500V	912-2843-000		81349	CM05FD241J03	
5%, 500V	912-2834-000		81349	CM05FD181J03	
5%, 500V	912-2974-000		81349	CM06FD471J03	
5%, 500V	912-2971-000		81349	CM06FD431J03	
5%, 500V	912-2855-000		81349	CM05FD361J03	
5%, 500V	912-2852-000		81349	CM05FD331J03	
5%, 500V	912-2828-000		81349	CM05FD151J03	
%, 500V	912-2813-000		81349	CM05FD910J03	
%, 500V	912-2804-000		81349	CM05ED680J03	
5%, 500V	912-2834-000		81349	CM05FD181J03	
5%, 500V	912-2825-000		81349	CM05FD131J03	
%, 500V	912-2807-000		81349	CM05ED750J03	
%, 500V	912-2789-000		81349	CM05ED430J03	
%, 500V (A2)	912-2792-000		81349	CM05ED470J03	
%, 500V	912-2783-000		81349	CM05ED360J03	
%, 500V (A2)	912-2783-000		81349	CM05ED360J03	
%, 500V	912-2786-000		81349	CM05ED390J03	
%, 500V	912-2810-000		81349	CM05ED820J03	
%, 500V	912-2813-000		81349	CM05FD910J03	
%, 500V (A1)	912-2801-000		81349	CM05ED620J03	
%, 500V	912-2804-000		81349	CM05ED680J03	
%, 500V	912-2804-000		81349	CM05ED680J03	
%, 500V	912-2798-000		81349	CM05ED560J03	
%, 500V (A1)	912-2777-000		81349	CM05ED300J03	
%, 500V	912-2780-000		81349	CM05ED330J03	
%, 500V	912-2768-000		81349	CM05ED220J03	
%, 500V (A1)	912-2798-000		81349	CM05ED560J03	
%, 500V	912-2804-000		81349	CM05ED680J03	
%, 500V	912-2801-000		81349	CM05ED620J03	
%, 500V	912-2786-000		81349	CM05ED390J03	
%, 500V	912-2789-000		81349	CM05ED430J03	
%, 500V (A1)	912-2768-000		81349	CM05ED220J03	
%, 500V	912-2774-000		81349	CM05ED270J03	
	372-2656-100		52072	CAD10SP100-230-4 30	
	410-0585-010		18542	1017-18-1	
	240-2043-000		96906	MS75085-03	
	278-0449-010		20462	278-0449-010	
	278-0449-020		20462	278-0449-020	
	278-0449-030		20462	278-0449-030	
	278-0449-040		20462	278-0449-040	
	278-0846-390		02113	278-0846-390	
	278-0846-400		02113	278-0846-400	
	278-0846-410		02113	278-0846-410	
	278-0846-420		02113	278-0846-420	
	278-0846-430		02113	278-0846-430	
	278-0846-440		02113	278-0846-440	
	638-6788-001			638-6788-001	
	353-3691-010		28480	1N5711	
	353-6442-020		04713	1N4002	
	353-3644-010		31433	1N4454-1	
PF, 250V	922-0595-020		81349	PC26J100	
%, 300V	912-3909-000		81349	CM04FC271J03	
0%P80%,50V	913-3331-020		56289	292CY5U103D8050	
RM 0.5PF,	912-2753-000		81349	CM05CD100D03	
10%, 100VDC	913-5019-440		81349	CK06BX104K	
P80%M20%,	913-3331-020		56289	292CY5U103Z050B	

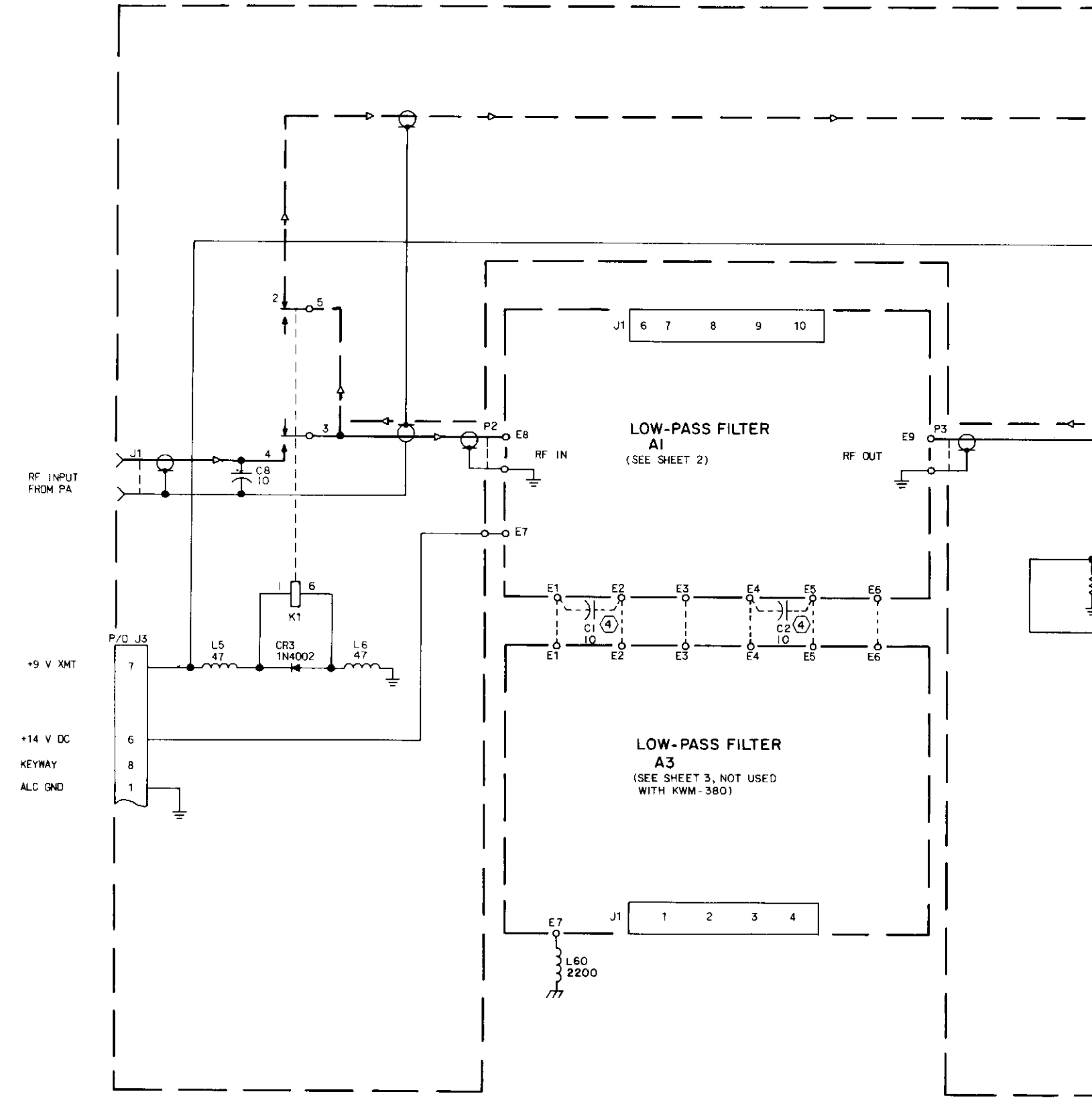
PARTS LIST (Cont)

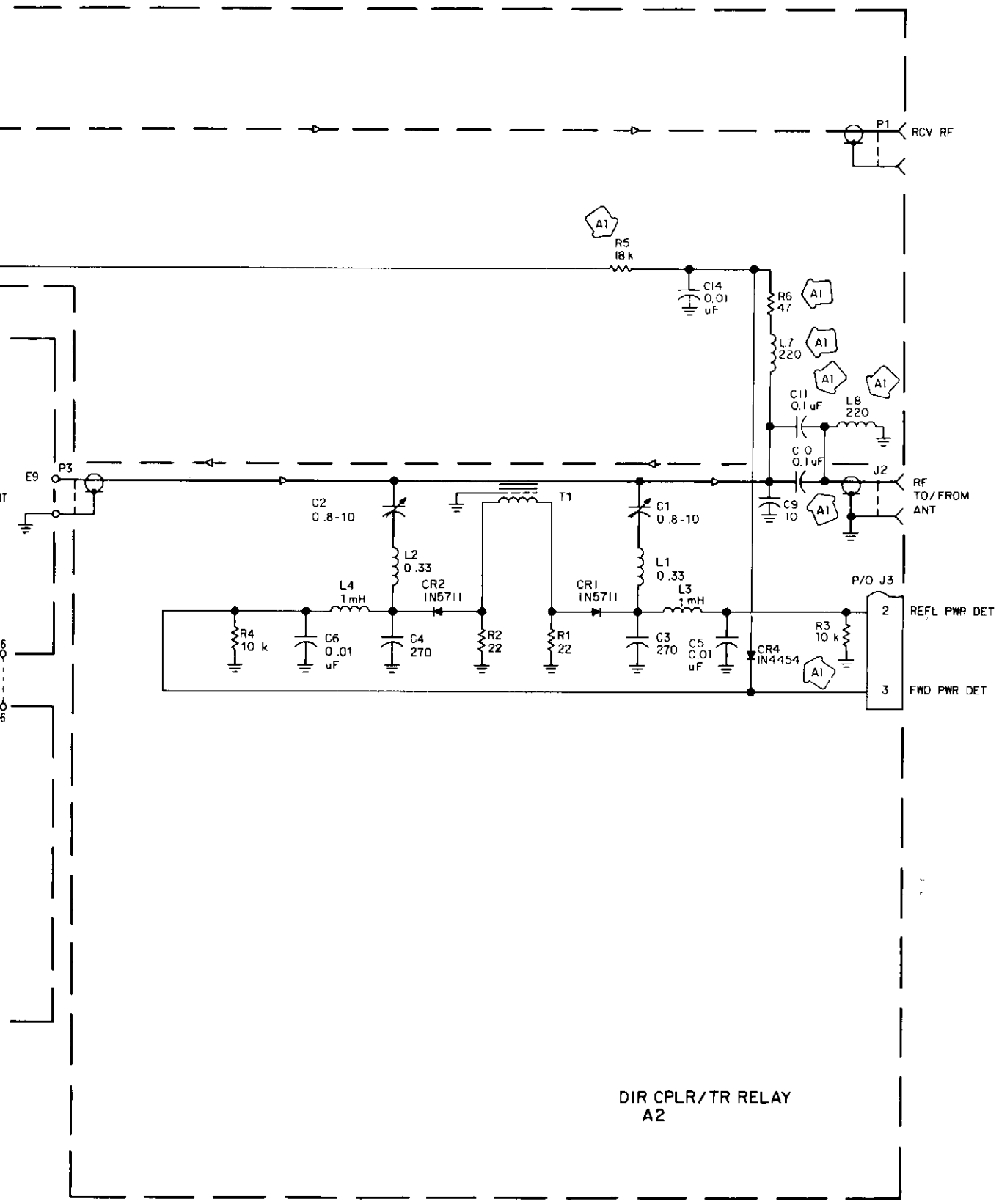
REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	SMR CODE
H1	WASHER,SEALING CD PL STL, 0.195 ID X 0.315 OD (QTY 2)	310-0440-000		25184	110-5	
J1,J2	PHONO-JACK	360-0148-000		82389	3501FP	
J3	HOUSING,CONN,EL (A2)	372-0043-330		00779	87478-2	
J3	CONNECTOR,HDR	372-2656-100		52072	CAD10SP100-230-4	
J4	CONNECTOR,RCPT ELEC (A3)	357-7405-010		81349	MIL-C-39012/95-0 001	
J4	CONNECTOR,RCPT ELEC	357-7195-010		98291	52-051-0000	
K1	RELAY,REED,RF	410-0585-020		18542	1017-20-1	
L1,L2	COIL,RF 0.33UH	240-1564-000		96906	MS18130-3	
L3,L4	COIL,RF 1000UH	240-1644-000		96906	MS14049-5	
L5,L6	COIL,RF 47UH	240-2043-000		96906	MS75085-03	
L7,L8	COIL,RF 220UH (A1)	240-2524-000		96906	MS90538-20	
MP1	LABEL,PRESS SENS (ESDS)	280-2745-040		12998	280-2745-040	
R1,R2	RESISTOR,FXD CMPSN, 22 OHMS, 5%, 1W	745-3281-000		81349	RCR32G220JS	
R3,R4	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS	
R5	RESISTOR,FXD CMPSN, 18K, 10%, 1/4W	745-0794-000		81349	RCR07G183KS	
R6	RESISTOR,FIXED CMPSN, 100 OHMS, 10%, 1/4W (A1)	745-0713-000		81349	RCR07G101KS	
T1	XMFR,DIR COUP	641-6745-001			641-6745-001	

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
	638-6900-001	
A1	C46 Changed from 68 pF to 62 pF. C50, C51 changed from 33 pF to 30 pF. C54 changed from 68 pF to 56 pF. C58 changed from 27 pF to 22 pF.	REV D
A2	C43 changed from 39 pF to 36 pF. C41 changed from 36 pF to 47 pF.	REV E
	638-6788-001	
A1	Added C10, C11 913-5019-440. Added L7, L8 240-2524-000.	REV G
NA	Data change.	REV H
A2	Changed J3 from 372-2656-100 to 372-0043-330.	REV J
NA	Added ESDS label.	REV K
NA	Data change.	REV L
A3	Changed J4 from 357-7195-010 to 375-7405-010.	REV M
NA	Data change.	REV N

Low-Pass Filter, Parts Location
Figure 2 (Sheet 2)


J1
6 7 8 9 10
LOW-PASS FILTER
A1
(SEE SHEET 2)
P2
E8
RF IN
E9
P3
RF OUT
RF INPUT
FROM PA
J1
4
C8
10
2
5
3
E7
1
6
K1
E1 E2 E3 E4 E5 E6
C1
10
4
C2
10
4
E1 E2 E3 E4 E5 E6
P/O J3
+9 V XMT
7
L5
47
CR3
1N4002
L6
47
+14 V DC
6
KEYWAY
8
ALC GND
1
LOW-PASS FILTER
A3
(SEE SHEET 3, NOT USED
WITH KWM-380)
E7
J1
1 2 3 4
L60
2200



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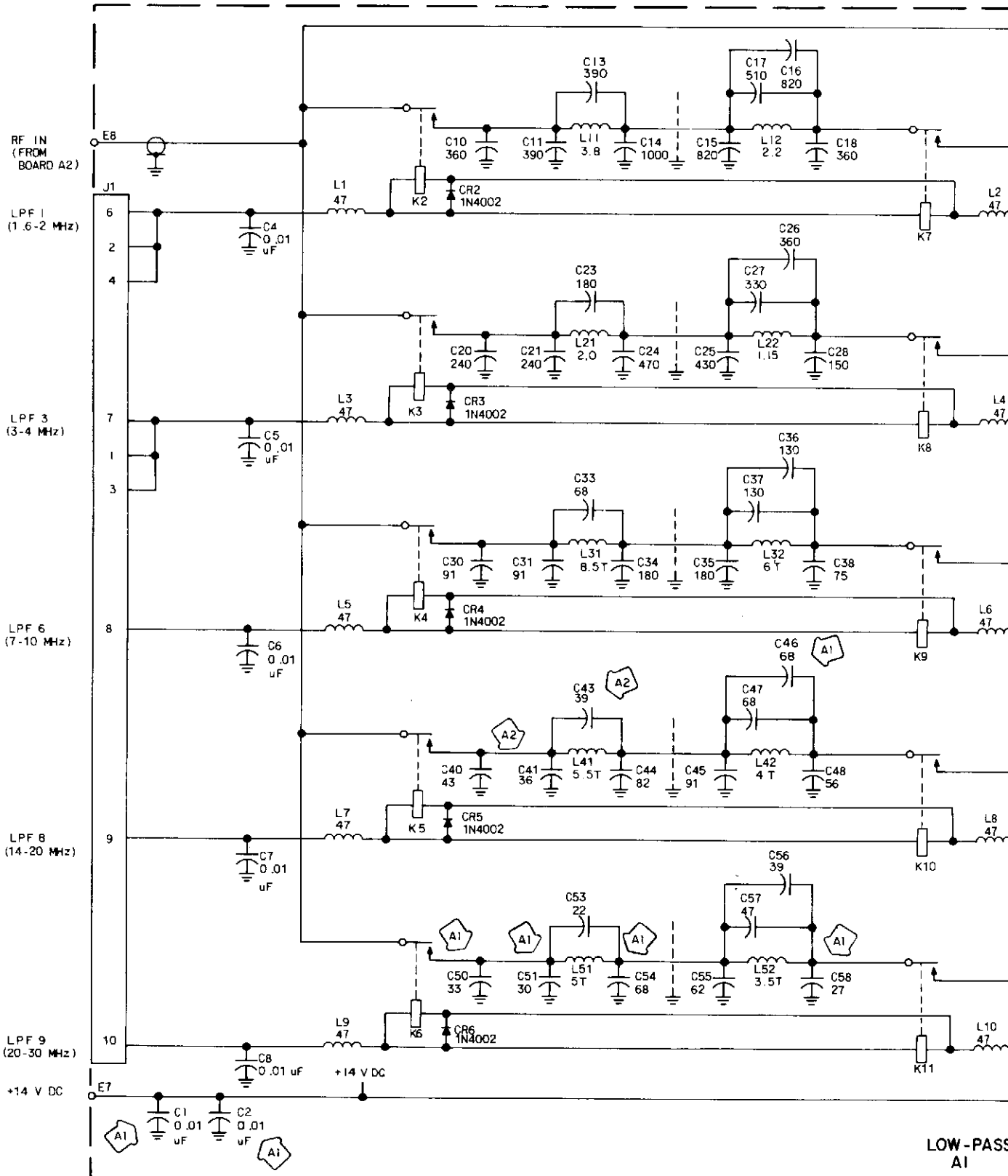
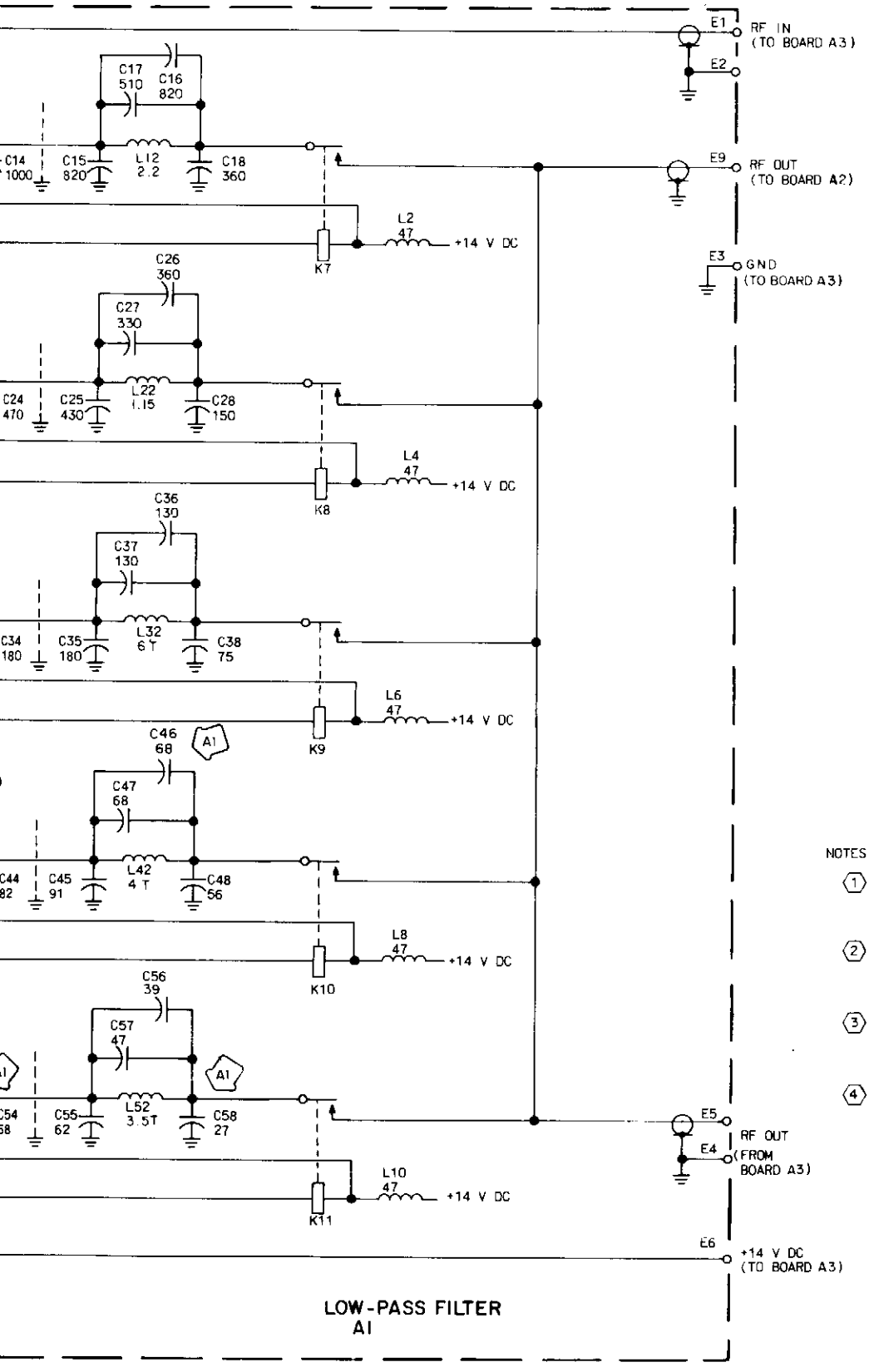
TPA-1686-034

Low-Pass Filter, Schematic Diagram
Figure 3 (Sheet 1 of 3)


RF IN (FROM BOARD A2)
E8
J1
LPF 1 (1.6-2 MHz)
LPF 3 (3-4 MHz)
LPF 6 (7-10 MHz)
LPF 8 (14-20 MHz)
LPF 9 (20-30 MHz)
+14 V DC
E7
C1 0.01 uF
C2 0.01 uF
C4 0.01 uF
C5 0.01 uF
C6 0.01 uF
C7 0.01 uF
C8 0.01 uF
L1 47
L2 47
L3 47
L4 47
L5 47
L6 47
L7 47
L8 47
L9 47
L10 47
K2
K3
K4
K5
K6
K7
K8
K9
K10
K11
CR2 1N4002
CR3 1N4002
CR4 1N4002
CR5 1N4002
CR6 1N4002
C10 360
C11 390
L11 3.8
C14 1000
C15 820
L12 2.2
C18 360
C13 390
C17 510
C16 820
C20 240
C21 240
L21 2.0
C24 470
C25 430
L22 1.15
C28 150
C23 180
C27 330
C26 360
C30 91
C31 91
L31 8.5T
C34 180
C35 180
L32 6T
C38 75
C33 68
C37 130
C36 130
C40 43
C41 36
L41 5.5T
C44 82
C45 91
L42 4T
C48 56
C43 39
C47 68
C46 68
C50 33
C51 30
L51 5T
C54 68
C55 62
L52 3.5T
C58 27
C53 22
C57 47
C56 39
A1
A2
LOW-PASS
A1

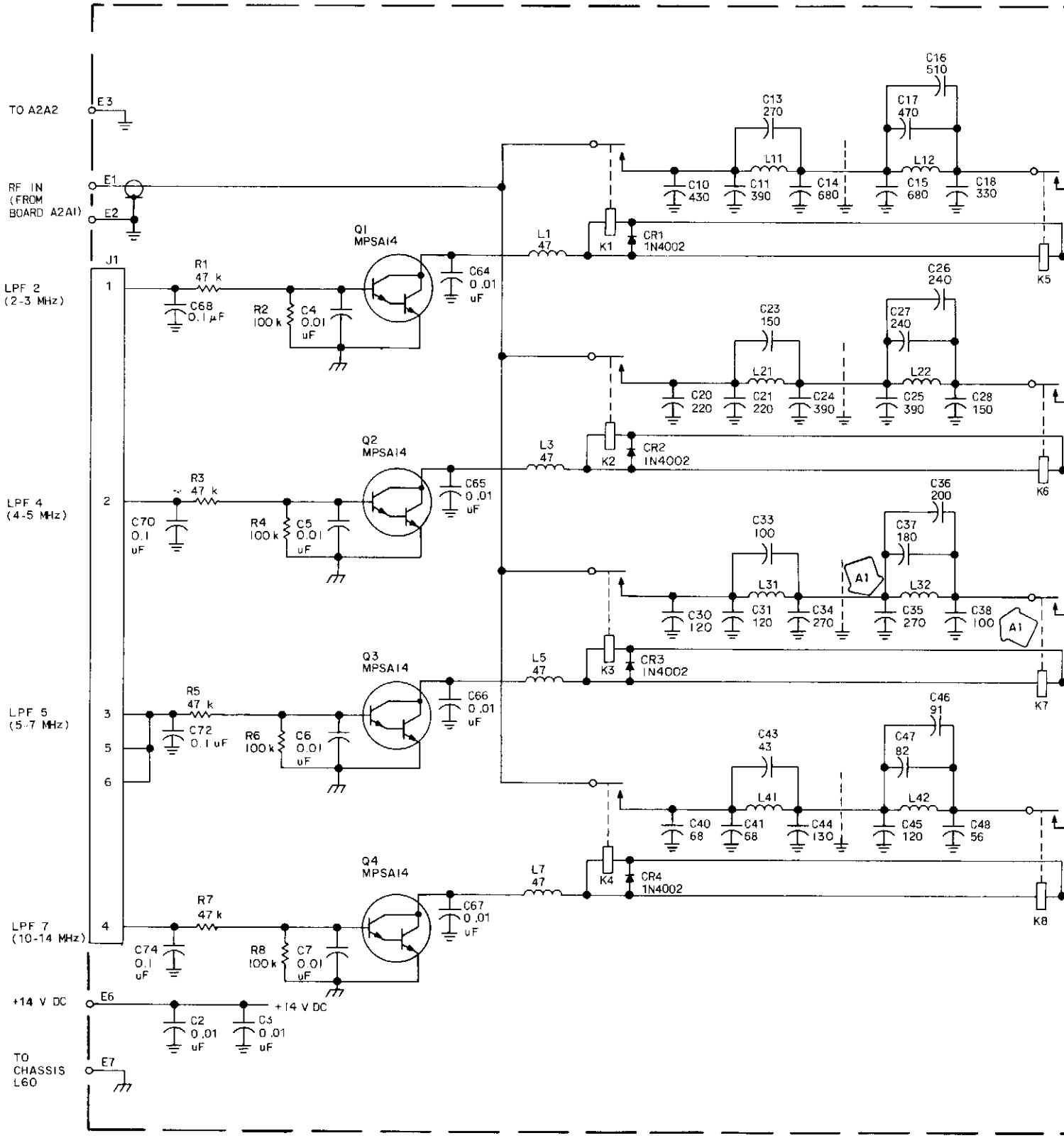


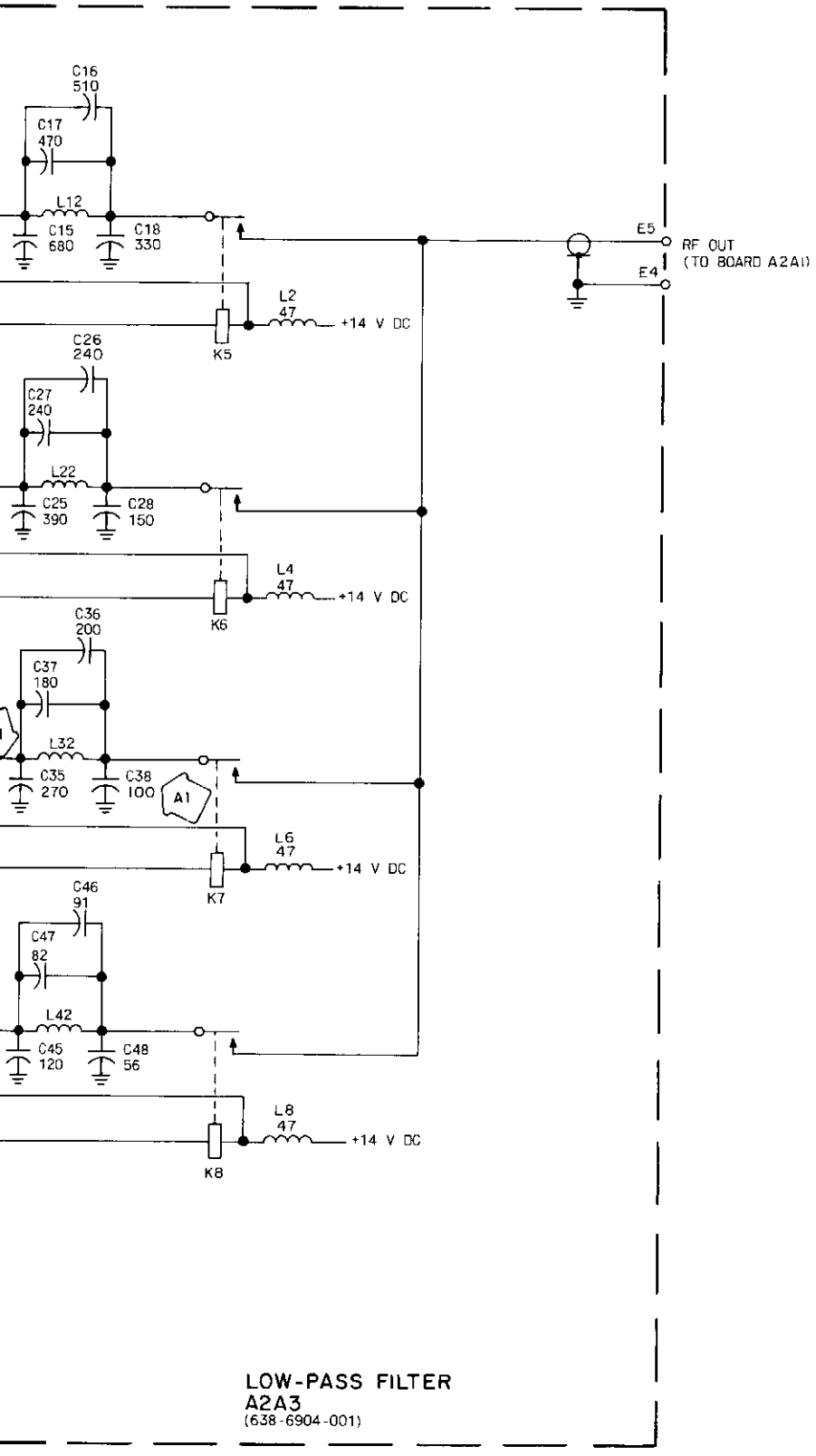
NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN PICOFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATIONS, PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
3. TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.
4. C1 AND C2 CONNECTED TO A1 AS SHOWN ONLY WHEN A3 IS NOT USED.

634-6912
TPA 1686 034

Low-Pass Filter, Schematic Diagram
Figure 3 (Sheet 2)


TO A2A2
E3
RF IN (FROM BOARD A2A1)
E1
E2
J1
LPF 2 (2-3 MHz)
LPF 4 (4-5 MHz)
LPF 5 (5-7 MHz)
LPF 7 (10-14 MHz)
1
2
3
5
6
4
R1 47 k
C68 0.1 µF
R2 100 k
C4 0.01 uF
Q1 MPSA14
C64 0.01 uF
L1 47
K1
CR1 1N4002
C10 430
C13 270
C11 390
L11
C14 680
C16 510
C17 470
C15 680
L12
C18 330
K5
R3 47 k
C70 0.1 uF
R4 100 k
C5 0.01 uF
Q2 MPSA14
C65 0.01 uF
L3 47
K2
CR2 1N4002
C20 220
C23 150
C21 220
L21
C24 390
C26 240
C27 240
C25 390
L22
C28 150
K6
R5 47 k
C72 0.1 uF
R6 100 k
C6 0.01 uF
Q3 MPSA14
C66 0.01 uF
L5 47
K3
CR3 1N4002
C30 120
C33 100
C31 120
L31
C34 270
C36 200
C37 180
C35 270
L32
C38 100
A1
K7
R7 47 k
C74 0.1 uF
R8 100 k
C7 0.01 uF
Q4 MPSA14
C67 0.01 uF
L7 47
K4
CR4 1N4002
C40 68
C43 43
C41 68
L41
C44 130
C46 91
C47 82
C45 120
L42
C48 56
K8
+14 V DC
E6
C2 0.01 uF
C3 0.01 uF
+14 V DC
TO CHASSIS L60
E7



634 6912
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Low-Pass Filter, Schematic Diagram
Figure 3 (Sheet 3)

Rockwell International

Receiver-Exciter (638-6908-002)

instructions

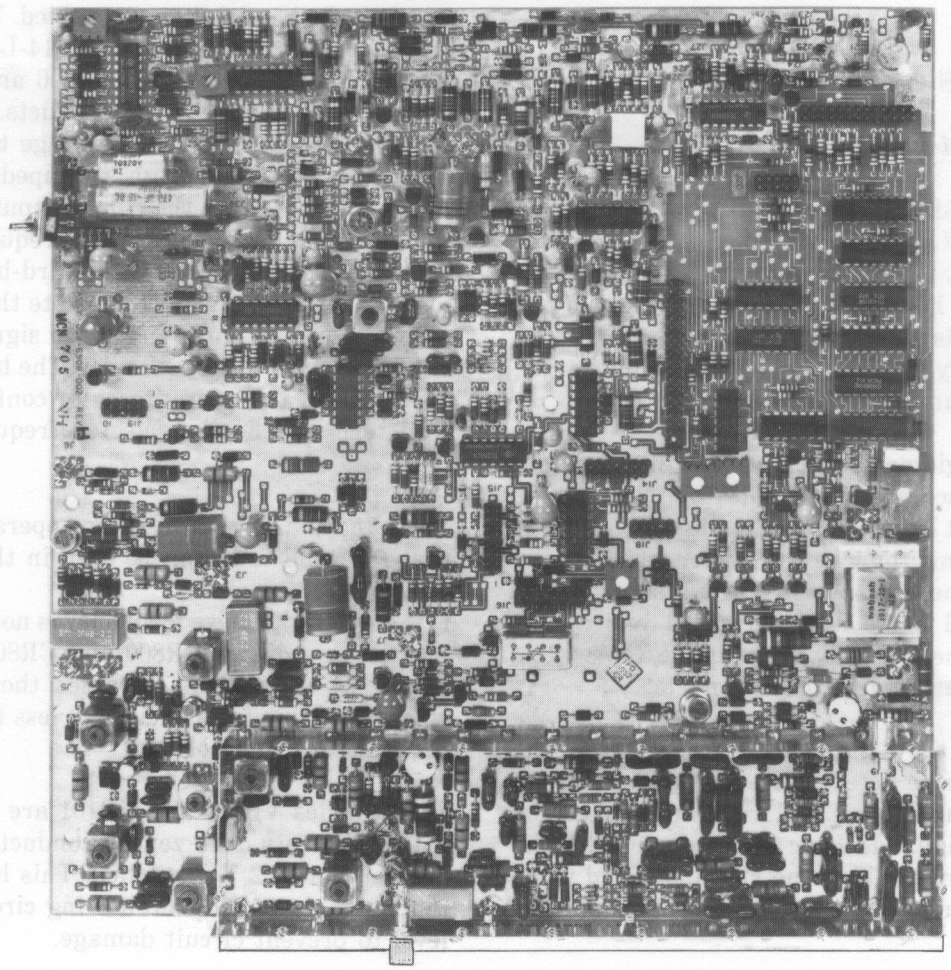
Collins Telecommunications Products Division

Printed in USA

523-0771741-001211
1 August 1982

1. DESCRIPTION

Receiver-Exciter, 638-6908-002, figure 1, is a single layer planar circuit card measuring 255.3 mm (10.05 in) by 268 mm (10.55 in). The receiver front end is contained in an rf shield.



TPA-5289-017

Receiver-Exciter
Figure 1

The receiver is a double-conversion superheterodyne type. The exciter is a single sideband type. Operating frequencies are determined by the frequency synthesizer assembly.

A number of the circuits are common to both the transmit and receive functions. Switching diodes keep the rf signals from the circuits not required for the function in operation. The diodes are biased by the +9 V DC RCV and +9 V DC XMT voltages enabled or inhibited by the control logic. The receiver-exciter is in the receive function unless a tune-in-process, key (in CW), or ptt or VOX signal (in voice) is present. Then the circuits automatically switch to the transmit function.

The receive and transmit circuits are discussed separately even though some components are common. The control logic circuits are also discussed in a separate paragraph. Passband tuning and the optional noise blanker, speech processor, and control interface are discussed in other instruction sections of this instruction book.

2. PRINCIPLES OF OPERATION

2.1 Control Logic

The receiver and exciter circuits are enabled or inhibited by +5-V or +9-V logic 1, or 0-V logic 0 signals developed by the control logic circuits. Figures 2 through 5 show how most of the logic signals are developed. Signals for which logic development is not shown are easily determined by referring to the schematic diagram.

Conventional logic notation is used with the signal names. An overscored signal indicates the signal is enabling when at logic 0. Push-to-talk is an example. Depressing the microphone ptt switch grounds the ptt line and generates a logic 0 $\overline{\text{PTT}}$ signal. Conversely, a signal name not overscored indicates a logic 1 enables the function. For example, CW will be logic 1 when operating in the CW mode.

By referring to the logic chart in each figure, the logic signals can be determined. As an example, in figure 2, XMT and +9 V DC XMT will be logic 0 if the CTTL or AM signal is logic 1. This prevents the exciter from being enabled and rf transmitted when an invalid frequency is tuned or the AM mode is selected.

2.2 Receiver

2.2.1 Receive Signal Path (Refer to figure 6)

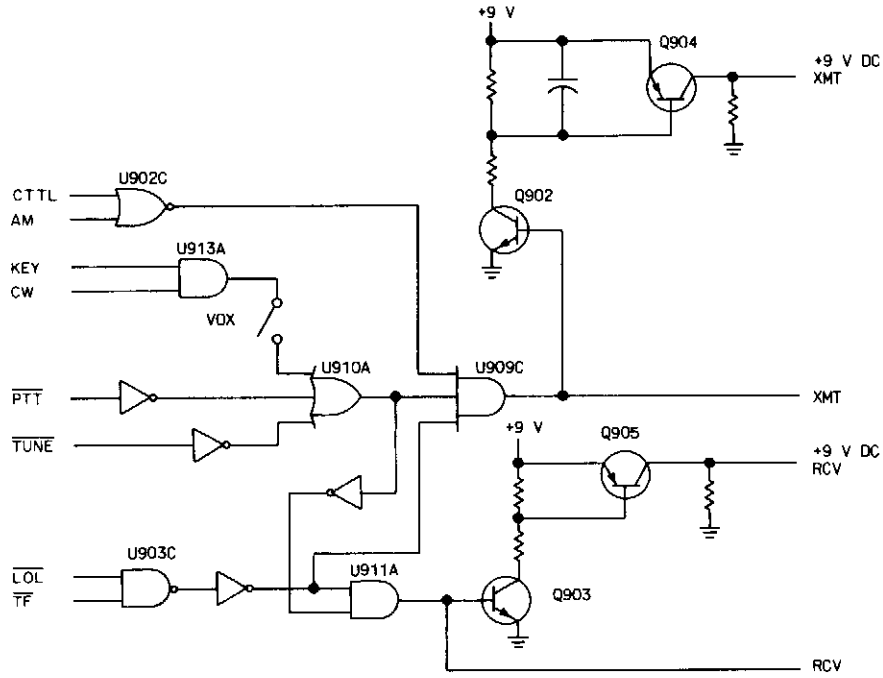
The rf signal path in the receiver is enabled when the +9 V DC RCV voltage is present. This voltage is developed by the logic circuits in the receiver-exciter and is present any time the transceiver is not in a transmit mode. (Refer to paragraph 2.1 for an explanation of the logic circuits.) The dc voltage forward biases rf switching diodes in the receive signal path. A +9 V DC XMT voltage similarly forward biases diodes in the transmit signal path during the transmit mode. The forward biased diodes steer the rf signal through the receiver or exciter circuits, as applicable for the mode.

The receive signal is input through J9 to two high-pass filters. The first filter, L802-L804/C800-C801 attenuates signals in the 0.5- to 1.6-MHz broadcast band. The second filter is one selected from three, depending on the band of operation. For example, when a frequency in the 7- to 10-MHz range is selected, the band 6 filter is enabled. The receive signal is steered through filter L814-L817/C818-C824. This is done by pin diodes CR806 and CR807 being forward biased when Q908 conducts. Inductor L818 permits the +9 V RCV bias voltage to be applied to CR806 but offers too high an impedance for the rf signal to pass. From the filter output at C820/L817, the rf signal, now limited to frequencies above 7 MHz, is conducted through forward-biased CR807 on toward the first mixer U100. (Note that even though reference is made to several band signals, there is no band switch on the transceiver. The band signals are developed by the microprocessor control circuit card as determined by the selected frequency of operation.)

The band 8 and band 9 filters operate similarly to that for band 6, as can be seen in the schematic.

If the selected receive frequency is not in band 6, 8, or 9, switching diodes CR800 and CR801 are forward-biased by Q909. This bypasses the filter sections when operating frequencies are less than 7 MHz and between 10 and 14 MHz.

Zener diodes VR100 and VR101 are front-end overload protectors. The zeners conduct when a signal greater than 6.2 V is applied. This limits the maximum signal applied to following circuits to the 7-V level to prevent circuit damage.

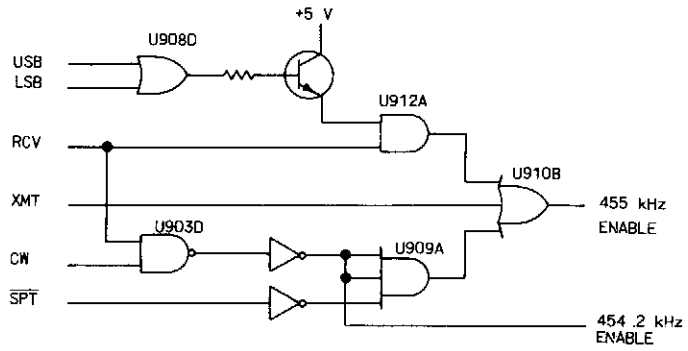


	USB	LSB	CW	AM	SPT	KI	CTTL	PTT	TUNE	LOL	TF	KEY
XMT (AND +9 V DC XMT) =0	-	-	X	X	-	-	1	X	X	X	X	X
	-	-	X	1	-	-	X	X	X	X	X	X
	-	-	X	X	-	-	X	X	X	0	X	X
	-	-	X	X	-	-	X	X	X	X	0	X
	-	-	0	X	-	-	X	1	1	X	X	X
	-	-	X	X	-	-	X	1	1	X	X	0
*	-	-	X	X	-	-	X	1	1	X	X	X
XMT (AND +9 V DC XMT) =1	-	-	X	0	-	-	0	X	0	1	1	X
	-	-	X	0	-	-	0	0	X	1	1	X
**	-	-	1	0	-	-	0	X	X	1	1	1
RCV (AND +9 V DC RCV) =0	-	-	X	-	-	-	-	X	X	0	X	X
	-	-	X	-	-	-	-	X	X	X	0	X
	-	-	X	-	-	-	-	X	0	X	X	X
	-	-	X	-	-	-	-	0	X	X	X	X
**	-	-	1	-	-	-	-	X	X	X	X	1
RCV (AND +9 V DC RCV) =1	-	-	0	-	-	-	-	1	1	1	1	X
	-	-	X	-	-	-	-	1	1	1	1	0
*	-	-	X	-	-	-	-	1	1	1	1	X

1= LOGIC 1 X= DON'T CARE
0= LOGIC 0 -= NOT APPLICABLE
* VOX SW OPEN ** VOX SW CLOSED

TPA-2179-014

+9 V DC XMT and +9 V DC RCV, Simplified Logic Diagram
Figure 2

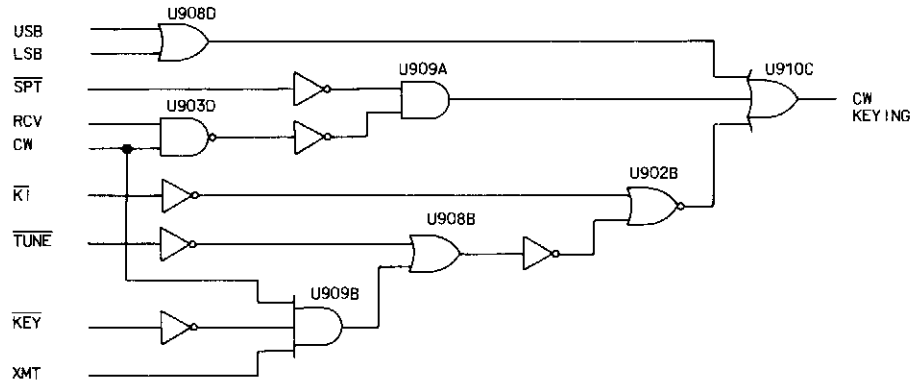


	USB	LSB	CW	AM	SPT	KI	TXI	PTT	TUNE	LOL	TF	KEY	XMT	RCV
455 kHz ENABLE =0	0	0	0	-	X	-	-	-	-	-	-	-	0	X
	X	X	X	-	1	-	-	-	-	-	-	-	0	0
455 kHz ENABLE =1	X	X	X	-	X	-	-	-	-	-	-	-	1	X
	1	X	X	-	X	-	-	-	-	-	-	-	X	1
	X	1	X	-	X	-	-	-	-	-	-	-	X	1
	X	X	1	-	0	-	-	-	-	-	-	-	X	1
454 .2 kHz ENABLE =1	-	-	1	-	-	-	-	-	-	-	-	-	-	1
=0	-	-	1	-	-	-	-	-	-	-	-	-	-	0
=0	-	-	0	-	-	-	-	-	-	-	-	-	-	1

1= LOGIC 1 X= DON'T CARE
0= LOGIC 0 -= NOT APPLICABLE

TPA-2182-013

455-kHz and 454.2-kHz Enable, Simplified Logic Diagram
Figure 3

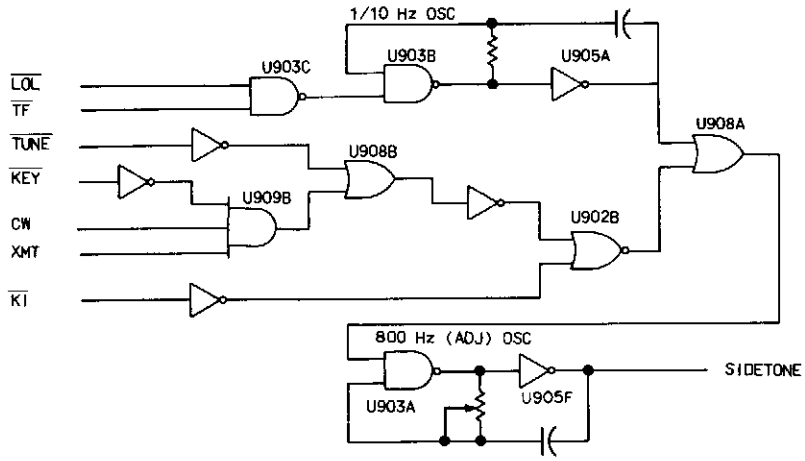


	USB	LSB	CW	AM	SPT	KI	TXI	PTT	TUNE	LOL	TF	KEY	XMT	RCV
CW KEYING =0	CW KEYING=0 UNDER ALL CONDITIONS EXCEPT FOR CW KEYING = 1 BELOW.													
CW KEYING =1	1	X	X	-	X	X	-	-	X	-	-	X	X	X
	X	1	X	-	X	X	-	-	X	-	-	X	X	X
	X	X	1	-	0	X	-	-	X	-	-	X	X	1
	X	X	X	-	X	1	-	-	1	-	-	X	X	X
	X	X	1	-	X	X	-	-	X	-	-	0	1	X

1= LOGIC 1 X= DON'T CARE
0= LOGIC 0 -= NOT APPLICABLE

TPA-2181-013

CW Keying, Simplified Logic Diagram
Figure 4



	USB	LSB	CW	AM	SPT	KI	TXI	PTT	TUNE	LOL	TF	KEY	XMT	RCV
SIDETONE =0	-	-	0	-	-	X	-	-	1	1	1	X	X	-
	-	-	0	-	-	0	-	-	X	1	1	X	X	-
	-	-	X	-	-	X	-	-	1	1	1	1	X	-
	-	-	X	-	-	0	-	-	X	1	1	1	X	-
	-	-	X	-	-	X	-	-	1	1	1	X	0	-
	-	-	X	-	-	0	-	-	X	1	1	X	0	-
SIDETONE =1 (PULSED)	-	-	X	-	-	X	-	-	X	0	X	X	X	-
	-	-	X	-	-	X	-	-	X	X	0	X	X	-
(CONSTANT UNLESS TF OR LOL=0)=1	-	-	X	-	-	1	-	-	0	•	•	X	X	-
	-	-	1	-	-	X	-	-	X	•	•	0	1	-

1=LOGIC 1
0=LOGIC 0

X=DON'T CARE
-=NOT APPLICABLE
•=SIDETONE PULSED IF TF OR LOL=0

TPA-2180-013

Sidetone Oscillator, Simplified Logic Diagram
Figure 5

A pin diode, CR104, is located between the junction of switching diodes CR103 and CR107. The pin diode is controlled by the AGC 3 signal from Q403. Varying the dc voltage on CR104 varies the resistance of the diode to ground. This controls the rf signal level applied to the following circuits.

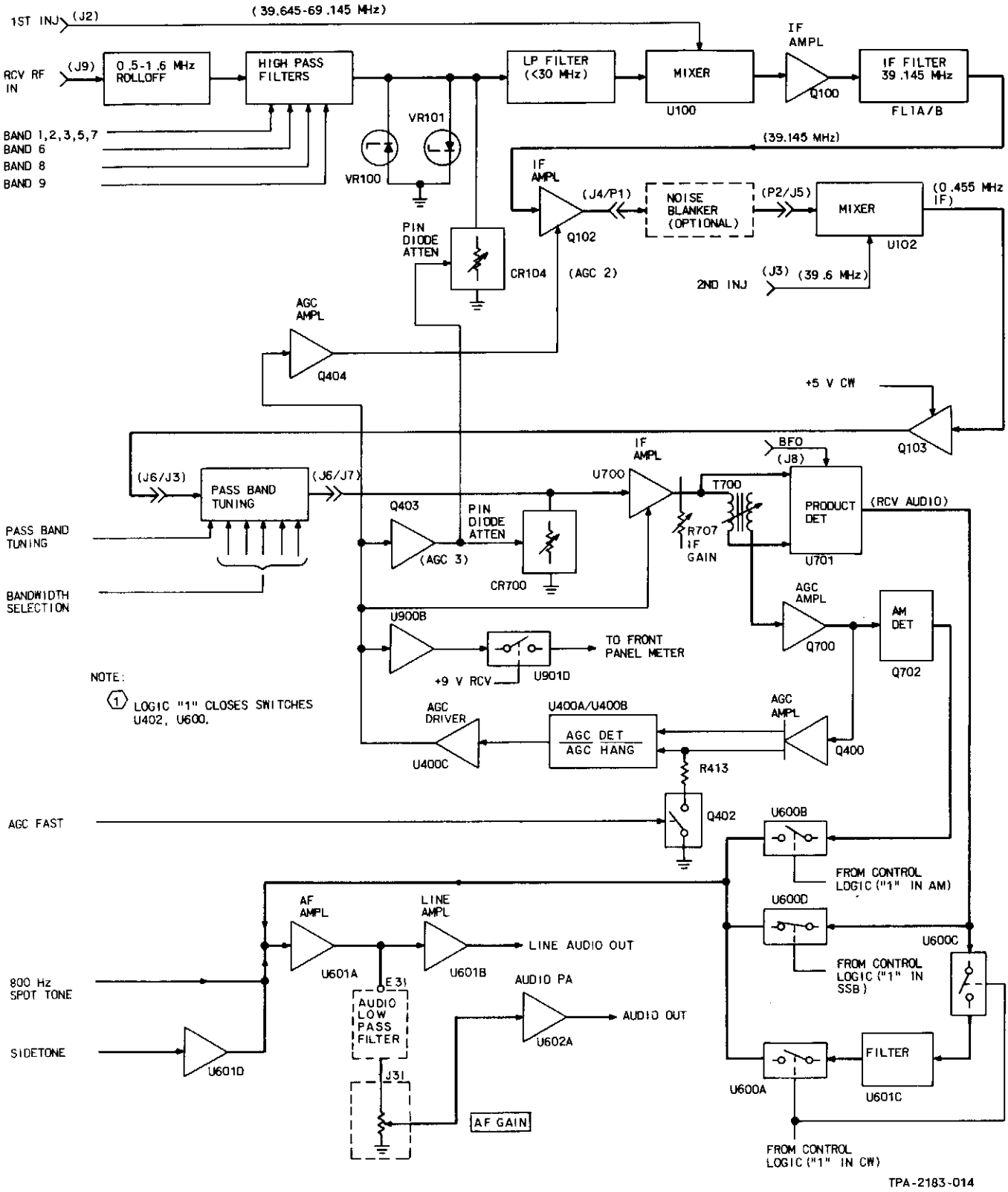
Low-pass filter C107-C114/L105-L107 attenuates frequencies above 30 MHz. From the filter, the signal is applied to the first receive mixer, U100.

The first receive mixer is a balanced-diode type. The local oscillator injection frequency is from the synthesizer and within the range of 39.645 to 69.145 MHz, depending on the selected receive frequency. The mixer resulting output is 39.145 MHz, the first if frequency.

The mixer output is applied through forward-biased CR110 to amplifier Q100. The amplified if is applied through CR111 to crystal filter FL1A/B. Amplifier Q101 is in parallel with Q100, but since the +9 V DC XMT voltage is not present, diodes CR109 and CR112 are reverse-biased. This directs the receive signal through receive amplifier Q100.

Variable inductors L119 and L120 match the rf path circuit impedance to that of the crystal filter. The 39.145-MHz if signal is applied through forward-biased diode CR114 to receive if amplifier Q102. (Transmit if amplifier Q104 is isolated from the receive signal by reverse-biased CR113 since the +9 V DC XMT voltage is not present.) Inductors L123 and L124 are adjusted to peak the if signal. Amplifier Q102 is a dual-gate FET with the AGC 2 signal applied to one gate. This provides automatic gain control for the if amplifier.

The output of Q102 is applied to the noise blanker if the optional noise blanker is installed. (Refer to the noise blanker instructions in this instruction book for further information.) From Q102 (or the noise blanker output), the 39.145-MHz receive if is applied to the second receive mixer U101. The +9 V DC RCV



Receive Signal Path
Figure 6

voltage forward biases CR117 to permit the 39.6-MHz local oscillator frequency to be applied to the mixer. The second mixer output is the 455-kHz if.

The 455-kHz if is applied to amplifier Q103. When in the CW mode, the +5 V DC CW voltage forward biases CR124. This places the capacitive reactance of C180 to ground to increase the gain of Q103. From Q103 the signal is applied through forward-biased CR115 to the passband tuning circuit. (Diode CR116 is reverse-biased in the receive mode to prevent the receive signal from being coupled to the transmit signal circuits.) Passband tuning is described in the passband tuning instructions of this instruction book. The passband tuning output is applied, through forward-biased CR120, to if amplifier U700. A pin diode CR700 controlled by AGC 3 voltage is at the input of the amplifier for gain control. Resistor R702 (for circuit card 638-6908-001) or R707 (for circuit card 638-6908-002) is adjusted to preset the gain of the amplifier. The amplifier also has a direct AGC signal input, AGC 1.

The amplifier output is divided by T700. One part goes to the product detector, U701; the other part goes to amplifier Q700 and detector Q702. One output from Q700 is applied to Q400 to develop the AGC signals. The other Q700 output is applied to Q702 to detect the AM signal.

The bfo input to product detector U701 is 455 kHz in sideband or 454.2 kHz in CW. When in sideband, the 455-kHz signal (from the oscillator circuit card) is applied from the J10 input through forward-biased CR501 (by +9 V DC RCV) and forward-biased CR504 (by SSB) to the product detector. In CW, the 454.2-kHz signal (also from the oscillator circuit card) is applied from the J11 input through forward-biased CR505 (by +5 V DC CW) to the product detector. The product detector output is an audio signal corresponding to the transmitted SSB or CW signal.

Audio output from the product detector is applied to electronic switches U600C and U600D. In the sideband mode, a logic 1 is applied to U600D-12. (Refer to paragraph 2.1 for a discussion of the logic signals.) The logic 1 closes the switch to apply the audio signal to amplifier U601A. In the CW mode, switch U600D is open and U600C is closed by the logic 1 level at pin 6. The audio CW signal is applied to U601C. This is an active bandpass filter centered at 800 Hz. The filter output is applied through U600A (closed by the logic 1 level at pin 13) to amplifier U601A. When in the AM mode, a logic 1 closes switch U600B. This permits the AM detector output to be applied to amplifier U601A.

When in the CW receive mode, depressing the front-panel SPOT switch enables the 454.2-kHz and 455-kHz oscillators on the oscillator circuit card. The 454.2-kHz signal is input through J11 to amplifier Q502, and the 455-kHz signal, through J10 to amplifier Q501. The amplifier outputs are both applied to the junction of CR506/CR507. These diodes are biased (by the +9-V supply and R536) into the forward current region where mixing occurs. Mixing the two bfo signals generates an 800-Hz difference signal. The signal level is adjusted by R615 and applied to amplifier U601A.

The output of audio amplifier U601A is applied to U601B, the line audio amplifier, to ANTIVOX amplifier U300C, and to gain control R5B on the front panel. If the audio low-pass filter is installed, the audio output from U601A is applied to the audio low-pass filter before being impressed across the gain control R5B. (Refer to paragraph 2.3.2 for a discussion of the VOX circuit.) The af gain control potentiometer applies the adjusted-level audio signal to amplifier U602A. This amplifier output drives the speaker or headphones.

2.2.2 AGC

The output from the last if amplifier is used to develop the AGC voltage. The voltage is applied to the front-panel meter (as S-units) and to four control points: if amplifier Q102, if amplifier U700, attenuator CR104, and attenuator CR700. The attenuators are pin diodes whose resistance varies with the applied AGC voltage.

The AGC output from Q700 is applied to amplifier Q400. Output from Q400 is along two paths. One is through C402 and rectifier CR400 to U400A, the AGC detector circuit. The other output is through C404 and rectifier CR403 to U400B, the AGC hang-release circuit. The hang-release circuit prevents the AGC from keeping the receiver gain reduced too long when a sudden, large input signal is received. (Keeping the gain reduced too long could cause following signal to be missed.)

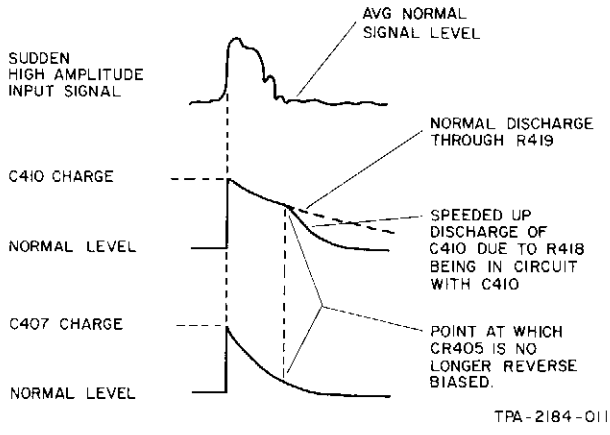
When the AGC is turned off (front-panel AGC switch in the out position), Q401 conducts. This grounds the Q400 output at C402 to prevent an AGC signal from being applied to the AGC detector circuit. In this condition, AGC 1, AGC 2, and AGC 3

signals are at static levels. AGC 1 and 3 are approximately 0 V, and AGC 2 is at approximately 4 V.

During AGC operation, the signal through C402 is rectified and filtered by CR400, C406, and R411. The resulting dc signal, varying with the signal level input to Q400, is applied to buffer U400A. The output of U400A charges C410. The voltage on C410 is applied to buffer U400C to develop the AGC output voltage. Capacitor C410 will discharge through R419 and also through R418 under the proper conditions, described in the following paragraphs.

The AGC signal through C404 is rectified and filtered by CR403, C405, R412, C407, and R416. The resulting dc signal in this path also varies with the signal level input to Q400 and is applied to buffer U400B. The time constant of the filter can be shortened by switching R413 into the discharge path C407. This is done by turning on Q402 to ground R413. Selecting fast AGC response time (front-panel AGC SLOW switch in the out position) supplies the necessary forward bias to Q402 to do this.

The output from U400B, due to the voltage on C407, is applied to the cathode of CR405. The anode voltage on CR405 is from C410. When the output voltage from U400B goes lower than at C410, CR405 will conduct. This places R418 in the discharge path of C410 and speeds up capacitor discharge. The increased discharge rate releases the AGC voltage from the high level at which it was hung due to the sudden, large input signal. Figure 7 shows how the speeded up discharge of C410 allows the AGC to quickly return to a lower level.



AGC Hang-Release Waveforms
Figure 7

The rf gain of the receiver is determined by the voltage at the junction of R408 and R410. The voltage is set by the front-panel RF GAIN control R409. This voltage is applied to the inputs of U400A and U400B as a dc reference. The AGC circuits operate as if the dc reference level was a constant signal level input. That is, C410 would remain charged to keep a fixed input on U400C, the AGC output amplifier.

With a high-level voltage from the gain control applied to U400A and B, receiver gain is reduced. Lowering the voltage causes less AGC voltage to be applied to the receiver circuits, giving more overall gain in the rf and if signal stages. With the RF GAIN set to maximum, the no-signal output at the junction of L400 and R420 is approximately 1 V dc. An rf input must be 1 μV or greater before AGC operation begins occurring at maximum rf gain.

2.3 Transmitter

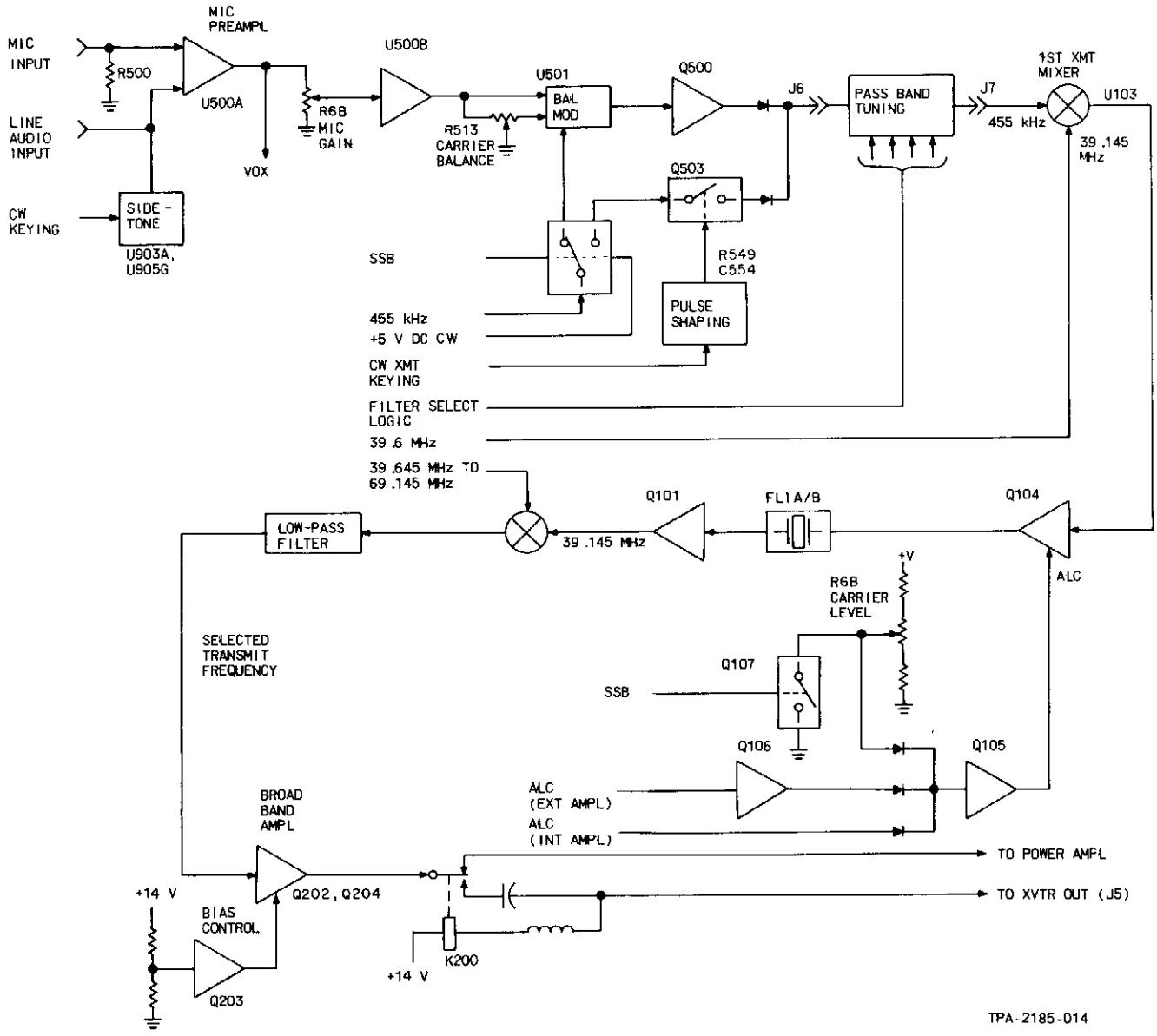
2.3.1 Transmit Signal Path (Refer to figure 8)

The transmit signal path in the exciter is enabled when the +9 V DC XMT voltage is present. This occurs when $\overline{TF}$ and $\overline{LOL}$ are logic 1, the AM mode or an out-of-band frequency is not selected, and either $\overline{TUNE}$ is logic 0, $\overline{KEY}$ is logic 0 when CW is logic 1, or $\overline{PTT}$ is logic 0. Refer to figure 2 for a control logic diagram and logic chart showing how these signals are related.

The audio input to microphone preamplifier U500A is through J24/J25 for the microphone input or J21/J22 for the line audio input. The microphone input is connected for either high- or low-impedance (3.3-kΩ nominal) microphones.

A third input to U500A is from the sidetone generator. The sidetone signal, normally generated during CW keying, is from RC oscillator U903A/U905G. Potentiometer R921 adjusts the oscillator frequency. The frequency is nominally set to 800 Hz but may be shifted to any frequency desired by the operator, within the range of the oscillator.

If $\overline{TF}$ or $\overline{LOL}$ goes to logic 0 due to a fault, gate U903B is enabled. This turns on a 10-Hz RC oscillator, U903B/U905A, that switches the 800-Hz sidetone oscillator on and off at a 1/10-second rate. The 10-Hz oscillator causes a rapidly beeping audio output to be generated, to warn the operator of the transceiver fault.



Transmit Signal Path
Figure 8

The microphone/preamplifier output is applied to the VOX circuit (discussed in paragraph 2.3.2) and to the front-panel MIC gain portion of potentiometer R6B. The audio signal tapped by the potentiometer is applied to amplifier U500B.

The audio output from the amplifier is applied to balanced modulator U501. This is the modulating signal for the 455-kHz input to the balanced modulator. The 455-kHz signal is input from J10 through forward-biased CR500 (by +9 V DC XMT) and forward-biased CR502 (by SSB). Potentiometer R513 is adjusted for minimum rf carrier output from the exciter when there is no audio input. If the transceiver is not in a sideband mode, CR502 will be reverse-biased. This keeps the 455-kHz signal from U501 and no output is produced. Thus, if the operating mode is CW, an audio output will not affect the output signal.

In a sideband mode, the balanced modulator output is a double sideband signal applied to amplifier Q500. The amplifier output is applied, through forward-biased CR508 (in sideband), to the passband tuning assembly filter. If the transceiver is operating in CW, the SSB logic signal is not applied to CR508 and +5 V CW is applied to CR509. Absence of the SSB logic signal keeps any output from Q500 from being applied to other circuits. The +5 V CW logic signal forward biases CR509 to permit the output of Q503 to be applied to the passband tuning assembly filter.

Transistor Q503 is a dual-gate FET used as a switch. One input is the 455-kHz signal (through forward-biased CR500 (by +9 V DC XMT) and forward-biased CR503 (by +5 V CW)). The other input is a wave-shaped logic 1 from the low-pass filter. This input is the gating signal for the 455-kHz input, developed each time the key is operated during the CW mode. The rise and decay times of the input pulse are shaped by R549 and C554 and associated components. The output is a logic 1 pulse with rounded edges. The pulse shaping eliminates any key clicks that might be generated in straight on-off switching of the FET gate.

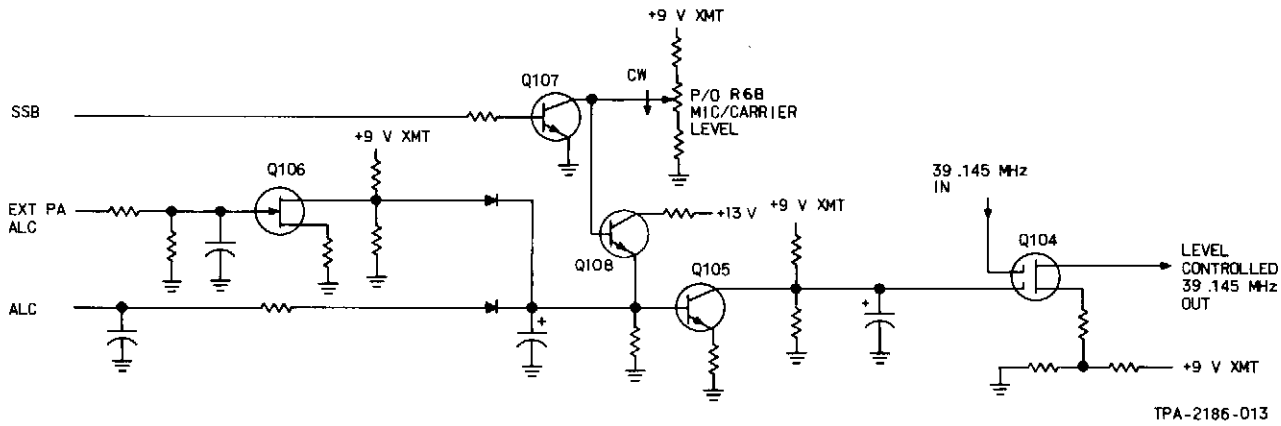
The 455-kHz signal, double sideband modulated if in sideband or keyed CW if in CW, is applied through forward-biased CR116 to the passband tuning assembly. In the passband tuning assembly, the signal is passed through a 2.1-kHz filter. The output signal is either upper or lower sideband or CW. Operation of the passband tuning circuit is discussed in the passband tuning instructions of this instruction book.

The filtered 455-kHz output from the passband tuning assembly is applied through forward-biased CR119 to U103, the first transmit mixer. The local oscillator input to the mixer is a 39.600-MHz signal from the oscillator assembly. The resulting mixer output is a 39.145-MHz signal applied to if amplifier Q104. Inductor L135 is a signal peaking adjustment.

If amplifier Q104 is a dual-gate FET that is the ALC and carrier level control point for the transmit signal. Figure 9 is a simplified diagram of the ALC circuit. The ALC signals from the internal power amplifier and an external (linear) power amplifier, if used, are applied to the base of Q105. In CW, the gain of Q105 is controlled by the voltage tapped by R6B, the front-panel MIC/CARRIER control. In sideband, switch Q107 is turned on by the SSB logic 1 signal. This grounds the voltage from R6B and lets the microphone amplifier gain adjustment control the signal amplitude input to Q104. The output of Q105 is applied to gate 2 of Q104 to control the 39.145-MHz output signal level.

The level-controlled output from Q104 is applied, through forward-biased CR113, to crystal filter FL1A/B. The filter has an 8-kHz passband centered on 39.145 MHz. Inductor L136 is adjusted to peak the transmit signal. Inductors L120 and L119 are adjusted to match the rf circuit path impedance to that of the crystal filter. The 39.145-MHz signal is amplified by Q101 to compensate for the filter insertion loss. Inductor L110 is adjusted to peak the output signal. Diodes CR112 and CR109 in the rf path are forward biased by the +9 V DC XMT voltage.

From amplifier Q101, the 39.145-MHz signal is input to the second transmit mixer, U100. The variable local oscillator input to U100 is from the synthesizer assembly. The local oscillator frequency is in the



Exciter ALC, Simplified Schematic Diagram
Figure 9

range of 39.645 to 69.145 MHz, depending upon the selected operating frequency of the transceiver. The difference frequency output from the mixer is the operating frequency of the transceiver. Note that although the difference frequency range is from 0.5 to 30.0 MHz, the exciter will be inhibited by the control circuit if an invalid frequency is selected.

The mixer output is passed through low-pass filter L105-L107/C107-C114 to the exciter broadband amplifier. The filter attenuates signals greater than 30 MHz. The +9 V DC XMT voltage forward biases diode CR108 to permit the rf signal to be applied to the exciter amplifier.

The broadband amplifier Q202 and Q204 develops approximately 23 dB of gain for a maximum output of 100 mW rf. The two amplifier stages have negative feedback for stability. Transistor Q203 is a constant current bias source for Q204.

Relay K200 is normally open. This directs the exciter amplifier output to the power amplifier. When the exciter output is used to drive a transverter, the transceiver rear panel J5 connector is connected to ground through a 1-mH rf choke. With the connector grounded (for dc but not for rf), U200 energizes. This directs the exciter amplifier output to the external transverter unit. Relay U200 will remain energized as long as primary power is applied to the transceiver and the connector is at dc ground. Relay operation is not a function of ptt or CW keying.

2.3.2 VOX

The VOX circuit develops a signal to cause the transceiver to switch to transmit. The ANTIVOX circuit prevents the speaker output from causing the VOX circuit to switch.

The input to VOX amplifier U300D is from the microphone preamplifier U500A. The signal will be voice or RTTY audio if in sideband, or the sidetone signal if in CW. The output of U300D charges C307. The voltage at C307 is also present at the noninverting input of comparator U300B. The inverting input of U300B is from the ANTIVOX amplifier, U300C. When the noninverting input is greater than that at the inverting input, U300B outputs a logic 1. This turns on Q302 to ground the VOX OUT line.

Capacitor C307 discharges through R311, R312, and Q300 when CW operation is selected, or through R313, R314, and Q301 when SSB operation is selected. (The SSB or CW logic 1 input turns on Q301 or Q300, respectively.) By adjusting R311 (front-panel CW DELAY control) or R313 (front-panel SSB DELAY control), the discharge of C307 can be set to the rate desired. This permits the operator to adjust the delay between the last audio or sidetone signal and the time the transceiver switches back to receive.

ANTIVOX amplifier U300C receives its input from the audio output driver amplifier U601A. This signal from the receiver is one that may be picked up from the speaker output by the microphone. The microphone output would then be sensed by the VOX amplifier which would tend to switch the transceiver to the transmit mode. The VOX GAIN and ANTIVOX GAIN controls (R305 and R309, respectively) are adjusted to prevent this. The VOX GAIN is adjusted to cause the VOX output to go to logic 0 when speaking into the microphone in a normal operating voice. The ANTIVOX GAIN is then adjusted to the point where the speaker output does not cause VOX switching when the microphone is near its normal operating location.

3. TESTING/TROUBLESHOOTING PROCEDURES

A performance test for the receiver-exciter is given in table 2. In addition to the required performance criteria, troubleshooting comments are given.

It is assumed that the repair technician is trained in solid-state circuit troubleshooting and repair techniques, and is familiar with the test equipment to be used. Step-by-step operating procedures are not given in the tests and not all possible troubleshooting information can be listed.

Testing and troubleshooting of the receiver-exciter requires the receiver-exciter be installed in the transceiver.

3.1 Test Equipment Required

Table 1 lists the equipment required to perform the tests. A suggested type is given; however, that specific equipment is not required. Any that meets or exceeds the indicated minimum specifications is acceptable for use.

3.2 Performance Test

The following test procedures measure the performance of the speech processor. After being repaired, repeat the numbered test where repair was performed to verify that no further malfunctions exist.

3.2.1 Preliminary Setup

Do not apply power to the equipment until instructed to do so in the procedures. Do not connect power with power switches turned on.

Connect the equipment as instructed in the procedures for each test.

3.2.2 Test Procedures

Perform the tests as given in table 2. The tests are subdivided as follows:

1 through 7	Control circuits tests
8 through 15	Receiver circuits tests
16 through 21	Exciter circuits tests

4. REPAIR

Repair of the receiver-exciter is accomplished using standard maintenance and circuit card repair procedures.

Table 1. Test Equipment Required.

ITEM	USED FOR	SUGGESTED TYPE	MINIMUM SPECIFICATIONS
Signal generator	Applying of signal to receiver	Hewlett-Packard 8640B	14.9 to 15.1 MHz, 0.5 μV to 100 mV; CW and AM, 30% and 80% modulation, 400 and 1000 Hz
Distortion analyzer	Measuring signal-to-noise ratio of receiver and for ac voltmeter	Hewlett-Packard 331A	Distortion: -40 to +10 dB AM Voltmeter: 0.005 to 10 V
Multimeter	Measuring ac and dc voltages	Fluke 8000A	Dc: 0 to 20 V Ac: 0 to 5 V
Rf voltmeter with high-impedance probe and 50-Ω adapter	Measuring of signal levels	Boonton 92C	Scale calibrated in dB; range of -30 to +25 dB
Audio oscillator	Applying audio input to exciter	Hewlett-Packard 204C	300-3000 Hz, 0 to 50 mV
Attenuator	Attenuating rf signal input to rf voltmeter	Sierra Electric 662A-30	30 dB, 50 Ω
CW key	Keying exciter in CW mode	AC-2827	Continuously closed switch provision
Microphone	Keying exciter testing VOX and antiVOX	MM-280, MM-281, SM-280, or SM-281	Low impedance, dynamic, ptt switch
Audio function generator	Rf alignment transmit/ receive	Hewlett-Packard 3325	Scan from 0 - 3 kHz
Spectrum analyzer	Rf alignment transmit/ receive and sensitivity	Hewlett-Packard 141T	

Table 2. Receiver-Exciter, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Disconnect cable between receiver-exciter J1 and power amplifier.		
	b. Set MIC/CARRIER to max ccw position.		
	c. Turn on transceiver power.		
	d. Tune transceiver to 14.2 MHz.		
2. Mode select	a. Press MOX to in position to key exciter.		
	b. Set MODE select switch to following positions and measure dc voltage at points-of-test:		
	MODE SWITCH POSITION / POINT-OF-TEST		
	USB / U912-11	Logic 1 (+5 V dc)	Check U912.
	LSB / U912-10	Logic 1 (+5 V dc)	Check U912.
	CW / U912-4	Logic 1 (+5 V dc)	Check U912.
	c. Release MOX to unkey exciter.		
3. Bandwidth selectivity	a. Set BW SELECTIVITY to 2.2.		
	b. Measure dc voltage at U908-10.	Logic 1 (+5 ±1 V).	Check U908.
	Note All other BW logic signals are coupled from the front-panel switch directly through the receiver-exciter card to pass-band tuning assembly.		
	Note Tests 4 through 7 check transmission inhibit circuits.		
4. Invalid frequency	a. Tune the transceiver to any frequency less than 1.600 00 MHz.		
	b. Press MOX to in position to key exciter.		
	c. Measure dc voltage at Q904-C. (Use end of R925 nearest Q904 as test point.)	Not more than +2 V dc (Prevents transmission.)	Check Q904, Q902, U902, and U909.
	d. Tune transceiver to 1.850 00 MHz.		
	e. Measure dc voltage at Q904-C.	+8 ±1 V dc (Permits transmission.)	Check Q904, Q902, U902, and U909.

Table 2. Receiver-Exciter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. AM	a. Set MODE to AM RCV.		
	b. Measure dc voltage at Q904-C.	Not more than +1 V dc (Prevents transmission.)	Check U902, U909, Q902, and Q904.
6. Loss-of-lock	a. Jumper J13-6 to ground.		
	b. Measure dc voltage at Q904-C (use end of R925 nearest Q904) and at Q905-C (use end of R929 nearest Q905).	Not more than +1 V dc. Audio signal from speaker is rapid beeping.	Check U903, U905, U911, U909, Q902, Q903, Q904, or Q905.
	c. Release MOX to unkey exciter.		
	d. Measure dc voltage at Q904-C and Q905-C.	Not more than +1 V dc. Audio signal from speaker is rapid beeping.	Check U904, U905, and U910.
	e. Remove jumper from J13-6.		
	f. Jumper J20-2 to ground.		
	g. Measure dc voltage at Q904-C and Q905-C.	Not more than +1 V dc. Audio signal from speaker is rapid beeping.	Check U903C.
	h. Press MOX to in position to key exciter.		
	i. Measure voltage at Q904-C and Q905-C.	Not more than +1 V dc. Audio signal from speaker is rapid beeping.	Check U904, U905, and U910.
	j. Release MOX to unkey exciter.		
7. Key interlock	a. Jumper J20-1 to ground.		
	b. Measure dc voltage at Q904-C.	+8 ±1 V dc	Check U904.
	c. While monitoring voltage at Q904-C, jumper J20-3 to ground.	Not more than +1 V dc	Check U904, U902, and U910.
	d. Remove jumpers from between J20-1 and J20-3 and ground.		
8. Rf alignment Transmit (Cont)	a. Connect the passband tuning module to J6 and J7. Select the CW filter (one centered on 455.0 kHz). Select CW mode, AGC off, and full rf gain. Ensure that a jumper connects J4 and J5.		

Table 2. Receiver-Exciter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. (Cont)	b. With receiver-exciter in CW mode and carrier level fully cw, inject a 54.195-MHz signal at a 17-dB level into J2. Close the CW key.	Output at J1 into a 50-ohm load should be a maximum of NLT +20 dBm.	Adjust L110, L119, L120, L135, and L136 for a maximum output using a spectrum analyzer.
	c. Check transmit passband in SSB mode.		
	d. Connect 1-mV output of audio function generator to mic input and connect spectrum analyzer to J1.		
	e. Connect spectrum analyzer scan in/out to audio function generator so spectrum analyzer tracks.		
	f. Scan the audio function generator from 0-3 kHz and monitor J1.	Flat passband should be obtained in LSB and USB.	Adjust L119 and L120.
	g. Apply 5-mV, 1-kHz signal at mic input.	20 dB at J1 in USB	
Receive	h. Apply a 54.145-MHz signal at 17 dB to J2. Apply a 15.000-MHz signal to J9 at a sufficient level to obtain a 10 (s+n/n) ratio at audio output.		Adjust L114, L119, L120, L123, and L124 for maximum output while reducing signal level at J9 to maintain 10 (s+n/n) ratio. Check all five coils for best adjustment.
	i. Connect spectrum analyzer scan in/out to FM port on signal generator. Set FM control on DC. Apply rf output at 15.000 MHz to J9 analyzer. Apply input to J6.		
	j. Put on manual scan and set at center of screen. Set the signal generator for 15.000 MHz. Set output to 0.35 mV. Fine tune analyzer at 455 center frequency to peak on output of J6.		
	k. On the spectrum analyzer, set 30-kHz BW, 20-kHz scan width, scan tune of 20 ms, and a 100-Hz video filter.		
	l. With manual scan set at left side (first vert) of screen, adjust FM vernier so that output frequency is 14.990 MHz. Filter response should be seen.	Less than 1 μV for 10 dB s+n/n ratio at audio output	Adjust L114 and L123 if necessary to provide flattest response over frequency range of 39.145 ±0.0030 MHz.

Table 2. Receiver-Exciter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. Test setup	a. Make sure cable connected between receiver-exciter J1 and power amplifier is disconnected. b. Set BW SELECTIVITY switch to 2.2, PBT to OPT 2 (USB position), AGC off (switch-out position), and RF GAIN to max cw position. c. Connect signal generator to transceiver rf connector through 6-dB attenuator and rf fuseholder. d. Connect distortion analyzer input to AUD OUT on rear panel. Connect 600-Ω resistor across same terminals. e. Turn on transceiver power.		
10. Sensitivity	a. Set signal generator output to 2.001 00 MHz at 1 μV. Tune transceiver to 2.000 00. b. Set level reference on distortion analyzer. c. Set analyzer mode to distortion and measure receiver USB sensitivity for each of the listed frequencies (MHz) and input levels (μV).	Not less than -10 dB for 1-μV inputs and not less than -16 dB for 10-μV inputs	If signal not detectable, signal trace to find malfunctioning stage. If sensitivity poorer, perform alignment as follows. Adjust signal generator output level to keep signal at AUDIO OUT approx -10 dB s+n+d/n+d.
(Cont)	*Note* Measurement is $\frac{\text{signal + noise + distortion}}{\text{noise + distortion}}$ and is a more sensitive measurement than (s+n)/n.		Keep signal generator level adjusted for this output level during adjustments. Adjust, in order, L119, L120, L123, L124, and T700 for maximum audio output.

XCVR FREQ	SIG GEN FREQ	OUTPUT LEVEL
2.0000	2.0010	1
3.5000	3.5010	10
7.0000	7.0010	1
7.0000	7.0010	10
14.0000	14.0010	1
14.0000	14.0010	10
20.0000	20.0010	1
29.9990	30.0000	1

Table 2. Receiver-Exciter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)			*Note* To perform the above adjustments, a spectrum analyzer must be used as part of the test setup.
	d. Repeat test 9.c, except set signal generator frequency for 1 kHz below transceiver frequency and set PBT control for LSB reception.	Same as test 9.c.	
	e. Adjust signal generator for 14.100-MHz, 2-mV AM output modulated 30% with 400 Hz. Set transceiver MODE to AM and 14.100 00 MHz.		
	f. Repeat tests 9.b and c to measure AM modulation.	Not more than -26 dB	Check amplifiers Q700 and Q702.
	g. Turn off signal generator AM modulation.		
11. AGC	a. Make sure transceiver AGC is off.		
	b. Set signal generator output to 2 μV and 15.000 MHz. Adjust frequency slightly for max output to distortion analyzer.		
	c. Note audio output level at AUD OUT.		
	d. Switch on AGC and measure audio signal at AUD OUT.	Audio output decreases by 1 dB.	Adjust so audio output to distortion analyzer decreases by 1 dB when AGC is turned on.
	e. Set signal generator output to 4 μV and measure signal at AUD OUT. Record value.		
	f. Increase signal generator output to 200 mV and measure increase in signal level at AUD OUT.	Not more than 8 dB mW	Check Q700, Q400, Q403, Q404, and U400.
	g. Switch on AGC SLOW.		
	h. Turn off signal generator rf output and note time until receiver background noise heard.	1 to 3 seconds	Check Q400, Q401, and U400.
	i. Turn on signal generator rf output and switch on AGC FAST.		
	j. Repeat test 10.	0.1 to 1 second	Check Q402.
	k. Switch out AGC FAST.		

Table 2. Receiver-Exciter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
12. If passband	a. Set signal generator for 2-mV, unmodulated rf output at 14.1010 MHz.		
	b. Set transceiver PBT for USB and MODE to USB.		
	c. Use rf voltmeter with high-impedance probe and measure voltage at J4 while performing following step.		
	d. Vary signal generator frequency from 14.097 to 14.103 MHz.	Voltage variation at J4 not more than 2 dB	Refer to test 9.c for adjustment. If inductors do not correct variation, replace FL1A/B.
13. AM operation	a. Set transceiver frequency to 14.100 00, AGC to on, MODE to AM RCV, and signal generator to 14.1000 MHz with 2-mV AM output modulated 30% with 400 Hz.		
	b. Set level reference on distortion analyzer for 0 dB, then switch to distortion measurement for signal-to-noise ratio.	Not less than -26 dB	Check Q700 and Q702.
	c. Reduce signal generator output to 6 μV and repeat test b.	Not less than -10 dB	Check Q700 and Q702.
14. Receive line audio output	*Note* Volume control does not affect line audio signal.		
	a. Adjust PBT for USB signal reception.		
	b. Set signal generator output to 14.1010 MHz at 200 mV.		
	c. Switch in AGC and measure distortion plus noise at AUD OUT.	-15 dB mW ±5 dB	Check U701 and U601.
	d. Vary front-panel AF GAIN control and note speaker output.	Output volume varies proportionally to AF GAIN.	Check R622 (AF GAIN) on front panel and U602.
	e. Connect 5-W, 4-Ω resistor to type PJ-055 phone plug. Insert plug into rear panel SPKR jack.		
	f. Connect distortion analyzer to resistor.		
	g. With AF GAIN, adjust audio output to 1-W level (2 V ac across 4 Ω) and measure distortion plus noise.	Not less than -35 dB	Check U601 and U602.
	h. Repeat test 13.g for 3-W output (3.46 V ac).	Not less than -20 dB	Check U601 and U602.

Table 2. Receiver-Exciter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
15. S-meter	a. Set signal generator output to 100 μV.		
	b. Make sure AGC is switched in. Note S-meter indication.	S9	Adjust R912 for proper S-meter indication. Check meter and U901.
	c. Set signal generator output to 100 mV. Note S-meter indication.	+60 dB	Adjust R908 for proper S-meter indication. Check U900.
16. Spot tone	a. Set frequency to signal generator frequency, MODE to CW, and signal generator output to 2 μV.	800-Hz tone heard in speaker	
	b. Press SPOT switch and compare amplitudes of received and spot tones.	Tones are equal in amplitude.	Press SPOT switch and adjust R615 so both signal amplitudes sound the same level.
17. Exciter tests setup	a. Make sure cable connected between receiver-exciter J1 and power amplifier is disconnected (prevent power amplifier from developing rf output).		
	b. Set MODE to USB.		
	c. Tune to any frequency within Amateur Radio Service bands.		
	d. Set MIC/CARRIER to max ccw position.		
18. Carrier balance	a. Connect rf voltmeter with 50-Ω adapter to J1.		
	b. Switch in MOX and adjust R153 (carrier balance) for minimum voltage at J1.	Approx 12 mV at J1	Check U501.
19. Power output/ alignment	a. Set MODE to CW and MIC/CARRIER to max cw position.		
	b. Connect rf voltmeter with 50-Ω probe to J1.		
	c. Switch in MOX and measure exciter output at 1.8, 14, and 29.2 MHz. Set MIC/CARRIER to max ccw position and measure exciter output.	Not less than +20 dB mW for each frequency	Adjust L135, L136, and L110 for NLT +20 dB mW for all frequencies. Check U103, Q104, FL1A/B, Q101.
(Cont)			

Table 2. Receiver-Exciter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
19. (Cont)	d. Set MIC/CARRIER to max ccw position and measure exciter output.	Not more than 0 dB mW	Check Q104, Q105.
	e. Switch out MOX and set MODE to USB. Set MIC/CARRIER to max cw position.		
	f. Connect audio oscillator to AUD IN on on rear panel. Adjust for 40-mW, 2000-Hz signal.		
	g. Connect 1-mH rf choke from XVTR on rear panel to ground.		
	h. Connect rf voltmeter with 50-Ω probe between XVTR and ground.		
	i. Switch in MOX and measure transverter output signal.	Not less than +20 dB mW	Check K200 and C218.
	j. Switch out MOX and remove rf choke from XVTR.		
20. ALC	a. With audio oscillator signal input to AUD IN, adjust oscillator for 40 mV, 1000 Hz.		
	b. Connect rf voltmeter with 50-Ω adapter to J1.		
	c. Switch in MOX and record rf output at J1 with MIC/CARRIER in max cw position.	Not less than +20 dB mW	
	d. Apply -6 V dc to ALC connector on rear panel.		
	e. Measure rf output at J1 and compare with value recorded in test 19.c.	Not less than 10 dB difference between tests 19.c and e	Check Q104, Q105, Q106, and Q108.
	f. Switch out MOX.		
21. Sidetone	a. Set MODE to CW and frequency to 14.100 00 MHz.		
	b. Set PBT to center (CW) position.		
	c. Set RF and AF GAIN controls to max cw position.		
	d. Connect CW key to rear panel KEY jack.		
	e. Connect 4-Ω, 5-W resistor across type PJ-055 plug and insert plug into rear panel SPKR jack.		
(Cont)	f. Connect rf signal generator to rf fuse-holder and 6-dB attenuator. Connect attenuator to rf connector on rear panel of transceiver.		

Table 2. Receiver-Exciter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
21. (Cont)	g. Set signal generator to 14.100 00 MHz at 2-μV output.		
	h. With transceiver in receive function, measure and record output signal level at 4-Ω resistor.		
	i. Switch in VOX and hold CW key closed.		
	j. Measure output signal level at 4-Ω speaker and compare with level recorded in test 20.e.	Same level ±3 dB	Adjust R616 to set audio output level. Check U601.
	k. Release CW key.		
	l. Connect frequency meter across 4-Ω speaker.		
	m. Hold CW key closed and measure audio frequency.	800 ±10 Hz	Adjust R921 to set audio frequency. Check U903, U905.
	n. Release CW key and switch out VOX.		
22. VOX	a. Set MODE to USB, VOX GAIN to max ccw position, ANTIVOX GAIN to max cw position, SSB DELAY to max cw position, and CW DELAY to max cw position.		
	b. Input 2000-Hz signal to MIC jack.		
	c. Adjust audio input to 1 mV rms and note VOX action.	VOX does not switch from receive to transmit.	
	d. Adjust audio input to 8 mV rms and note VOX action.	VOX switches from receive to transmit.	
	e. Adjust audio input to 30 mV rms. Remove signal (disconnect mic plug) and note time until VOX switches to receive.	1 to 4 seconds	
	f. Connect signal generator through 6-dB attenuator and rf fuseholder to transceiver rf connector.		
	g. Tune signal generator to 14.1010 MHz and transceiver to 14.000 00 MHz. Adjust RF GAIN to max cw position. Switch in AGC.		
	h. Set signal generator output to 2 mV, adjust audio input to 2 mV rms, and note VOX action.	VOX does not switch from receive to transmit.	
	i. Increase audio input to 16 mV and note VOX action.	VOX switches from receive to transmit.	

Table 2. Receiver-Exciter, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
23. Shutdown	Turn off power and disconnect test equipment. Reconnect cable between receiver-exciter J1 and power amplifier.		

5. PARTS LIST/DIAGRAMS

5.1 Introduction

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc.). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
01281	TRW INC TRW SEMICONDUCTOR DIV 14520 AVIATION BLVD LAWNDALE CA 90260
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75265

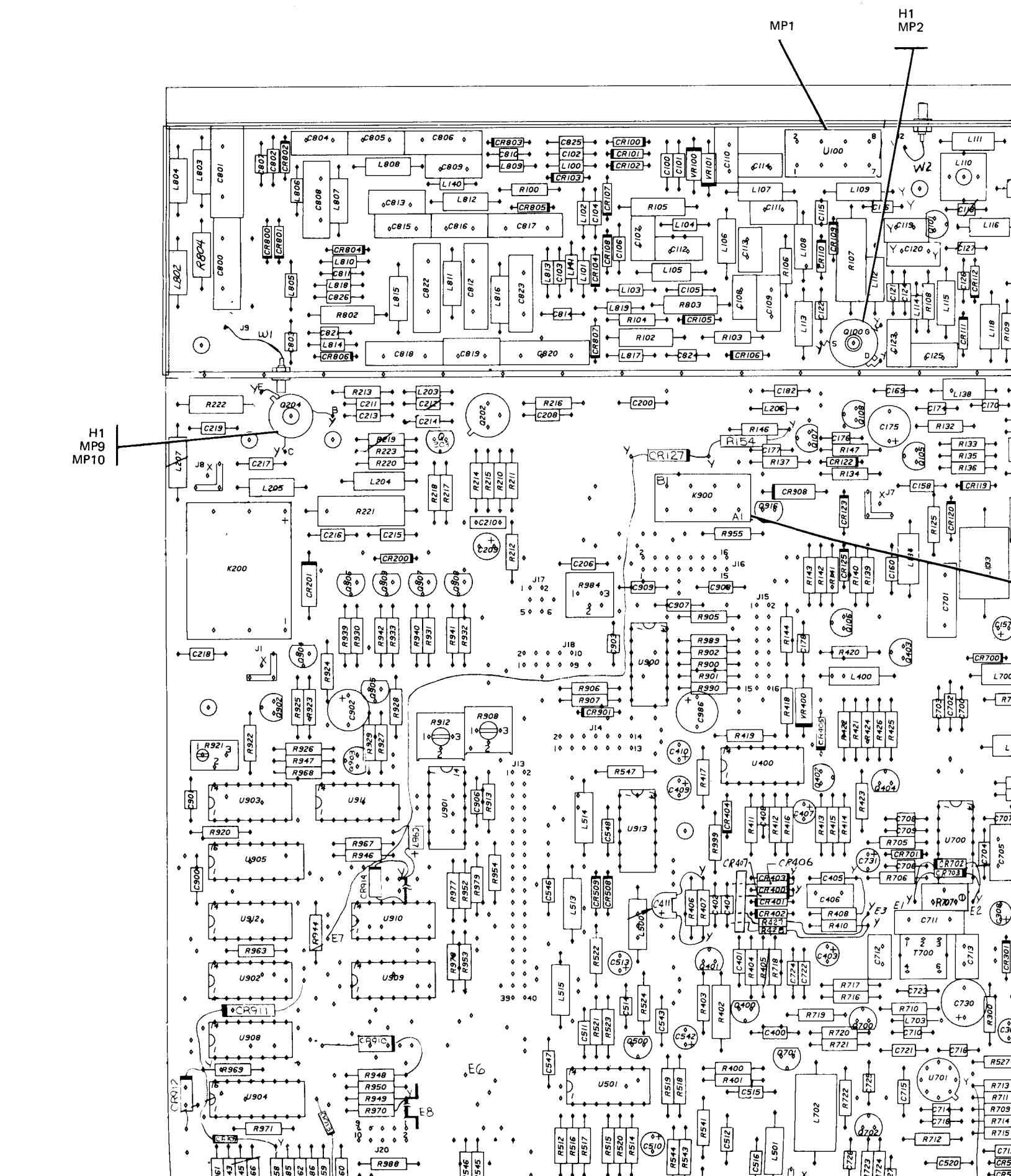
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
02111	SPECTROL ELECTRONICS CORP SUB OF CARRIER CORP 17070 E GALE AVE P O BOX 1220 CITY OF INDUSTRY CA 91749
02113	COILCRAFT INC 1102 SILVER LAKE RD CARY IL 60013
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV SUB OF SCHLUMBERGER LTD NORTH AMERICAN SALES MAIL STOP 14-1053 401 ELLIS ST P O DRAWER 7284 MOUNTAIN VIEW CA 94042
09021	AIRCO INC AIRCO ELECTRONICS BRADFORD PA
12040	NATIONAL SEMICONDUCTOR CORP COMMERCE DR P O BOX 443 DANBURY CT 06810
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
14655	CORNELL-DUBILIER ELECTRONICS DIV OF FEDERAL PACIFIC ELECTRIC CO GOVT CONTRACTS DEPT 150 AVE L NEWARK NJ 07101
15542	MINI-CIRCUITS LABORATORY DIV OF SCIENTIFIC COMPONENTS CORP 2625 E 14TH ST BROOKLYN NY 11235
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
18542	WABASH RELAY AND ELECTRONICS DIV WABASH INC 1ST AND WEBSTER STS P O BOX 708 WABASH IN 46992
18796	ERIE TECHNOLOGICAL PRODUCTS INC STATE COLLEGE DIV 1900 W COLLEGE AVE STATE COLLEGE PA 16801
19080	ROBISON ELECTRONICS INC 3580 SACRAMENTO DR P O BOX Y SAN LUIS OBISPO CA 93406
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
28480	HEWLETT-PACKARD CO CORPORATE HQ 3000 HANOVER ST PALO ALTO CA 94304
31433	UNION CARBIDE CORP ELECTRONICS DIV HWY 276 SE P O BOX 5928 GREENVILLE SC 29606
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
57582	KAHGAN ELECTRONICS CORP 556 PENINSULA BLVD HEMPSTEAD NY 11550
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP P O BOX 7600 LAUTER AVE FLORENCE SC 29501
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV 2500 HARBOR BLVD FULLERTON CA 92634
75378	CTS KNIGHTS INC 400 REIMANN AVE SANDWICH IL 60548
81349	MILITARY SPECIFICATIONS

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054
91637	DALE ELECTRONICS INC P O BOX 609 COLUMBUS NE 68601
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544
98978	INTERNATIONAL ELECTRONIC RESEARCH CORP SUB OF DYNAMICS CORP OF AMERICA 135 W MAGNOLIA BLVD BURBANK CA 91502

5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Receiver-Exciter	638-6908-002	REV U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H1
MP2
H1
MP9
MP10
U100
W2
W1
Q100
Q204
Q202
K900
K200
CR127
R154
U900
U400
U903
U914
U905
U912
U910
U902
U909
U908
U904
U501
U913
U700
U701
T700
L702
L501
J9
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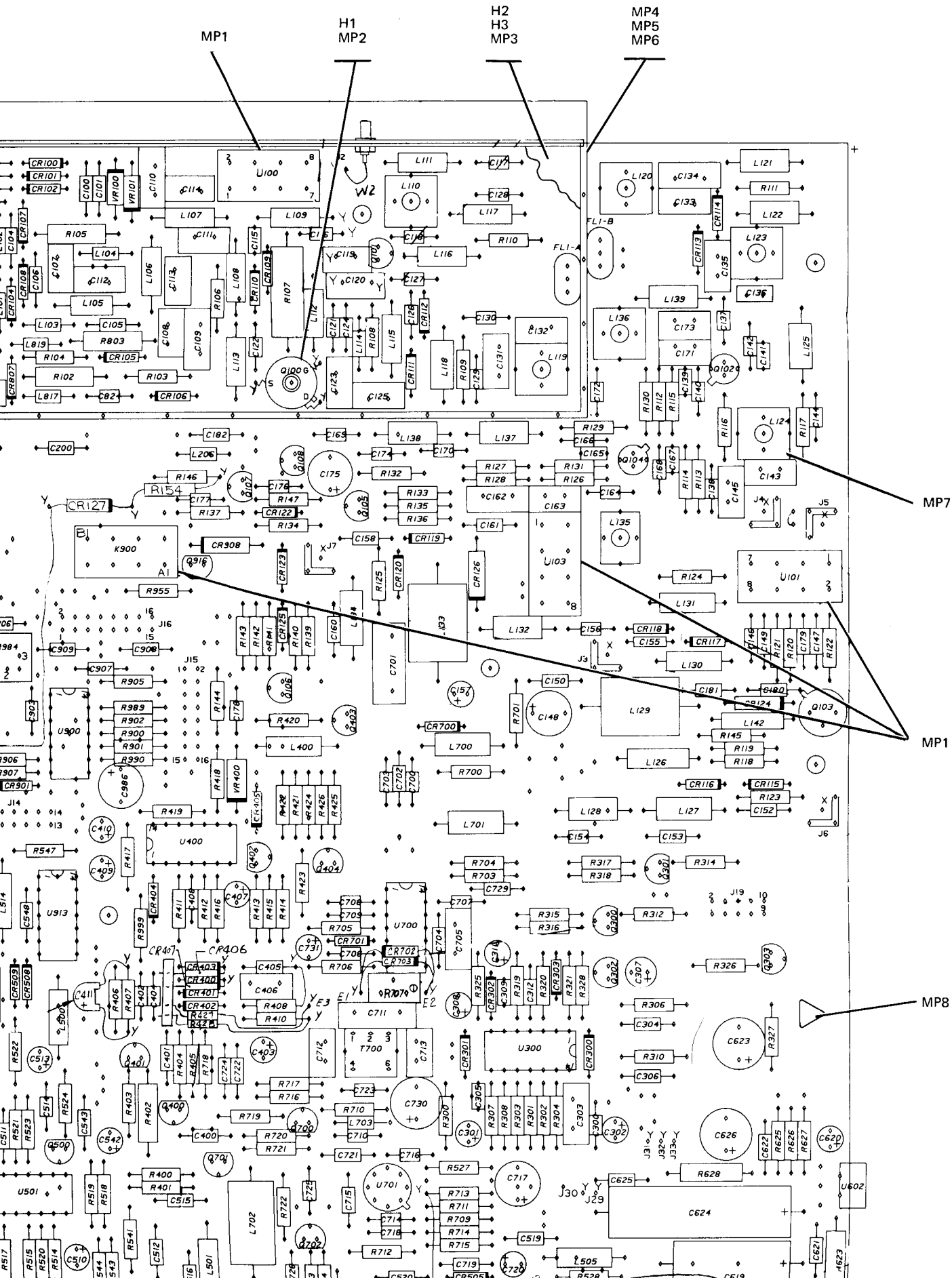
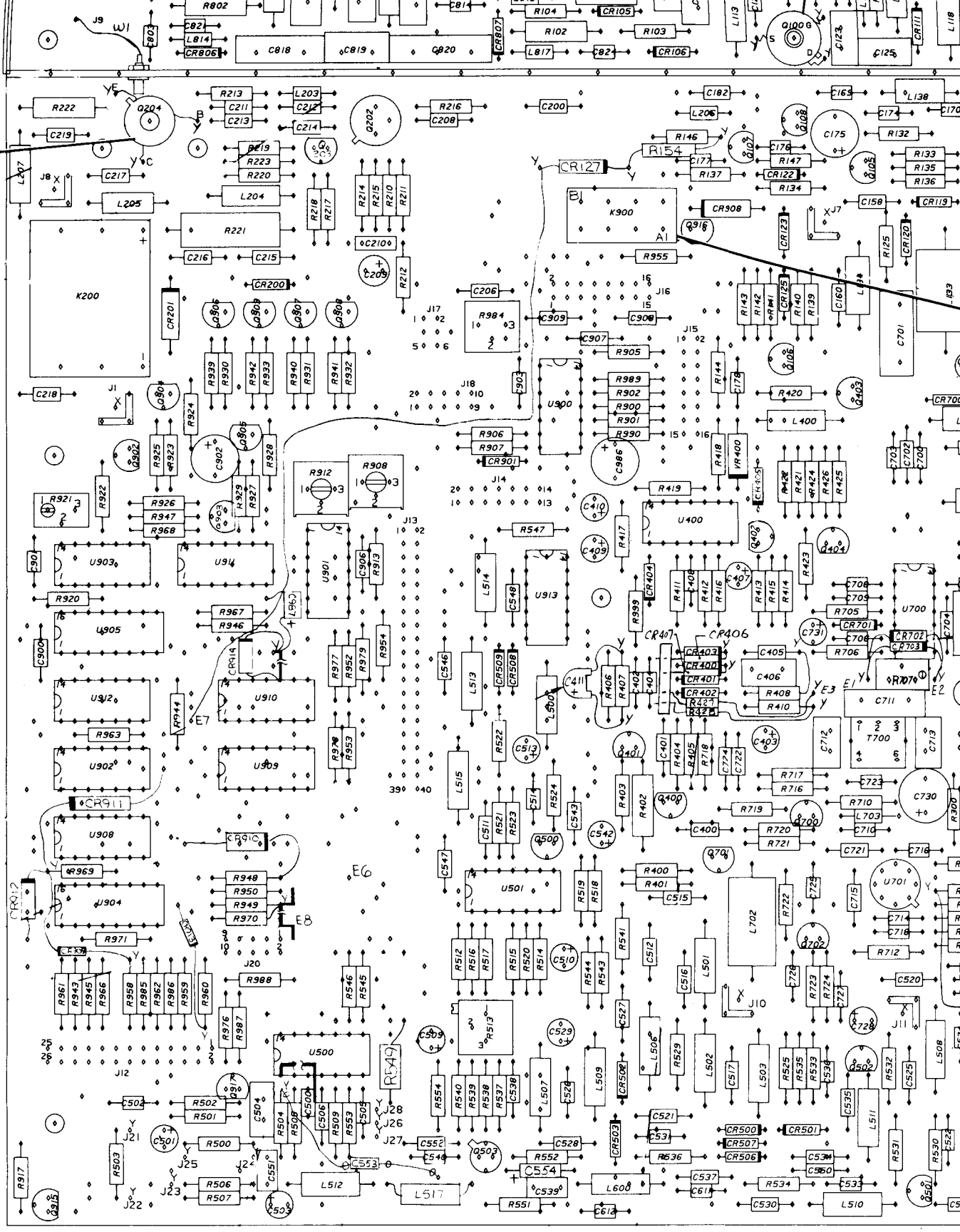
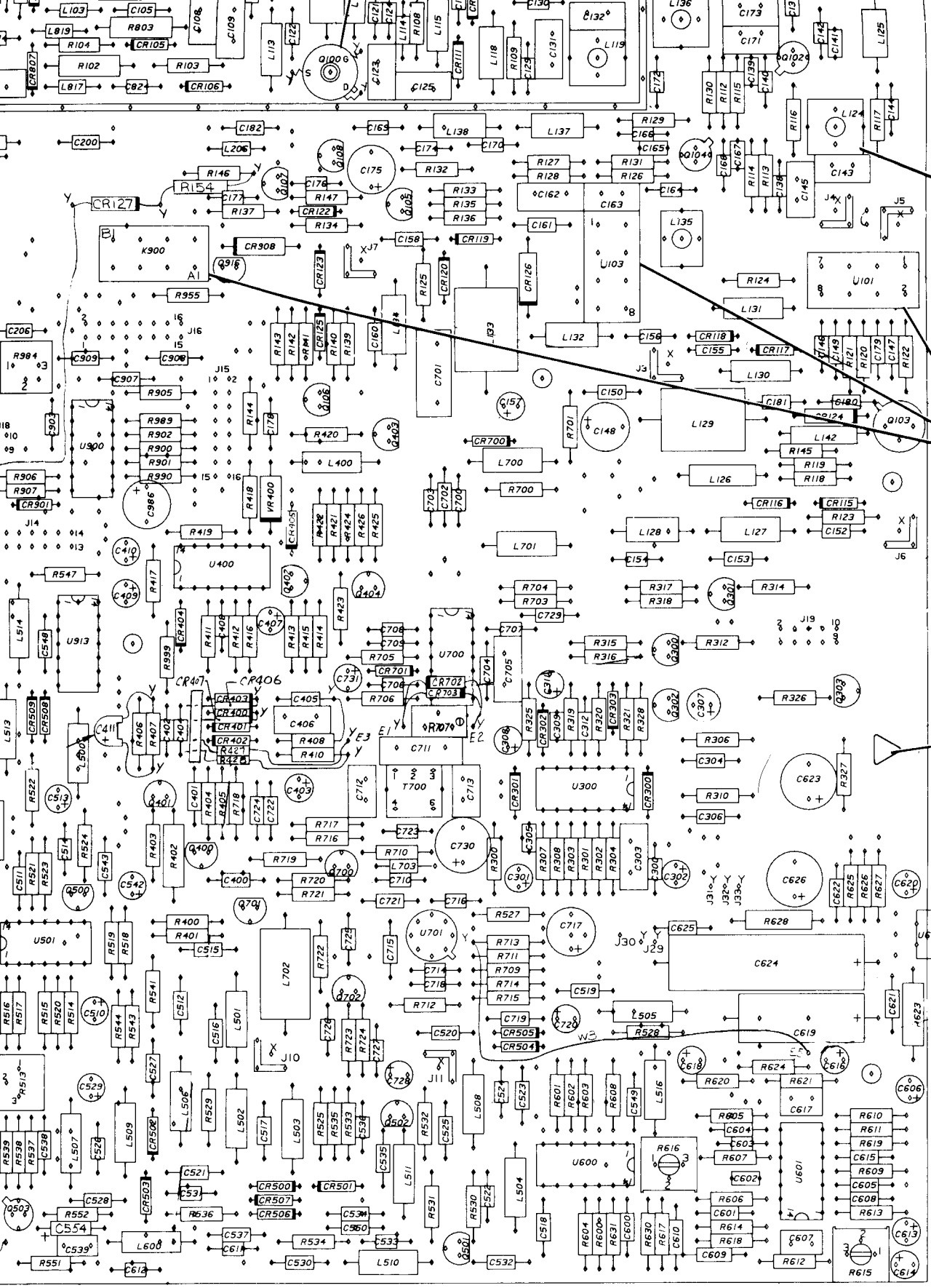
E6
E7
E8


MP1
H1
MP2
H2
H3
MP3
MP4
MP5
MP6
MP7
MP1
MP8

H1
MP9
MP10



638-6908-002



638-6908-002

CAUTION ELECTROSTATIC SENSITIVE DEVICES OBSERVE PRECAUTIONS FOR HANDLING

TPA-5293-018

Receiver-Exciter, Parts Location
Figure 10 (Sheet 1 of 4)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	RECEIVER/EXCITER	638-6908-002			
CR100-CR103	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR104	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR105-CR108	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR109-CR114	SEMICOND DEVICE	353-3733-010		28480	HP3168
CR115-CR120	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR121	NOT USED				
CR122, CR123	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR124	SEMICOND DEVICE	353-6442-020		04713	1N4002
CR125	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR126	SEMICOND DEVICE	353-6442-020		04713	1N4002
CR127	SEMICOND DEVICE (A7)	353-3644-010		31433	1N4454
CR128-CR199	NOT USED				
CR200	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR201	SEMICOND DEVICE	353-6442-020		04713	1N4002
CR202-CR299	NOT USED				
CR300-CR303	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR304-CR399	NOT USED				
CR303	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR304-CR399	NOT USED				
CR400-CR405	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR406-CR499	NOT USED				
CR500-CR510	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR511-CR699	NOT USED				
CR700	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR701	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR702, CR703	SEMICOND DEVICE	353-3644-010		31433	1N4454
CR704-CR799	NOT USED				
CR800, CR801	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR802	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR803	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR804	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR805	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR806	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR807	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR808-CR900	NOT USED				
CR901	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR902-CR907	NOT USED				
CR908	SEMICOND DEVICE	353-6442-020		04713	1N4002
CR909-CR914	SEMICOND DEVICE (A7)	353-3644-010		31433	1N4454
CR915	SEMICOND DEVICE (A8)	353-3644-010		31433	1N4454-1
C100, C101	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C102, C103	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D8050
C104	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C105, C106	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D8050
C107	CAPACITOR,FXD MICA DIEL, 91PF, 5%, 500V	912-3876-000		81349	CM04FD910J03
C108	CAPACITOR,FXD MICA DIEL, 20PF, 5%, 500V	912-3841-000		81349	CM04ED200J03
C109, C110	CAPACITOR,FXD MICA DIEL, 120PF, 5%, 500V	912-2822-000		81349	CM05FD121J03
C111	CAPACITOR,FXD MICA DIEL, 62PF, 5%, 500V	912-3864-000		81349	CM04ED620J03
C112	CAPACITOR,FXD MICA DIEL, 15PF, 5%, 500V	912-3839-000		81349	CM04CD150J03
C113	CAPACITOR,FXD MICA DIEL, 82PF, 5%, 500V	912-3873-000		81349	CM04ED820J03
C114	CAPACITOR,FXD MICA DIEL, 62PF, 5%, 500V	912-3864-000		81349	CM04ED620J03
C115	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C116	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C117	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C118	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C119	CAPACITOR,FXD MICA DIEL, 22PF, 5%, 500V	912-3842-000		81349	CM04ED220J03
C120	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-2840-000		81349	CM05FD221J03
C121, C122	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C123	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V (A4)	912-3856-000		81349	CM04ED470J03
C123	CAPACITOR,FXD MICA DIEL, 12PF, 5%, 500V (A4)	912-3838-000		81349	CM04CD120J03
C124	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C125	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V (A4)	912-3856-000		81349	CM04ED470J03
C125	CAPACITOR,FXD MICA DIEL, 12PF, 5%, 500V (A4)	912-3838-000		81349	CM04CD120J03
C126-C128	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C129	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER
C130	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010
C131	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-2840-000
C132, C133	CAPACITOR,FXD MICA DIEL, 22PF, 5%, 500V	912-3842-000
C134	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-2840-000
C135	CAPACITOR,FXD MICA DIEL, 12PF, 5%, 500V	912-3838-000
C136	CAPACITOR,FXD MICA DIEL, 8PF, PORM 0.5PF, 300V	912-4141-110
C137, C138	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010
C139	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000
C140	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C141	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000
C142	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C143	CAPACITOR,FXD MICA DIEL, 12PF, 5%, 500V	912-3838-000
C144	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C145	CAPACITOR,FXD MICA DIEL, 12PF, 5%, 500V	912-3838-000
C146	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C147	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C148	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190
C149, C150	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C151	NOT USED	
C152, C153	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C154	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010
C155, C156	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C157	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330
C158	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C159	NOT USED	
C160, C161	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C162	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-2840-000
C163	CAPACITOR,FXD MICA DIEL, 22PF, 5%, 500V	912-3842-000
C164	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C165	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000
C166	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C167	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000
C168	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C169, C170	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010
C171	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-3837-000
C172	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C173	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-3837-000
C174	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C175	CAPACITOR,FXD ELCTLT, 33UF, 20%, 35V	184-9102-880
C176-C178	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C179-C181	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C183	CAPACITOR,FXD CER DIEL, 0.001UF, P80%M20%, 50VDC (A1)	913-3331-010
C184-C199	NOT USED	
C200	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040
C201	NOT USED	
C206, C207	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040
C208	CAPACITOR,FXD CER DIEL, 0.047UF, P80%M20%, 50V	913-3331-040
C209	CAPACITOR,FXD ELCTLT, 22UF, 20%, 15V	184-9102-140
C210	CAPACITOR,FXD CER DIEL, 0.22UF, PORM10%, 50V	913-5019-480
C211-C2117	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040
C218, C219	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C220-C299	NOT USED	
C300	CAPACITOR,FXD CER DIEL, 1000PF, PORM5%, 100V	913-3281-270
C301	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170
C302	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350
C303	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-2840-000
C304	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390
C305	CAPACITOR,FXD CER DIEL, 100PF, 10%, 200V	913-4006-000
C306	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C307	CAPACITOR,FXD ELCTLT, 3.3UF, 20%, 35V	184-9102-380
C308	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350
C309	CAPACITOR,FXD CER DIEL, 100PF, 10%, 200V	913-4006-000
C310	NOT USED	
C311	CAPACITOR,FXD TNTLM ELCTLT, 0.22UF, 20%, 35V	184-9102-310
C312	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C313-C315	NOT USED	
C400, C401	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C402	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C403	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170
C404	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C405	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C406	CAPACITOR,FXD MICA DIEL, 120PF, 5%, 500V	912-2822-000
C407	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350

PARTS LIST (Cont)

	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
, 220PF, 5%, 500V	912-2840-000		81349	CM05FD221J03
, 22PF, 5%, 500V	912-3842-000		81349	CM04ED220J03
, 220PF, 5%, 500V	912-2840-000		81349	CM05FD221J03
, 12PF, 5%, 500V	912-3838-000		81349	CM04CD120J03
, 8PF, PORM 0.5PF, 300V	912-4141-110		72136	DM5C080D300WV
0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
, 12PF, 5%, 500V	912-3838-000		81349	CM04CD120J03
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
, 12PF, 5%, 500V	912-3838-000		81349	CM04CD120J03
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
7UF, 20%, 20V	184-9102-190		56289	196D239
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
, 220PF, 5%, 500V	912-2840-000		81349	CM05FD221J03
, 22PF, 5%, 500V	912-3842-000		81349	CM04ED220J03
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
, 10PF, PORM 0.5PF,	912-3837-000		81349	CM04CD100D03
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
, 10PF, PORM 0.5PF,	912-3837-000		81349	CM04CD100D03
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
3UF, 20%, 35V	184-9102-880		56289	196D247A
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
0.001UF, P80%M20%,	913-3331-010		56289	292CX7R102M050B
0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D8050
0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D8050
0.047UF, P80%M20%, 50V	913-3331-040		56289	292CY5U473Z050B
2UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
0.22UF, PORM10%, 50V	913-5019-480		81349	CK06BX224K
0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D8050
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
1000PF, PORM5%, 100V	913-3281-270		18796	8121-100C0G102J
0UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
, 220PF, 5%, 500V	912-2840-000		81349	CM05FD221J03
TLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
100PF, 10%, 200V	913-4006-000		81349	CK05BX101K
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
.3UF, 20%, 35V	184-9102-380		56289	199D335X0035CB1
UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
100PF, 10%, 200V	913-4006-000		81349	CK05BX101K
TLT, 0.22UF, 20%, 35V	184-9102-310		56289	199D224X0035AB1
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
0UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
, 120PF, 5%, 500V	912-2822-000		81349	CM05FD121J03
UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
C408	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C409	CAPACITOR,FXD ELCTLT, 3.3UF, 20%, 35V (A6)	184-9102-380		56289	199D335X0035CB1
C409	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C410	CAPACITOR,FXD ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C411	CAPACITOR,FXD TNTLM ELCTLT, 100UF, 20%, 10V (A2)	184-9102-100		56289	196D235
C412-C499	NOT USED				
C500	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V (A3)	913-4014-000		81349	CK05BX471K
C500	CAPACITOR,FXD CER DIEL, 2200PF, 10%, 100V (A3)	913-5019-120		81349	CK05BX222K
C501	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
C502	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C503	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
C504	CAPACITOR,FXD MICA DIEL, 15PF, 5%, 500V	912-3839-000		81349	CM04CD150J03
C505	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C506	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C507, C508	NOT USED				
C509	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V (A6)	184-9102-350		56289	199D105X0035BB1
C509	CAPACITOR,FXD TNTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
C510	CAPACITOR,FXD ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C511, C512	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C513	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
C514	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C515-C522	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C522	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C523	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C524	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C525	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C526	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C527, C528	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D8050
C529	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C530	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C531	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C532	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C533	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C534, C535	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C536	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C537, C538	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C539	CAPACITOR,FXD CER DIEL, 0.47UF, 20%, 50V	913-3279-250		16546	CY30C474M
C540	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C541	NOT USED				
C542	CAPACITOR,FXD ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C543	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D8050
C544	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V (A7)	913-3331-030		56289	292CY5U104D8050
C545	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V (A7)	913-3331-040		56289	292CY5U473D8050
C546-C550	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C551	CAPACITOR,FXD CER DIEL, 0.47UF, 20%, 50V	913-3279-250		16546	CY30C474M
C552	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C553	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC (A6)	913-3331-030		56289	292CY5U104Z050C
C554	CAPACITOR,FXD TNTLM ELCTLT, 0.22UF, 20%, 35V (A7)	184-9102-310		56289	199D224X0035AB1
C555-C599	NOT USED				
C600, C601	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C602	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C603	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 100V	913-4778-000		81349	CK12BX102K
C604, C605	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C606	CAPACITOR,FXD ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C607	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 500V	912-3848-000		81349	CM04ED330J03
C608	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C609, C610	CAPACITOR,FXD CER DIEL, 10,000PF, 10%, 100V	913-5020-430		81349	CK13BX103K
C611, C612	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C613, C614	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
C615	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C616	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
C617	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-3867-000		81349	CM04ED680J03
C618	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
C619	CAPACITOR,FIXED ELCTLT, 100UF, 10%, 20V	184-9086-610		81349	M39003-01-2301
C620	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
C621, C622	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C623	CAPACITOR,FXD ELCTLT, 330UF, 20%, 6V	184-9102-060		56289	196D234
C624	CAPACITOR,FXD AL ELCTLT, 470UF, P75%M10%, 16V	183-1510-040		56289	500D477G016DF5
C625	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C626	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239

PARTS LIST (Cont)

ABLE DE	MFR CODE	MFR PART NUMBER	REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	56289	292CY5U103D8050	C627-	NOT USED				
	56289	199D335X0035CB1	C699					
	56289	199D105X0035BB1	C700	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	56289	199D226X0015DB1	C701	CAPACITOR,FXD MICA DIEL, 1500PF, 5%, 500V	912-3327-000		14655	DM20FD152J04CR
	56289	196D235	C702	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
			C703	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C704	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
			C705	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 500V	912-2852-000		81349	CM05FD331J03
	81349	CK05BX471K	C706-	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	81349	CK05BX222K	C710					
	56289	199D474X0035AB1	C711	CAPACITOR,FXD MICA DIEL, 510PF, 5%, 500V	912-2980-000		81349	CM06FD511J03
	56289	292CY5U103D8050	C712,	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 500V	912-3848-000		81349	CM04ED330J03
	56289	199D475X0035DB1	C713					
	81349	CM04CD150J03	C714	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	56289	292CY5U103D8050	C715	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
	56289	292CY5U104D8050	C716	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C717	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
			C718	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	56289	199D105X0035BB1	C719	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V (A3	913-3331-040		56289	292CY5U473D8050
	56289	199D475X0035DB1						
	56289	199D226X0015DB1	C719	CAPACITOR,FXD CER DIEL, 0.033UF, 10%, 100VDC	913-5019-380		81349	CK06BX333K
	56289	292CY5U104D8050	C720	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
			C721,	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
	56289	199D106X0020CB1	C722					
	56289	292CY5U102D8050	C723	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	56289	292CY5U104Z050C	C724	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
			C725	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	56289	292CY5U103Z050B	C726	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
			C727	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	56289	292CY5U104D8050	C728	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
	56289	292CY5U103D8050	C729	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
	56289	292CY5U104D8050	C730	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
	56289	292CY5U103D8050	C731	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
	56289	292CY5U473D8050	C732-	NOT USED				
			C799					
	56289	199D105X0035BB1	C800	CAPACITOR,FXD MICA DIEL, 1800PF, 5%, 500V	912-3333-000		14655	DM20FD182J04CR
	56289	292CY5U104D8050	C801	CAPACITOR,FXD MICA DIEL, 2700PF, 5%, 500V (A3)	912-3348-000		14655	DM20FD272J04CR
	56289	292CY5U103D8050	C801	CAPACITOR,FXD MICA DIEL, 2700PF, 5%, 500V	912-3348-000		57582	KD20272J501
	56289	292CY5U104D8050	C801	CAPACITOR,FXD MICA DIEL, 3000PF, 5%, 500V	912-3037-000		81349	CM06FD302J03
	56289	292CY5U103D8050	C802	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
	56289	292CY5U104D8050	C803	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C804	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-2840-000		81349	CM05FD221J03
	56289	292CY5U103D8050	C805	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-000		81349	CM05FD151J03
	56289	292CY5U104D8050	C806	CAPACITOR,FXD MICA DIEL, 470PF, 5%, 500V	912-2974-000		81349	CM06FD471J03
			C807	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	16546	CY30C474M	C808	CAPACITOR,FXD MICA DIEL, 560PF, 5%, 500V	912-2983-000		81349	CM06FD561J03
	56289	292CY5U102D8050	C809	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-000		81349	CM05FD151J03
			C810,	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	56289	199D226X0015DB1	C811					
	56289	292CY5U473D8050	C812	CAPACITOR,FXD MICA DIEL, 1000PF, 5%, 500V	912-3315-000		14655	DM20FD102J04CR
	56289	292CY5U104D8050	C813	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 500V	912-2846-000		81349	CM05FD271J03
			C814	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	56289	292CY5U473D8050	C815	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 500V	912-2852-000		81349	CM05FD331J03
			C816	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 500V	912-2834-000		81349	CM05FD181J03
	56289	292CY5U104D8050	C817	CAPACITOR,FXD MICA DIEL, 560PF, 5%, 500V	912-2983-000		81349	CM06FD561J03
			C818	CAPACITOR,FXD MICA DIEL, 680PF, 5%, 500V	912-2989-000		81349	CM06FD681J03
	16546	CY30C474M	C819	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-2858-000		81349	CM05FD391J03
	56289	292CY5U104Z050C	C820	CAPACITOR,FXD MICA DIEL, 1000PF, 5%, 500V	912-3315-000		14655	DM20FD102J04CR
			C821	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
	56289	292CY5U104Z050C	C822	CAPACITOR,FXD MICA DIEL, 2200PF, 5%, 500V	912-3339-000		14655	DM20FD222J04CR
			C823	CAPACITOR,FXD MICA DIEL, 560PF, 5%, 500V	912-2983-000		81349	CM06FD561J03
	56289	199D224X0035AB1	C824	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C825,	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
			C826					
			C827-	NOT USED				
	56289	292CY5U104D8050	C899					
			C900	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
	81349	CK05BX471K	C901	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
	81349	CK12BX102K	C902	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
	56289	292CY5U104D8050	C903	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C904,	NOT USED				
	56289	199D226X0015DB1	C905					
	81349	CM04ED330J03	C906-	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
	56289	292CY5U104D8050	C909					
	81349	CK13BX103K	C910-	NOT USED				
			C985					
	56289	292CY5U103D8050	C986	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	199D1022
			C987	CAPACITOR,FXD TNTLM ELCTLT, 0.47UF, 20%, 35V (A7)	184-9102-330		56289	199D474X0035AB1
	56289	199D474X0035AB1						
			FL1-A, FL1-B	FILTER,BP,XTAL	293-1332-010		75378	293-1332-010
	56289	292CY5U104D8050						
	56289	199D106X0020CB1	H1	WASHER,LOCK SST, 0.088 ID X 0.172 OD (QTY 2)	310-0275-000		96906	MS35338-134
	81349	CM04ED680J03	H2	SCREW,MACH STL, 4-40 X 3/16 (QTY 2)	343-0132-000		96906	MS51957-12
	56289	199D474X0035AB1	H3	SCREW,MACH CD PL STL, 2-56 X 5/16 (QTY 20)	343-0125-000		96906	MS51957-4
	81349	M39003-01-2301	J1	CONNECTOR,RCPT ELEC	357-0067-020		00779	226287-2
	56289	199D106X0020CB1	J2	CONNECTOR,RCPT ELEC	357-7207-100		98291	52-046-0000
	56289	292CY5U104D8050	J3-J8	CONNECTOR,RCPT ELEC	357-0067-020		00779	226287-2
			J9	CONNECTOR,RCPT ELEC	357-7207-100		98291	52-046-0000
	56289	196D234	J10,J11	CONNECTOR,RCPT ELEC	357-0067-020		00779	226287-2
	56289	500D477G016DF5	J12		372-2656-050			
	56289	292CY5U104D8050	J13	CONNECTOR,HDR	372-2656-240		52072	CAD40SP100-230-4 30
	56289	196D239						

Receiver-Exciter, Parts Location
Figure 10 (Sheet 2)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
J14	CONNECTOR,HDR	372-2656-200		52072	CAD14SP100-230-4 30
J15,J16	CONNECTOR,HDR	372-2656-210		52072	CAD16SP100-230-4 30
J17	CONNECTOR,HDR	372-2656-140		52072	CAD06SP100-230-4 30
J18-J20	CONNECTOR,HDR	372-2656-100		52072	CAD10SP100-230-4 30
J21-J33	CONNECTOR,HDR	372-2656-130		52072	CAS01SP100-230-4 30
K200	RELAY,REED,RF	410-0585-020		18542	1017-20-1
K201- K899	NOT USED				
K900	RELAY,ARM	974-1076-430		81349	M39016-6-116L
L100- L104	COIL,RF 100UH (A9)	240-2047-000		96906	MS75085-07
L101, L102	COIL,RF 560UH	240-2723-050		96906	MS75085-16
L103	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L104	COIL,RF 560UH	240-2723-050		96906	MS75085-16
L105	COIL,RF 0.33UH	240-1564-000		96906	MS18130-3
L106, L107	COIL,RF 0.22UH	240-1563-000		96906	MS18130-2
L108, L109	COIL,RF 18UH	240-1583-000		96906	MS14046-7
L110	COIL,RF,VAR	242-0439-060		02113	242-0439-060
L111- L113	COIL,RF 18UH	240-1583-000		96906	MS14046-7
L114	COIL,RF 0.18UH (A4)	240-2014-000		96906	MS75083-04
L114		240-0439-090			
L115- L118	COIL,RF 18UH	240-1583-000		96906	MS14046-7
L119, L120	COIL,RF,VAR	242-0439-060		02113	242-0439-060
L121, L122	COIL,RF 18UH	240-1583-000		96906	MS14046-7
L123, L124	COIL,RF,VAR	242-0439-060		02113	242-0439-060
L125	COIL,RF 18UH	240-1583-000		96906	MS14046-7
L126, L127	COIL,RF 330UH	240-2715-430		96906	MS75089-17
L128	COIL,RF 18UH	240-1583-000		96906	MS14046-7
L129	COIL,RF 2200UH	240-1646-000		96906	MS14050-2
L130- L132	COIL,RF 18UH	240-1583-000		96906	MS14046-7
L133	COIL,RF 2200UH	240-1646-000		96906	MS14050-2
L134	COIL,RF 330UH	240-2715-430		96906	MS75089-17
L135, L136	COIL,RF,VAR	242-0439-060		02113	242-0439-060
L137- L139	COIL,RF 18UH	240-1583-000		96906	MS14046-7
L140, L141	COIL,RF 100UH (A9)	240-2047-000		96906	MS75085-07
L140	COIL,RF 560UH	240-2723-050		96906	MS75085-16
L142	COIL,RF 2200UH	240-2715-530		96906	MS75089-27
L143- L202	NOT USED				
L203	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L204	COIL,RF 220UH	240-2715-410		96906	MS75089-15
L205	COIL,RF 10UH	240-1580-000		96906	MS14046-4
L206	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L207	COIL,RF 2200UH	240-2715-530		96906	MS75089-27
L208, L209	COIL,RF 1.80UH (A1)	240-2026-000		96906	MS75084-03
L208, L209	COIL,RF 2.70UH	240-2028-000		96906	MS75084-05
L210- L399	NOT USED				
L400	COIL,RF 150UH	240-2715-390		96906	MS75089-13
L401- L499	NOT USED				
L500	COIL,RF 120UH	240-2715-380		96906	MS75089-12
L501- L511	COIL,RF 330UH	240-2715-430		96906	MS75089-17
L512	COIL,RF 120UH	240-2715-380		96906	MS75089-12
L513- L517	COIL,RF 330UH	240-2715-430		96906	MS75089-17
L518- L599	NOT USED				
L600	COIL,RF 330UH	240-2715-430		96906	MS75089-17
L601- L699	NOT USED				
L700	COIL,RF 330UH	240-2715-430		96906	MS75089-17
L701	COIL,RF 82UH	240-2715-360		96906	MS75089-10
L702	COIL,RF 1000UH	240-1644-000		96906	MS14049-5
L703	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L704- L799	NOT USED				
L800	COIL,RF 3.30UH (A3)	240-1574-000		96906	MS18130-14
L801	COIL,RF 15UH (A3)	240-1582-000		96906	MS14046-6
L802	COIL,RF 2.70UH	240-1573-000		96906	MS18130-13
L803	COIL,RF 4.70UH	240-1576-000		96906	MS18130-16

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER
L804	COIL,RF 5.60UH	240-1577-0
L805, L806	COIL,RF 100UH (A9)	240-2047-0
L805	COIL,RF 560UH	240-2723-0
L807	COIL,RF 0.47UH	240-1565-0
L808	COIL,RF 0.82UH	240-1567-0
L809, L810	COIL,RF 100UH	240-2047-0
L811	COIL,RF 0.68UH	240-1566-0
L812	COIL,RF 1UH	240-1568-0
L813, L814	COIL,RF 100UH	240-2047-0
L815	COIL,RF 1.20UH	240-1569-0
L816	COIL,RF 1.80UH	240-1571-0
L817- L819	COIL,RF 100UH (A9)	240-2047-0
L818, L819	COIL,RF 560UH	240-2723-0
MP1	INSULATOR (QTY 4)	150-0684-0
MP2	HOLDER,SEMICOND	352-9984-0
Q100	TRANSISTOR,FET	352-1041-0
Q101	TRANSISTOR,JFET	352-5502-0
Q102	TRANSISTOR,FET	352-1140-0
Q103	TRANSISTOR	352-0671-0
Q104	TRANSISTOR,FET	352-1140-0
Q105	TRANSISTOR	352-5501-0
Q106	TRANSISTOR	352-5505-0
Q107, Q108	TRANSISTOR	352-5501-0
Q109- Q199	NOT USED	
Q202	TRANSISTOR	352-0671-0
Q203	TRANSISTOR	352-5500-0
Q204	TRANSISTOR,PLNR	352-1138-0
Q205- Q299	NOT USED	
Q300- Q303	TRANSISTOR	352-5501-0
Q304- Q399	NOT USED	
Q400- Q404	TRANSISTOR	352-5501-0
Q405- Q499	NOT USED	
Q500	TRANSISTOR	352-5501-0
Q501, Q502	TRANSISTOR	352-5505-0
Q503	TRANSISTOR,FET	352-1140-0
Q504- Q699	NOT USED	
Q700- Q702	TRANSISTOR	352-5501-0
Q703- Q901	NOT USED	
Q902, Q903	TRANSISTOR	352-5035-0
Q904, Q905	TRANSISTOR	352-5500-0
Q906- Q909	TRANSISTOR	352-5035-0
Q910- Q914	NOT USED	
Q915	TRANSISTOR	352-5501-0
Q916, Q917	TRANSISTOR (A5)	352-5035-0
Q917	TRANSISTOR	352-5501-0
R100	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/2W	745-1324-0
R101	NOT USED	
R102	RESISTOR,FXD CMPSN, 27 OHMS, 10%, 1/2W	745-1286-0
R103, R104	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-0
R105	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/2W	745-1324-0
R106	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-0
R107	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1W	745-3296-0
R108	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-0
R109	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-0
R110	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-0
R111	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-0
R112	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-0
R113	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-0
R114	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-0
R115	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-0
R116	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-0
R117	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-0
R118	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-0
R119	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-0
R120	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/4W	745-0677-0
R121	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-0
R122	RESISTOR,FXD CMPSN, 240 OHMS, 5%, 1/4W	745-0726-0
R123	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-0
R124	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-0
R125	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-0

	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	240-1577-000		96906	MS14046-1
	240-2047-000		96906	MS75085-07
	240-2723-050		96906	MS75085-16
	240-1565-000		96906	MS18130-4
	240-1567-000		96906	MS18130-7
	240-2047-000		96906	MS75085-07
	240-1566-000		96906	MS18130-6
	240-1568-000		96906	MS18130-8
	240-2047-000		96906	MS75085-07
	240-1569-000		96906	MS18130-9
	240-1571-000		96906	MS18130-11
	240-2047-000		96906	MS75085-07
	240-2723-050		96906	MS75085-16
	150-0684-060		19080	RCRP800060-4A
	352-9984-030		98978	TXB2P032-025B
	352-1041-010		17856	U322
	352-5502-010		17856	J310
	352-1140-010		01295	3N201
	352-0671-010		02735	2N3866
	352-1140-010		01295	3N201
	352-5501-010		04713	MPS2222A
	352-5505-010		17856	2N5486
	352-5501-010		04713	MPS2222A
	352-0671-010		02735	2N3866
	352-5500-010		04713	MPS2907A
	352-1138-010		01281	PT5701
	352-5501-010		04713	MPS2222A
	352-5501-010		04713	MPS2222A
	352-5035-010		04713	MPSA14
	352-5500-010		04713	MPS2907A
	352-5035-010		04713	MPSA14
	352-5501-010		04713	MPS2222A
	352-5035-010		04713	MPSA14
	352-5501-010		04713	MPS2222A
%, 1/2W	745-1324-000		81349	RCR20G221KS
, 1/2W	745-1286-000		81349	RCR20G270KS
W	745-0749-000		81349	RCR07G102KS
%, 1/2W	745-1324-000		81349	RCR20G221KS
W	745-0749-000		81349	RCR07G102KS
, 1W	745-3296-000		81349	RCR32G470KS
%, 1/4W	745-0713-000		81349	RCR07G101KS
W	745-0749-000		81349	RCR07G102KS
%, 1/4W	745-0713-000		81349	RCR07G101KS
W	745-0749-000		81349	RCR07G102KS
/4W	745-0773-000		81349	RCR07G472KS
%, 1/4W	745-0737-000		81349	RCR07G471KS
%, 1/4W	745-0719-000		81349	RCR07G151KS
%, 1/4W	745-0722-000		81349	RCR07G181KS
, 1/4W	745-0701-000		81349	RCR07G470KS
0W	745-0785-000		81349	RCR07G103KS
%, 1/4W	745-0743-000		81349	RCR07G681KS
W	745-0749-000		81349	RCR07G102KS
, 1/4W	745-0677-000		81349	RCR07G100KS
%, 1/4W	745-0725-000		81349	RCR07G221KS
, 1/4W	745-0726-000		81349	RCR07G241JS
W	745-0749-000		81349	RCR07G102KS
%, 1/4W	745-0737-000		81349	RCR07G471KS
W	745-0749-000		81349	RCR07G102KS

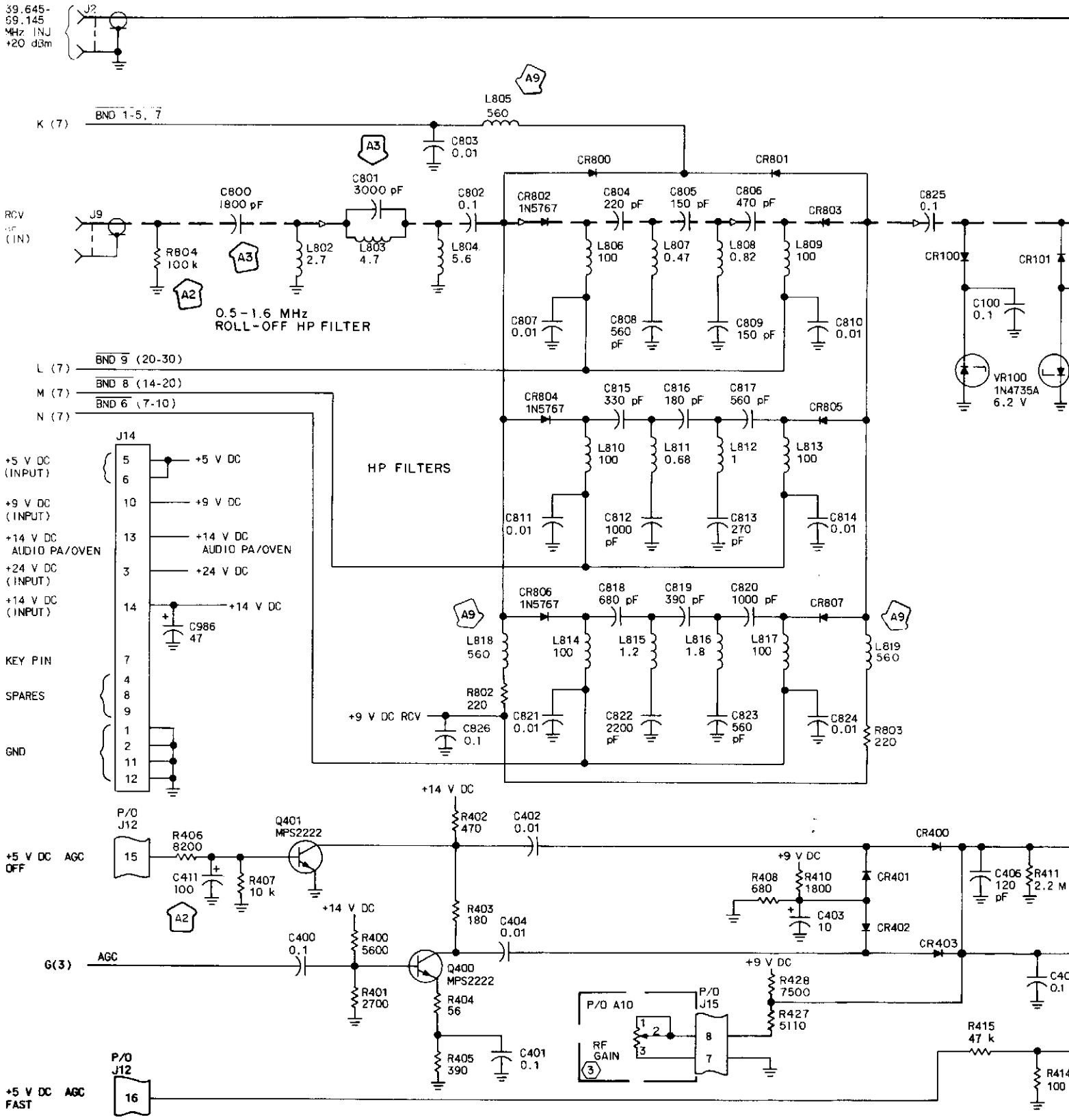
REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R126	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R127	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R128	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R129	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R130	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R131	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R132	RESISTOR,FXD FILM, 4.22K, 1%, 1/8W	705-1026-000		81349	RN55D4221F
R133	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W	705-1025-000		81349	RN55D4021F
R134	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R135	RESISTOR,FXD FILM, 2.43K, 1%, 1/8W	705-3605-180		81349	RN55D2431F
R136	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R137	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R138	NOT USED				
R139,	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R140					
R141	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W (A3)	745-0725-000		81349	RCR07G221KS
R142	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R143	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R144	RESISTOR,FXD FILM, 715 OHMS, 1%, 1/8W	705-0989-000		81349	RN55D7150F
R145	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R146	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R147	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R148	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/8W (A1)	745-2277-000		81349	RCR05G180KS
R149-	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W (A1)	745-2320-000		81349	RCR05G271KS
R151					
R152	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/8W (A1)	745-2277-000		81349	RCR05G180KS
R153	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W (A1)	745-2320-000		81349	RCR05G271KS
R154	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W (A7)	745-0821-000		81349	RCR07G104KS
R155-	NOT USED				
R207					
R208	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000		81349	RCR07G221KS
R209	RESISTOR,FXD CMPSN, 4.7 OHMS, 5%, 1/4W	745-4382-000		81349	RCR07G4R7JS
R210,	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R211					
R212	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W	745-0710-000		81349	RCR07G820KS
R213	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R214	RESISTOR,FXD CMPSN, 4.7 OHMS, 5%, 1/4W	745-4382-000		81349	RCR07G4R7JS
R215	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R216	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R217	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R218,	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R219					
R220	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R221	RESISTOR,FXD CMPSN, 22 OHMS, 5%, 1W	745-3281-000		81349	RCR32G220JS
R222	RESISTOR,FXD CMPSN, 6.8 OHMS, 10%, 1/2W	745-1549-000		81349	RCR20G6R8KS
R223	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R224-	NOT USED				
R299					
R300	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R301	RESISTOR,FXD CMPSN, 8.2K, 10%, 1/4W	745-0782-000		81349	RCR07G822KS
R302,	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R303					
R304	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R305	NOT USED				
R306	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R307	RESISTOR,FXD CMPSN, 0.12MEGO, 10%, 1/4W	745-0824-000		81349	RCR07G124KS
R308	RESISTOR,FXD CMPSN, 2.2MEGO, 10%, 1/4W	745-0869-000		81349	RCR07G225KS
R309	NOT USED				
R310	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R311	NOT USED				
R312	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R313	NOT USED				
R314	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R315-	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R318					
R319	RESISTOR,FXD CMPSN, 10MEGO, 10%, 1/4W	745-0893-000		81349	RCR07G106KS
R320	RESISTOR,FXD CMPSN, 0.33MEGO, 10%, 1/4W	745-0839-000		81349	RCR07G334KS
R321	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R322-	NOT USED				
R324					
R325	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R326	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R327,	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R328					
R329-	NOT USED				
R399					
R400	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
R401	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R402	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/2W	745-1338-000		81349	RCR20G471KS
R403	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-000		81349	RCR07G181KS
R404	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R405	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R406	RESISTOR,FXD CMPSN, 8.2K, 10%, 1/4W	745-0782-000		81349	RCR07G822KS
R407	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R408	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000		81349	RCR07G681KS
R409	NOT USED				
R410	RESISTOR,FXD CMPSN, 1.8K, 10%, 1/4W	745-0758-000		81349	RCR07G182KS
R411	RESISTOR,FXD CMPSN, 2.2MEGO, 10%, 1/4W	745-0869-000		81349	RCR07G225KS
R412	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R413	RESISTOR,FXD CMPSN, 0.56MEGO, 10%, 1/4W	745-0848-000		81349	RCR07G564KS
R414	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R415	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS

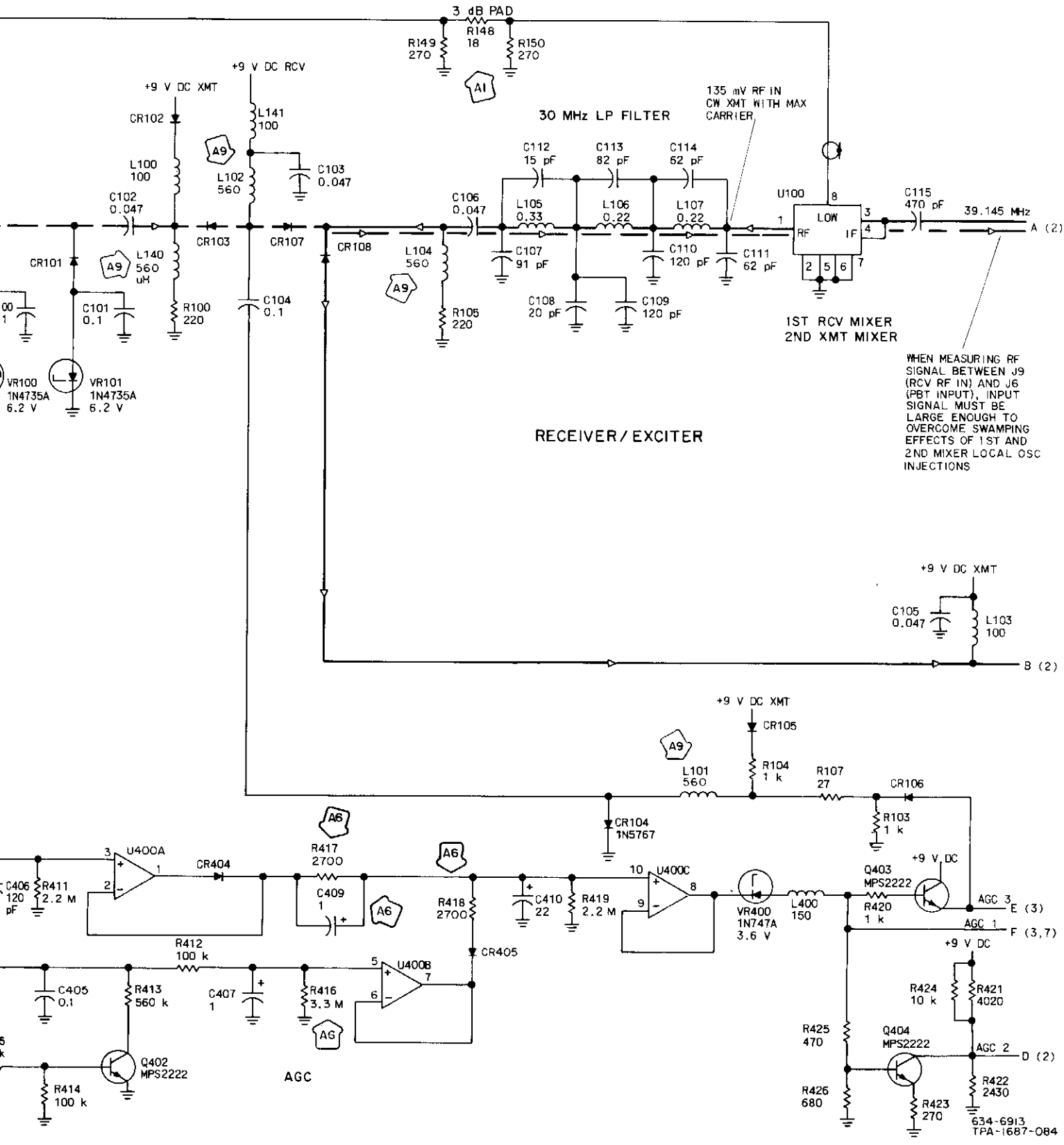
REF DES	DES
R416	RES
R416	RES
R417	RES
R417	RES
R418	RES
R418	RES
R419	RES
R420	RES
R421	RES
R422	RES
R423	RES
R424	RES
R425	RES
R426	RES
R427-	NOT
R499	
R500	RES
R501	RES
R502	RES
R503	RES
R504,	RES
R505	
R506,R50	RES
7	
R508	NOT
R509	RES
R510,	NOT
R511	
R512	RES
R513	RES
R514	RES
R515,	RES
R516	
R517	RES
R518	RES
R519	RES
R520	RES
R521	RES
R522	RES
R523	RES
R524	RES
R525	RES
R526	RES
R527	RES
R528,	RES
R529	
R530	RES
R531	RES
R532	RES
R533	RES
R534,	RES
R535	
R536	RES
R537	RES
R538	RES
R539	RES
R540	RES
R541	RES
R542	RES
R543	RES
R544	RES
R545,	RES
R546	
R547	RES
R548	RES
R549	RES
R550	NOT
R551	RES
R552	RES
R553	RES
R554	RES
R555-	NOT
R599	
R600	RES
R601-	RES
R603	
R604	RES
R605	RES
R606,	RES
R607	
R608,	RES
R609	
R610,	RES
R611	
R612	RES
R613	RES
R614	RES
R615,	RES
R616	
R617	RES
R618	RES
R619	RES

PARTS LIST (Cont)

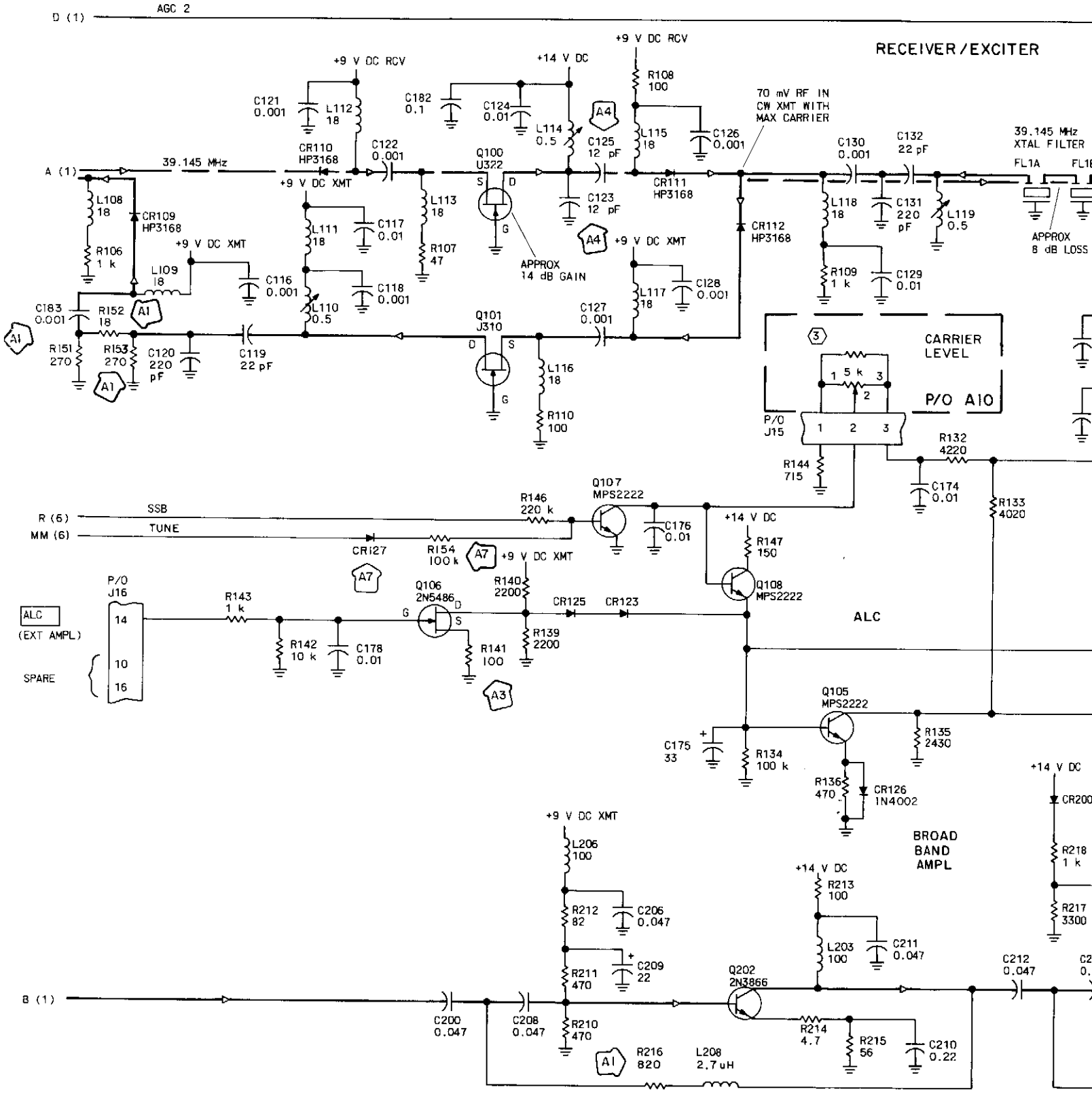
REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R416	RESISTOR,FXD CMPSN, 2.2MEGO, 10%, 1/4W (A6)	745-0869-000		81349	RCR07G225KS
R416	RESISTOR,FXD CMPSN, 3.3MEGO, 10%, 1/4W	745-0875-000		81349	RCR07G335KS
R417	RESISTOR,FXD CMPSN, 910 OHMS, 5%, 1/4W (A6)	745-0747-000		81349	RCR07G911JS
R417	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R418	RESISTOR,FXD CMPSN, 27K, 10%, 1/4W (A6)	745-0800-000		81349	RCR07G273KS
R418	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R419	RESISTOR,FXD CMPSN, 2.2MEGO, 10%, 1/4W	745-0869-000		81349	RCR07G225KS
R420	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R421	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W	705-1025-000		81349	RN55D4021F
R422	RESISTOR,FXD FILM, 2.43K, 1%, 1/8W	705-3605-180		81349	RN55D2431F
R423	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R424	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R425	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R426	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000		81349	RCR07G681KS
R427-R499	NOT USED				
R500	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R501	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R502	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R503	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R504, R505	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R506,R507	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R508	NOT USED				
R509	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R510, R511	NOT USED				
R512	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R513	RESISTOR,VAR NON-WW,50K, 10%	382-0052-130		02111	64P503
R514	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R515, R516	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R517	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R518	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R519	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R520	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R521	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R522	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-000		81349	RCR07G181KS
R523	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R524	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R525	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R526	RESISTOR,FXD CMPSN, 1.2K, 10%, 1/4W	745-0752-000		81349	RCR07G122KS
R527	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R528, R529	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R530	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R531	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R532	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R533	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R534, R535	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R536	RESISTOR,FXD CMPSN, 0.39MEGO, 10%, 1/4W	745-0842-000		81349	RCR07G394KS
R537	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R538	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R539	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R540	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000		81349	RCR07G471KS
R541	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R542	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W (A7)	745-0773-000		81349	RCR07G472KS
R543	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R544	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R545, R546	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R547	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R548	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W (A7)	745-0803-000		81349	RCR07G333KS
R549	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W	745-0803-000		81349	RCR07G333KS
R550	NOT USED				
R551	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R552	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R553	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W	745-0803-000		81349	RCR07G333KS
R554	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R555-R599	NOT USED				
R600	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R601-R603	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R604	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R605	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R606, R607	RESISTOR,FXD CMPSN, 0.15MEGO, 10%, 1/4W	745-0827-000		81349	RCR07G154KS
R608, R609	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R610, R611	RESISTOR,FXD CMPSN, 1.8K, 10%, 1/4W	745-0758-000		81349	RCR07G182KS
R612	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R613	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W	745-0803-000		81349	RCR07G333KS
R614	RESISTOR,FXD CMPSN, 0.82MEGO, 10%, 1/4W	745-0854-000		81349	RCR07G824KS
R615, R616	RESISTOR,VAR 500K, 20%, 1/2W	382-0038-120		91637	101T50002
R617	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R618	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000		81349	RCR07G224KS
R619	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS

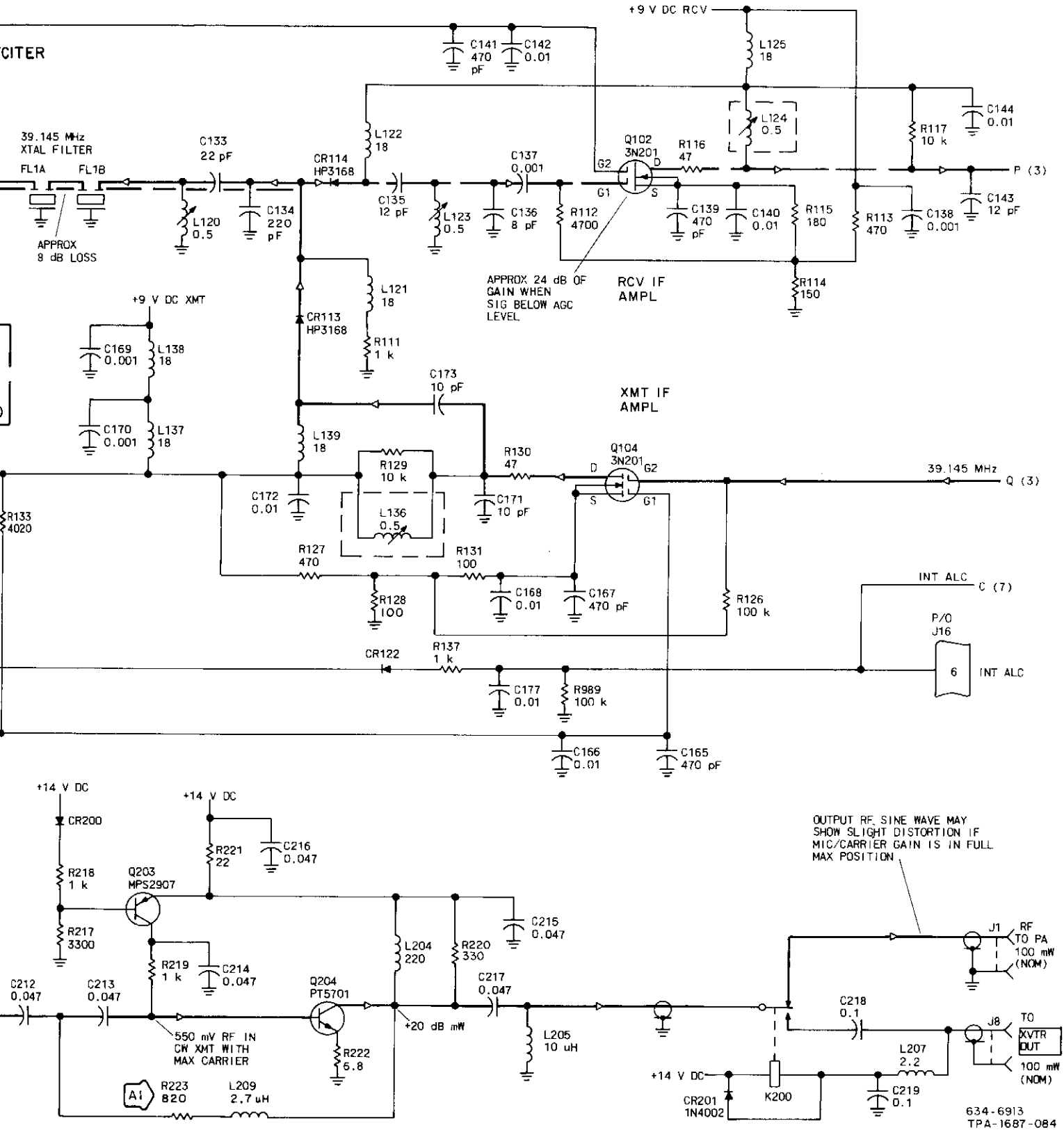
Receiver-Exciter, Parts Location
Figure 10 (Sheet 3)


39.645-
69.145
MHz INJ
+20 dBm
J2
A9
L805
560
K (7)
BND 1-5, 7
A3
C803
0.01
CR800
CR801
C801
3000 pF
C800
1800 pF
C802
0.1
CR802
1N5767
C804
220 pF
C805
150 pF
C806
470 pF
CR803
C825
0.1
RCV
(IN)
J9
R804
100 k
A2
A3
L802
2.7
L803
4.7
L804
5.6
L806
100
L807
0.47
L808
0.82
L809
100
CR100
CR101
C100
0.1
VR100
1N4735A
6.2 V
C807
0.01
C808
560
pF
C809
150 pF
C810
0.01
0.5 - 1.6 MHz
ROLL-OFF HP FILTER
L (7)
BND 9 (20-30)
M (7)
BND 8 (14-20)
BND 6 (7-10)
N (7)
CR804
1N5767
C815
330 pF
C816
180 pF
C817
560 pF
CR805
L810
100
L811
0.68
L812
1
L813
100
C811
0.01
C812
1000
pF
C813
270
pF
C814
0.01
HP FILTERS
J14
+5 V DC
(INPUT)
5
6
+5 V DC
+9 V DC
(INPUT)
10
+9 V DC
+14 V DC
AUDIO PA/OVEN
13
+14 V DC
AUDIO PA/OVEN
+24 V DC
(INPUT)
3
+24 V DC
+14 V DC
(INPUT)
14
+14 V DC
C986
47
KEY PIN
7
SPARES
4
8
9
GND
1
2
11
12
A9
CR806
1N5767
C818
680 pF
C819
390 pF
C820
1000 pF
CR807
A9
L818
560
L814
100
L815
1.2
L816
1.8
L817
100
L819
560
R802
220
+9 V DC RCV
C821
0.01
C822
2200
pF
C823
560
pF
C824
0.01
R803
220
C826
0.1
+14 V DC
P/O
J12
R406
8200
Q401
MPS2222
R402
470
C402
0.01
CR400
+5 V DC AGC
OFF
15
C411
100
R407
10 k
A2
+9 V DC
R408
680
R410
1800
CR401
C406
120
pF
R411
2.2 M
C403
10
CR402
+14 V DC
R403
180
C404
0.01
CR403
C400
0.1
R400
5600
G(3)
AGC
Q400
MPS2222
+9 V DC
R428
7500
R401
2700
R404
56
P/O A10
P/O
J15
R427
5110
R415
47 k
RF
GAIN
3
R405
390
C401
0.1
P/O
J12
+5 V DC AGC
FAST
16

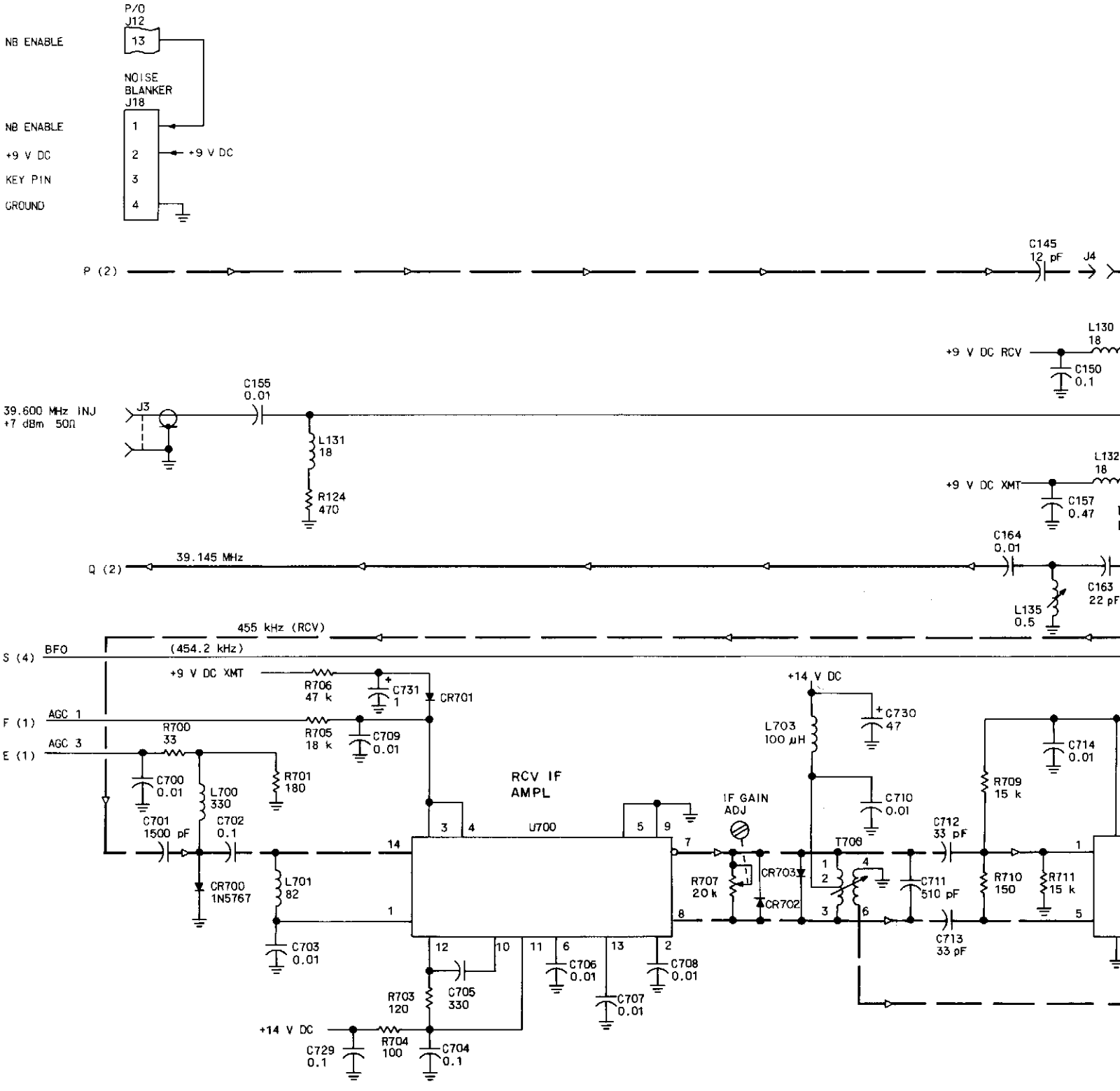


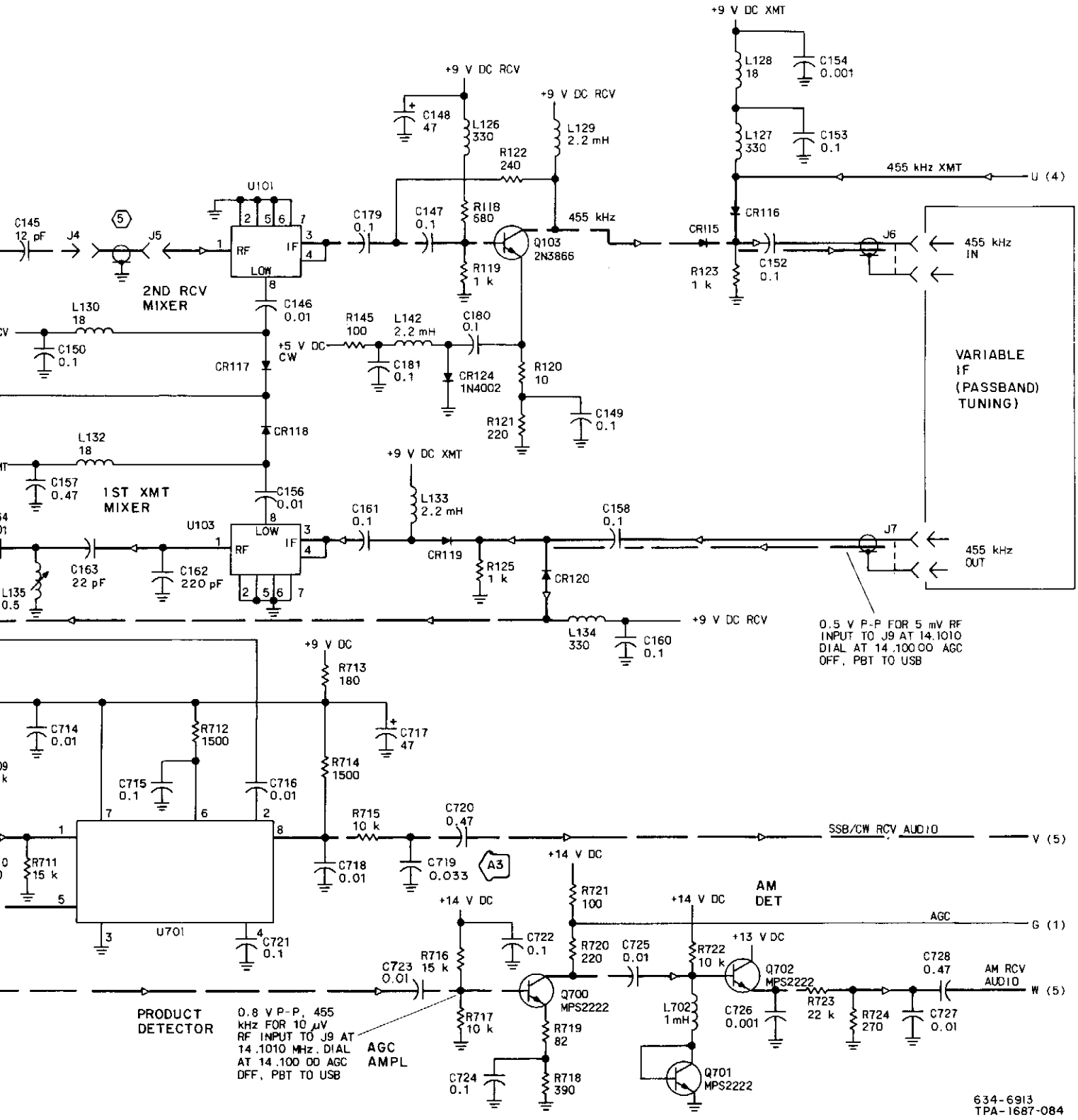
Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 1 of 8)


RECEIVER/EXCITER
D (1)
AGC 2
A (1)
39.145 MHz
+9 V DC RCV
+14 V DC
+9 V DC XMT
70 mV RF IN
CW XMT WITH
MAX CARRIER
39.145 MHz
XTAL FILTER
APPROX
14 dB GAIN
APPROX
8 dB LOSS
CARRIER
LEVEL
P/O A10
P/O
J15
R (6)
SSB
MM (6)
TUNE
ALC
(EXT AMPL)
SPARE
P/O
J16
ALC
BROAD
BAND
AMPL
B (1)

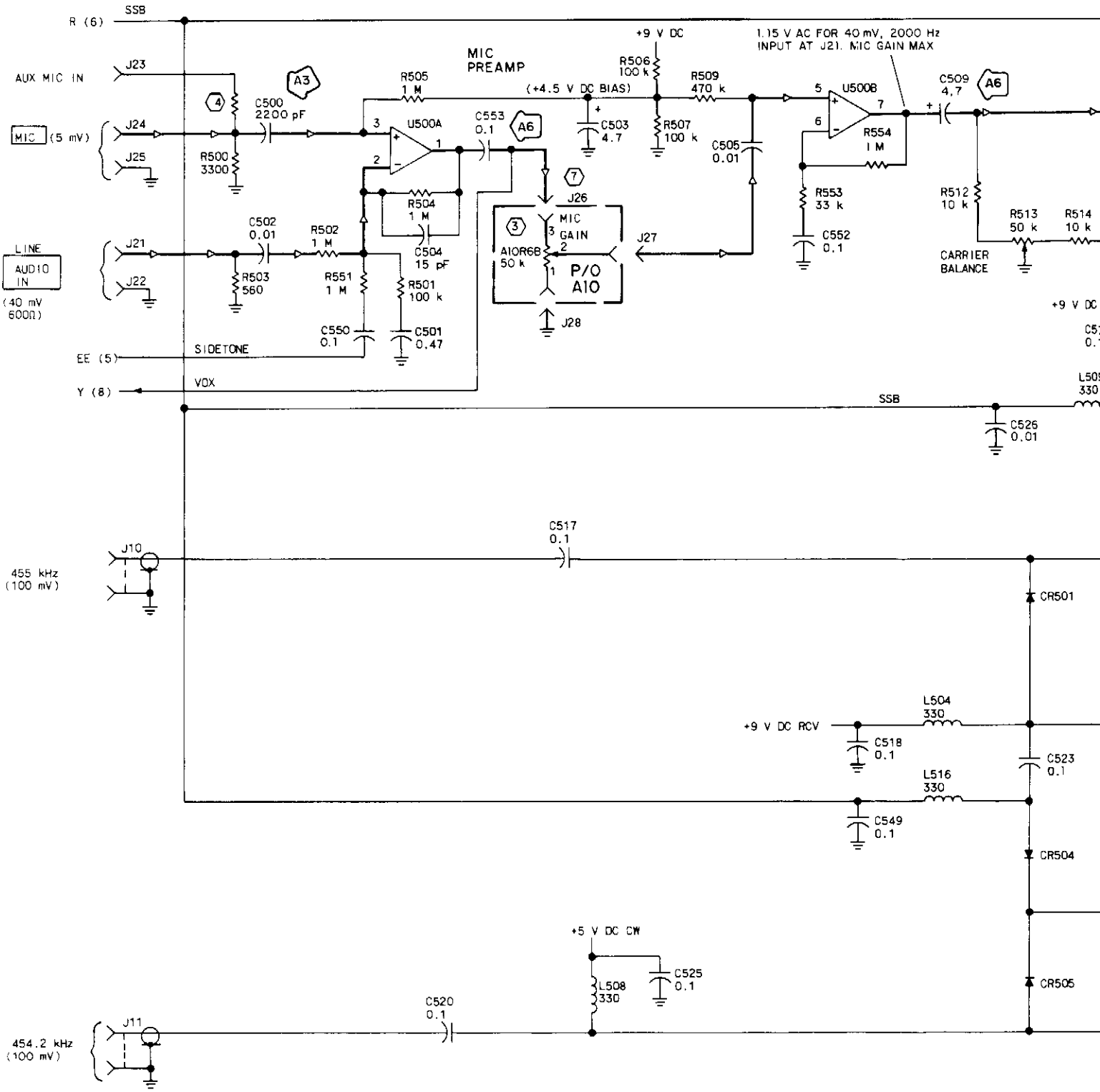


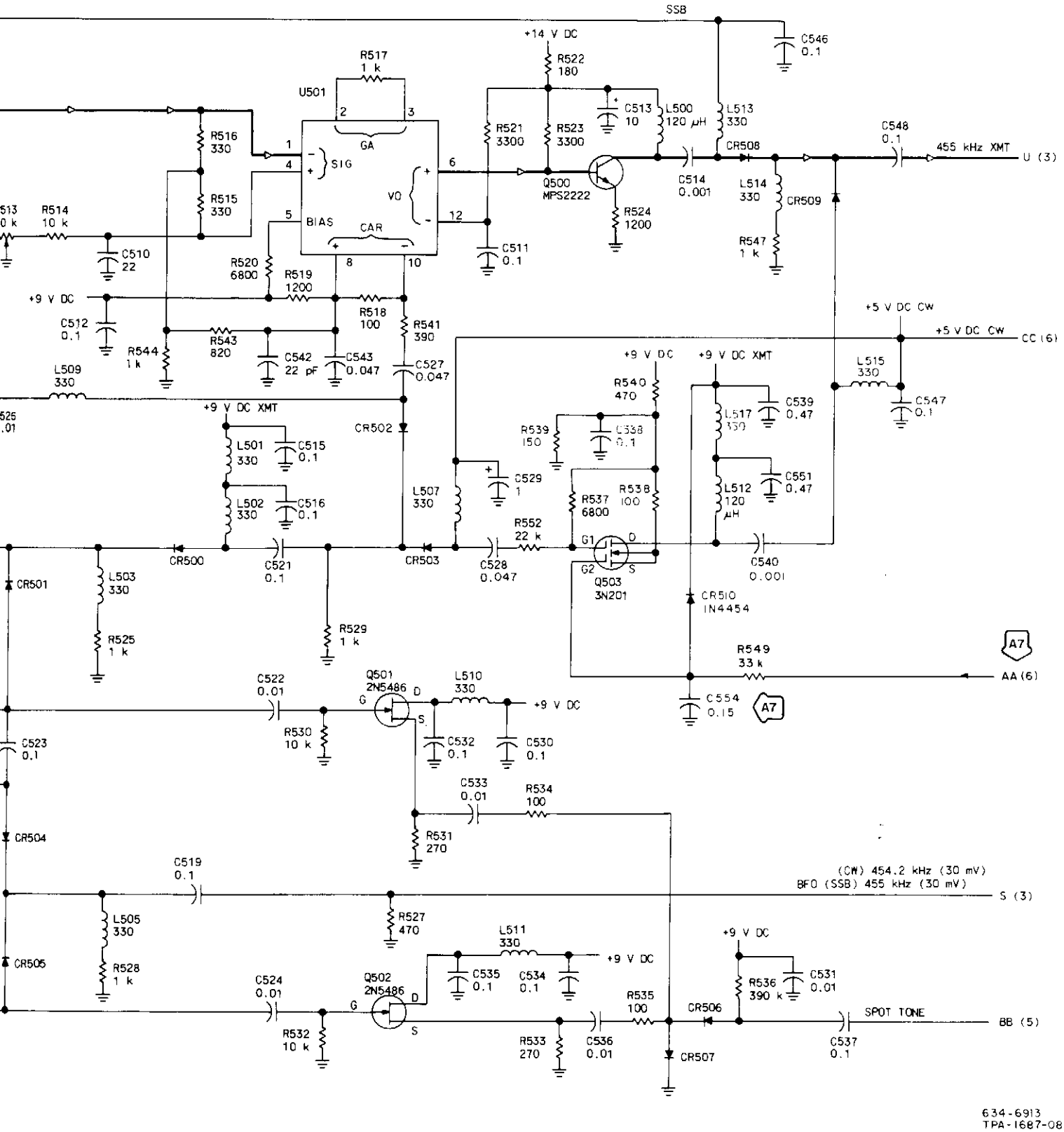
Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 2)


P/O
J12
NB ENABLE
13
NOISE
BLANKER
J18
NB ENABLE
1
+9 V DC
2
+9 V DC
KEY PIN
3
GROUND
4
P (2)
C145
12 pF
J4
+9 V DC RCV
L130
18
C150
0.1
39.600 MHz INJ
+7 dBm 50Ω
J3
C155
0.01
L131
18
R124
470
+9 V DC XMT
L132
18
C157
0.47
Q (2)
39.145 MHz
C164
0.01
C163
22 pF
L135
0.5
455 kHz (RCV)
S (4)
BFO
(454.2 kHz)
+9 V DC XMT
R706
47 k
C731
1
CR701
F (1)
AGC 1
R705
18 k
C709
0.01
E (1)
AGC 3
R700
33
C700
0.01
L700
330
R701
180
C701
1500 pF
C702
0.1
CR700
1N5767
L701
82
C703
0.01
RCV IF
AMPL
U700
14
1
3
4
5
9
7
8
12
10
11
6
13
2
C705
330
R703
120
C706
0.01
C707
0.01
C708
0.01
+14 V DC
C729
0.1
R704
100
C704
0.1
+14 V DC
L703
100 µH
C730
47
IF GAIN
ADJ
R707
20 k
CR703
CR702
C710
0.01
T709
1
2
3
4
6
C711
510 pF
C712
33 pF
C713
33 pF
C714
0.01
R709
15 k
R710
150
R711
15 k
1
5

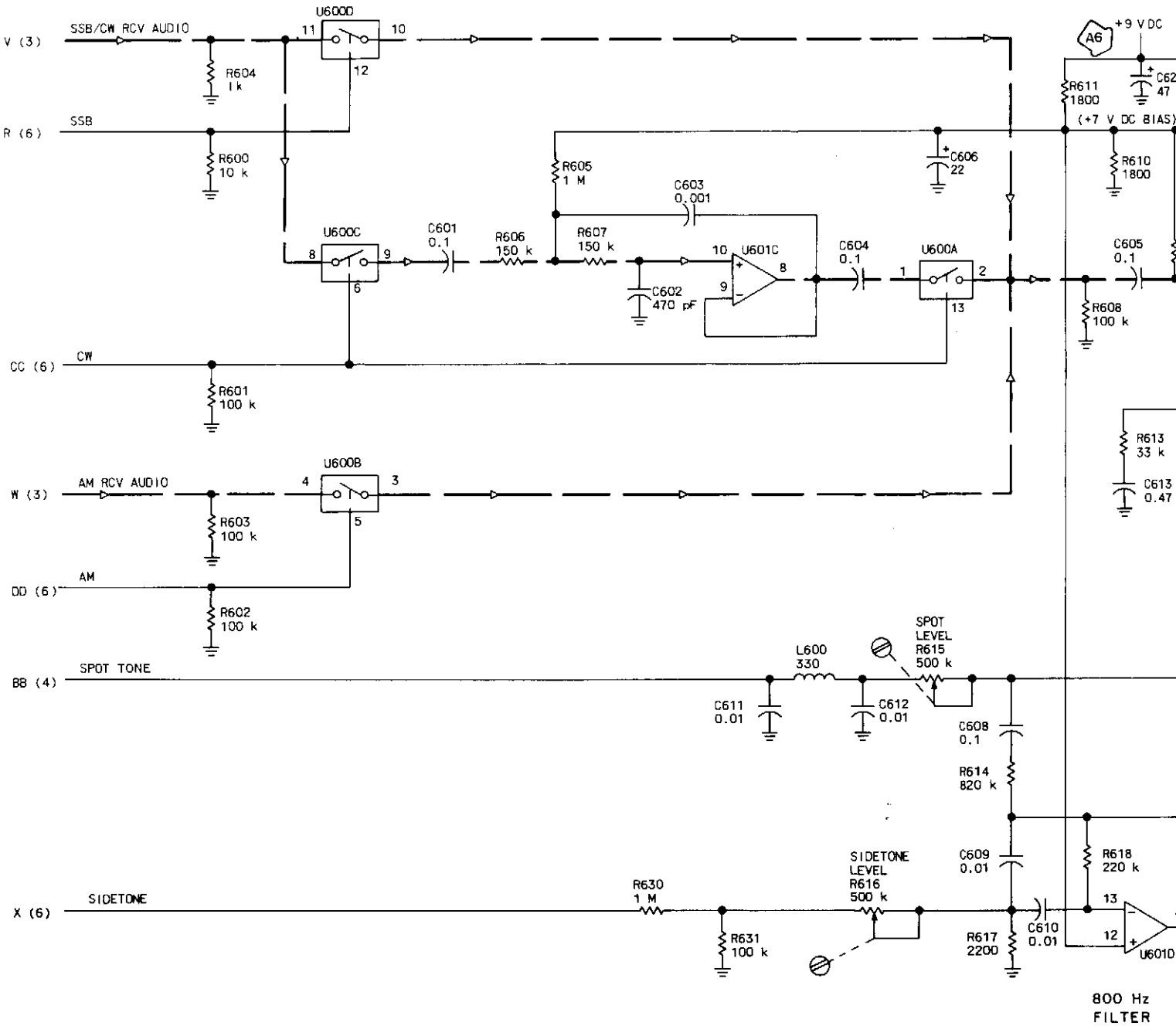


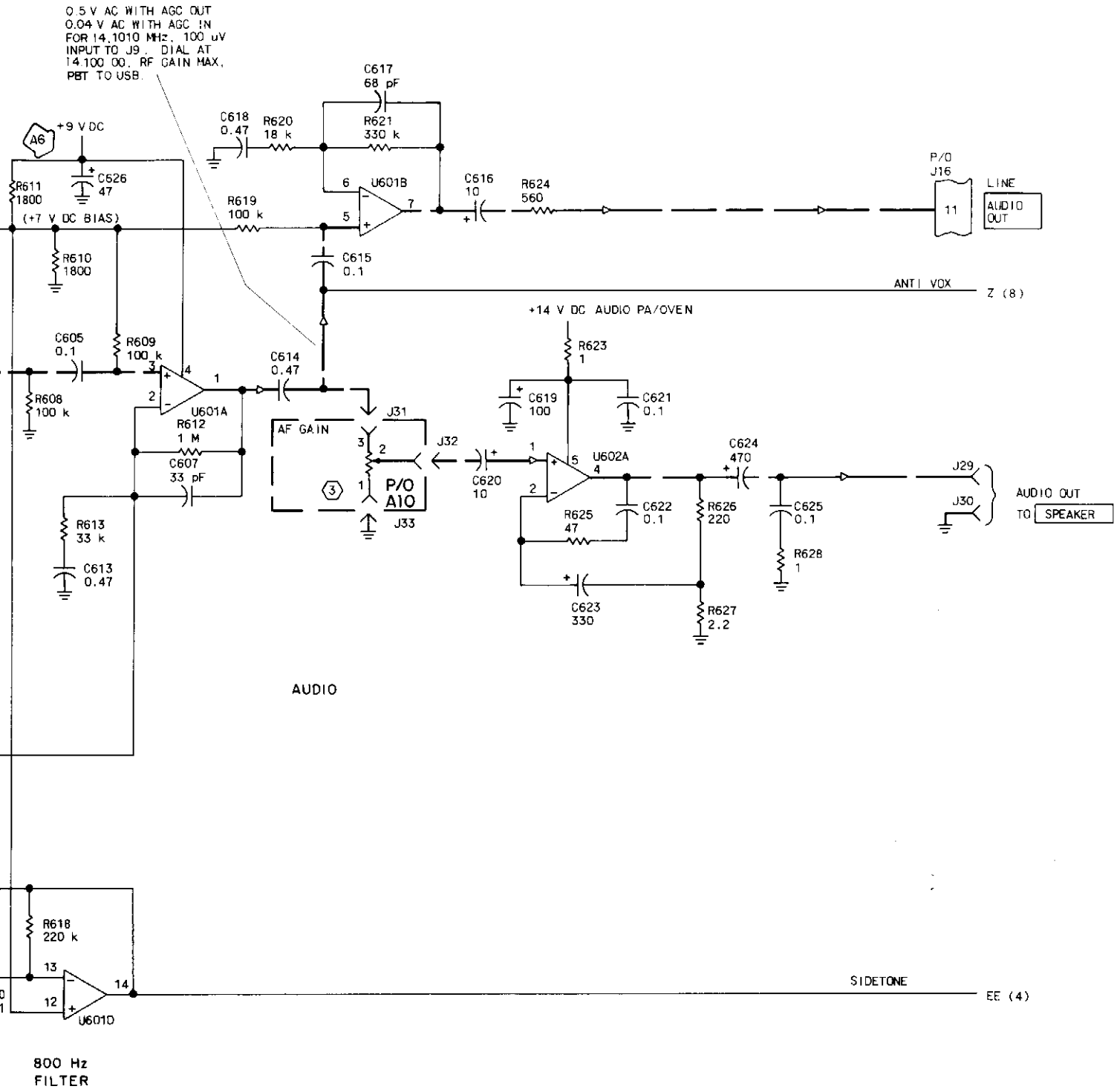
Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 3)


R (6)
SSB
AUX MIC IN
J23
MIC (5 mV)
J24
J25
R500 3300
C500 2200 pF
A3
MIC PREAMP
R505 1 M
U500A
C553 0.1
A6
+9 V DC
R506 100 k
(+4.5 V DC BIAS)
C503 4.7
R507 100 k
R509 470 k
1.15 V AC FOR 40 mV, 2000 Hz INPUT AT J21, MIC GAIN MAX
U500B
C509 4.7
C505 0.01
R554 1 M
R553 33 k
C552 0.1
R512 10 k
R513 50 k
R514 10 k
CARRIER BALANCE
R504 1 M
C504 15 pF
J26
MIC GAIN
A10R68 50 k
P/O A10
J27
J28
LINE AUDIO IN (40 mV 600Ω)
J21
J22
C502 0.01
R502 1 M
R503 560
R551 1 M
R501 100 k
C550 0.1
C501 0.47
EE (5)
SIDETONE
Y (8)
VOX
C526 0.01
J10
455 kHz (100 mV)
C517 0.1
CR501
+9 V DC RCV
L504 330
C518 0.1
C523 0.1
L516 330
C549 0.1
CR504
+5 V DC CW
L508 330
C525 0.1
CR505
C520 0.1
J11
454.2 kHz (100 mV)



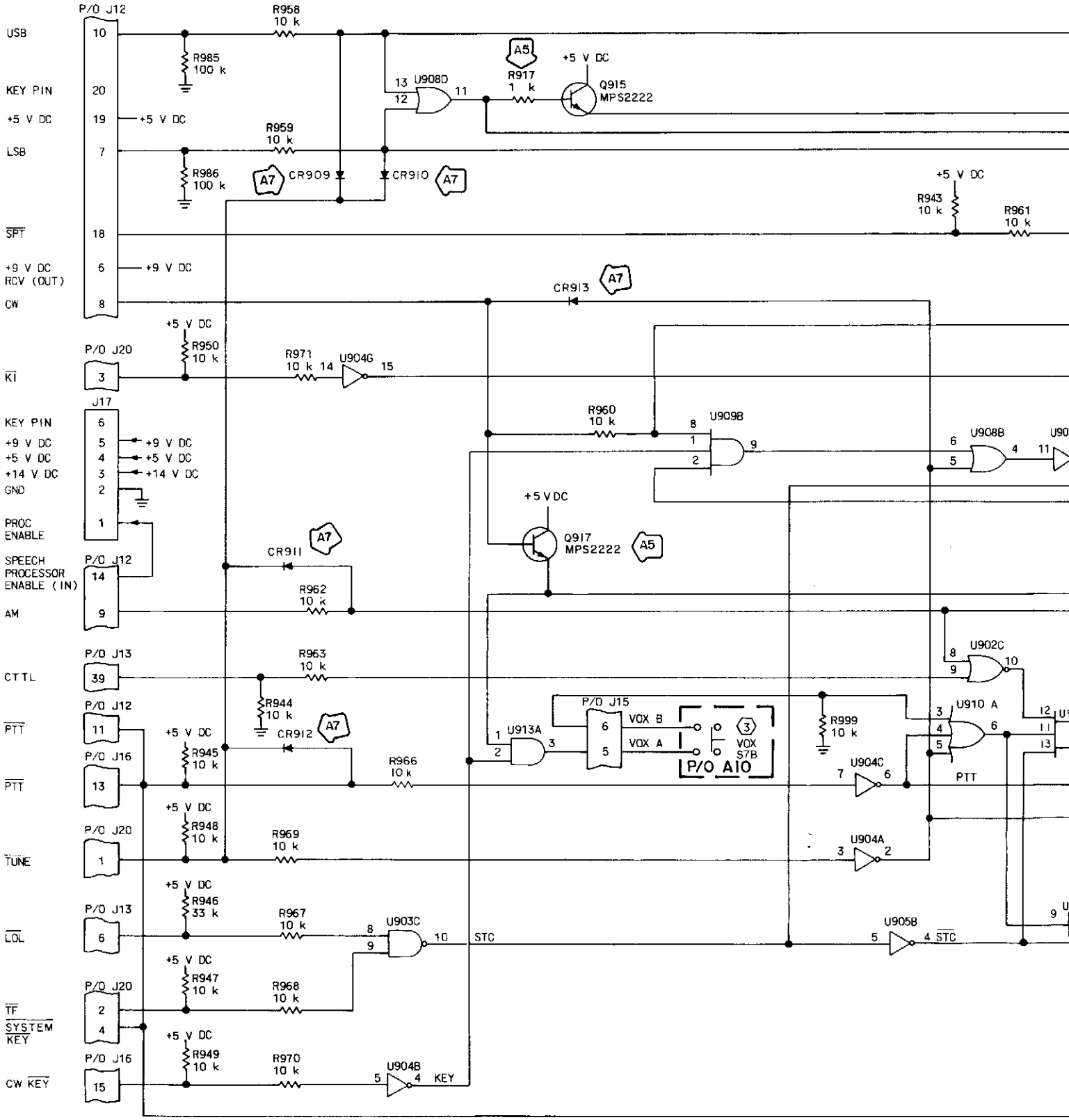
Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 4)

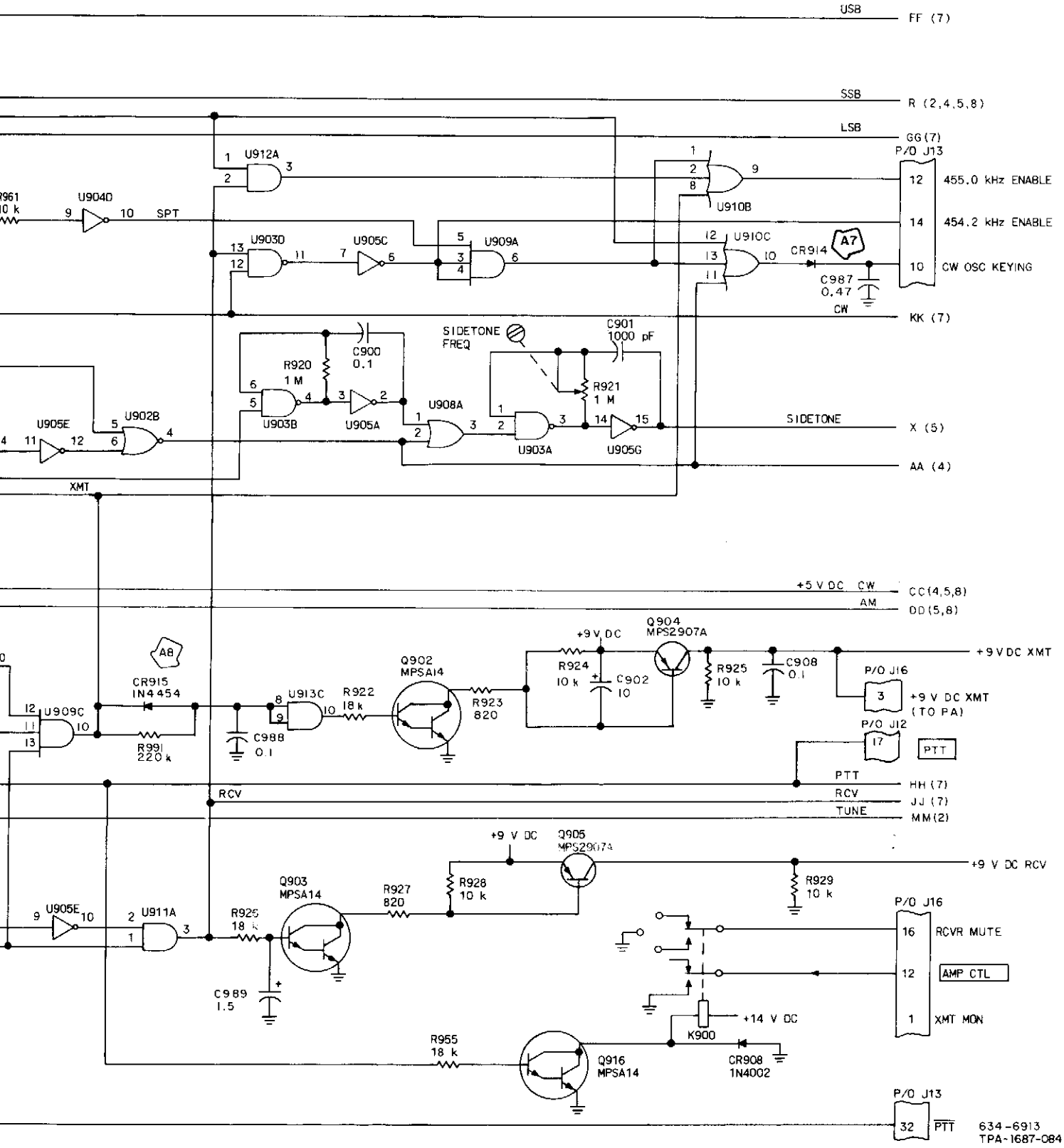

0.5 V AC
0.04 V A
FOR 14.1
INPUT TO
14.100 O
PBT TO
V (3)
SSB/CW RCV AUDIO
U600D
11
10
12
R604
1k
R (6)
SSB
R600
10 k
R605
1 M
C603
0.001
U600C
8
9
6
C601
0.1
R606
150 k
R607
150 k
10
U601C
8
9
C602
470 pF
C604
0.1
U600A
1
2
13
A6
+9 V DC
R611
1800
(+7 V DC BIAS)
C606
22
R610
1800
C605
0.1
R608
100 k
CC (6)
CW
R601
100 k
R613
33 k
C613
0.47
W (3)
AM RCV AUDIO
U600B
4
3
5
R603
100 k
DD (6)
AM
R602
100 k
BB (4)
SPOT TONE
L600
330
SPOT
LEVEL
R615
500 k
C611
0.01
C612
0.01
C608
0.1
R614
820 k
X (6)
SIDETONE
R630
1 M
SIDETONE
LEVEL
R616
500 k
C609
0.01
R618
220 k
13
12
U601D
C610
0.01
R631
100 k
R617
2200
800 Hz
FILTER



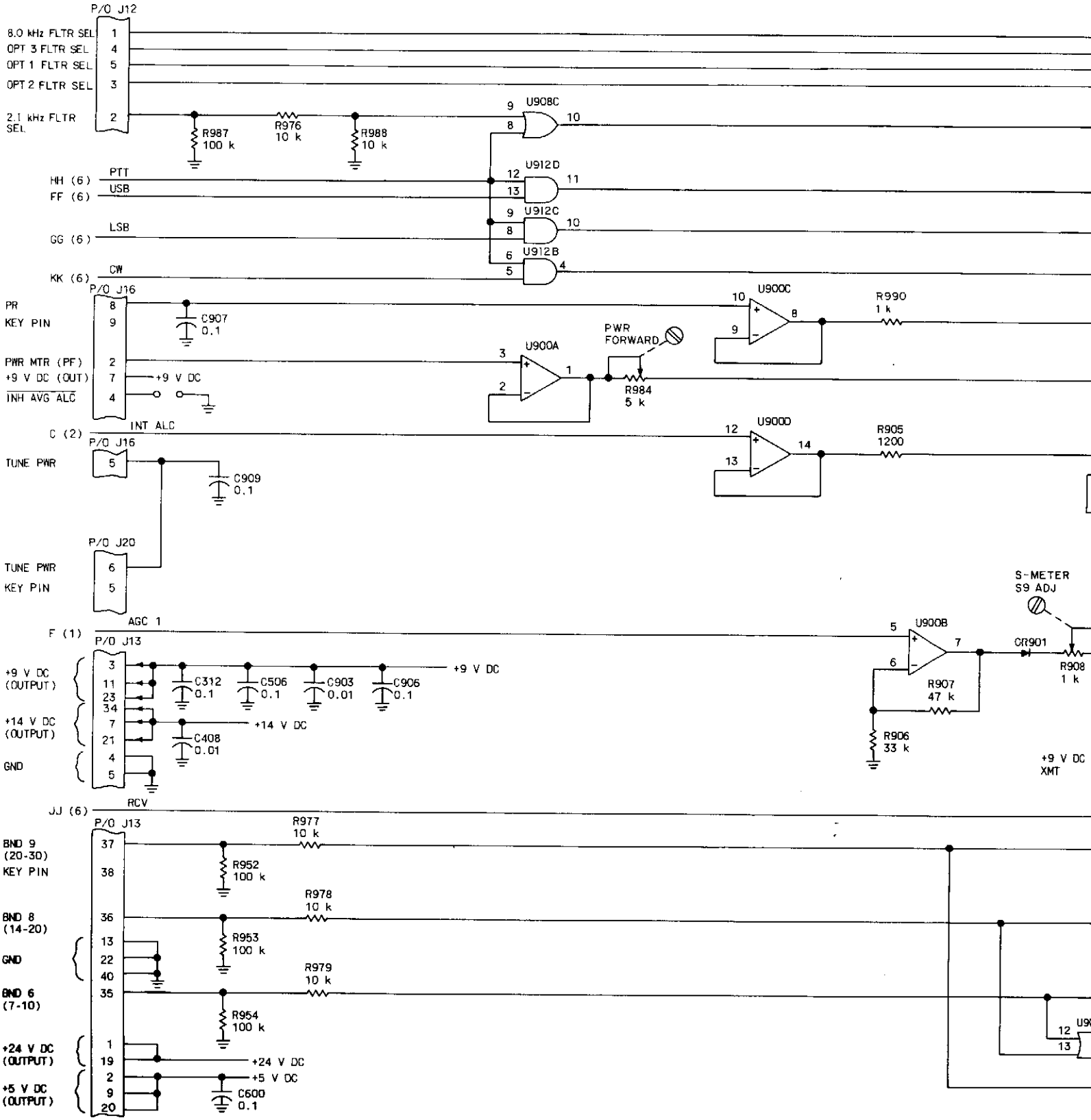
634-6913
TPA-1687-084

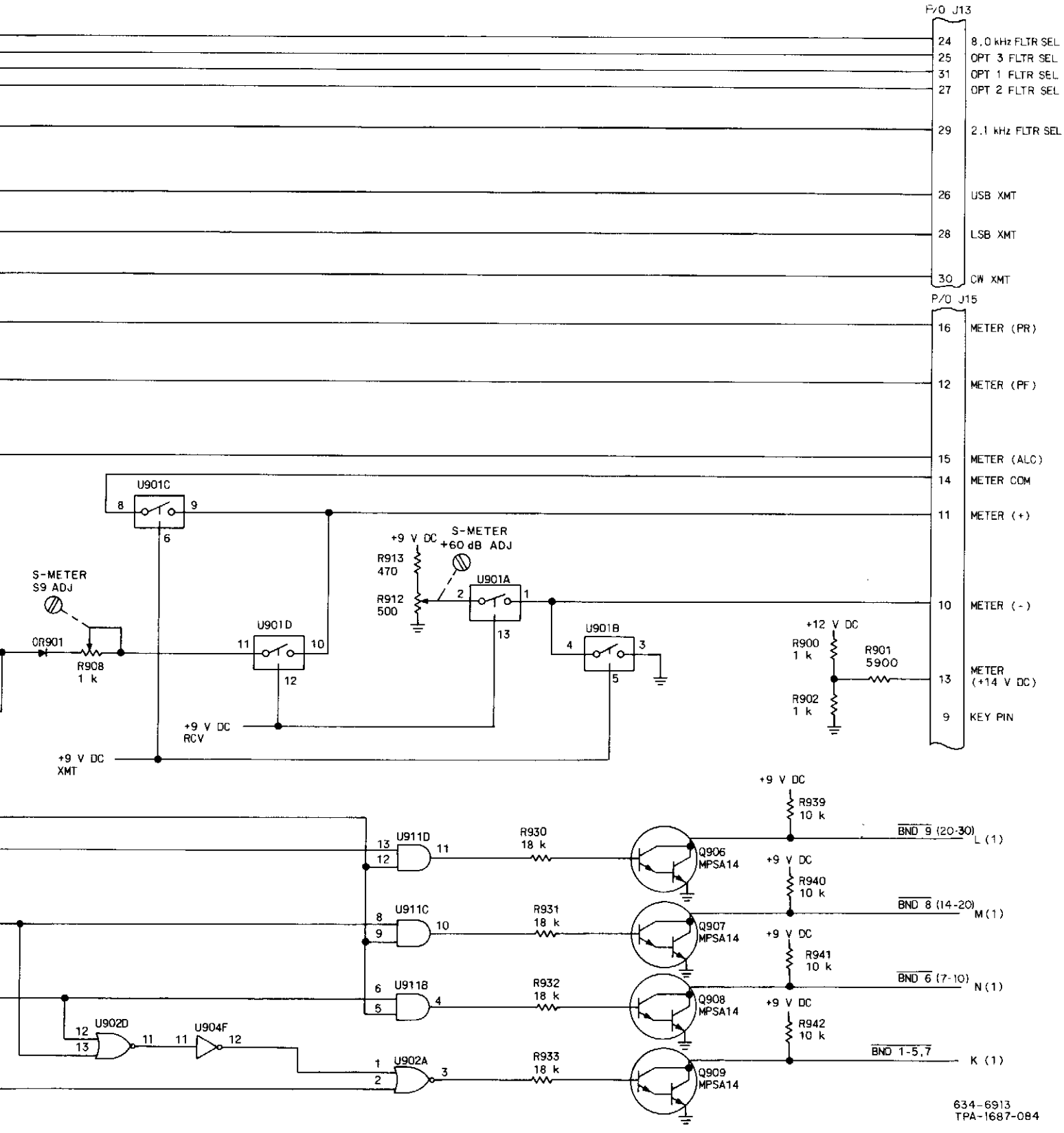
Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 5)


P/O J12
USB
10
R985
100 k
R958
10 k
A5
R917
1 k
+5 V DC
Q915
MPS2222
13 U908D
12
11
KEY PIN
20
+5 V DC
19
+5 V DC
R959
10 k
LSB
7
R986
100 k
A7
CR909
CR910
A7
+5 V DC
R943
10 k
R961
10 k
SPT
18
+9 V DC
RCV (OUT)
6
+9 V DC
CW
8
CR913
A7
+5 V DC
R950
10 k
P/O J20
KI
3
R971
10 k
14
U904G
15
J17
KEY PIN
6
+9 V DC
5
+5 V DC
4
+14 V DC
3
GND
2
PROC
ENABLE
1
R960
10 k
U909B
8
1
2
9
U908B
6
5
4
11
+5 V DC
Q917
MPS2222
A5
CR911
A7
SPEECH
PROCESSOR
ENABLE (IN)
P/O J12
14
AM
9
R962
10 k
P/O J13
CTTL
39
R963
10 k
U902C
8
9
10
P/O J12
PTT
11
R944
10 k
A7
CR912
+5 V DC
R945
10 k
P/O J15
6
VOX B
5
VOX A
3
VOX
S7B
P/O A10
1
U913A
2
3
R999
10 k
U910 A
3
4
5
6
12
11
13
P/O J16
PTT
13
R966
10 k
U904C
7
6
PTT
+5 V DC
R948
10 k
P/O J20
TUNE
1
R969
10 k
U904A
3
2
+5 V DC
R946
33 k
P/O J13
LOL
6
R967
10 k
8
9
U903C
10
STC
U905B
5
4
STC
+5 V DC
R947
10 k
P/O J20
TF
2
SYSTEM
KEY
4
R968
10 k
+5 V DC
R949
10 k
P/O J16
CW KEY
15
R970
10 k
5
U904B
4
KEY

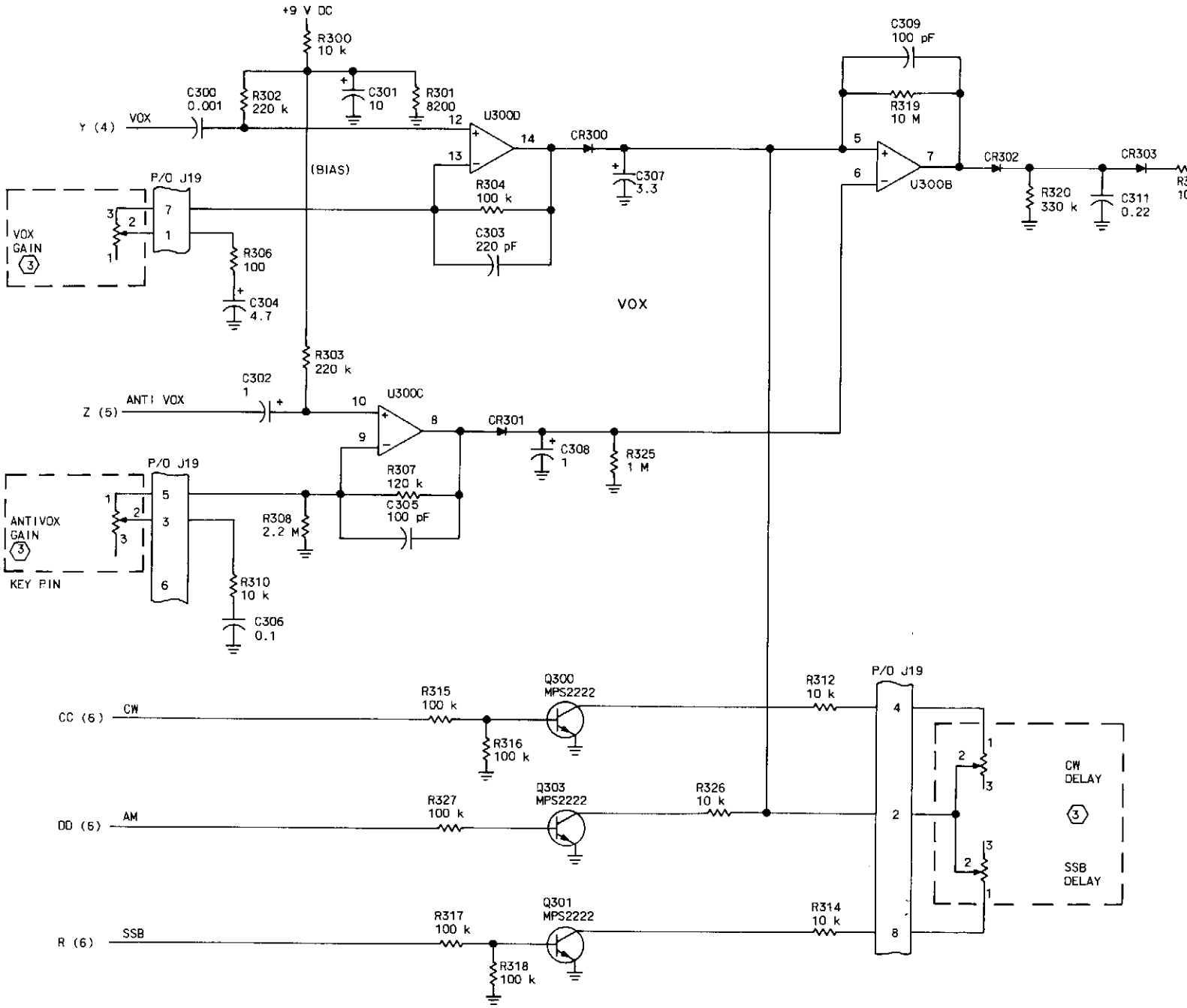


Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 6)


P/O J12
8.0 kHz FLTR SEL
OPT 3 FLTR SEL
OPT 1 FLTR SEL
OPT 2 FLTR SEL
2.1 kHz FLTR SEL
1
4
5
3
2
R987 100 k
R976 10 k
R988 10 k
U908C
9
8
10
HH (6)
FF (6)
PTT
USB
U912D
12
13
11
GG (6)
LSB
U912C
9
8
10
KK (6)
CW
U912B
6
5
4
P/O J16
PR
KEY PIN
8
9
C907 0.1
U900C
10
9
8
R990 1 k
PWR MTR (PF)
+9 V DC (OUT)
INH AVG ALC
2
7
4
+9 V DC
U900A
3
2
1
PWR FORWARD
R984 5 k
C (2)
INT ALC
U900D
12
13
14
R905 1200
P/O J16
TUNE PWR
5
C909 0.1
P/O J20
TUNE PWR
KEY PIN
6
5
S-METER S9 ADJ
F (1)
AGC 1
P/O J13
5
U900B
7
6
CR901
R908 1 k
R907 47 k
R906 33 k
+9 V DC XMT
+9 V DC (OUTPUT)
3
11
23
34
C312 0.1
C506 0.1
C903 0.01
C906 0.1
+9 V DC
+14 V DC (OUTPUT)
7
21
C408 0.01
+14 V DC
GND
4
5
JJ (6)
RCV
P/O J13
BND 9 (20-30) KEY PIN
37
38
R977 10 k
R952 100 k
BND 8 (14-20)
36
R978 10 k
R953 100 k
GND
13
22
40
BND 6 (7-10)
35
R979 10 k
R954 100 k
+24 V DC (OUTPUT)
1
19
+24 V DC
+5 V DC (OUTPUT)
2
9
20
+5 V DC
C600 0.1



Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 7)


+9 V DC
R300 10 k
C300 0.001
R302 220 k
C301 10
R301 8200
Y (4) VOX
U300D
12
13
14
CR300
(BIAS)
R304 100 k
C303 220 pF
C307 3.3
C309 100 pF
R319 10 M
5
6
7
U300B
CR302
CR303
R320 330 k
C311 0.22
P/O J19
VOX GAIN
3
2
1
7
1
R306 100
C304 4.7
VOX
R303 220 k
C302 1
Z (5) ANTI VOX
10
9
8
U300C
CR301
C308 1
R325 1 M
R307 120 k
C305 100 pF
R308 2.2 M
P/O J19
ANTIVOX GAIN
KEY PIN
5
3
6
R310 10 k
C306 0.1
CC (6) CW
R315 100 k
Q300 MPS2222
R316 100 k
R312 10 k
P/O J19
4
DD (6) AM
R327 100 k
Q303 MPS2222
R326 10 k
2
CW DELAY
SSB DELAY
R (6) SSB
R317 100 k
Q301 MPS2222
R318 100 k
R314 10 k
8

NOTES:

1. UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, INDUCTANCE VALUES ARE IN MICROHENRYS AND DIODES ARE TYPE 1N4454.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
3. RF GAIN, AF GAIN, CARRIER LEVEL, MIC GAIN, VOX AND ANTIVOX GAINS, AND CW AND SSB DELAYS ARE FRONT PANEL CONTROLS.
4. SPARE RESISTOR.
5. J4 AND J5 ARE JUMPERED TOGETHER IF NOISE BLANKER IS NOT INSTALLED.
6. TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PART LIST FOR REPLACEMENT PARTS.
7. OPTIONAL SPEECH PROCESSOR CONNECTS BETWEEN J26 AND R508 (MIC GAIN POT)
8.
9. THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.
10. TEST VOLTAGES AND WAVEFORMS SHOWN ARE NOMINAL.

MICROCIRCUIT INFORMATION

REF DES	COMMON DEVICE	PWR (V DC) +14	+9	+5	GND	SPARES
U100	SRA-1H					
U101	SBL-1					
U103	SBL-1					
U300	TL0 84		4		11	
U400	TL0 84	4			11	D
U500	TL0 84		4		11	
U501	1496				14	
U600	4066			14	7	
U601	TL0 84				11	
U602	CA2002				3	
U700	µA757	11			5	
U701	DA3028					
U900	324		4		11	
U901	4066		14		7	
U902	4001			14	7	
U903	4011			14	7	
U904	4049			1	8	
U905	4049			1	8	F
U908	4071			14	7	
U909	4073			14	7	
U910	4075			14	7	
U911	4081			14	7	
U912	4081			14	7	
U913	4081			14	7	B,C,D

634-6913
TPA-1687-084

Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 8)

Passband Tuning (638-6912-XXX) and Passband Tuning Option (638-6914-002)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

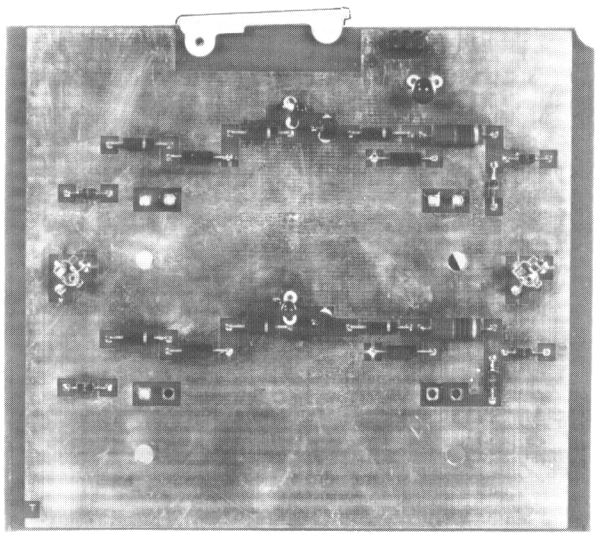
523-0771742-001211
1 August 1982

1. DESCRIPTION

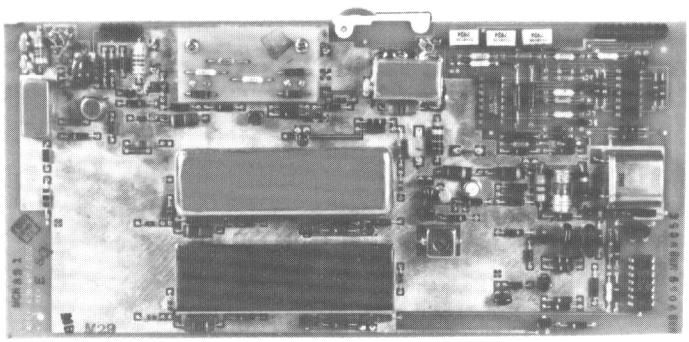
Passband Tuning 638-6912-XXX has three positions for three filters, FL1 through FL3, and Passband Tuning Option 638-6914-002 has positions for two filters, FL4 and FL5. The circuit cards are shown in figure 1. Table 1 lists the filter configuration for each circuit card dash number.

2. PRINCIPLES OF OPERATION

Passband tuning (PBT) adjusts the position of the 455-kHz if signal within the passband of the selected bandwidth filter. This variable adjustment operates in the receive mode only. In circuit cards 638-6912-002 and -003, a preset-voltage input is enabled in the transmit mode. This voltage automatically positions



PASS BAND TUNING OPTION
(WITH NO FILTERS INSTALLED)



PASS BAND TUNING
(WITH SUBASSEMBLY A1 AND
OPTIONAL FL2 INSTALLED)

TPA-5272-017

Passband Tuning and Passband Tuning Option Circuit Cards
Figure 1

Table 1. Circuit Card Configuration.

	638-6912-XXX		638-6914-002
	-002	-003	
FL1	2.1 kHz	3.0 kHz	
FL2	OPT	OPT	
FL3	NOTE 2	NOTE 2	
FL4			OPT
FL5			OPT

NOTES:

1. Optional filters are:

   AC-3810 (360 Hz) AC-3812 (1.7 kHz) AC-3814 (3 kHz)
   AC-3811 (140 Hz) AC-3813 (6 kHz)

2. FL3 as supplied is subassembly A1 (642-3578-001) but may be replaced with optional AC-3813.

the transmit if signal to the proper location within the filter passband for the USB, LSB, or CW mode of operation.

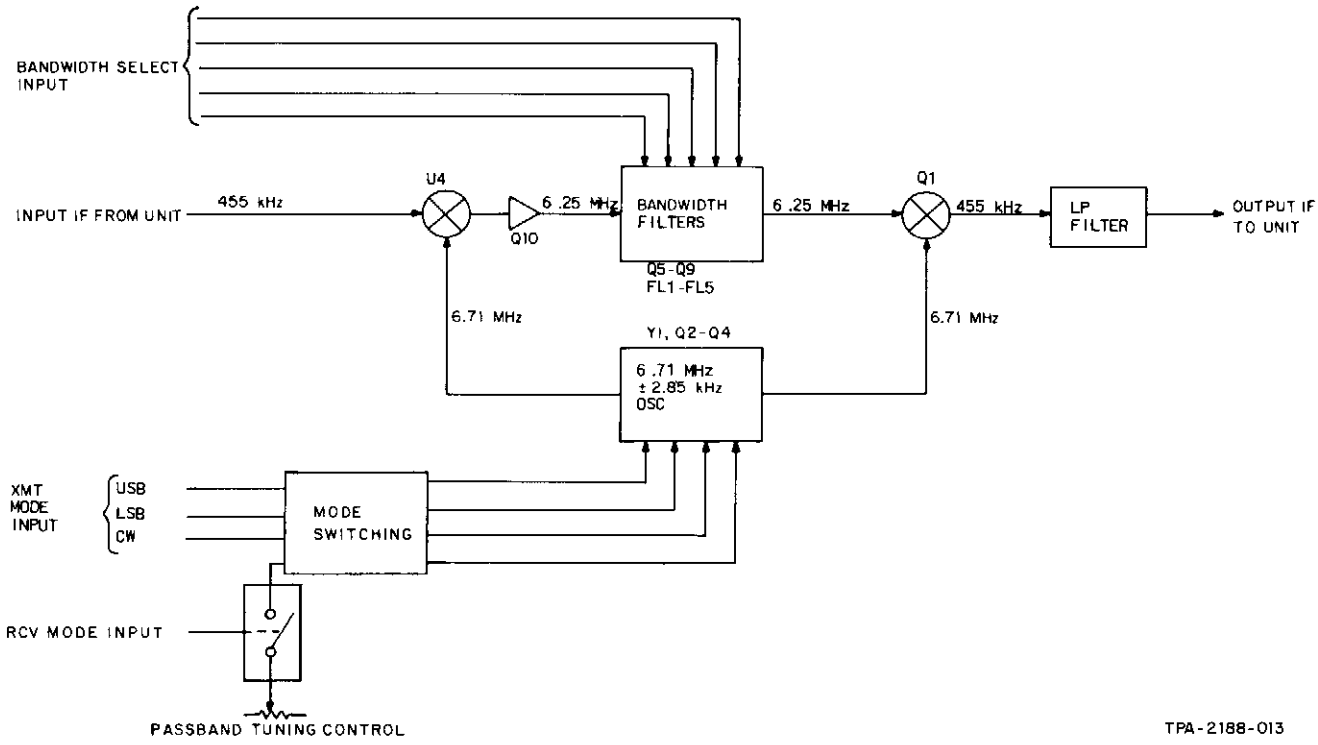
In all circuit cards, the 455-kHz receive if signal is mixed with the PBT oscillator output to develop a PBT if signal. This signal, with a controlled frequency shift as described in the following paragraphs, is applied to the selected bandwidth filter. The filter output, after passing all or part of the signal, is again mixed with the PBT oscillator output. The resulting second mixer output signal is at the 455-kHz receive if and is coupled to the next receiver or exciter stage of the unit. Figure 2 is a block diagram of the circuit. Refer to the schematic diagram, figure 6, for complete circuit details.

The 455-kHz receive if and the 6.71-MHz PBT oscillator signals are mixed by U4 to produce a PBT if of 6.255 MHz. (These frequencies are nominal values, as explained in a following paragraph.) Amplifier Q10 increases the PBT if signal level to compensate for bandwidth filter insertion loss. The bandwidth switch applies +5 V to the base of Q5, Q6, Q7, Q8, or Q9, depending on the selected bandwidth. With the applicable transistor turned on, a switching diode pair in the collector circuit is forward biased. This permits the PBT if signal to be applied to the related bandwidth filter. (Some filters are optional and may not be installed. Unless installed, the if path at the filter is an open circuit.) The position of the if signal within the filter passband is determined by the frequency of the PBT oscillator and the 455-kHz receive if.

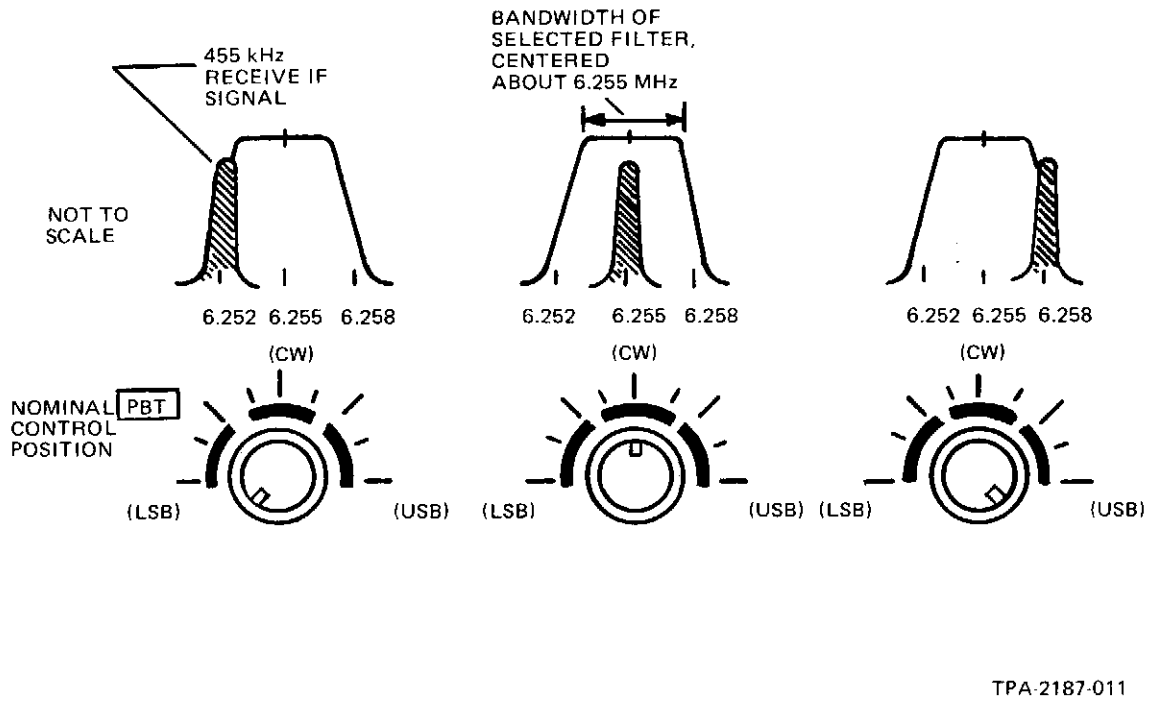
Figure 3 shows how varying the PBT oscillator frequency moves the PBT if signal to different positions in the passband of the selected filter. Note that the front-panel PBT control must be set to left of center for received LSB signals to be centered within the passband. Similarly, the control must be set to the center for CW/AM signals, and to the right of center for USB signals. If the control is not positioned so the proper PBT if is developed, part or all of the signal may be outside the filter passband.

The PBT oscillator circuit is Q2, Y1, CR13, and associated components. Capacitor C16 is adjusted to set the oscillator output to 6.7100 MHz when the transceiver is in the receive mode and the PBT control is in midposition. In the counterclockwise position (low end of voltage range), the oscillator output is 6.7070 MHz. The clockwise position produces 6.7127 MHz. Varactor diode CR13 causes the oscillator frequency to vary around 6.71 MHz as the dc voltage on CR13 is varied.

The voltage applied to CR13 with respect to the PBT control position is shaped to counter the varactor diode characteristic curve. The voltage curve is controlled by the points at which diodes CR11 and CR12 begin conducting. When the voltage increases above



Passband Tuning, Block Diagram
Figure 2



Passband Tuning Circuit Signal Positioning in Passband
Figure 3

approximately +11.3 V, CR11 is reverse-biased. This switches R30 and R33 out of the circuit. Similarly, at approximately +8.6 V, CR12 switches R39 and R49 out of the circuit. This produces a linear change in frequency for a linear change in the PBT control rotation. Amplifier Q3, driven by the PBT oscillator, operates into the saturation region. This develops a square-wave output to second mixer Q1 and buffer Q4. The Q4 output is the PBT oscillator input to the first mixer U4.

The 6.2-MHz PBT if is input to gate 1 of second mixer Q1. The 6.7-MHz oscillator output is applied to gate 2. The mixing function produces the 455-kHz output that is returned to the if signal path in the unit.

The second mixer also amplifies the output 455-kHz receive if signal. Potentiometer R65 is adjusted to produce approximately 9.5 dB of gain from the amplifier. A low-pass filter, C53/L6/C30/L16/C40/L17/C41/L18, attenuates harmonics greater than the 455-kHz if signal. The higher frequency harmonics may be present due to the oscillator square-wave output.

In the passband tuning circuit cards used in receiver-exciter units, a +5-V input from the mode switch during transmit causes U3A, U3B, or U3C to turn on switch U1C, U1B, or U1A, respectively. The enabled switch applies a fixed voltage (set by R28, R31, or R34) to varactor diode CR13. This causes the 6.71-MHz oscillator output to be 6.7115 MHz in USB, 6.7100 MHz in CW, and 6.7085 in LSB. In receive, U3D enables switch U1D. This permits the varactor diode voltage to be varied by the PBT control.

3. TESTING/TROUBLESHOOTING PROCEDURES

A performance test for the passband tuning and passband tuning option is given in table 2. In addition to the required performance criteria, troubleshooting comments are given.

It is assumed that the repair technician is trained in solid-state circuit troubleshooting and repair techniques, and is familiar with the test equipment to be used. Step-by-step operating procedures may not be given in all tests and not all possible troubleshooting information can be listed.

The tests in table 2 must be performed in sequence.

Testing and troubleshooting of the passband tuning and passband tuning option requires the passband tuning and passband tuning option be installed in the transceiver.

3.1 Test Equipment Required

Table 1 lists the equipment required to perform the tests. A suggested type is given; however, that specific equipment is not required. Any that meets or exceeds the indicated minimum specifications is acceptable for use.

3.2 Performance Test

The following test procedures measure the performance of the passband tuning assembly. After being

Table 2. Test Equipment Required.

ITEM	USED FOR	SUGGESTED TYPE	MINIMUM SPECIFICATIONS
Rf load (not required for 638-6912-004)	Terminating transmitter rf output when checking PBT filter selection	Bird 8135	150 W, 50 ohms, 2 to 30 MHz
Dc voltmeter	Measuring voltage regulator output	Fluke 8000A	18 ±1 V, 5% accuracy
Frequency counter	Measuring oscillator frequency	Fluke 1910A	6.6 to 6.8 MHz, 2-Hz accuracy
Rf voltmeter with 50-ohm adapter	Measuring mixer output level	Boonton 92C with 50-ohm adapter	-30 to +10 dB mW
Signal generator	Injecting 455-kHz signal into circuit	Hewlett-Packard 8640B	455 ±3 kHz, 1- to 1000-μV output

repaired, repeat the numbered test where repair was performed to verify that no further malfunctions exist.

3.2.1 Preliminary Setup

Be certain no power is applied to the equipment until instructed to do so in the procedures. Do not connect power with power switches turned on.

Connect the equipment as instructed in the procedures for each test.

3.2.2 Test Procedures

Perform the tests as given in table 2.

Caution

Damage will occur if the center conductor of either coax cable interconnecting the passband tuning circuit card and passband tuning option card shorts to ground. Be sure to isolate these cables from ground if they are disconnected from the passband tuning option card and primary power is applied.

Table 3. Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	Tune unit to 3.55 MHz. On receiver-exciter units, connect dummy load to transceiver rf output connector. Set MIC/CARRIER to max ccw position. *Note* References in the following test procedure are to passband tuning circuit card.		
2. +18-V regulator	Measure dc voltage at junction of R51/R52.	+18.0 ±0.5 V	Check for +28-V input at J1-3 or U2-11. Check U2, R50-R53. Check for excessive load on +18-V output.
3. Oscillator frequency	a. Connect frequency counter to Q4 emitter.		
	b. Set PBT control to center position.		
	c. With unit in receive, measure PBT oscillator frequency.	6.71 MHz ±10 Hz	Adjust C16 for correct frequency. Check U3D, U1D, CR13, and Q2-Q4.
	d. Adjust PBT control to maximum ccw position. Measure frequency at Q4 emitter.	6.707 500 MHz ±200 Hz	Check R37, R38, R54, R55, and front-panel PBT potentiometer.
	e. Adjust PBT control to maximum cw position. Measure frequency. *Note* Steps f through m apply to receiver-exciter units only.	6.712 700 MHz ±300 Hz	Check R37, R38, R54, R55, and front-panel PBT potentiometer.

Table 3. Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	f. Set MODE switch to USB. Set PBT control to center position to obtain 6.71 MHz ±10 Hz.		
	g. Depress MOX switch to key transmitter.		
	h. Measure frequency at Q4 emitter.	6.711 500 MHz ±10 Hz	Adjust R28 for correct frequency. Check U3A, R27-R34, and R36.
	i. Release MOX switch. Set MODE to LSB.		
	j. Key transmitter and measure frequency at Q4 emitter.	6.708 500 MHz ±10 Hz	Adjust R34 for correct frequency. Check U3A, R27-R34, and R36.
	k. Unkey transmitter and set MODE to CW.		
	l. Key transmitter and measure frequency at Q4 emitter.	6.710 000 MHz ±10 Hz	Adjust R31 for correct frequency. Check U3B, R27-R34, and R36.
	m. Unkey transmitter.		
4. Second mixer adjustments	a. Set PBT control to midposition.		
	b. Connect J6 to rf voltmeter through 50-ohm adapter.		
	c. Connect signal generator output to J3. Adjust signal generator for 1000-μV, 455-kHz output.		
	d. With nonmetallic alignment tool, slightly adjust L4 slug about current setting while observing rf voltage.	L4 set for max rf output from J6	Adjust L4 as required. Check Q1 and output filter.
	e. Connect rf voltmeter through high-impedance probe to C1/L1/J3 junction. Adjust signal generator input to J3 for -30-dB mW signal as measured by rf voltmeter.		
	f. Measure rf output (through 50-ohm adapter) at J6.	9.5 ±2.5 dB	Adjust R65 as required. Check Q1, U4, Q10, and FL1.
5. Gain	With signal generator input set for -30-dB signal at C1, measure rf signal level at J6, through 50-ohm adapter, at each BW switch position for which a filter is installed.	9.5 ±2.5 dB	Check applicable filter.

4. REPAIR

Repair of the passband tuning and passband tuning option is accomplished using standard maintenance and circuit card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

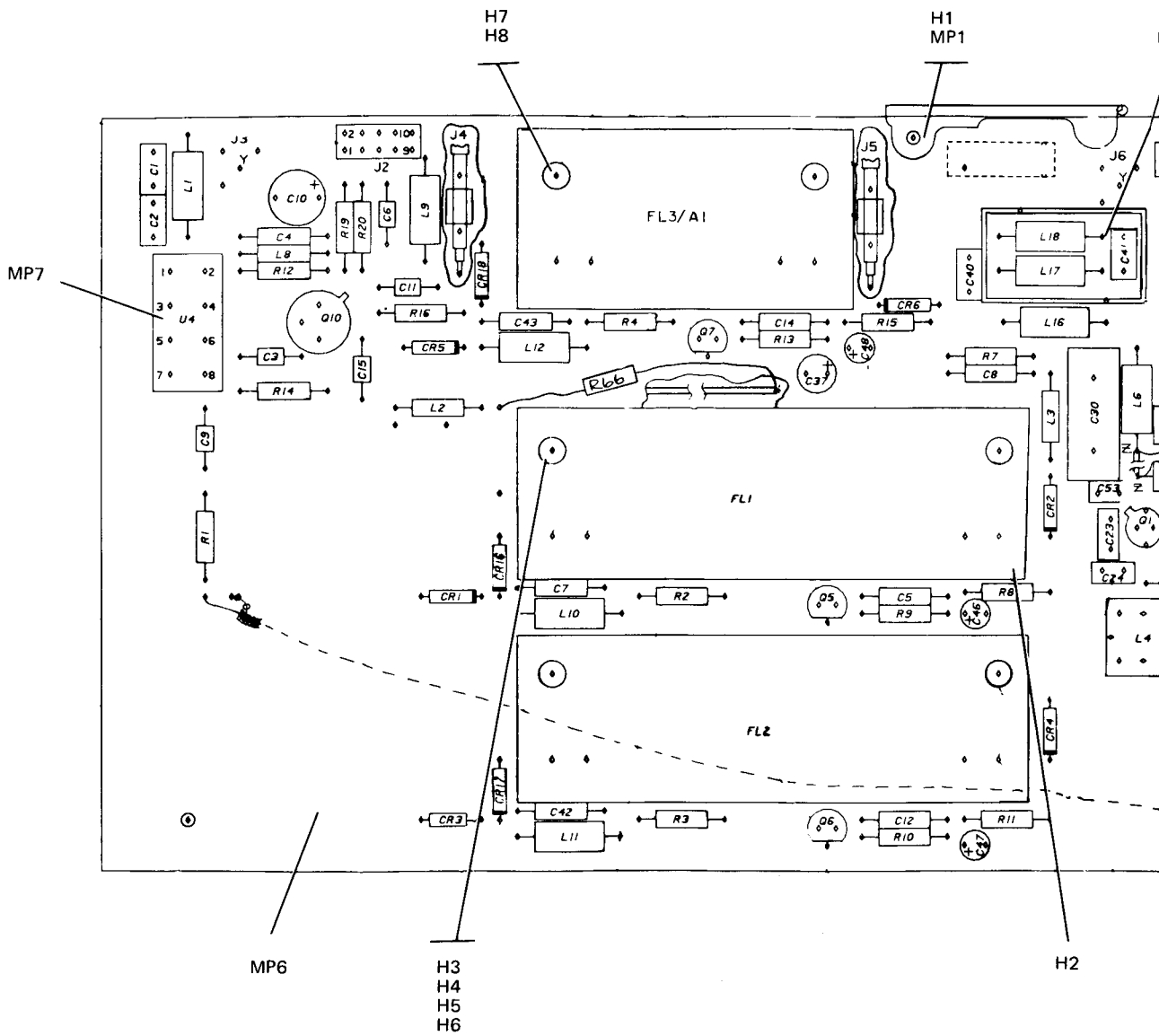
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00136	MCCOY ELECTRONICS CO WATTS AND CHESTNUT ST MT HOLLY SPRINGS PA 17065
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
00853	SANGAMO WESTON INC SANGAMO CAPACITOR DIV SANGAMO RD P O BOX 128 PICKENS SC 29671
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75265
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
05375	VARI-L CO INC 11101 EAST 51ST AVE DENVER CO 80239
08289	BLINN DELBERT CO INC THE 1678 E MISSION BLVD P O BOX 2007 POMONA CA 91766
12954	SIEMENS CORP COMPONENTS GROUP 8700 E THOMAS RD P O BOX 1390 SCOTTSDALE AZ 85252
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
18741	KILOVAC CORP P O BOX 4422 SANTA BARBARA CA 93103
18796	ERIE TECHNOLOGICAL PRODUCTS INC STATE COLLEGE DIV 1900 W COLLEGE AVE STATE COLLEGE PA 16801
19080	ROBISON ELECTRONICS INC 3580 SACRAMENTO DR P O BOX Y SAN LUIS OBISPO CA 93406
20462	PREM ENTERPRISES INC 3519 N CHAPEL HILL MC HENRY IL 60050
25120	PIEZO TECHNOLOGY INC 2525 SHADER RD P O BOX 7859 ORLANDO FL 32854
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
49956	RAYTHEON CO EXECUTIVE OFFICES 141 SPRING ST LEXINGTON MA 02173
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
72982	ERIE TECHNOLOGICAL PRODUCTS INC 645 W 11TH ST ERIE PA 16512
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV 2500 HARBOR BLVD FULLERTON CA 92634
73899	JFD ELECTRONICS COMPONENTS CORP 112 MOTT ST OCEANSIDE NY 11572
77250	ALLIED PRODUCTS CORP PHEOLL MFG CO DIV 5700 W ROOSEVELT RD CHICAGO IL 60650
79807	WROUGHT WASHER MFG INC 2100 S BAY ST MILWAUKEE WI 53207
80294	BOURNS INSTRUMENTS INC 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATIONS
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
96214	TEXAS INSTRUMENTS INC EQUIPMENT GROUP 13500 N CENTRAL EXPY P O BOX 226015 DALLAS TX 75266
96906	MILITARY STANDARD
99378	ATLEE CORP 8 GILL ST WOBURN MA 01801

5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Passband Tuning	638-6912-002	REV N
Passband Tuning	638-6912-003	REV N
Circuit Card Assembly	642-3578-001	REV B
Passband Tuning Option	638-6914-002	REV D


H7
H8
H1
MP1
MP7
MP6
H3
H4
H5
H6
H2
FL3/A1
FL1
FL2
J1
J2
J3
J4
J5
J6
U4
Q10
Q7
Q5
Q6
R66
L1
L2
L3
L4
L6
L8
L9
L10
L11
L12
L16
L17
L18
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C14
C15
C30
C37
C40
C41
C42
C43
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
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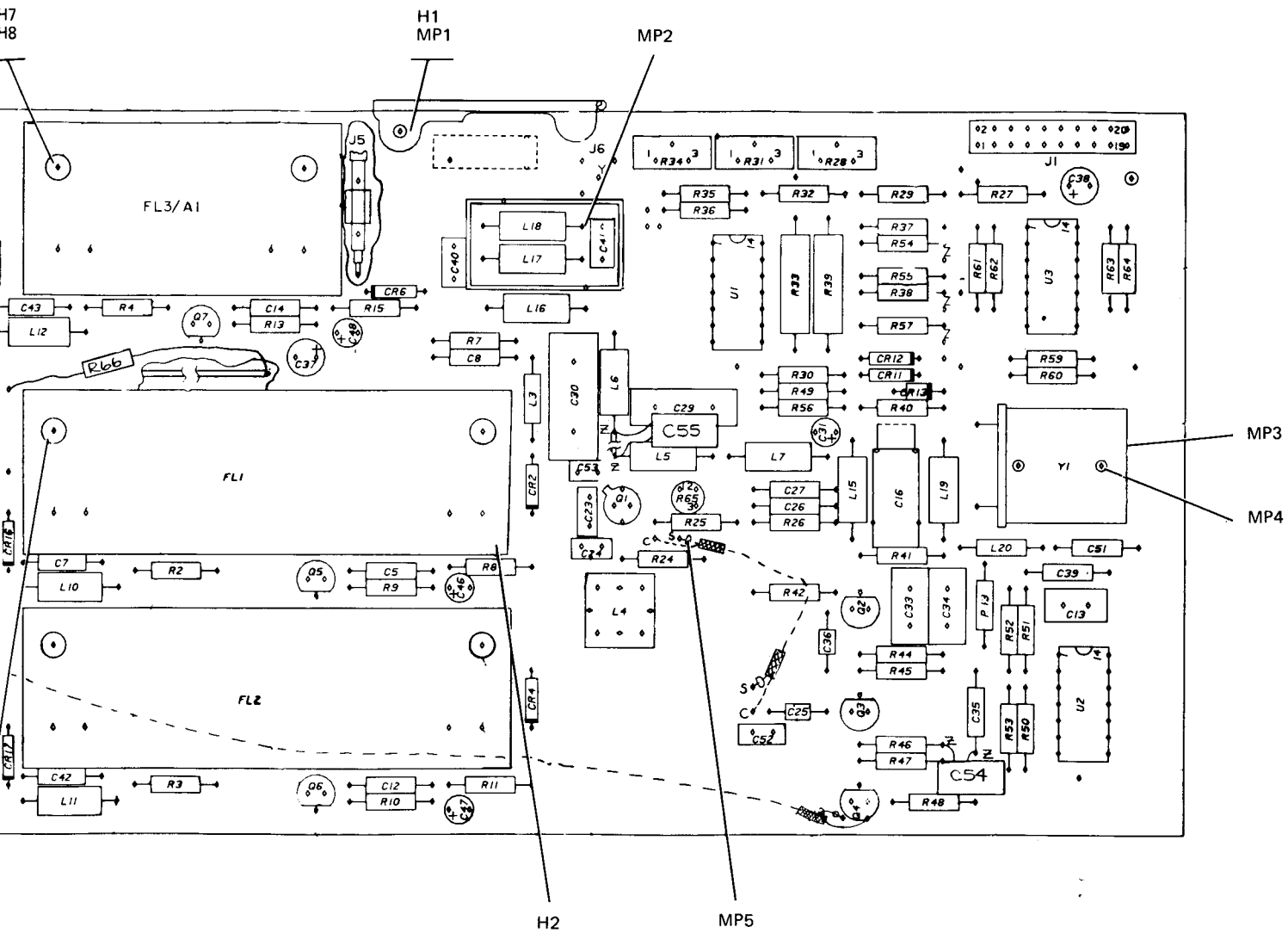
R15
R16
R19
R20
CR1
CR2
CR3
CR4
CR5
CR6
CR18



TPA-5701-018

Passband Tuning, Parts Location
Figure 4 (Sheet 1 of 2)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	PASS BAND TUNING	638-6912-002			638-6912-002
	PASS BAND TUNING	638-6912-003			638-6912-003
	CIRCUIT CARD ASSEMBLY	642-3578-001			
CR1-CR6	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR7-CR10	NOT USED				
CR11, CR12	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR13	SEMICOND DEVICE	922-6131-020		12954	BB109-6131-020
CR14, CR15	NOT USED				
CR16-CR18	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1,C2	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100C0G332K
C3	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C4,C5	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C6	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C7,C8	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C9	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C10	CAPACITOR,FXD TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C11	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C12	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C13	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-3879-000		81349	CM04FD101J03
C14	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C15	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C16	CAPACITOR,VAR GL DIEL, 0.8 TO 8.5PF, 750V	922-0486-000		73899	VC9GW
C17-C22	NOT USED				
C23	CAPACITOR,FXD MICA DIEL, 1000PF, 5%, 100V	912-2093-240		00853	D71F102J0
C24	CAPACITOR,FXD MICA DIEL, 62PF, 5%, 50V	912-4141-320		93790	CD5EY620J0
C25	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C26,C27	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C28	NOT USED				
C29	CAPACITOR,FXD CER DIEL, 820PF, 5%, 100V	913-1098-480		72982	8121M101C0G0-821 J
C30	CAPACITOR,FXD CER DIEL, 6800PF, PORM5%, 100V	913-3281-390		18796	8141M100C0G682J
C31	CAPACITOR,FXD CER DIEL, 0.047UF, 10%, 100VDC (A1)	913-5019-400		81349	CK06BX473K
C32	NOT USED				
C33,C34	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-2858-000		81349	CM05FD391J03
C35	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C36	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C37	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
C38	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 10V	184-9102-060		56289	199D226X0010CB1
C39	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C40,C41	RELAY,AMT CER DIEL, 3900PF, PORM10%, 100V	913-3281-180		18741	H18S5
C42,C43	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C44,C45	NOT USED				
C46-C48	CAPACITOR,FXD TNTLM ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
C49,C50	NOT USED				
C51	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
C52	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450		93790	CD5FY221J0
C53	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 50V	912-4141-220		93790	CD5EY330J0
C54	CAPACITOR,FXD MICA DIEL, 1000PF, 5%, 100V (A4)	912-2093-240		00853	D71F102J0
C55	CAPACITOR,FXD CER DIEL, 0.1UF, 10%, 100VDC (A1)	913-5019-440		81349	CK06BX104K
FL1	FILTER,BP,XTAL	293-1337-060		25120	293-1337-060
H1	PIN,SPRING SST, 0.078 DIA X 1/4 (QTY 1)	311-0355-000		96906	MS16562-199
H2	INSULATOR,WASHER MICA, 0.063 ID X 0.323 OD (QTY 4)	302-0640-070		08289	MW323-63
H3	WASHER,FLAT BRS, 0.125 ID X 0.312 OD (QTY 6)	310-0054-000		79807	310-0054-000
H4	NUT,PLAIN,HEX NP BRS, 4-40 (QTY 8)	313-0051-000		77250	P313-0051-000
H5	WASHER,FLAT CRES, 0.125ID X 0.250 OD (QTY 6)	310-0779-030		96906	MS15795-803
H6	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 4)	310-0279-000		96906	MS35338-135
H7	SCREW,MACH STL, 4-40 X 5/8 (QTY 2)	343-0138-000		96906	MS51957-18
H8	POST (QTY 2)	541-5966-002			541-5966-002
J1	CONNECTOR,HDR	372-2656-090		52072	CAD20SP100-230-430
J2	CONNECTOR,HDR	372-2656-100		52072	CAD10SP100-230-430
J3-J6	CONNECTOR,RCPT	357-0067-020		00779	226287-2
J4	CABLE, COAX	641-7100-022			
J5	CABLE, COAX	641-7100-023			641-7100-023
J7-J9	CONNECTOR,HDR	372-2656-130		52072	CAS01SP100-230-430
L1	COIL,RF 15UH	240-1582-000		96906	MS14046-6
L2,L3	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L4	INDUCTOR,RF	242-0441-070		20462	242-0441-070

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER
L5	COIL,RF 1000UH	240-2715-490
L6	COIL,RF 180UH	240-2715-400
L7	COIL,RF 1000UH	240-2715-490
L8	COIL,RF 15UH	240-2037-000
L9	COIL,RF 150UH	240-2520-000
L10-L12	COIL,RF 100UH	240-2715-370
L13,L14	NOT USED	
L15	COIL,RF 18UH	240-1583-000
L16	COIL,RF 10UH	240-2715-250
L17	COIL,RF 18UH	240-2715-280
L18	COIL,RF 10UH	240-2715-250
L19	COIL,RF 12UH	240-2715-260
L20	COIL,RF 330UH	240-2715-430
MP1	HANDLE	789-2348-001
MP2	CONTACT,ELEC (QTY 15)	372-2601-030
MP5	SHIELD	641-7128-001
MP4	CLIP,SPR TNSN	139-3003-010
MP3	RIVET,TUBULAR CS, 0.061 DIA X 0.125 (QTY 2)	305-1701-000
MP6	LABEL,PRESS SENS (ESDS)	280-2745-040
MP7	INSULATOR	150-0684-060
Q1	TRANSISTOR,FET (ESDS)	352-1140-010
Q2-Q4	TRANSISTOR	352-0723-010
Q5-Q7	TRANSISTOR	352-5501-010
Q8,Q9	NOT USED	
Q10	TRANSISTOR	352-0671-010
R1	RESISTOR,FXD FILM, 680 OHMS, 1%, 750V	705-0701-000
R2-R4	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000
R5,R6	NOT USED	
R7	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W	745-0737-000
R8	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000
R9,R10	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000
R11	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000
R12	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000
R13	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000
R14	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000
R15	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000
R16	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000
R17,R18	NOT USED	
R19	RESISTOR,FXD CMPSN, 4.3 OHMS, 5%, 1/4W	745-4381-000
R20	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000
R21-R23	NOT USED	
R24	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000
R25	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000
R26	RESISTOR,FXD CMPSN, 82 OHMS, 5%, 1/4W	745-0709-000
R27	RESISTOR,FXD FILM, 2.43K, 1%, 1/8W (A3)	705-3605-180
R27	RESISTOR,FXD FILM, 976 OHMS, 1%, 1/8W	705-3600-960
R28	RESISTOR,VAR 10K, 20%, 1/2W	382-0038-360
R29	RESISTOR,FXD FILM, 1K, 1%, 1/8W (A3)	705-0996-000
R29	RESISTOR,FXD FILM, 3.09K, 1%, 1/8W	705-3605-230
R30	RESISTOR,FXD FILM, 309K, 1%, 1/4W	705-3601-230
R31	RESISTOR,VAR 10K, 20%, 1/2W	382-0038-360
R32	RESISTOR,FXD FILM, 866 OHMS, 1%, 1/8W	705-0993-000
R33	RESISTOR,FXD FILM, 523K, 1%, 1/4W	705-3601-330
R34	RESISTOR,VAR 10K, 20%, 1/2W	382-0038-360
R35	RESISTOR,FXD FILM, 1.40K, 1%, 1/8W	705-1003-000
R36	RESISTOR,FXD FILM, 3.4K, 1%, 1/8W	705-3605-250
R37	RESISTOR,FXD FILM, 634 OHMS, 1%, 1/8W	705-3600-870
R38	RESISTOR,FXD FILM, 1.24K, 1%, 1/8W	705-3605-040
R39	RESISTOR,FXD FILM, 316K, 1%, 1/4W	705-6716-000
R40	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000
R41	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000
R42	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W (A2)	745-0779-000
R43	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000
R44	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000
R45	RESISTOR,FXD CMPSN, 18K, 10%, 1/4W	745-0794-000
R46	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000
R47	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000
R48	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000
R49	RESISTOR,FXD FILM, 287K, 1%, 1/8W	705-1114-000
R50	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000
R51	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/4W	745-0677-000
R52	RESISTOR,FXD FILM, 107K, 1%, 1/8W (A3)	705-3604-020
R52	RESISTOR,FXD FILM, 110K, 1%, 1/8W	705-1094-000
R53	RESISTOR,FXD FILM, 71.5K, 1%, 1/8W	705-1085-000
R54	RESISTOR,FXD FILM, 4.12K, 1%, 1/8W	705-3605-290
R55	RESISTOR,FXD FILM, 3.48K, 1%, 1/8W	705-1022-000
R56	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000
R57	RESISTOR,FXD FILM, 24.9K, 1%, 1/8W	705-1063-000
R58	NOT USED	
R59	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000
R60	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000
R61-R64	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000
R65	RESISTOR,VAR 200 OHMS, 10%, 0.5W	382-0027-050
R66	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W (A1)	745-0701-000
TP3-TP6	JACK-TIP	360-0079-190
U1	INTEGRATED CIRCUIT (ESDS)	351-8252-020
U2	INTEGRATED CIRCUIT V RGLTR (A3)	351-1035-060
U2	INTEGRATED CIRCUIT V RGLTR	351-1035-040
U3	INTEGRATED CIRCUIT COMPARATOR	351-1122-010
U4	MIXER,RF	277-0405-010
Y1	CRYSTAL UNIT,QTZ 6.71MHZ	289-7338-010

PARTS LIST (Cont)

	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	240-2715-490		96906	MS75089-23
	240-2715-400		96906	MS75089-14
	240-2715-490		96906	MS75089-23
	240-2037-000		96906	MS75084-14
	240-2520-000		96906	MS90538-16
	240-2715-370		96906	MS75089-11
	240-1583-000		96906	MS14046-7
	240-2715-250		96906	MS75088-13
	240-2715-280		96906	MS75089-2
	240-2715-250		96906	MS75088-13
	240-2715-260		96906	MS75088-14
	240-2715-430		96906	MS75089-17
	789-2348-001			789-2348-001
	372-2601-030			372-2601-030
	641-7128-001			
	139-3003-010		99378	100-206-6
0.125 (QTY 2)	305-1701-000		96906	MS16535-2
	280-2745-040		12998	280-2745-040
	150-0684-060		19080	RCRP800060-4A
	352-1140-010		01295	3N201
	352-0723-010		04713	MPS918
	352-5501-010		04713	MPS2222A
	352-0671-010		02735	2N3866
%, 750V	705-0701-000		96214	705-0701-000
10%, 1/4W	745-0719-000		81349	RCR07G151KS
10%, 1/4W	745-0737-000		81349	RCR07G471KS
1/4W	745-0791-000		81349	RCR07G153KS
10%, 1/4W	745-0821-000		81349	RCR07G104KS
1/4W	745-0791-000		81349	RCR07G153KS
10%, 1/4W	745-0743-000		81349	RCR07G681KS
10%, 1/4W	745-0821-000		81349	RCR07G104KS
/4W	745-0749-000		81349	RCR07G102KS
1/4W	745-0791-000		81349	RCR07G153KS
10%, 1/4W	745-0731-000		81349	RCR07G331KS
5%, 1/4W	745-4381-000		81349	RCR07G4R3JS
10%, 1/4W	745-0725-000		81349	RCR07G221KS
1/4W	745-0797-000		81349	RCR07G223KS
1/4W	745-0785-000		81349	RCR07G103KS
%, 1/4W	745-0709-000		81349	RCR07G820JS
1/8W (A3)	705-3605-180		81349	RN55D2431F
%, 1/8W	705-3600-960		81349	RN55D9760F
	382-0038-360		73138	72XR10K
W (A3)	705-0996-000		81349	RN55D1001F
1/8W	705-3605-230		81349	RN55D3091F
/4W	705-3601-230		81349	RN60D3093F
	382-0038-360		73138	72XR10K
%, 1/8W	705-0993-000		81349	RN55D8660F
/4W	705-3601-330		81349	RN60D5233F
	382-0038-360		73138	72XR10K
1/8W	705-1003-000		81349	RN55D1401F
/8W	705-3605-250		81349	RN55D3401F
%, 1/8W	705-3600-870		81349	RN55D6340F
1/8W	705-3605-040		81349	RN55D1241F
/4W	705-6716-000		81349	RN60D3163F
10%, 1/4W	745-0821-000		81349	RCR07G104KS
1/4W	745-0785-000		81349	RCR07G103KS
1/4W (A2)	745-0779-000		81349	RCR07G682KS
10%, 1/4W	745-0746-000		81349	RCR07G821KS
10%, 1/4W	745-0740-000		81349	RCR07G561KS
1/4W	745-0794-000		81349	RCR07G183KS
10%, 1/4W	745-0725-000		81349	RCR07G221KS
10%, 1/4W	745-0731-000		81349	RCR07G331KS
10%, 1/4W	745-0725-000		81349	RCR07G221KS
/8W	705-1114-000		81349	RN55D2873F
10%, 1/4W	745-0821-000		81349	RCR07G104KS
0%, 1/4W	745-0677-000		81349	RCR07G100KS
/8W (A3)	705-3604-020		81349	RN55D1073F
/8W	705-1094-000		81349	RN55D1103F
1/8W	705-1085-000		81349	RN55D7152F
1/8W	705-3605-290		81349	RN55D4121F
1/8W	705-1022-000		81349	RN55D3481F
10%, 1/4W	745-0821-000		81349	RCR07G104KS
1/8W	705-1063-000		81349	RN55D2492F
1/4W	745-0773-000		81349	RCR07G472KS
/4W	745-0749-000		81349	RCR07G102KS
10%, 1/4W	745-0845-000		81349	RCR07G474KS
5W	382-0027-050		80294	3329HCT1-201
0%, 1/4W (A1)	745-0701-000		81349	RCR07G470KS
	360-0079-190		00779	2-332095-4
	351-8252-020		02735	CD4066BF
	351-1035-060		49956	RC723DB
	351-1035-040		49956	RM723DC
	351-1122-010		27014	LM339N
	277-0405-010		05375	CM1P
	289-7338-010		00136	289-7338-010

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	CIRCUIT CARD ASSEMBLY	642-3578-001			642-3578-001
C1	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C
L1,L2	COIL,RF 100UH	240-2047-000		96906	MS75085-07
R1,R2	RESISTOR,FXD FILM, 33.2 OHMS, 1%, 1/8W	705-0925-000		81349	RN55D33R2F
R3	RESISTOR,FXD FILM, 20.5 OHMS, 1%, 1/8W	705-0915-000		81349	RN55D20R5F

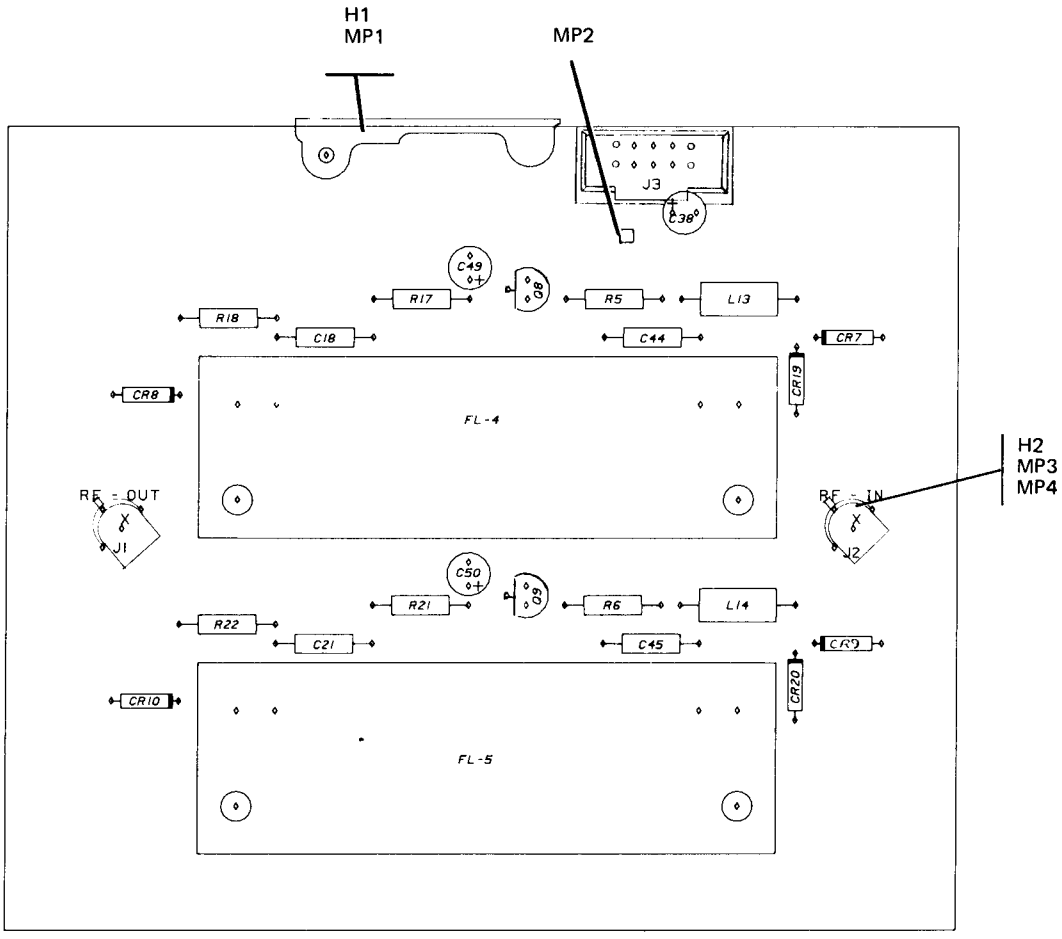
MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
	638-6912-002, -003	

A1	Changed C31 from .47UF to .047UF -002 only.
	Added C55, 913-5019-440
	Added R66, 745-0701-000
		REV H

A2	Changed R42 from 10K to 6.8K	REV J
A3	Changed R27, from 2.43K to 976 ohms Changed R29, from 1K to 3.09K Changed R52, from 107K to 110K Changed U2, from RC723DB to RM723DC	REV K
N/A	Data Change	REV L
A4	Added C54-912-2093-240	REV M

Passband Tuning, Parts Location
Figure 4 (Sheet 2)



638-6914-002

TPA-5296-019

Passband Tuning Option, Parts Location
Figure 5 (Sheet 1 of 2)

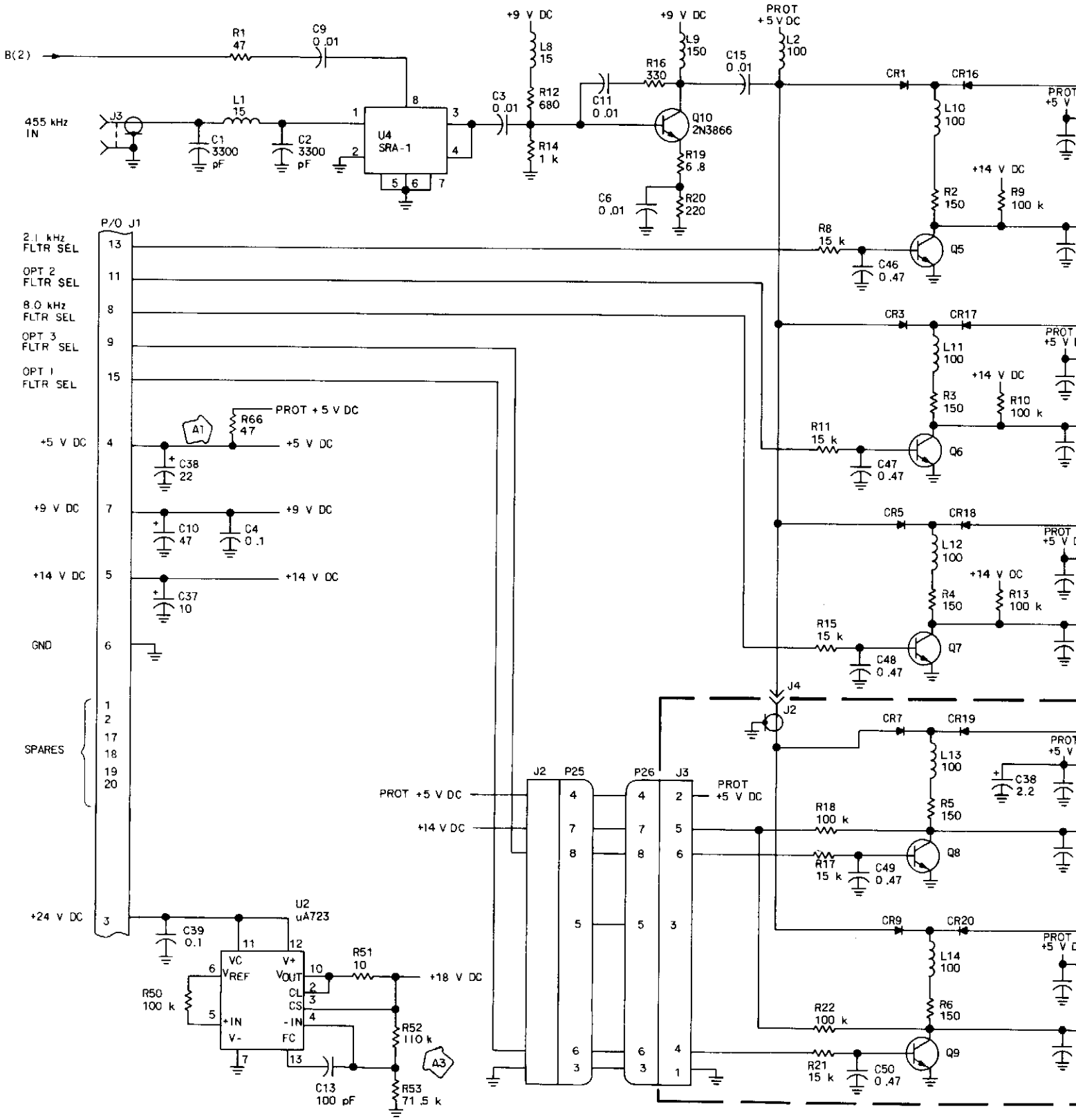
PARTS LIST

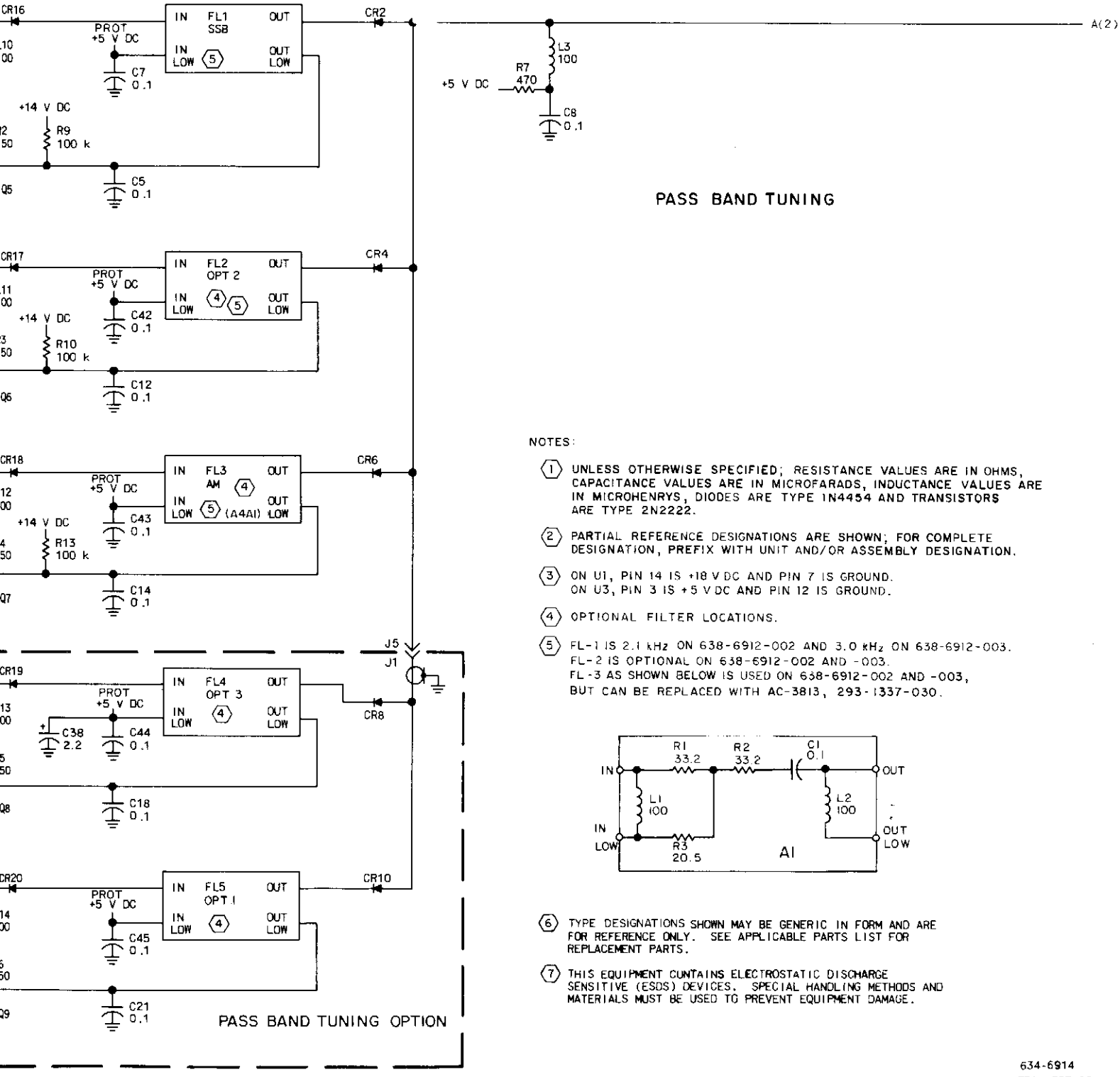
REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	PASS BAND TUNING	638-6914-002			
CR1-CR6	NOT USED				
CR7-CR10	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR11-CR18	NOT USED				
CR19,CR20	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1-C17	NOT USED				
C18	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104D8050
C19,C20	NOT USED				
C21	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104D8050
C22-C37	NOT USED				
C38	CAPACITOR,FXD TNTLM ELCTLT, 22UF, 20%, 10V	184-9102-080		56289	199D226X0010CB1
C39-C43	NOT USED				
C44,C45	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104D8050
C46-C48	NOT USED				
C49,C50	CAPACITOR,FXD TNTLM ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
J3	CONNECTOR,HDR (A1)	372-2656-140		52072	CAD06SP100-230-430
J3	CONNECTOR, HDW	372-0043-330			
L1-L12	NOT USED				
L13,L14	COIL,RF 100UH	240-2715-370		96906	MS75089-11
Q1-Q7	NOT USED				
Q8,Q9	TRANSISTOR	352-5501-010		04713	MPS2222A
R1-R4	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W NOT USED	745-0821-000		81349	RCR07G104KS
R5,R6	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R7-R16	NOT USED				
R17	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R18	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R19,R20	NOT USED				
R21	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVI
	638-6914-002	
A1	J3 changed to 372-0043-330	REV D

Passband Tuning Option, Parts Location
Figure 5 (Sheet 2)


B(2)
R1 47
C9 0.01
455 kHz IN
J3
L1 15
C1 3300 pF
C2 3300 pF
U4 SRA-1
+9 V DC
L8 15
C3 0.01
R12 680
R14 1 k
C11 0.01
R16 330
L9 150
Q10 2N3866
R19 6.8
C6 0.01
R20 220
C15 0.01
PROT +5 V DC
L2 100
CR1
CR16
L10 100
R2 150
R9 100 k
+14 V DC
R8 15 k
C46 0.47
Q5
P/O J1
2.1 kHz FLTR SEL
OPT 2 FLTR SEL
8.0 kHz FLTR SEL
OPT 3 FLTR SEL
OPT 1 FLTR SEL
CR3
CR17
L11 100
R3 150
R10 100 k
R11 15 k
C47 0.47
Q6
R66 47
A1
+5 V DC
C38 22
CR5
CR18
L12 100
R4 150
R13 100 k
R15 15 k
C48 0.47
Q7
+9 V DC
C10 47
C4 0.1
+14 V DC
C37 10
GND
SPARES
J4
J2
CR7
CR19
L13 100
R5 150
C38 2.2
R18 100 k
R17 15 k
C49 0.47
Q8
J2 P25
P26 J3
PROT +5 V DC
+14 V DC
CR9
CR20
L14 100
R6 150
R22 100 k
R21 15 k
C50 0.47
Q9
+24 V DC
C39 0.1
U2 uA723
R50 100 k
R51 10
+18 V DC
R52 110 k
R53 71.5 k
A3
C13 100 pF



NOTES:

(1) UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, INDUCTANCE VALUES ARE IN MICROHENRYS, DIODES ARE TYPE 1N4454 AND TRANSISTORS ARE TYPE 2N2222.

(2) PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

(3) ON U1, PIN 14 IS +18 V DC AND PIN 7 IS GROUND.
ON U3, PIN 3 IS +5 V DC AND PIN 12 IS GROUND.

(4) OPTIONAL FILTER LOCATIONS.

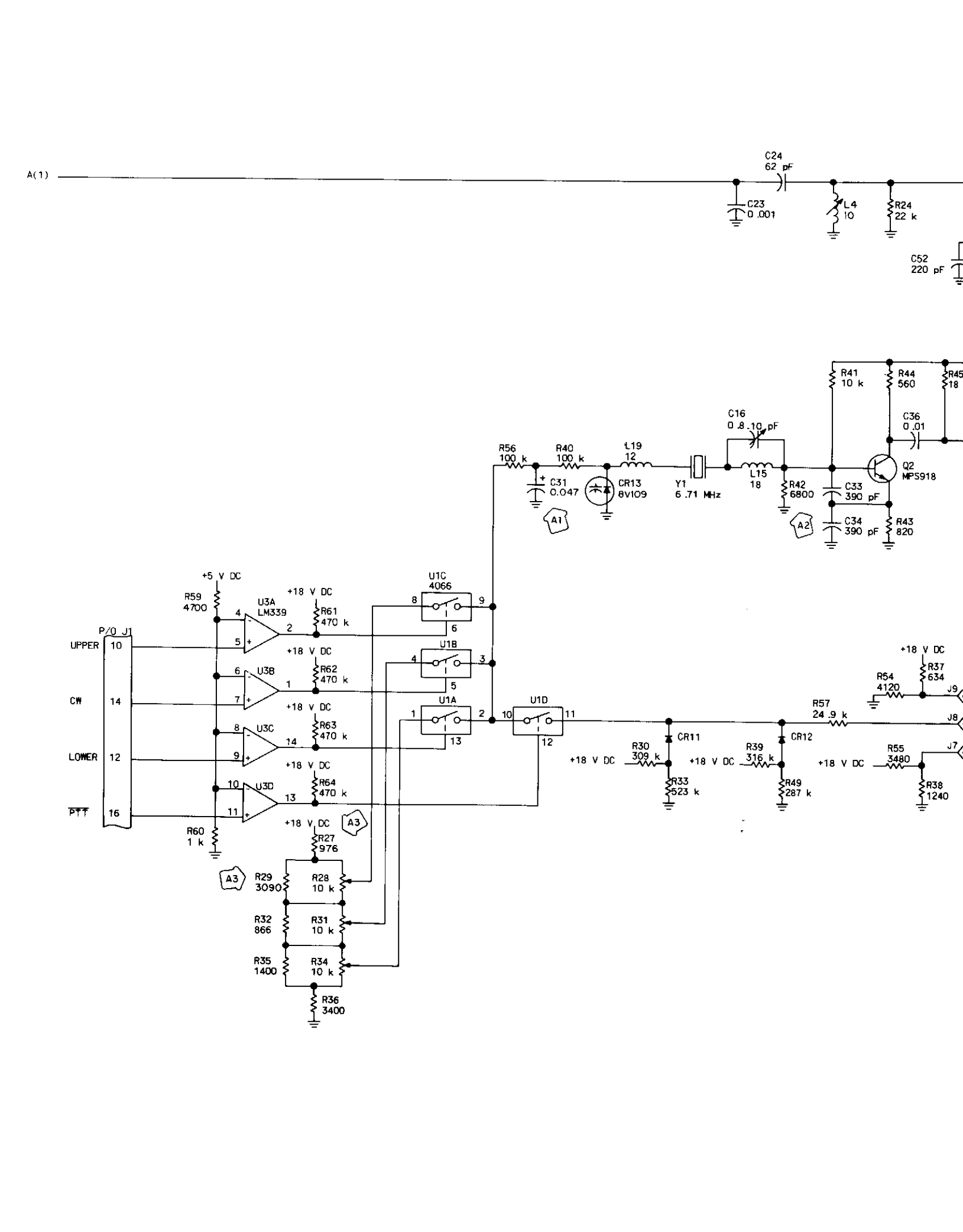
(5) FL-1 IS 2.1 kHz ON 638-6912-002 AND 3.0 kHz ON 638-6912-003.
FL-2 IS OPTIONAL ON 638-6912-002 AND -003.
FL-3 AS SHOWN BELOW IS USED ON 638-6912-002 AND -003, BUT CAN BE REPLACED WITH AC-3813, 293-1337-030.

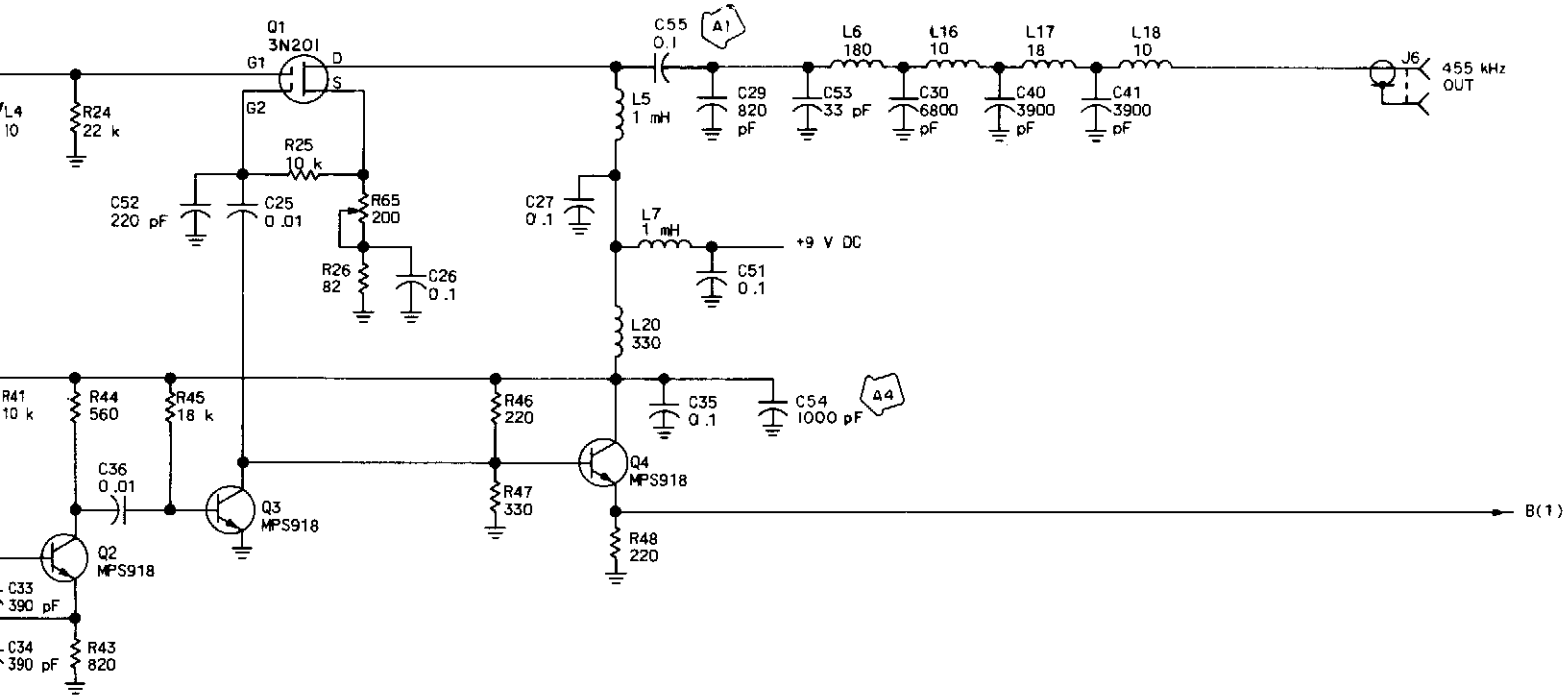
(6) TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

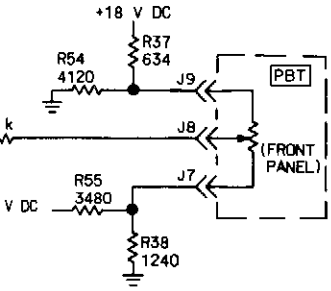
(7) THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

634-6914
TPA-1723 024

Passband Tuning and Passband Tuning Option, Schematic Diagram
Figure 6 (Sheet 1 of 2)


A(1)
C24
62 pF
C23
0.001
L4
10
R24
22 k
C52
220 pF
R41
10 k
R44
560
R45
18
C16
0.8-10 pF
C36
0.01
R56
100 k
R40
100 k
L19
12
C31
0.047
CR13
BV109
Y1
6.71 MHz
L15
18
R42
6800
Q2
MPS918
C33
390 pF
C34
390 pF
R43
820
A1
A2
+5 V DC
R59
4700
U3A
LM339
+18 V DC
R61
470 k
U1C
4066
P/O J1
UPPER
10
CW
14
LOWER
12
PTT
16
U3B
R62
470 k
U1B
U3C
R63
470 k
U1A
U3D
R64
470 k
U1D
R60
1 k
A3
R27
976
R29
3090
R28
10 k
R32
866
R31
10 k
R35
1400
R34
10 k
R36
3400
R30
309 k
CR11
R33
523 k
R39
316 k
CR12
R49
287 k
R57
24.9 k
R54
4120
R37
634
J9
J8
R55
3480
J7
R38
1240





PASS BAND TUNING

634-6914
TPA-1723-024

Passband Tuning and Passband Tuning Option, Schematic Diagram
Figure 6 (Sheet 2)

Synthesizer (641-7099-XXX)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0771743-001211
1 August 1982

1. DESCRIPTION

Synthesizer 641-7099-002, figure 1, consists of output loop A1, 638-6916-002, and variable loop A2, 638-6920-001. Synthesizer 641-7099-003 consists of an output loop A1, 638-6916-003, and variable loop A2, 638-6920-002. Both synthesizers operate identically, the only difference being that the -003 version uses SMB connectors.

The phase-locked loop (pll) frequency synthesizer receives a 39.6-MHz signal from the oscillator circuit card to develop a 9.9-MHz output to the control circuit card and a 39.145- to 69.14499-MHz output to the receiver exciter. Three pll's are used to develop the variable frequency used as the second local oscillator injection frequency in the receiver-exciter. Use of three loops permits tuning the transceiver in 10-Hz steps.

2. PRINCIPLES OF OPERATION

2.1 Principles of Phase-Locked Loops

A phase-locked loop compares the frequency and phase of its voltage-controlled oscillator (vco) output to that of a reference frequency. If the two signals differ in frequency or phase, an error voltage is developed and applied to the vco. This causes the vco to shift its output frequency in the direction necessary to decrease the difference. Frequency correction continues until lock is achieved, after which the vco will track the reference frequency. Figure 2 is a block diagram of a basic pll.

Placing a programmable divider in the feedback path from the vco to the frequency/phase detector (comparator) allows the vco output to be changed in multiples of the reference frequency. The loop output frequency then becomes some multiple, N, of the reference frequency ($f_{out} = N \times f_{ref}$, where N is the division ratio of the programmable divider). Changes in the operating frequency are made by changing the divider ratio.

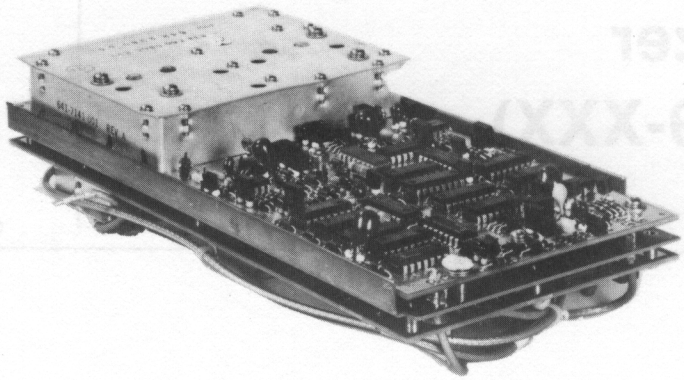
2.2 Overall Synthesizer Operation (Refer to figure 3)

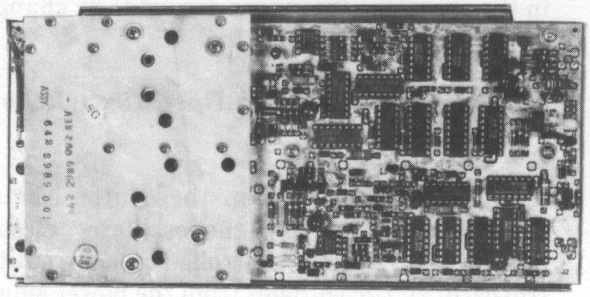
External signals input to the synthesizer are the 39.6-MHz output from the oscillator circuit; frequency data, clock, and strobe signals from the control card; and dc voltages from the power supply. The dc voltages are operating voltages for the loop circuits.

The 39.6-MHz input is divided down to 9.9 MHz and returned to the control card for use as a clock signal; to 100 kHz for the synthesizer loop 2 reference frequency; and to 500 Hz for the variable reference loop reference frequency.

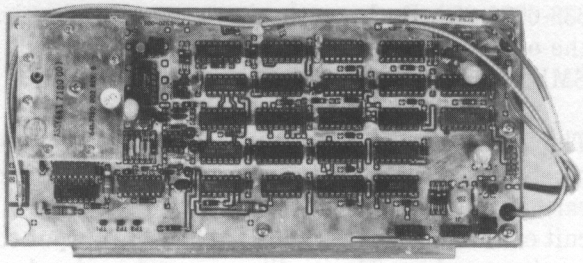
Frequency data, clock, and strobe signals are applied to the synthesizer serial-to-parallel converters. Serial data from the control card is sequentially clocked through A2U23, U22, U21, and A1U18. The strobe signal transfers frequency data to the converter parallel data outputs for use by the loop -N counters.

The synthesizer contains three loops to get 10-Hz frequency increments. Loop 1 develops the 39.145- to 69.145-MHz signal used in the receiver-exciter as a local oscillator variable injection frequency. The loop





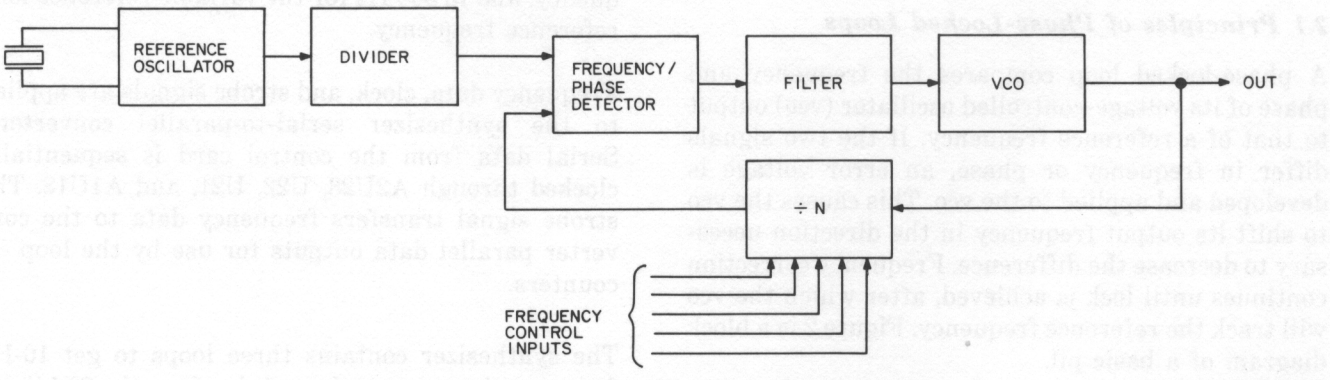
A1



A2

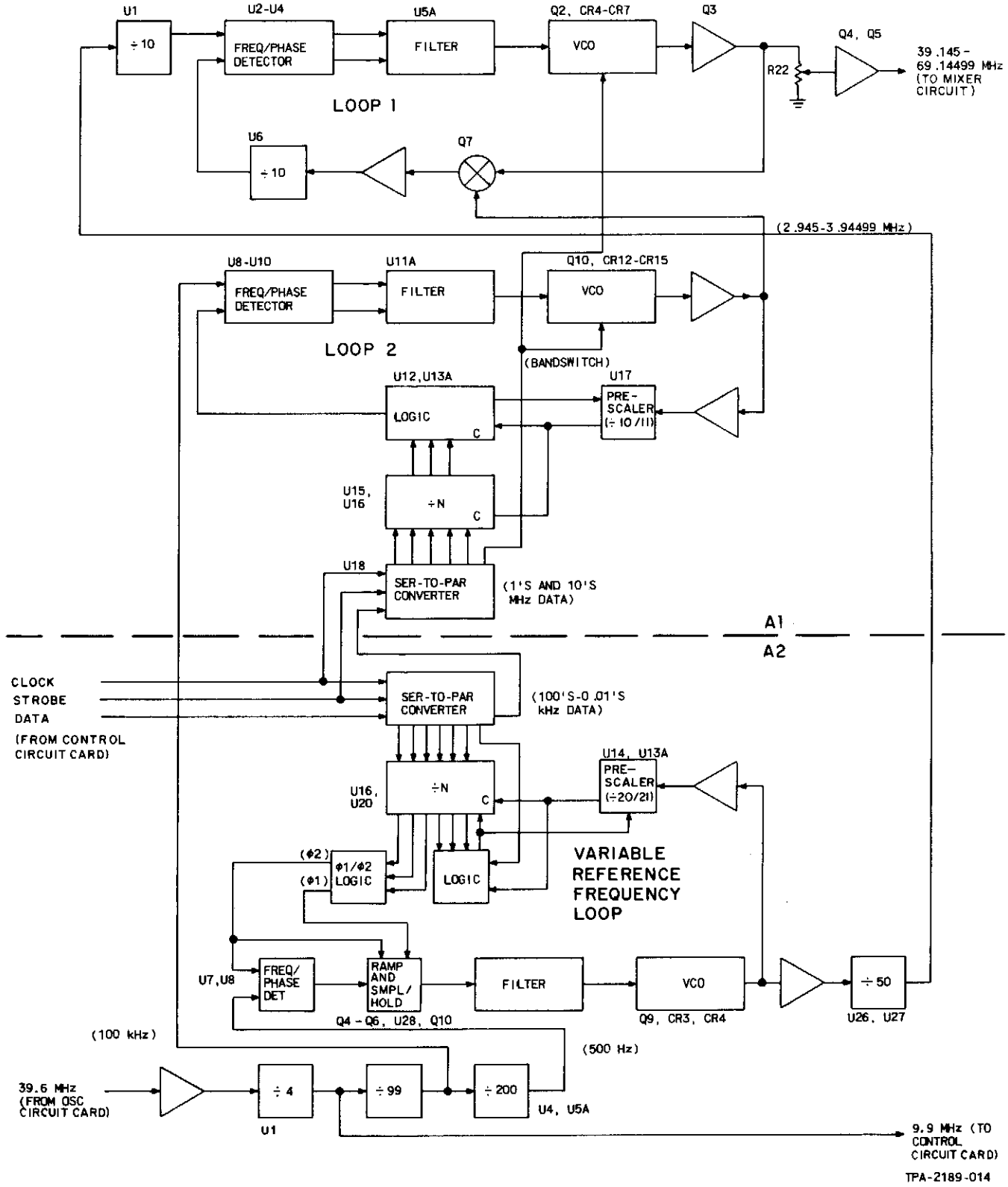
TPA-5271-017

Synthesizer
Figure 1



TPA-0832-013

Basic Phase-Locked Loop, Block Diagram
Figure 2



Frequency Synthesizer, Block Diagram
Figure 3

2 output is used as a mixing frequency with the loop 1 vco output. The variable reference frequency loop output is used as the reference frequency for loop 1.

Loop 2 frequency is controlled by the 1's and 10's MHz frequency data. This data is loaded into serial-to-parallel decoders, then applied to the ÷N divider. Frequency data inputs to the divider determine the division ratio, N. The ratio is the number by which the vco frequency is divided to equal, when locked, the 100-kHz reference frequency input to the frequency/phase detector. Before a locked condition is obtained, the difference between the divided-down vco output and the reference frequency causes the error voltage that drives the vco frequency to a value that nulls the error. At this frequency, the divided-down vco output is 100 kHz — the detector reference frequency. The vco output, proportional in frequency to the selected 1's and 10's MHz frequency digits, is applied to the loop 1 mixer.

The variable reference frequency loop is controlled by the 100's kHz through 10's Hz frequency data. Frequency data is loaded into serial-to-parallel decoders, then applied to the variable reference loop ÷N divider. Operation of the variable reference loop is similar to that of loop 2. The divided-down vco output is compared with a 500-Hz reference frequency input. Any difference causes an error voltage that shifts the vco to the correct frequency. The variable reference loop vco output is the reference input to loop 1.

The loop 1 circuit is somewhat different from the other two. The ÷N ratio for loop 1 is fixed, but the vco output is mixed with the loop 2 vco output that is varied with the selected operating frequency. The loop 1 reference frequency is variable also, and depends on the selected operating frequency. Frequency error detection and correction voltage generation is the same as for the other two loops.

In addition to the phase-locked loops, the synthesizer also has two voltage regulators. One develops a +20-V dc output; the other develops +18 V dc. Both regulators are series-type with current limiting, and have a common +24-V dc input.

2.3 Detailed Operation

2.3.1 Loop-2 Programmable Divider (Part of A1)

Data representing the MHz frequency digits is loaded from serial-to-parallel converter U18 into counters U15 and U16 when the counter load lines (pin 11) are logic 0. This occurs when U17 clocks the Q output of U12A to logic 0. The next output pulse from U17 clocks the U12A Q output back to logic 1; this makes the load line logic 1, and thus permits the counters to operate. The following pulses from U17 clock the counters down toward zero. When all inputs to U14A are logic 0, the output to U12A is logic 1. The next pulse from U17-11 clocks the U12A-Q output to logic 1 and the Q output to logic 0. This logic 0 is the load command for the counters and the reset command for U13A which reinitiates the count cycle.

The loop 2 vco output through Q11 and Q12 is the clock signal for prescaler U17. The prescaler output is the clock signal for U16, U12A, and U13A. The QD output of U16 is the clock signal for counter U15. The prescaler develops one output pulse for each eleven input clock pulses when the M1 mode line is logic 0, and one output for ten input pulses when the mode line is logic 1. This shifting from -11 to -10 is necessary for the proper division ratio of the MHz frequency data. It occurs after the first two output pulses from U17 following the load/reset command.

The U12A Q output, controlled by the ÷N ratio of U15 and U16, is 100 kHz when the loop is locked. Resistor R84 and capacitor C81 at flip-flop U12B stretch the U12B output to a nominal width of 1 to 2 microseconds. The 5-volt pulse gates Q14 on and off. The transistor switches +9 volts to shift the 100-kHz pulse amplitude from 5 volts to 9 volts to drive the CMOS frequency/phase detector gate U8C.

2.3.2 Frequency/Phase Detectors (Part of A1)

The frequency/phase detector generates the signal that is used to control the vco frequency. The vco output is divided by the selected ratio, N (depending on the operating frequency chosen), and applied to one input of the detector circuit. When the vco is locked to the proper frequency, the divided-down output and the reference frequency applied to the detector are the same. If this condition does not exist, the detector output will cause a control voltage to shift the frequency of the vco to a value that, divided by N, does equal the reference frequency.

Phase detectors in loops 1 and 2 are the same. Loop 2 circuit is discussed. It is made up of gates U8A through D, U9A/B, and U10A through C on A1. The reference frequency (100 Hz for loop 2, or a variable frequency from the variable reference frequency loop for loop 1) is input to U8B-6. The divided-down vco

output is applied to U8C-8. The outputs are from U10A-6 and U10B-9. Outputs for various conditions are shown in figure 4.

When the vco input to U8C-8 is different in frequency from the reference input to U8B-6, the detector output is a series of pulses (width will vary with the difference in frequency). Assume the vco input is lower in frequency than the reference input. This is shown for a typical situation at the top of figure 4. The output from U10B is a series of logic 0 pulses. The U10A output holds a constant logic 1. The pulses cause the control voltage to start pulling the vco frequency higher. As the divided-down vco frequency gets to the reference frequency value, the phase difference is sensed. The U10B output is then a series of more regularly spaced pulses, as shown in the second group of waveforms in figure 4. The resulting control voltage keeps shifting vco output closer to the reference to eliminate the phase difference. When both inputs to the detector become the same, the loop is locked. In the locked condition, the detector outputs are a series of logic 0 narrow spikes that apply minute correction voltages for keeping the vco locked.

Phase detector outputs are developed from transitions in the input signals. When the reference input goes from logic 1 to logic 0, the output from U10B goes from logic 1 to logic 0. If the U10B output was already at logic 0, the input transition has no effect. When the vco input goes from logic 1 to logic 0, the output from U10B goes from logic 0 to logic 1. If the U10B output was already at logic 1, the vco input transition has no effect. With U10B changing, the U10A output remains at logic 1.

Similarly, when the U10B output makes transitions as described above for U10B, the U10A output remains at logic 1. The phasing of these transitions is shown in figure 4.

2.3.3 Integrator/Filter (Part of A1)

Phase detector outputs are applied to an integrator/filter circuit (U11A in loop 2, U5A in loop 1). The integrator output is the control voltage for the vco. In addition to integration, U11A filters out control voltage fluctuations to develop ac required for the vco varactor control voltage.

Capacitor C55 is the storage capacitor for integrator U11A. The capacitor is charged to the value required for loop lock. If the vco frequency becomes too high (as will be the case, for example, when a lower operating frequency is chosen), the charge on C55 will have to be decreased to bring the vco back into lock. When the vco is off frequency, the phase detector output from U10A is pulsed from logic 1 to logic 0 while the U10B output remains at logic 1 (refer to figure 4). This causes the output from U11A to discharge C55 to some lower value. The lower value control voltage causes the vco output to decrease in frequency. As the frequency reaches the correct value, phase detector output becomes the series of logic 0 spikes from both outputs. This keeps control voltage output at the new, lower value to maintain the new vco frequency.

A similar operation occurs when the vco frequency must be increased. Phase detector U10B output pulses to logic 0. This causes the charge on C55 to be increased, since the pulses are applied to the inverting input of U11A. The resulting increased output voltage increases vco varactor control voltage to raise the vco frequency. The retained charge on C55 keeps control voltage at the new value to maintain the higher frequency.

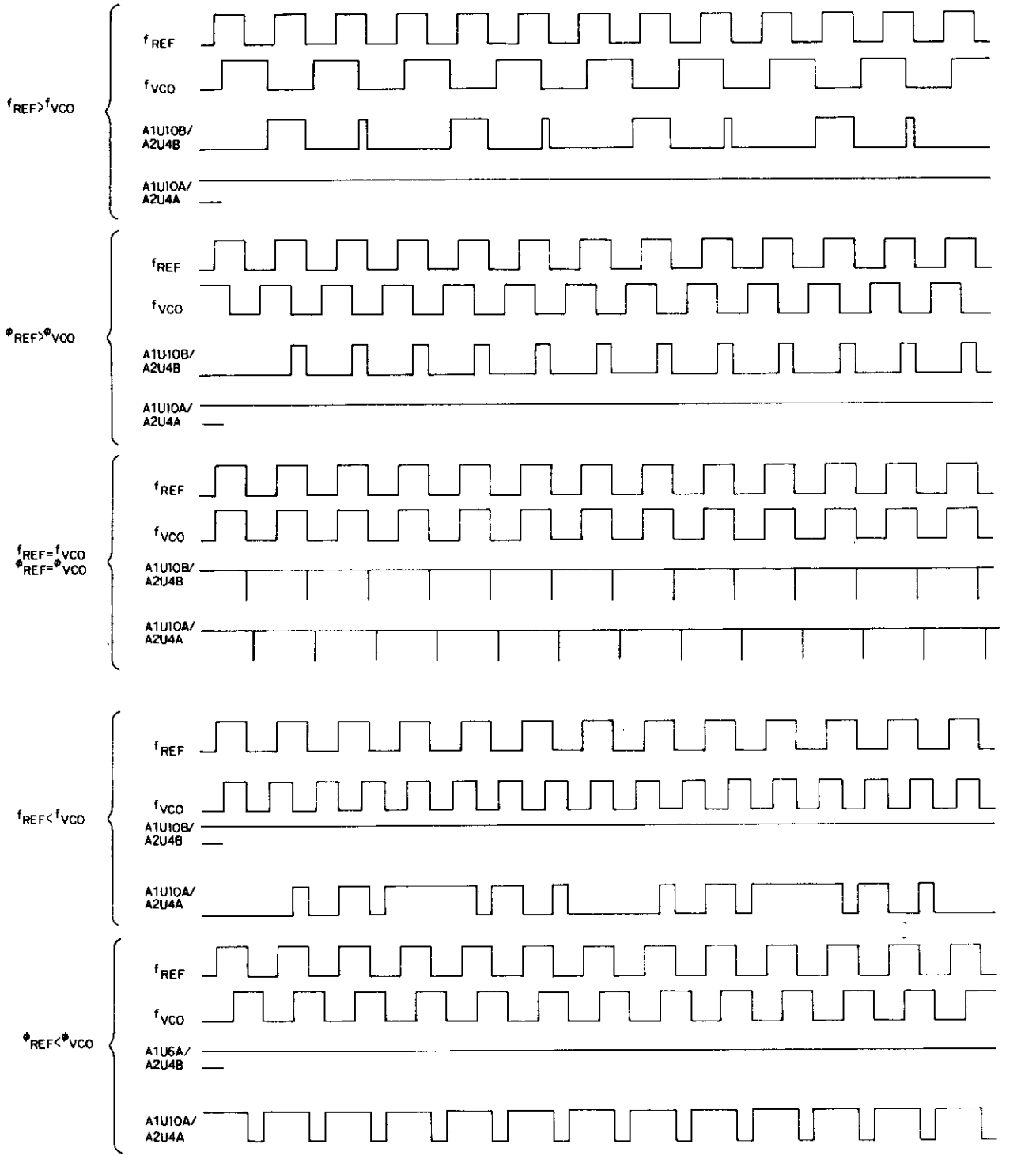
A tracking voltage is output from U11A in loop 2 through R61 and R88 to the vco input of loop 1. This signal ensures that the frequency of loop 1 is always higher than that of loop 2. The tracking voltage is the primary control voltage for the vco of loop 1. The filter output of loop 1 provides fine control of the vco since the tracking voltage tunes the vco close to the proper frequency.

2.3.4 VCO (Part of A1)

Voltage-controlled oscillators use variable-capacitance diodes (varactors) as the capacitance elements in the tank circuit. (Loop 1 vco tunes from 39.145 to 69.144 99 MHz; loop 2 vco from 36.2 to 65.2 MHz.)

A logic 1 bandswitch signal is output from U18 when a frequency of 13 MHz or greater is selected. This turns on Q9, Q8, and Q1. With Q8 on, pin diode CR11 conducts, providing an rf ground through C60. This shorts L11 to ground, leaving only L12 in the tank circuit of the oscillator to generate the higher frequencies. The loop 1 bandswitch works similarly for Q1, L1, and L2.

The vco output of loop 2 is divided down by 10/11 prescaler U17, which in turn clocks the rest of the programmable divider. Loop 2 vco output is also mixed with the vco output of loop 1 in mixer Q7. The if from this mixer is filtered and divided by 10 in loop 1.



TPA-2198-014

Detector Outputs for Various VCO Frequencies
Figure 4

Loop 1 vco develops the synthesizer external output signal. The frequency range is from 39.145 MHz (for a dial frequency of zero) to 69.144 99 MHz (for a dial frequency of 29.999 99 MHz). The Q1 vco output is amplified by Q3 and applied to potentiometer R22, and through Q6 to loop mixer Q7. Potentiometer R22 is an adjustment for the external signal output level. From R22, the signal is amplified by Q4 and Q5 before being output. Both amplifiers have negative feedback control — through R24 for Q4 and T1/R28 for Q5. Transformer T1 also matches the amplifier impedance to the 50-ohm output impedance.

2.3.5 Loop 1 Programmable Divider (Part of A1)

The programmable divider in loop 1 does not have a variable count ÷N counter. The loop 2 vco output is mixed with the loop 1 vco output (in Q7) to develop an if. The mixer if output is applied to the loop 1 frequency/phase detector (through ÷10 counter U10 and 5- to 9-V level shifter U19). The frequency/phase detector reference frequency input is the divided-by-10 (through U1) vco output from the variable reference frequency loop. This frequency is proportional to the transceiver operating frequency 100's kHz through 10's Hz digits.) The variable frequencies from loop 2 and the variable reference frequency loop take the place of the usual ÷N counter in this pll.

2.3.6 39.6-MHz Dividers (Part of A1)

The 39.6-MHz output from the oscillator circuit card is divided down into three lower frequencies for use in other circuits. Flip-flop U1A and B divide by 4 to develop the 9.9-MHz signal. This frequency is used as a clock signal in the control circuit card. Counters U2 and U3 divide the 9.9-MHz output from U1B by 99 for the loop 2, 100-kHz reference frequency. Flip-flops U4A and B and U5B divide the 100 kHz by 200 to develop a 500-Hz output. This is a reference frequency for the variable reference frequency loop frequency/phase detector.

2.3.7 Variable Reference Frequency Loop (A2)

Because several circuits are different from loops 1 and 2, the variable reference frequency loop is discussed separately. Figure 5 shows a simplified diagram of the loop.

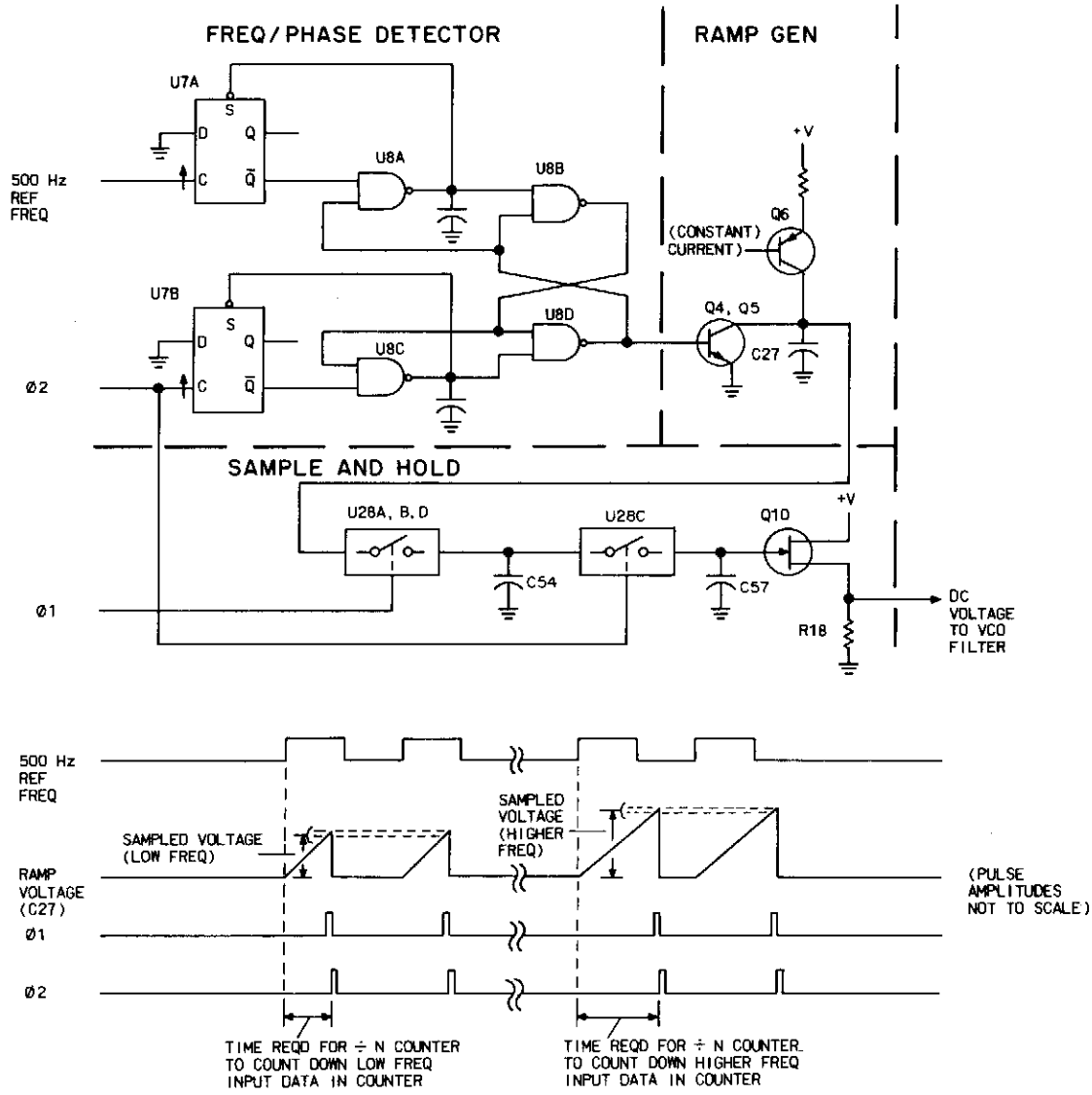
Serial data proportional to the 100's kHz through 10's Hz frequency digits is clocked into serial-to-parallel converters U21 through U23. (The data is not a bcd equivalent of the respective frequency digits. It has been modified by the microprocessor in the control circuit card.) The serial data is strobed to the converter outputs in parallel format for application to counters U16 through U20. At the time the counter load line is a logic 0, data is loaded into the counters. After data has been loaded into counters, the load line (U12A Q output) is clocked to logic 1. This permits the counters to count down from the loaded data value. Clock signal for the counters are the U13A Q output for U16 and U17, and the QD output from the preceding counter for U18 through U20. (Refer to schematic diagram for circuit details.)

Prescaler U14 and flip-flop U13A form a ÷20/21 counter. When both the M1 and M2 mode lines of U14 are logic 0, U14 develops one output pulse for each 11 input pulses (from Q8). Flip-flop U13A is clocked by the U14 output to alternate the M1 mode line level between logic 0 and logic 1. Thus, when both mode lines are logic 0, 11 input pulses to U14 will cause one output pulse to the U13A clock. This toggles the M1 line to logic 1 to cause the next 10 input pulses to U14 to develop 1 output pulse (which toggles M1 back to logic 0). In this manner, the U14/U13A division ratio is 21 while the M2 input is held at logic 0.

When counter U16 has been clocked down (by 1/21 of the input pulse frequency to U14) for a number of times appropriate to the data stored, the inputs to gate U15C will be logic 1's. Gate U15C outputs a logic 0 to U15B. This causes the U16 counter to be inhibited and the U14 M2 line to command a constant ÷20 mode from U14/U13A. The divided-by-20 output from U13A-5 clocks U17 down toward zero. The QD output from U17 is the clock input from U18 and clocks U18 down toward zero. This continues with the QD output of U18 the clock for U19, and that of U19 the clock for U20. When the counter reaches zero, the MM output from the counter is logic 1. With all inputs to U11C and D at logic 1, the output from U10C is logic 1. The next output from U13A clocks the Q output from U12A to logic 0. This is the load/reset command that initiates a new count cycle.

The outputs from U19 and U20 are combined at gates U10A/B and U11B to generate Ø1 and Ø2 clock pulses for the frequency/phase detector, ramp generator, and sample and hold circuit. These pulses are 100-μs wide with the Ø2 pulse immediately following the Ø1 pulse.

The frequency/phase detector is a set-reset flip-flop made up of U7A/B and U8A through D (shown in



Variable Reference Frequency Loop, Simplified Diagram
Figure 5

figure 4). The reference frequency input is a 500-Hz signal from U5B. This is the set pulse. The Ø2 pulse from the ÷N counter is the reset pulse. Capacitors C58 and C62 develop a short delay to give the logic time to switch and settle before U7B and U7A are reset. The detector works in conjunction with the ramp generator and sample and hold circuit to develop a dc voltage output to the filter and vco.

With the output of U8C at logic 0, Q5 is off and C27 charges through current source Q6. Charging continues until the Ø2 pulse is output from U10A. The Ø2 pulse clocks U7B to reset the detector flop-flop, causing U8C to output a logic 1. Logic 1 turns on Q4 and Q5 to discharge C27. Transistor Q5 keeps C27 discharged until the U8C output is returned to logic 0. Return to logic 0 is caused by the 500-Hz input set pulse to the detector flip-flop.

The voltage ramp developed by C27 is applied to switches U28A, B, and D. (The parallel combination is used for a low-impedance path.) The Ø1 pulse momentarily closes the switches to transfer a sample of C27 voltage to C54. Immediately after Ø1, Ø2 goes to logic 1 to close switch U28C and transfer the C54 voltage to C57. With only the high-impedance gate of

FET Q10 for a discharge path, C57 holds the sampled voltage. This makes the FET output voltage developed across R18 proportional to the ramp voltage at the time of sampling. Since the time between the 500-Hz set pulse to detector flip-flop and Ø2 reset pulse is a function of the frequency-related data in the ÷N counter, the sampled voltage controlling Q10 is also proportional to the vco operating frequency. This is shown graphically in figure 5.

The voltage across R18 is filtered by U24A and applied to the vco as the control voltage. Amplifier U24B is a buffer between test point TP1 and the filter output voltage. The vco output is the input to the ÷20/21 prescaler and, divided by 50, is the reference frequency for the loop-1 frequency/phase detector.

2.3.8 Loop and Loss-of-Lock Monitors

When the frequency/phase detector output for loop 1 of 2 remains at logic 0 for longer than approximately 20 percent of the time, capacitor A1C48 will discharge to a level where Q16 will conduct. With Q16 on, Q15 is also turned on to output a logic 0 loop monitor (LM) signal to A2U6B. This logic 0 is a set signal for flip-flop U6B. When set, the logic 0 Q-output from U6B sets flip-flop U6A. The resulting U6A Q-output is the logic 0 loss-of-lock (LOL) signal that indicates the synthesizer is in an out-of-lock state.

Flip-flops U6A and B are normally kept in a reset state (LOL output equals logic 1) by the C and D inputs. The D inputs are normally synchronized with the clock signals to keep the Q output at logic 1. If the Ø2 input (frequency-dependent) gets out of synchronization with the 500-Hz reference frequency input, either U6A or U6B will be set to develop a logic 0 LOL output signal.

2.3.9 +18-V and +20-V Regulators (Part of A2)

The +24-V input (J1-24) is applied to voltage regulators U25A and U25B. The regulators control series pass transistors Q3 and Q2 respectively. Transistors Q11 and Q12 are for current limiting. (Current sensing is done by R46 and R47.) The output from U25A/Q3 is +20 volts; from U25B/Q2, +18 volts.

3. TESTING/TROUBLESHOOTING PROCEDURES

A performance test for the synthesizer is given in table 2. In addition to the required performance criteria, some troubleshooting comments are also given in this table. Because of the complexity of synchronizer pll's, troubleshooting procedures for these circuits are given in a separate table, table 4. Refer to this troubleshooting procedures table when directed to do so in the test procedures table.

In the troubleshooting procedures, conversion from transceiver dial (displayed) frequency to bcd logic is required. Table 3 gives instructions for converting the data. In the steps where this is required, the correct bcd logic levels for a 15.000 00-MHz dial frequency are given. If this frequency is not used, convert the dial frequency used to the proper bcd logic levels for the frequency used.

It is assumed that the repair technician is trained in solid-state circuit troubleshooting and repair techniques, and is familiar with the test equipment to be used. Step-by-step operating procedures are not given in the tests and not all possible troubleshooting information can be listed. The tests in table 2 must be performed in sequence.

Testing and troubleshooting of the synthesizer requires the synthesizer be installed in the transceiver.

3.1 Test Equipment Required

Table 1 lists the equipment required to perform the tests. A suggested type is given; however, that specific equipment is not required. Any that meets or exceeds the indicated minimum specifications is acceptable for use.

3.2 Performance Test

The following test procedures measure the performance of the synthesizer. After being repaired, repeat the numbered test where repair was performed to verify that no further malfunctions exist.

3.2.1 Preliminary Setup

Do not apply power to the equipment until instructed to do so in the procedures. Do not connect power with power switches turned on.

Connect the equipment as instructed in the procedures for each test.

3.2.2 Test Procedures

Perform the tests as given in table 2.

Table 1. Test Equipment Required.

ITEM	USED FOR	SUGGESTED TYPE	MINIMUM SPECIFICATIONS
Rf voltmeter w/50-Ω adapter	Measuring pll output levels	Boonton 92C w/50-Ω adapter	0 thru 3 V rf, also calibrated in dB mW
Dc voltmeter	Measuring dc control voltage to vco	Fluke 8000A	0 thru 20 V, 0.005 V accuracy, 10 000 Ω/V impedance
Frequency counter	Measuring frequency at various pll points	Fluke 1910A	39 thru 70 MHz, displayed to 5 decimal places; 1-Hz accuracy
Oscilloscope with dual trace input	Observing detector output pulse	Tektronix 455	5 mV to 2 V/div vertical; 1 μs/div horizontal; 1-MHz bandwidth
Dc power supply (2 required)	External vco control voltage and dc filter output voltage	Hewlett-Packard 6264B	0 to 20 V dc, variable; 100-mA max current; 0.1-mV ac max ripple

Table 2. Synthesizer Test Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	a. Disconnect A1P1 from receiver-exciter J1.		
	b. Remove synthesizer assembly from card cage. (First remove two screws securing coax from A1P1 to side of card cage.)		
	c. Turn on transceiver power.		
2. Output level	a. Connect A1P1 to rf voltmeter through 50-Ω adapter.		
	b. Measure rf output level at 00.000 00, 12.999 99, 13.000 00 and 29.999 99 MHz.	+17.0 dB mW at lowest point.	Adjust A1R22 for +17.0 ±0.1 dB mW at 29.999 99 MHz. Recheck for other frequencies. If output not adjustable, perform troubleshooting procedures, table 4.
3. Output frequency	a. Disconnect voltmeter and connect frequency counter to A1P1.		
	b. Tune the transceiver to each of the following frequencies and observe the frequency counter display for each frequency.		Measure frequency at oscillator circuit card P1 for 39.000 00 MHz. If frequency is not correct, check oscillator circuit card. If frequency correct, perform troubleshooting procedures, table 4.
	00.000 00	39.145 00	
	00.999 99	40.144 99	
	12.000 00	51.145 00	
	12.999 99	52.144 99	
	13.000 00	52.145 00	
	13.999 99	53.144 99	
	14.000 00	53.145 00	
	29.000 00	68.145 00	
	29.999 99	69.144 99	
4. Vco tracking	a. Connect frequency counter to A1P1 through 50-Ω adapter.		
	b. Set transceiver dial to 29.500 00 MHz.		
	c. Connect dc voltmeter to A1TP1 and adjust A1C61 for minimum voltage at TP1.		
	d. Connect A1TP3 to ground and adjust A1C89 for maximum output frequency.		
	e. Remove ground connection from TP3.		
(Cont)	f. Measure voltage at TP1.	+15.0 ±0.03 V	Adjust A1L12 as necessary.

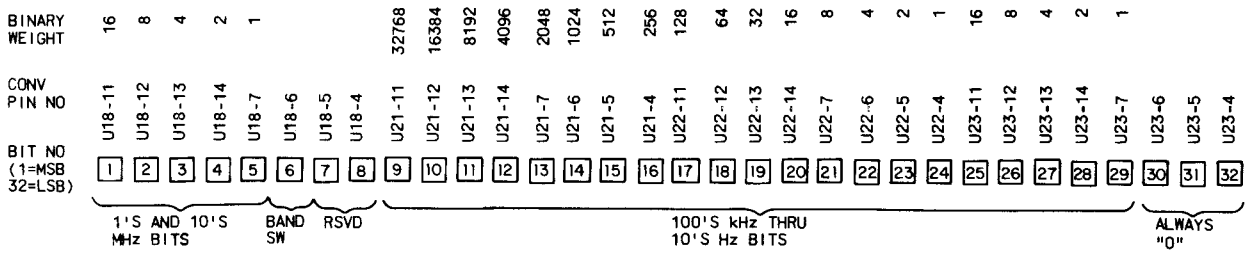
Table 2. Synthesizer Test Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	g. Measure voltage at TP2.	+14.3 ±0.03 V	Adjust A1L2 as necessary.
	h. Set transceiver dial to 12.500 00 MHz.		
	i. Measure voltage at TP1.	+15.0 ±0.03 V	Adjust A1L11 as necessary.
	j. Measure voltage at TP2.	+14.3 ±0.03 V	Adjust A1L1 as necessary.
	k. Set transceiver dial to 0.500 00 MHz.		
	l. Measure voltage at TP3.	+9.0 ±0.3 V	If voltage is less than 8.7 V: Adjust C61 for voltage at TP3 of 1 V lower than measured. Set dial to 29.500 00 MHz and adjust L12 for +15.0 ±0.03 V at TP1. Set dial to 12.500 00 MHz and adjust L11 for +15.0 ±0.03 V at TP1. Set dial to 0.500 00 MHz and measure voltage at TP3. If not 9.0 ±0.3 V, repeat test 4.1. If voltage is more than 9.3 V: Adjust C89 for voltage at TP3 of 1 V higher than measured. Set dial to 29.500 00 MHz and adjust L2 for +14.3 ±0.03 V at TP2. Set dial to 12.500 00 MHz and adjust L1 for +14.3 ±0.03 V at TP2. Set dial to 0.500 00 MHz and measure voltage at TP3. If not +9.0 ±0.3 V, repeat test 4.1.
	m. Disconnect frequency counter from A1P1.		

Table 2. Synthesizer Test Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. Loss-of-lock monitor	a. Set transceiver dial to 29.999 99 MHz. b. Ground A1TP2 output.	Rapid beeping sound is heard. (A2J1-6 is at logic 1 level.)	Check A2U6A/B, A1Q15, and Q16.
6. +20-V output	Measure voltage at A2TP3.	+19.25 ±1.25 V dc	Check A2Q3, Q12, and U25A.
7. +18-V output	Measure voltage at A2TP2.	+17.4 ±1.2 V dc	Check A2Q2, Q11, and U25B.
8. Test end	If troubleshooting procedures are to be performed, skip this step. If troubleshooting procedures are not to be performed, turn off transceiver power. Replace synthesizer assembly in card cage (replace screws securing coax from A1P1 to side of card cage) and reconnect A1P1 to receiver-exciter J1.		

Table 3. Serial-to-Parallel Frequency Data Conversion Scheme.



CONVERSION INSTRUCTIONS

BITS 1-5: CONVERT 1'S AND 10'S MHz DIGITS(0-29) TO EQUIVALENT BINARY NUMBER.
BIT 6: LOGIC 0 IF DIAL FREQUENCY IS LESS THAN 13 MHz; LOGIC 1 IF 13 MHz OR MORE.
BIT 7: LOGIC 1 IF DIAL FREQUENCY IS 0 THRU 9 MHz OR 14 THRU 23 MHz; LOGIC 0 OTHERWISE.
BIT 8: LOGIC 1 IF DIAL FREQUENCY IS 0 THRU 3 MHz OR 24 THRU 27 MHz; LOGIC 0 OTHERWISE.
BIT 9-24: ADD 294500 TO DIAL FREQUENCY 10'S Hz THRU 100'S kHz DIGITS (XX.00000-XX.99999). DIVIDE SUM BY 20. SUBTRACT 2. CONVERT WHOLE-NUMBER PART OF ANSWER TO EQUIVALENT BINARY NUMBER. USE VALUE OF REMAINDER FRACTION, IF ANY, BELOW.
BITS 25-29: EXPRESS REMAINDER, IF ANY, AS DECIMAL FRACTION, THEN MULTIPLY IT BY 20. CONVERT RESULT TO EQUIVALENT BINARY NUMBER. IF NO REMAINDER, BITS ARE LOGIC 0.
BITS 30-32: ALWAYS LOGIC 0.

EXAMPLE .54321 MHz

BITS 1-5=0
BITS 6=0
BITS 7,8=1
BITS 9-24= $\frac{54321 + 294500}{20} - 2$
$= \frac{348821}{20} - 2$
$= 17439.05$

BINARY EQUIV OF

THESE BITS=1 OTHERS =0:

	17439
(BIT 10)	-16384
	1055
(BIT 14)	-1024
	31
(BIT 20)	-16
	15
(BIT 21)	-8
	7
(BIT 22)	-4
	3
(BIT 23)	-2
	1
(BIT 24)	-1
	0

BITS 25-29= 0.05 x 20=1

BINARY EQUIV OF

THIS BIT=1 OTHERS =0:

	1
(BIT 29)	-1
	0

BITS 30-32=0

EXAMPLE 15.00000 MHz

BITS 1-5= BINARY EQUIV OF

	15
(BIT 2)	-8
	7
(BIT 3)	-4
	3
(BIT 4)	-2
	1
(BIT 5)	-1
	0

THESE BITS=1 OTHERS =0

BIT 6=1
BIT 7=1
BIT 8=0
BIT 9-24= $\frac{00000 + 294500}{20} - 2$
$= \frac{294500}{20} - 2$
$= 14723$

BINARY EQUIV OF

THESE BITS=1 OTHERS =0:

	14723
(BIT 11)	-8192
	6531
(BIT 12)	-4096
	2435
(BIT 13)	-2048
	387
(BIT 16)	-256
	131
(BIT 17)	-128
	3
(BIT 23)	-2
	1
(BIT 24)	-1
	0

BITS 25-29=0 (NO REMAINDER FROM ABOVE)
BITS 30-32=0

EXAMPLE 29.99999 MHz

BITS 1-5 BINARY EQUIV OF

	29
(BIT 1)	-16
	13
(BIT 2)	-8
	5
(BIT 3)	-4
	1
(BIT 5)	-1
	0

THESE BITS=1 OTHERS =0

BIT 6=1
BIT 7,8=0
BITS 9-24= $\frac{99999 + 294500}{20} - 2$
$= \frac{394499}{20} - 2$
$= 19722.95$

BINARY EQUIV OF

THESE BITS=1 OTHERS =0:

	19722
(BIT 10)	-16384
	3338
(BIT 13)	-2048
	1290
(BIT 14)	1024
	266
(BIT 16)	-256
	10
(BIT 21)	-8
	2
(BIT 23)	-2
	0

BITS 25-29 0.95 x 20 = 19

BINARY EQUIV OF

THESE BITS=1 OTHERS =0:

	19
(BIT 25)	-16
	3
(BIT 28)	-2
	1
(BIT 29)	-1
	0

BITS 30-32=0

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Table 4. Synthesizer Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	a. Disconnect A1P1 from receiver-exciter J1.		
	b. Remove synthesizer assembly from card cage.		
	c. Turn on transceiver power.		
2. 39.6-MHz dividers (test assumes input to A2P3 is 39.6000 MHz)	a. Measure frequency at A2P5.	9.9000 MHz	Check A2U1A and U1B.
	b. Measure frequency at A2P4.	100.0 kHz	Check A2U2 and U3.
	c. Measure frequency at A2U5B-13.	500 Hz	Check A2U4A, U4B and U5B.
	Note Tests 3 through 7 are for loop 2 operation.		
3. Output frequency and level	a. Set transceiver frequency to 15.000 00 MHz.		
	b. Measure frequency and rf voltage level at A1Q7 gate 1.	51.2 MHz, 500 mV +20 mV rf. If output is correct, loop 2 is operating properly. Omit remaining tests for loop 2 and go to test 8.	
	Note Checking output of serial-to-parallel converter U18 requires conversion of frequency value to equivalent serial data. Refer to table 3 for conversion information.		
4. Serial-to-parallel conversion	a. Set transceiver to frequency at which suspected malfunction occurs, or to 15.000 00 MHz.		
	b. Measure logic levels at following pins of A1U18.	*Note* Values in parentheses are for 15.000 00 MHz. Use appropriate values for frequency being checked.	Check A1U18.
(Cont)	-6 -7 -14 -13	(1) (1) (1) (1)	

Table 4. Synthesizer Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	-12 -11	(1) (0)	
5. ÷N counter	a. Set transceiver dial to 15.000 00 MHz.		
	b. Measure frequency at A1U17-11 and at A1U12-8.	Output from U12-8 is 1/50 of output from U17-11.	Check A1U12A, U12B, U13A, U14A, U15, U16, and U17.
6. Vco	a. Apply +11.0 V dc to U11-2. Tune transceiver to 15 MHz. Apply +5.79 V dc to junction of A1R62/C57 (end nearest shield).		
	b. Measure frequency at A1R76.	49.22 MHz (This is output frequency that is normally generated for 13.5-MHz dial frequency.)	Check loop-2 vco circuit.
	c. Increase voltage at A1R62 to +15.01 V.		
	d. Measure frequency at A1R76.	65.21 MHz (This is output frequency that is normally generated for 29.5-MHz dial frequency.)	Check loop-2 vco circuit.
	e. Tune transceiver to 12 MHz.		
	f. Decrease voltage at A1R62 to +15.00 V.		
	g. Measure frequency at A1R76.	48.23 MHz (frequency normally generated for 12.5-MHz dial frequency)	Check bandswitch circuit Q8, Q9, CR11, L11. Check loop 2 vco circuit.
	h. Decrease voltage at A1R62 to +5.35 V.		
	i. Measure frequency at A1R76.	36.21 MHz	Check loop 2 vco circuit.
7. Frequency phase detector	a. With +11 V at A1U11-2 and voltage applied to junction of A1R62/C57 set to +15.015 V dc, set transceiver dial to 12.500 00 MHz.		
	b. Measure frequency at A1U12-8.	100 kHz *Note* Slight adjustment of dc voltage may be required to obtain 100 kHz at U12-8.	Check that frequency at R76 is 33.28 MHz. Check loop 2 ÷N counter circuit, U12, U13A, U15 thru U18.
(Cont)			

Table 4. Synthesizer Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont)	c. With dual-trace scope, observe outputs at A1U10-6 and -9.	Logic 1 level with momentary negative-going spikes. (Refer to figure 4.)	Check A1Q13, Q14, U8, U9, and U10.
	d. Remove power supply from A1R62/C57 and A5A1U11-2.		
	Note Tests 8 through 13 are for variable reference frequency loop operation.		
8. Output frequency and level	a. Set transceiver frequency to 15.000 00 MHz.		
	b. Measure frequency and observe waveform at A2P6. (Use 390-Ω resistor between A2P6 and voltmeter.)	2.4950 MHz; +3-V (min) amplitude pulses rounded off from L3/C38 action. If output is correct, variable reference loop is operating properly. Omit remaining tests for variable reference frequency loop and go to test 14.	
	Note Checking output of serial-to-parallel converter U21 thru U23 requires conversion of frequency value to equivalent serial data. Refer to table 3 for conversion information.		
9. Serial-to-parallel converters	a. Set transceiver to frequency at which suspected malfunction occurs, or to 15.000 00 MHz.		
	b. Measure logic levels at following pins:	***Note*** Values in parentheses are for 15.000 00 MHz. Use appropriate values for frequency being checked.	
	A2U21-11	(0)	Check A2U23.
	-12	(0)	
	-13	(1)	
	-14	(1)	
	-7	(1)	
	-6	(0)	
	-5	(0)	
(Cont)	-4	(1)	

Table 4. Synthesizer Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	A2U22-11	(1)	Check A2U22.
	-12	(0)	
	-13	(0)	
	-14	(0)	
	-7	(0)	
	-6	(0)	
	-5	(1)	
	-4	(1)	
	A2U23-11	(0)	Check A2U21.
	-12	(0)	
	-13	(0)	
	-14	(0)	
	-7	(0)	
	-6	(0)	
	-5	(0)	
	-4	(0)	
10. Vco	a. Set transceiver frequency to 15.000 00 MHz.		
	b. Ground A2U24-1.		
	c. Apply +12.96 V to junction of A2R21/C51/R22.		
	d. Measure frequency at A2P6.	3.955 MHz	Check A2Q9, Q7, and oscillator components. Check A2U26 and U27.
	e. Apply +2.94 V to junction of A2R21/C51/R22.		
	f. Measure frequency at P6.	4.039 MHz	Check A2CR3 and CR4.
	g. Make any necessary minor adjustments to voltage at R21/C51/R22 to obtain 2.945 MHz at P6. (Equal to dial set at XX.000 00 MHz.)		
11. +N counter	With dual-trace scope, observe A2U10-8: (Ø1) and A2U10-6 (Ø2).	Logic 1 pulse widths = 50 µs. Repetition rate = 500 Hz (period = 0.76 ms). Ø1 occurs first, then Ø2 occurs when Ø1 goes from 1 to 0.	Check A2U10A thru C, U11B thru D, U12A, U13A/B, U14, U15A thru D, and U16 thru U20.
12. Frequency/ phase detector	a. Disconnect scope input from A2U10-8 (Ø1) and connect it to junction of A2R14/C27.		
(Cont)	b. Observe voltage ramp at C27 and Ø2 at U10-6.	Ramp increases to 2.8 V, then drops to 0 V when Ø2 goes from 1 to 0.	Check A2U7A/B, U8A thru D and Q4 thru Q6.

Table 4. Synthesizer Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
12. (Cont)		(For normal operation with dial at XX.999 99, ramp goes to +12.87 V.)	
	c. Measure dc voltage at A2R18.	+4.03 V (For normal operation with dial at XX.999 99 MHz, voltage is +12.87 V.)	Check A2C27, R17, U28A thru C, C54, C57, Q10, and R18.
	d. Disconnect scope. Remove power supply from A2R21/C51/R22. Remove ground from A2U24-1.		
13. Dc filter	Measure dc voltage at A2TP1 filter (for 2.94 MHz at P6).	+3.98 V dc (For normal operation with dial at XX.999 99 MHz, voltage is +12.67 V.)	Check A2U24.
14. Loop 1 operation	a. Set transceiver dial to 15.000 00 MHz.		
	b. Apply +14.345 V to A1TP2.		
	c. Measure frequency at A1P1.	68.6486 MHz	Check loop 1 vco (Q2) circuit.
	d. Apply +6.267 V to TP2. Measure frequency at P1.	52.6469 MHz	Check loop 1 vco circuit.
	e. Set transceiver dial to 12.000 00 MHz.		
	f. Apply +5.869 V to TP2. Measure frequency to P1.	39.6165 MHz	Check bandswitch Q1, CR3, and L1. Check loop 1 vco circuit.
	g. Apply +14.343 V to TP2. Measure frequency at P1.	51.6756 MHz	Check loop 1 vco circuit.
	h. Using 50-Ω adapter with rf voltmeter, measure output level at P1.	Not less than +17 dB mW.	Adjust A1R22 to set level. Check A1Q4 and Q5.
	i. Set transceiver dial to 0.500 00 MHz and adjust voltage at TP2 to +5.869 V.		
	j. Measure frequency at A1U6-11.	344.5 kHz	Check A1Q6, Q7, and U6.
	k. Connect dual-trace scope to A1U4-6 and U4-9. Observe outputs.	Logic 1 level with momentary negative-going spikes. (Refer to figure 4.) Frequency of pulses varies with transceiver dial frequency.	Check A1U2A thru D, U3A thru B, U4A thru B.

Table 4. Synthesizer Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
15. Test end	Turn off transceiver power. Disconnect test equipment and replace synthesizer in card cage.		

4. REPAIR

Repair of the synthesizer is accomplished using standard maintenance and circuit card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All parts list illustrations containing ESDS items are shown with the following symbol:

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter

code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

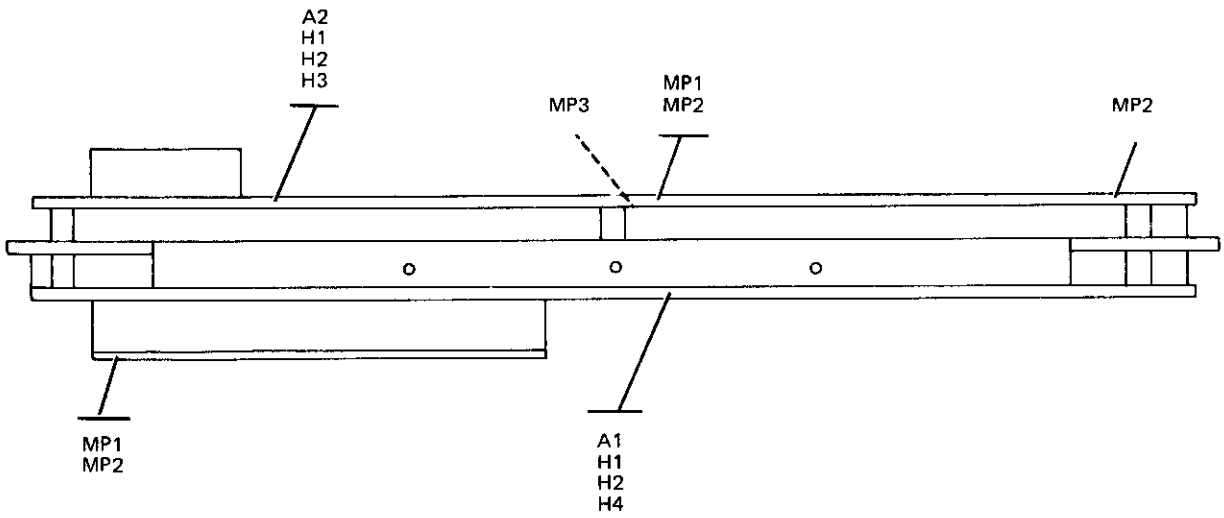
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75265
02113	COILCRAFT INC 1102 SILVER LAKE RD CARY IL 60013
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
03550	VANGUARD ELECTRONICS CO INC 930 W HYDE PARK BLVD INGLEWOOD CA 90302
04232	STAVER CO INC THE 41-51 N SAXON AVE BAY SHORE NY 11707
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
05411	DU PAGE MFG CO 2250 CURTISS AVE DOWNERS GROVE IL 60515
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV SUB OF SCHLUMBERGER LTD NORTH AMERICAN SALES MAIL STOP 14-1053 401 ELLIS ST P O DRAWER 7284 MOUNTAIN VIEW CA 94042
12040	NATIONAL SEMICONDUCTOR CORP COMMERCE DR P O BOX 443 DANBURY CT 06810
12954	SIEMENS CORP COMPONENTS GROUP 8700 E THOMAS RD P O BOX 1390 SCOTTSDALE AZ 85252
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
22229	SOLITRON DEVICES INC SEMICONDUCTOR GROUP SAN DIEGO OPERS 8808 BALBOA AVE SAN DIEGO CA 92123
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
28480	HEWLETT-PACKARD CO CORPORATE HQ 3000 HANOVER ST PALO ALTO CA 94304
31019	SOLID STATE SCIENTIFIC INC COMMERCE DR MONTGOMERYVILLE PA 18936
34335	ADVANCED MICRO DEVICES 901 THOMPSON PL SUNNYVALE CA 94086
51642	CENTRE ENGINEERING INC 2820 E COLLEGE AVE STATE COLLEGE PA 16801
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
72982	ERIE TECHNOLOGICAL PRODUCTS INC 645 W 11TH ST ERIE PA 16512
79807	WROUGHT WASHER MFG INC 2100 S BAY ST MILWAUKEE WI 53207

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
79963	ZIERICK MFG CO RADIO CIRCLE MT KISCO NY 10549
81349	MILITARY SPECIFICATIONS
91637	DALE ELECTRONICS INC P O BOX 609 COLUMBUS NE 68601
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

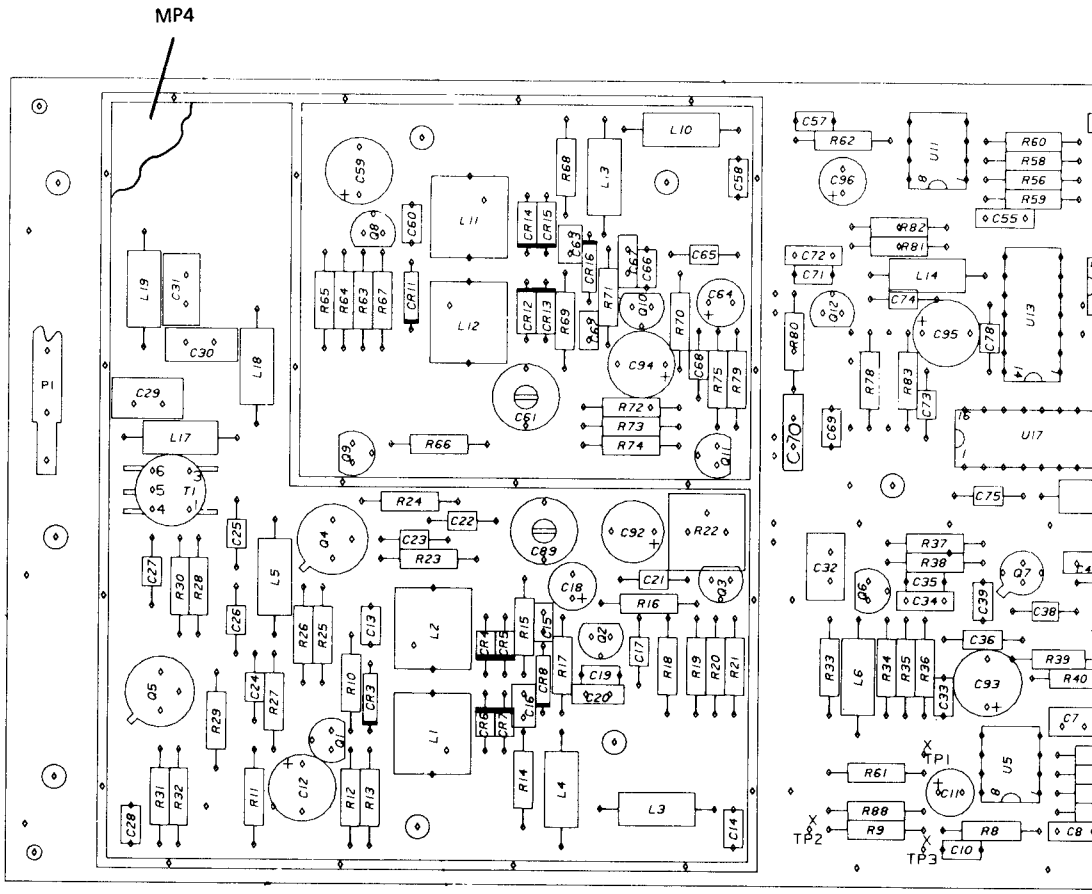
5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

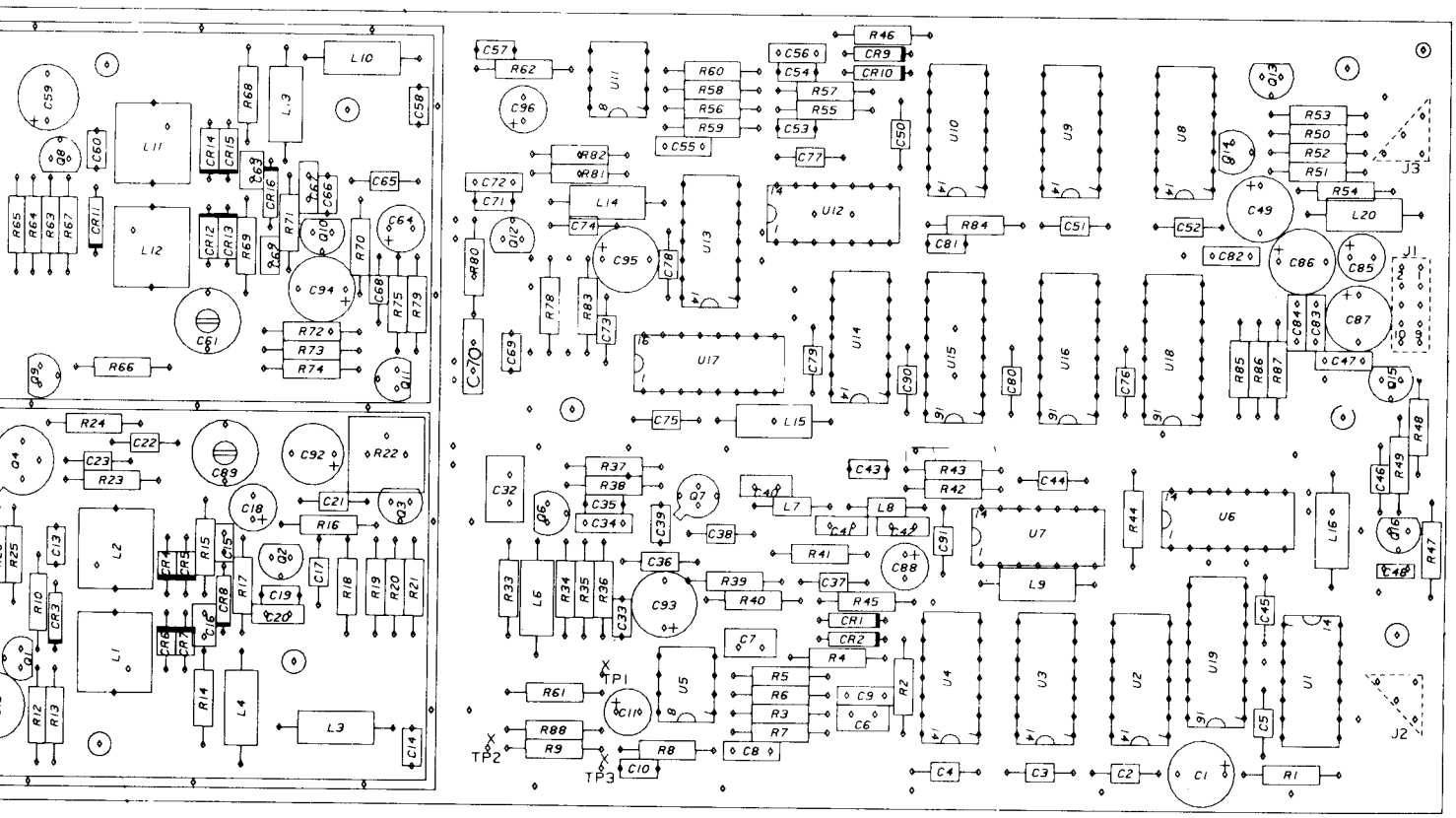
CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Synthesizer	641-7099-002	REV C
Synthesizer	641-7099-003	REV C
Synthesizer Output Loop	638-6916-002	REV L
Synthesizer Output Loop	638-6916-003	REV L
Variable Loop	638-6920-001	REV L
Variable Loop	638-6920-002	REV L



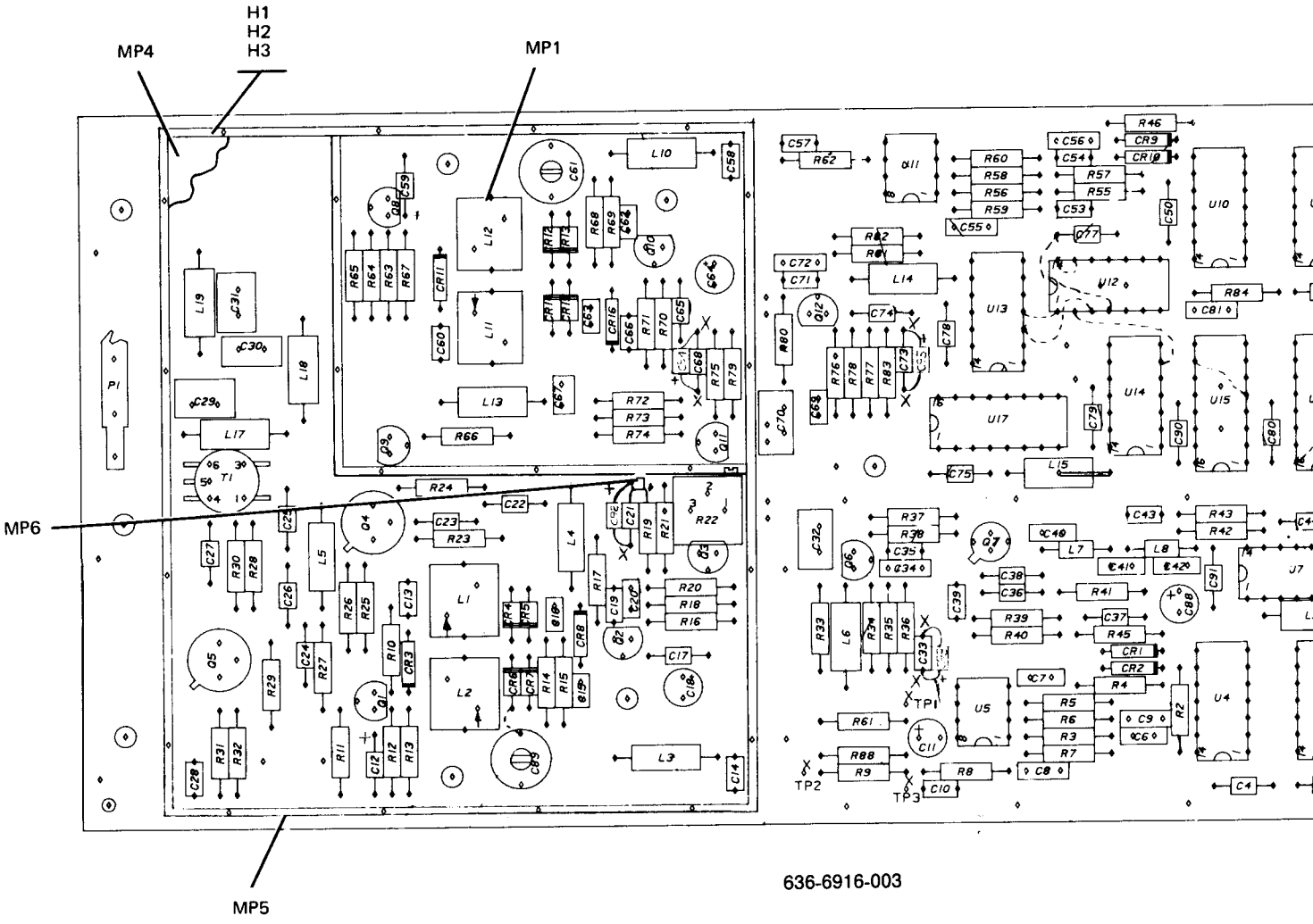
Synthesizer, Parts Location
Figure 6 (Sheet 1 of 6)


MP4
P1
T1
L1
L2
L3
L4
L5
L6
L10
L11
L12
L13
L14
L17
L18
L19
C12
C28
C29
C30
C31
C59
C61
C64
C65
C66
C68
C70
C78
C92
C93
C94
C95
C96
R66
R72
R73
R74
R75
R79
R83
R88
U11
U13
U17
U5
Q1
Q2
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
TP1
TP2
TP3

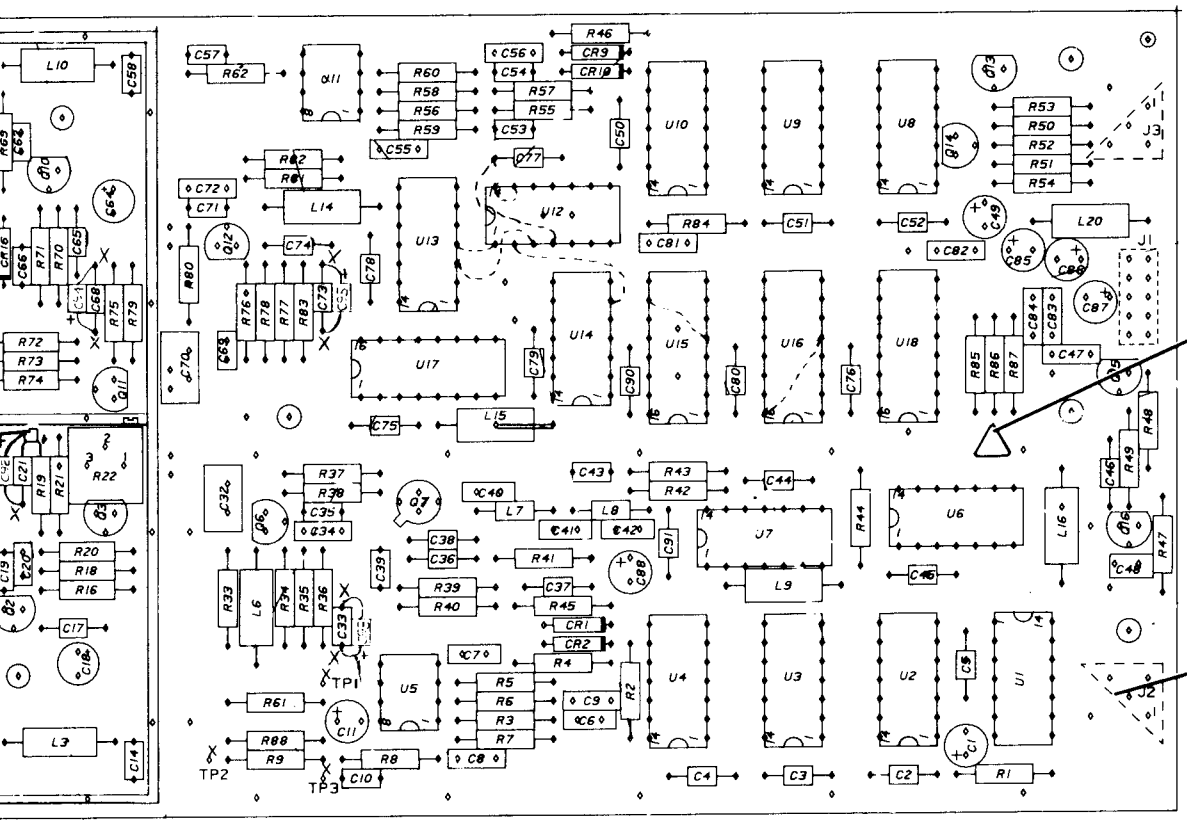
638-6916-002



Synthesizer, Parts Location
Figure 6 (Sheet 2)



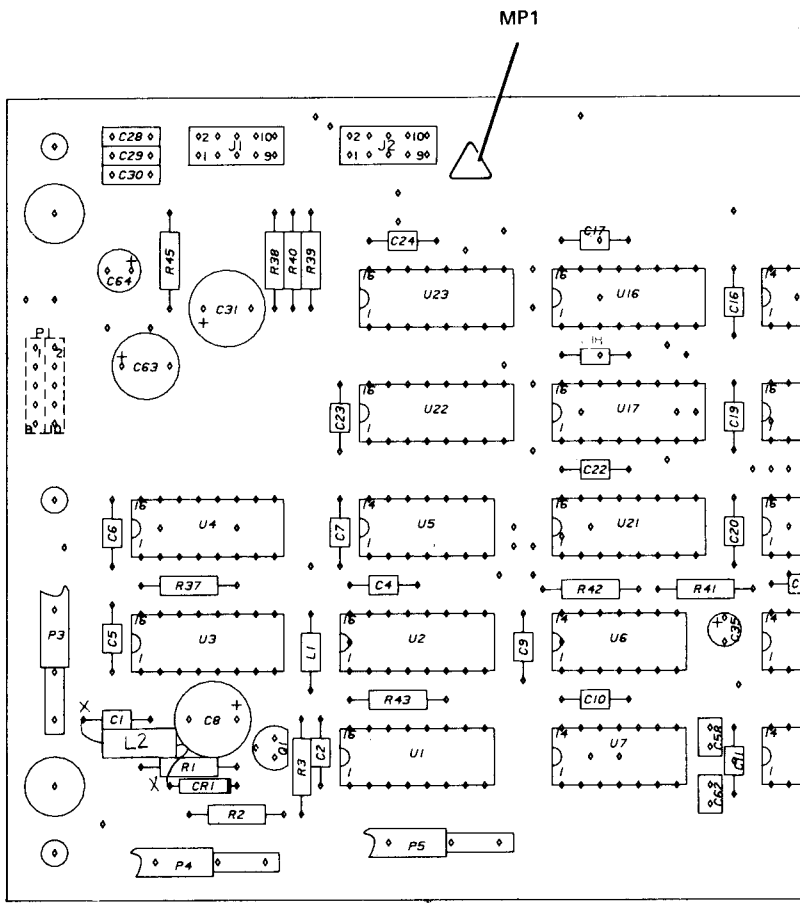
Synthesizer, Parts Loca
Figure 6 (Sheet 3)

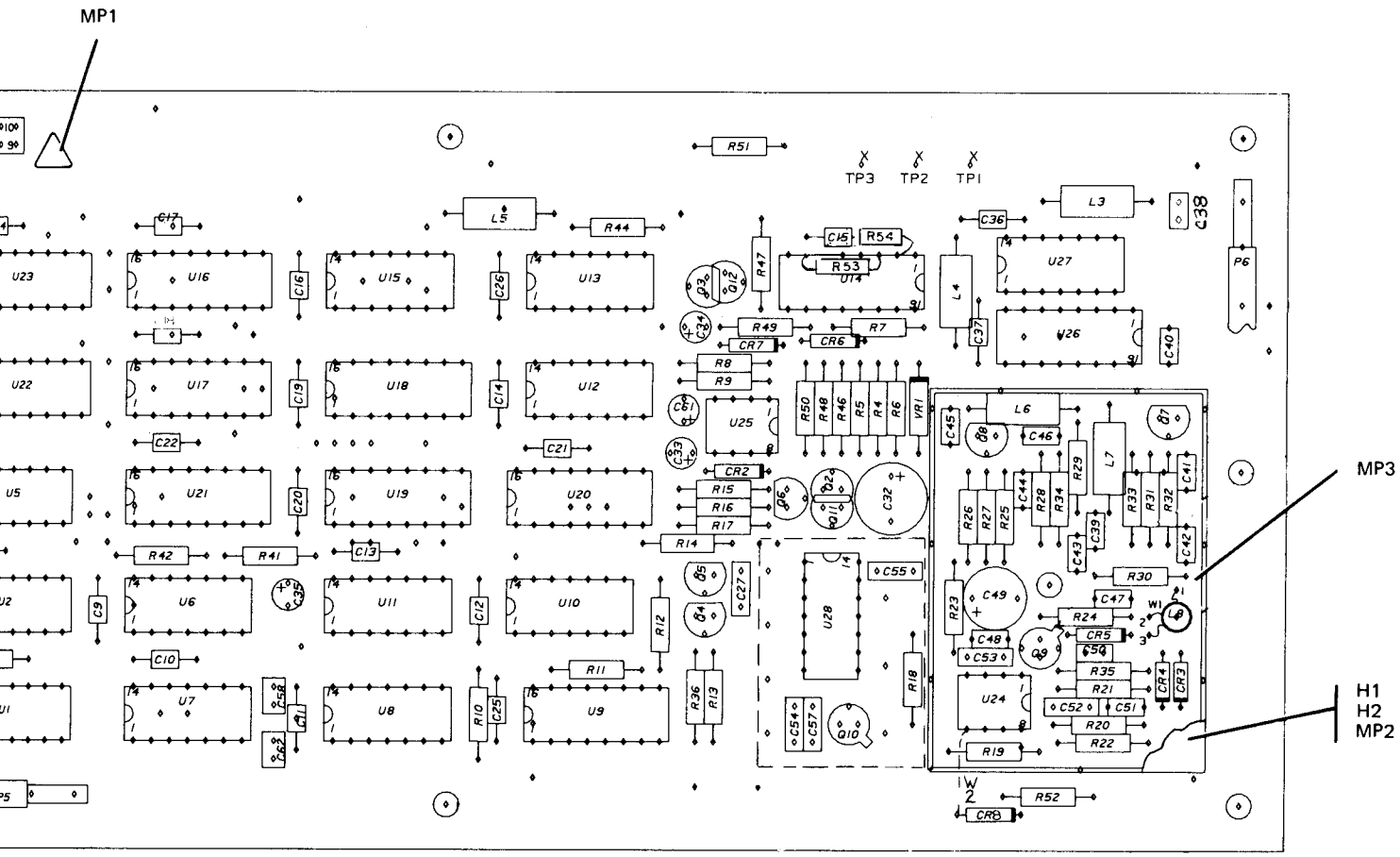


636-6916-003

TPA-5297-049

Synthesizer, Parts Location
Figure 6 (Sheet 3)


MP1
C28
C29
C30
J1
J2
C64
R45
R38
R40
R39
C31
C63
P1
C24
C17
U23
U16
C16
C23
U22
U17
C19
C22
C6
U4
C7
U5
U21
C20
R37
C4
R42
R41
P3
C5
U3
L1
U2
C9
U6
C35
C1
C8
L2
R43
C10
Q1
R1
C2
U1
U7
R3
CR1
R2
P4
P5



Synthesizer, Parts Location
Figure 6 (Sheet 4)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	SYNTHESIZER (ESDS)	641-7099-002	A		641-7099-002
	SYNTHESIZER (ESDS)	641-7099-003	B		
	OUTPUT LOOP (ESDS)	638-6916-002	C		638-6916-002
	OUTPUT LOOP (ESDS)	638-6916-003	D		
	VARIABLE LOOP (ESDS)	638-6920-001	E		638-6920-001
	VARIABLE LOOP (ESDS)	638-6920-002	F		
H1	WASHER,FLAT SST, 0.125 ID X 0.312 OD (QTY 18)	310-0045-000		79807	310-0045-000
H2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 20)	310-0279-000		96906	MS35338-135
H3	SCREW,MACH STL, 4-40 X 1 (QTY 5)	343-0141-000		96906	MS51957-21
H4	SCREW,MACH SST, 4-40 X 5/16 (QTY 15)	343-0134-000		96906	MS51957-14
MP1	TERMINAL,LUG	304-1089-000		79963	403
MP2	TIE,CABLE	435-1169-100		96906	MS3367-4-9
MP3	LABEL,PRESS SENS	280-2745-020		12998	280-2745-020
	OUTPUT LOOP (ESDS)	638-6916-002	C		638-6916-002
	OUTPUT LOOP (ESDS)	638-6916-003	D		
CR1,CR2	SEMICOND DEVICE	353-3644-050		03508	DA2779GE
CR3	SEMICOND DEVICE	353-3733-010		28480	HP-3168
CR4-CR7	SEMICOND DEVICE (OBSOLETE) (A3)	922-6131-010		12954	BB109-6131-010
CR4-CR7	SEMICOND DEVICE	922-6131-030		12954	BB409N
CR8	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
CR9,CR10	SEMICOND DEVICE	353-3644-050		03508	DA2779GE
CR11	SEMICOND DEVICE	353-3733-010		28480	HP-3168
CR12-CR15	SEMICOND DEVICE (OBSOLETE) (A3)	922-6131-010		12954	BB109-6131-010
CR12-CR15	SEMICOND DEVICE	922-6131-030		12954	BB409N
CR16	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
C1	CAPACITOR,FIXED TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C2-C5	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C6,C7	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430		93790	CD5FY181J0
C8,C9	CAPACITOR,FIXED CER DIEL, 0.82UF, 10%, 50VDC	913-5019-550		81349	CK06BX824K
C10	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C11	CAPACITOR,FIXED TNTLM ELCTLT, 2.2UF, 20%, 35V	184-9102-370		56289	199D225X0035CB1
C12	CAPACITOR,FIXED TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C13	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C14	CAPACITOR,FIXED CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C15	CAPACITOR,FIXED CER DIEL, 18PF, 10%, 100VDC	913-1098-030		72982	8101-100-COG-180 K
C16	CAPACITOR,FIXED CER DIEL, 100PF, PORM5%, 100V	913-3281-280		51642	200-100NP0-101J
C17	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C18	CAPACITOR,FIXED TNTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C19	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C20	CAPACITOR,FXD MICA DIEL, 4PF, PORM 0.5PF, 300V	912-4141-080		93790	CD5CC040D0
C21-C27	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C28	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C29-C31	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V	912-3856-000		81349	CM04ED470J03
C32	CAPACITOR,FIXED CER DIEL, 18PF, 10%, 100VDC	913-1098-030		72982	8101-100-COG-180 K
C33	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C34	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K
C35	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C36-C38	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C39	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C40	CAPACITOR,FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4141-120		93790	CD5CC120D0
C41	CAPACITOR,FXD MICA DIEL, 36PF, 5%, 50V	912-4141-240		93790	CD5EY360J0
C42	CAPACITOR,FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4141-120		93790	CD5CC120D0
C43	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C44-C46	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C47	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K
C48	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450		93790	CD5FY221J0
C49	CAPACITOR,FIXED TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C50-C52	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C53,C54	CAPACITOR,FIXED CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C55,C56	CAPACITOR,FIXED CER DIEL, 0.22UF, 10%, 50VDC	913-5019-480		81349	CK06BX224K
C57	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C58	CAPACITOR,FIXED CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
C59	CAPACITOR,FIXED TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C60	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C61	CAPACITOR,VAR CER DIEL, 2 TO 8PF, 350V	917-1218-000		72982	538011C0P089R
C62	CAPACITOR,FIXED CER DIEL, 18PF, 10%, 100VDC	913-1098-030		72982	8101-100-COG-180 K
C63	CAPACITOR,FIXED CER DIEL, 100PF, PORM5%, 100V	913-3281-280		51642	200-100NP0-101J
C64	CAPACITOR,FIXED TNTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C65	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C66	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C67	CAPACITOR,FXD MICA DIEL, 4PF, PORM 0.5PF, 300V	912-4141-080		93790	CD5CC040D0
C68	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C69	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C70	CAPACITOR,FXD MICA DIEL, 8PF, PORM 0.5PF, 300V	912-4141-110		93790	CD5CC080D0
C71	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C72	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K

PARTS LIST (Co

REF DES	DESCRIPTION
C73-C80	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC
C81	CAPACITOR,FIXED CER DIEL, 2200PF, 10%, 100V
C82-C84	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC
C85	CAPACITOR,FIXED TNTLM ELCTLT, 4.7UF, 20%, 35V
C86-C88	CAPACITOR,FIXED TNTLM ELCTLT, 22UF, 20%, 15V
C89	CAPACITOR,VAR CER DIEL, 2 TO 8PF, 350V
C90,C91	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC
C92-C95	CAPACITOR,FIXED TNTLM ELCTLT, 47UF, 20%, 20V
C96	CAPACITOR,FIXED TNTLM ELCTLT, 4.7UF, 20%, 35V
H1	WASHER,LOCK SST, 0.088 ID X 0.172 OD (QTY 15)
H2	WASHER,FLAT BRS, 0.105 ID X 1/4 OD (QTY 15)
H3	SCREW,MACH SST, 2-56 X 3/8 (QTY 15)
J1	CONNECTOR,HDR
J2,J3	CONNECTOR,RCPT ELEC
	CONNECTOR,RCPT ELEC
L1	COIL,RF,VAR 0.253MIN UH TO 0.479MAX UH
L2	COIL,RF,VAR 0.315MIN UH TO 0.630MAX UH (A1)
L2	COIL,RF,VAR 0.315MIN UH TO 0.565MAX UH
L3-L6	COIL,RF 4.70UH
L7,L8	COIL,RF 68UH
L9,L10	COIL,RF 4.70UH
L11	COIL,RF,VAR 0.253MIN UH TO 0.479MAX UH
L12	COIL,RF,VAR 0.315MIN UH TO 0.630MAX UH (A1)
L12	COIL,RF,VAR 0.315MIN UH TO 0.565MAX UH
L13,L14	COIL,RF 4.70UH
L15	COIL,RF 2.70UH
L16	COIL,RF 68UH
L17-L19	COIL,RF 0.22UH
L20	COIL,RF 68UH
L21	COIL,RF 4.70UH
MP1	CAN,SQUARE (QTY 4)
MP2	LABEL,PRESS SENS (ESDS)
MP3	JACK,TIP (QTY 2)
MP4	COVER
MP5	SHIELD
MP6	CONNECTOR,HDR (QTY 5)
Q1	TRANSISTOR
Q2	TRANSISTOR
Q3	TRANSISTOR
Q4,Q5	TRANSISTOR
Q6	TRANSISTOR
Q7	TRANSISTOR,FET (ESDS)
Q8	TRANSISTOR
Q9	TRANSISTOR
Q10	TRANSISTOR
Q11,Q12	TRANSISTOR
Q13-Q15	TRANSISTOR
Q16	TRANSISTOR
R1	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W
R2-R5	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W
R6,R7	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W
R8	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W
R9	RESISTOR,FXD FILM, 154K, 1%, 1/8W
R10	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W
R11	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
R12	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W
R13	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W
R14	RESISTOR,FXD FILM, 1.82K, 1%, 1/8W
R15	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W
R16	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W
R17	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W
R18,R19	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W
R20	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W
R21	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W
R22	RESISTOR,VAR 200 OHMS, 20%, 1/2W
R23	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W
R24	RESISTOR,FXD FILM, 243 OHMS, 1%, 1/8W
R25	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W
R26	RESISTOR,FXD FILM, 10 OHMS, 1%, 1/8W
R27	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W
R28	RESISTOR,FXD FILM, 243 OHMS, 1%, 1/8W
R29	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W
R30	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W
R31	RESISTOR,FXD FILM, 10 OHMS, 1%, 1/8W
R32	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W (A2)
R33	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W
R34	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W
R35	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W
R36	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W
R37	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W
R38	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W
R39	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W
R40	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
C73-C80	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C81	CAPACITOR,FIXED CER DIEL, 2200PF, 10%, 100V	913-5019-120		81349	CK05BX222K
C82-C84	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K
C85	CAPACITOR,FIXED TNTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
C86-C88	CAPACITOR,FIXED TNTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
C89	CAPACITOR,VAR CER DIEL, 2 TO 8PF, 350V	917-1218-000		72982	538011C0P089R
C90,C91	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C92-C95	CAPACITOR,FIXED TNTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239
C96	CAPACITOR,FIXED TNTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
H1	WASHER,LOCK SST, 0.088 ID X 0.172 OD (QTY 15)	310-0275-000		96906	MS35338-134
H2	WASHER,FLAT BRS, 0.105 ID X 1/4 OD (QTY 15)	310-0130-000		05411	310-0130-000
H3	SCREW,MACH SST, 2-56 X 3/8 (QTY 15)	343-0126-000		96906	MS51957-5
J1	CONNECTOR,HDR	372-2656-100		52072	CAD10SP100-230-430
J2,J3	CONNECTOR,RCPT ELEC	357-0067-020	A,C,E	00779	226287-2
	CONNECTOR,RCPT ELEC	357-7405-010	B,D,F	98291	51-051-0000
L1	COIL,RF,VAR 0.253MIN UH TO 0.479MAX UH	242-0439-070		02113	115CLWNDW9-5TURNS
L2	COIL,RF,VAR 0.315MIN UH TO 0.630MAX UH (A1)	242-0439-040		02113	115CLWNDBR11-5TURNS
L2	COIL,RF,VAR 0.315MIN UH TO 0.565MAX UH	242-0439-090		02113	115CLWNDBR11-5TURNS
L3-L6	COIL,RF 4.70UH	240-1576-000		96906	MS18130-16
L7,L8	COIL,RF 68UH	240-2045-000		96906	MS75085-05
L9,L10	COIL,RF 4.70UH	240-1576-000		96906	MS18130-16
L11	COIL,RF,VAR 0.253MIN UH TO 0.479MAX UH	242-0439-070		02113	115CLWNDW9-5TURNS
L12	COIL,RF,VAR 0.315MIN UH TO 0.630MAX UH (A1)	242-0439-040		02113	115CLWNDBR11-5TURNS
L12	COIL,RF,VAR 0.315MIN UH TO 0.565MAX UH	242-0439-090		02113	115CLWNDBR11-5TURNS
L13,L14	COIL,RF 4.70UH	240-1576-000		96906	MS18130-16
L15	COIL,RF 2.70UH	240-2715-180		96906	MS75088-6
L16	COIL,RF 68UH	240-2715-350		96906	MS75089-9
L17-L19	COIL,RF 0.22UH	240-1563-000		96906	MS18130-2
L20	COIL,RF 68UH	240-2715-350		96906	MS75089-9
L21	COIL,RF 4.70UH	240-1576-000		96906	MS18130-16
MP1	CAN,SQUARE (QTY 4)	141-0941-010		04232	307A40
MP2	LABEL,PRESS SENS (ESDS)	280-2745-040		12998	280-2745-040
MP3	JACK,TIP (QTY 2)	360-0079-190		00779	2-332095-4
MP4	COVER	642-2989-001			
MP5	SHIELD	641-7141-001			
MP6	CONNECTOR,HDR (QTY 5)	372-2656-130		52072	CAS01SP100-230-430
Q1	TRANSISTOR	352-5500-010		04713	MPS2907A
Q2	TRANSISTOR	352-5505-020		17856	2N5485
Q3	TRANSISTOR	352-0723-010		04713	MPS918
Q4,Q5	TRANSISTOR	352-0766-010		04713	2N5109
Q6	TRANSISTOR	352-0723-010		04713	MPS918
Q7	TRANSISTOR,FET (ESDS)	352-1140-020		01295	3N202
Q8	TRANSISTOR	352-5500-010		04713	MPS2907A
Q9	TRANSISTOR	352-5015-010		04713	MPS2369
Q10	TRANSISTOR	352-5505-020		17856	2N5485
Q11,Q12	TRANSISTOR	352-0723-010		04713	MPS918
Q13-Q15	TRANSISTOR	352-5015-010		04713	MPS2369
Q16	TRANSISTOR	352-5500-010		04713	MPS2907A
R1	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W	745-0710-000		81349	RCR07G820KS
R2-R5	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R6,R7	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R8	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
R9	RESISTOR,FXD FILM, 154K, 1%, 1/8W	705-1101-000		81349	RN55D1543F
R10	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R11	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R12	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R13	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R14	RESISTOR,FXD FILM, 1.82K, 1%, 1/8W	705-3605-120		81349	RN55D1821F
R15	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W	705-1067-000		81349	RN55D3012F
R16	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R17	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R18,R19	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R20	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R21	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W	745-0710-000		81349	RCR07G820KS
R22	RESISTOR,VAR 200 OHMS, 20%, 1/2W	382-0038-020		91637	101T200R0
R23	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R24	RESISTOR,FXD FILM, 243 OHMS, 1%, 1/8W	705-3600-670		81349	RN55D2430F
R25	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R26	RESISTOR,FXD FILM, 10 OHMS, 1%, 1/8W	705-0900-000		81349	RN55D10R0F
R27	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R28	RESISTOR,FXD FILM, 243 OHMS, 1%, 1/8W	705-3600-670		81349	RN55D2430F
R29	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R30	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR07G332KS
R31	RESISTOR,FXD FILM, 10 OHMS, 1%, 1/8W	705-0900-000		81349	RN55D10R0F
R32	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W (A2)	745-0707-000		81349	RCR07G680KS
R33	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R34	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R35	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R36	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R37	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R38	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R39	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R40	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLI PART NUMB
R41	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0
R42	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0
R43,R44	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0
R45	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0
R46	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W	745-0
R47	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0
R48-R51	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0
R52,R53	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0
R54	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0
R55-R58	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0
R59,R60	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0
R61	RESISTOR,FXD FILM, 1.82K, 1%, 1/8W	705-3
R62	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0
R63	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0
R64	NOT USED	
R65	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0
R66	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0
R67	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0
R68	RESISTOR,FXD FILM, 1.82K, 1%, 1/8W	705-3
R69	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W	705-1
R70	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0
R71	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0
R72,R73	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0
R74,R75	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0
R76,R77	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0
R78	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0
R79	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0
R80	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0
R81	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0
R82	NOT USED	
R83	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0
R84	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0
R85-R87	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0
R88	RESISTOR,FXD FILM, 24.9K, 1%, 1/8W	705-1
T1	TRANSFORMER,RF	278-0
U1	INTEGRATED CIRCUIT DECADE COUNTER	351-1
U2	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
U3	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
U4	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
U5	INTEGRATED CIRCUIT OPRTNL AMPLIFIER	351-1
U6	INTEGRATED CIRCUIT DECADE COUNTER	351-1
U7	INTEGRATED CIRCUIT LOGIC GATE	351-1
U8	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
U9	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
U10	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
U11	INTEGRATED CIRCUIT OPRTNL AMPLIFIER,DUAL	351-1
U12,U13	INTEGRATED CIRCUIT FLIP-FLOP	351-1
U14	INTEGRATED CIRCUIT LOGIC GATE	351-1
U15,U16	INTEGRATED CIRCUIT COUNTER	351-1
U17	INTEGRATED CIRCUIT DIGITAL ARRAY	351-1
U18	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8
U19	INTEGRATED CIRCUIT LEVEL SHIFTER (ESDS)	351-8
	VARIABLE LOOP (ESDS) (ESDS)	638-6
	VARIABLE LOOP (ESDS)	638-6
CR1,CR2	SEMICOND DEVICE	353-3
CR3,CR4	SEMICOND DEVICE (OBSOLETE) (A4)	922-6
CR3,CR4	SEMICOND DEVICE	922-6
CR5	SEMICOND DEVICE (ESDS)	353-3
CR6-CR8	SEMICOND DEVICE	353-3
C1,C2	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3
C3	NOT USED	
C4-C7	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3
C8	CAPACITOR,FIXED TNTLM ELCTLT, 33UF, 20%, 35V	184-9
C9-C26	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3
C27-C30	CAPACITOR,FIXED CER DIEL, 0.47UF, 10%, 50VDC	913-5
C31,C32	CAPACITOR,FIXED TNTLM ELCTLT, 33UF, 20%, 35V	184-9
C33	CAPACITOR,FIXED TNTLM ELCTLT, 22UF, 20%, 15V	184-9
C34,C35	CAPACITOR,FIXED TNTLM ELCTLT, 4.7UF, 20%, 35V	184-9
C36,C37	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3
C38	CAPACITOR,FIXED CER DIEL, 100PF, PORM5%, 100V	913-3
C39-C48	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V (A1)	913-4
C39	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4
C40	CAPACITOR,FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4
C41-C44	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4
C45	CAPACITOR,FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4
C46-C48	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4
C49	CAPACITOR,FIXED TNTLM ELCTLT, 100UF, 20%, 10V	184-9
C50	CAPACITOR,FIXED CER DIEL, 47PF, 10%, 100VDC (A3)	913-1
C50	CAPACITOR,FIXED CER DIEL, 27PF, 10%, 100VDC	913-1
C51	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5
C52	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5
C53	CAPACITOR,FIXED CER DIEL, 0.033UF, 10%, 100VDC	913-5
C54,C55	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5

Synthesizer, Parts Location
Figure 6 (Sheet 5)

PARTS LIST (Cont)

USABLE ON CODE	MFR CODE	MFR PART NUMBER	REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	56289	292CY5U103Z050B	R41	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
			R42	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
	81349	CK05BX222K	R43,R44	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
	81349	CK06BX104K	R45	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
	56289	199D475X0035DB1	R46	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W	745-0803-000		81349	RCR07G333KS
	56289	199D226X0015DB1	R47	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
	72982	538011C0P089R	R48-R51	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
	56289	292CY5U103Z050B	R52,R53	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
			R54	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
	56289	196D239	R55-R58	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
	56289	199D475X0035DB1	R59,R60	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
	96906	MS35338-134	R61	RESISTOR,FXD FILM, 1.82K, 1%, 1/8W	705-3605-120		81349	RN55D1821F
	05411	310-0130-000	R62	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR07G562KS
	96906	MS51957-5	R63	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
	52072	CAD10SP100-230-4 30	R64	NOT USED				
A,C,E	00779	226287-2	R65	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
B,D,F	98291	51-051-0000	R66	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
	02113	115CLWNDW9-5TURN S	R67	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
			R68	RESISTOR,FXD FILM, 1.82K, 1%, 1/8W	705-3605-120		81349	RN55D1821F
	02113	115CLWNDBR11-5TU RNS	R69	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W	705-1067-000		81349	RN55D3012F
	02113	115CLWNDBR11-5TU RNS	R70	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
			R71	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
	96906	MS18130-16	R72,R73	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
	96906	MS75085-05	R74,R75	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
	96906	MS18130-16	R76,R77	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR07G680KS
	02113	115CLWNDW9-5TURN S	R78	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
	02113	115CLWNDBR11-5TU RNS	R79	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-000		81349	RCR07G181KS
	02113	115CLWNDBR11-5TU RNS	R80	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
			R81	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
	96906	MS18130-16	R82	NOT USED				
	96906	MS75088-6	R83	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
	96906	MS75089-9	R84	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
	96906	MS18130-2	R85-R87	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
	96906	MS75089-9	R88	RESISTOR,FXD FILM, 24.9K, 1%, 1/8W	705-1063-000		81349	RN55D2492F
	96906	MS18130-16	T1	TRANSFORMER,RF	278-0430-220		03550	22490
	04232	307A40	U1	INTEGRATED CIRCUIT DECADE COUNTER	351-1636-010		01295	SN74LS90N
	12998	280-2745-040	U2	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-340		31019	SCL4011BE
	00779	2-332095-4	U3	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-350		31019	SCL4012BE
			U4	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-360		31019	SCL4023BE
			U5	INTEGRATED CIRCUIT OPRTNL AMPLIFIER	351-1071-070		07263	UA1458TC
			U6	INTEGRATED CIRCUIT DECADE COUNTER	351-1636-010		01295	SN74LS90N
			U7	INTEGRATED CIRCUIT LOGIC GATE	351-1523-090		04713	SN74LS04N
			U8	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-340		31019	SCL4011BE
			U9	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-350		31019	SCL4012BE
			U10	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-360		31019	SCL4023BE
	52072	CAS01SP100-230-4 30	U11	INTEGRATED CIRCUIT OPRTNL AMPLIFIER,DUAL	351-1370-010		27014	LF353AN
	04713	MPS2907A	U12,U13	INTEGRATED CIRCUIT FLIP-FLOP	351-1525-040		04713	SN74LS74AN
	17856	2N5485	U14	INTEGRATED CIRCUIT LOGIC GATE	351-1523-250		04713	SN74LS27N
	04713	MPS918	U15,U16	INTEGRATED CIRCUIT COUNTER	351-1527-030		34335	SN74LS191N
	04713	2N5109	U17	INTEGRATED CIRCUIT DIGITAL ARRAY	351-1653-020		07263	11C90DC
	04713	MPS918	U18	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8346-010		02735	CD4094BE
	01295	3N202	U19	INTEGRATED CIRCUIT LEVEL SHIFTER (ESDS)	351-8458-010		02735	CD40109BE
	04713	MPS2907A		VARIABLE LOOP (ESDS) (ESDS)	638-6920-001 E			638-6920-001
	04713	MPS2369		VARIABLE LOOP (ESDS)	638-6920-002 F			
	17856	2N5485	CR1,CR2	SEMICOND DEVICE	353-3644-050		03508	DA2779GE
	04713	MPS918	CR3,CR4	SEMICOND DEVICE (OBSOLETE) (A4)	922-6131-010		12954	BB109-6131-010
	04713	MPS2369	CR3,CR4	SEMICOND DEVICE	922-6131-030		12954	BB409N
	04713	MPS2907A	CR5	SEMICOND DEVICE (ESDS)	353-3691-010		28480	1N5711
	81349	RCR07G820KS	CR6-CR8	SEMICOND DEVICE	353-3644-050		03508	DA2779GE
	81349	RCR07G472KS	C1,C2	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
	81349	RCR07G391KS	C3	NOT USED				
	81349	RCR07G562KS	C4-C7	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
	81349	RN55D1543F	C8	CAPACITOR,FIXED TNTLM ELCTLT, 33UF, 20%, 35V	184-9102-880		56289	196D247A
	81349	RCR07G561KS	C9-C26	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
	81349	RCR07G103KS	C27-C30	CAPACITOR,FIXED CER DIEL, 0.47UF, 10%, 50VDC	913-5019-520		81349	CK06BX474K
	81349	RCR07G272KS	C31,C32	CAPACITOR,FIXED TNTLM ELCTLT, 33UF, 20%, 35V	184-9102-880		56289	196D247A
	81349	RCR07G151KS	C33	CAPACITOR,FIXED TNTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
	81349	RN55D1821F	C34,C35	CAPACITOR,FIXED TNTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
	81349	RN55D3012F	C36,C37	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
	81349	RCR07G561KS	C38	CAPACITOR,FIXED CER DIEL, 100PF, PORM5%, 100V	913-3281-280		51642	200-100NP0-101J
	81349	RCR07G151KS	C39-C48	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V (A1)	913-4018-000		81349	CK05BX102K
	81349	RCR07G472KS	C39	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
	81349	RCR07G101KS	C40	CAPACITOR,FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4141-120		93790	CD5CC120D0
	81349	RCR07G820KS	C41-C44	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
	91637	101T200R0	C45	CAPACITOR,FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4141-120		93790	CD5CC120D0
	81349	RCR07G102KS	C46-C48	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
	81349	RN55D2430F	C49	CAPACITOR,FIXED TNTLM ELCTLT, 100UF, 20%, 10V	184-9102-100		56289	196D235
	81349	RCR07G272KS	C50	CAPACITOR,FIXED CER DIEL, 47PF, 10%, 100VDC (A3)	913-1098-020		72982	8111-100-C0G-470K
	81349	RN55D10R0F	C50	CAPACITOR,FIXED CER DIEL, 27PF, 10%, 100VDC	913-1098-570		72982	8111-100-C0G-270K
	81349	RCR07G101KS	C51	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
	81349	RN55D2430F	C52	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K
	81349	RCR07G272KS	C53	CAPACITOR,FIXED CER DIEL, 0.033UF, 10%, 100VDC	913-5019-380		81349	CK06BX333K
	81349	RCR07G332KS	C54,C55	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K
	81349	RN55D10R0F						
	81349	RCR07G680KS						
	81349	RCR07G331KS						
	81349	RCR07G682KS						
	81349	RCR07G272KS						
	81349	RCR07G101KS						
	81349	RCR07G560KS						
	81349	RCR07G271KS						
	81349	RCR07G102KS						
	81349	RCR07G152KS						

P3

1
2
P2

9

Synthesizer, Parts Location
Figure 6 (Sheet 5)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
C56	NOT USED				
C57	CAPACITOR,FIXED CER DIEL, 0.022UF, 10%, 100VDC	913-5019-360		81349	CK06BX223K
C58	CAPACITOR,FIXED CER DIEL, 100PF, PORM5%, 100V	913-3281-280		51642	200-100NP0-101J
C59,C60	NOT USED				
C61	CAPACITOR,FIXED TNTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
C62	CAPACITOR,FIXED CER DIEL, 100PF, PORM5%, 100V	913-3281-280		51642	200-100NP0-101J
C63	CAPACITOR,FIXED TNTLM ELCTLT, 100UF, 20%, 10V	184-9102-100		56289	196D235
C64	CAPACITOR,FIXED TNTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1
H1	WASHER,FLAT BRS, 0.105 ID X 1/4 OD (QTY 7)	310-0130-000		05411	310-0130-000
H2	SCREW,MACH SST, 2-56 X 3/8 (QTY 7)	343-0126-000		96906	MS51957-5
L1	COIL,RF 100UH	240-2047-000		96906	MS75085-07
L2,L3	COIL,RF 0.15UH	240-1562-000		96906	MS18130-1
L4,L5	COIL,RF 2.70UH	240-2715-180		96906	MS75088-6
L6,L7	COIL,RF 1UH (A3)	240-1568-000		96906	MS18130-8
L6,L7	COIL,RF 0.100UH	240-2723-140		96906	MS75083-1
L8	COIL,RF ADJ, 4 1/2 TURNS	242-0596-010		02113	242-0596-010
MP1	LABEL,PRESS SENS (ESDS)	280-2745-040		12998	280-2745-040
MP2	COVER	641-7180-001			
MP3	SHIELD	641-7179-001			
P1	CONNECTOR,RCPT ELEC	372-2655-010		52072	CA05STL101WW
P2	NOT USED				
P3	CABLE,COAX	641-7100-004	E		641-7100-004
P3	CABLE,COAX	641-7100-028	F		
P4	CABLE,COAX	641-7100-005	E		641-7100-005
P4	CABLE,COAX	641-7100-032	F		
P5	CABLE,COAX	641-7100-009	E		641-7100-009
P5	CABLE,COAX	641-7100-036	F		
P6	CABLE,COAX	641-7100-006	E		641-7100-006
	CABLE,COAX	641-7100-037	F		
Q1	TRANSISTOR	352-5015-010		04713	MPS2369
Q2,Q3	TRANSISTOR	352-5501-010		04713	MPS2222A
Q4,Q5	TRANSISTOR	352-5015-010		04713	MPS2369
Q6	TRANSISTOR	352-5500-010		04713	MPS2907A
Q7,Q8	TRANSISTOR	352-0723-010		04713	MPS918
Q9	TRANSISTOR (A3)	352-0756-050		12040	SF50095
Q9	TRANSISTOR (ESDS)	352-0998-010		17856	2N5397
Q10	TRANSISTOR	352-0898-030		22229	2N4393
Q11,Q12	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R2	RESISTOR,FXD CMPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS
R3	RESISTOR,FXD CMPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS
R4	RESISTOR,FXD FILM, 3.48K, 1%, 1/8W	705-1022-000		81349	RN55D3481F
R5	RESISTOR,FXD FILM, 9.09K, 1%, 1/8W	705-1042-000		81349	RN55D9091F
R6	RESISTOR,FXD FILM, 4.32K, 1%, 1/8W	705-3605-300		81349	RN55D4321F
R7	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R8	RESISTOR,FXD FILM, 9.09K, 1%, 1/8W	705-1042-000		81349	RN55D9091F
R9	RESISTOR,FXD FILM, 3.74K, 1%, 1/8W	705-3605-270		81349	RN55D3741F
R10,R11	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R12	RESISTOR,FXD FILM, 4.32K, 1%, 1/8W	705-3605-300		81349	RN55D4321F
R13	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R14	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R15	RESISTOR,FXD FILM, 3.48K, 1%, 1/8W	705-1022-000		81349	RN55D3481F
R16,R17	RESISTOR,FXD FILM, 154 OHMS, 1%, 1/8W	705-0957-000		81349	RN55D1540F
R18	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R19,R20	RESISTOR,FXD FILM, 11K, 1%, 1/8W	705-1046-000		81349	RN55D1102F
R21	RESISTOR,FXD FILM, 24.9K, 1%, 1/8W	705-1063-000		81349	RN55D2492F
R22	RESISTOR,FXD FILM, 11K, 1%, 1/8W	705-1046-000		81349	RN55D1102F
R23,R24	RESISTOR,FXD FILM, 154 OHMS, 1%, 1/8W (A2)	705-0957-000		81349	RN55D1540F
R23	RESISTOR,FXD FILM, 154 OHMS, 1%, 1/8W	705-0957-000		81349	RN55D1540F
R24	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R25	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R26	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R27	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R28	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R29,R30	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R31	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R32	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R33	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R34	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS
R35	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W	705-1067-000		81349	RN55D3012F
R36	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R37-R41	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R42	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R43,R44	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R45	RESISTOR,FXD FILM, 10 OHMS, 1%, 1/8W	705-0900-000		81349	RN55D10R0F
R46,R47	RESISTOR,FXD FILM, 20.5 OHMS, 1%, 1/8W	705-0915-000		81349	RN55D20R5F
R48,R49	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R50-R52	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R53,R54	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W (A2)	745-2320-000		81349	RCR05G271KS
TP1-TP3	CONNECTOR,HDR	372-2656-130		52072	CAS01SP100-230-4 30
U1	INTEGRATED CIRCUIT FLIP-FLOP	351-7813-020		27014	DM74S112N
U2,U3	INTEGRATED CIRCUIT COUNTER	351-1835-030		01295	SN74LS668AN
U4	INTEGRATED CIRCUIT MOS ARRAY (ESDS)	351-8176-010		07263	4518BDM
U5	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-110		31019	SCL4013BE
U6,U7	INTEGRATED CIRCUIT FLIP-FLOP	351-1525-040		04713	SN74LS74AN
U8	INTEGRATED CIRCUIT LOGIC GATE	351-1523-110		04713	SN74LS00N
U9	INTEGRATED CIRCUIT LEVEL SHIFTER (ESDS)	351-8458-010		02735	CD40109BE
U10	INTEGRATED CIRCUIT LOGIC GATE	351-1523-250		04713	SN74LS27N
U11		353-7770-010			
U12,U13	INTEGRATED CIRCUIT FLIP-FLOP	351-7813-010		27014	DM74S74N
U14	INTEGRATED CIRCUIT DIGITAL ARRAY	351-1653-020		07263	11C90DC
U15	INTEGRATED CIRCUIT DIGITAL GATE	351-7770-010		01295	SN74S00N
U16-U20	INTEGRATED CIRCUIT COUNTER	351-1527-030		34335	SN74LS191N

REF DES	DESCRIPTION
U21-U23	INTEGRATED CIRCUIT REGISTER (ESDS
U24,U25	INTEGRATED CIRCUIT OPRTNL AMPLIFI
U26	INTEGRATED CIRCUIT DIGITAL ARRAY
U27	INTEGRATED CIRCUIT
U28	INTEGRATED CIRCUIT MOS ARRAY (ESDS
VR1	SEMICOND DEVICE

PARTS LIST (Cont)

MFR PART NUMBER	REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
CK06BX223K	U21-U23	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8346-010		02735	CD4094BE
200-100NP0-101J	U24,U25	INTEGRATED CIRCUIT OPRTNL AMPLIFIER,DUAL	351-1370-010		27014	LF353AN
	U26	INTEGRATED CIRCUIT DIGITAL ARRAY	351-1653-020		07263	11C90DC
199D475X0035DB1	U27	INTEGRATED CIRCUIT	351-7566-010		27014	DM74196N
200-100NP0-101J	U28	INTEGRATED CIRCUIT MOS ARRAY (ESDS)	351-8179-010		27014	CD4016MJ
196D235	VR1	SEMICOND DEVICE	353-3591-500		04713	1N4626
199D226X0015DB1						
510-0130-000						
MS51957-5						
MS75085-07						
MS18130-1						
MS75088-6						
MS18130-8						
MS75083-1						
742-0596-010						
380-2745-040						
EA05STL101WW						
941-7100-004						
941-7100-005						
941-7100-009						
941-7100-006						
MPS2369						
MPS2222A						
MPS2369						
MPS2907A						
MPS918						
MF50095						
1N5397						
1N4393						
CR07G821KS						
CR07G123KS						
CR07G821KS						
1N55D3481F						
1N55D9091F						
1N55D4321F						
CR07G682KS						
1N55D9091F						
1N55D3741F						
CR07G103KS						
1N55D4321F						
CR07G152KS						
CR07G560KS						
1N55D3481F						
1N55D1540F						
CR07G103KS						
1N55D1102F						
1N55D2492F						
1N55D1102F						
1N55D1540F						
1N55D1540F						
CR07G560KS						
CR07G271KS						
CR07G272KS						
CR07G682KS						
CR07G560KS						
CR07G152KS						
CR07G272KS						
CR07G271KS						
CR07G682KS						
CR07G560KS						
1N55D3012F						
CR07G682KS						
CR07G103KS						
CR07G104KS						
CR07G102KS						
1N55D10R0F						
1N55D20R5F						
1N55D1001F						
CR07G104KS						
CR056271KS						
AS01SP100-230-4						
MM74S112N						
MM74LS668AN						
MC18BDM						
CL4013BE						
MM74LS74AN						
MM74LS00N						
CD4019BE						
MM74LS27N						
MM74S74N						
11C90DC						
MM74S00N						
MM74LS191N						

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE
	638-6916-002
A1	Changed L2 from 242-0439-040 to 242-0439-090 Changed L12 from 242-0439-040 to 242-0439-090
NA	Data change only
A2	Deleted R32
A3	Changed CR4-CR7 from 922-6131-010 to 922-6131-030 Changed CR12-CR15 from 922-6131-010 to 922-6131-030
	638-6920-001
A1	Changed C40 from 1000PF to 12PF Changed C45 from 1000PF to 12PF
A2	Changed R24 154 ohms to 56 ohms
A3	Changed C50 from 47PF to 27PF Changed L6, L7 from 1UH to .100UH Changed Q9 from 352-0756-010 to 352-0998-010-2N5397
A4	Changed CR3, CR4 from 922-6131-001 to 922-6131-030

TS LIST (Cont)

	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	351-8346-010		02735	CD4094BE
,DUAL	351-1370-010		27014	LF353AN
	351-1653-020		07263	11C90DC
	351-7566-010		27014	DM74196N
	351-8179-010		27014	CD4016MJ
	353-3591-500		04713	1N4626

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
	638-6916-002	
A1	Changed L2 from 242-0439-040 to 242-0439-090 Changed L12 from 242-0439-040 to 242-0439-090	REV H
NA	Data change only	REV J
A2	Deleted R32	REV K
A3	Changed CR4-CR7 from 922-6131-010 to 922-6131-030 Changed CR12-CR15 from 922-6131-010 to 922-6131-030	REV L
	638-6920-001	
A1	Changed C40 from 1000PF to 12PF Changed C45 from 1000PF to 12PF	REV G
A2	Changed R24 154 ohms to 56 ohms	REV H
A3	Changed C50 from 47PF to 27PF Changed L6, L7 from 1UH to .100UH Changed Q9 from 352-0756-010 to 352-0998-010-2N5397	REV J
A4	Changed CR3, CR4 from 922-6131-001 to 922-6131-030	REV L

Synthesizer, Parts Location
Figure 6 (Sheet 6)

FREQUENCY SYNTHESIZ
OUTPUT LOOP A1

MICROCIRCUIT INFORMATION FOR A5A1

U NO.	TYPE	PWR (V DC)								SPARE SECTIONS
		+5	GND	+5(A)	+5(B)	+5(C)	+9(A)	+9(B)	+20 FLTR	
U1	74LS90		10		5					
U2	4011B		7				14			
U3	4012B		7				14			
U4	4023B		7				14			
U5	LM1458		4						8	B
U6	74LS90		10		5					
U7	74LS04		7			14				
U8	4011B		7					14		
U9	4012B		7					14		
U10	4023B		7					14		
U11	LF353		4						8	B
U12	74LS74	14	7							
U13	74LS74		7	14						B
U14	74LS27	14	7							
U15	74LS191	16	8							
U16	74LS191	16	8							
U17	11C90		10,12,13	4,5						
U18	4094B	16	8							
U19	40109B		8		1,9,15		16			A, B

÷10
U1
QA
QB
QC
QD
R01 R02 R91 R92
VAR REF
J2
294.5 kHz FOR DIAL FREQUENCY XX.000 00
U19D
U2B
U2A
U4B
U3A
U4C
U3B
U2D
U4A
U19C
U2C
+5 V DC (B)
+9 V DC
R1 82
+9 V DC (A)
C1 ⑤
C2 0.01
C3 0.01
C4 0.01
CR1
CR2
R2 4700
R3 4700
R4 4700
R5 4700
R45 22 k
C6 180 pF
C7 180 pF
R7 ⑤
R6 ⑤
C8 ⑤
C9 ⑤
U5A
H = 1.0 µs DIV
V = 5 V/DIV
+9 V DC
R13 150
R12 2700
C12 47
R11 10 k
Q1 MPS2907
R10 560
CR3 HP3168
C13 0.01
L2
L1
A1
TP3
TP2
TP1
R8 5600
R9 154 k
C10 0.01
R88 24.9 k
L3 4.7
C14 470 pF
R61 1820
C11 2.2
÷10
U6
QA
QB
QC
QD
R01 R02 R91
A
B
C

NOTES:

① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, INDUCTANCE VALUES ARE IN MICROHENRYS AND DIODES ARE 1N4454

② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

③ TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.

④ THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

⑤ COMPONENT VALUES THAT DIFFER BETWEEN CARD PART NUMBER ENDINGS.

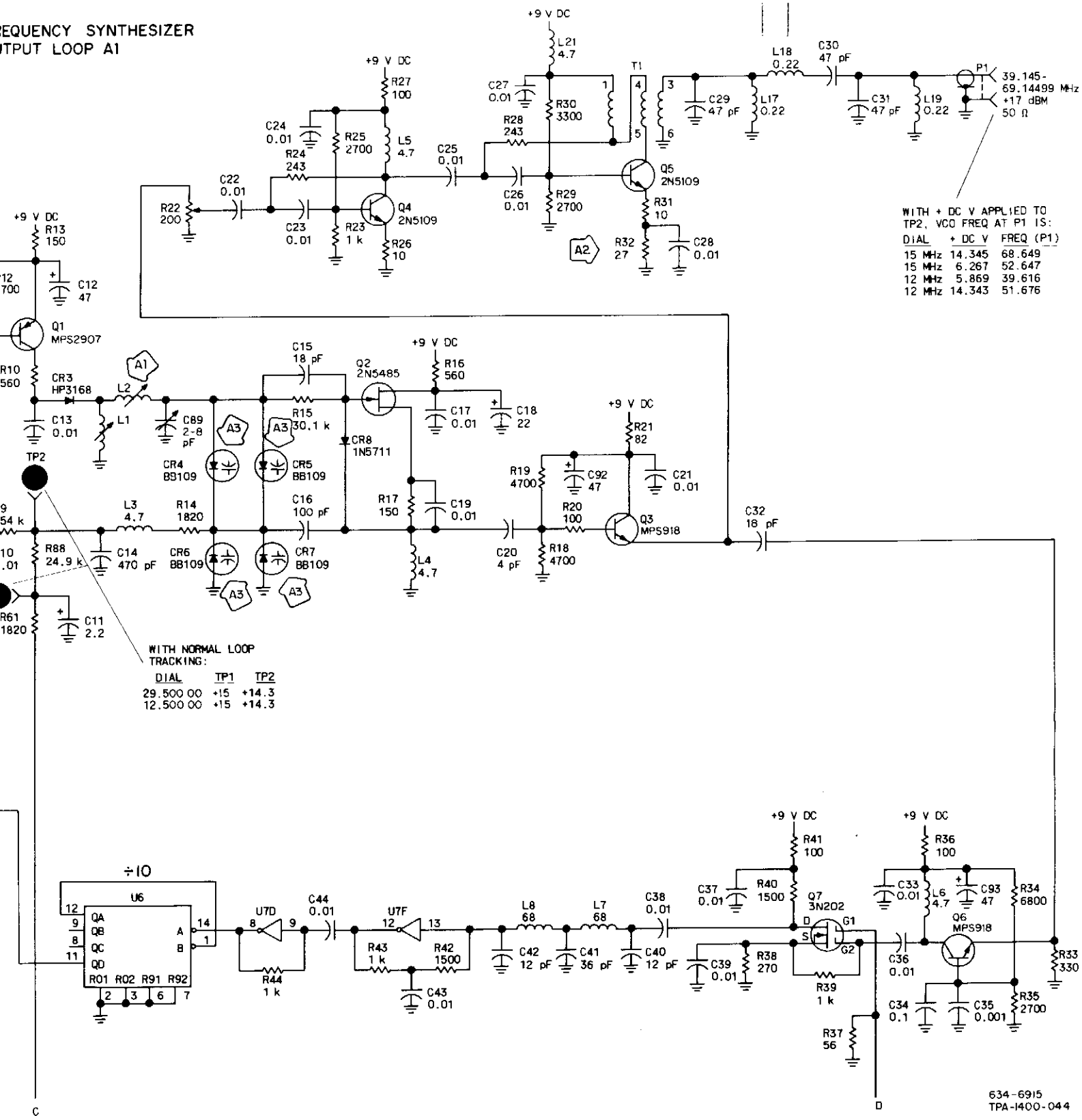
REF DES	COMPONENT VALUE	
	-001	-002
C1	22	47
C8	0.68	0.82
C9	0.68	0.82
C55	0.18	0.22
C56	0.18	0.22
C70	12	6
C96	NONE	4.7
R6	470	390
R7	470	390
R59	3300	2700
R60	3300	2700

⑥ J1 ON A5A1 CONNECTS TO P1 ON A5A2. PIN NUMBERS ON J1 CORRESPOND TO THOSE ON P1.

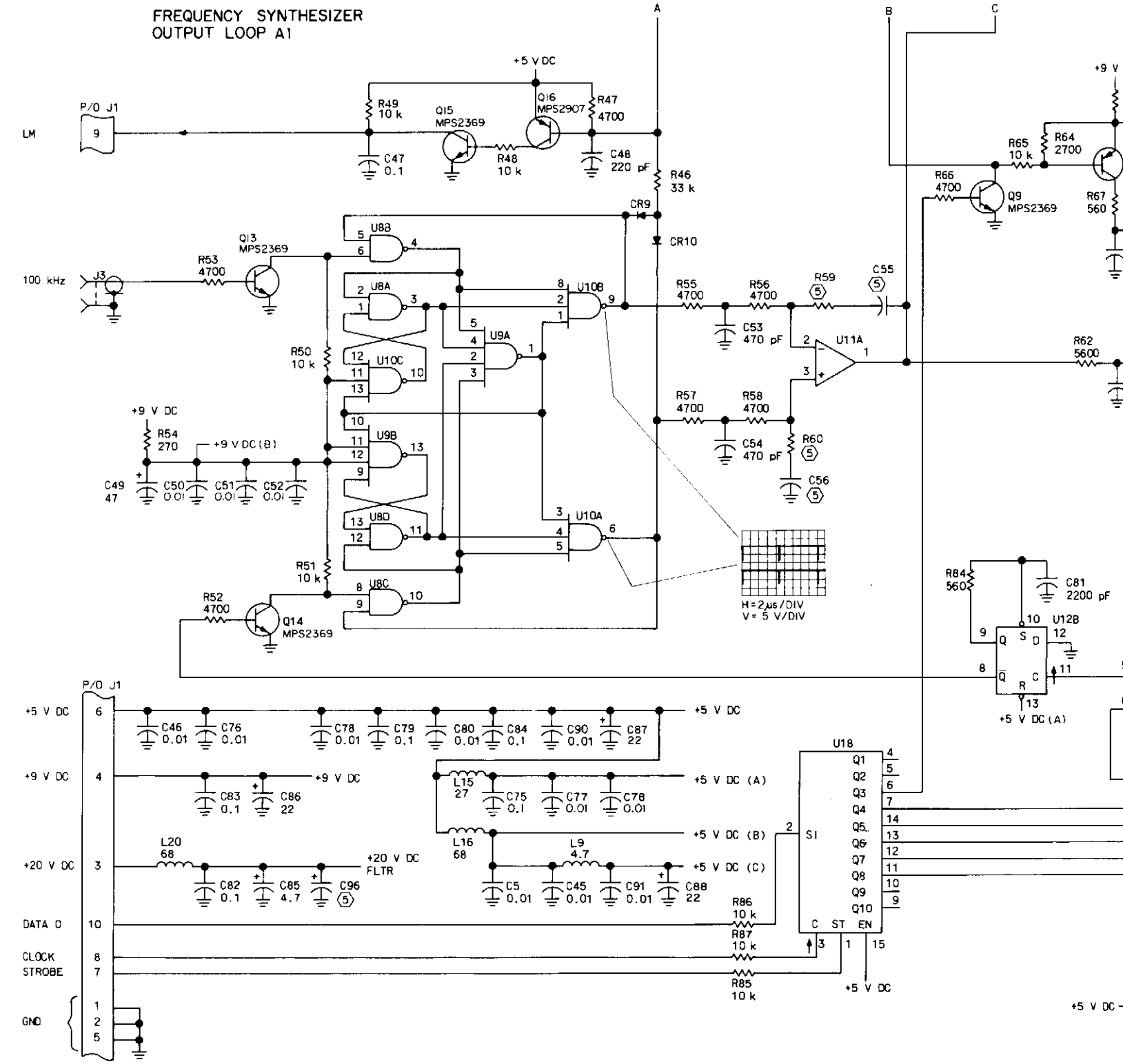
⑦ TEST VOLTAGES AND WAVEFORMS SHOWN ARE NOMINAL.

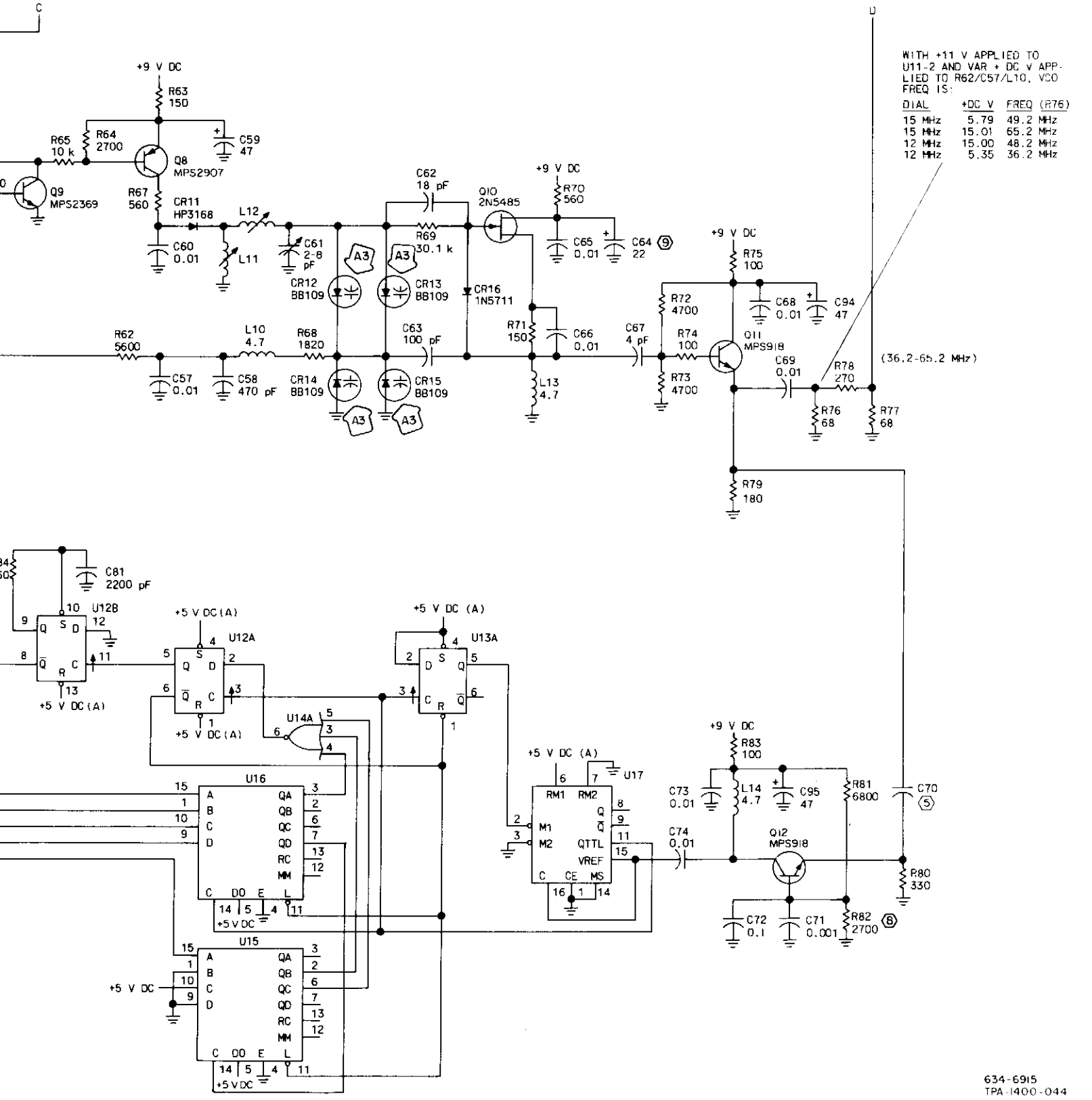
⑧ USED ON -001 ONLY.

⑨ USED ON -002 ONLY.



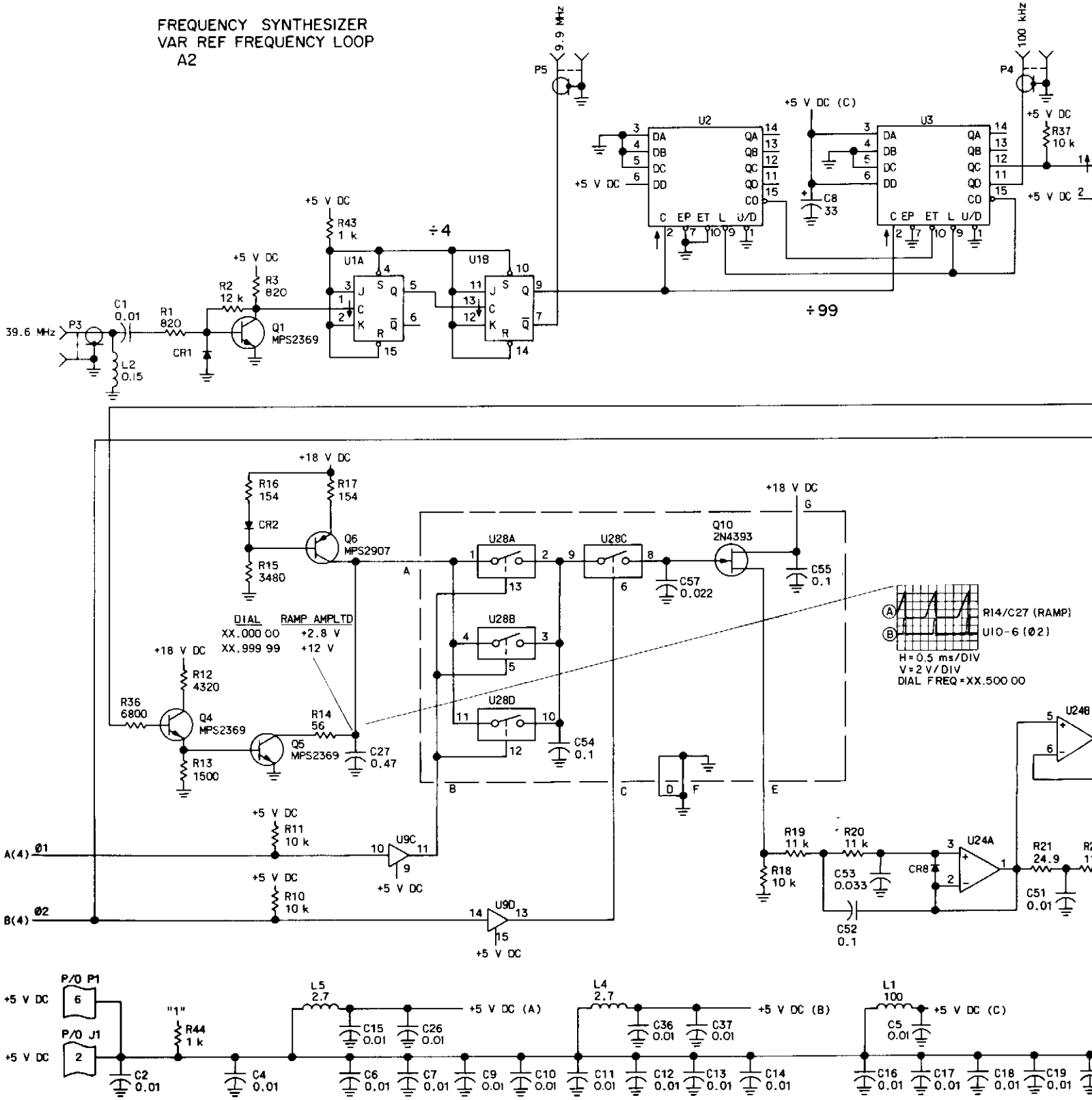
Synthesizer, Schematic Diagram
Figure 7 (Sheet 1 of 4)

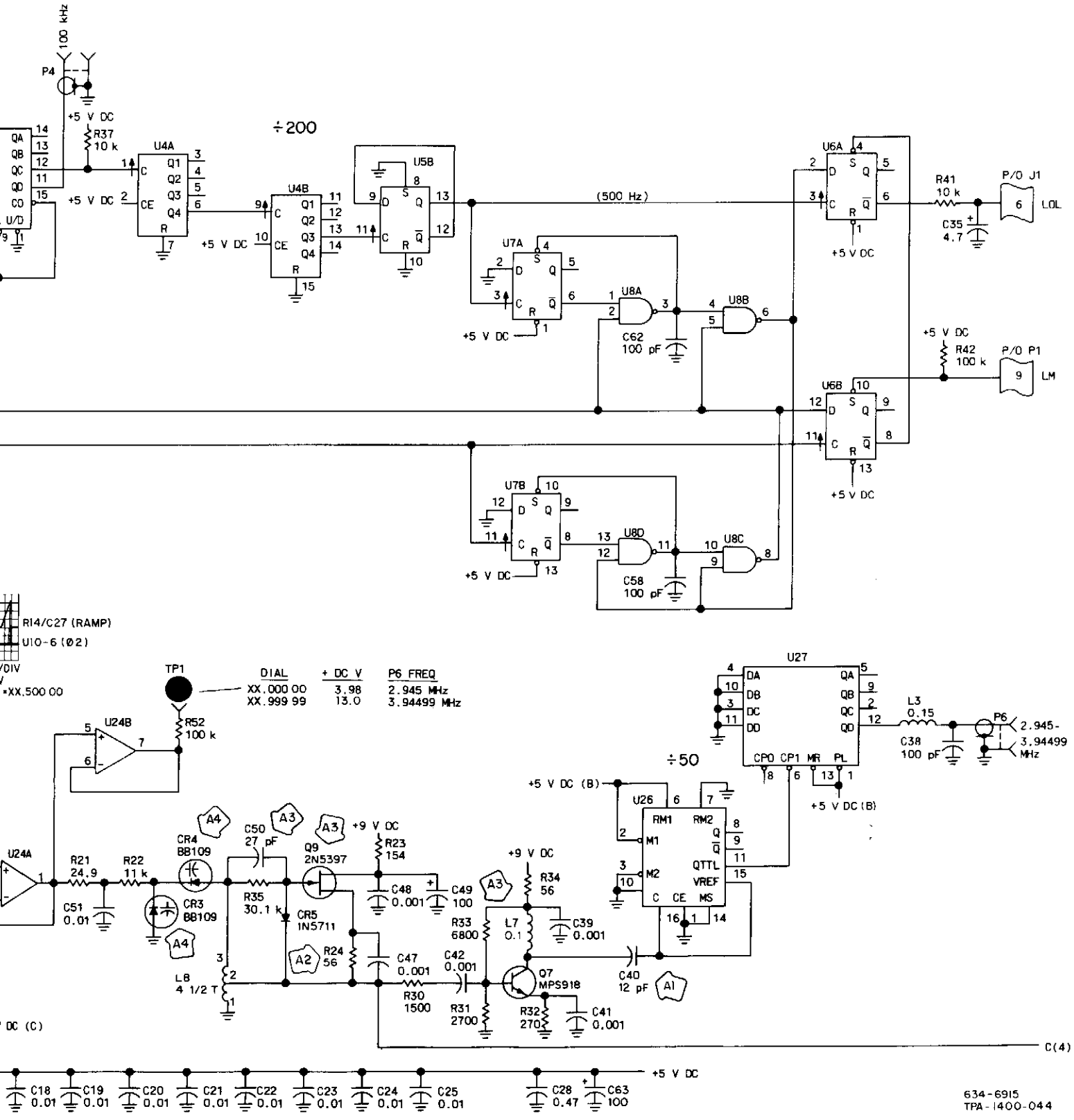

FREQUENCY SYNTHESIZER
OUTPUT LOOP A1
A
B
C
+5 V DC
P/O J1
LM
9
R49 10 k
Q15 MPS2369
Q16 MPS2907
R47 4700
C47 0.1
R48 10 k
C48 220 pF
R46 33 k
CR9
CR10
U8B
U8A
U8D
U8C
U10B
U9A
U10C
U9B
U10A
Q13 MPS2369
R53 4700
100 kHz
J3
R50 10 k
R51 10 k
R52 4700
Q14 MPS2369
+9 V DC
R54 270
+9 V DC (B)
C49 47
C50 0.01
C51 0.01
C52 0.01
R55 4700
R56 4700
R59
C55
C53 470 pF
U11A
R57 4700
R58 4700
C54 470 pF
R60
C56
R62 5600
H = 2 µs/DIV
V = 5 V/DIV
R65 10 k
R64 2700
R66 4700
Q9 MPS2369
R67 560
+9 V
R84 560
C81 2200 pF
U12B
+5 V DC (A)
P/O J1
+5 V DC
6
C46 0.01
C76 0.01
C78 0.01
C79 0.1
C80 0.01
C84 0.1
C90 0.01
C87 22
+9 V DC
4
C83 0.1
C86 22
+9 V DC
L15 27
C75 0.1
C77 0.01
C78 0.01
+5 V DC (A)
L16 68
+5 V DC (B)
+20 V DC
3
L20 68
C82 0.1
C85 4.7
C96
+20 V DC FLTR
L9 4.7
C5 0.01
C45 0.01
C91 0.01
C88 22
+5 V DC (C)
U18
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
SI
C
ST
EN
DATA 0
10
R86 10 k
CLOCK
8
R87 10 k
STROBE
7
R85 10 k
GND
1
2
5
+5 V DC
+5 V DC



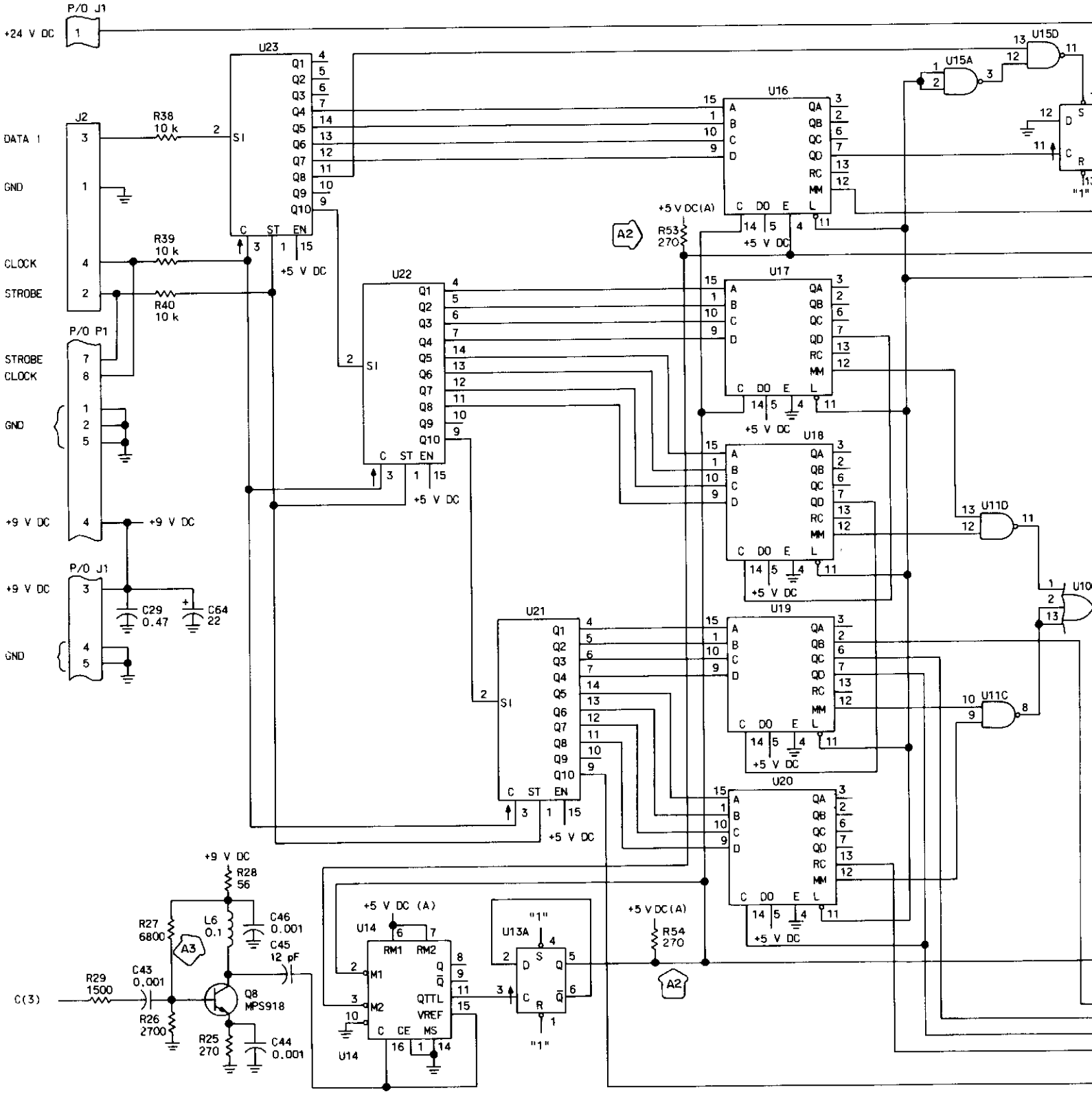
Synthesizer, Schematic Diagram
Figure 7 (Sheet 2)

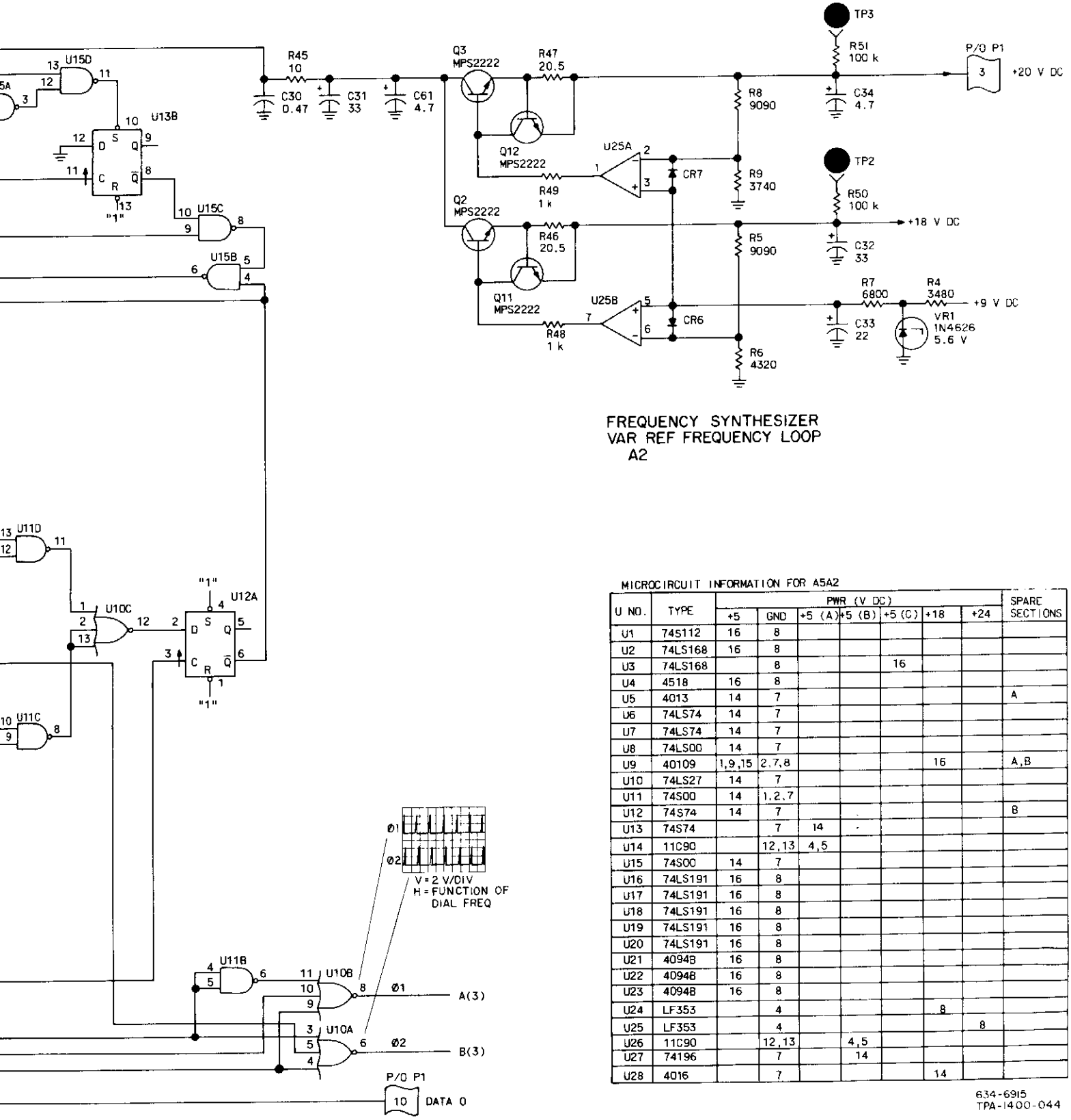
FREQUENCY SYNTHESIZER
VAR REF FREQUENCY LOOP
A2





Synthesizer, Schematic Diagram
Figure 7 (Sheet 3)


P/O J1
+24 V DC
U23
J2
R38
10 k
DATA 1
GND
R39
10 k
CLOCK
STROBE
R40
10 k
P/O P1
STROBE
CLOCK
GND
+9 V DC
P/O J1
C29
0.47
C64
22
U22
U21
U16
U17
U18
U19
U20
U15A
U15D
U11D
U11C
+5 V DC
+5 V DC(A)
R53
270
R54
270
A2
A3
R28
56
R27
6800
L6
0.1
C46
0.001
C45
12 pF
R29
1500
C43
0.001
Q8
MPS918
R26
2700
R25
270
C44
0.001
C(3)
U14
U13A
"1"



FREQUENCY SYNTHESIZER
VAR REF FREQUENCY LOOP
A2

MICROCIRCUIT INFORMATION FOR A5A2

U NO.	TYPE	PWR (V DC)							SPARE SECTIONS
		+5	GND	+5 (A)	+5 (B)	+5 (C)	+18	+24	
U1	74S112	16	8						
U2	74LS168	16	8						
U3	74LS168		8			16			
U4	4518	16	8						
U5	4013	14	7						A
U6	74LS74	14	7						
U7	74LS74	14	7						
U8	74LS00	14	7						
U9	40109	1,9,15	2,7,8				16		A,B
U10	74LS27	14	7						
U11	74S00	14	1,2,7						
U12	74S74	14	7						B
U13	74S74		7	14					
U14	11C90		12,13	4,5					
U15	74S00	14	7						
U16	74LS191	16	8						
U17	74LS191	16	8						
U18	74LS191	16	8						
U19	74LS191	16	8						
U20	74LS191	16	8						
U21	4094B	16	8						
U22	4094B	16	8						
U23	4094B	16	8						
U24	LF353		4				8		
U25	LF353		4					8	
U26	11C90		12,13		4,5				
U27	74196		7		14				
U28	4016		7				14		

634-6915
TPA-1400-044

Synthesizer, Schematic Diagram
Figure 7 (Sheet 4)

Oscillator (638-6918-001, -002)

Rockwell International

instructions

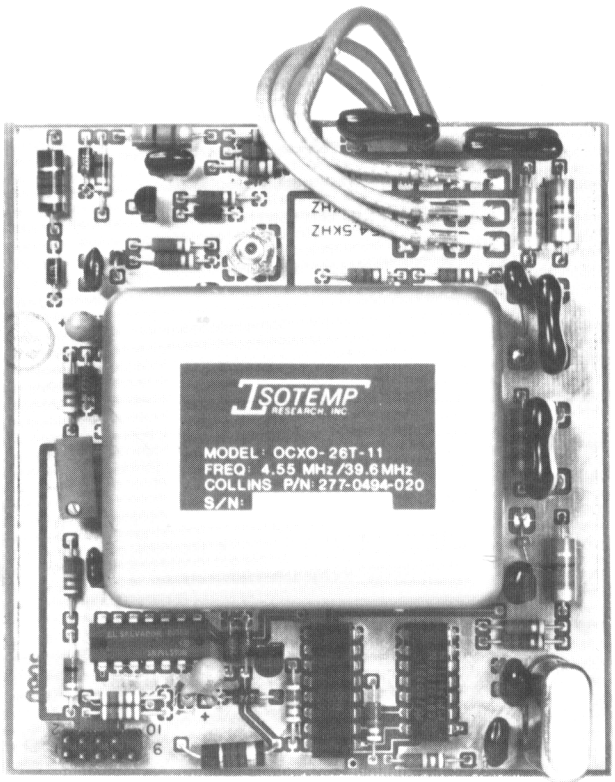
Collins Telecommunications Products Division

Printed in USA

523-0772531-001211
15 October 1982

1. DESCRIPTION

Oscillator (638-6918-001, -002), shown in figure 1, has an oven oscillator circuit and a standard crystal oscillator circuit. The controlled-temperature oven oscillator is stable, after warm-up, to ±20 Hz over the entire temperature range. The oven oscillator circuit develops 39.6- and 4.55-MHz output signals. The standard crystal oscillator circuit develops 454.2-kHz output signal. Oscillator 638-6918-001 is different from 638-6918-002 only in that the -002 has type SMB connectors on the coaxial cables.



TPA-5550-017

Oscillator
Figure 1

2. THEORY (Refer to the schematic diagram, figure 3)

2.1 Oven Oscillator

Plus 14.0-V oven voltage for the oscillator is continuously present when power is applied to the unit. The oven temperature is internally controlled and has been factory set. There is no further need for adjustment. The oscillator takes approximately 20 minutes to warm up to achieve the specified frequency stability.

The 39.6-MHz oscillator output is adjustable over a limited range by voltage from R10. This voltage, developed from the regulated +9-V supply, sets the frequency of the oscillator in the oven.

A second oscillator in the oven develops a 4.55-MHz output. There is no frequency adjustment for this oscillator. Slight frequency inaccuracies that might be present will be reduced to a negligible amount when going through U3, a divide-by-10 circuit.

2.1.1 39.6-MHz Output

The 39.6-MHz oscillator output is applied to amplifier Q1, and also directly output through J2. The output from the amplifier goes through 3-dB isolating attenuator R17/R18/R19 before being output at P1.

2.1.2 455-kHz Output

The 4.55-MHz oscillator output is applied to amplifier Q2. A 455-kHz enable input signal enables or inhibits this amplifier. The input enable signal is logic 1 when the 455-kHz output is desired. With a logic 1 input, inverter U2E applies the resulting logic 0 to the emitter of Q2. This causes Q2 to conduct the 4.55-MHz signal to the divide-by-10 counter, U3.

The output of U3 is gated by U1A. The CW keying input enables or inhibits this NAND gate. With the CW mode selected (and the CW key depressed in receiver-exciter units), U1A outputs the 455-kHz signal. The output is inverted by U2F and applied, through filter L4-L5/C6-C8, to the 455-kHz bfo output, P3. This LC filter attenuates harmonics of the 455-kHz square-wave signal output from the logic circuits.

2.2 454.2-kHz Oscillator

The 454.2-kHz oscillator is a crystal oscillator made up of U2A/B, U1D, and Y1. The 454.2-kHz enable signal enables or inhibits the oscillator. A logic 1 enables the NAND gate, U1D. Positive feedback from U2B through Y1 to U2A causes the circuit to oscillate. The resulting output from U1D is a 454.2-kHz square wave. This is inverted by U2C and applied through filter L2-L3/C3-C5, to the 454.2-kHz bfo output, A7P2. The LC filter attenuates harmonics of the 454.2-kHz square-wave signal output from the logic circuits.

3. TESTING

A performance test for the oscillator is given in table 2. In addition to the required performance criteria, troubleshooting comments are given.

It is assumed that the repair technician is trained in solid-state circuit troubleshooting and repair techniques, and is familiar with the test equipment to be used. Step-by-step operating procedures may not be given in all tests and not all possible troubleshooting information can be listed.

Circuit board parts location and wiring diagram, figure 2, and a schematic diagram, figure 3, follow the test procedures.

3.1 Test Equipment Required

Table 1 lists the equipment required to perform the tests. A suggested type is given; however, that specific equipment is not required. Any that meets or exceeds the indicated minimum specifications is acceptable for use.

3.2 Performance Test

The following test procedures measure the performance of the oscillator. After being repaired, repeat the numbered test where repair was performed to verify that no further malfunctions exist.

Table 1. Test Equipment Required.

ITEM	USED FOR	SUGGESTED TYPE	MINIMUM SPECIFICATIONS
RF voltmeter (with 50-ohm adapter)	Measuring oscillator output levels	Boonton 92C with 50-ohm probe	0 to 1-V rms
Frequency counter	Measuring oscillator frequency	Fluke 1910A	0 to 39.600 00 MHz, 1-Hz accuracy

3.2.1 Preliminary Setup

Do not apply power to the equipment until instructed to do so in the procedures. Do not connect power with power switches turned on.

Connect the equipment as instructed in the procedures for each test.

3.2.2 Test Procedures

Perform the tests as given in table 2.

Table 2. Oscillator Test Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	a. If using a receiver-exciter, do not key transmitter during this test.		
	b. Set MODE to CW.		
	c. Disconnect J2.		
	d. Temporarily connect 1000-ohm resistor between center conductor of J2 and ground.		
2. Output levels	a. Turn on primary power to unit and, using high-impedance probe on rf voltmeter, measure 39.6-MHz output level at J2.	400 mV rms, or greater	Check U4 and associated components.
	b. Using high-impedance probe on rf voltmeter, measure 39.6-MHz output level of P1. (Leave oscillator connected to unit.)	300 mV rms, or greater	Check Q1 and associated components.
	c. Depress SPOT switch (on unit front panel) and measure 455-kHz output level at P2.	10 mV rms, or greater	Check U4, U2E, Q2, U3, U1A, U2F and associated components.
	d. Measure 454.2-kHz output level at P3.	30 mV rms or greater	Check U1D, U2A/B, Y1, and associated components.
	Note Oscillator should be on continuously for at least 20 minutes before measuring frequency to accuracy specified.		
3. Frequency	a. Connect frequency counter to J2 across 1000-ohm resistor. Measure frequency.	39.600 00 MHz ±20 Hz	Adjust R10 for correct frequency. Check U1.
	b. Depress SPOT switch and measure frequency at P2.	455.000 kHz ±20 Hz	Adjust for correct frequency. Check U4, Q2, U12E, U3, U1A, U2F.
	c. Measure frequency at P3.	454.2 kHz ±200 Hz	Check Y1, U1D, U2A/B.
4. Control logic	a. Connect rf voltmeter (with 50-ohm adapter) to P3. Note 454.2-kHz rf output then switch MODE to any except CW.	Oscillator output is turned off when MODE not in CW.	Check U1D. If no malfunction present, check receiver-exciter logic circuits.
	b. Connect rf voltmeter (with 50-ohm adapter) to P2. Set MODE to CW.		
	c. Note 455-kHz rf output, then depress SPOT switch.	Oscillator output is off until turned on by SPOT switch.	

Table 2. Oscillator Test Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. End	a. Disconnect 1000-ohm resistor from J2. Disconnect test equipment. Reconnect J2 and install oscillator in unit.		

4. REPAIR

Repair of the oscillator card is accomplished using standard maintenance and circuit card repair procedures. Refer to the maintenance section of this instruction book for information.

The oven subassembly is a nonrepairable item. Do not attempt to repair it.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All parts list illustrations containing ESDS items are shown with the following symbol:

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier

(REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00136	MCCOY ELECTRONICS CO WATTS AND CHESTNUT ST MT HOLLY SPRINGS PA 17065
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
00853	SANGAMO WESTON INC SANGAMO CAPACITOR DIV SANGAMO RD P O BOX 128 PICKENS SC 29671
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75265
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV SUB OF SCHLUMBERGER LTD NORTH AMERICAN SALES MAIL STOP 14-1053 401 ELLIS ST P O DRAWER 7284 MOUNTAIN VIEW CA 94042
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
57582	KAHGAN ELECTRONICS CORP 556 PENINSULA BLVD HEMPSTEAD NY 11550
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP P O BOX 7600 LAUTER AVE FLORENCE SC 29501
77250	ALLIED PRODUCTS CORP PHEOLL MFG CO DIV 5700 W ROOSEVELT RD CHICAGO IL 60650
79807	WROUGHT WASHER MFG INC 2100 S BAY ST MILWAUKEE WI 53207
81349	MILITARY SPECIFICATIONS
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

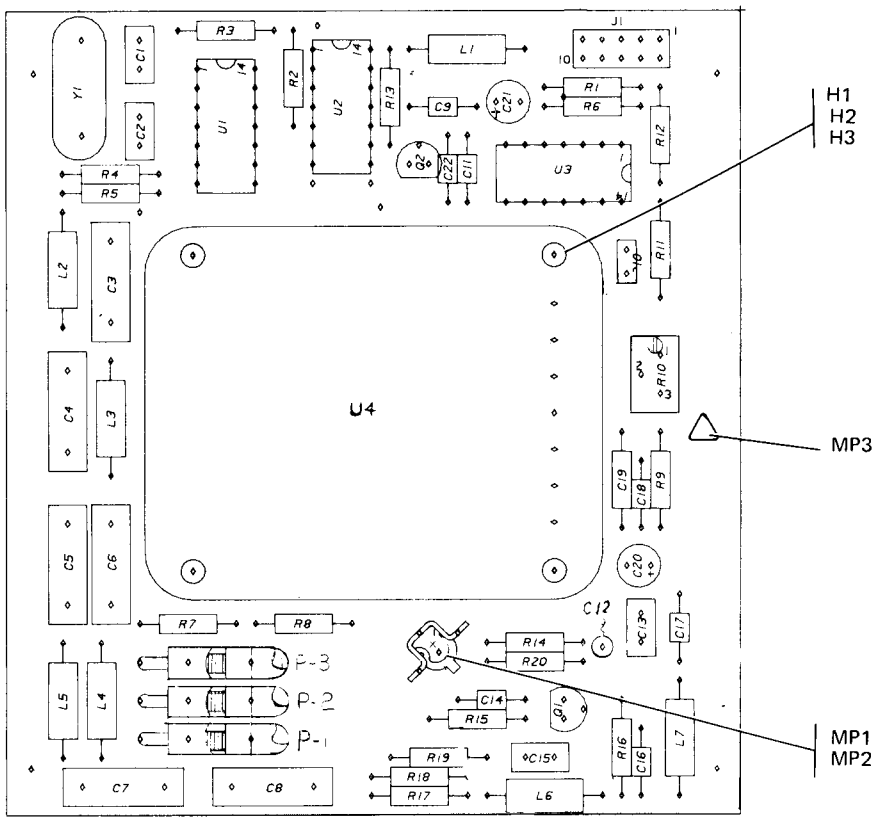
5.3 Usable On Codes

USABLE ON CODES	UNIT PART NUMBER	FIG-ITEM
A	638-6918-001	5
B	638-6918-002	5

5.4 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Oscillator	638-6918-001	REV F
Oscillator	638-6918-002	REV F



OSCILLATOR

ELECTROSTATIC SENSITIVE DEVICES OBSERVE PRECAUTIONS FOR HANDLING

TPA-5534-019

Oscillator, Parts Location Diagram
Figure 2 (Sheet 1 of 2)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	OSCILLATOR	638-6918-001	A		
	OSCILLATOR	638-6918-002	B		638-6918-002
C1	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V	912-3856-000		81349	CM04ED470J03
C2	CAPACITOR,FXD MICA DIEL, 22PF, 5%, 500V	912-3842-000		81349	CM04ED220J03
C3	CAPACITOR,FXD MICA DIEL, 1200PF, 5%, 500V (A1)	912-3321-000		00853	D205F122J0
C3	CAPACITOR,FIXED MICA DIEL, 330PF, 5%, 50V	912-4141-490		93790	CD5FY331J0
C4	CAPACITOR,FXD MICA DIEL, 1500PF, 5%, 500V (A1)	912-3327-000		00853	D205F152J0
C4,C5	CAPACITOR,FXD MICA DIEL, 3300PF, 5%, 500V	912-3354-000		57582	KD20332J501
C5,C6	CAPACITOR,FXD MICA DIEL, 1200PF, 5%, 500V (A1)	912-3321-000		00853	D205F122J0
C6	CAPACITOR,FIXED MICA DIEL, 330PF, 5%, 50V	912-4141-490		93790	CD5FY331J0
C7	CAPACITOR,FXD MICA DIEL, 1500PF, 5%, 500V (A1)	912-3327-000		00853	D205F152J0
C7,C8	CAPACITOR,FXD MICA DIEL, 3300PF, 5%, 500V	912-3354-000		57582	KD20332J501
C8	CAPACITOR,FXD MICA DIEL, 1200PF, 5%, 500V (A1)	912-3321-000		00853	D205F122J0
C9	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C10	CAPACITOR,FXD MICA DIEL, 8PF, PORM 0.5PF, 300V	912-4141-110		72136	DM5C080D300WV
C11	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C12	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C13	CAPACITOR,FXD MICA DIEL, 12PF, 5%, 500V	912-3838-000		81349	CM04CD120J03
C14	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C15	CAPACITOR,FXD MICA DIEL, 15PF, 5%, 500V	912-3839-000		81349	CM04CD150J03
C16	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C17	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
C18	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
C19	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C20,C21	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
C22	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V (A1)	913-3331-010		56289	292CY5U102D8050
C22	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
H1	NUT,PLAIN,HEX SST, 4-40 (QTY 4)	313-0132-000		77250	P313-0132-000
H2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 4)	310-0279-000		96906	MS35338-135
H3	WASHER,FLAT SST, 0.125 ID X 0.281 OD (QTY 4)	310-6340-000		79807	310-6340-000
J1	CONNECTOR,HDR	372-2656-100	A	52072	CAD10SP100-230-430
J1	CONNECTOR,RCPT ELEC	357-7405-010	B	81349	MIL-C-39012/95-0001
L1-L5	COIL,RF 220UH (A1)	240-2715-410		96906	MS75089-15
L1	COIL,RF 220UH	240-2715-410		96906	MS75089-15
L2	COIL,RF 330UH	240-2715-430		96906	MS75089-17
L3	COIL,RF 39UH	240-2715-320		96906	MS75089-6
L4	COIL,RF 330UH	240-2715-430		96906	MS75089-17
L5	COIL,RF 39UH	240-2715-320		96906	MS75089-6
L6	COIL,RF 1UH	240-1568-000		96906	MS18130-8
L7	COIL,RF 220UH	240-2715-410		96906	MS75089-15
MP1	CONNECTOR,RCPT ELEC	357-0067-020		00779	226287-2
MP2	JACK,TIP	360-0079-190		00779	2-332095-4
MP3	LABEL,PRESS SENS (ESDS)	280-2745-040		12998	280-2745-040
P1	COAX ASSEMBLY	641-7100-025	A		
P1	CONNECTOR,PLUG ELEC	357-7375-010	B	98291	51-328-3188
P2	COAX ASSEMBLY	641-7100-026	A		641-7100-026
P2	CONNECTOR,PLUG ELEC	357-7375-010	B	98291	51-328-3188
P3	COAX ASSEMBLY	641-7100-027	A		641-7100-027
P3	CONNECTOR,PLUG ELEC	357-7375-010	B	98291	51-328-3188
Q1	TRANSISTOR	352-0723-010		04713	MPS918
Q2	TRANSISTOR	352-5015-010		04713	MPS2369
R1	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R2	RESISTOR,FXD CMPSN, 22MEGO, 10%, 1/4W	745-0905-000		81349	RCR07G226KS
R3	RESISTOR,FXD CMPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS
R4,R5	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R6	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R7	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R8	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
R9	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R10	RESISTOR,VAR WW, 5K, PORM5%, 3/4W	381-1721-300		81349	RT22C2W503
R11	RESISTOR,FXD CMPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS
R12	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R13	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
R14	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R15	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R16	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS
R17	RESISTOR,FIXED CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R18	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/4W	745-0686-000		81349	RCR07G180KS
R19	RESISTOR,FIXED CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R20	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS
U1	INTEGRATED CIRCUIT	351-8159-340		07263	4011BPC
U2	INTEGRATED CIRCUIT	351-8159-210		07263	F4049BPC
U3	MIXER	351-1636-010		01295	SN74LS90N
U4	MIXER,RF	277-0494-020			
Y1	XTAL UNIT,QTZ 454.2KHZ	289-7337-010		00136	289-7337-010

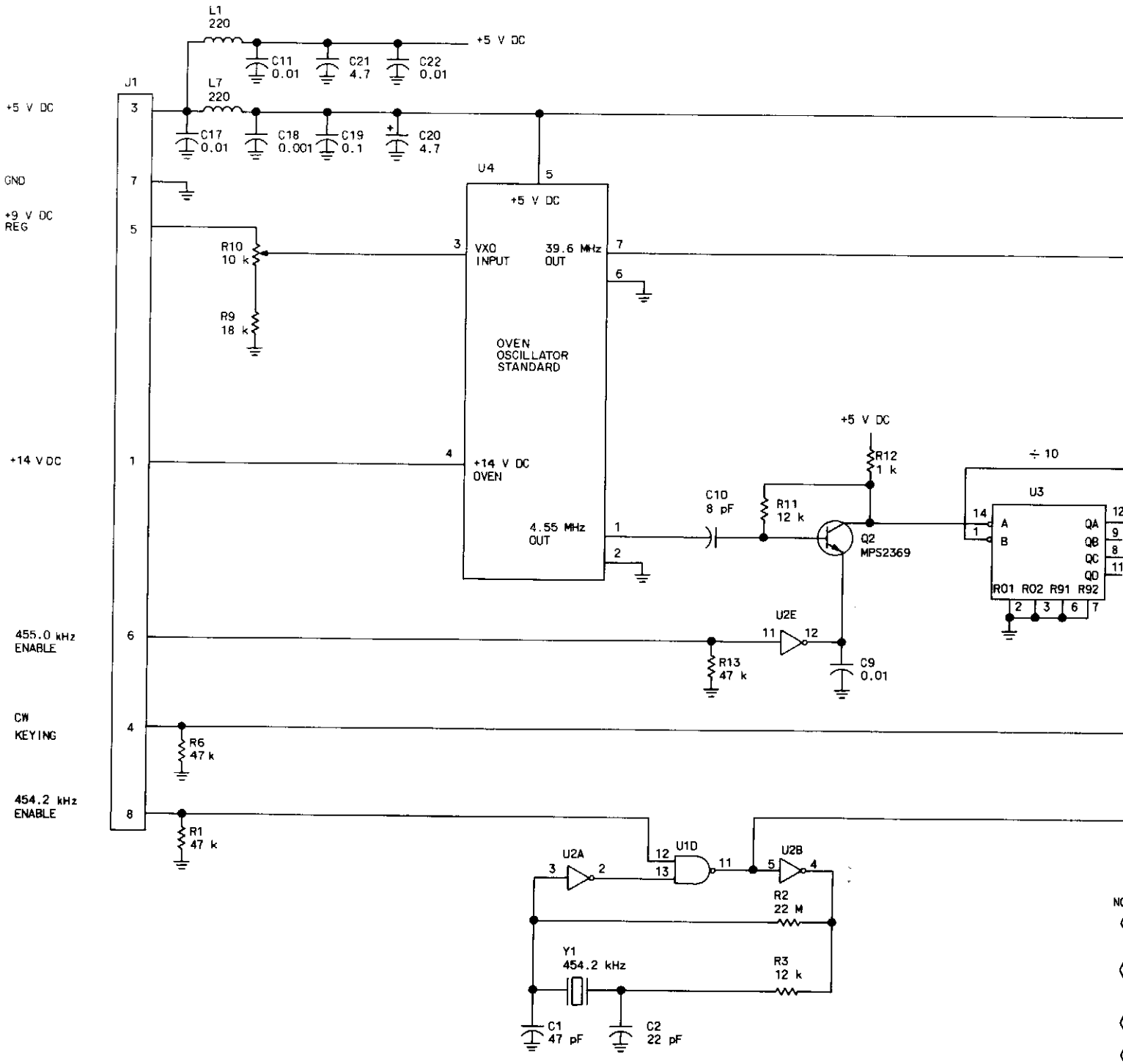
MODIFICATION HISTORY

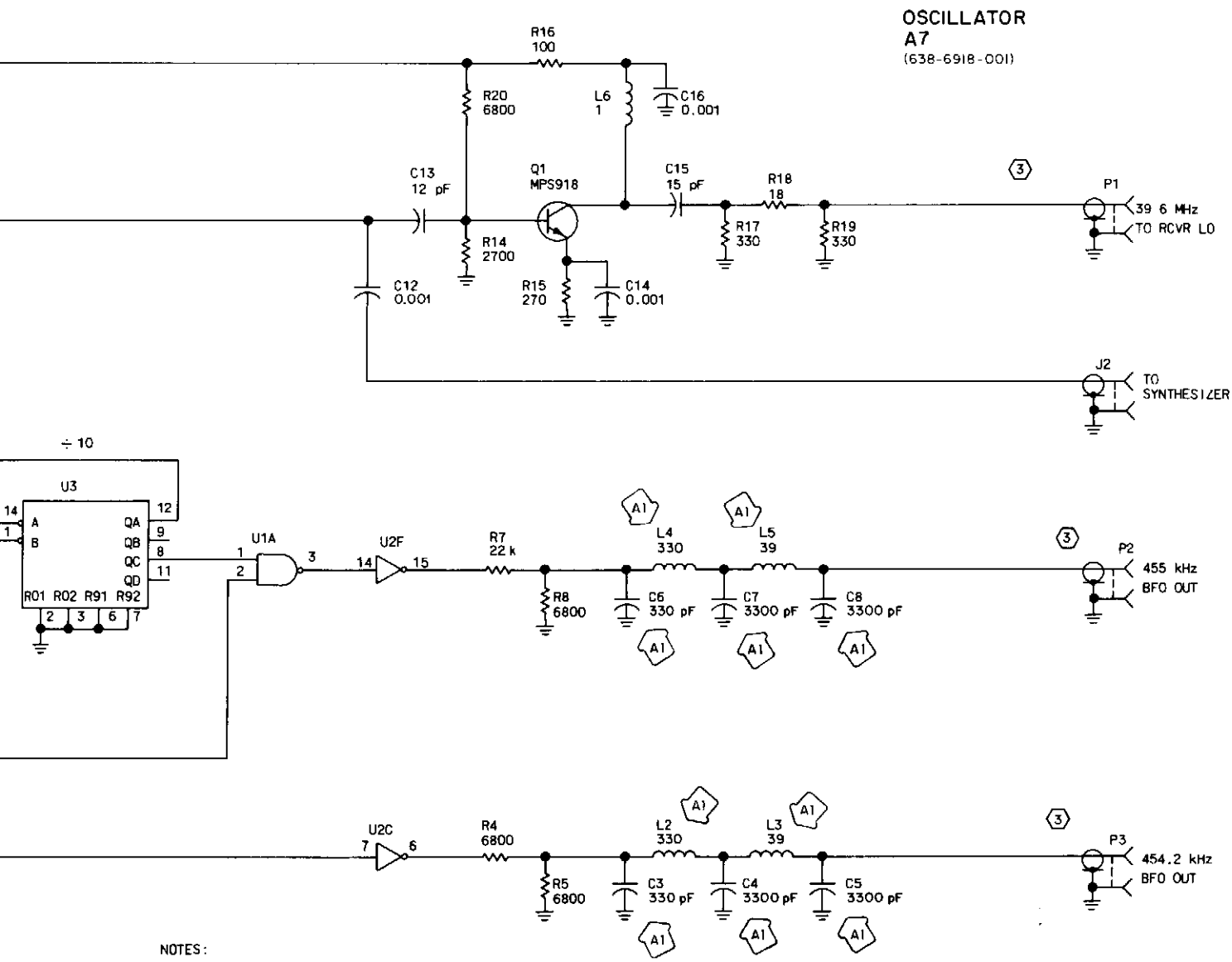
REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE
A1	Changed C3 from 1200 to 330 pF. Changed C4 from 1500 to 3300 pF. Changed C6 from 1200 to 330 pF. Changed C7 from 1500 to 3300 pF. Changed L2 from 220 to 330 μH. Changed L3 from 220 to 39 μH. Changed L4 from 220 to 330 μH. Changed L5 from 220 to 39 μH.
NA	Data change only.
NA	Data change only.
NA	Data change only.

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Changed C3 from 1200 to 330 pF. Changed C4 from 1500 to 3300 pF. Changed C6 from 1200 to 330 pF. Changed C7 from 1500 to 3300 pF. Changed L2 from 220 to 330 μH. Changed L3 from 220 to 39 μH. Changed L4 from 220 to 330 μH. Changed L5 from 220 to 39 μH.	REV B
NA	Data change only.	REV C
NA	Data change only.	REV D
NA	Data change only.	REV E

Oscillator, Parts Location Diagram
Figure 2 (Sheet 2)


L1
220
+5 V DC
C11
0.01
C21
4.7
C22
0.01
J1
L7
220
+5 V DC
3
C17
0.01
C18
0.001
C19
0.1
C20
4.7
GND
7
U4
5
+5 V DC
+9 V DC
REG
5
R10
10 k
3
VXO
INPUT
39.6 MHz
OUT
7
6
R9
18 k
OVEN
OSCILLATOR
STANDARD
+5 V DC
R12
1 k
÷ 10
+14 V DC
1
4
+14 V DC
OVEN
C10
8 pF
R11
12 k
U3
14
A
1
B
QA
QB
QC
QD
12
9
8
11
4.55 MHz
OUT
1
2
Q2
MPS2369
R01 R02 R91 R92
2
3
6
7
U2E
455.0 kHz
ENABLE
6
11
12
R13
47 k
C9
0.01
CW
KEYING
4
R6
47 k
454.2 kHz
ENABLE
8
R1
47 k
U2A
U1D
U2B
3
2
12
13
11
5
4
R2
22 M
Y1
454.2 kHz
R3
12 k
C1
47 pF
C2
22 pF



NOTES:

1. UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
3. PENDENT CABLE
4. TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.
5. THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

MICROCIRCUIT INFORMATION

U NO	TYPE	PWR (V DC)		SPARE
		+5	GND	SECTIONS
U1	4011	14	7	B,C
U2	4049	1	8	E
U3	74LS90	5	10	

634-6917
TPA-1401-014

Oscillator, Schematic Diagram
Figure 3

Control (638-6929-003, -004, -006)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0771745-001211
1 August 1982

1. DESCRIPTION

Control 638-6929-003, -004, -006 receives frequency tuning inputs and develops control signal outputs. The circuit card has both receive- and transmit-control circuits and is used in receiver-exciter or receiver only units. (Differences are referenced, where applicable.)

Control 638-6929-003 permits full-coverage receive but restricts transmit operation to those frequencies authorized for Amateur Radio Service ("ham") and Military Affiliate Radio Service (MARS). Control 638-6929-004 permits full-coverage receive but restricts transmit operation to the band from 1.600 00 through 29.999 99 MHz. Control 638-6929-006 operates identically to 638-6929-004 except it replaces the old connectors with new SMB connectors. All three circuit cards physically look alike and are as shown in figure 1.

The control takes frequency-select data from the front panel or optional external keypad and develops output signals. A microprocessor with associated ROM, decoders, and latches processes the input data to develop the output signals. These output signals are parallel and serial format frequency data to the synthesizer frequency display and, in receiver-exciter units, the low-pass filters and exciter circuit. (Refer to figure 2.)

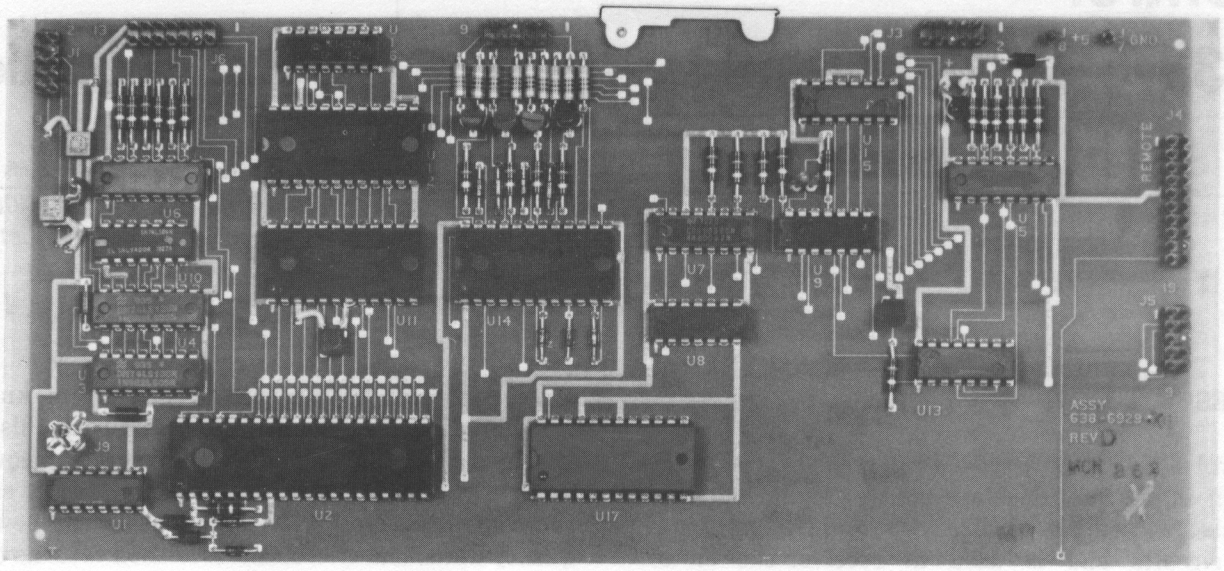
Figure 3 is a flow chart showing the basic operation of the microprocessor. When power is applied, the microprocessor resets and initializes to output 15.000 00-MHz frequency data. Internal instructions then command the input data lines to be polled until a frequency change is sensed. When tuning knob or remote keypad frequency data is received, this data is added to or subtracted from the last frequency data in the microprocessor. The new result causes the control card outputs to change to the new frequency data. The microprocessor then returns to the polling routine until it senses another change in input data.

2. PRINCIPLES OF OPERATION

Figure 4 is a block diagram of the control. Refer to the schematic diagram, figure 7, for details of the circuits.

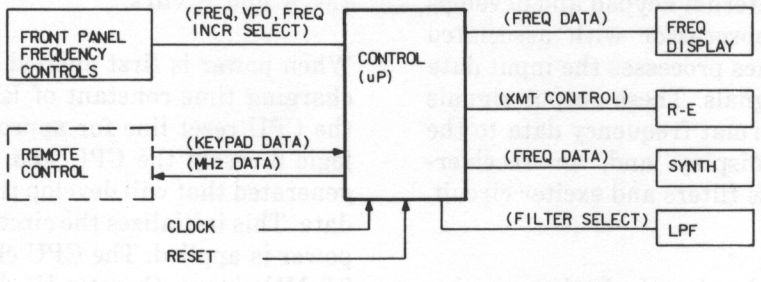
The central processor unit (CPU) is a type 6802. It is driven by an external clock and has a parallel 8-bit bidirectional data bus, a parallel 16-bit unidirectional address bus (with bits A11 and A12 unused), and clock (ϕ2), read/write (R/W), and valid memory address (VMA) control signals. An internal 128 x 8-bit RAM permits storing operating frequencies for the A and B vfo's.

When power is first applied to the control card, the charging time constant of R1/C2 keeps a logic 0 on the CPU reset line for approximately 1 second. The logic 0 resets the CPU and causes an output to be generated that will develop the 15.000 00-MHz output data. This initializes the circuits to 15 MHz each time power is applied. The CPU clock is derived from the 9.9-MHz input. Counter U1 divides the 9.9 MHz by 3 for a 3.3-MHz input to the CPU. Internal circuits further divide this by 4 for an 825-kHz clock used internally in the CPU and output from the CPU as ϕ2.



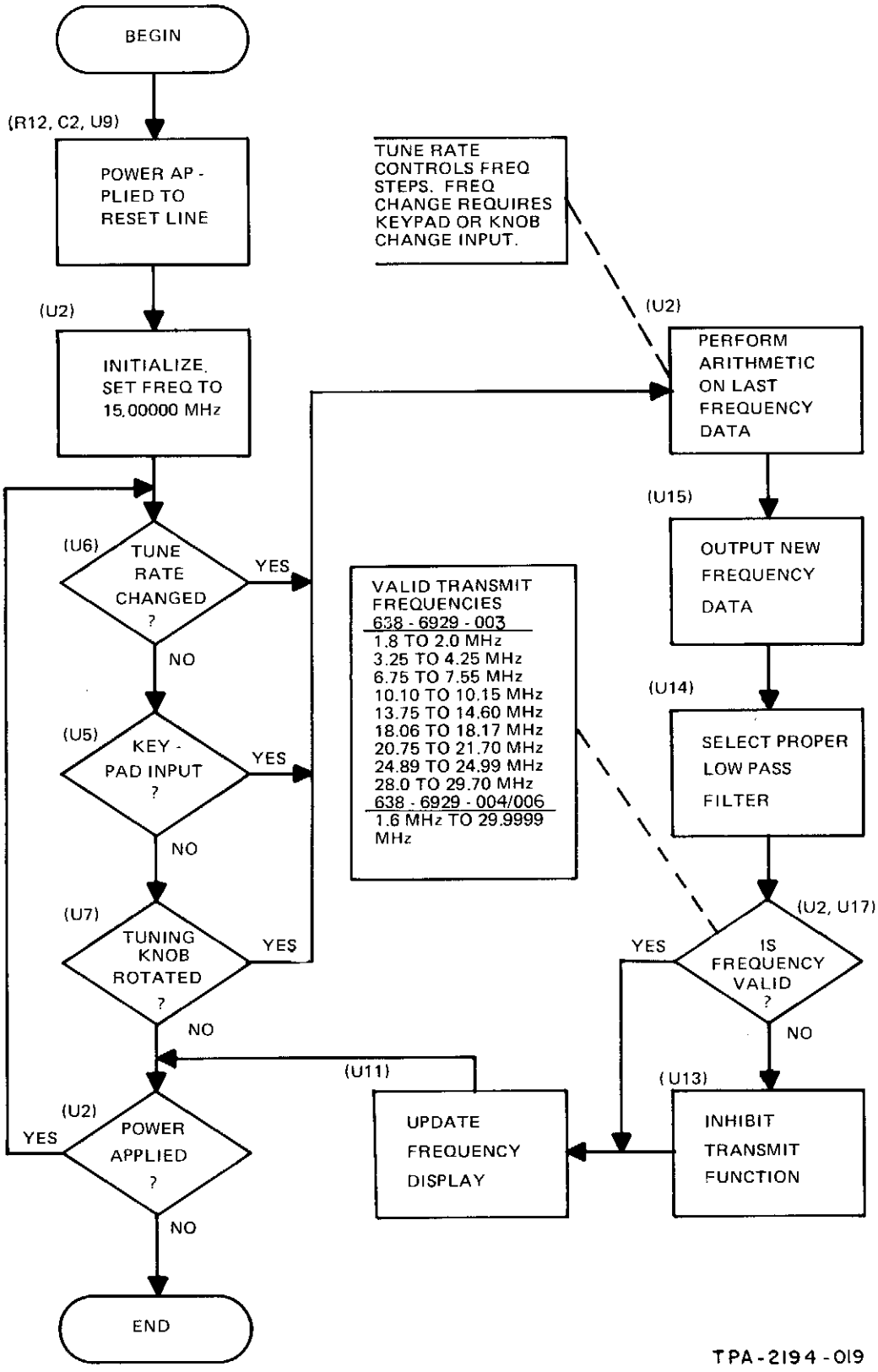
TPA-5274-017

Control
Figure 1

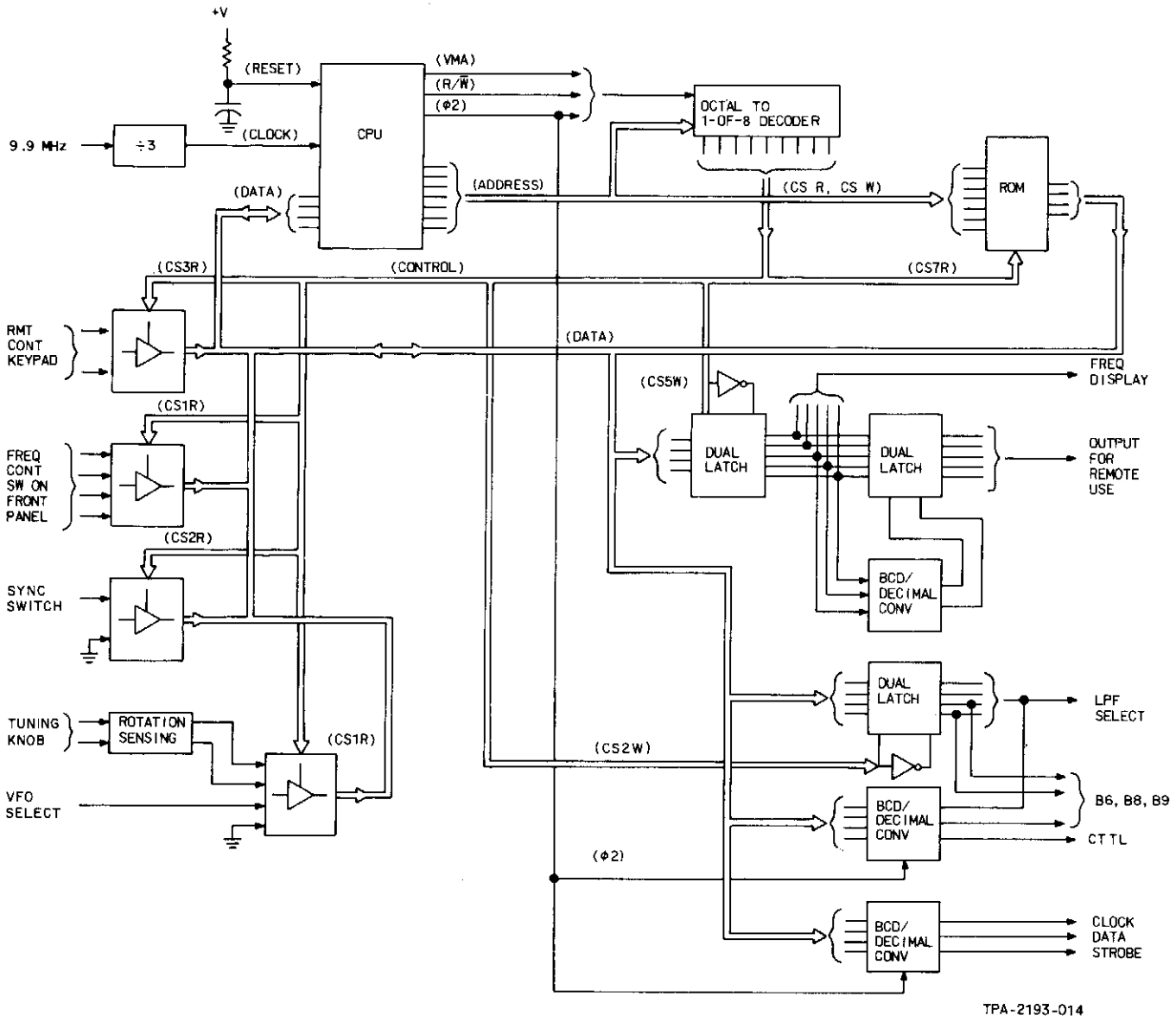


TPA-2192-013

Control, Simplified Block Diagram
Figure 2



Microprocessor Basic Flow Diagram
Figure 3



Control, Simplified Diagram
Figure 4

Along with the $\phi 2$ output, the R/W and VMA outputs from the CPU are also applied to decoders U3 and U4. The R/W is at logic 1 when the CPU is ready to read input data. This signal goes to logic 0 when the CPU is in a write (data output) state. The VMA output is logic 1 when the CPU address output is a valid address.

Data is transferred on the data bus in an 8-bit parallel format. The CPU data bus lines are bidirectional to input or output 8-bit data words, depending on the CPU internal operating mode. Input data presence on the bus is controlled by the CS1R, CS2R, CS3R, and CS7R control signals discussed in the following paragraphs. The input data is from the ROM, keypad, or front-panel controls. The ROM data is used by the CPU in processing data to be output to external circuits. Keypad or front-panel control inputs are frequency data to the CPU. The bus applies the CPU output data to the latch used with the frequency display and the latches and converters used for control of other circuits. The latches and converters must be enabled by the CS2W, CS3W, and CS5W signals to output the bus data.

The address bus is unidirectional from the CPU. Address bits A0-A10 and A13-A15 are applied in parallel format to ROM U17 and decoders U3 and U4, respectively. When enabled by the $\phi 2$, R/W, and VMA signals, the decoders output the chip-select command associated with the particular bit pattern of A13, A14, and A15. These commands select (enable) the ROM and various input and output chips (integrated circuits). When enabled by the CS7R command, ROM U17 outputs the data stored in the location addressed by the CPU A0-A10 output. This ROM-originated data word is input through the data bus to the CPU.

The internal RAM in the CPU contains the frequency data processed from the front-panel or keypad controls. This is the storage for frequencies loaded into the A and B vfo registers. The RAM will output, on the CPU data bus lines, the proper stored frequency as requested by the vfo select input line at J6-3. A sync input (J6-5) causes the CPU to store the frequency of the selected vfo in the unselected vfo register. After synchronizing the frequencies, a new frequency may be input that will change only the selected vfo frequency. In split-frequency operation, the vfo select line is controlled by logic circuits to automatically select the proper vfo register for receive or transmit. When power is turned off, all data in the RAM is erased.

The ROM is a 256 x 8-bit memory containing a look-up table and instructions for the CPU. The look-up table supplies constants necessary for computation within the CPU. The instructions tell the CPU what to do with the previous data that has been input to the CPU.

When the CS7R output from U3 goes to logic 0, the ROM is enabled. The A0-A10 word from the address bus addresses a particular location in the ROM. Data stored in that memory address is output to the data bus as the D0-D7 word. This data is received by the CPU for use in internal processing of the data. At the time the ROM-originated data word is on the data bus, no other chip is selected. This way, no invalid outputs are developed and applied to circuits external to the control card. Only the processed CPU output data is applied from the data bus through the latches and decoders to the circuits.

Decoders U3 and U4 develop the chip select read and write commands. The decoders will both be simultaneously addressed by bits A13, A14, and A15. Unless VMA is logic 1 and $\phi 2$ and R/W at the decoder inputs are logic 0, all the decoder outputs will be logic 1 regardless of the A13-A15 inputs.

Referring to the schematic diagram and following the logic levels, it is seen that the U3 outputs are controlled by the address line inputs when R/W is logic 1 and $\phi 2$ is logic 0. Inverter U10B causes the logic 1 R/W to be applied to U3 as logic 0. This satisfies the input control line conditions that enable developing an output from the address inputs. The U3 outputs are chip select read (CSxR) commands. (Note that the read commands are developed when the R/W control line is logic 1.) Decoder U4 similarly develops chip-select write (CSxW) commands when R/W is logic 0. Table 1 shows the chip-select outputs for each input address.

Table 1. Chip-Select Outputs for Input Addresses.

ADDRESS			U3 OUTPUTS					U4 OUTPUTS			
A15	A14	A13	CS1R	CS2R	CS3R	CS6R	CS7R	CW2W	CS3W	CS5W	CS6W
0	0	0	1	1	1	1	1	1	1	1	1
0	0	1	0	1	1	1	1	1	1	1	1
0	1	0	1	0	1	1	1	0	1	1	1
0	1	1	1	1	0	1	1	1	0	1	1
1	0	0	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1	0	1
1	1	0	1	1	1	0	1	1	1	1	0
1	1	1	1	1	1	1	0	1	1	1	1

Front-panel control or keypad data is transferred to the data bus through tristate buffers U5, U6, and U7. Before the buffer will transfer data, the buffer enable signal must be logic 0. When the enable signal is logic 0, the input logic level is transferred directly through the buffer to the data bus. A logic 1 enable signal causes the buffer output to the bus to be at a high level of impedance regardless of the input logic level. The enable signals are the CS1R, CS2R, and CS3R outputs from decoder U3.

When CS1R is logic 0, parts of buffers U6 and U7 are enabled. (Refer to the schematic diagram for circuit details.) Any input from the frequency tuning increment switches (10 Hz, 100 Hz, 1 kHz, or 1 MHz), tuning knob, or VFO select switch is applied to the data bus. These inputs are data bits D0-D3 and D5-D7, respectively. Bit D4 is hardwired to logic 0.

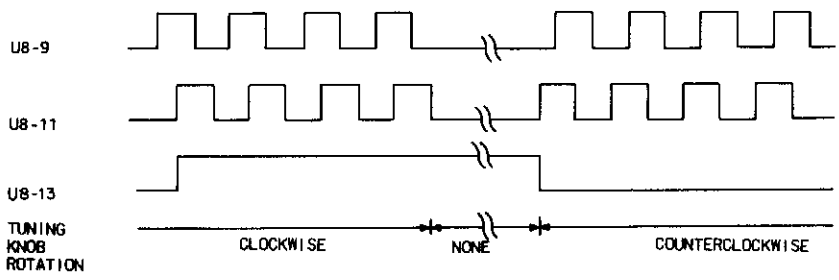
The frequency tuning knob input is developed from an optical encoder. As the knob is rotated, light beams are chopped into pulses that are applied to flip-flop U8B. Input pulse A (J6-1) will precede pulse B (J6-2) if the tuning knob is rotated clockwise, and vice versa for counterclockwise. Clockwise rotation causes the Q-output of U8B to be set to logic 1, logic 0 for counterclockwise rotation. (Refer to figure 5.) This signal is inverted and applied to the data bus through buffer U7-7 as data bit D6. Thus, when D6 is logic 0, the pulse stream applied through U7-5 as D5 causes the CPU to add a frequency increment to the frequency already in the RAM. The size of the frequency increment is determined by the computer through the level of the 10-Hz, 100-Hz, 1-kHz, and 1-MHz inputs D0-D3.

When CS2R is logic 0, sync buffer U7-12 is enabled. If the SYNC switch is depressed, data bit D0 will be logic 1. This data bit level commands the CPU to store the frequency data held in the selected vfo register into the other vfo register, giving both vfo registers the same frequency value.

When CS3R is logic 0, buffer U5 and part of buffer U6 are enabled. This permits data from a remote keypad to be input to the data bus. Two data bits are generated in parallel when any key on the keypad is depressed. One bit represents the keypad row and the other the column.

At certain times, data on the data bus is strobed into latching flip-flops for output to other circuit cards. Strobe signals are the CS2W, CS3W, CS5W, and CS6W outputs from decoders U3 and U4. Bits D0-D7 are strobed into latches U11A and U11B when the inverted CS5W signal from U10D-8 goes from logic 0 to logic 1. This data remains at the flip-flop outputs until the next CS5W positive-going transition strobes the then-present data bits to the outputs. The outputs are applied to the frequency display circuit card and to U12A, U12B, and U16. Data at J1-3, -5, -7, and -9 are binary-coded for developing a decimal digit at the display. Data bits at J1-6, -8, and -10 are binary-coded for addressing display decoders. These decoders steer the decimal digit data to the correct display driver for that digit.

The U11 outputs are also applied to U12A, U12B, and U16 to be decoded and applied (from J4-11 through -17) to the unit's control interface connector. Decoder U16 develops the strobe signals for U12A



Tuning Knob Rotation Sensor Circuit Output
Figure 5

and U12B. When U16-10 and -13 are both logic 0, the outputs at U16-3 and U16-14 are logic 1. When U16-10 goes to logic 1, U16-3 becomes logic 0 and U16-14 remains logic 1. For all other input combinations, both outputs are logic 0. As the outputs go from logic 0 to logic 1, the related latch, U12A or U12B, has data at the latch inputs strobed to the outputs and held until the next positive-going strobe transition. The resulting latch outputs are strobe and bcd operating-frequency signals for the 10's MHz and 1's MHz digits.

Data from the data bus is strobed into latches U14A and U14B when the inverted CS2W signal (from U10-10) goes from logic 0 to logic 1. At the same time, the CS3W signal goes from logic 0 to logic 1. Data bits D1, D2, D3, and D7 are present when the CS3W signal is logic 1 and are clocked into U13.

The filter select and CTTL signals, discussed in the following paragraphs, are used on receiver-exciter units only.

The outputs from U13 and U14 develop a low-pass filter selection signal, a band signal (B6, B8, or B9 for high-pass filter selection), and a transmit control signal. Data bits D5, D6, and D7 are clocked into and through latch U15 when the CS6W signal is logic 0. This data is output as frequency data, clock, and strobe signals.

The logic 1 filter select signal from U13 through U14A and U14B turns on one of the five switching transistors (Q1-Q5). The enabled transistor causes relays in the low-pass filter assembly to energize, selecting a particular filter. Filters for the 2-3 MHz, 4-5 MHz, 5-7 MHz and 10-14 MHz bands are not present in the -003 circuit card. In this card, diodes CR3, CR6, CR7, and CR9 perform an OR function to cause the next higher frequency band filter to be enabled if a frequency within the ranges not directly covered by the filters is selected.

The CTTL signal from U13 is logic 1 if the selected transmit frequency is not valid. Valid frequencies for the 658-6929-003 circuit card are 1.8 to 2.0 MHz, 3.25 to 4.25 MHz, 6.75 to 7.55 MHz, 10.10 to 10.15 MHz, 13.75 to 14.60 MHz, 18.06 to 18.17 MHz, 20.75 to 21.70 MHz, 24.89 to 24.99 MHz, 28.00 to 29.70 MHz. Valid frequencies for the 683-6929-004 circuit card are 1.6 to 29.9999 MHz.

3. TESTING/TROUBLESHOOTING PROCEDURES

A performance test for the control circuits is given in table 3. Related troubleshooting information is limited to only a few input or output circuit components. Due to the complexity of the microprocessor circuit and the specialized equipment required to test it, a suspected malfunctioning circuit card should be sent to an authorized Rockwell-Collins Service Agency.

In addition to the circuit card, include the equipment type and number and name, the 10-digit company part number, and the serial number. This information is found on the equipment nameplate located on the rear of the chassis.

Testing and troubleshooting of the control requires the control be installed in the transceiver.

3.1 Test Equipment Required

Table 2 lists the equipment required to perform the tests. A suggested type is given; however, that specific equipment is not required. Any that meets or exceeds the indicated minimum specifications is acceptable for use.

3.2 Performance Test

The following test procedures measure the performance of the control card. If repairs are performed,

Table 2. Test Equipment Required.

ITEM	USED FOR	SUGGESTED TYPE	MINIMUM SPECIFICATIONS
Dc voltmeter	Measuring logic levels	Fluke 8000A	0-10 V dc, 50 mV accuracy
Remote keypad (used only if AC-3803 is installed)	Remote keying in of frequency data	Various	2-out-of-8 connected to common, 16 keys. Refer to AC-3803 Control Interface instruction sheet for pad and pin arrangements.

repeat the numbered test where repair was performed to verify that no further malfunctions exist.

3.2.1 Preliminary Setup

Be certain no power is applied to the equipment until instructed to do so in the procedures. Do not connect power with power switches turned on.

Connect the equipment as instructed in the procedures for each test.

3.2.2 Test Procedures

Perform the tests as given in table 3.

Table 3. Control Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	In receiver-exciter units, do not key transmitter during this test. Select vfo A.		
2. Initialization	Turn on primary power to unit. After approximately 2 seconds, observe frequency display.	15.000 00 MHz	If no display, check R12, C7, and U9D/E.
3. Tuning rate	a. Press in rightmost frequency control switch. Observe frequency display while rotating tuning knob.	10's Hz digit changes. Higher frequency digits will also change if 10's Hz digit is rolled over from 9 to 0 or 0 to 9.	
	b. Press in second-from-right frequency control switch. Observe frequency display while rotating tuning knob.	100's Hz digit changes. Higher frequency digits will also change if 100's Hz digit is rolled over from 9 to 0 or 0 to 9.	
	c. Press in third-from-right frequency control switch. Observe frequency display while rotating tuning knob.	1's kHz digit changes. Higher frequency digits will also change if 1's kHz digit is rolled over from 9 to 0 or 0 to 9.	
	d. Press in leftmost frequency control switch. Observe frequency display while rotating tuning knob.	1's MHz digit changes. 10's MHz digit changes when 1's MHz digit is rolled over from 9 to 0 or 0 to 9. Increasing frequency goes from 29.000 00 to 0.000 00 and keeps increasing. Decreasing frequency goes from 0.000 00 to 29.000 00 and keeps decreasing MHz digits.	

Table 3. Control Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. Vfo select and sync	a. Record frequency displayed. (This is vfo A frequency.)		
	b. Switch to vfo B and dial in new frequency.		
	c. Switch to vfo A and note that frequency displayed is that recorded for vfo A.		
	d. Switch back to vfo B and note that frequency displayed is frequency selected for vfo B.		
	e. Depress SYNC switch. Switch to vfo A and observe displayed frequency.	Frequency is same as vfo B.	
5. Filter select (applies to 638-6929-004, used in receiver-exciters)	Press in leftmost frequency control switch. Tune frequency to values indicated below and measure dc voltage at corresponding pin of J2.		
	MHz / J2-PIN	VOLTAGE	
	1.6 / 6	+2 V or less	Check Q1.
	2.5 / 1	+4 V or more	Check U14.
	3.5 / 7	+2 V or less	Check Q2.
	4.5 / 2	+4 V or more	Check U14.
	6 / 3	+4 V or more	Check U14.
	9 / 8	+2 V or less	Check Q2.
	12 / 4	+4 V or more	Check U14.
	20 / 10	+2 V or less	Check Q2.
			If output transistors are not faulty, return card to repair center or factory.
6. Transmit inhibit (applies to 638-6929-004, used in receiver-exciters)	Connect dc voltmeter to J5-7. Using frequency control switches and tuning knob, vary frequency from less than to greater than 1.600 00 MHz and note CTTL output.	CTTL output is logic 0 when frequency is within 1.600 00 to 29.99 99 MHz and logic 1 when less than 1.600 00 MHz.	If output is not correct, return card to repair center or factory.
7. Filter select (applies to 638-6929-003 only)	Press in leftmost frequency control switch. Tune frequency to values indicated below and measure dc voltage at corresponding pin of J2.		
	MHz / J2-PIN	VOLTAGE	
	1 / 6	+2 V or less	Check Q1.
	2 / 7	+2 V or less	Check Q2.
	4 / 8	+2 V or less	Check Q3.
	10 / 9	+2 V or less	Check Q4.
	20 / 10	+2 V or less	Check Q5.
8. Transmit inhibit (applies to 638-6929-003 only)	Connect dc voltmeter to J5-7. Using frequency control switches and tuning knob, vary frequency from less than to greater than frequencies in bands indicated below and note CTTL output.		

Table 3. Control Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8. Transmit inhibit (applies to 638-6929-003 only) (Cont)	FREQUENCY BAND 1.8-2.0 3.25-4.25 6.75-7.55 13.75-14.6 20.75-21.7	CTTL output is logic 0 when selected frequency is within indicated bands and logic 1 when outside.	
9. Remote control interface (applicable only if control interface is installed in transceiver)	a. Connect key pad to transceiver control interface connector.		This test assumes keypad functions properly.
	b. Record frequency displayed on transceiver.		If results not correct for any step, check control interface for malfunctions.
	c. On keypad, depress following keys in sequence indicated: [1], [2], [.], [3], [4], [5], [0], [6].		
	d. Observe transceiver frequency display.	Display is 12.345 06, but operating frequency has not changed.	
	e. Depress [STO], [1]. Observe transceiver frequency display.	Display is that initially recorded in first step.	
	f. Depress [RCL], [1]. Observe transceiver frequency display.	Display is 12.345 06. Operating frequency also goes to this.	
	g. Depress following keys in sequence indicated. [3], [.], [5], [1], [STO], [2], then [2], [9], [.], [6], [3], [STO], [3].	Frequency display remains at 12.345 06.	
	h. Depress [STEP] and note frequency display.	Display is 3.510 00 MHz. Operating frequency also goes to this.	
	i. Depress [STEP] and note frequency display.	Display is 29.630 00 MHz. Operating frequency also goes to this.	
(Cont)	j. Depress [STEP] and note frequency display.	Display is 12.345 06 MHz. Operating frequency also goes to this.	

Table 3. Control Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. Remote control interface (applicable only if control interface is installed in transceiver) (Cont)	k. Depress [0], [STO], [2], then [STEP]. Note frequency display.	Display and operating frequency is 29.630 00 MHz. (Control skips memory locations loaded with blank data.)	
	l. Depress [3], [·], [5], [CLR]. Note frequency display.	Display shows 3.500 00 until [CLR] depressed, then clears and returns to last frequency used.	
	m. Depress [3], [·], [4], [5], [ENT]. Note frequency display.	Display and operating frequency goes to 3.450 00 MHz.	
	n. Turn off power and disconnect equipment.		

4. REPAIR

Repair of the control is accomplished using standard maintenance and circuit card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All parts list illustrations containing ESDS items are shown with the following symbol:

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier

(REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc.). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

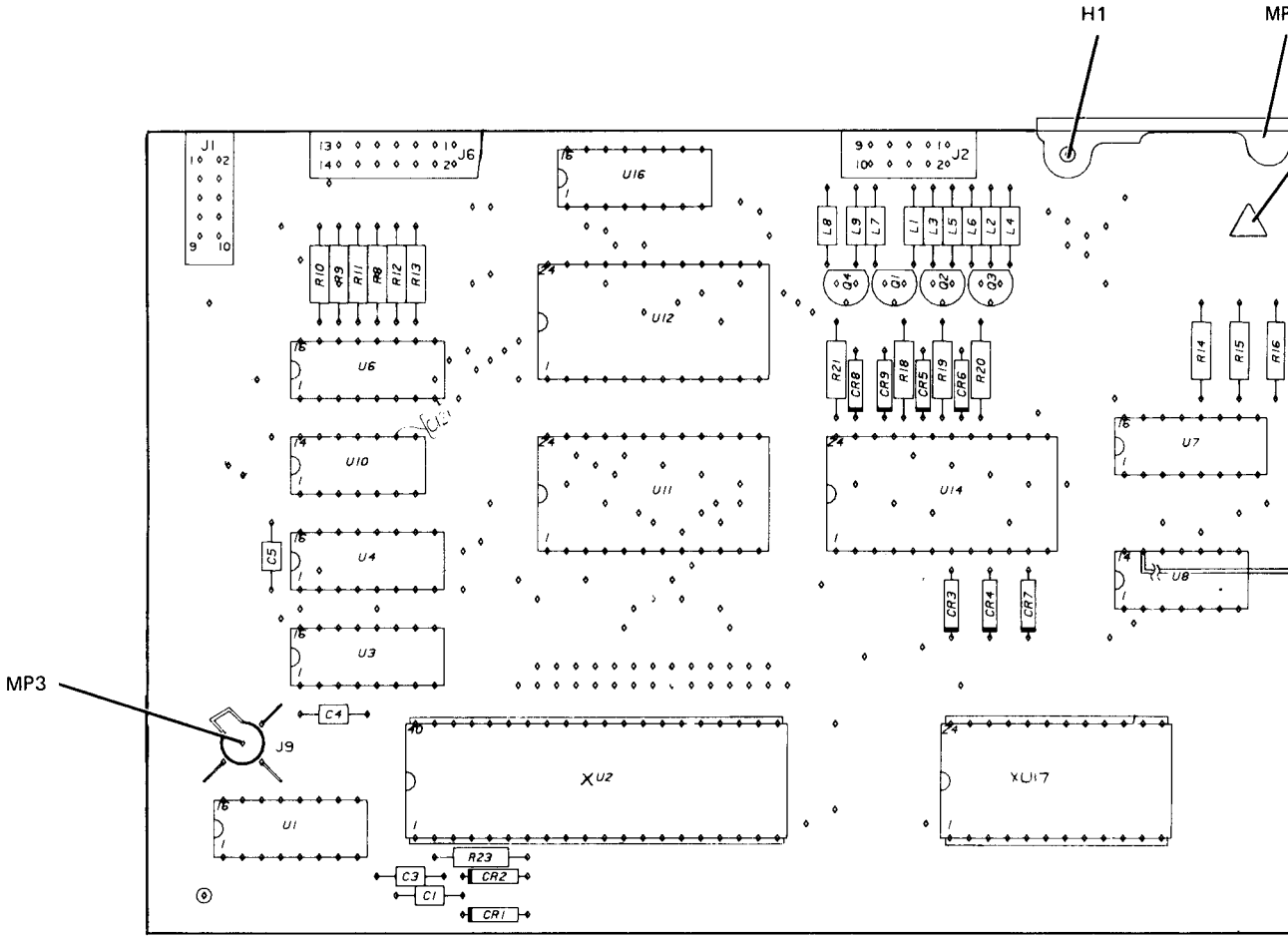
Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV SUB OF SCHLUMBERGER LTD NORTH AMERICAN SALES MAIL STOP 14-1053 401 ELLIS ST P O DRAWER 7284 MOUNTAIN VIEW CA 94042
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
31433	UNION CARBIDE CORP ELECTRONICS DIV HWY 276 SE P O BOX 5928 GREENVILLE SC 29606
34335	ADVANCED MICRO DEVICES 901 THOMPSON PL SUNNYVALE CA 94086
34576	ROCKWELL INTERNATIONAL CORP ELECTRONIC DEVICES DIV 3430 MIRALOMA AVE P O BOX 3369 ANAHEIM CA 92803
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
81349	MILITARY SPECIFICATIONS
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544

5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Control	638-6929-003	REV M
Control	638-6929-004	REV M
Control	638-6929-006	REV M


H1
MP
MP3
J1
J6
J2
J9
U16
U12
U6
U10
U11
U14
U7
U4
U8
U3
U1
XU2
XU17
R10
R9
R11
R8
R12
R13
R14
R15
R16
R21
R18
R19
R20
R23
L8
L9
L7
L1
L3
L5
L6
L2
L4
Q4
Q1
Q2
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CR9
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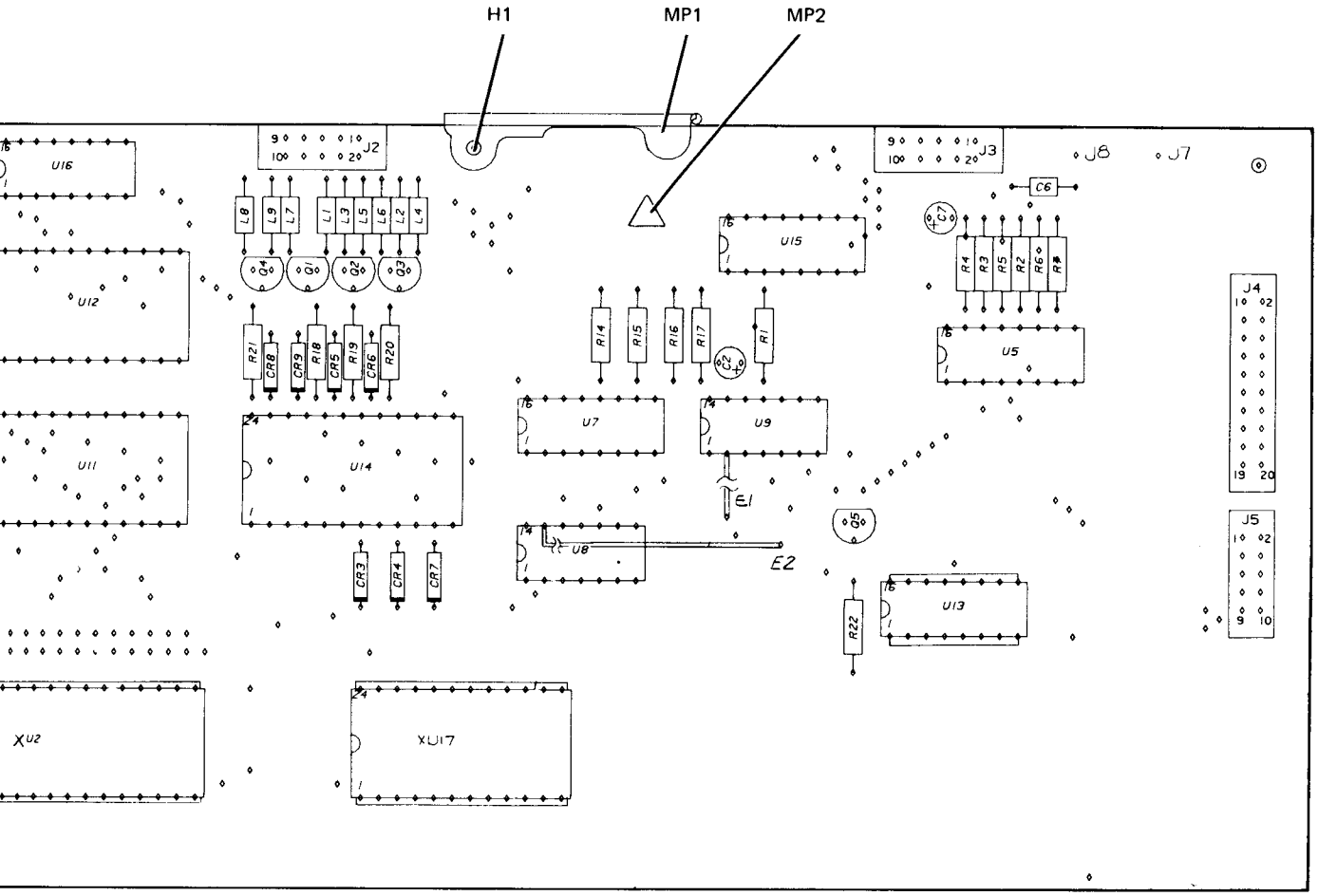
C1
CR2
CR1



ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

TPA-5299-018

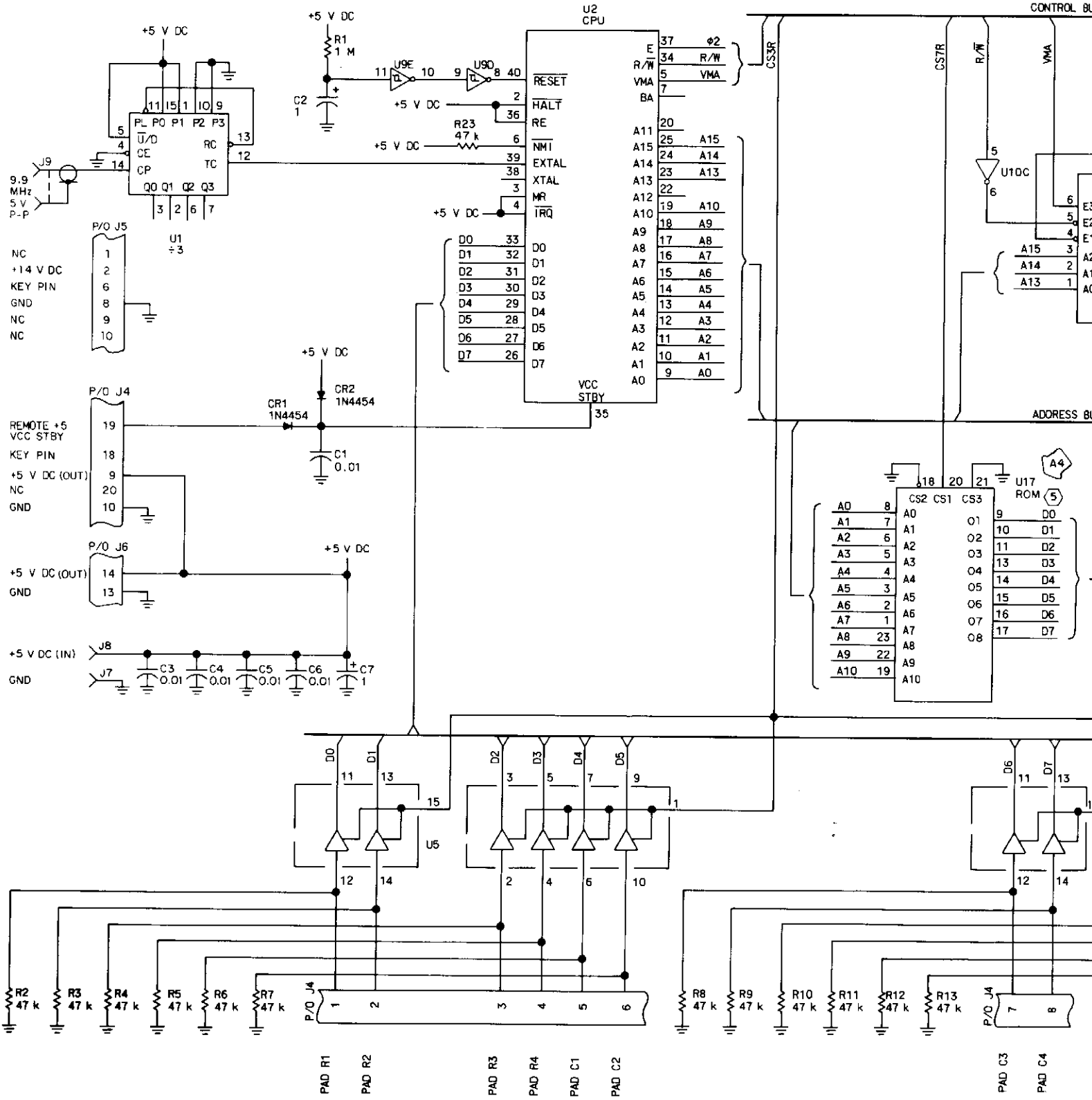
Control, Parts Location
Figure 6 (Sheet 1 of 2)

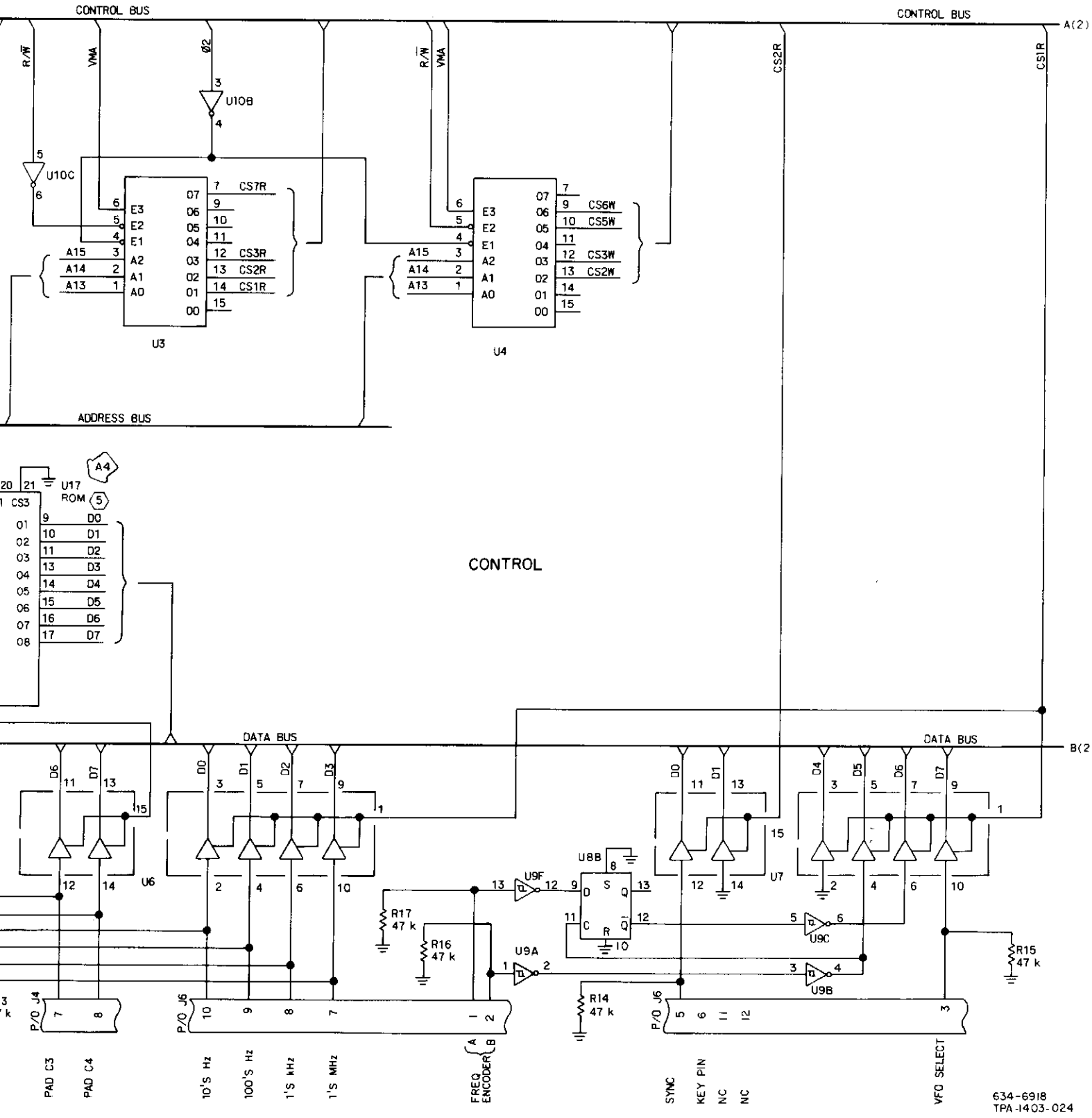
PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	CONTROL (ESDS)	638-6929-003	A		638-6929-003
	CONTROL (ESDS) (A6)	638-6929-004	B		638-6929-004
	CONTROL (ESDS)	638-6929-006	C		
CR1-CR9	SEMICOND DEVICE	353-3644-010	A	31433	1N4454
CR1,CR2	SEMICOND DEVICE	353-3644-010	B,C	31433	1N4454-1
CR3	NOT USED		B,C		
CR4,CR5	SEMICOND DEVICE	353-3644-010	B,C	31433	1N4454-1
CR6,CR7	NOT USED		B,C		
CR8	SEMICOND DEVICE	353-3644-010	B,C	31433	1N4454-1
C1	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C2	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C3-C6	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C7	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C8-C11	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V (A1)	913-4014-000		81349	CK05BX471K
H1	PIN,SPRING SST, 0.078 DIA X 1/4	311-0355-000		96906	MS16562-199
J1-J3	CONNECTOR,HDR	372-2656-100		52072	CAD10SP100-230-430
J4	CONNECTOR,HDR	372-2656-090		52072	CAD20SP100-230-430
J5	CONNECTOR,HDR	372-2656-100		52072	CAD10SP100-230-430
J6	CONNECTOR,HDR	372-2656-200		52072	CAD14SP100-230-430
J7,J8	CONNECTOR,HDR	372-2656-130		52072	CAS01SP100-230-430
J9	CONNECTOR,RCPT ELEC	357-0067-020	A,B	00779	226287-2
J9	CONNECTOR,RCPT ELEC	357-7405-010		98291	51-051-0000
L1-L9	COIL,RF 100UH (A2)	240-2047-000		96906	MS75085-07
L1-L9	COIL,RF 560UH	240-2723-050		96906	MS75085-16
MP1	HANDLE	789-2348-001			789-2348-001
MP2	LABEL,PRESS SENS (ESDS)	280-2745-040		12998	280-2745-040
MP3	JACK,TIP	360-0079-190		00779	2-332095-4
Q1-Q5	TRANSISTOR	352-5035-010		04713	MPSA14
R1	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R2-R23	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS
U1	INTEGRATED CIRCUIT COUNTER	351-1527-030		34335	SN74LS191N
U2	MICROPROCESSOR (ESDS)	351-8676-010		04713	MC6802P
U3,U4	INTEGRATED CIRCUIT DECODER	351-1526-030		04713	SN74LS138N
U5-U7	INTEGRATED CIRCUIT BUFFER (ESDS)	351-8490-010		04713	MC14503BCP
U8	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-110		07263	4013BPC
U9	INTEGRATED CIRCUIT HEX TRIGGER (ESDS)	351-8565-020		04713	MC14584BCP
U10	INTEGRATED CIRCUIT LOGIC GATE	351-1523-090		04713	SN74LS04N
U11,U12	INTEGRATED CIRCUIT CMOS ARRAY (ESDS)	351-8180-020		04713	MC14508BCP
U13	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-160		07263	4042BPC
U14	INTEGRATED CIRCUIT CMOS ARRAY (ESDS)	351-8180-020		04713	MC14508BCP
U15	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-160		07263	4042BPC
U16	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8159-270		07263	4028BPC
U17	INTEGRATED CIRCUIT READ ONLY MEMORY (ESDS)(A4)	351-8870-050	A	34576	R1453-12
U17	INTEGRATED CIRCUIT READ ONLY MEMORY (ESDS)(A4)	351-8870-060	B	34576	R1451-12
X2	SOCKET,IC (A5)	220-0075-070		00779	641268-1
X17	SOCKET,IC (A5)	220-0075-050		00779	641266-1

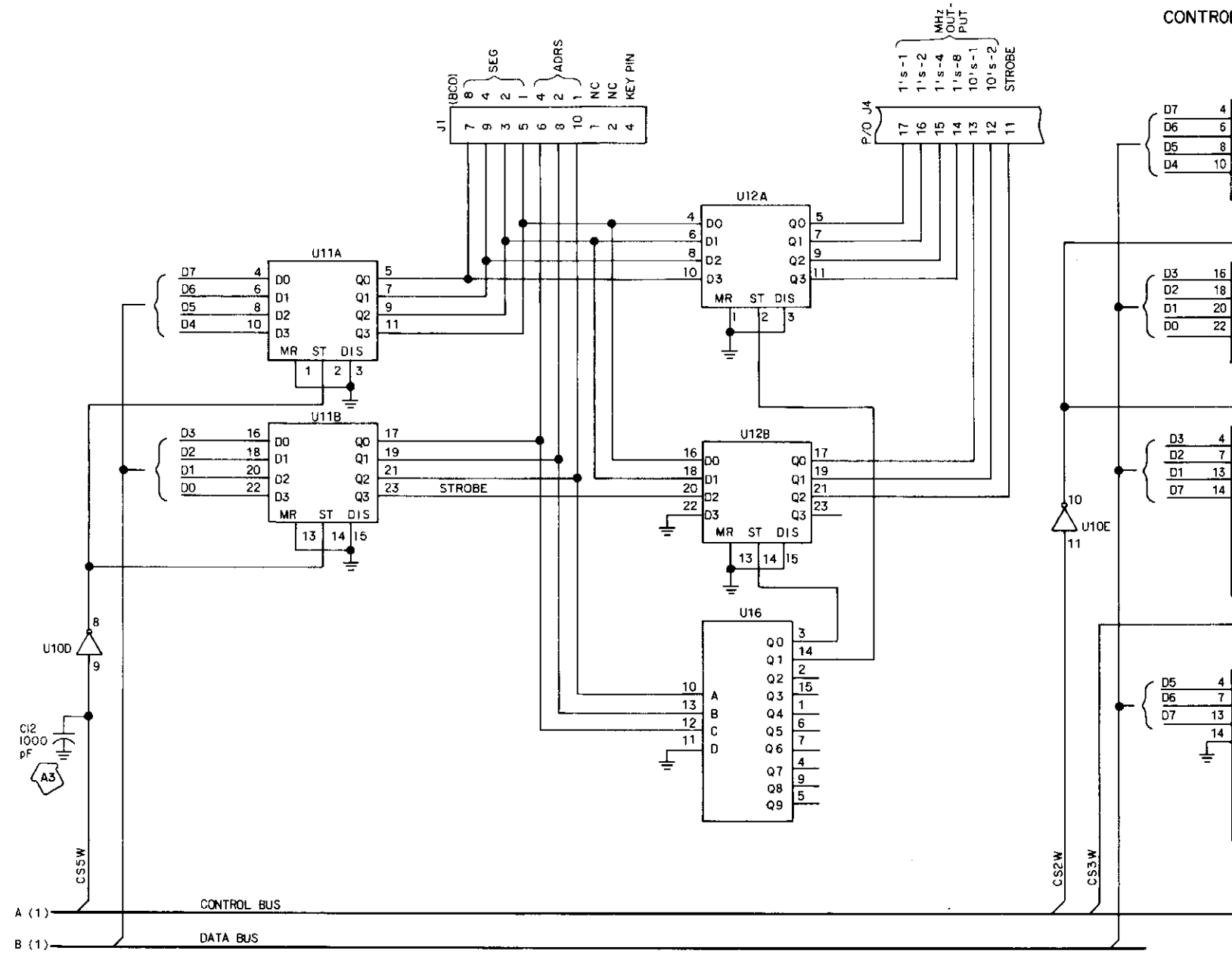
MODIFICATION HISTORY

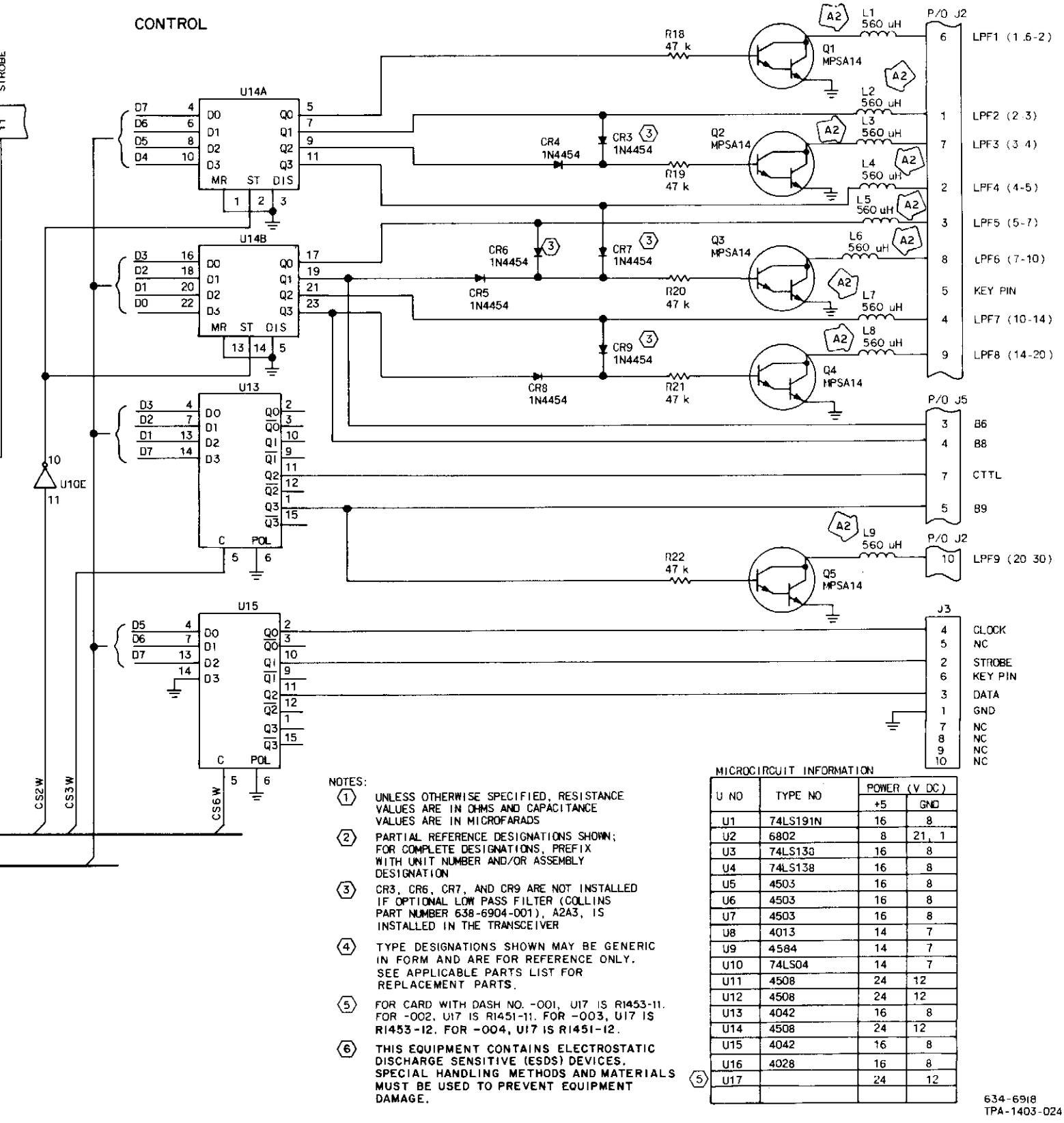
REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFEC
	638-6929-003, -004, -006	
A1	Deleted C8-C11 Added C12-913-4778-000 1000pF	REV E
A2	Changed L1-L9 from 100μH to 560μH	REV F
A3	Changed C12 from 1000pF to 330pF	REV G
A4	Changed U17 from 351-8870-010 to TO 351-8870-050	REV H
A5	Added X2-220-0075-070 Added X17-220-0075-050	REV J
NA	Data change only	REV K
A6	Added 003 Status	REV L
NA	Change pn of sleeving	REV M


+5 V DC
U2
CPU
CONTROL BU
ADDRESS BU
U1
÷3
9.9 MHz 5 V P-P
J9
P/O J5
NC
+14 V DC
KEY PIN
GND
NC
NC
P/O J4
REMOTE +5 VCC STBY
KEY PIN
+5 V DC (OUT)
NC
GND
P/O J6
+5 V DC (OUT)
GND
+5 V DC (IN)
GND
J8
J7
CR1 1N4454
CR2 1N4454
C1 0.01
C2 1
C3 0.01
C4 0.01
C5 0.01
C6 0.01
C7 1
R1 1 M
R23 47 k
U9E
U9D
U10C
U17 ROM
U5
R2 47 k
R3 47 k
R4 47 k
R5 47 k
R6 47 k
R7 47 k
R8 47 k
R9 47 k
R10 47 k
R11 47 k
R12 47 k
R13 47 k
PAD R1
PAD R2
PAD R3
PAD R4
PAD C1
PAD C2
PAD C3
PAD C4



Control, Schematic Diagram
Figure 7 (Sheet 1 of 2)


CONTROL
J1
(BCD)
8 4 2 1
SEG
4 2 1
ADRS
NC
NC
KEY PIN
7 9 3 5 6 8 10 1 2 4
P/O J4
MHz OUT-PUT
1's-1
1's-2
1's-4
1's-8
10's-1
10's-2
STROBE
17 16 15 14 13 12 11
U11A
U11B
U12A
U12B
U16
D0 D1 D2 D3
Q0 Q1 Q2 Q3
MR ST DIS
U10D
U10E
C12
1000
pF
A3
CS5W
CS2W
CS3W
CONTROL BUS
DATA BUS
A (1)
B (1)
STROBE



NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS
2. PARTIAL REFERENCE DESIGNATIONS SHOWN; FOR COMPLETE DESIGNATIONS, PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION
3. CR3, CR6, CR7, AND CR9 ARE NOT INSTALLED IF OPTIONAL LOW PASS FILTER (COLLINS PART NUMBER 638-6904-001), A2A3, IS INSTALLED IN THE TRANSCEIVER
4. TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.
5. FOR CARD WITH DASH NO. -001, U17 IS R1453-11. FOR -002, U17 IS R1451-11. FOR -003, U17 IS R1453-12. FOR -004, U17 IS R1451-12.
6. THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

MICROCIRCUIT INFORMATION

U NO	TYPE NO	POWER (V DC)	
		+5	GND
U1	74LS191N	16	8
U2	6802	8	21, 1
U3	74LS139	16	8
U4	74LS138	16	8
U5	4503	16	8
U6	4503	16	8
U7	4503	16	8
U8	4013	14	7
U9	4584	14	7
U10	74LS04	14	7
U11	4508	24	12
U12	4508	24	12
U13	4042	16	8
U14	4508	24	12
U15	4042	16	8
U16	4028	16	8
U17 (5)		24	12

634-6918
TPA-1403-024

Control, Schematic Diagram
Figure 7 (Sheet 2)

Noise Blanker (641-7146-001)

Rockwell International

instructions

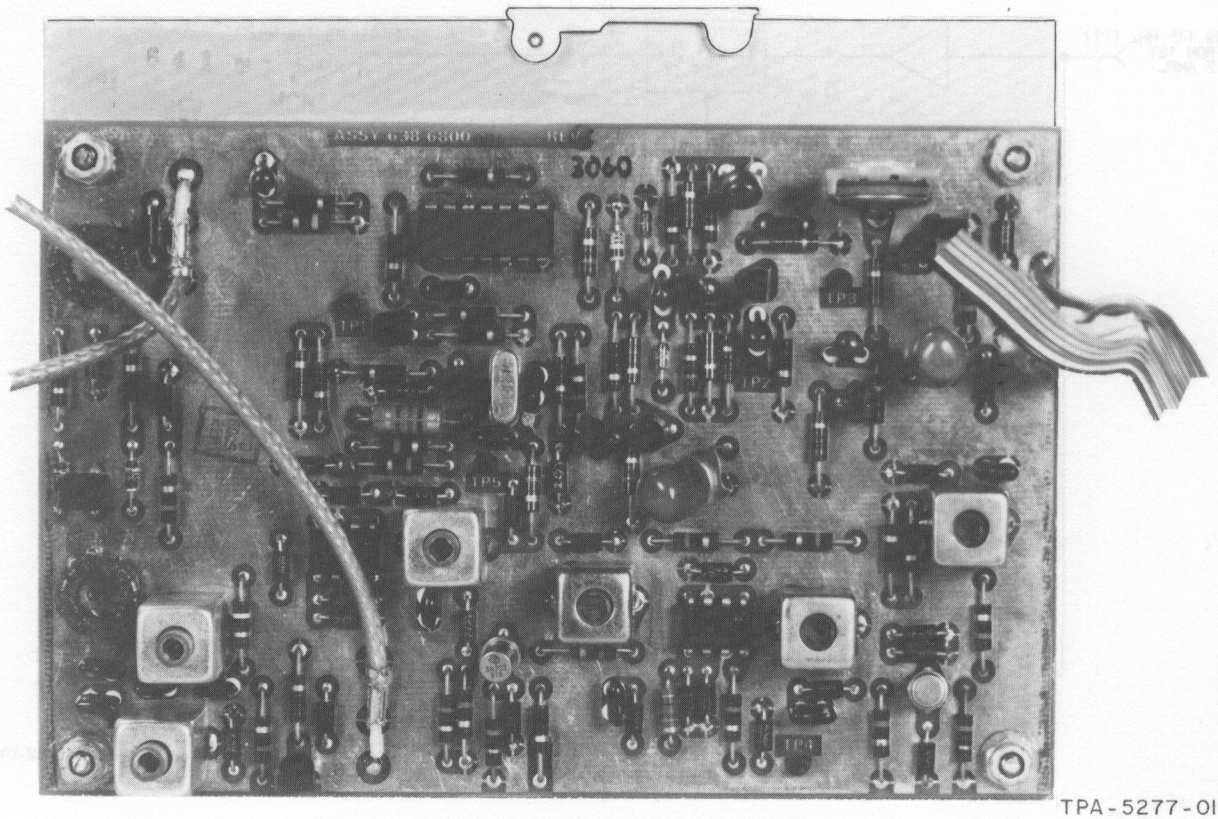
Collins Telecommunications Products Division

Printed in USA

523-0771746-001211
1 August 1982

1. DESCRIPTION

Noise Blanker, 641-7146-001, figure 1, consists of circuit card 638-6800-001 or 638-6800-002, with three attached pendant cables. It reduces spike-type noise in the if signal through use of a diode switch that is opened by the detection of noise in the signal. The switch is composed basically of two transformers and four diodes in the signal path. During noise pulses, the diodes are reverse-biased to turn off the signal. The detector circuit detects audio in the 39.145-MHz input signal. Noise causes a multivibrator to turn off a transistor and reverse bias the four diodes in the switch. Thus the signal is inhibited and the noise is reduced or eliminated from the final audio output.



Noise Blanker
Figure 1

2. PRINCIPLES OF OPERATION (Refer to block diagram, figure 2, and schematic diagrams, figures 4 and 5)

2.1 Noise Blanker 638-6800-001

The input to the noise blanker is a modulated 39.145-MHz signal that branches into a switch circuit and a noise detection/switch control circuit. The switch consists of T1, T2, CR1, CR2, CR5, CR6, R5, and R6. The diodes must be forward-biased to pass the signal from T1 to T2. Transistor Q2 provides bias for the diodes. Amplifier Q1 develops unity gain between the input and output to compensate for insertion loss of the switch circuit.

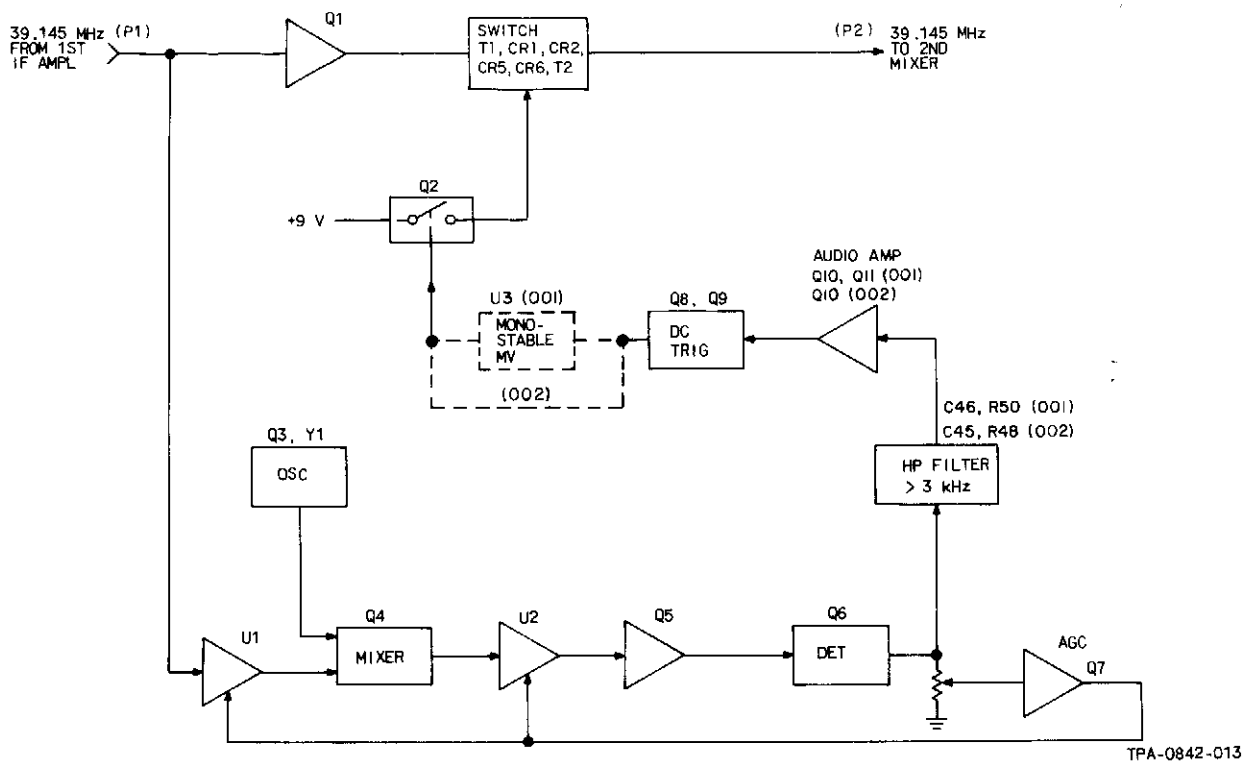
In the noise detection/switch control circuit, the input signal is amplified by U1 and applied to mixer Q4.

A 31.000-MHz injection signal, from oscillator Q3, produces an 8.145-MHz if output from Q4. Tuned circuits L5/C26, L7/C32, and L8/C37 are tuned to pass only the 8.145-MHz signal to U2 and Q5. The inductors are adjusted to peak the audio signal at TP3.

Gains of amplifiers U1 and U2 are controlled by AGC amplifier Q7. The AGC is adjusted by R31 to establish the noise blanker sensitivity level. Proper AGC adjustment will give a signal at TP2 with a downward swing that does not go below 2.0 volts and an upward swing that does not go above 3.0 volts with a 10 000-microvolt, 90-percent amplitude-modulated input signal applied to the noise blanker.

Transistor Q6 detects the audio portion of the if signal. High-pass filter C46/R50 passes audio frequencies greater than 3 kHz. Since almost all voice audio is below this frequency, the primary signal from the filter will be only noise pulses. The pulses are differentiated by C46 with only the negative portions being conducted by amplifiers Q11 and Q10. The signal is amplified to approximately 2 volts at TP2 and applied to Q9. (Diode CR4 clamps any positive-going pulses to ground.)

Because of the combination of VR1 and CR3 in the Q9 circuit, Q9 will not conduct unless the negative-going portion of the signal swings below 2 volts. (The normal audio will be between 2 and 3 volts. Any noise spike of greater amplitude will drive the signal to



Noise Blanker, Block Diagram
Figure 2

below 2 volts. This overcomes the biasing voltage of Q9 and causes Q9 to conduct.) When Q9 conducts, due to a noise spike, Q8 is also turned on to apply trigger pulse to U3.

The circuit at U3 is a monostable multivibrator with a 370-microsecond output pulse width (determined by C47 and R37). When U3 is triggered, the 370-microsecond output turns off Q2. With Q2 off, switching diodes CR1 and CR2 are reverse-biased to inhibit the signal through the primary rf path in the noise blanker. This blanks out the signal to eliminate the noise spike.

(It may appear that because of conduction time through the noise detection/switch control circuit being longer than that through the switch circuit, the noise spike will be passed before the diodes can be switched off. This is not the case, due to a characteristic of a filter in the receiver-circuit located ahead of the noise blanker circuit. This filter will stretch a spike-type pulse to approximately 150 microseconds. Thus, as this elongated noise pulse starts through the diode switch, it is also being detected by the other part of the noise blanker. Before the pulse has time to build in amplitude to a level to be heard above the normal audio output, it has been detected and the multivibrator output developed to back-bias the switching diodes. Inhibiting the diodes for 370 microseconds gives the pulse time to rise and decay before the diodes are turned back on to pass the signal. The 370-microsecond absence of the signal is not detectable to the listener in hearing the normal audio output of the receiver.)

2.2 Noise Blanker 638-6800-002

Noise blanker 638-6800-002 is very similar to noise blanker 638-6800-001. The major difference is the absence of U3, Q11, VR1 and their associated components. With U3 removed, the noise blanker does not produce a 370-μs interrupt pulse but instead only blanks for the period of time in which a noise pulse is detected.

Q6 detects the audio portion of the if signal. The audio signal then passes through high-pass filter C45/R48 from which the primary signal will be noise pulses. At this time, the noise pulses are also differentiated with only the positive portion being conducted by amplifier Q10. When a noise spike of sufficient amplitude is detected, Q9 conducts, which in turn causes Q8 to conduct, supplying a ground to the base of Q2, cutting Q2 off. With Q2 off, switching diodes CR1 and CR2 are reversed-biased to inhibit the signal through the primary rf path in the noise blanker. This blanks out the signals to eliminate the noise spike.

3. TESTING/TROUBLESHOOTING PROCEDURES

A performance test for the noise blanker is given in table 2. In addition to the required performance criteria, troubleshooting comments are given.

It is assumed that the repair technician is trained in solid-state circuit troubleshooting and repair techniques, and is familiar with the test equipment to be used. Step-by-step operating procedures are not given in the tests and not all possible troubleshooting information can be listed. All tests in table 2 must be performed in sequence.

Testing and troubleshooting of the noise blanker requires the noise blanker be installed in the transceiver.

3.1 Test Equipment Required

Table 1 lists the equipment required to perform the tests. A suggested type is given; however, that specific equipment is not required. Any that meets or exceeds the indicated minimum specifications is acceptable for use.

3.2 Performance Test

The following test procedures measure the performance of the noise blanker. After being repaired, repeat the numbered test where repair was performed to verify that no further malfunctions exist.

3.2.1 Preliminary Setup

Do not apply power to the equipment until instructed to do so in the procedures. Do not connect power with power switches turned on.

Connect the equipment as instructed in the procedures for each test.

3.2.2 Test Procedures

Perform the tests as given in table 2.

Table 1. Test Equipment Required.

ITEM	USED FOR	SUGGESTED TYPE	MINIMUM SPECIFICATIONS
Signal generator	Rf signal input to noise blanker	Hewlett-Packard 8640B	39.145 MHz, 0 to 10 000 μV; CW and 30, 90, and 95% AM, 5 kHz
Rf voltmeter with high-impedance probe	Measuring rf signal voltages	Boonton 92C	Calibration in dB; -10 to -30 dB
Scope	Observing blanking signals	Tektronix 455	0.5 to 1.0 V/div vertical, 10 μs/div horizontal; 1-MHz bandwidth

Table 2. Noise Blanker Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	a. With primary power disconnected from unit, disconnect rf connectors P1 and P2 from receiver circuit.		
	b. Turn on primary power to unit and press in NB switch.		
2. Main path gain	a. Connect signal generator to P1 through 50-ohm coaxial cable. Set generator frequency to 39.145 ±0.005 MHz, without modulation. Adjust output to -20 dB mW.		
	b. Connect rf voltmeter to P2. Note output signal level.	-20 ±1 dB mW (0-dB gain)	Adjust L2 then L1 for max signal out. Increase signal generator output, if necessary, for initial adjustment. Readjust L1 and L2 for final tuning. Check Q1, T1, T2, CR1, CR2, and Q2.
3. Oscillator	Measure rf signal (with high-impedance probe) between TP5 and ground at point near ground-end of R13 or C13.	Not less than 0.75 V rms	Check Y1, Q3, and associated circuitry.
4. Blanker path AGC adjustment	a. With signal generator input connected to P1 and frequency set for 39.145 ±0.005 MHz, adjust for 90% AM at 5 kHz.		
	b. Connect one scope channel to TP2 and other channel to TP1.		
	c. Observe TP2 display while adjusting generator output from 10 to 10 000 μV.	Signal goes to but not below 2.0 V.	Perform blanker path alignment (test 7) before further troubleshooting. If no signal at TP2, check for signal presence at each stage from U1-Q10.

Table 2. Noise Blanker Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. Blanker switching (638-6800-001)	a. With 10 000 ±1000-μV input, note position of R31 and signal level at TP2.		
	b. Slightly increase signal generator modulation level until TP1 indicates trigger pulse presence. (Without trigger, TP1 is at approximately +7 V.)		
	c. Disconnect scope from TP2 and connect to TP2-6 (output pin). Observe signal.	Signal is not present for 370 ±75 μs after voltage at TP1 goes to high level.	Check CR1, CR2, T1, and T2. Check R37/C47 for timing malfunction.
6. Blanker switching (638-6800-002)	a. With 10 000 ±1000-μV, 20-ms input, note position of R31 and signal level at TP2.		
	b. Increase signal generator modulation level until TP1 indicates trigger pulse presence. (With no blanking present, TP1 is approximately +7 V.)		
	c. Disconnect scope from TP2 and connect to TP2-6 (output pin). Observe signal.	Signal is not present for NLT 4 ms.	Check CR1, CR2, T1, and T2.
7. Blanker alignment (not required if AGC adjustment (test 4.c) is correct)	a. Set R31 to max ccw position.		
	b. Set generator modulation to 30% at 5 kHz. Connect scope to TP3 and increase generator output until audio and noise signals are seen.		
	c. Adjust L8, L7, L5, and L4 (in that order) for maximum audio signal at TP3. (Adjust generator output level for convenient level at TP3.)		
	d. Set generator output to 10 000 ±1000 μV, 90% modulation.		
	e. Adjust R31 until signal at TP2 just reaches 2.0 V without causing blanking.		

4. REPAIR

Repair of the noise blanker is accomplished using standard maintenance and circuit card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All parts list illustrations containing ESDS items are shown with the following symbol:

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

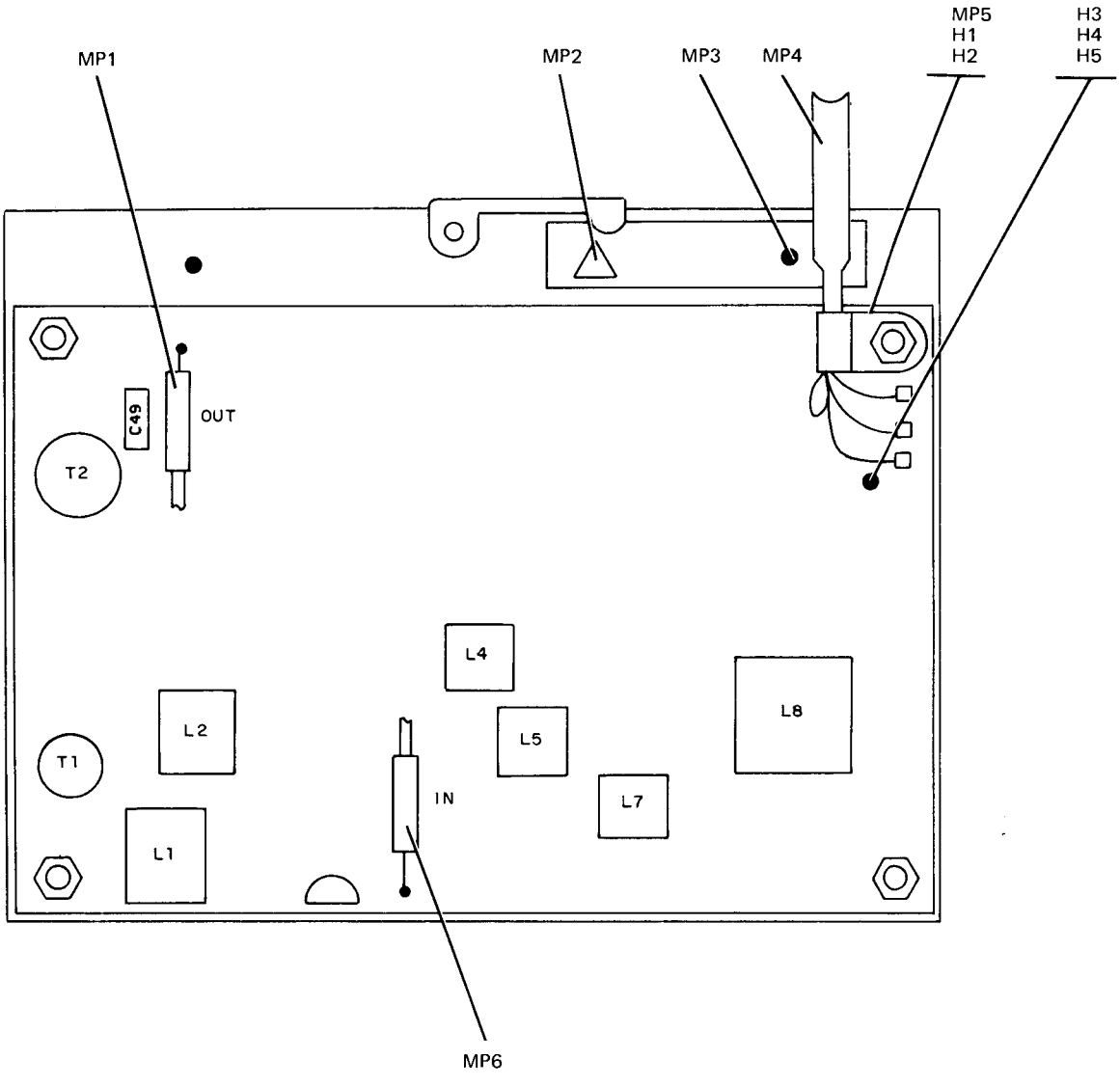
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75265
02113	COILCRAFT INC 1102 SILVER LAKE RD CARY IL 60013
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025

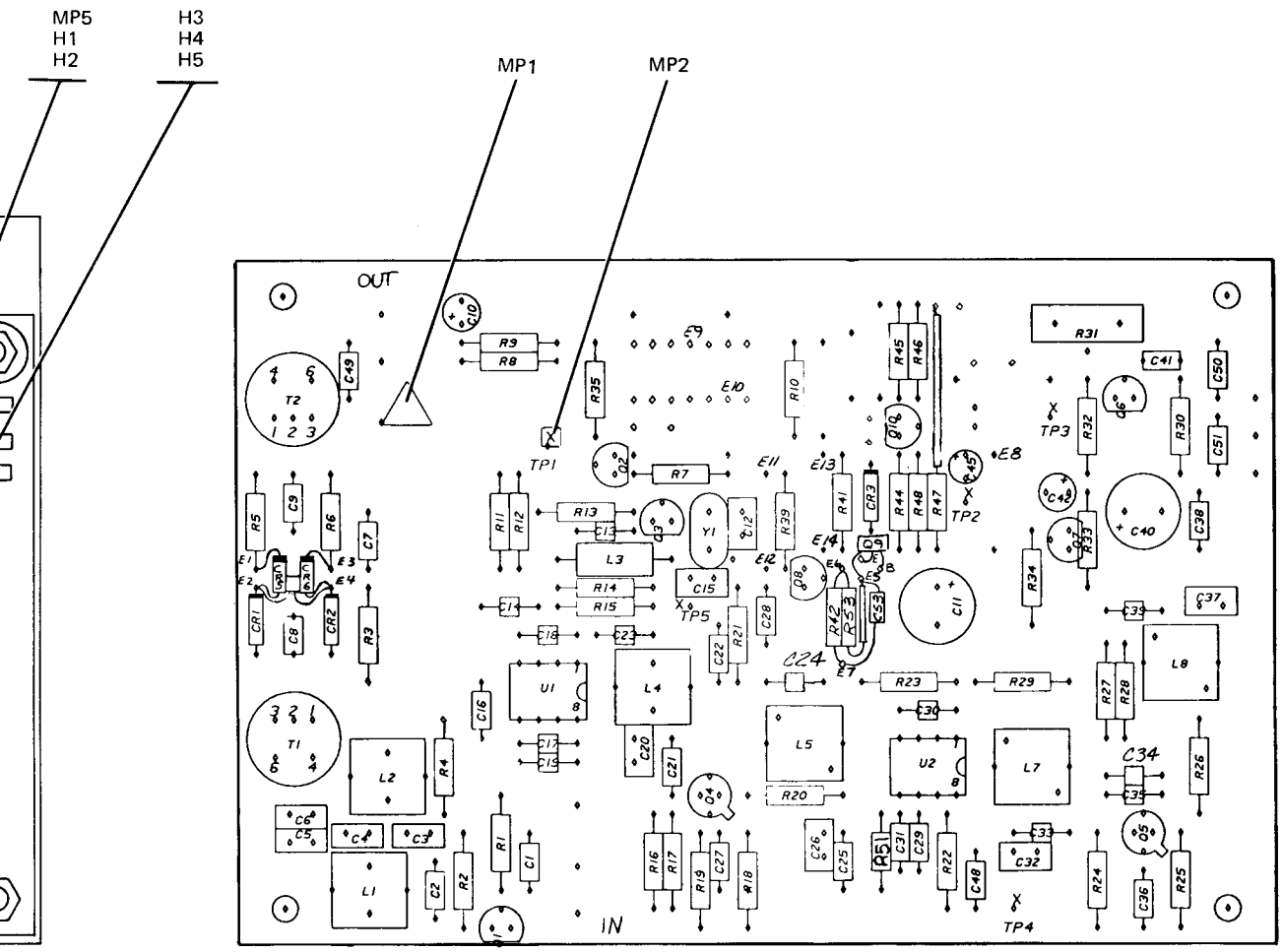
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
20462	PREM ENTERPRISES INC 3519 N CHAPEL HILL MC HENRY IL 60050
23875	M-TRON INDUSTRIES INC 100 DOUGLAS ST YANKTON SD 57078
28480	HEWLETT-PACKARD CO CORPORATE HQ 3000 HANOVER ST PALO ALTO CA 94304
31433	UNION CARBIDE CORP ELECTRONICS DIV HWY 276 SE P O BOX 5928 GREENVILLE SC 29606
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
55943	AMRAD CORP 349 BONHAM ST P O BOX 876 PARIS TX 75460
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
71450	CTS CORP 905 N WEST BLVD ELKHART IN 46514
72962	ESNA DIV OF AMERACE CORP 2330 VAUXHALL ROAD UNION NJ 07083
81349	MILITARY SPECIFICATIONS
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
96906	MILITARY STANDARD

5.3 Equipment Covered

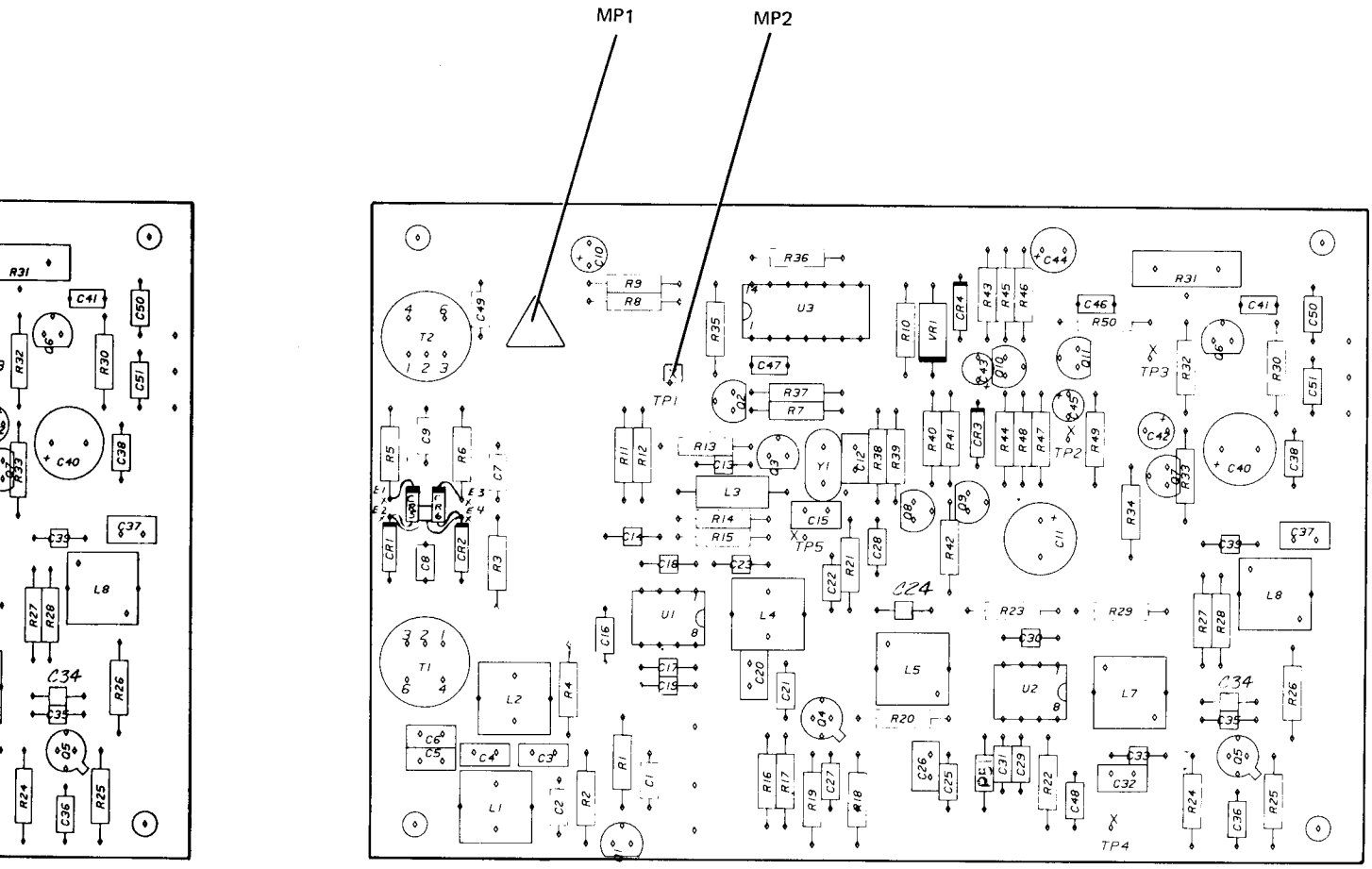
Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Noise Blanker	641-7146-001	REV D
Noise Blanker Circuit Card	638-6800-001	REV F
Noise Blanker Circuit Card	638-6800-002	REV F


MP1
MP2
MP3
MP4
MP5
H1
H2
H3
H4
H5
C49
OUT
T2
L4
L2
L5
L8
T1
IN
L7
L1
MP6
OUT
C49
T2
R5
C9
R6
C7
CR1
C8
CR2
R3
T1
L2
R4
C6
C5
C4
C3
L1
C2
R2


MP5
H1
H2
H3
H4
H5
MP1
MP2
OUT
IN
TP1
TP2
TP3
TP4
TP5
T1
T2
U1
U2
L1
L2
L3
L4
L5
L7
L8
Y1
C24
C34

638-6800-001



638-6800-002

ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

TPA-5291-018

Noise Blanker, Parts Location
Figure 3 (Sheet 1 of 2)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	NOISE BLANKER (ESDS)	641-7146-001			641-7146-001
	NOISE BLANKER CIRCUIT CARD (ESDS)	638-6800-001	A		638-6800-001
	NOISE BLANKER CIRCUIT CARD (ESDS)	638-6800-002	B		
H1	SCREW,MACH STL, 4-40 X 5/8 (QTY 1)	343-0138-000		96906	MS51957-18
H2	WASHER,FLAT CRES, 0.164ID X 0.320 OD (QTY 1)	310-0779-050		96906	MS15795-805
H3	POST (QTY 4)	541-5964-002			541-5964-002
H4	NUT,SLFLKG,HEX AL, 4-40 (QTY 4)	333-0346-000		72962	69NM40
H5	SCREW,MACH STL, 4-40 X 1/2 (QTY 4)	343-0137-000		96906	MS51957-17
MP1	CABLE, COAX	641-7100-019			641-7100-019
MP2	LABEL,PRESS SENS (ESDS)	280-2745-040		12998	280-2745-040
MP3	PLATE,NOISE BLANKER	641-7131-001			
MP4	CABLE, COAX	641-7172-001			
MP5	CLAMP,LOOP	150-1554-000		55943	610-0002
MP6	CABLE,COAX	641-7100-018			641-7100-018
	NOISE BLANKER CIRCUIT CARD (ESDS)	638-6800-001	A		638-6800-001
	NOISE BLANKER CIRCUIT CARD (ESDS)	638-6800-002	B		
CR1,CR2	SEMICOND DEVICE	353-3733-010	A	28480	HP-3168
CR3	SEMICOND DEVICE	353-3644-010	B	31433	1N4454
CR3,CR4	SEMICOND DEVICE	353-3644-010	A	31433	1N4454
CR5,CR6	SEMICOND DEVICE	353-3733-010		28480	HP-3168
C1,C2	CAPACITOR,FIXED CER DIEL, 0.001UF, P80%M20%, 50VDC	913-3331-010		56289	292CX7R102M050B
C3	CAPACITOR,FXD MICA DIEL, 18PF, PORM 0.5PF, 100V	912-4141-140		93790	CD5CA180D0
C4	CAPACITOR,FXD MICA DIEL, 1PF, PORM 0.5PF, 300V	912-4141-060		93790	CD5CC010D0
C5	CAPACITOR,FXD MICA DIEL, 15PF, PORM 0.5PF, 300V	912-4141-130		93790	CD5CC150D0
C6	CAPACITOR,FXD MICA DIEL, 6PF, PORM 0.5PF, 300V	912-4141-090		93790	CD5CC060D0
C7	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C8	CAPACITOR,FIXED CER DIEL, 2200PF, 10%, 100V	913-5019-120		81349	CK05BX222K
C9	CAPACITOR,FIXED CER DIEL, 0.001UF, P80%M20%, 50VDC	913-3331-010		56289	292CX7R102M050B
C10	CAPACITOR,FIXED TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C11	CAPACITOR,FIXED TNTLM ELCTLT, 100UF, 20%, 20V	184-9102-640		56289	196D240A
C12	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0
C13,C14	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C15	CAPACITOR,FXD MICA DIEL, 39PF, 2%, 50V	912-4141-040		93790	CD5EY390G0
C16-C19	CAPACITOR,FIXED CER DIEL, 0.001UF, P80%M20%, 50VDC	913-3331-010		56289	292CX7R102M050B
C20	CAPACITOR,FXD MICA DIEL, 15PF, PORM 0.5PF, 300V	912-4141-130		93790	CD5CC150D0
C21,C22	CAPACITOR,FIXED CER DIEL, 0.001UF, P80%M20%, 50VDC	913-3331-010		56289	292CX7R102M050B
C23	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C24	CAPACITOR,FIXED CER DIEL, 0.047UF, P80%M20%, 50V	913-3331-040		56289	292CY5U473Z050C
C25	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C26	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0
C27	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C28	CAPACITOR,FIXED CER DIEL, 0.047UF, P80%M20%, 50V	913-3331-040		56289	292CY5U473Z050C
C29	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C30	CAPACITOR,FIXED CER DIEL, 0.047UF, P80%M20%, 50V	913-3331-040		56289	292CY5U473Z050C
C31	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C32	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0
C33,C34	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C35	CAPACITOR,FIXED CER DIEL, 0.001UF, P80%M20%, 50VDC	913-3331-010		56289	292CX7R102M050B
C36	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C37	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0
C38	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C39	CAPACITOR,FIXED CER DIEL, 0.047UF, P80%M20%, 50V	913-3331-040		56289	292CY5U473Z050C
C40	CAPACITOR,FIXED TNTLM ELCTLT, 100UF, 20%, 20V	184-9102-640		56289	196D240A
C41	CAPACITOR,FIXED CER DIEL, 0.022UF, 10%, 50VDC (A1)	913-5019-240		81349	CK05BX223K
C41	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020	A	56289	292CY5U103Z050B
C42	CAPACITOR,FIXED TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C43	CAPACITOR,FIXED TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350	A	56289	199D105X0035BB1
C44	CAPACITOR,FIXED TNTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390	A	56289	199D475X0035DB1
C45	CAPACITOR,FIXED TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350	A	56289	199D105X0035BB1
C46,C47	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000	A	81349	CK05BX102K
C48	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C49	CAPACITOR,FIXED CER DIEL, 0.001UF, P80%M20%, 50VDC	913-3331-010		56289	292CX7R102M050B
C50,C51	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C52	CAPACITOR,FXD MICA DIEL, 15PF, PORM 0.5PF, 300V (A1)	912-4141-130		93790	CD5CC150D0

PAR

REF DES	DESCRIPTION
C53	CAPACITOR,FIXED CER DIEL, 0.01UF, P80% 50VDC
E1-E4	CONNECTOR,HDR
L1,L2	COIL,RF,VAR 0.525MIN UH TO 1.020MAX UH
L3	COIL,RF 1.50UH
L4	COIL,RF,VAR 0.525MIN UH TO 1.020MAX UH
L5	INDUCTOR,RF
L6	NOT USED
L7,L8	INDUCTOR,RF
MP1	LABEL,PRESS SENS (ESDS)
MP2	CONNECTOR,HDR (QTY 9)
MP2	CONNECTOR,HDR (QTY 12)
Q1	TRANSISTOR,JFET
Q2	TRANSISTOR
Q3	TRANSISTOR
Q4	TRANSISTOR,FET (ESDS)
Q5	TRANSISTOR,FET (ESDS)
Q6	TRANSISTOR
Q7	TRANSISTOR (ESDS)
Q8	TRANSISTOR
Q9	TRANSISTOR
Q10	TRANSISTOR
Q11	TRANSISTOR (ESDS)
R1	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W
R2,R3	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W
R4	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/4W
R5,R6	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/4W
R7	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
R8	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W
R9	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W
R10	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W
R11,R12	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
R13	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W
R14,R15	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W
R16	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W
R17	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W
R18	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
R19	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W
R20,R21	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W
R22	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W
R23	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W
R24	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W
R25	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W
R26	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W
R27	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
R28	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W
R29	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W
R30	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W
R31	RESISTOR,VARIABLE 5K, 30%, 0.25 TO 0 W
R32	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
R33	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W
R34	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W
R35	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
R36	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
R37	RESISTOR,FXD CMPSN, 0.15MEGO, 10%, 1/4W
R38	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
R39	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W
R40	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W
R41	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W
R41	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/4W
R42	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W
R42	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
R43	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
R44	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W
R44	RESISTOR,FIXED CMPSN, 22K, 10%, 1/4W
R45	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W
R46	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W
R46	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W
R47	RESISTOR,FXD CMPSN, 0.12MEGO, 10%, 1/4W
R47	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W
R48	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W
R48	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W
R49	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W
R50	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W
R51	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/4W
R52	NOT USED
R53	RESISTOR,FIXED CMPSN, 10K, 10%, 1/4W
T1	TRANSFORMER,RF
U1,U2	INTEGRATED CIRCUIT AMPLIFIER
U3	MICROCIRCUIT (ESDS)
VR1	SEMICOND DEVICE
Y1	CRYSTAL UNIT,QTZ 31.00000MHZ

RTS LIST

	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	641-7146-001			641-7146-001
	638-6800-001	A		638-6800-001
	638-6800-002	B		
	343-0138-000		96906	MS51957-18
QTY 1)	310-0779-050		96906	MS15795-805
	541-5964-002			541-5964-002
	333-0346-000		72962	69NM40
	343-0137-000		96906	MS51957-17
	641-7100-019			641-7100-019
	280-2745-040		12998	280-2745-040
	641-7131-001			
	641-7172-001			
	150-1554-000		55943	610-0002
	641-7100-018			641-7100-018
	638-6800-001	A		638-6800-001
	638-6800-002	B		
	353-3733-010	A	28480	HP-3168
	353-3644-010	B	31433	1N4454
	353-3644-010	A	31433	1N4454
	353-3733-010		28480	HP-3168
XM20%,	913-3331-010		56289	292CX7R102M050B
5PF,	912-4141-140		93790	CD5CA180D0
PF, 300V	912-4141-060		93790	CD5CC010D0
5PF,	912-4141-130		93790	CD5CC150D0
PF, 300V	912-4141-090		93790	CD5CC060D0
M20%,	913-3331-020		56289	292CY5U103Z050B
100V	913-5019-120		81349	CK05BX222K
ZM20%,	913-3331-010		56289	292CX7R102M050B
, 35V	184-9102-350		56289	199D105X0035BB1
0%, 20V	184-9102-640		56289	196D240A
V	912-4141-400		93790	CD5FY151J0
M20%,	913-3331-020		56289	292CY5U103Z050B
	912-4141-040		93790	CD5EY390G0
XM20%,	913-3331-010		56289	292CX7R102M050B
5PF,	912-4141-130		93790	CD5CC150D0
XM20%,	913-3331-010		56289	292CX7R102M050B
M20%,	913-3331-020		56289	292CY5U103Z050B
XM20%,	913-3331-040		56289	292CY5U473Z050C
M20%,	913-3331-020		56289	292CY5U103Z050B
V	912-4141-400		93790	CD5FY151J0
M20%,	913-3331-020		56289	292CY5U103Z050B
XM20%,	913-3331-040		56289	292CY5U473Z050C
M20%,	913-3331-020		56289	292CY5U103Z050B
XM20%,	913-3331-040		56289	292CY5U473Z050C
M20%,	913-3331-020		56289	292CY5U103Z050B
V	912-4141-400		93790	CD5FY151J0
M20%,	913-3331-020		56289	292CY5U103Z050B
XM20%,	913-3331-010		56289	292CX7R102M050B
M20%,	913-3331-020		56289	292CY5U103Z050B
V	912-4141-400		93790	CD5FY151J0
M20%,	913-3331-020		56289	292CY5U103Z050B
XM20%,	913-3331-040		56289	292CY5U473Z050C
0%, 20V	184-9102-640		56289	196D240A
, 50VDC	913-5019-240		81349	CK05BX223K
M20%,	913-3331-020	A	56289	292CY5U103Z050B
, 35V	184-9102-350		56289	199D105X0035BB1
, 35V	184-9102-350	A	56289	199D105X0035BB1
0%, 35V	184-9102-390	A	56289	199D475X0035DB1
, 35V	184-9102-350	A	56289	199D105X0035BB1
200V	913-4018-000	A	81349	CK05BX102K
M20%,	913-3331-020		56289	292CY5U103Z050B
XM20%,	913-3331-010		56289	292CX7R102M050B
M20%,	913-3331-020		56289	292CY5U103Z050B
5PF,	912-4141-130		93790	CD5CC150D0

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
C53	CAPACITOR,FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020	B	56289	292CY5U103Z050B
E1-E4	CONNECTOR,HDR	372-2656-130		52072	CAS01SP100-230-4 30
L1,L2	COIL,RF,VAR 0.525MIN UH TO 1.020MAX UH	242-0439-060		02113	115CLWNDV17-5TUR NS
L3	COIL,RF 1.50UH	240-1570-000		96906	MS18130-10
L4	COIL,RF,VAR 0.525MIN UH TO 1.020MAX UH	242-0439-060		02113	115CLWNDV17-5TUR NS
L5	INDUCTOR,RF	242-0441-060		20462	242-0441-060
L6	NOT USED				
L7,L8	INDUCTOR,RF	242-0441-060		20462	242-0441-060
MP1	LABEL,PRESS SENS (ESDS)	280-2745-040		12998	280-2745-040
MP2	CONNECTOR,HDR (QTY 9)	372-2656-130	A	52072	CAS01SP100-230-4 30
MP2	CONNECTOR,HDR (QTY 12)	372-2656-130	B	52072	CAS01SP100-230-4 30
Q1	TRANSISTOR,JFET	352-5502-010		17856	J310
Q2	TRANSISTOR	352-5501-010		04713	MPS2222A
Q3	TRANSISTOR	352-0723-010		04713	MPS918
Q4	TRANSISTOR,FET (ESDS)	352-1140-020		01295	3N202
Q5	TRANSISTOR,FET (ESDS)	352-1140-010		01295	3N201
Q6	TRANSISTOR	352-5505-010		17856	2N5486
Q7	TRANSISTOR (ESDS)	352-0769-030		04713	2N5459
Q8	TRANSISTOR	352-5501-010		04713	MPS2222A
Q9	TRANSISTOR	352-5500-010		04713	MPS2907A
Q10	TRANSISTOR	352-5501-010		04713	MPS2222A
Q11	TRANSISTOR (ESDS)	352-0769-030	A	04713	2N5459
R1	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR07G151KS
R2,R3	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R4	RESISTOR,FXD CMPSN, 3.9K, 10%, 1/4W	745-0770-000		81349	RCR07G392KS
R5,R6	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/4W	745-0677-000		81349	RCR07G100KS
R7	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R8	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R9	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R10	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R11,R12	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R13	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R14,R15	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R16	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R17	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R18	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R19	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R20,R21	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R22	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R23	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R24	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R25	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS
R26	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R27	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R28	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R29	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W	745-0701-000		81349	RCR07G470KS
R30	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS
R31	RESISTOR,VARIABLE 5K, 30%, 0.25 TO 0 W	376-0274-060		71450	X201R502B
R32	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R33	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R34	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R35	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R36	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R37	RESISTOR,FXD CMPSN, 0.15MEGO, 10%, 1/4W	745-0827-000		81349	RCR07G154KS
R38	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R39	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R40	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R41	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000	A	81349	RCR07G151KS
R41	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/4W	745-0677-000	B	81349	RCR07G100KS
R42	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000	A	81349	RCR07G472KS
R42	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000	B	81349	RCR07G103KS
R43	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R44	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000	A	81349	RCR07G472KS
R44	RESISTOR,FIXED CMPSN, 22K, 10%, 1/4W	745-0797-000	B	81349	RCR07G223KS
R45	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
R46	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W	745-0725-000	A	81349	RCR07G221KS
R46	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000	B	81349	RCR07G682KS
R47	RESISTOR,FXD CMPSN, 0.12MEGO, 10%, 1/4W	745-0824-000	A	81349	RCR07G124KS
R47	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000	B	81349	RCR07G473KS
R48	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000	A	81349	RCR07G153KS
R48	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W	745-0833-000	B	81349	RCR07G224KS
R49	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R50	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R51	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/4W	745-0677-000		81349	RCR07G100KS
R52	NOT USED				
R53	RESISTOR,FIXED CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
T1	TRANSFORMER,RF	278-0444-010		20462	2259
U1,U2	INTEGRATED CIRCUIT AMPLIFIER	351-1142-010		04713	MC1350P
U3	MICROCIRCUIT (ESDS)	351-8200-020	A	02735	CD4047BE
VR1	SEMICOND DEVICE	353-2938-000		01295	1N746A
Y1	CRYSTAL UNIT,QTZ 31.00000MHZ	289-1679-000		23875	289-1679-000

REVISION IDENT	DESCRI REASO
NA	638-680
A1	Changec
	Added C

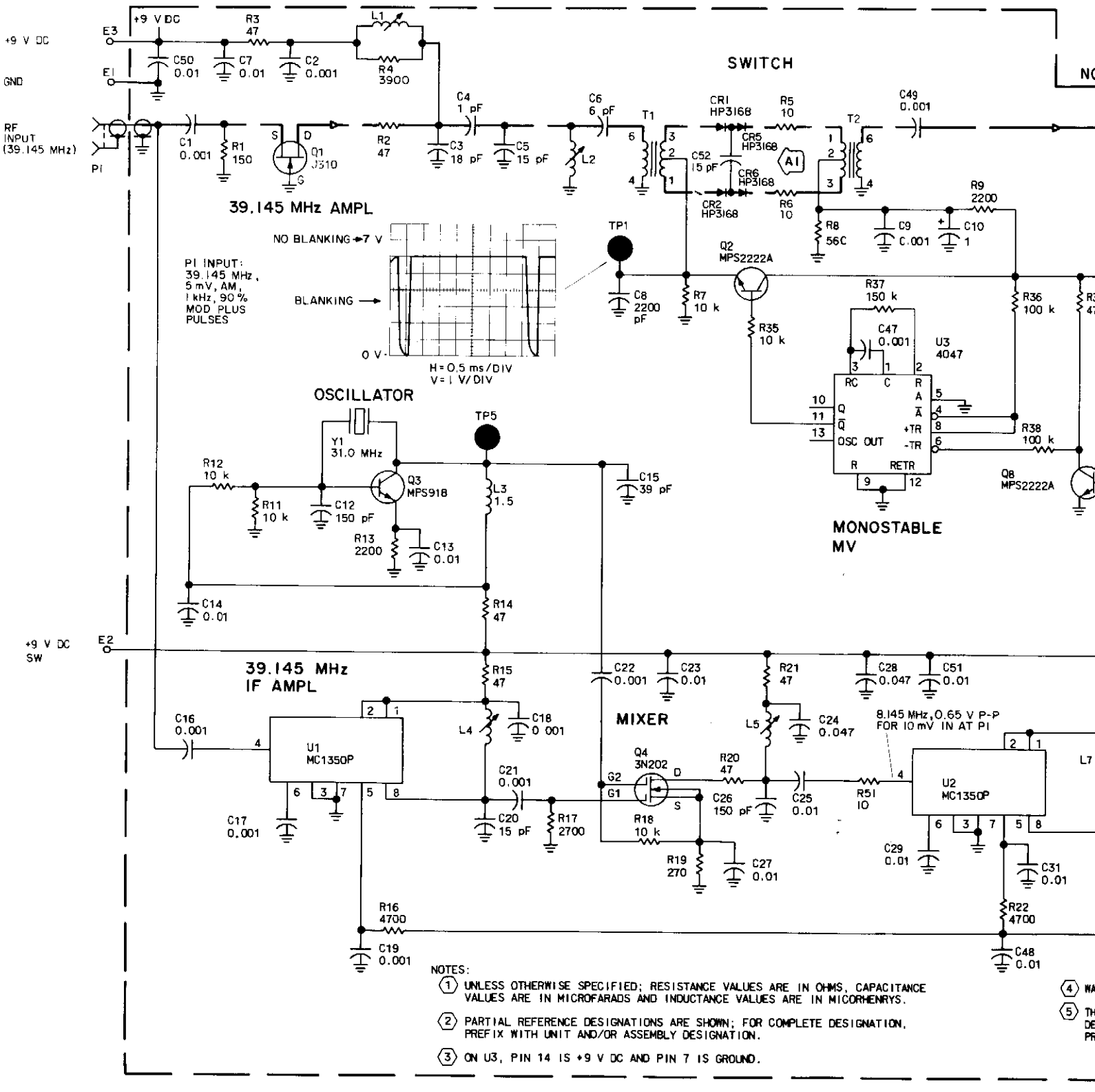
PARTS LIST (Cont)

	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
P80%M20%,	913-3331-020	B	56289	292CY5U103Z050B
	372-2656-130		52072	CAS01SP100-230-4 30
AX UH	242-0439-060		02113	115CLWNDV17-5TUR NS
	240-1570-000		96906	MS18130-10
AX UH	242-0439-060		02113	115CLWNDV17-5TUR NS
	242-0441-060		20462	242-0441-060
	242-0441-060		20462	242-0441-060
	280-2745-040		12998	280-2745-040
	372-2656-130	A	52072	CAS01SP100-230-4 30
	372-2656-130	B	52072	CAS01SP100-230-4 30
	352-5502-010		17856	J310
	352-5501-010		04713	MPS2222A
	352-0723-010		04713	MPS918
	352-1140-020		01295	3N202
	352-1140-010		01295	3N201
	352-5505-010		17856	2N5486
	352-0769-030		04713	2N5459
	352-5501-010		04713	MPS2222A
	352-5500-010		04713	MPS2907A
	352-5501-010		04713	MPS2222A
	352-0769-030	A	04713	2N5459
, 1/4W	745-0719-000		81349	RCR07G151KS
1/4W	745-0701-000		81349	RCR07G470KS
4W	745-0770-000		81349	RCR07G392KS
1/4W	745-0677-000		81349	RCR07G100KS
W	745-0785-000		81349	RCR07G103KS
, 1/4W	745-0740-000		81349	RCR07G561KS
4W	745-0761-000		81349	RCR07G222KS
1/4W	745-0701-000		81349	RCR07G470KS
W	745-0785-000		81349	RCR07G103KS
4W	745-0761-000		81349	RCR07G222KS
1/4W	745-0701-000		81349	RCR07G470KS
4W	745-0773-000		81349	RCR07G472KS
4W	745-0764-000		81349	RCR07G272KS
W	745-0785-000		81349	RCR07G103KS
, 1/4W	745-0728-000		81349	RCR07G271KS
1/4W	745-0701-000		81349	RCR07G470KS
4W	745-0773-000		81349	RCR07G472KS
1/4W	745-0701-000		81349	RCR07G470KS
4W	745-0764-000		81349	RCR07G272KS
, 1/4W	745-0728-000		81349	RCR07G271KS
1/4W	745-0701-000		81349	RCR07G470KS
W	745-0785-000		81349	RCR07G103KS
W	745-0791-000		81349	RCR07G153KS
1/4W	745-0701-000		81349	RCR07G470KS
4W	745-0764-000		81349	RCR07G272KS
0 0 W	376-0274-060		71450	X201R502B
, 1/4W	745-0821-000		81349	RCR07G104KS
/4W	745-0857-000		81349	RCR07G105KS
	745-0749-000		81349	RCR07G102KS
W	745-0785-000		81349	RCR07G103KS
, 1/4W	745-0821-000		81349	RCR07G104KS
, 1/4W	745-0827-000		81349	RCR07G154KS
, 1/4W	745-0821-000		81349	RCR07G104KS
4W	745-0773-000		81349	RCR07G472KS
	745-0749-000		81349	RCR07G102KS
, 1/4W	745-0719-000	A	81349	RCR07G151KS
1/4W	745-0677-000	B	81349	RCR07G100KS
4W	745-0773-000	A	81349	RCR07G472KS
W	745-0785-000	B	81349	RCR07G103KS
, 1/4W	745-0821-000		81349	RCR07G104KS
4W	745-0773-000	A	81349	RCR07G472KS
/4W	745-0797-000	B	81349	RCR07G223KS
, 1/4W	745-0731-000		81349	RCR07G331KS
, 1/4W	745-0725-000	A	81349	RCR07G221KS
4W	745-0779-000	B	81349	RCR07G682KS
, 1/4W	745-0824-000	A	81349	RCR07G124KS
W	745-0809-000	B	81349	RCR07G473KS
W	745-0791-000	A	81349	RCR07G153KS
, 1/4W	745-0833-000	B	81349	RCR07G224KS
4W	745-0755-000		81349	RCR07G152KS
W	745-0797-000		81349	RCR07G223KS
1/4W	745-0677-000		81349	RCR07G100KS
/4W	745-0785-000		81349	RCR07G103KS
	278-0444-010		20462	2259
	351-1142-010		04713	MC1350P
	351-8200-020	A	02735	CD4047BE
	353-2938-000		01295	1N746A
	289-1679-000		23875	289-1679-000

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
NA	638-6800-001 replaced with 638-6800-002	REV C
A1	Changed C41 from 0.022 μF to 0.01 μF Added C52, P/N 912-4141-130 15 pF	REV E

Noise Blanker, Parts Location
Figure 3 (Sheet 2)

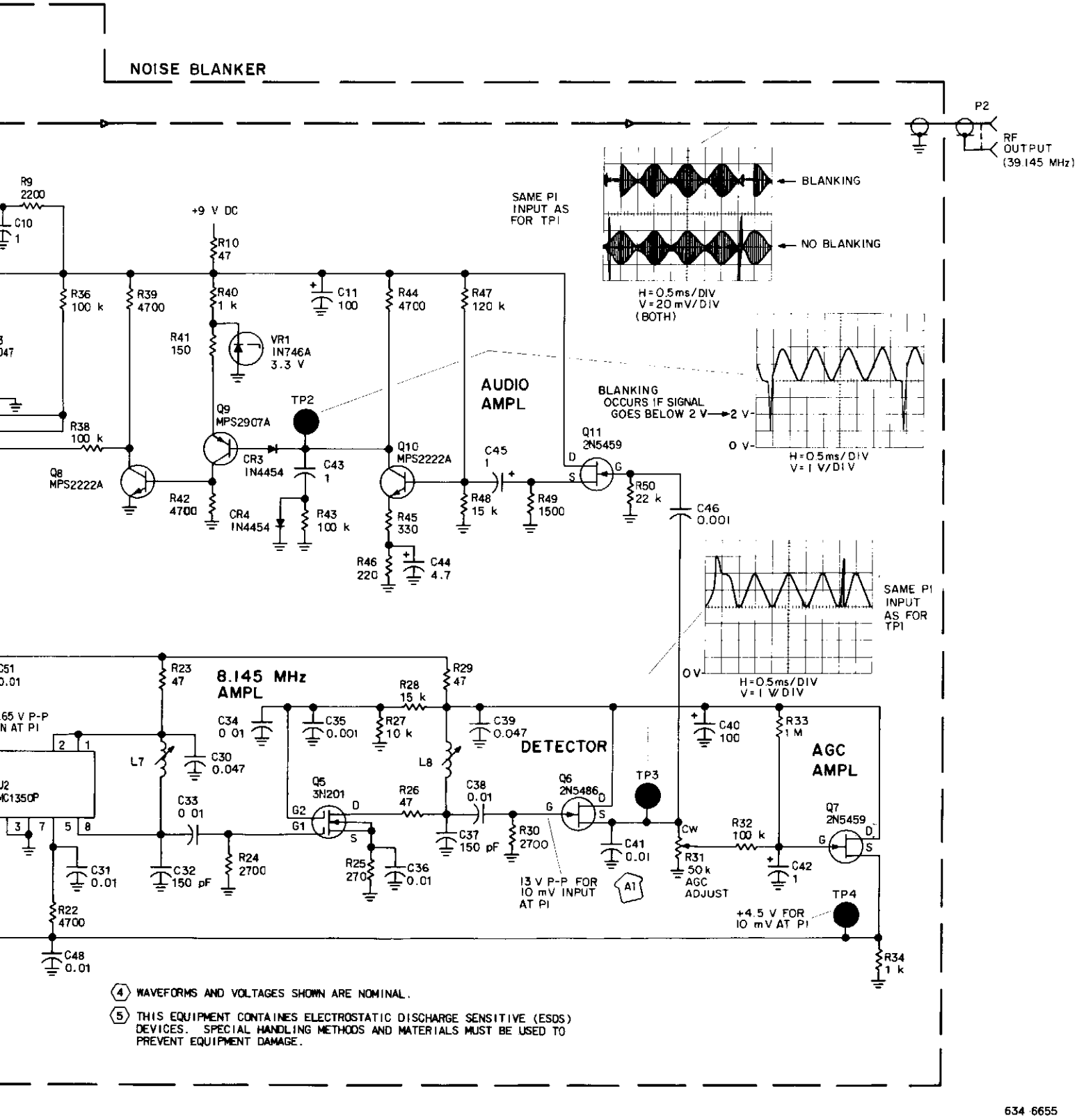


NOTES:

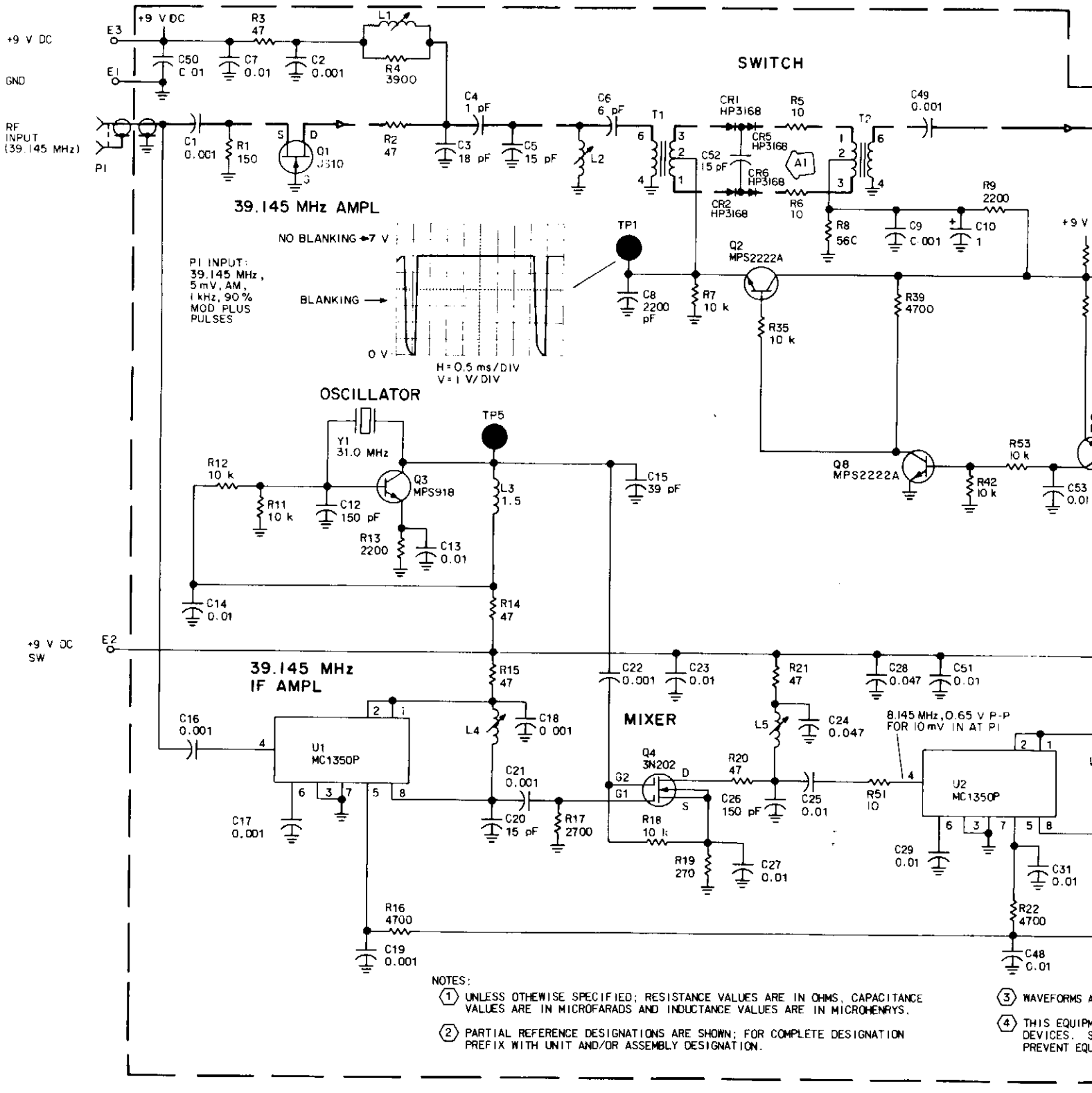
(1) UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICORHENRYS.

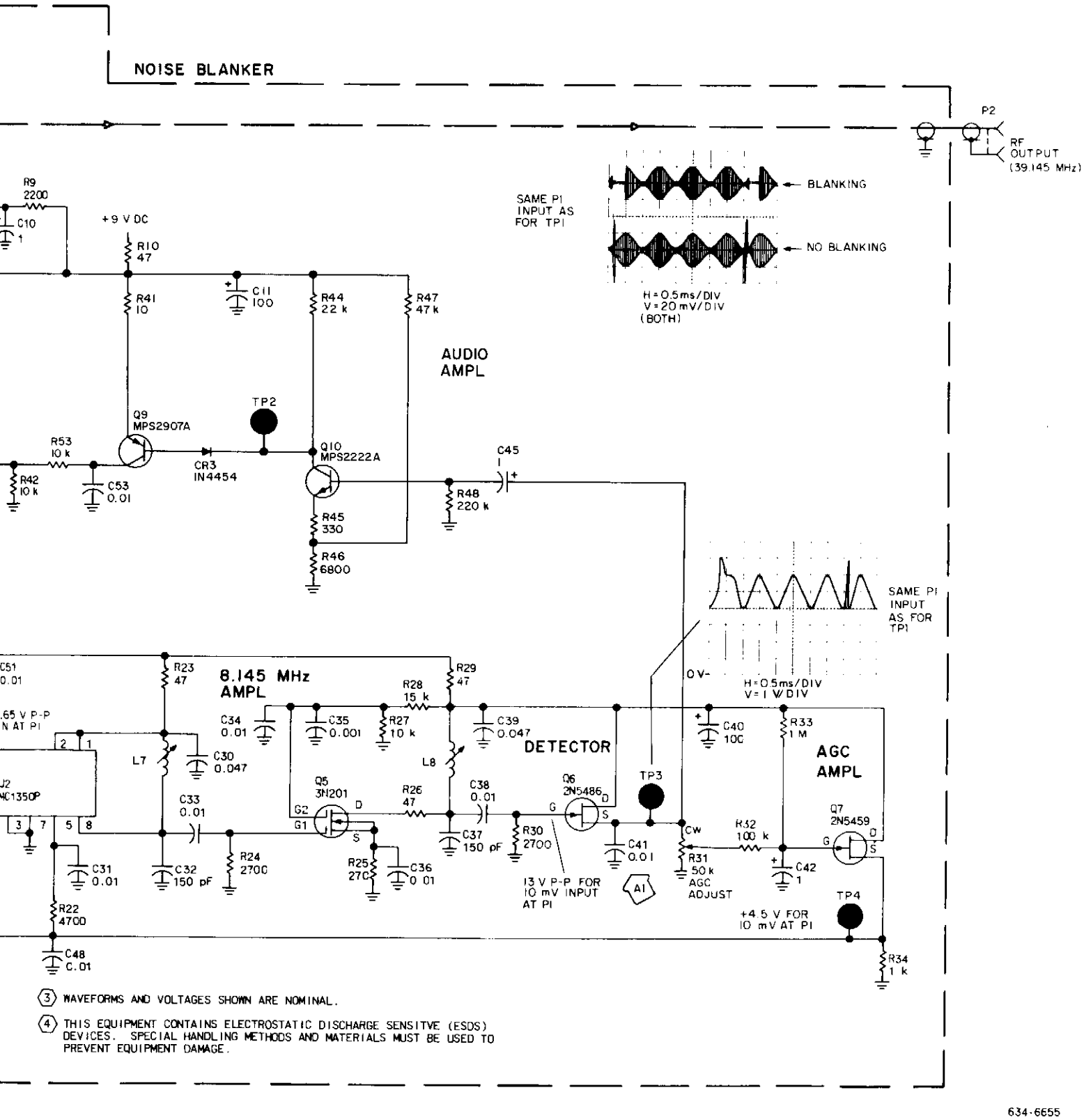
(2) PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

(3) ON U3, PIN 14 IS +9 V DC AND PIN 7 IS GROUND.



Noise Blanker (638-6800-001), Schematic Diagram
Figure 4


+9 V DC
GND
RF INPUT (39.145 MHz)
P1
E3
E1
E2
+9 V DC SW
C50 C 01
C7 0.01
C2 0.001
R3 47
L1
R4 3900
C1 0.001
R1 150
Q1 J310
R2 47
C4 1 pF
C3 18 pF
C5 15 pF
C6 6 pF
L2
T1
SWITCH
CR1 HP3168
CR5 HP3168
CR6 HP3168
CR2 HP3168
C52 15 pF
R5 10
R6 10
A1
T2
C49 0.001
R9 2200
R8 56C
C9 C 001
C10 1
39.145 MHz AMPL
NO BLANKING → 7 V
BLANKING →
0 V
H = 0.5 ms/DIV
V = 1 V/DIV
P1 INPUT: 39.145 MHz, 5 mV, AM, 1 kHz, 90% MOD PLUS PULSES
TP1
C8 2200 pF
R7 10 k
Q2 MPS2222A
R35 10 k
R39 4700
OSCILLATOR
TP5
Y1 31.0 MHz
R12 10 k
R11 10 k
C12 150 pF
Q3 MPS918
R13 2200
C13 0.01
L3 1.5
C15 39 pF
C14 0.01
R14 47
Q8 MPS2222A
R53 10 k
R42 10 k
C53 0.01
39.145 MHz IF AMPL
R15 47
C16 0.001
U1 MC1350P
L4
C18 0 001
C17 0.001
C21 0.001
C20 15 pF
R17 2700
MIXER
C22 0.001
C23 0.01
R21 47
L5
C24 0.047
C28 0.047
C51 0.01
Q4 3N202
R20 47
C26 150 pF
C25 0.01
R18 10 k
R19 270
C27 0.01
R51 10
8.145 MHz, 0.65 V P-P FOR 10 mV IN AT P1
U2 MC1350P
C29 0.01
C31 0.01
R22 4700
C48 0.01
R16 4700
C19 0.001
NOTES:
1 UNLESS OTHEWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.
2 PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
3 WAVEFORMS A
4 THIS EQUIPM DEVICES. S PREVENT EQU



Noise Blanker (638-6800-002), Schematic Diagram
Figure 5

Speech Processor (638-6933-001)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

523-0771747-001211
1 August 1982

1. DESCRIPTION

Speech Processor 638-6933-001, figure 1, consists of a circuit card and three pendant cables. The circuit design, for which a patent is pending, is proprietary. All processing is done at audio frequencies and is smooth and continuous across the entire 300- to 3000-Hz spectrum. The speech processor is connected into the receiver-exciter circuit between the microphone amplifier and the microphone gain control.

The speech processor is essentially a preemphasis circuit followed by a variable gain stage. The variable gain stage is controlled by an AGC circuit that operates on the speech modulation envelope. The speech modulation envelope is compared with a processing level threshold. When the envelope peaks exceed the processing threshold, the gain of the variable gain stage is decreased. Holding the speech peaks to the processing threshold decreases the peak-to-average signal level ratio. Since only low-frequency speech modulation envelope level is controlled and not the speech carrier frequencies (300 to 3000 Hz), no clipping occurs.

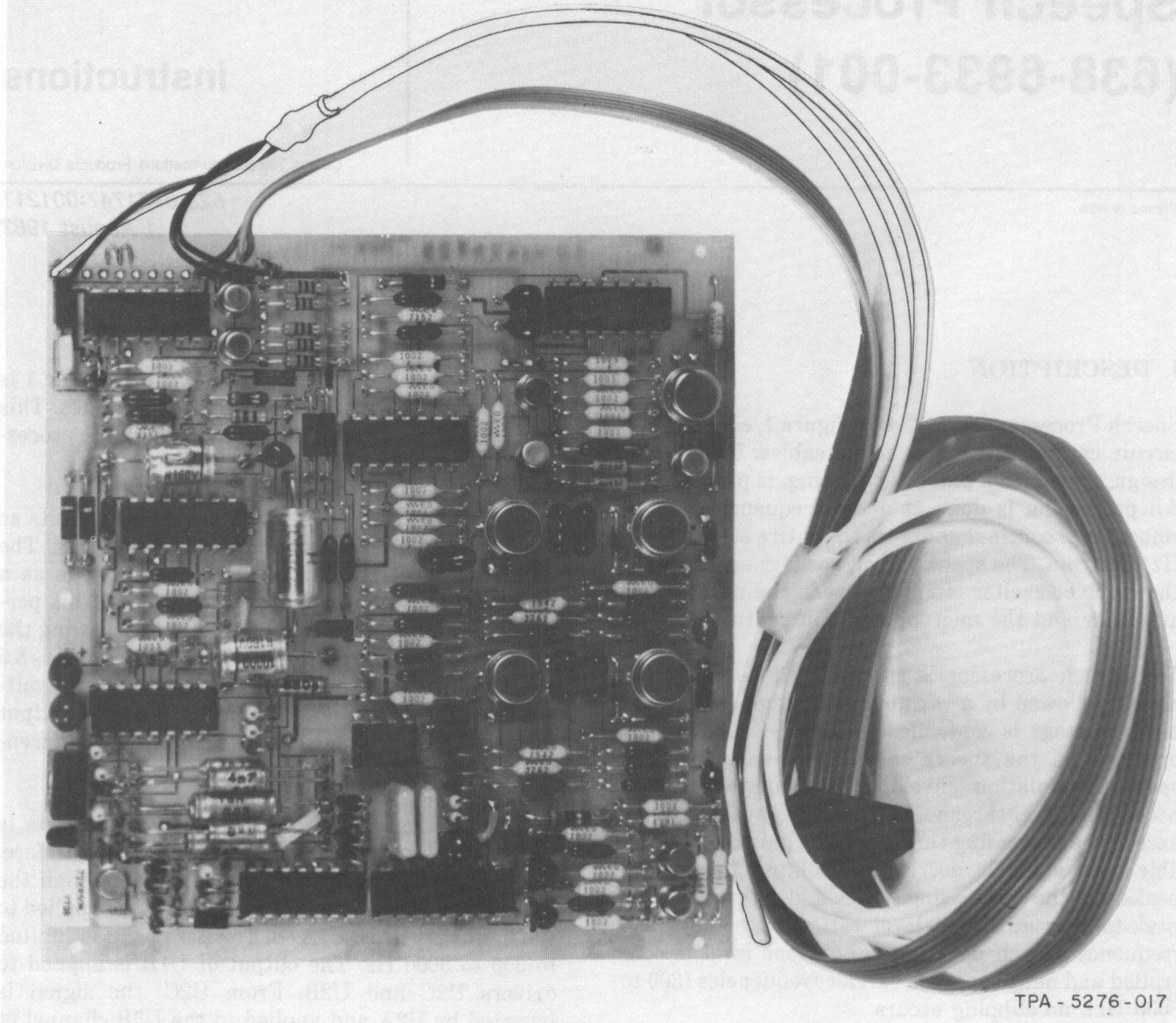
2. PRINCIPLES OF OPERATION (Refer to block diagram, figure 2, and schematic, figure 4)

With a logic 0 on the CONT input line (J1-1), Q1 and Q2 are off. This places a logic 1 on the control input (pin 6) of U12C to close the switch, and logic 0 on the control inputs of U12A and B to open them. The closed switch conducts the audio signal from the input directly to the output to bypass the speech processor. A logic 1 on the CONT input line turns on Q1 which turns on Q2. With Q1 on, a logic 0 is applied to U12C to open the switch. With Q2 on, a logic 1 is applied to U12A and B to close these switches. This condition routes the audio signal through the processor.

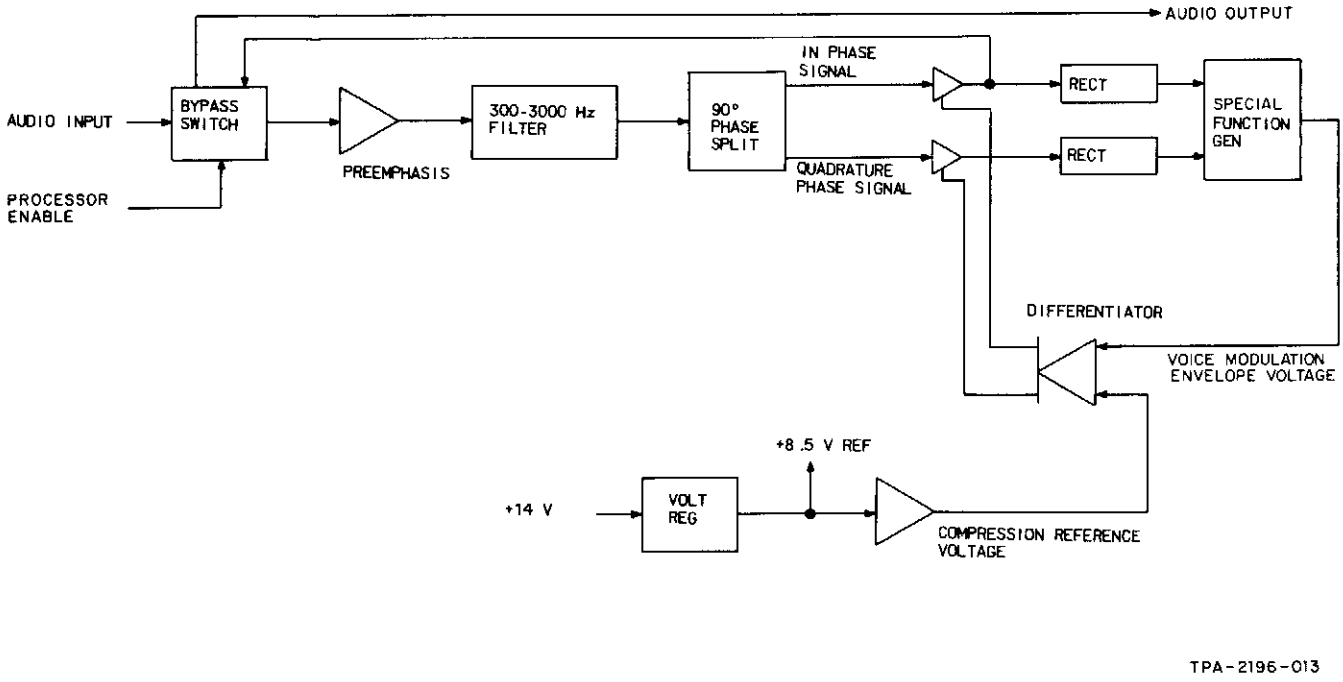
The +14-V input is applied to the various circuits as the V_{cc} voltage and to voltage regulator U11. The regulator develops a +8.5-V reference voltage as a zero reference for the circuit amplifiers. (This permits the single-ended supply amplifiers to swing the signal positive and negative with respect to the +8.5 V.) Amplifier U9C develops another reference voltage from the 8.5-V regulator output. The U9C output is the reference voltage for the compression differentiator, Q6/Q7.

The audio signal input to the processor circuits is first applied to preemphasis amplifier U1D. Here, the higher frequencies are amplified more than the lower frequencies. From U1D, the signal is applied to the bandpass filter U1A/B. The pass band is limited to 300 to 3000 Hz. The output of U1B is applied to drivers U2C and U2B. From U2C, the signal is inverted by U2A and applied to the U3B channel of the phase-shifter network. From U2B, the signal is applied directly to the U3C channel of the phase-shifter network. The U3B channel is called the in-phase (I) channel. The U3C channel is the quadrature-phase (Q) channel. The signals are 90 degrees apart with respect to each other.

Outputs from the phase shifters are applied to gain-controlled amplifiers U4A (I-channel) and U4D (Q-channel). The amplifier outputs are further amplified by U4B/Q8 and U4C/Q9 and applied to precision full-wave rectifier circuits U5/U6 and U7/U8.



Speech Processor
Figure 1



Speech Processor, Block Diagram
Figure 2

The output of each full-wave rectifier is applied to a special function circuit which mathematically squares the input voltage. (This is simply a frequency doubler with an output signal at twice the frequency of the input signal and a peak-value of the input level mathematically squared. The output signal is referenced to zero and always positive.) The signals which entered their respective squaring circuits 90 degrees apart are 180 degrees apart after being squared. The instantaneous amplitude of each of these signals is added together. The resultant is a dc voltage which is proportional to the peak voltage squared (Vp^2). The special function circuit next takes the square root of the voltage value to convert the Vp^2 voltage to Vp.

The special function generator output is applied to Q7 in differentiator Q6/Q7. When the voltage at Q7 exceeds that set by U9C and applied to Q6, the outputs from Q4 and Q5 decrease by a proportional amount. Since these outputs are the AGC voltage for amplifiers U4A and U4D, the audio signal peak amplitude is held to the level predetermined by the differentiator. By holding the peaks to a predetermined level, a higher-level audio signal can be input to the processor to raise the level of the valleys. This produces a higher average signal level to increase the "talk power" in the transmitter rf output signal.

3. TESTING/TROUBLESHOOTING PROCEDURES

A performance test for the speech processor is given in table 2. In addition to the required performance criteria, troubleshooting comments are given.

It is assumed that the repair technician is trained in solid-state circuit troubleshooting and repair techniques, and is familiar with the test equipment to be used. Step-by-step operating procedures are not given in the tests and not all possible troubleshooting information can be listed.

The tests in table 2 must be performed in sequence.

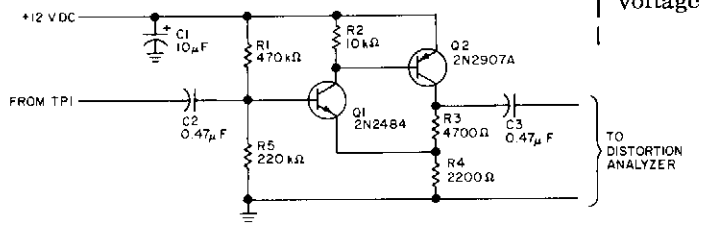
Testing and troubleshooting of the speech processor requires the speech processor be installed in the transceiver.

3.1 Test Equipment Required

Table 1 lists the equipment required to perform the tests. A suggested type is given; however, that specific equipment is not required. Any that meets or exceeds the indicated minimum specifications is acceptable for use.

Table 1. Test Equipment Required.

ITEM	USED FOR	SUGGESTED TYPE	MINIMUM SPECIFICATIONS
Oscilloscope	Observing waveforms and measuring voltages near processing threshold level	Tektronix 455	0.1 V/div vertical 0.5 ms/div horizontal
Audio voltmeter	Measuring input signal levels and test point voltages	Voltmeter portion of distortion analyzer	0 to 5 mV rms, also calibrated to measure 0 to 20 dB
Distortion analyzer	Measuring harmonic distortion	Hewlett-Packard 333A	0 to 5% distortion
Audio oscillator	Input signal to speech	Hewlett-Packard 200 AB (Use additional 600-Ω attenuator, if necessary, for lower signal levels.)	300, 1000, 3000 Hz at 0 to 700 mV p-p
Microphone	Voice input to transceiver for R31/R94 adjustment	MM-280, MM-281, or SM-280	Dynamic, low impedance
Rf load	Terminating rf output signal	Bird 8135	150 W, 14 to 15 MHz, 50 Ω
Buffer amplifier	Amplifying output to distortion analyzer	Locally fabricated per following schematic	High-impedance input, distortion of less than 0.1%, voltage gain approximately 3



3.2 Performance Test

The following test procedures measure the performance of the speech processor. After being repaired, repeat the numbered test where repair was performed to verify that no further malfunctions exist.

3.2.1 Preliminary Setup

Do not apply power to the equipment until instructed to do so in the procedures. Do not connect power with power switches turned on.

Connect the equipment as instructed in the procedures for each test.

3.2.2 Test Procedures

Perform the tests as given in table 2.

4. REPAIR

Repair of the speech processor is accomplished using standard maintenance and circuit card repair procedures.

Table 2. Speech Processor Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	a. Disconnect P26/P28 and J26/J28 from receiver-exciter and front panel.		
	b. Connect audio oscillator to P26 (input) and P28 (ground).		
	c. Connect scope to J26 (output) and J28 (ground).		
	d. Turn on transceiver power.		
	e. Do not key transmitter during this test.		
2. Processor enable/bypass	a. Adjust audio oscillator for 1000-Hz, 50 mV p-p output.		
	b. Switch out PROC.		
	c. Measure and record output signal level.	49 to 51 mV p-p	Check Q1, Q2, and U12.
	d. Switch in PROC. Adjust R31 for maximum signal output.		
	e. Measure and record output signal level.	225 to 275 mV p-p	Check U1A, B, D; U2A, C; U3B; U4A, B; and Q8.
	f. Connect scope to TP1.		
	g. Adjust audio oscillator output level to 0.5 mV rms.		
	h. Adjust R94 for maximum output at TP1.		
3. Compression threshold and harmonic distortion	a. With scope channel 1 connected to TP1, connect channel 2 to TP4. Set scope V/DIV to 0.1 and adjust channel 2 trace to top of scope.		
	b. Increase audio oscillator output level until downward shift in dc level in channel 2 trace is just noticed. (This is processing threshold.)		
	c. Measure and record signal level at TP1 in mV p-p.	490 to 610 mV p-p	Check for identical signal levels at U6-6 and U8-6. If levels unusual, check U5/U6 or U7/U8 circuit not having same peak signal level as input at TP1 or TP2.
(Cont)			

Table 2. Speech Processor Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)			If levels equal, measure dc voltage at TP3. Voltage should begin increasing as soon as U6-6 or U8-6 output begins increasing. If not, check U9, U10. If U9, U10 circuit operating properly, measure voltages at TP3 and TP4 or TP5. When voltage at TP3 exceeds output voltage at U9-8 (approximately 9.58 V), voltage at TP4 or TP5 begins decreasing linearly with increases in voltage at TP3. If not, check Q3, Q4, Q6, and Q7.
	d. Increase audio oscillator output level 20 dB above processing threshold recorded above. Record the output level at TP1 in mV p-p.	Not more than 1.2 times level recorded in previous step	Check U4A, D.
	e. Connect distortion analyzer input to locally-fabricated buffer amplifier output. Connect buffer amplifier input TP1.		
	f. Set analyzer reference level, then measure distortion of signal at TP1.	Not more than 3%	
	g. Repeat test for 300- and 3000-Hz output from audio oscillator.	Not more than 3%	Check U5/U6 or U7/U8 channels U9 and U10.
4. Frequency response	a. Adjust audio oscillator output for 300 Hz at 0.5 mV rms.		
	b. Observe scope trace of TP4 and adjust audio oscillator output level until processing threshold just occurs.		
	c. Measure and record audio oscillator output signal level.	2.1 to 2.5 mV rms	
	d. Repeat test for 1000- and 3000-Hz outputs from audio oscillator.	1.02 to 1.3 mV rms for 1000 Hz 0.97 to 1.2 mV rms for 3000 Hz	

Table 2. Speech Processor Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. Peak indicator threshold	a. Adjust audio oscillator for 1000 Hz. b. Connect scope to TP4 and increase audio oscillator output level until threshold level signal just appears at TP4. c. Measure and record output level (in dB). d. Increase output level until LED CR5 just lights. e. Measure and record output level (in dB). f. Subtract first output level from second to get difference in levels (in dB).	13 to 17 dB	
6. R31 and R94 adjustment	a. Disconnect scope and audio oscillator and reconnect P26, P28, J26, and J28 to transceiver. b. Connect dummy load to transceiver rf connector. Connect microphone to MIC jack. Set MIC/CARRIER to max ccw position. c. Tune transceiver to 14.2 MHz. d. Set MODE to USB and METER to ALC. e. Switch out PROC and switch in MOX. f. Speak into microphone in usual operating voice level while adjusting MIC/CARRIER for indication of S7 to S9 on meter. g. Switch in PROC. h. While speaking in same voice level, adjust R94 until LED peak indicator just flashes on voice peaks. i. Continue speaking and adjust R31 to obtain an indication of S1 to S3 on meter. *Note* Circuit is now adjusted for 10 dB of voice processing. j. Switch out MOX. Turn off transceiver and replace assembly.		

5. PARTS LIST/DIAGRAMS

5.1 Introduction

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subasembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75265
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04404	HEWLETT-PACKARD CO AUTOMATIC MEASUREMENT DIV 974 E ARQUES AVE SUNNYVALE CA 94086
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV SUB OF SCHLUMBERGER LTD NORTH AMERICAN SALES MAIL STOP 14-1053 401 ELLIS ST P O DRAWER 7284 MOUNTAIN VIEW CA 94042
09021	AIRCO INC AIRCO ELECTRONICS BRADFORD PA
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
15818	TELEDYNE INC TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
18796	ERIE TECHNOLOGICAL PRODUCTS INC STATE COLLEGE DIV 1900 W COLLEGE AVE STATE COLLEGE PA 16801

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
19080	ROBISON ELECTRONICS INC 3580 SACRAMENTO DR P O BOX Y SAN LUIS OBISPO CA 93406
25088	SIEMENS CORP 186 WOOD AVE S ISELIN NJ 08830
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
49956	RAYTHEON CO EXECUTIVE OFFICES 141 SPRING ST LEXINGTON MA 02173
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
72982	ERIE TECHNOLOGICAL PRODUCTS INC 645 W 11TH ST ERIE PA 16512
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV 2500 HARBOR BLVD FULLERTON CA 92634
79807	WROUGHT WASHER MFG INC 2100 S BAY ST MILWAUKEE WI 53207
80205	NATIONAL AEROSPACE STANDARD
81349	MILITARY SPECIFICATIONS
96906	MILITARY STANDARD

5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Speech Processor	638-6933-001	REV G

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	SPEECH PROCESSOR	638-6933-001			
CR1-CR4	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR5	DIODE,LIGHT EMI	353-0232-040		04404	5082-4484
C1	CAPACITOR,FXD CER DIEL, 0.47UF, 20%, 50V	913-3279-250		16546	CY30C474M
C2	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100C0G332K
C3	CAPACITOR,FXD CER DIEL, 1500PF, PORM10%, 100V	913-3281-140		18796	8131-100C0G152K
C4	CAPACITOR,FXD PLSTC ,20000PF, 2.5%, 160V	933-1408-740		25088	B33062-B1203-H
C5	CAPACITOR,FXD PLSTC DIEL, 10000PF, 2.5%, 160V	933-1408-470		25088	B33062-1000H160V
C6	CAPACITOR,FXD ELCTLT, 6.8UF, 20%, 25V	184-9102-230		56289	199D685X0025CB1
C7	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1
C8	CAPACITOR,FXD PLSTC 3.300PF, 20%, 25V	933-1455-040		56289	704C1AC332PF630A X
C9	CAPACITOR,FXD PLSTC 82PF, 20%, 25V	933-1455-020		56289	704C1AB821PF251A X
C10	CAPACITOR,FXD PLSTC 18.000PF, 20%, 25V	933-1455-070		56289	704C1FG183PF630A X
C11	CAPACITOR,FXD PLSTC 4.700PF, 20%, 25V	933-1455-050		56289	704C1AC472PF630A X
C12	CAPACITOR,FXD PLSTC 8.200PF, 20%, 25V	933-1455-060		56289	704C1FD822PF630A X
C13	CAPACITOR,FXD PLSTC 1.800PF, 20%, 25V	933-1455-030		56289	704C1AB182PF161A X
C14,C15	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C16,C17	CAPACITOR,FXD CER DIEL, 4.7UF, 20%, 50V	913-3279-320		16546	CY50C475M
C18-C21	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C22	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-3837-000		81349	CM04CD100D03
C23	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-001			912-2828-001
C24	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-3837-000		81349	CM04CD100D03
C25	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-001			912-2828-001
C26	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-3837-000		81349	CM04CD100D03
C27	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-001			912-2828-001
C28	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-3837-000		81349	CM04CD100D03
C29	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-001			912-2828-001
C30	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C31	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C32	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C33	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C34	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C35	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-3837-000		81349	CM04CD100D03
C36	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C37	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D8050
C38	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-3879-000		81349	CM04FD101J03
C39	CAPACITOR,FXD TNTLM ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1
C40	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V (A3)	184-9102-350		56289	199D105X0035BB1
C41	CAPACITOR,FXD CER DIEL, 5600PF, 10%, 100V (A3)	913-5020-390		81349	CK13BX562K
C42	CAPACITOR,FXD CER DIEL, 180PF, 5%, 100V	913-1098-510		72982	8121M101C0G0-181 J
C43	CAPACITOR,FXD CER DIEL, 0.22UF, 20%, 50V	913-3279-220		16546	CY30C224M
C44	NOT USED				
C45	CAPACITOR,FXD CER DIEL, 330PF, 1%, 100V	913-3281-550		18796	8121-100C0G0331F
C46	CAPACITOR,FXD PLSTC DIEL, 10000PF, 2.5%, 160V	933-1408-470		25088	B33062-1000H160V
C47	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V (A3)	913-3331-030		56289	292CY5U104D8050
C48	NOT USED				
C49	CAPACITOR,FXD CER DIEL, 0.1UF, PORM10%, 100V	913-5019-440		81349	CK06BX104K
C50	CAPACITOR,FXD CER DIEL, 4700PF, PORM10%, 100V	913-5019-160		81349	CK05BX472K
C51	CAPACITOR,FXD CER DIEL, 0.47UF, 20%, 50V	913-3279-250		16546	CY30C474M
C52	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
C53	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
C54	CAPACITOR,FXD TNTLM ELCTLT, 33UF, 20%, 10V (A2)	184-9102-090		56289	199D336X0010DB1
H1	NUT,PLAIN,HEX SST, 2-56 (QTY 3)	313-0037-000		96906	MS35649-224
H2	WASHER,FLAT PSVT CRES, 0.089 ID X 0.149 OD (QTY 9)	310-0740-080		80205	NAS620C2
H3	WASHER,LOCK SST, 0.097 ID X 0.165 OD (QTY 3)	310-0070-000		79807	310-0070-000
H4	WASHER (QTY 1)	546-3038-003			546-3038-003
H5	SCREW,MACH SST, 2-56 X 7/16 (QTY 3)	343-0127-000		96906	MS51957-6
H6	PIN,SPRING SST, 0.078 DIA X 1/4 (QTY 1)	311-0355-000		96906	MS16562-199
Q1	TRANSISTOR	352-0661-020		07263	2N2222A
Q2,Q3	TRANSISTOR	352-0551-010		15818	2N2907A
Q4	TRANSISTOR	352-0798-110		04713	2N3810
Q5	NOT USED				
Q6,Q7	TRANSISTOR	352-0549-000		07263	2N2484
Q8-Q10	TRANSISTOR	352-0661-020		07263	2N2222A
MP1	PLATE,SHIELD	647-2822-001			
MP2	POST	541-5949-002			541-5949-002
MP3	INSULATOR,COMP	150-0792-100		19080	RCCS250437-2C
MP4	INSULATOR,COMP	150-0792-110		19080	RCCS250437-3C
MP5	INSULATOR,COMP	150-0792-120		19080	RCCS250437-4C
MP6	HANDLE	789-2348-001			789-2348-001
MP7	CABLE,COAX	641-7123-009			
MP8	CABLE,COAX	641-7171-001			
MP9	LABEL,PRESS SENS (ESDS)	280-2745-040		12998	280-2745-040
MP10	CONNECTOR,HDR (QTY 12)	372-2656-130		52072	CAS01SP100-230-4 30
R1,R2	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F

PARTS LIST (C

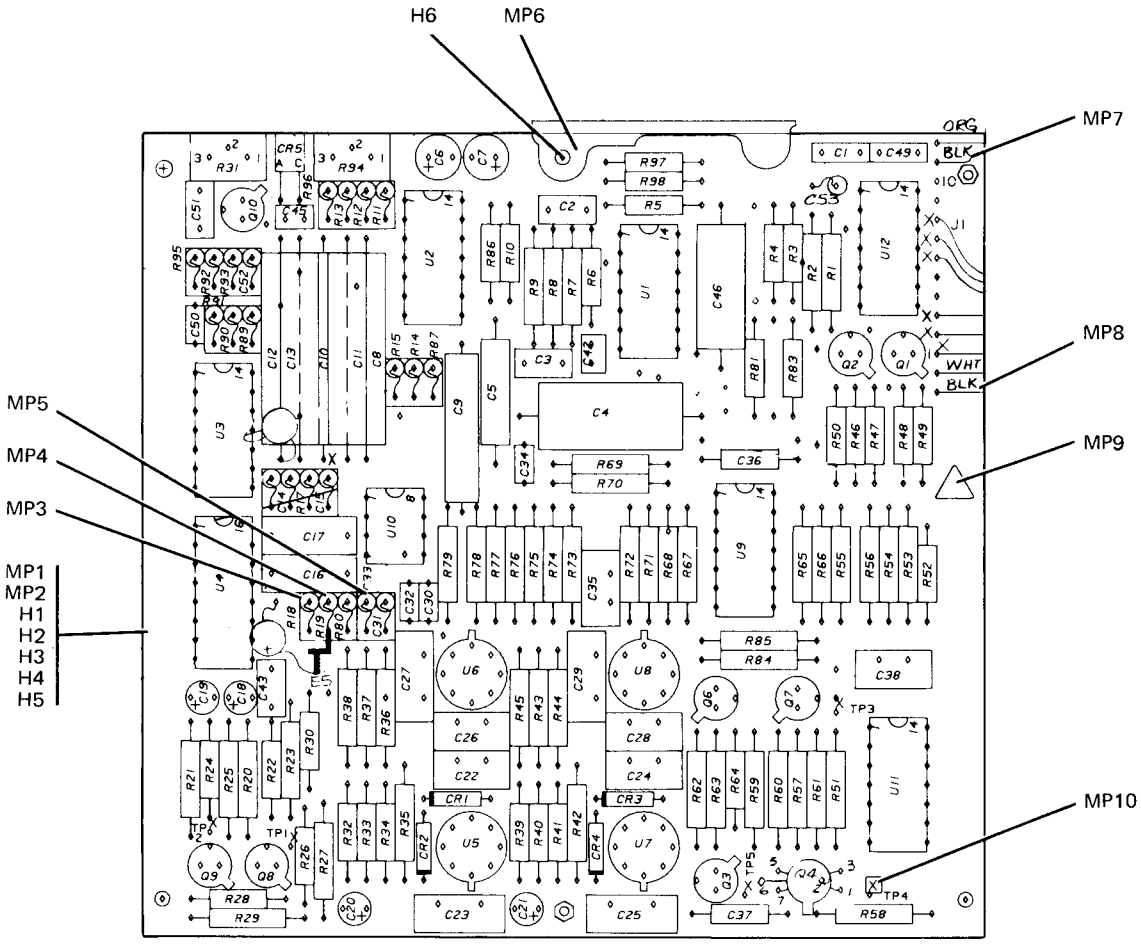
REF DES	DESCRIPTION
R3,R4	RESISTOR,FXD FILM, 49.9K, 1%, 1/8W (A2)
R3	RESISTOR,FXD FILM, 49.9K, 1%, 1/8W
R4	RESISTOR,FXD FILM, 150K, 1%, 1/8W
R5,R6	RESISTOR,FXD FILM, 24.3K, 1%, 1/8W
R7	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R8	RESISTOR,FXD FILM, 68.1K, 1%, 1/8W
R9	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R10	RESISTOR,FXD FILM, 100K, 1%, 1/8W
R11	RESISTOR,FXD FILM, 1K, 1%, 1/8W
R12	RESISTOR,FXD FILM, 100K, 1%, 1/8W
R13	RESISTOR,FXD FILM, 17.8K, 1%, 1/8W
R14	RESISTOR,FXD FILM, 100K, 1%, 1/8W
R15	RESISTOR,FXD FILM, 17.8K, 1%, 1/8W
R16,R17	RESISTOR,FXD FILM, 40.2K, 1%, 1/8W
R18,R19	RESISTOR,FXD FILM, 100K, 1%, 1/8W
R20,R21	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R22	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W
R23	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R24	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W
R25	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R26	RESISTOR,FXD FILM, 4.99K, 1%, 1/8W
R27	RESISTOR,FXD FILM, 1K, 1%, 1/8W
R28	RESISTOR,FXD FILM, 4.99K, 1%, 1/8W
R29	RESISTOR,FXD FILM, 1K, 1%, 1/8W
R30	RESISTOR,FXD FILM, 68K,5%,1/4W
R31	RESISTOR,VAR 50K, 20%, 1/2W
R32-R34	RESISTOR,FXD FILM, 20K, 1%, 1/8W
R35	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R36	RESISTOR,FXD FILM, 15.4K, 1%, 1/8W
R37	RESISTOR,FXD FILM, 22.6K, 1%, 1/8W
R38	RESISTOR,FXD FILM, 6.19K, 1%, 1/8W
R39-R41	RESISTOR,FXD FILM, 20K, 1%, 1/8W
R42	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R43	RESISTOR,FXD FILM, 22.6K, 1%, 1/8W
R44	RESISTOR,FXD FILM, 15.4K, 1%, 1/8W
R45	RESISTOR,FXD FILM, 6.19K, 1%, 1/8W
R46-R50	RESISTOR,FXD FILM, 10K, 5%, 1/4W
R51	RESISTOR,FXD FILM, 1K, 1%, 1/8W (A1)
R51	RESISTOR,FXD FILM, 100K, 1%, 1/8W
R52	RESISTOR,FXD FILM, 10 OHMS, 5%, 1/4W
R53	RESISTOR,FXD FILM, 13K, 1%, 1/8W
R54	RESISTOR,FXD FILM, 71.5K, 1%, 1/8W
R55	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R56	RESISTOR,FXD FILM, 1.27K, 1%, 1/8W (A2)
R56	RESISTOR,FXD FILM, 2.67K, 1%, 1/8W
R57-R60	RESISTOR,FXD FILM, 1K, 1%, 1/8W
R61	RESISTOR,FXD FILM, 1K, 1%, 1/8W
R62,R63	RESISTOR,FXD FILM, 49.9 OHMS, 1%, 1/8W
R64	RESISTOR,FXD FILM, 18.2K, 1%, 1/8W (A3)
R64	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W
R65-R68	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R69,R70	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W
R71,R72	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R73	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W
R74	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R77,R78	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W
R79	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R80	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W
R81	RESISTOR,FXD FILM, 3.32K, 1%, 1/8W
R82	RESISTOR,FXD FILM, 820 OHMS, 5%, 1/4W (A3)
R83	RESISTOR,FXD FILM, 8.2K, 5%, 1/4W
R84,R85	RESISTOR,FXD FILM, 10K, 1%, 1/8W
R86	RESISTOR,FXD FILM, 18K, 5%, 1/4W
R87	RESISTOR,FXD FILM, 1K, 1%, 1/8W
R88	RESISTOR,FXD CMPSN, 82 OHMS, 5%, 1/2W (A2)
R89	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W
R90	RESISTOR,FXD FILM, 301K, 1%, 1/8W (A4)
R90	RESISTOR,FXD FILM, 221K, 1%, 1/8W
R91	RESISTOR,FXD FILM, 10K, 5%, 1/4W
R92	RESISTOR,FXD FILM, 61.9K, 1%, 1/8W
R93	RESISTOR,FXD FILM, 301K, 1%, 1/8W
R94	RESISTOR,VAR 10K, 20%, 1/2W
R95	RESISTOR,FXD FILM, 20K, 1%, 1/8W
R96	RESISTOR,FXD FILM, 1K, 1%, 1/8W
R97,R98	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W
U1-U3	INTEGRATED CIRCUIT
U4	
U5-U8	INTEGRATED CIRCUIT
U9	INTEGRATED CIRCUIT
U10	
U11	INTEGRATED CIRCUIT
U12	INTEGRATED CIRCUIT

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
R3,R4	RESISTOR,FXD FILM, 49.9K, 1%, 1/8W (A2)	705-3605-810		81349	RN55D4992F
R3	RESISTOR,FXD FILM, 49.9K, 1%, 1/8W	705-3605-810		81349	RN55D4992F
R4	RESISTOR,FXD FILM, 150K, 1%, 1/8W	705-3604-090		81349	RN55D1503F
R5,R6	RESISTOR,FXD FILM, 24.3K, 1%, 1/8W	705-3605-660		81349	RN55D2432F
R7	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R8	RESISTOR,FXD FILM, 68.1K, 1%, 1/8W	705-1084-000		81349	RN55D6812F
R9	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R10	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R11	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R12	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R13	RESISTOR,FXD FILM, 17.8K, 1%, 1/8W	705-1056-000		81349	RN55D1782F
R14	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R15	RESISTOR,FXD FILM, 17.8K, 1%, 1/8W	705-1056-000		81349	RN55D1782F
R16,R17	RESISTOR,FXD FILM, 40.2K, 1%, 1/8W	705-1073-000		81349	RN55D4022F
R18,R19	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R20,R21	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R22	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W	705-3605-800		81349	RN55D4752F
R23	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R24	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W	705-3605-800		81349	RN55D4752F
R25	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R26	RESISTOR,FXD FILM, 4.99K, 1%, 1/8W	705-3605-330		81349	RN55D4991F
R27	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R28	RESISTOR,FXD FILM, 4.99K, 1%, 1/8W	705-3605-330		81349	RN55D4991F
R29	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R30	RESISTOR,FXD FILM, 68K,5%,1/4W	745-0911-100		09021	CF1-4-68K5PCT
R31	RESISTOR,VAR 50K, 20%, 1/2W	382-0038-380		73138	72XR50K
R32-R34	RESISTOR,FXD FILM, 20K, 1%, 1/8W	705-3605-620		81349	RN55D2002F
R35	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R36	RESISTOR,FXD FILM, 15.4K, 1%, 1/8W	705-1053-000		81349	RN55D1542F
R37	RESISTOR,FXD FILM, 22.6K, 1%, 1/8W	705-1061-000		81349	RN55D2262F
R38	RESISTOR,FXD FILM, 6.19K, 1%, 1/8W	705-1034-000		81349	RN55D6191F
R39-R41	RESISTOR,FXD FILM, 20K, 1%, 1/8W	705-3605-620		81349	RN55D2002F
R42	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R43	RESISTOR,FXD FILM, 22.6K, 1%, 1/8W	705-1061-000		81349	RN55D2262F
R44	RESISTOR,FXD FILM, 15.4K, 1%, 1/8W	705-1053-000		81349	RN55D1542F
R45	RESISTOR,FXD FILM, 6.19K, 1%, 1/8W	705-1034-000		81349	RN55D6191F
R46-R50	RESISTOR,FXD FILM, 10K, 5%, 1/4W	745-0910-890		09021	CF1-4-1002J
R51	RESISTOR,FXD FILM, 1K, 1%, 1/8W (A1)	705-0996-000		81349	RN55D1001F
R51	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R52	RESISTOR,FXD FILM, 10 OHMS, 5%, 1/4W	745-0910-170		09021	CF1-4-10R0J
R53	RESISTOR,FXD FILM, 13K, 1%, 1/8W	705-3605-530		81349	RN55D1302F
R54	RESISTOR,FXD FILM, 71.5K, 1%, 1/8W	705-1085-000		81349	RN55D7152F
R55	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R56	RESISTOR,FXD FILM, 1.27K, 1%, 1/8W (A2)	705-1001-000		81349	RN55D1271F
R56	RESISTOR,FXD FILM, 2.67K, 1%, 1/8W	705-3605-200		81349	RN55D2671F
R57-R60	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R61	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R62,R63	RESISTOR,FXD FILM, 49.9 OHMS, 1%, 1/8W	705-3600-340		81349	RN55D49R9F
R64	RESISTOR,FXD FILM, 18.2K, 1%, 1/8W (A3)	705-3605-600		81349	RN55D1822F
R64	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W	705-3605-800		81349	RN55D4752F
R65-R68	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R69,R70	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W	705-1025-000		81349	RN55D4021F
R71,R72	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R73	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W	705-1025-000		81349	RN55D4021F
R74	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R77,R78	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W	705-1025-000		81349	RN55D4021F
R79	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R80	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W	705-1025-000		81349	RN55D4021F
R81	RESISTOR,FXD FILM, 3.32K, 1%, 1/8W	705-1021-000		81349	RN55D3321F
R82	RESISTOR,FXD FILM, 820 OHMS, 5%, 1/4W (A3)	745-0910-630		09021	CF1-4-820RJ
R83	RESISTOR,FXD FILM, 8.2K, 5%, 1/4W	745-0910-870		09021	CF1-4-8201J
R84,R85	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN55D1002F
R86	RESISTOR,FXD FILM, 18K, 5%, 1/4W	745-0910-950		09021	CF1-4-1802J
R87	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R88	RESISTOR,FXD CMPSN, 82 OHMS, 5%, 1/2W (A2)	745-1040-000		81349	RC20BF820J
R89	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W	705-1067-000		81349	RN55D3012F
R90	RESISTOR,FXD FILM, 301K, 1%, 1/8W (A4)	705-1115-000		81349	RN55D3013F
R90	RESISTOR,FXD FILM, 221K, 1%, 1/8W	705-3604-170		81349	RN55D2213F
R91	RESISTOR,FXD FILM, 10K, 5%, 1/4W	745-0910-890		09021	CF1-4-1002J
R92	RESISTOR,FXD FILM, 61.9K, 1%, 1/8W	705-1082-000		81349	RN55D6192F
R93	RESISTOR,FXD FILM, 301K, 1%, 1/8W	705-1115-000		81349	RN55D3013F
R94	RESISTOR,VAR 10K, 20%, 1/2W	382-0038-360		73138	72XR10K
R95	RESISTOR,FXD FILM, 20K, 1%, 1/8W	705-3605-620		81349	RN55D2002F
R96	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN55D1001F
R97,R98	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
U1-U3	INTEGRATED CIRCUIT	351-1316-020		01295	TL084CN
U4		351-1477-010			
U5-U8	INTEGRATED CIRCUIT	351-1040-020		27014	LM101AH
U9	INTEGRATED CIRCUIT	351-1316-020		01295	TL084CN
U10		351-1476-010			
U11	INTEGRATED CIRCUIT	351-1035-060		49956	RC723DB
U12	INTEGRATED CIRCUIT	351-8252-010		02735	CD4066BE

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
	638-6933-001	
A1	Changed R51 from 1K to 100K	REV D
A2	Added C54-184-9102-090 33UF Changed R4 from 49.9K to 150K Changed R56 from 1.27K to 2.67K Deleted R88	REV E
A3	Changed R64 from 18.2K to 47.5K Deleted R82-745-0910-630 Deleted C40-184-9102-350 Deleted C41-913-5020-390 Deleted C47-913-3331-030	REV F
A4	Changed R90 from 301K to 221K	REV G



Speech Processor, Parts Location
Figure 3

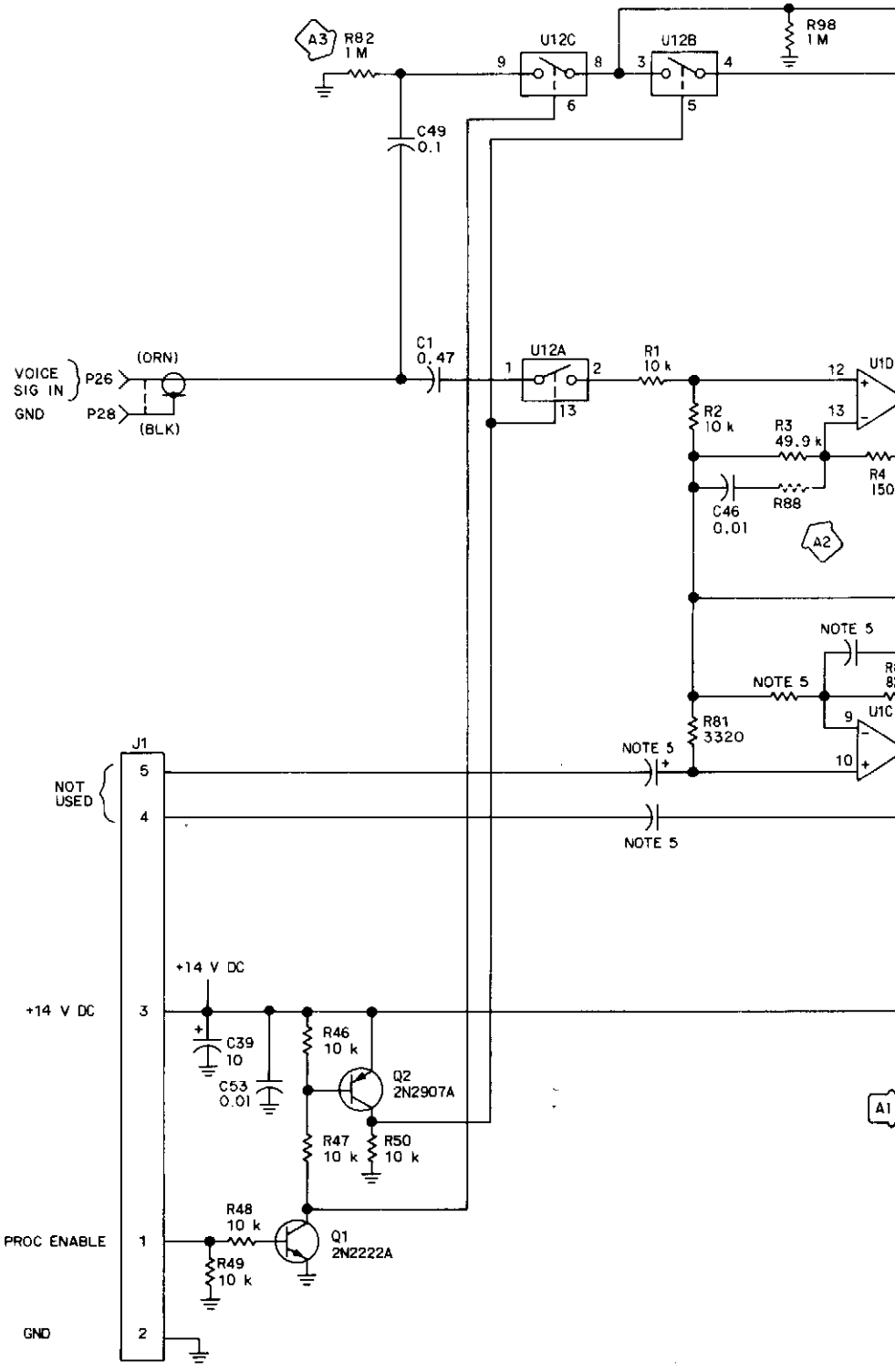
NOTES:

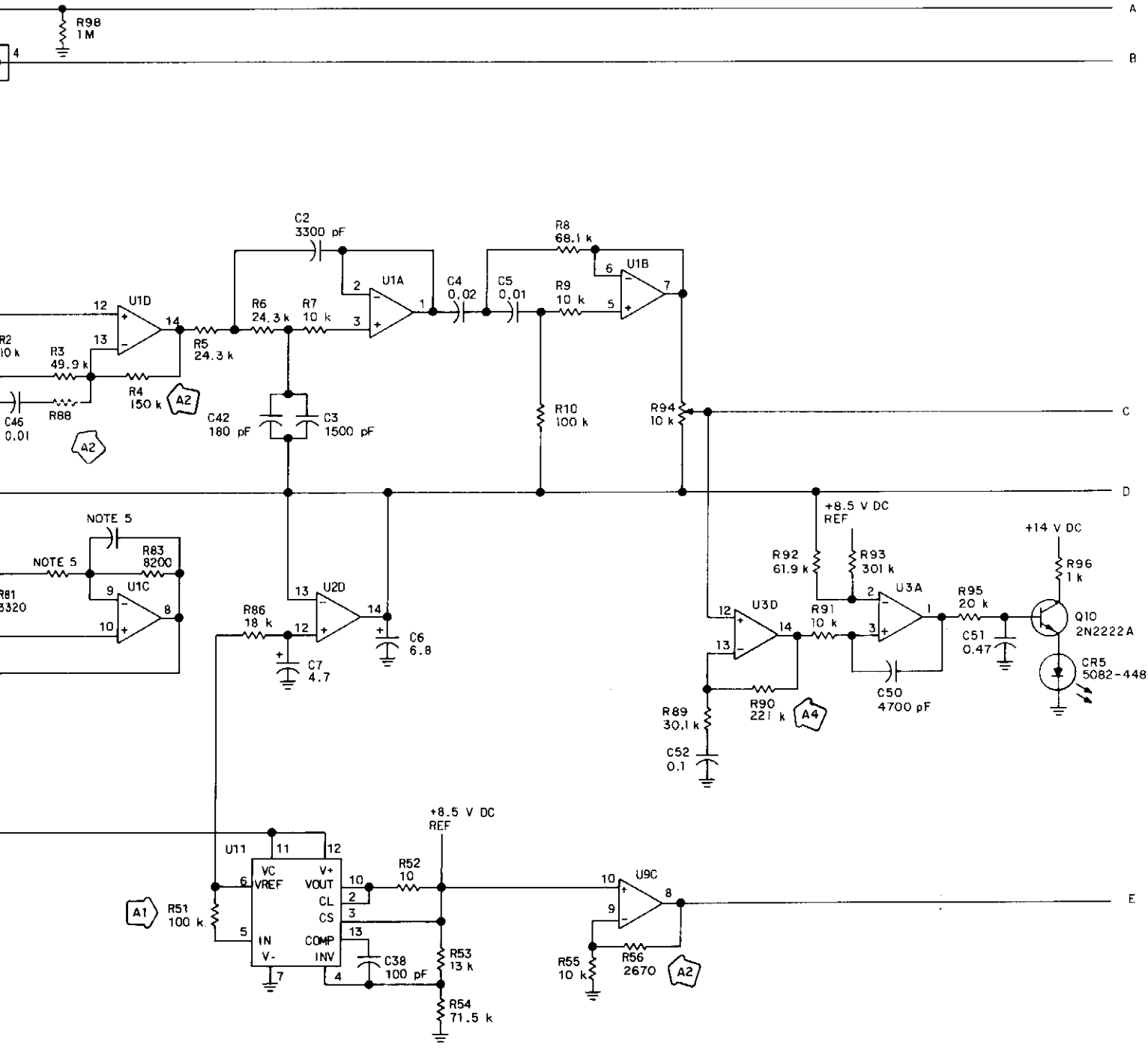
1. UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
3. TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.
4. THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.
5. COMPONENT LOCATIONS AVAILABLE FOR INSTALLATION OF COMPONENTS FOR IMPLEMENTATION OF A PREAMPLIFIER. NOT USED ON 638-6933-001.

MICROCIRCUIT INFORMATION

REF DES	COMMON DEVICE	PWR (V DC) +14	PWR (V DC) GND	SPARE SECTIONS
U1	TL084	4	11	
U2	TL084	4	11	
U3	TL084	4	11	B,C
U4	LM13600	11	6	
U5	LM101A	7	4	
U6	LM101A	7	4	
U7	LM101A	7	4	
U8	LM101A	4	11	
U9	TL084	4	11	
U10	RC4200			
U11	723			
U12	CD4066B	14	7	D

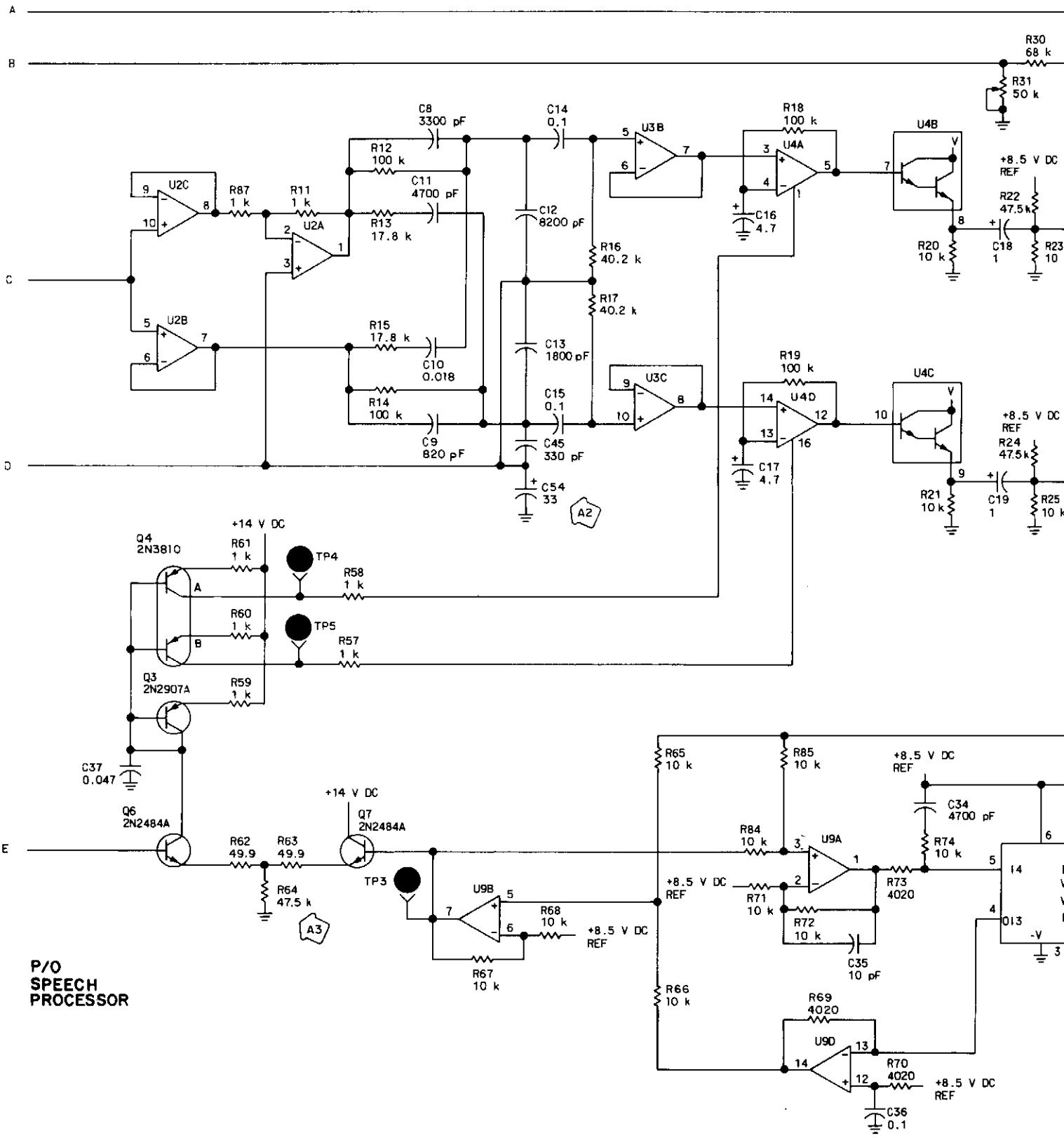
P/O SPEECH PROCESSOR

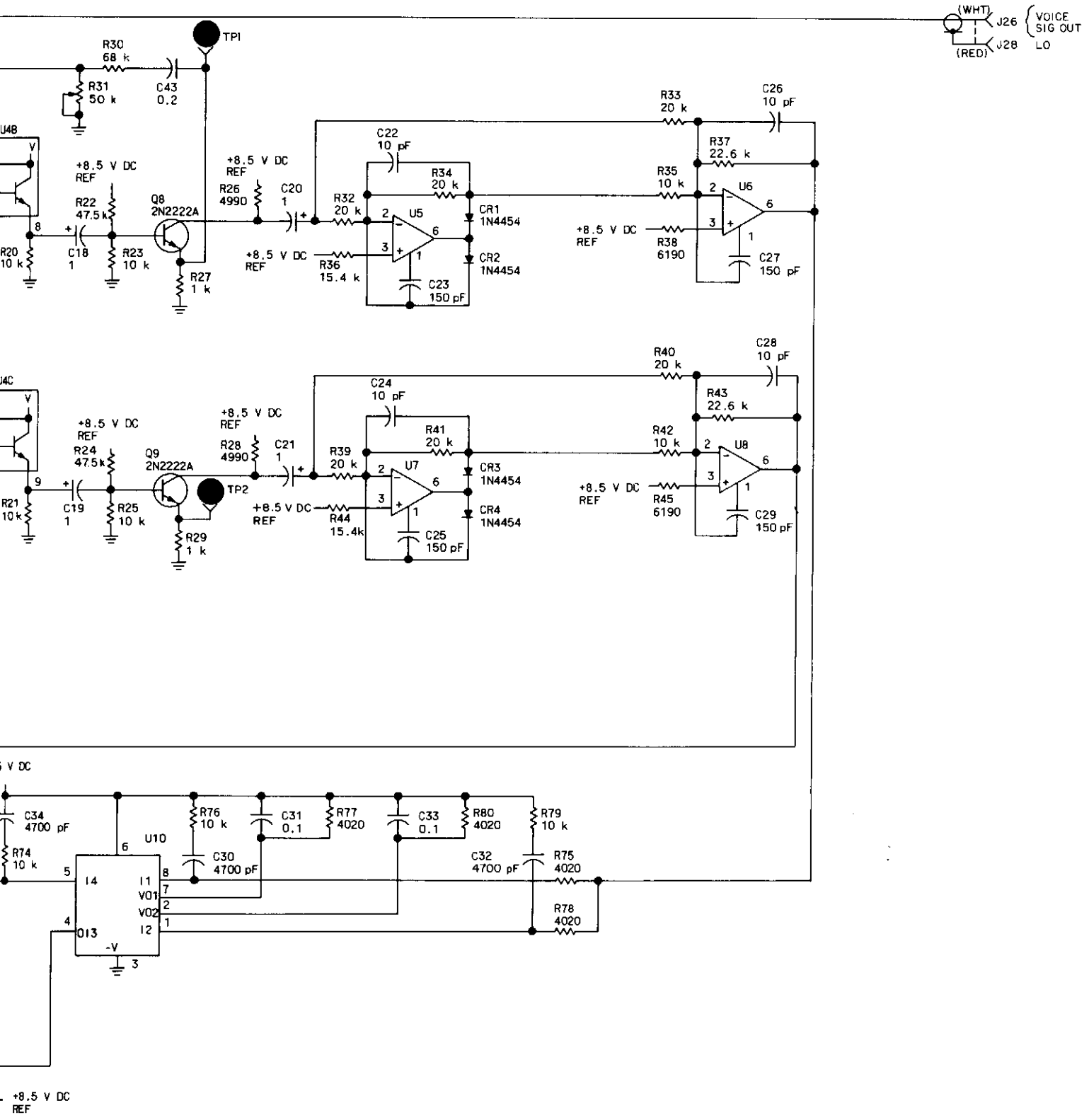




634-6921
TPA-2046-024

Speech Processor, Schematic Diagram
Figure 4 (Sheet 1 of 2)


A
B
C
D
E
R30 68 k
R31 50 k
C8 3300 pF
C14 0.1
R12 100 k
C11 4700 pF
U2C
U2A
U2B
U3B
U3C
U4A
U4B
U4C
U4D
R87 1 k
R11 1 k
R13 17.8 k
C12 8200 pF
R16 40.2 k
R17 40.2 k
R18 100 k
C16 4.7
R20 10 k
R22 47.5 k
C18 1
R23 10
+8.5 V DC REF
R15 17.8 k
C10 0.018
C13 1800 pF
R14 100 k
C9 820 pF
C15 0.1
C45 330 pF
C54 33
A2
R19 100 k
C17 4.7
R21 10 k
R24 47.5 k
C19 1
R25 10 k
+14 V DC
Q4 2N3810
R61 1 k
TP4
R58 1 k
R60 1 k
TP5
R57 1 k
Q3 2N2907A
R59 1 k
C37 0.047
Q6 2N2484A
Q7 2N2484A
R62 49.9
R63 49.9
R64 47.5 k
A3
TP3
U9B
R68 10 k
R67 10 k
R65 10 k
R85 10 k
R84 10 k
U9A
C34 4700 pF
R74 10 k
R73 4020
R71 10 k
R72 10 k
C35 10 pF
R66 10 k
R69 4020
U9C
R70 4020
C36 0.1
P/O SPEECH PROCESSOR



634-6921
TPA-2046-024

Speech Processor, Schematic Diagram
Figure 4 (Sheet 2)

Control Interface (638-6910-001)

Rockwell International

instructions

Collins Telecommunications Products Division

Printed in USA

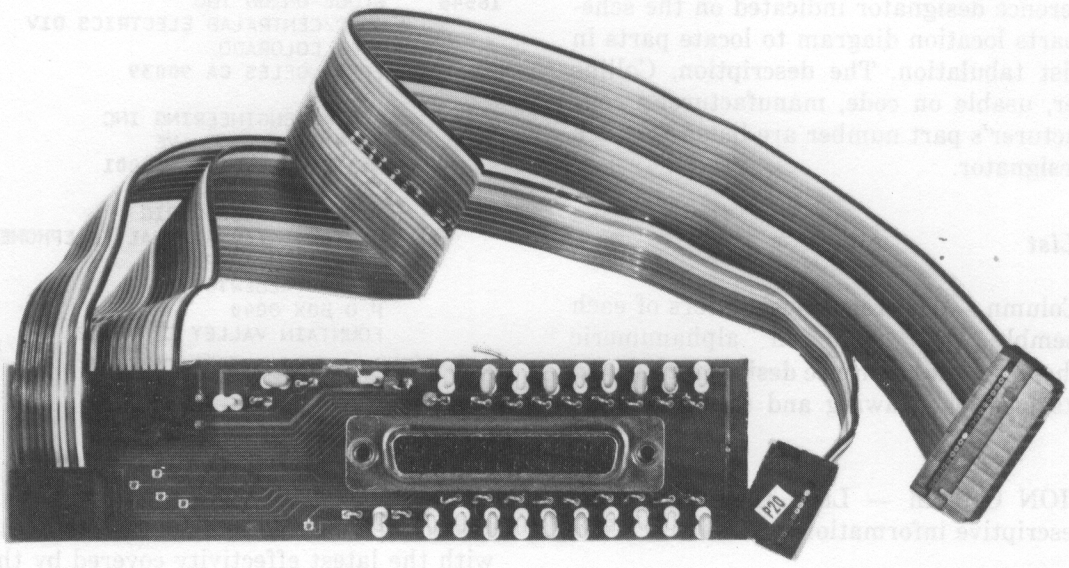
523-0771748-001211
1 August 1982

1. DESCRIPTION

Control Interface, 638-6910-001, figure 1, interfaces a remote user-supplied keypad control to the transceiver and provides additional interface connections for future use with a linear power amplifier. All components of the circuit, including connectors, are mounted on one circuit card.

2. PRINCIPLES OF OPERATION

The control interface has each input/output line filtered. The ROW 1 through COL 4 lines have RC filters. All other lines have LC filters. Refer to the schematic diagram for further details.



TPA-5268-017

Control Interface
Figure 1

The ROW, COL, and +5-V pins at connector J3 go to a 16-key keypad for frequency select, store, and recall commands. The remaining pins of J3 are reserved for use with linear power amplifier functions.

3. TESTING/TROUBLESHOOTING PROCEDURES

The control interface is tested by using standard resistance measurements to determine continuity through the filters. Use an ohmmeter to locate any malfunctioning component.

4. REPAIR

Repair of the control interface is accomplished using standard maintenance and circuit card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

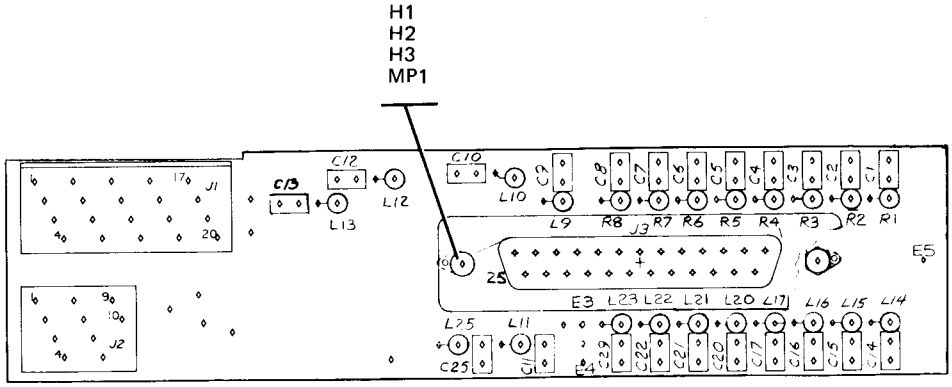
Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
02113	COILCRAFT INC 1102 SILVER LAKE RD CARY IL 60013
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
51642	CENTRE ENGINEERING INC 2820 E COLLEGE AVE STATE COLLEGE PA 16801
71468	ITT CANNON ELECTRIC DIV OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORP 10550 TALBERT AVE P O BOX 8040 FOUNTAIN VALLEY CA 92708
81349	MILITARY SPECIFICATIONS
96906	MILITARY STANDARD

5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Control Interface	638-6910-001	REV H



638-6910-001

TPA-5294-019

PARTS LIST

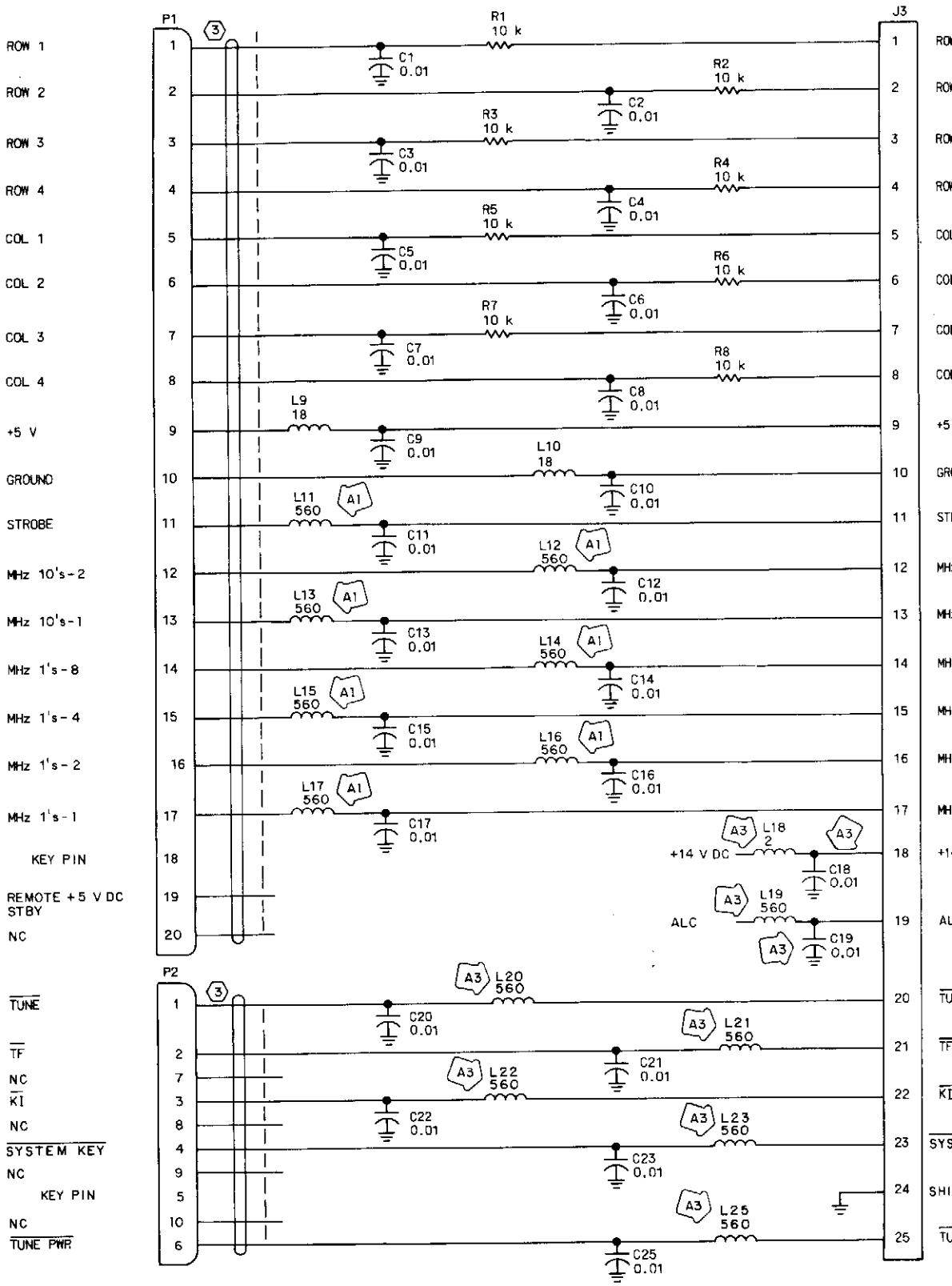
REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	CONTRO INTERFACE	638-6910-001			
C1-C17	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C18,C19	(A3)				
C18,C19	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
C20-C25	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V (A1)	913-3279-110		16546	CY20C103M
C20-C23	CAPACITOR,FIXED CER DIEL, 0.01UF, 20%, 50V	913-3279-110		51642	200-050-601-103M
C24	NOT USED				
C25	CAPACITOR,FIXED CER DIEL, 0.01UF, 20%, 50V	913-3279-110		51642	200-050-601-103M
H1	WASHER,FLAT CRES, 0.125ID X 0.250 OD (QTY 2)	310-0779-030		96906	MS15795-803
H2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 2)	310-0279-000		96906	MS35338-135
H3	SCREW,MACH STL, 4-40 X 3/16 (QTY 2)	343-0132-000		96906	MS51957-12
J1	CABLE, REMOTE CONTROL	641-7163-001			
J2	CABLE, RECEIVER	641-7159-001			
J3	CONNECTOR,RCPT ELEC	371-0386-080		71468	DBU25SBF
L9,L10	COIL,RF 18UH	240-2038-000		96906	MS75084-15
L11-L17	COIL,RF 560UH (A1)	240-2723-050		96906	MS75085-16
L18	COIL,RF 2UH (A2)	240-0979-010		02113	240-0979-010
L19	COIL,RF 560UH (A3)	240-2723-050		96906	MS75085-16
L20-L23	COIL,RF 560UH (A1)(A2)(A3)	240-2723-050		96906	MS75085-16
L24	NOT USED				
L25	COIL,RF 560UH (A1)(A2)(A3)	240-2723-050		96906	MS75085-16
R1-R8	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R9,R10	(A1)				
R10	RESISTOR,FIXED CMPSN, 10K, 10%, 1/4W (A1)(A3)	745-0785-000		81349	RCR07G103KS
R11-R17	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W (A1)	745-0785-000		81349	RCR07G103KS
R18,R19	NOT USED				
R20-R25	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS

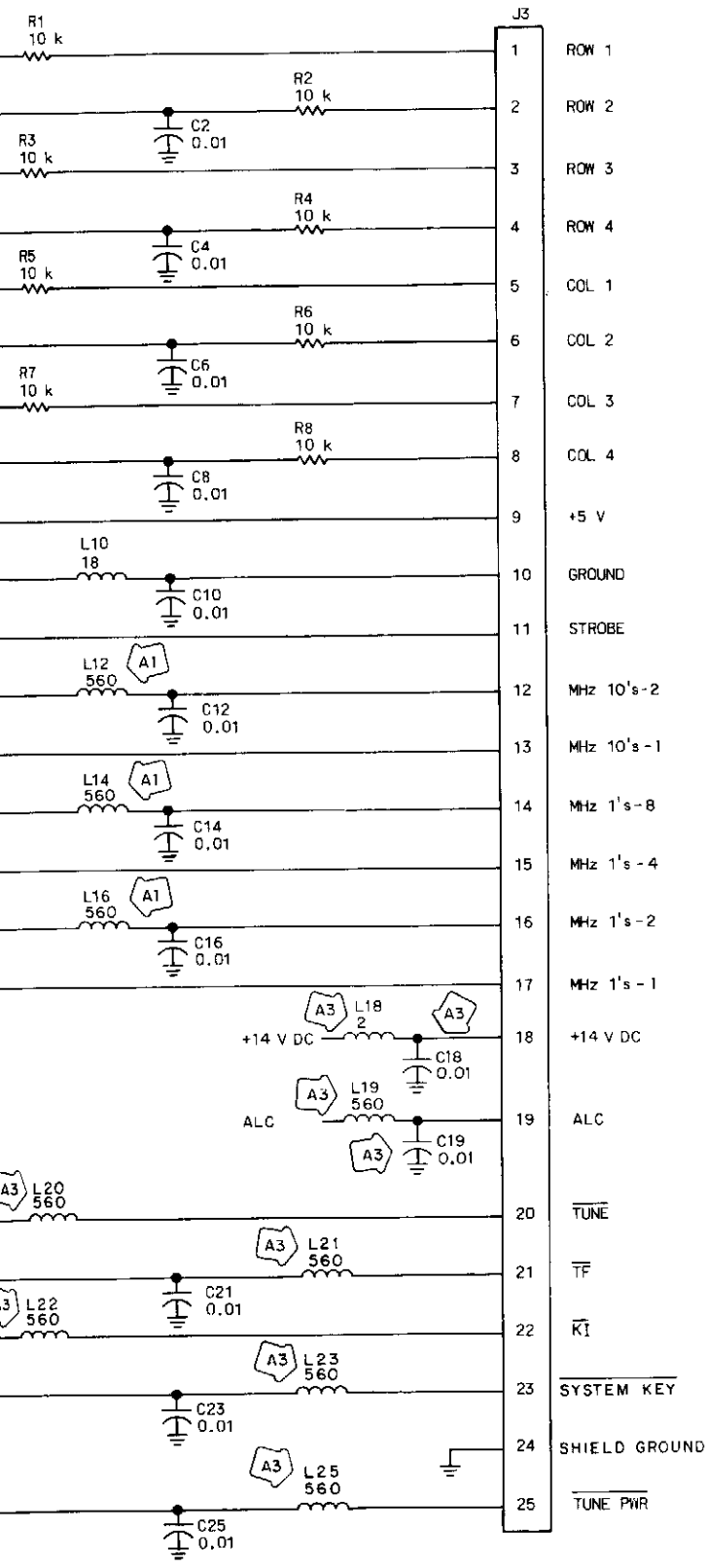
MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
	638-6910-001	
A1	Delete C24-913-3279-110 Added R10-745-0785-000 10K Deleted R11-R17-745-0785-000 10K Added L11-L17-240-2723-050 560UH Added L20-L23-240-2723-050 560UH Added L25-240-2723-050 560UH	REV F
A2	Deleted L20-L23, L25 V	REV G

A3	Delete R10, R20-R25
	Added L19-L23, L25
	Added L18-240-0979-010
	Added C18, C19-913-5019-200
	Changed 343-0132-000 to 343-0133-000 H3
	Added Terminal Strip TB1-306-0083-000
		REV H

Control Interface, Parts Location
Figure 2


P1
J3
P2
ROW 1
ROW 2
ROW 3
ROW 4
COL 1
COL 2
COL 3
COL 4
+5 V
GROUND
STROBE
MHz 10's-2
MHz 10's-1
MHz 1's-8
MHz 1's-4
MHz 1's-2
MHz 1's-1
KEY PIN
REMOTE +5 V DC STBY
NC
TUNE
TF
NC
KI
NC
SYSTEM KEY
NC
KEY PIN
NC
TUNE PWR
R1 10 k
R2 10 k
R3 10 k
R4 10 k
R5 10 k
R6 10 k
R7 10 k
R8 10 k
C1 0.01
C2 0.01
C3 0.01
C4 0.01
C5 0.01
C6 0.01
C7 0.01
C8 0.01
C9 0.01
C10 0.01
C11 0.01
C12 0.01
C13 0.01
C14 0.01
C15 0.01
C16 0.01
C17 0.01
C18 0.01
C19 0.01
C20 0.01
C21 0.01
C22 0.01
C23 0.01
C25 0.01
L9 18
L10 18
L11 560
L12 560
L13 560
L14 560
L15 560
L16 560
L17 560
L18 2
L19 560
L20 560
L21 560
L22 560
L23 560
L25 560
+14 V DC
ALC
A1
A3



NOTES:

(1) UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.

(2) PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATION PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.

(3) PENDANT CABLE.

634-6922
TPA-2016-014

Control Interface, Schematic Diagram
Figure 3

Audio Low-Pass Filter (646-5802-001)

Rockwell International

instructions

Collins Telecommunications Products Division

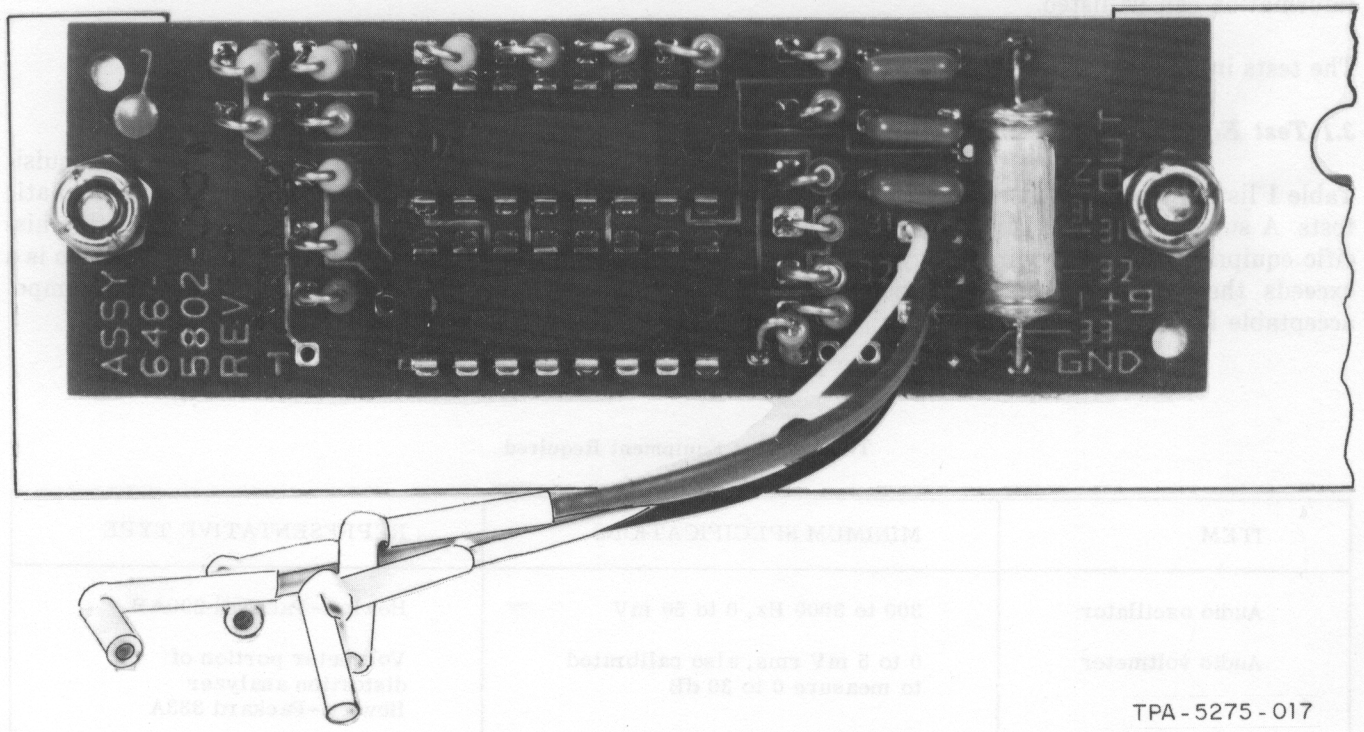
Printed in USA

523-0771761-001211
1 August 82

1. DESCRIPTION

Audio Low-Pass Filter 646-5802-001, figure 1, is a single-layer planar board with pendant connectors for interfacing the receiver-exciter.

The audio low-pass filter improves the audio response of the receiver by reducing high-frequency hiss. The filter is connected between the audio amplifier and the audio gain control of the receiver-exciter.



Audio Low-Pass Filter
Figure 1

2. PRINCIPLES OF OPERATION (Refer to figure 3)

The audio low-pass filter is an electronic low-pass filter with a 3-kHz cutoff point to reduce high-frequency hiss. The filter is an active 5-pole elliptic function low-pass filter placed just before the receiver audio gain control. The filter has no effect on the 300- to 3000-Hz passband but rolls off very rapidly above 3000 Hz.

The filter consists of two second order variable active filters frequency tuned by trim resistors to provide the 300- to 3000-Hz passband.

3. TESTING/TROUBLESHOOTING PROCEDURES

A performance test for the audio low-pass filter is given in table 2. In addition to the required performance criteria, troubleshooting comments are given.

It is assumed that the repair technician is trained in solid-state circuit troubleshooting and repair techniques, and is familiar with the test equipment to be used. Step-by-step operating procedures may not be given in all tests and not all possible troubleshooting information can be listed.

The tests in table 2 must be performed in sequence.

3.1 Test Equipment Required

Table 1 lists the equipment required to perform the tests. A suggested type is given; however, that specific equipment is not required. Any that meets or exceeds the indicated minimum specifications is acceptable for use.

3.2 Performance Test

The following test procedures measure the performance of the audio low-pass filter. After being repaired, repeat the numbered test where repair was performed to verify that no further malfunctions exist.

3.2.1 Preliminary Setup

Be certain no power is applied to the equipment until instructed to do so in the procedures. Do not connect power with power switches turned on.

Connect the equipment as instructed in the procedures for each test.

3.2.2 Test Procedures

Perform the tests as given in table 2.

4. REPAIR

Repair of the audio low-pass filter is accomplished using standard maintenance and circuit card repair procedures.

5. PARTS LIST/DIAGRAMS

5.1 Introduction

This paragraph assists in identification and requisition of parts. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Table 1. Test Equipment Required.

ITEM	MINIMUM SPECIFICATIONS	REPRESENTATIVE TYPE
Audio oscillator	300 to 3000 Hz, 0 to 50 mV	Hewlett-Packard 200AB
Audio voltmeter	0 to 5 mV rms, also calibrated to measure 0 to 30 dB	Voltmeter portion of distortion analyzer Hewlett-Packard 333A
Dc power supply	9 V dc	Hewlett-Packard 6264B
50-kΩ resistor	50 kΩ ±3%	

Table 2. Audio Low-Pass Filter, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	a. Ground J33, E33 (circuit card ground).		
	b. Connect 9-V dc voltage source to E1 (+9 V dc in).		
	c. Terminate J31 (audio out) with a 50-kΩ ±3% load.		
	d. Connect audio oscillator to E31 (audio in) and E33 (ground).		
	e. Connect audio voltmeter to J31 (audio out).		
2. Current test	a. Connect current meter in series with voltage source.		Refer to schematic diagram.
	b. Apply power.		
	c. Measure current reading.	12 to 18 mA	
3. In-band gain	a. Apply a 1-kHz, 200-mV (open circuit) signal between E31 (audio input) and E33 (ground).		Refer to schematic diagram.
	b. Measure the output at J31 (audio out).	-1 to +3 dB with reference to E31 (audio in)	
4. Filter characteristics	a. Reduce the applied signal frequency until the output at J31 (audio out) drops 3 dB below the 1-kHz output reference noted in test 3.b.	Occurs at frequency of NMT 200 Hz	Refer to schematic diagram.
	b. Increase the applied signal frequency until the output at J31 (audio out) drops 3 dB below the 1-kHz reference noted in test 3.b.	Occurs at a frequency between 3.00 kHz and 3.30 kHz	Refer to schematic diagram.
	c. Increase the applied signal frequency until the output at J31 (audio out) drops 6 dB below the 1-kHz reference noted in test 3.b.	Occurs at a frequency between 3.05 kHz and 3.35 kHz	Refer to schematic diagram.
	d. Increase the applied signal frequency until the output at J31 (audio out) drops 20 dB below the 1-kHz output reference noted in test 3.b.	Occurs at a frequency between 3.35 kHz and 3.65 kHz	Refer to schematic diagram.
	e. Increase the applied signal frequency until the output at J31 (audio out) drops 30 dB below the 1-kHz output reference noted in test 3.b.	Occurs at a frequency between 3.55 kHz and 3.85 kHz	Refer to schematic diagram.
	f. Continue to increase the applied signal frequency up to 20 kHz.	Output signal remains in excess of 30 dB below the reference of para 3.b.	Refer to schematic diagram.
5.	Disconnect test equipment, return to normal operation.		

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The description, Collins part number, usable on code, manufacturer's code and manufacturer's part number are listed for each reference designator.

5.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modification.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history. NA (not applicable) in the REVISION IDENT column indicates a documentation change only. The change does not affect the circuit card/subassembly components.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc.). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

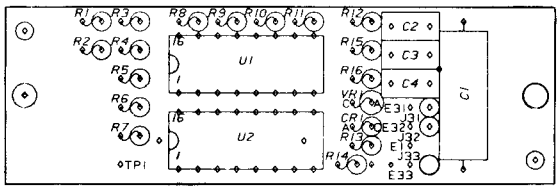
Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
14433	ITT SEMICONDUCTOR DIV WEST PALM BEACH FL
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
51642	CENTRE ENGINEERING INC 2820 E COLLEGE AVE STATE COLLEGE PA 16801
52072	CIRCUIT ASSEMBLY CORP 3169 REDHILL AVE COSTA MESA CA 92626
56699	MEPCO/ELECTRA INC 6071 ST ANDREWS RD COLUMBIA SC 29210
81349	MILITARY SPECIFICATIONS
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054

5.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Audio Low-Pass Filter	646-5802-001	REV A



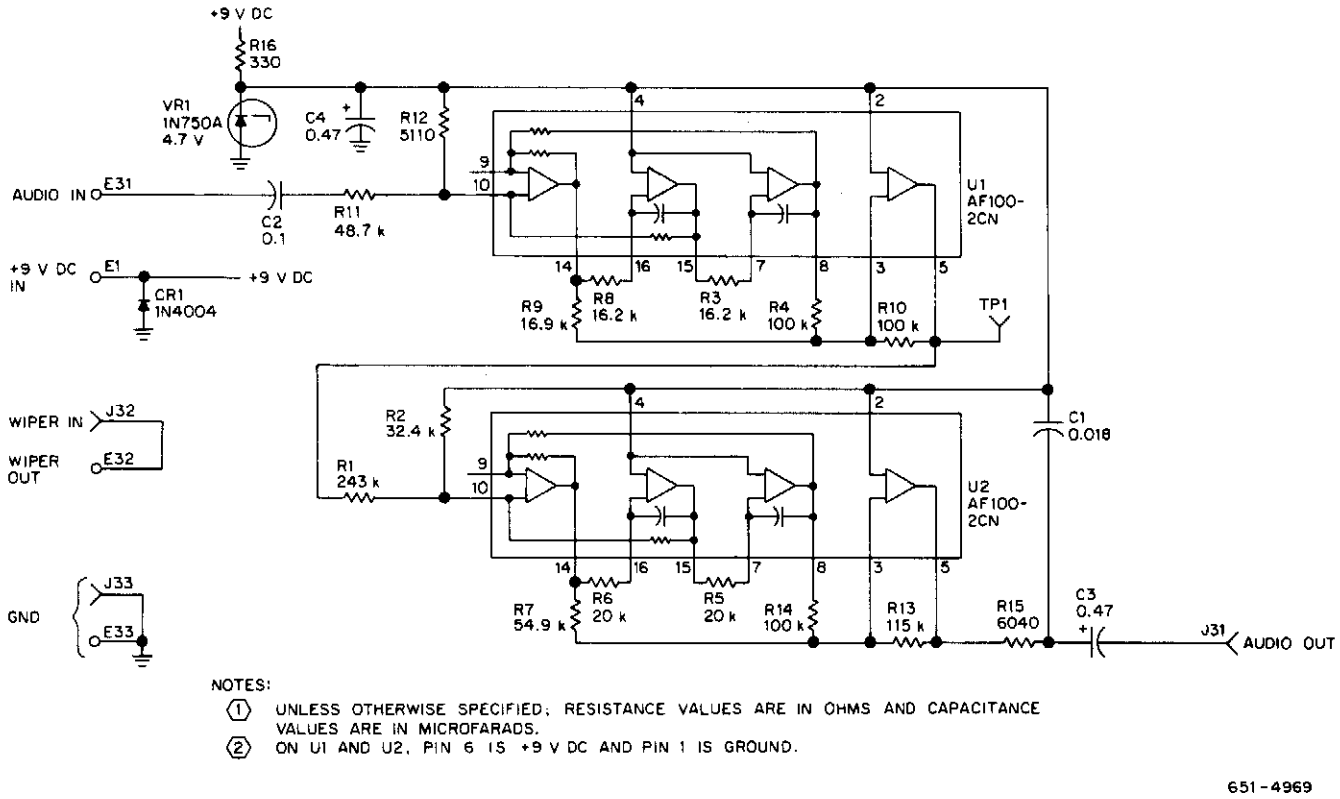
646-5802-001

TPA-5302-019

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	AUDIO LOW PASS FILTER	646-5802-001			
CR1	SEMICOND DEVICE	353-6442-040		14433	1N4004
C1	CAPACITOR,FIXED POLYSTYRENE DIEL, 18000PF, 1%, 25V	933-1455-070		56699	704C1FG183PF630AX
C2-C4	CAPACITOR,FIXED CER DIEL, 0.47UF, 20%, 50V	913-3279-250		51642	300-050-601-474M
J31-J33	CONNECTOR,HDR	372-2656-130		52072	CAS01SP100-230-430
R1	RESISTOR,FIXED FILM, 243K, 1%, 1/8W	705-3604-190		81349	RN55D2433F
R2	RESISTOR,FXD FILM, 32.4K, 1%, 1/8W	705-3605-720		81349	RN55D3242F
R3	RESISTOR,FXD FILM, 16.2K, 1%, 1/8W	705-1054-000		81349	RN55D1622F
R4	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R5,R6	RESISTOR,FXD FILM, 20K, 1%, 1/8W	705-3605-620		81349	RN55D2002F
R7	RESISTOR,FXD FILM, 54.9K, 1%, 1/8W	705-3605-830		81349	RN55D5492F
R8	RESISTOR,FXD FILM, 16.2K, 1%, 1/8W	705-1054-000		81349	RN55D1622F
R9	RESISTOR,FXD FILM, 16.9K, 1%, 1/8W	705-1055-000		81349	RN55D1692F
R10	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R11	RESISTOR,FXD FILM, 48.7K, 1%, 1/8W	705-1077-000		81349	RN55D4872F
R12	RESISTOR,FXD FILM, 5.11K, 1%, 1/8W	705-1030-000		81349	RN55D5111F
R13	RESISTOR,FIXED FILM, 113K, 1%, 1/8W	705-3604-030		81349	RN55D1133F
R14	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN55D1003F
R15	RESISTOR,FXD FILM, 6.04K, 1%, 1/8W	705-3605-370		81349	RN55D6041F
R16	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS
U1,U2	INTEGRATED CIRCUIT ACTIVE FILTER	351-0532-010		27014	AF100-2CN
VR1	SEMICOND DEVICE	353-2708-000		81483	1N750A

Audio Low-Pass Filter, Parts Location
Figure 2

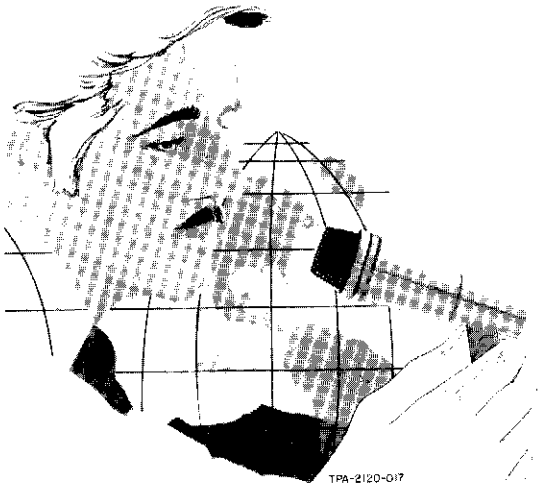


NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.
2. ON U1 AND U2, PIN 6 IS +9 V DC AND PIN 1 IS GROUND.

651-4969

Audio Low-Pass Filter, Schematic Diagram
Figure 3



Rockwell International

HF accessories

Collins AC-3801 Noise Blanker Kit

1. DESCRIPTION

The AC-3801 Noise Blanker Kit, part number 641-7105-001, is for use in transceivers and receivers located in high-impulse type rf noise environments.

The noise blanker, transceiver A11 subassembly, is installed into the KWM-380, HF-380, or 451S-1 card cage and is connected to the receiver-exciter circuit card on the bottom of the chassis.

After installation, the noise blanker is enabled by pressing the front panel NB switch. Pressing and releasing the NB switch (to the out position) bypasses blanker operation.

2. INSTALLATION

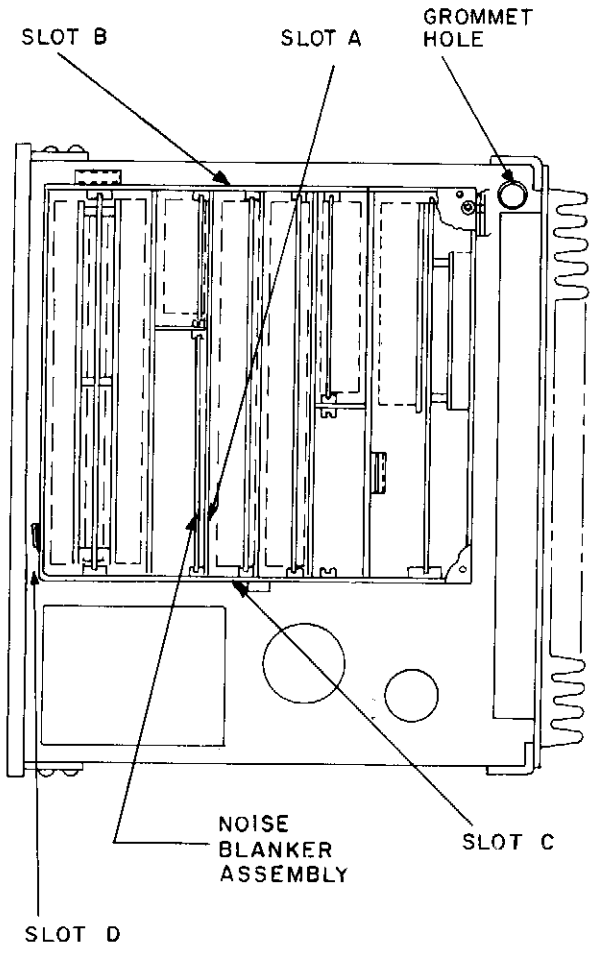
To install the noise blanker, perform the following:

a. Remove the KWM-380, HF-380, or 451S-1 dust cover by removing four screws from the bottom of the unit.
b. Remove card cage cover to expose plug-in circuit cards.
c. Refer to figure 1. Insert noise blanker card into compartment indicated.

Note

Refer to figures 1, 2, and 3 while performing steps d through g.

d. Route noise blanker coax cables through slots A and B, and through the grommet hole.
e. Route noise blanker ribbon cable through slots A, C, and D. Slot D is the space between front of chassis and rear of front panel.



Transceiver Card Cage
Figure 1

f. Turn the transceiver or receiver for access to the underside of the chassis. Remove the jumper between J4 and J5 on the receiver-exciter circuit card.

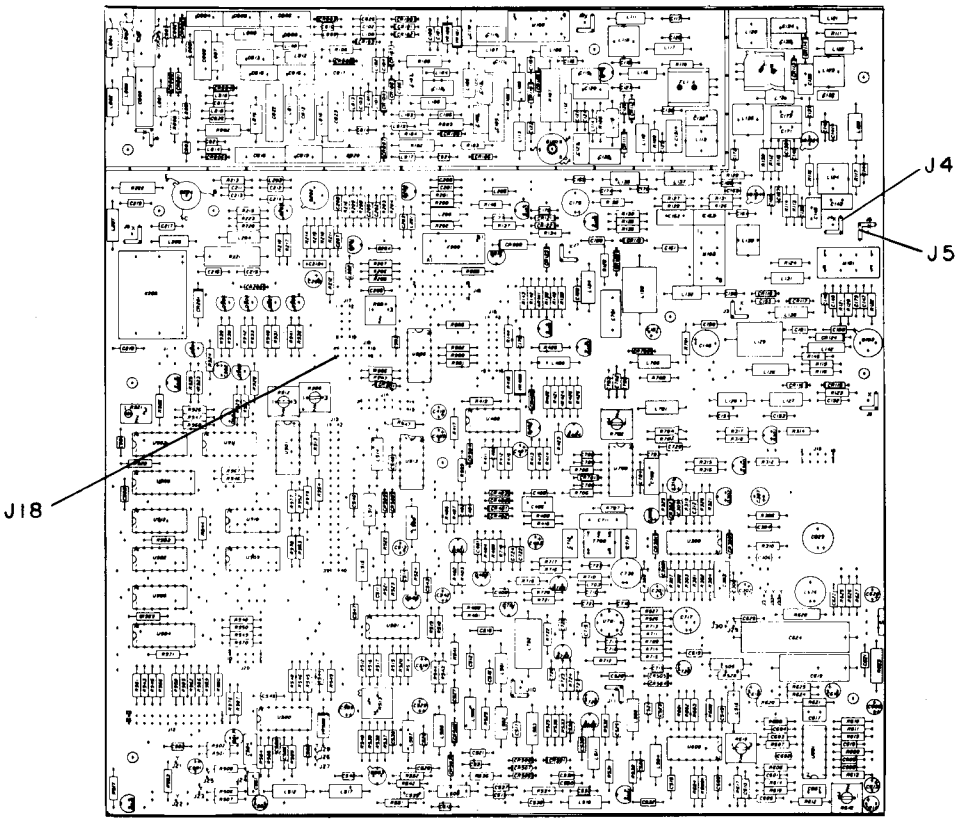
g. Connect noise blanker to receiver-exciter card as follows:

FROM NOISE BLANKER	TO RECEIVER-EXCITER
P1	J4
P2	J5
P18	J18

h. Reinstall card cage and dust covers.

3. PARTS LIST

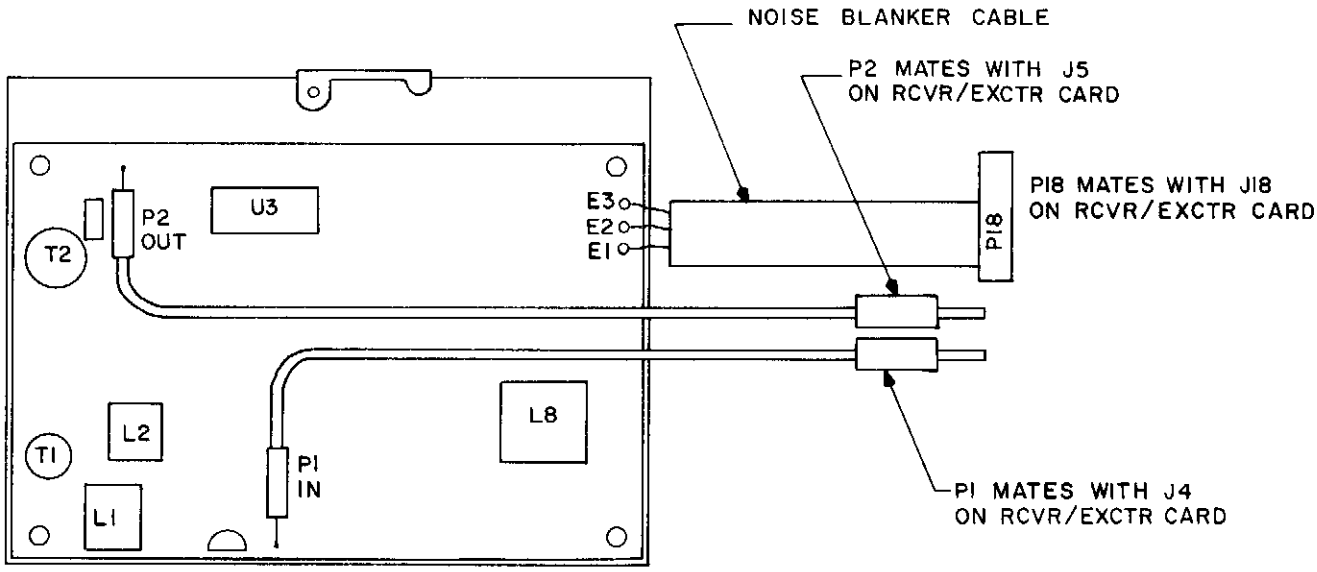
The instruction sheet and one noise blanker card, part number 641-7146-001, are the only parts in the AC-3801 kit.



ALTHOUGH SOME COMPONENT LOCATIONS MAY DIFFER DUE TO CIRCUIT BOARD CHANGES, LOCATIONS OF J4, J5, AND J18 ARE AS SHOWN HERE.

TPA-2215-019

Receiver-Exciter Circuit Card
Figure 2



Noise Blanker Circuit Card
Figure 3

Rockwell International

HF accessories

Collins AC-3802 Speech Processor Kit

1. DESCRIPTION

The AC-3802 Speech Processor, Collins part number 642-2438-001, is a new circuit (patent applied for) that increases the average power of speech to produce more "talk power" without using limiting or clipping. The processor, inserted into the microphone audio path, detects the voice envelope and operates to instantly reduce circuit gain with no attack or release delay.

The frequency response of the speech processor has been tailored for a full sounding transmitted audio (flat frequency response). This will produce an acceptable sound under both weak and moderately strong rf signal levels at the receiver. A speech processor is most effective when the transmitted signal is weak at the receiver location. Under average signal conditions a speech processor is not required and it is recommended that it not be used when signals are easily readable.

Slightly more audio "punch" can be obtained by adding preemphasis to the higher audio frequencies. This will increase the intelligibility of the transmitted signal under weak received signal conditions. However, this may produce undesirable audio quality during very strong signal conditions and can be characterized as having a lack of bass response or a "tinny" sound.

Note

Many of the microphones used by amateurs already produce a preemphasized response. They are advertised as "tailored for SSB communications," or "having a rising response." These microphones probably will not need any additional preemphasis by the speech processor.

The speech processor, transceiver subassembly A12, is installed in the transceiver card cage and is connected to the front panel and the receiver-exciter circuit card on the bottom of the chassis.

2. INSTALLATION

The preemphasis circuit is activated by adding a 1500-ohm, 1/4-watt carbon composition or 1/8-watt metal film resistor in the R88 location on the speech processor card. Refer to figure 4 for location of R88.

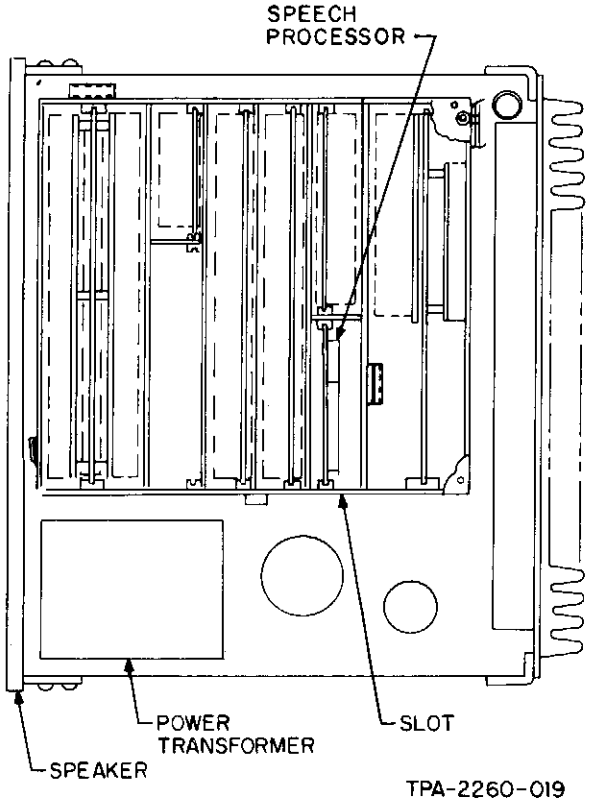
Perform the following for installation of the AC-3802.

a. Remove the KWM-380 or HF-380 dust cover by removing four screws from the bottom of the transceiver.
b. Remove the card cage cover to expose the plug-in circuit cards.
c. Refer to figure 1. Insert the metal backing plate of the speech processor assembly into the card guides.

Note

Refer to figures 1, 2, 3, and 4 while performing steps d through l.

d. Route the cables from the speech processor card through the slot on the side of the card cage to the front of the unit between the power transformer and the card cage, then down the front panel behind the loudspeaker and loop back across the receiver-exciter chassis under the existing ribbon cables.
e. Connect P17 of the ribbon cable assembly into J17 of the receiver-exciter board on the bottom of the chassis.
f. Unplug the wire from the front panel potentiometer which plugs into J26 of the receiver-exciter board.



Transceiver Card Cage
Figure 1

g. Plug J26 of the speech processor cable into P26 of the cable from the front panel.
h. Plug P26 of the speech processor cable into J26 on the receiver-exciter board.
i. Disconnect the wire from the front panel potentiometer which plugs into J28 on the receiver-exciter board.
j. Plug J28 of the speech processor cable into P28 of the cable from the front panel potentiometer.
k. Plug P28 of the speech processor cable into J28 on the receiver-exciter board.
l. Perform the following calibration procedure:

Note

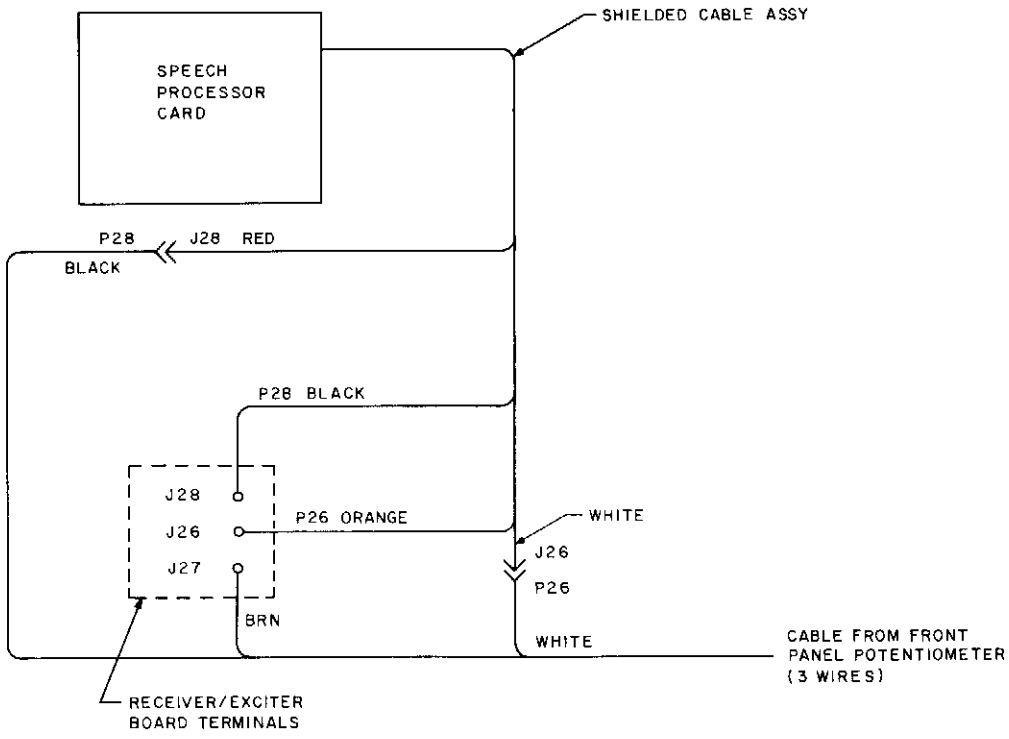
Ensure that the speech processor card is fully inserted into the card cage during adjustments.

(1) Connect a dummy load to the rear panel rf connector.
(2) Connect a microphone to the MIC input.
(3) Set the transmitter frequency to 14.300.00 MHz.
(4) On the front panel, set MODE switch to USB, PROC out, MOX in, and METER to ALC.
(5) Speak into the microphone with a normal voice and adjust the MIC/CARRIER control for an indication of S7 to S9 on the meter.
(6) Push PROC switch in.
(7) While speaking into the microphone in a normal operating speech level, adjust R94 on the speech processor card until the peak indicator just barely flashes. This indicates that only the voice peaks are activating the indicator. When these conditions are reached, the unit is set for 10 dB of processing. From this setting, adjusting R94 clockwise will produce more than 10 dB of processing and adjusting R94 counterclockwise will produce less than 10 dB of processing.
(8) Adjust the output level potentiometer R31 on the processor card for an indication of S1 to S3 on the (ALC) meter. If the output of the transceiver is monitored on an oscilloscope, the following should be observed: with the speech processor switched off, a clean "Christmas tree" pattern should be observed. With the speech processor switched on, the peaks should remain at the same amplitude on the scope (indicating the same pep output), but the "valleys" should fill in (indicating higher average power output).

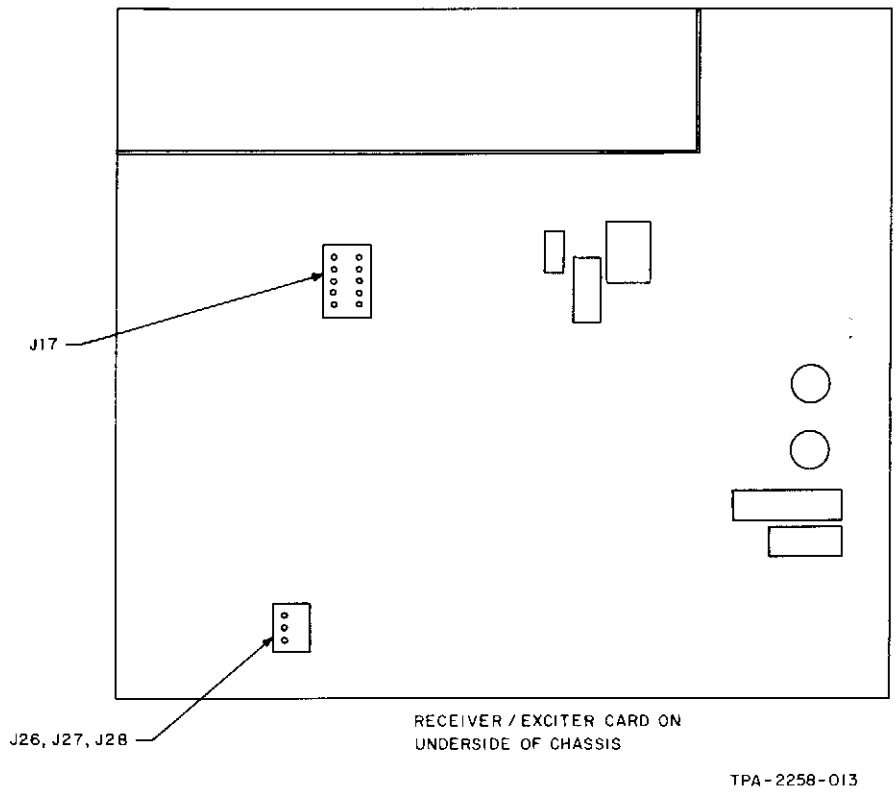
m. Reinstall the card cage cover and dust cover.

3. PARTS LIST

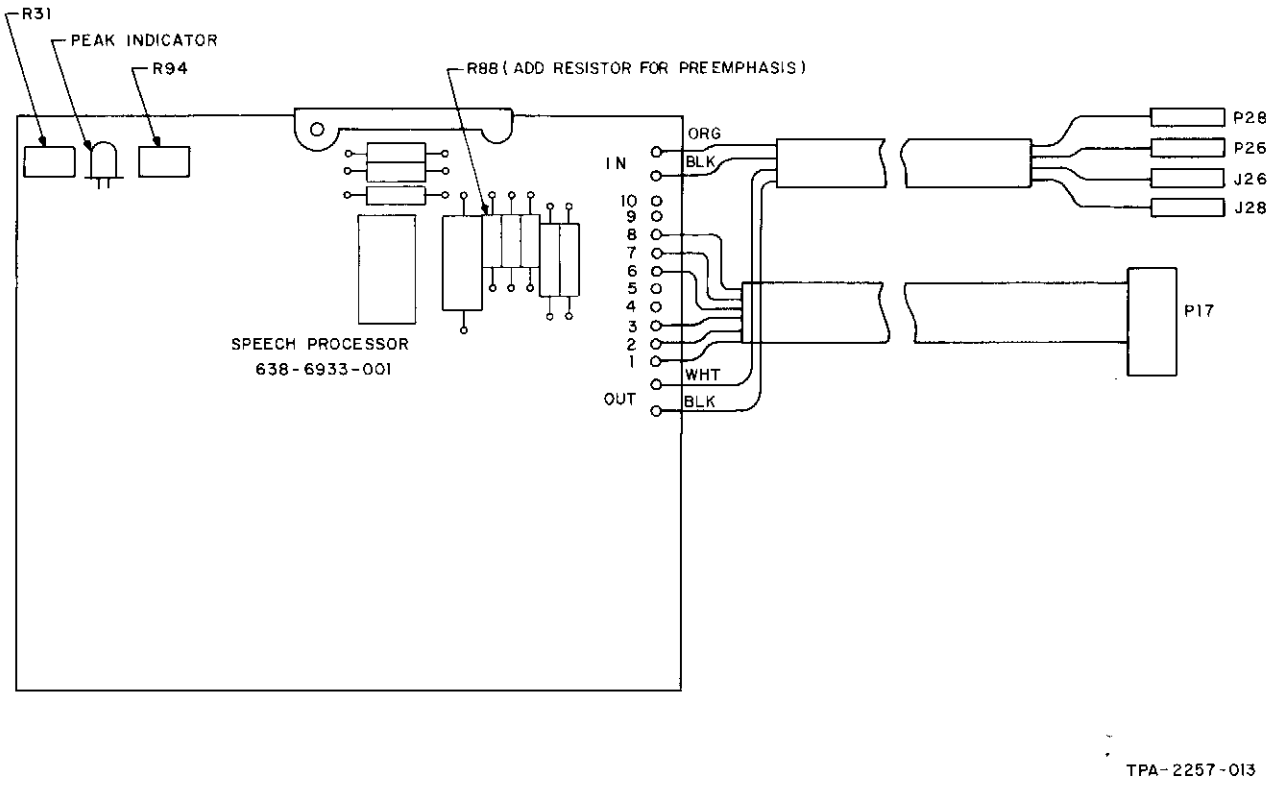
The instruction sheet and one speech processor assembly, Collins part number 638-6933-001, are the only parts in the AC-3802 kit.



AC-3802 Cable Connections
Figure 2



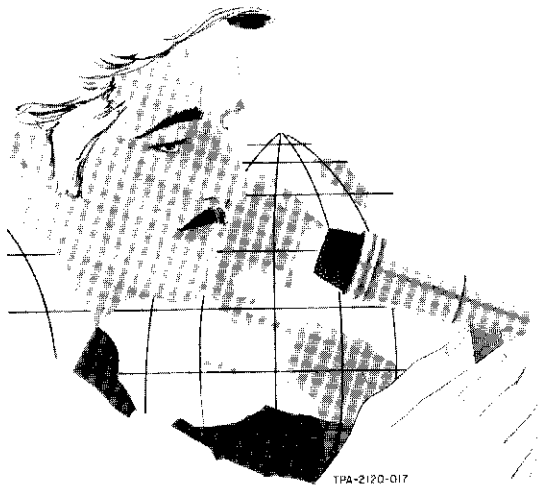
Receiver-Exciter Card
Figure 3



Speech Processor Card
Figure 4

Collins Telecommunications Products Division/Rockwell International
Cedar Rapids, Iowa 52498

•523-0770571-201218 2-15-82 Printed in USA



Rockwell International

HF accessories

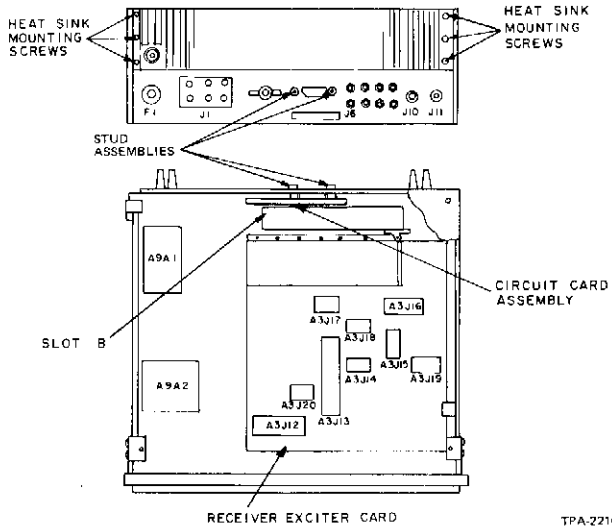
Collins AC-3803 Control Interface Kit

1. DESCRIPTION

The AC-3803 Control Interface Kit, part number 641-7150-001, interconnects the KWM-380 or HF-380 Transceiver to an external pad to enable digital selection, storage, and recall of transceiver operating frequencies. (Other functions are also available at the connector for future use with a linear power amplifier or CU-380 Antenna Coupler.) A mating connector is supplied as part of the kit. The keypad is not part of the kit; it must be supplied by the user. The AC-3805A Keypad may be used directly but the AC-3805 Keypad requires the use of the AC-3809 Interface Adapter.

2. INSTALLATION

a. Remove the KWM-380 or HF-380 dust cover by removing four screws from bottom of transceiver.
b. Remove card cage cover to expose plug-in circuit cards.
c. Refer to figure 1. On rear panel, remove and discard blank cover plate to expose connector hole.



Transceiver Component and Subassembly Locations
Figure 1

d. Install control interface circuit card assembly (figure 2) into transceiver as shown in figure 1. Remove and discard washers and nuts from kit stud assemblies. Insert studs through outside of chassis panel, then thread into posts on each side of circuit card connector inside chassis. Screw studs down to secure connector and circuit card to chassis. (Hex portion of stud assembly should now be outside rear panel to receive the external mating connector locking screw.)
e. Refer to figures 1, 2, and 3 and install internal connectors as follows:
   (1) Route P20 directly to J20 on receiver-exciter card on bottom of chassis.
   (2) Remove the heat-sink mounting screws to provide space and route connector P4 through slot B. Replace the heat-sink mounting screws.
   (3) Carefully raise the control card about 1/4 inch and remove from J2 the ribbon cable connector coming from the low-pass filter (LPF) card.
   (4) Raise the bandpass tuning (BPT) card about 3/8 inches and remove P11.
   (5) Raise the control card until J4 is accessible. If necessary to raise the board, the connectors at J1 and J6 can be removed. Route P4 along the card cage through slot A and connect to J4. Guide the ribbon cable into slot A as the card is lowered pin step (6).
   (6) Lower the control card partially into the cage. Carefully reattach the connector to J1 and J6 if they were previously removed. Lower the card until it is about 1/4 inch above the card cage and reconnect to J2 the ribbon cable from the LPF card. Lower the card completely into the card cage.
   (7) Reattach P11 to the BPT card. Lower the card completely into the card cage.
f. Solder unterminated white wire from control interface circuit card to ground lug at J6 (AUD OUT) on rear panel.

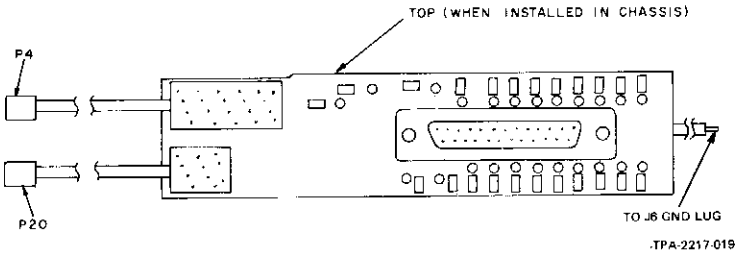
g. Solder unterminated yellow wire from control interface circuit card to center pin at J3 (ALC) on rear panel.
h. Run unterminated red wire from control interface circuit card along chassis toward wire bundle coming from A9A1 card. Pass red wire through chassis with wire bundle and solder to +14 V lug on top of chassis. Lug is located at top of a metal bracket and has two resistors and several wires connected to it.
i. Reinstall card cage and dust covers.

3. CONNECTOR PIN ASSIGNMENTS AND KEYPAD CONNECTION

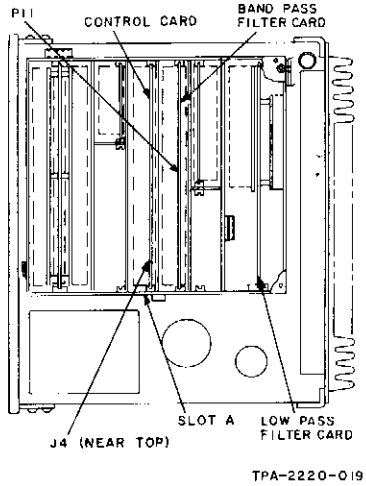
3.1 Interface Connector Pin Assignments

PIN	FUNCTION		PIN	FUNCTION	PIN	FUNCTION
1	Row 1		10	Ground	*19	ALC
2	Row 2		11	Strobe	20	$\overline{\text{TUNE}}$
3	Row 3		12	10 MHz-2	21	$\overline{\text{TF}}$ (tune fault)
4	Row 4		13	10 MHz-1	22	$\overline{\text{KI}}$ (key interlock)
5	Column 1	Keypad connections	14	1 MHz-8	*23	$\overline{\text{SYSTEM KEY}}$
6	Column 2		15	1 MHz-4	*24	SHIELD GROUND
7	Column 3		16	1 MHz-2	25	TUNE POWER
8	Column 4		17	1 MHz-1		
9	+5 V		*18	+14 V		

*Not used on earlier units. AC-3803 Service Bulletin No 1 describes these additions.



Control Interface Circuit Card Assembly
Figure 2

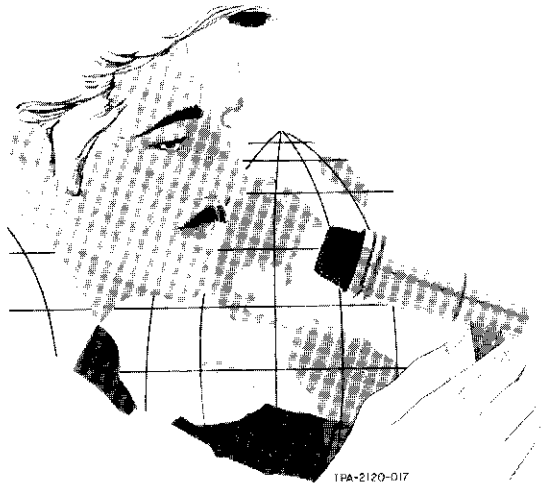


Transceiver Card Cage
Figure 3

4. PARTS LIST

The parts contained in the AC-3803 kit are listed below.

COLLINS PART NUMBER	QTY	DESCRIPTION
638-6910-001	1	Circuit card assembly
371-0062-000	2	Receptacle assembly
371-0170-000	1	Connector
371-0040-030	2	Stud assembly
371-0392-030	1	Hood



Rockwell International

HF accessories

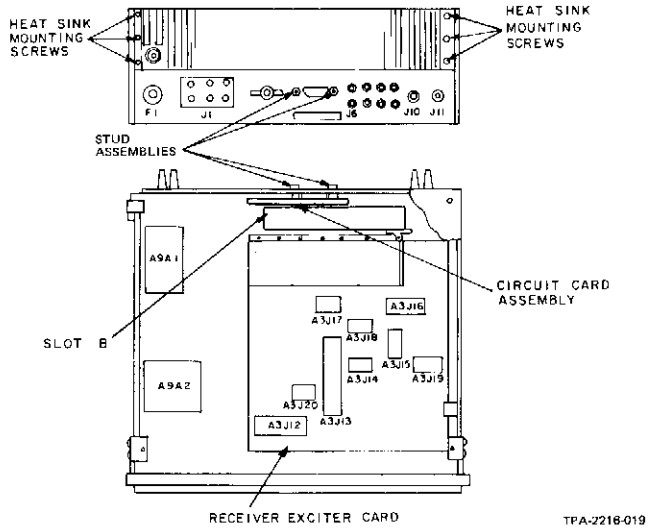
Collins AC-3803 Control Interface Kit

1. DESCRIPTION

The AC-3803 Control Interface Kit, part number 641-7150-001, interconnects the KWM-380 or HF-380 Transceiver to an external pad to enable digital selection, storage, and recall of transceiver operating frequencies. (Other functions are also available at the connector for future use with a linear power amplifier or CU-380 Antenna Coupler.) A mating connector is supplied as part of the kit. The keypad is not part of the kit; it must be supplied by the user. The AC-3805A Keypad may be used directly but the AC-3805 Keypad requires the use of the AC-3809 Interface Adapter.

2. INSTALLATION

a. Remove the KWM-380 or HF-380 dust cover by removing four screws from bottom of transceiver.
b. Remove card cage cover to expose plug-in circuit cards.
c. Refer to figure 1. On rear panel, remove and discard blank cover plate to expose connector hole.



Transceiver Component and Subassembly Locations
Figure 1

d. Install control interface circuit card assembly (figure 2) into transceiver as shown in figure 1. Remove and discard washers and nuts from kit stud assemblies. Insert studs through outside of chassis panel, then thread into posts on each side of circuit card connector inside chassis. Screw studs down to secure connector and circuit card to chassis. (Hex portion of stud assembly should now be outside rear panel to receive the external mating connector locking screw.)
e. Refer to figures 1, 2, and 3 and install internal connectors as follows:
   (1) Route P20 directly to J20 on receiver-exciter card on bottom of chassis.
   (2) Remove the heat-sink mounting screws to provide space and route connector P4 through slot B. Replace the heat-sink mounting screws.
   (3) Carefully raise the control card about 1/4 inch and remove from J2 the ribbon cable connector coming from the low-pass filter (LPF) card.
   (4) Raise the bandpass tuning (BPT) card about 3/8 inches and remove P11.
   (5) Raise the control card until J4 is accessible. If necessary to raise the board, the connectors at J1 and J6 can be removed. Route P4 along the card cage through slot A and connect to J4. Guide the ribbon cable into slot A as the card is lowered pin step (6).
   (6) Lower the control card partially into the cage. Carefully reattach the connector to J1 and J6 if they were previously removed. Lower the card until it is about 1/4 inch above the card cage and reconnect to J2 the ribbon cable from the LPF card. Lower the card completely into the card cage.
   (7) Reattach P11 to the BPT card. Lower the card completely into the card cage.
f. Solder unterminated white wire from control interface circuit card to ground lug at J6 (AUD OUT) on rear panel.

g. Solder unterminated yellow wire from control interface circuit card to center pin at J3 (ALC) on rear panel.
h. Run unterminated red wire from control interface circuit card along chassis toward wire bundle coming from A9A1 card. Pass red wire through chassis with wire bundle and solder to +14 V lug on top of chassis. Lug is located at top of a metal bracket and has two resistors and several wires connected to it.
i. Reinstall card cage and dust covers.

3. CONNECTOR PIN ASSIGNMENTS AND KEYPAD CONNECTION

3.1 Interface Connector Pin Assignments

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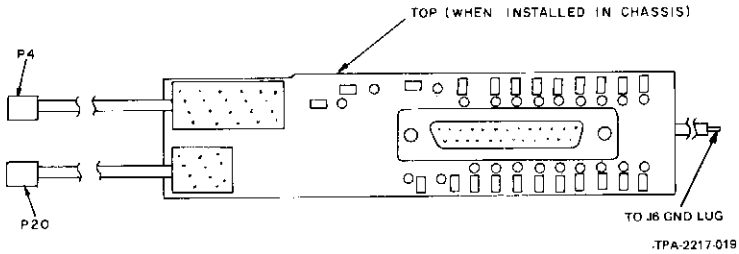
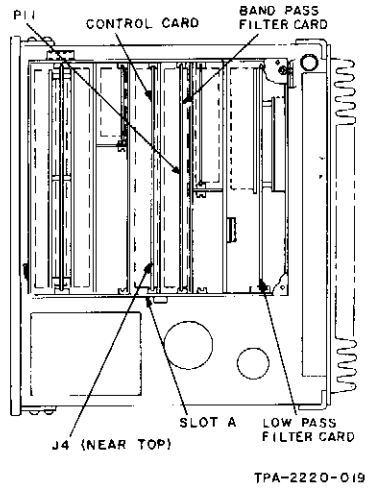
6	Column 2		15	1 MHz-4	*24	SHIELD GROUND
7	Column 3		16	1 MHz-2	25	TUNE POWER
8	Column 4		17	1 MHz-1		
9	+5 V		*18	+14 V		

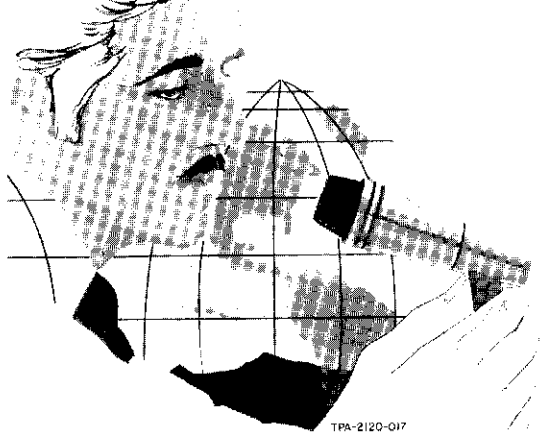
*Not used on earlier units. AC-3803 Service Bulletin No 1 describes these additions.



Control Interface Circuit Card Assembly
Figure 2



Transceiver Card Cage
Figure 3



Rockwell International

Collins AC-3805 and AC-3805A Keypads

HF accessories

1. DESCRIPTION

The AC-3805 and AC-3805A Keypads, part numbers 651-7412-001 and 651-7412-002 respectively, facilitate the digital selection, storage, and recall of transceiver operating frequencies for the KWM-380 or HF-380 Transceivers and the 451S-1 Receiver. Up to 11 frequencies can be stored for preset recall in the transceivers and receiver. The AC-3805 Keypad can be used directly with the 451S-1 Receiver; however, for use with the KWM-380 or HF-380 Transceiver, it must be used in conjunction with the AC-3809 Interface Adapter. The AC-3805A Keypad can be used directly with the KWM-380 and HF-380 Transceivers but may not be used with the 451S-1 Receiver.

AC-3805 and AC-3805A Keypad
Figure 1

2. INSTALLATION

To connect the AC-3805 and AC-3805A Keypads to the transceivers or receiver, proceed as directed by table 1.

Table 1. Keypad to Equipment Connection.

IF USING	WITH	PLUG KEYPAD INTO
AC-3805	451S-1	Control A
AC-3805	KWM-380	Interface adapter jack J1
AC-3805	HF-380	Interface adapter jack J1
AC-3805A	KWM-380	Control interface connector
AC-3805A	HF-380	Control interface connector

3. KEYPAD OPERATION

3.1 General

The radio operating frequency can be controlled by either the front-panel tuning knob or by the AC-3805 or AC-3805A Keypad. However, access to the radio frequency storage and recall capability is only available thru the use of the keypad. The keypad allows the user to enter a frequency directly into the radio, to store and recall frequencies for use, and to sequentially step from one stored frequency to another. The keypad consists of number keys, a decimal key, and lettered function keys.

3.2 Decimal Key

The decimal key separates megahertz frequency information (MHz) from kilohertz (999 kHz and lower) frequency information (kHz). The decimal key will generally be used for every keypad frequency input. Two special cases are: (1) if the MHz information were keyed in and the decimal not depressed, the entered frequency would contain the MHz information and

zeros for the kHz part of the frequency, and (2) if the decimal is depressed first, then only the kHz portion of the frequency would be entered or changed.

3.3 Entering Frequency

To enter a frequency via keypad operation, depress the digits comprising the desired frequency, separating the MHz from the kHz with the decimal key. As the frequency is keyed in, the radio display will show what is being keyed. The radio will not change to this frequency until the [ENT] (enter) key is depressed.

If an invalid or undesired sequence is keyed in, depress the [CLR] (clear) key. This returns the display to the current operating frequency. Depressing [CLR] after [ENT], [STO] (store), [RCL] (recall), or [STP] (step) will NOT cause a clearing operation. If an invalid frequency (one greater than 29.9999 MHz) or more than seven digits are depressed, one of two things will happen: the display will revert to the current operating frequency or the display will present all zeros. (Which will happen is determined by the type of read-only memory (ROM) on the control card internal to the radio.) If the display reverted to the current operating frequency, then the desired frequency must be re-keyed and then the [ENT] key depressed. If the display has all zeros, then the [CLR] key must be depressed, the desired frequency re-keyed, and the [ENT] key depressed.

Note

If the [ENT] key is depressed while the display shows all zeros, then the operating frequency will change to 0.00000 MHz.

3.4 Frequency Storage

Due to differences in internal components (ROM), the number of digits required to address a memory location and the number of memory locations may differ in the radios with which this keypad can be used. In order to determine your requirements, perform the following test.

a. Turn the radio off and then back on. The radio display will be 15.0000.
b. Enter the number 4.000 thru the keypad.
c. Press [STO] key.
d. Press [0] key.

If display returns to 15.000, then the radio requires only 1 digit (0-9) for memory location address for storage and recall, and the radio has 10 memory locations.

If display remains 4.000, then the radio requires two digits (00-10) for memory location address for storage and recall, and the radio has 11 memory locations.

Once the number of digits required has been determined, the method of storing frequencies is the same. To do this, key in the frequency, press [STO] key, and then the desired memory location. After the last digit of the memory location is pressed, the display will return to the current operating frequency. To store the current operating frequency, it is only necessary to press [STO], and then enter the desired memory location.

Loading a new frequency into a memory location that already contains a frequency replaces that frequency with the new frequency.

3.5 Frequency Recall

Depressing the [RCL] key and the applicable number of digits for the desired memory location immediately changes the operating frequency to the recalled frequency.

Depressing the [STP] key steps the memories, in sequence, through memory locations containing valid frequencies. Blank or invalid frequency locations are skipped. The stepping process starts from the present memory location in use. Thus, if memory location 3 is in use and only locations 0, 3, 7, 8, and 9 contain valid frequencies, the stepping sequence would be from 3 to 7, 8, 9, 0, and 3 if the [STP] key was depressed five times.

3.6 Memory Clear

Removing power from the unit clears all memories.

To selectively clear a memory location, depress in sequence [0], [STO], and the desired memory location. If more than one location is to be cleared, a fast method is to change the operating frequency to 0 MHz ([0], [.], [ENT]), and then depress [STO] and the desired memory location for each memory to be cleared.

3.7 Examples of Keypad Operation

Action Desired	Key Operation Sequence	Display
Turn equipment on		15.00000
Change to 14,00000 MHz	[1] [4] [.] [ENT]	14.00000
Change to 14.02350 MHz with error in keying	[1] [4] [.] [2] [3] [5] [0]	14.2350
	[CLR]	00000000
	[1] [4] [.] [0] [2] [3] [5] [ENT]	1402350
Change to 14.73100 MHz	[.] [7] [3] [1] [ENT]	14.73100
Change to 00.50000 MHz	[0] [.] [5] [ENT]	.50000
Store 14.00000 MHz in memory location 2 (see paragraph 3.4)	[1] [4] [.] [STO] [0] [2]	14.00000 will display until 2 is depressed, then display will show current operating frequency.
	or	
	[1] [4] [.] [STO] [2]	
Recall frequency in memory location 2 (see paragraph 3.4)	[RCL] [0] [2]	14.00000
	or	
	[RCL] [2]	

4. PARTS LIST

QUANTITY	DESCRIPTION	PART NUMBER	
1	Base	641-3973-001	
1	Keypad (A1)	266-9511-190	
2	Stud assembly	371-0040-000 AC-3805	AC-3805A
1	Connector (P1)	371-0169-000	371-0170-000
1	Hood	371-0392-020	371-0392-030

Wiring of keypad to connector is as follows. All wires are #26 AWG.

WIRE NO (see NOTE)	CONNECTOR PIN	KEYPAD PIN
1	P1-1	A1-1
2	P1-2	A1-2
3	P1-3	A1-3
4	P1-4	A1-4
5	P1-5	A1-5
6	P1-6	A1-6
7	P1-7	A1-7
8	P1-8	A1-8
9	P1-9	A1-9
10	P1-10 cable shield	

CAUTION

Use care when soldering wires to keypad to avoid temperature damage to keypad assembly.

Collins Telecommunications Products Divison/Rockwell International
Cedar Rapids, Iowa 52498

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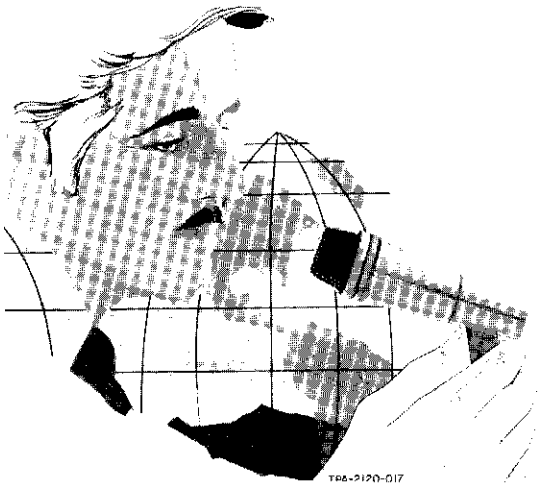


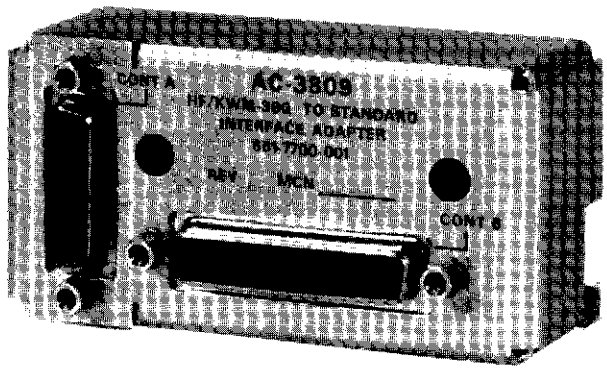
Rockwell International

HF accessories

Collins AC-3809 Interface Adapter

1. DESCRIPTION

AC-3809 Interface Adapter, part number 651-7700-001, shown in figure 1, is a wiring redirection device used in conjunction with AC-3803 Control Interface. It separates the high-power amplifier and antenna coupler control functions from the transceiver remote frequency control and special function connector. The power amplifier and antenna coupler control functions appear on the 25-pin connector. The transceiver remote frequency and special functions appear on the 15-pin connector (see figure 2).



TPA-5709-017

AC-3809 Interface Adapter
Figure 1

It allows the use of the AC-3805 Keypad, part number 651-7412-001, with the KWM-380 and HF-380 Transceivers if the transceivers are equippped with the AC-3803 Control Interface. (The AC-3805A Keypad, part number 651-7412-002, does not require the use of the interface adapter when used with these transceivers equipped with the control interface.)

2. INSTALLATION

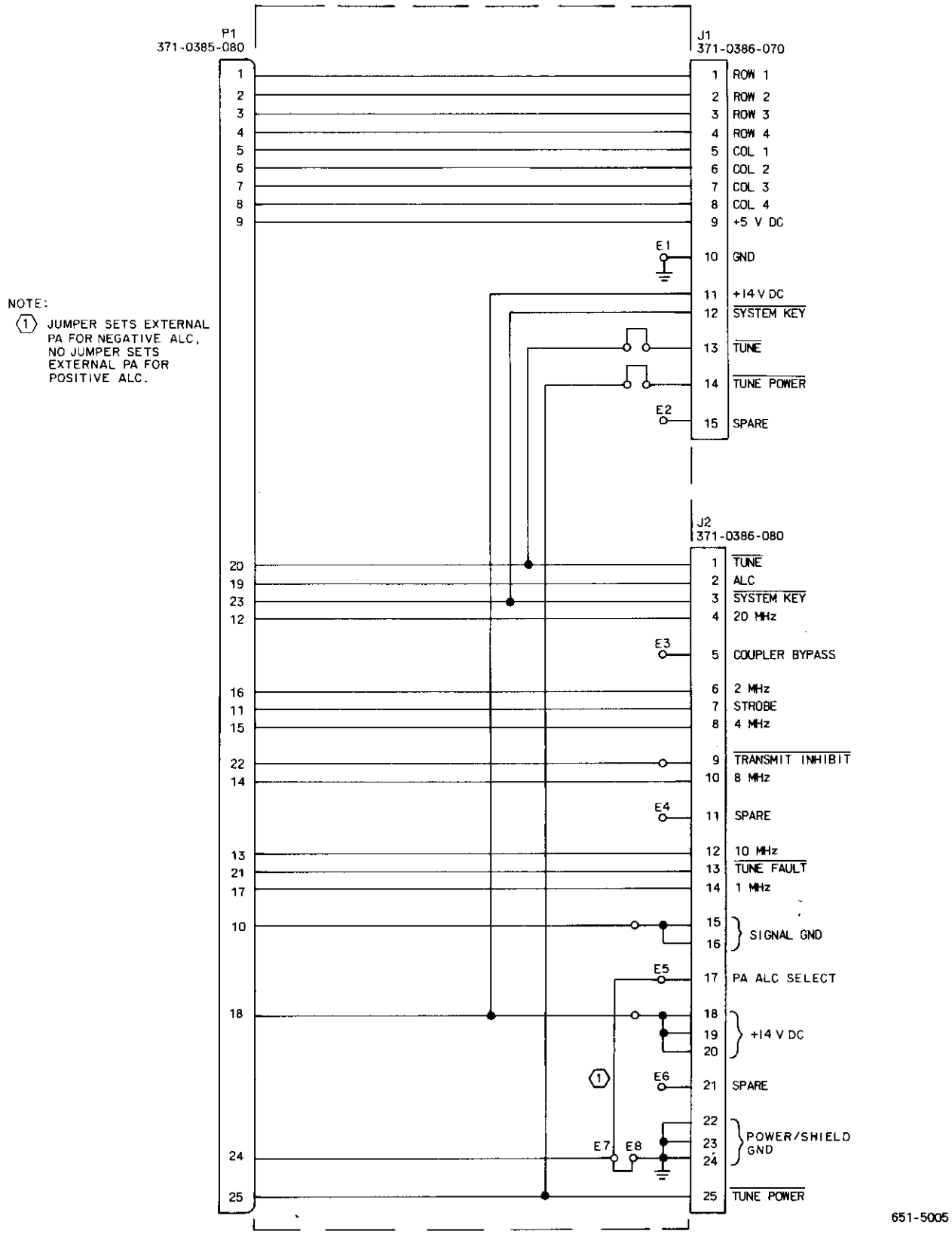
Perform the following steps for installation of the interface adapter.

a. Facing the rear of the transceiver, position the adapter such that the two connectors J1 and J2 are away from the transceiver.
b. Connect the single connector P1 of the adapter to the control interface connector on the rear of the transceiver.
c. Tighten the P1 connector screws to hold the unit secure. Do not overtighten the screws.

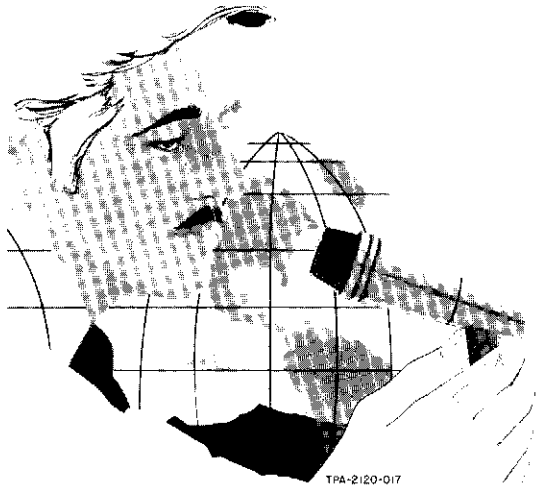
Figure 2 shows the wiring interconnections of the interface adapter.

3. PARTS LIST

QTY	DESCRIPTION	COLLINS PART NUMBER
1	Chassis adapter	651-7698-001
4	Receptacle assembly	371-0062-000
1	Bar	651-7415-001
2	Screw	343-0134-000
2	Washer, flat 0.112	310-0779-030
2	Washer, lock 0.112	310-0279-000
1	Card, interface adapter	646-5665-001
1	Connector, electrical J1	371-0386-070
1	Connector, electrical J2	371-0386-080
1	Connector, electrical P1	371-0385-080
4	Post, hex	540-9037-003
4	Washer, lock	310-0279-000
4	Screw, no 4 x 0.250	343-0133-000
2	Stud, assembly	371-0040-000
4	Washer, flat	310-0740-200



Adapter Wiring Interconnections
Figure 2



Rockwell International

HF accessories

Collins AC-3810, AC-3811, AC-3812, AC-3813, and AC-3814 Filter Kits

1. DESCRIPTION

The AC-3810, AC-3811, AC-3812, AC-3813, and AC-3814 filters are for use in the KWM-380 and HF-380 transceivers and 451S-1 receiver. The filters provide various bandwidths about a 6.255-MHz center frequency.

The AC-3810 CW/RTTY Filter kit, Collins part number 642-2439-001, contains a carrier-centered filter; 360-Hz bandwidth at -3-dB points, 1250-Hz bandwidth at -60-dB points.

The AC-3811 CW Filter kit, Collins part number 642-2440-001, contains a carrier-centered filter; 140-Hz bandwidth at -3-dB points, 600-Hz bandwidth at -60-dB points.

The AC-3812 Narrow SB/RTTY Filter kit, Collins part number 642-2441-001, contains a carrier-centered filter; 1.7-kHz bandwidth at -3-dB points, 3.4-kHz bandwidth at -60-dB points.

The AC-3813 AM Filter kit, Collins part number 642-2442-001, contains a carrier-centered filter; 6-kHz bandwidth at -3-dB points, 25-kHz bandwidth at -60-dB points.

The AC-3814 Wide SB/Data Filter kit, Collins part number 651-7410-001, contains a carrier-centered filter; 3-kHz bandwidth at -3-dB points, 8.6-kHz bandwidth at -60-dB points.

The AC-3813 (6-kHz) filter is used on passband tuning circuit card A4. When the AC-3813 kit is installed, the 6-kHz filter is selected by switching the transceiver SELECTIVITY switch to 8.0. The AC-3814 filter may be mounted on circuit card A4 in place of 2.1-kHz filter for transmit and receive operation or in any of the three optional positions for receive only. The AC-3810, AC-3811, and AC-3812 filters may be mounted in any of the three optional locations: one on circuit card A4 and two on passband tuning option card A13. Table 1 lists filter locations that correspond to front panel BW SELECTIVITY switch positions. If several accessory filters are installed, it is suggested that they be installed in order of decreasing bandwidth: 1700 Hz in OPT 1, 360 Hz in OPT 2, and 140 Hz in OPT 3.

Table 1. BW SELECTIVITY Switch and Filter Position Relationships.

BW SELECTIVITY SWITCH POSITION	FILTER POSITION ON CIRCUIT CARD
8.0	A4 upper
2.2	*A4 middle
OPT 1	A13 lower
OPT 2	A4 lower
OPT 3	A13 upper

*This filter position is also used in transmit mode.

2. INSTALLATION

To install the filters, perform the following:

a. Remove KWM-380 or HF-380 dust cover by removing four screws from bottom of transceiver.
b. Remove card cage cover to expose plug-in circuit cards.
c. Refer to figure 1 and remove passband tuning circuit card from transceiver after removing connectors.

Note

Refer to figures 2 and 3 for filter locations.

d. For the AC-3813 only, remove the existing piggyback circuit board filter from the AC-3813 filter location (see figure 2) on the passband tuning circuit card by removing mounting hardware and unsoldering the four pins. Pins may be cut to aid in disassembly.
e. Place mica washers (CPN 302-0640-070) on terminals of filter.
f. Install filter onto passband tuning circuit card and secure filter with two flat washers (CPN 310-0054-000), two lockwashers (310-0095-000), and two hexnuts (CPN 313-0051-000).

Note

If the circuit board has sockets for the filter terminals to plug into, disregard step g.

g. Solder filter terminals to circuit board pads on the circuit card. Clean the solder flux from the card.

Note

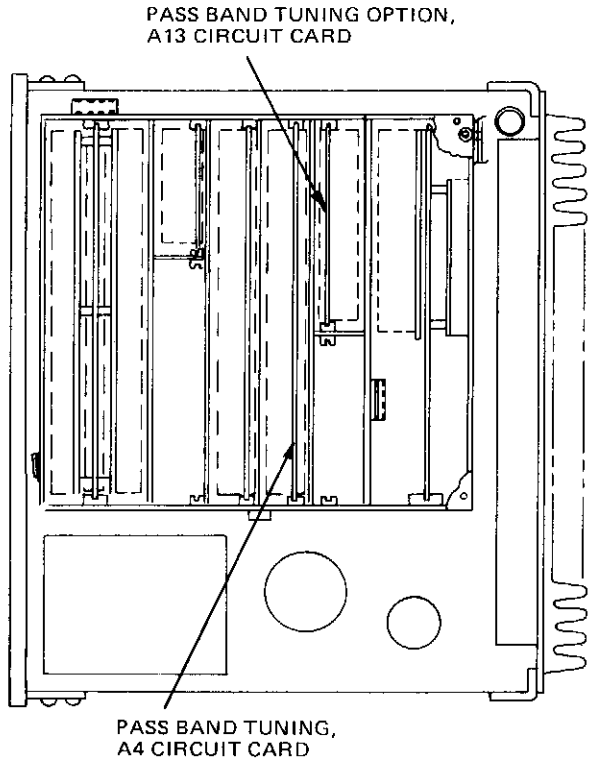
If the AC-3814 Filter is to be installed on the A4 circuit card in place of the 2.1-kHz filter, perform steps h and i; otherwise, proceed to step j.

h. Replace 2.1-kHz filter with 3-kHz filter as follows:
   (1) Remove mounting hardware from 2.1-kHz filter.
   (2) Using a soldering iron suitable for printed circuit use (30-watt) and a solder removal aid such as fine metallic braid or a suction device, remove solder from filter terminal connections to printed circuit card. Take care not to damage metallic pads and circuitry.
   (3) Remove 2.1-kHz filter from circuit card. Examine card and remove any solder splashes.
   (4) Install 3-kHz filter per paragraphs 2.e, f, and g.
   (5) Locate and note values of resistors R27 and R29 (figure 2). Resistor values should be 976 ohms for R27 and 3090 ohms for R29. If values are different, replace R27 and R29 with proper value resistors which are part of AC-3814 kits. Clean flux from circuit card after soldering.
i. Perform the following passband tuning oscillator alignment for the 3-kHz filter. (Refer to figure 2.)
   (1) Place A4 card partially into card cage, raise optional filter card if necessary, and reconnect all connectors.
   (2) Set front panel SELECTIVITY BW switch to 2.2 and MODE to USB.
   (3) Turn POWER switch on and set tuning knob to convenient frequency for receiver operation check. Vary PBT control and check for proper operation.
   (4) Connect a wattmeter and 50-ohm load to antenna jack.
   (5) Connect an audio oscillator to line AUD IN jack on chassis rear.
   (6) Locate junction of R1 and C9 on A4 card and connect a frequency counter to this point.
   (7) Set MODE switch to CW, MIC/CARRIER control fully counterclockwise, and push in MOX pushbutton switch.
   (8) Adjust potentiometer R31 on A4 card for a frequency of 6.7100 MHz ±10 Hz.
   (9) Set MODE switch to USB and adjust R28 for 6.7120 MHz ±100 Hz.
   (10) Set MODE switch to LSB and adjust R34 for 6.7080 MHz ±100 Hz.
   (11) Unkey exciter (depress MOX switch) and turn POWER switch off. Remove frequency counter connection from R1/C9 junction.
   (12) Carefully push A4 and optional filter cards down into card cage.
   (13) Set MODE switch to LSB, POWER to on and frequency to 7.0000 MHz.
   (14) Set audio oscillator frequency to 1000 Hz and output to 5 millivolts.
   (15) Push MOX switch in and carefully adjust MIC/CARRIER control for 80 watts rf output. Without changing MIC/CARRIER or audio oscillator level adjustments, change oscillator frequency to 300 Hz.
   (16) Adjust potentiometer R34 (LSB adjust) on A4 card to obtain 25 watts output. This sets response at 300 Hz down 5 dB. Slowly increase the audio oscillator frequency from 300 to 2400 Hz. Not more than 5 dB variation in rf output should be noted.
   (17) Unkey exciter (set MOX switch to output position) and set MODE switch to USB.
   (18) Repeat steps (14) and (15).
   (19) Adjust potentiometer R28 (USB adjust) on A4 card to obtain 25 watts output. This sets response at 300 Hz down 5 dB. Slowly increase the audio oscillator frequency from 300 to 2400 Hz. Not more than 5 dB variation in rf output should be noted.
   (20) Unkey exciter (set MOX switch to out position) and disconnect all test equipment.
j. Reinstall passband tuning circuit card into card cage.
k. Reinstall card cage and dust covers.

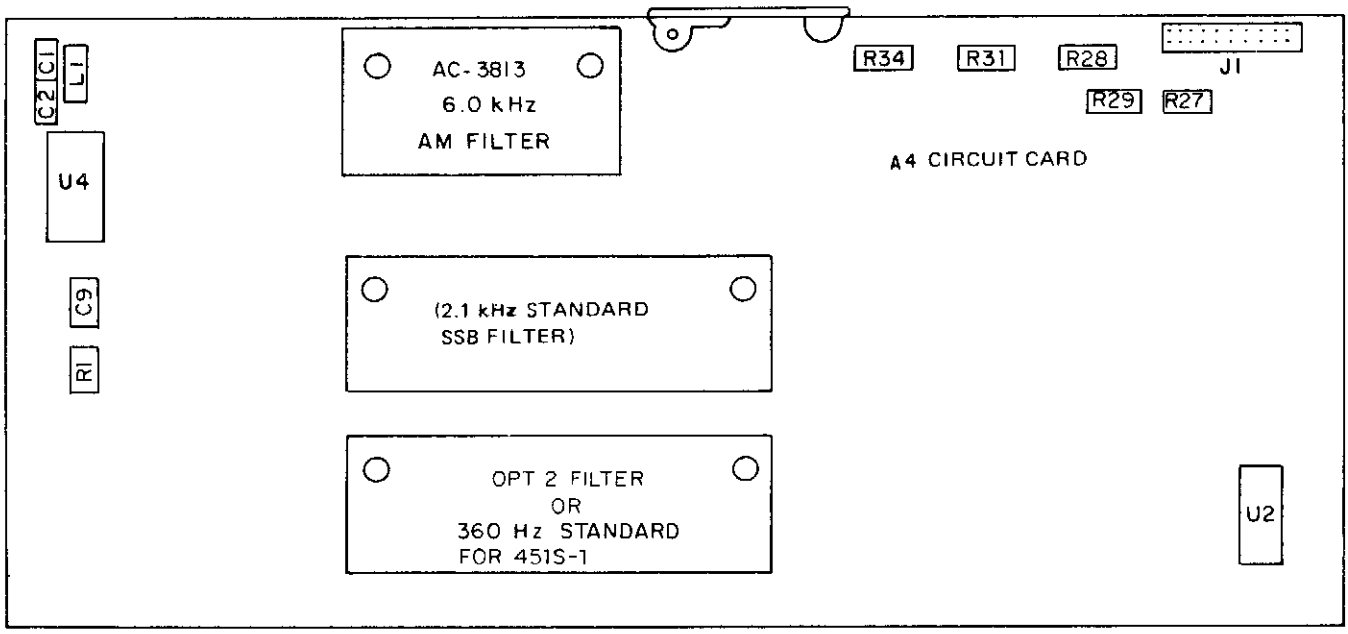
3. PARTS LIST

The following table lists the parts in the AC-3810, AC-3811, AC-3812, AC-3813, and AC-3814 filter kits.

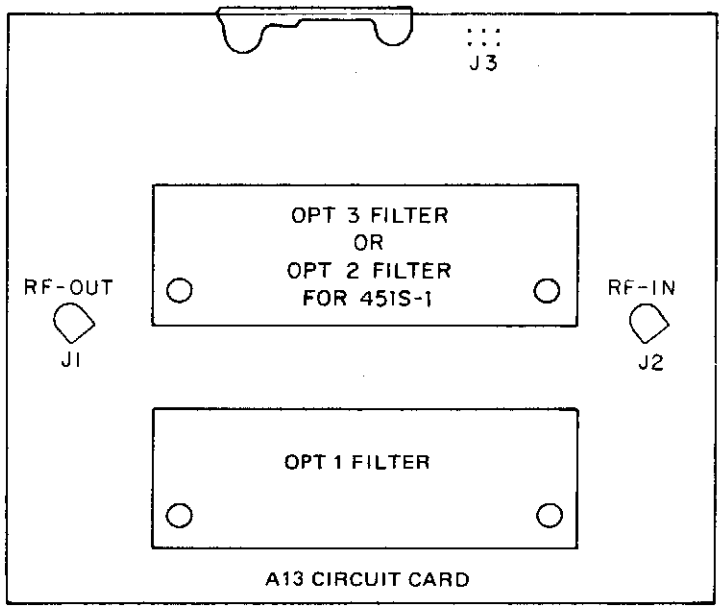
AC-3810 QTY	AC-3811 QTY	AC-3812 QTY	AC-3813 QTY	AC-3814 QTY	DESCRIPTION	COLLINS PART NUMBER
1					360-Hz bandpass filter	293-1337-040
	1				140-Hz bandpass filter	293-1337-050
		1			1.7-kHz bandpass filter	293-1337-020
			1		6-kHz bandpass filter	293-1337-030
				1	3-kHz bandpass filter	293-1337-060
2	2	2	2	2	Lockwasher, 0.112 diameter	310-0095-000
4	4	4	4	4	Washer, mica	302-0640-070
2	2	2	2	2	Washer, flat, 0.112 diameter	310-0054-000
2	2	2	2	2	Nut, hex, 0.112 x 40	313-0051-000
				1	Resistor, 976 ohms	705-3600-960
				1	Resistor, 3090 ohms	705-3605-230



Transceiver Card Cage
Figure 1

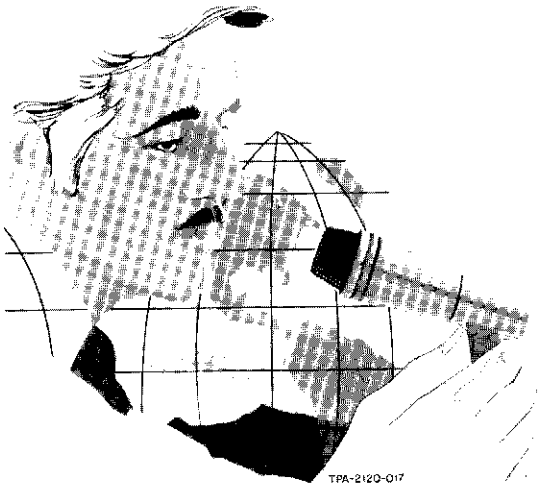


Passband Tuning, Card A4 (CPN 638-6912-001, -002)
Figure 2



Passband Tuning Option, Card A13 (CPN 638-6914-001)
Figure 3

Collins Telecommunications Products Division/Rockwell International
Cedar Rapids, Iowa 52498



Rockwell International

Collins AC-3821, AC-3822, and AC-3823 Transceiver-to-Coupler RF Cables

HF accessories

1. DESCRIPTION

The AC-3821, AC-3822, and AC-3823 Transceiver-to-Coupler RF Cables, part numbers 651-7768-XXX, 651-7769-XXX, and 651-7770-XXX, respectively, are rf cables to interconnect between a HF-281, HF-282, KWM-380 or HF-380 Transceiver and its associated antenna or antenna coupler. The AC-3821 consists of type RG-58C rf coaxial cable with type PL-259, uhf series, connectors attached. The AC-3822 consists of type RG-213 rf coaxial cable with type PL-259, uhf series, connectors attached. The AC-3823 consists of heliax low-loss rf coaxial cable with uhf series connectors attached. The AC-3821 is available in lengths from 1 to 20 metres (3 to 66 ft). The AC-3822 is available in lengths from 10 to 60 metres (33 to 200 ft). The AC-3823 is available in lengths from 60 to 120 metres (200 to 400 ft). Refer to table 1.

Table 1. Cable Length to Part Numbers.

LENGTH	AC-3821	AC-3822	AC-3823
M/FT	651-7768-XXX	651-7769-XXX	651-7770-XXX
1/3.3	001		
3/10	002		
10/33	003	001	
20/66	004	002	
30/100		003	
40/131		004	
50/164		005	
60/200		006	001
70/230			002
80/263			003
90/300			004
100/328			005
110/361			006
120/400			007

Note

Select length desired, then replace XXX of part number of type cable with corresponding digits shown. Example: 30 metres of AC-3822 cable is part number 651-7769-003.

2. INSTALLATION

Perform the following steps for the installation of the cables.

a. Use the shortest length of cable practical for the installation.
b. Install the cable in place between the transceiver and associated antenna coupler.

Note

It is suggested for safety that a lightning arrestor be installed in the cable, where the cable enters a building. The AC-2818 Lightning Arrestor, part number 622-3561-001, and AC-2819 Grounding Kit, part number 622-3562-001, are recommended for this application.

c. Secure the cable so there is no mechanical stress on the connectors.
d. Connect the cable connectors to the respective rf connectors on the transceivers and coupler.

3. PARTS LIST

All cable assemblies are supplied with the connectors attached. If replacement of a connector is required, refer to appropriate parts list (table 2, 3, or 4) for connector part number and then to appropriate figure (figure 1, 2, or 3) for installation of the connector.

Table 2. AC-3821 Replacement Parts.

DESCRIPTION	PART NUMBER
Connector PL-259 Adapter UG-175/U RG-58C coaxial cable	357-9014-000 357-7105-000 425-0042-000*

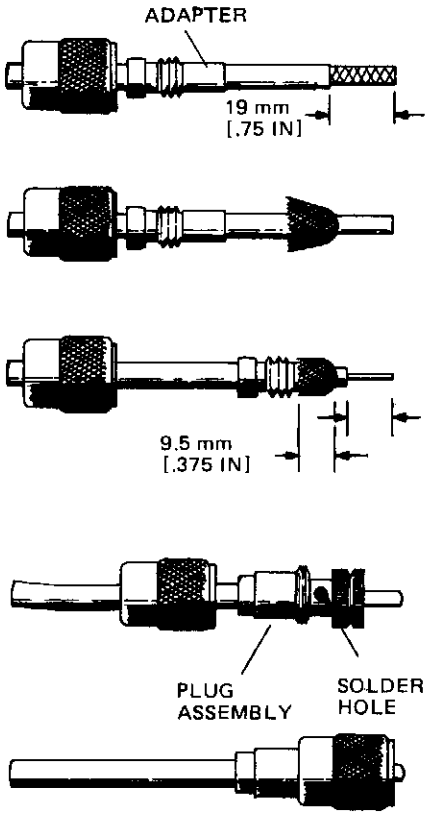
Table 3. AC-3822 Replacement Parts.

DESCRIPTION	PART NUMBER
Connector PL-259 RG-213 coaxial cable	357-9014-000 425-0952-000*

Table 4. AC-3823 Replacement Parts.

DESCRIPTION	PART NUMBER
Connector Andrews L44P Heliax coaxial cable	(357-0086-070) 425-0232-030*

*When ordering cable, specify length required.



1. CUT END OF CABLE AND REMOVE **19 mm** [.75 IN] OF OUTER JACKET. BE CAREFUL TO NOT NICK BRAID. SLIDE COUPLING RING AND ADAPTER ON CABLE.

2. FAN BRAID SLIGHTLY AND FOLD BACK OVER CABLE.

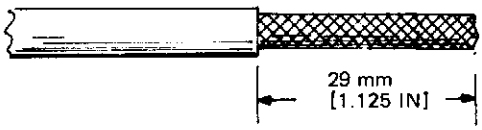
3. **POSITION** ADAPTER TO END OF OUTER JACKET AND PRESS BRAID DOWN OVER BODY OF ADAPTER. TRIM BRAID TO 9.5 mm [.375 IN.]. TRIM INNER DIELECTRIC TO EXPOSE 16 mm [.625 IN] OF CENTER CONDUCTOR. TIN EXPOSED CONDUCTOR.

4. SCREW PLUG ASSEMBLY ONTO ADAPTER. SOLDER BRAID TO SHELL THROUGH SOLDER HOLES. SOLDER CONDUCTOR TO CENTER CONTACT THROUGH SOLDER CUP.

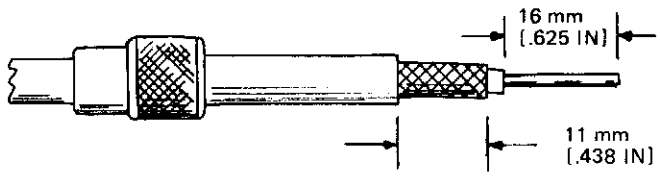
5. SCREW COUPLING RING ONTO PLUG ASSEMBLY.

TPA-0210-011

Connector Attached to RG-58C Cable
Figure 1



1. REMOVE 29 mm [1.125IN] OF OUTER JACKET. BE CAREFUL TO NOT NICK BRAID.



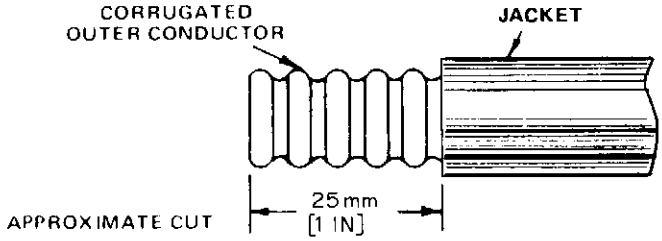
2. TRIM BRAID TO 11 mm [.438 IN] TRIM INNER DIELECTRIC TO EXPOSE 16 mm [.625 IN]OF CENTER CONDUCTOR. SLIDE COUPLING RING ON CABLE. TIN EXPOSED CONDUCTOR.

3. SCREW CONNECTOR BODY ONTO CABLE. SOLDER BRAID TO SHELL THROUGH SOLDER HOLES. SOLDER CONDUCTOR TO CENTER CONTACT.

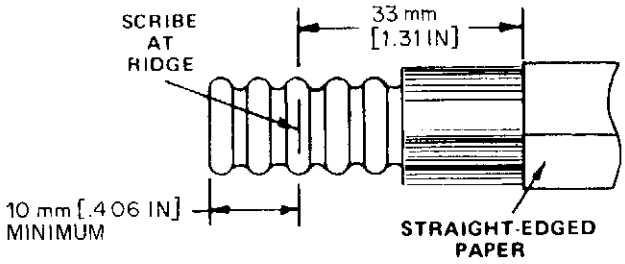
4. SCREW COUPLING RING ONTO PLUG ASSEMBLY.

TPA-1120-011

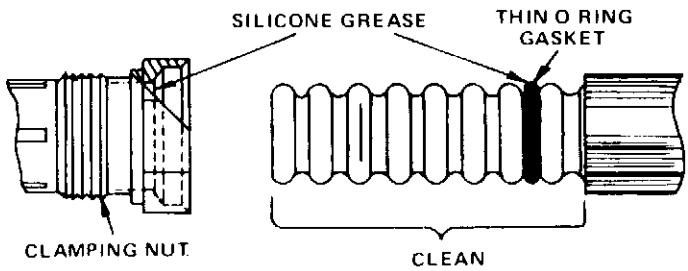
Connector Attached to RG-213 Cable
Figure 2



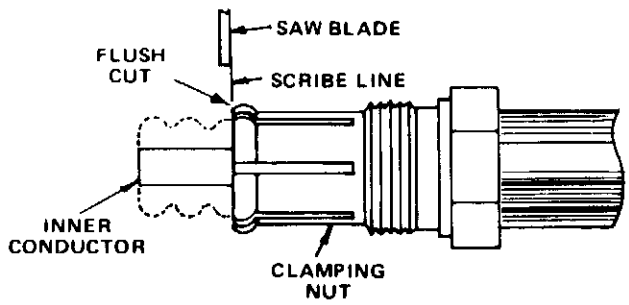
1. PREPARE CABLE. END OF CABLE MUST BE STRAIGHT FOR AT LEAST 254 mm [10 IN]. REMOVE JACKET TO APPROXIMATE DIMENSION SHOWN. USE KNIFE. DEBURR SHARP END OF CUT OUTER CONDUCTOR.



2. MAKE SECOND JACKETING CUT. SCRIBE LINE ON RIDGE OF EXPOSED CORRUGATED OUTER CONDUCTOR LINE MUST BE AT LEAST 10 mm [.406 IN] FROM END OF CABLE. REMOVE JACKET TO DIMENSION SHOWN USING STRAIGHT-EDGED PIECE OF HEAVY PAPER WRAPPED AROUND CABLE TO GUIDE CUT.



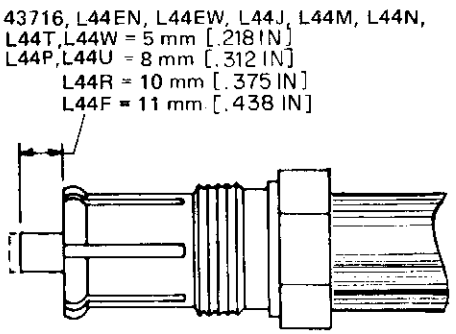
3. INSTALL GASKET. CLEAN OUTER CONDUCTOR WITH SOLVENT. ADD THIN O RING GASKET TO SECOND FULLY EXPOSED CORRUGATION GROOVE FROM JACKET. APPLY THIN COATING OF SILICONE GREASE TO OUTER SURFACE OF GASKET AND GASKET LEAD CHAMFER IN CLAMPING NUT USING FINGER TIP.



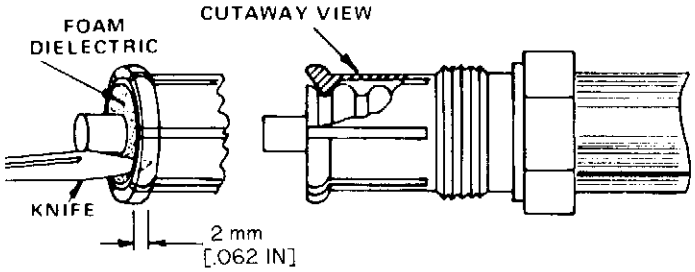
4. ADD CLAMPING NUT AND CUT CABLE. PUSH CLAMPING NUT ON CABLE. USE TWISTING MOTION TO ASSURE SPRING CONTACTS SNAP INTO GROOVE. REFER TO CUTAWAY VIEW IN STEP 6. GRIP CLAMPING NUT WITH ONE HAND AND ALIGN EDGE WITH SCRIBED LINE, THEN CAREFULLY CUT OUTER CONDUCTOR AND FOAM DIELECTRIC MATERIAL FLUSH WITH END OF CLAMPING NUT EXPOSING INNER CONDUCTOR. MAKE SHALLOW CUT; DO NOT DAMAGE INNER CONDUCTOR. USE HACKSAW WITH FINE-TOOTHED BLADE OR MODEL MAKER'S SAW.

TPA-5872-021

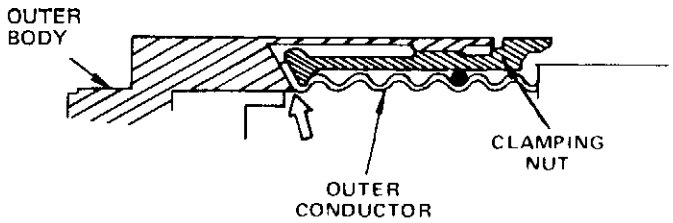
Connector Attached to Heliax and Low-Loss RF Cable
Figure 3 (Sheet 1 of 2)



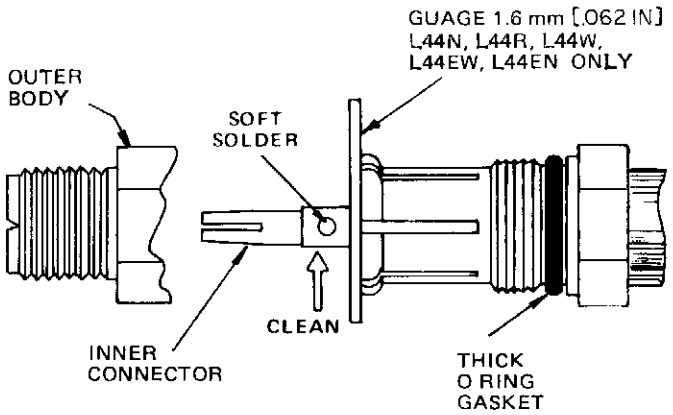
5. TRIM INNER CONDUCTOR. CUT INNER CONDUCTOR TO LENGTH SHOWN. USE FILE TO DEBURR CUT END OF INNER CONDUCTOR.



6. DETACH FOAM DIELECTRIC. SEPARATE ALL FOAM DIELECTRIC COMPLETELY FROM EDGE OF OUTER CONDUCTOR TO ASSURE GOOD ELECTRICAL CONTACT WITH OUTER BODY. REFER TO ENLARGED CUTAWAY VIEW IN STEP 7 WHICH ILLUSTRATES POSITIVE GRIP OF OUTER CONDUCTOR BETWEEN CLAMPING NUT AND OUTER BODY. USE TIP OF KNIFE AND WORK AROUND ENTIRE CIRCUMFERENCE. REMOVE BURRS FROM INSIDE EDGE OF OUTER CONDUCTOR WITH KNIFE. USE WIRE BRUSH TO REMOVE COPPER PARTICLES FROM FOAM.



7. INSPECT CONTACT SURFACE. THREAD OUTER BODY TO CLAMPING NUT AND TIGHTEN WITH WRENCHES. TURN OUTER BODY ONLY; DO NOT TURN CLAMPING NUT. DISASSEMBLE CONNECTION TO INSPECT FOR GOOD METAL-TO-METAL CONTACT. CUT FOAM DIELECTRIC FLUSH WITH EDGE OF FLARED OUTER CONDUCTOR.



8. ADD INNER CONNECTOR AND OUTER BODY. CLEAN INNER CONDUCTOR. FOR ALL CONNECTORS EXCEPT L44F, SLIP INNER CONNECTOR ONTO INNER CONDUCTOR. USE GUAGE AS INDICATED. SOLDER CONNECTOR TO CONDUCTOR WHILE PRESSING CONNECTOR AGAINST GUAGE. COOL WITH DAMP CLOTH THEN CLEAN WITH GARNET CLOTH. PLACE THICK O RING GASKET INTO GROOVE IN CLAMPING NUT. ADD THIN COATING OF SILICONE GREASE TO OUTER SURFACE OF GASKET. FOR ALL CONNECTORS, THREAD OUTER BODY ONTO CLAMPING NUT AND TIGHTEN. FOR L44F, ADD INNER CONNECTOR AND SOLDER PER ABOVE.

TPA-5872-021

Connector Attached to Heliax and Low-Loss RF Cable
Figure 3 (Sheet 2)

Collins Telecommunications Products Divison/Rockwell International
Cedar Rapids, Iowa 52498

Rockwell International

HF accessories

Collins AC-2801 Rack Mount Kit

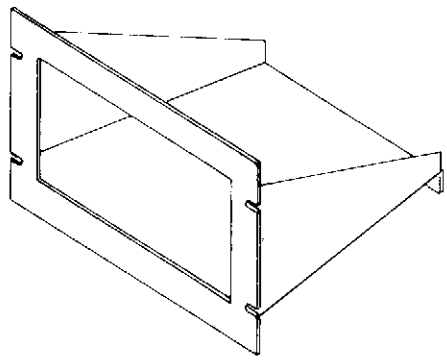
1. DESCRIPTION

The AC-2801 Rack Mount Kit consists of a rack mount, shown in figure 1, and the attaching hardware listed in table 1. Where large fixed installations are required, the AC-2801 may be used to mount the HF-281, HF-282, HF-380, or KWM-380 Transceivers or 451S-1 Receiver in a cabinet that has 483-mm (19-in) EIA standard equipment racks.

2. INSTALLATION

To install the transceiver or receiver in the rack mount, perform the following steps:

a. Remove the four screws on the bottom of the transceiver or receiver that secure the dust cover to the unit, and slide the dust cover off the unit.
b. Remove the four feet from the dust cover. Note that the screwheads are inside the dust cover. If the feet are to be reinstalled at a future time, the screwheads should be located inside the dust cover. This is done to prevent any of the chassis wiring from catching on the mounting hardware for the feet.
c. Slide the dust cover onto the unit and secure with two of the original screws used to secure the dust cover to the unit. Use the two screw holes nearest the front of the unit.
d. Slide the transceiver or receiver into the rack mount and secure the unit to the mount using the two sets of screws and washers at the holes at the bottom rear of the mount.



AC-2801 Rack Mount
Figure 1

Table 1. AC-2801 Attaching Hardware.

QTY	DESCRIPTION	PART NUMBER
1	Shelf, rack mount	641-6852-001
2	Screw	330-1767-230
2	Lockwasher	310-0282-000
2	Washer, flat	310-0779-050

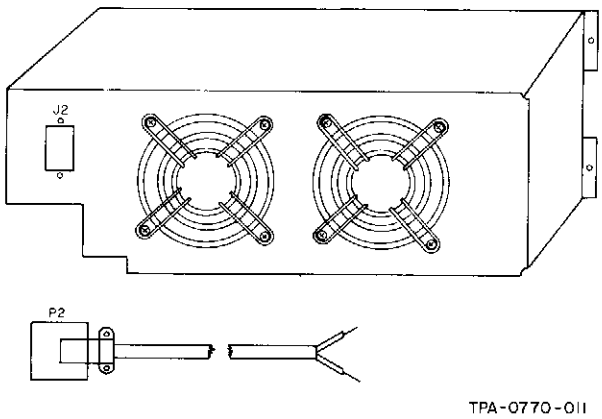
Rockwell International

HF accessories

Collins AC-2808 Blower Kit

1. DESCRIPTION

The AC-2808 Blower Kit, Collins part number 622-3547-001, is shown in figure 1. The blower kit consists of two blower motors mounted in a blower assembly and a blower assembly power cord. (A connector is purposely left off one end.)



AC-2808 Blower Kit
Figure 1

2. INSTALLATION

To install the blower kit, the blower assembly is mounted to the heat sink of the HF-281, HF-282, HF-380, or KWM-380 Transceiver and the open wires on the power cord are added to P1 on the back of the transceiver.

To mount the blower assembly, perform the following:

a. Remove four screws on the bottom of the transceiver that secure the dust cover to the unit. Slide dust cover off the unit.
b. Position transceiver so the screws that mount the heat sink to the chassis bracket are visible.
c. Remove top and middle screws and washers that secure the left-hand side of the heat sink to the chassis bracket. Remove top and bottom screws and washers that secure the right-hand side of the heat sink to the chassis bracket.
d. Attach blower assembly to the unit using the four screws and washers that were removed in step c.

To connect the power cable, perform the following:

a. Disconnect P1 located at the back of the transceiver.
b. Remove cover from P1 and connect the brown lead in the blower assembly power cable to P1-7 (refer to figure 2).
c. Connect the blue lead in the blower assembly power cable to P1-12.
d. Replace the P1 cover and connect the modified P1 to J1 on the transceiver.
e. Connect P2 on the blower assembly power cable to J2 on the blower assembly.

To achieve high average power operation, perform all the following steps for the HF-281. For the HF-282, perform only e through h and n. For the HF-380 or KWM-380, perform steps o through q.

a. Refer to figure 3 and remove the top cover of the low-pass filter.
b. Set the HF-281/282 to channel 1 and note the position of the rotor tab on switch S1. The rotor tab should be making contact with the stator contact number 1. Switch S1 is the rotor switch in the low-pass filter assembly nearest the front of the unit.
c. 1. For units having a black rubber flex coupling, loown the four setscrews on the flex coupling. (Refer to figure 3, detail B.)

2. For units with a plastic/metal flex coupling, skip step d. (The flex coupling will separate when pulled apart.)

d. Slide the flex coupling toward the back of the transceiver to disengage the two shafts.

e. Refer to figure 3, detail A, and remove two front panel mounting screws.

f. Pivot front panel down to gain access to interface card A1A1.

g. Locate the AVG ALC A and B holes on the interface card. Solder a jumper wire between holes A and B.

h. 1. Place front panel in the normal position and replace the two front panel mounting screws.
2. For the HF-282, skip to step n.

i. On units with the black rubber flex coupling, slide the flex coupling forward to connect both parts of the switch shaft. (The plastic/metal coupling should have reconnected properly in step h.)

j. Recheck the alignment of S1 rotor tab and contact number 1 on the stator part of the switch. The rotor tab should be positioned exactly in the center of the stator contacts.

k. On the black rubber flex coupling, the two setscrews that make contact with the round part of the shaft should be tightened first. Next, tighten the two setscrews that make contact with the flat part of the shaft.

l. Rotate the switch shaft to make sure the rotor tab makes contact with stator contacts 1 through 6.

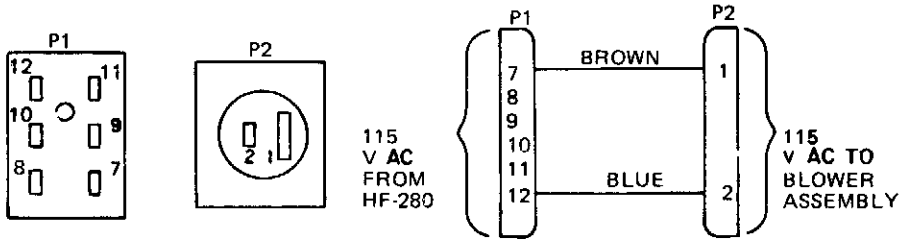
m. Replace the top cover on the low-pass filter assembly.

n. Replace transceiver dust cover.

o. Locate ALC inhibit terminals on receiver-exciter A3. Terminals are adjacent to J16-2 and J16-4. (Refer to figure 4.)

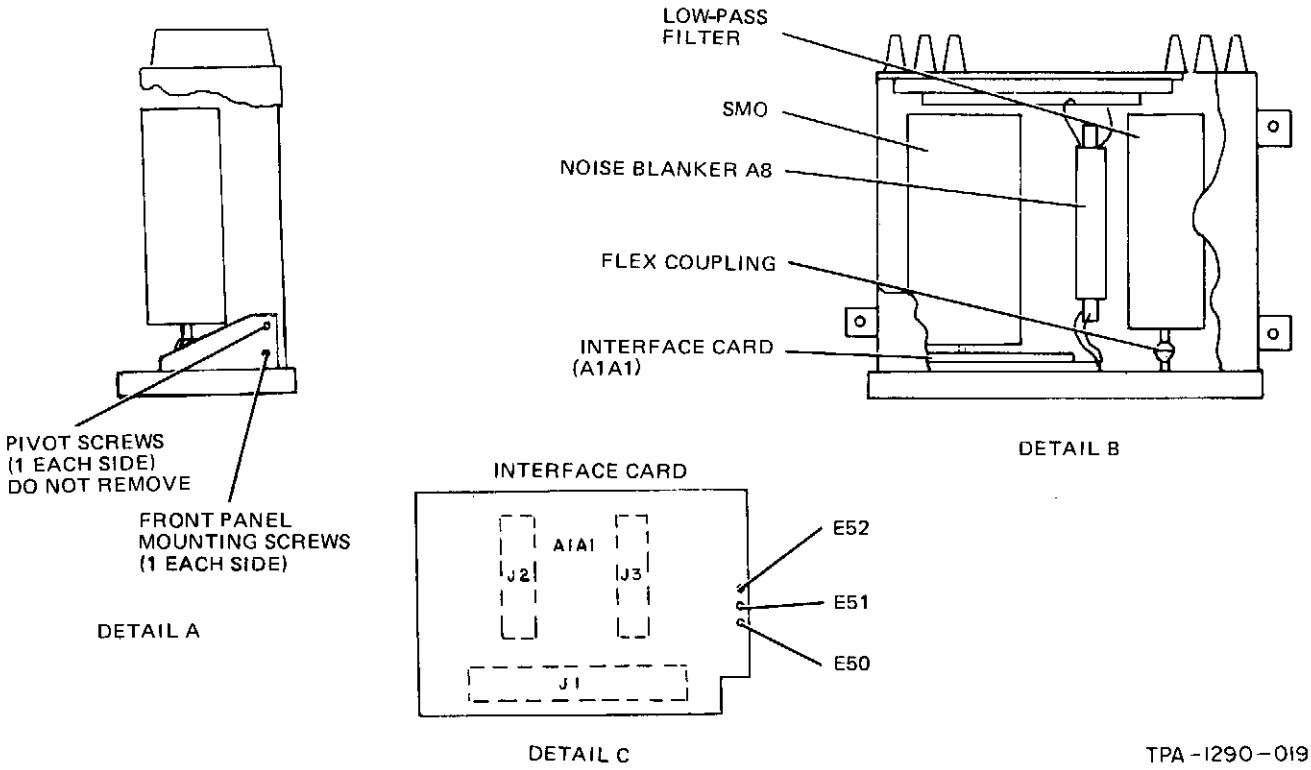
p. Solder jumper wire between terminals.

q. Replace transceiver dust cover.

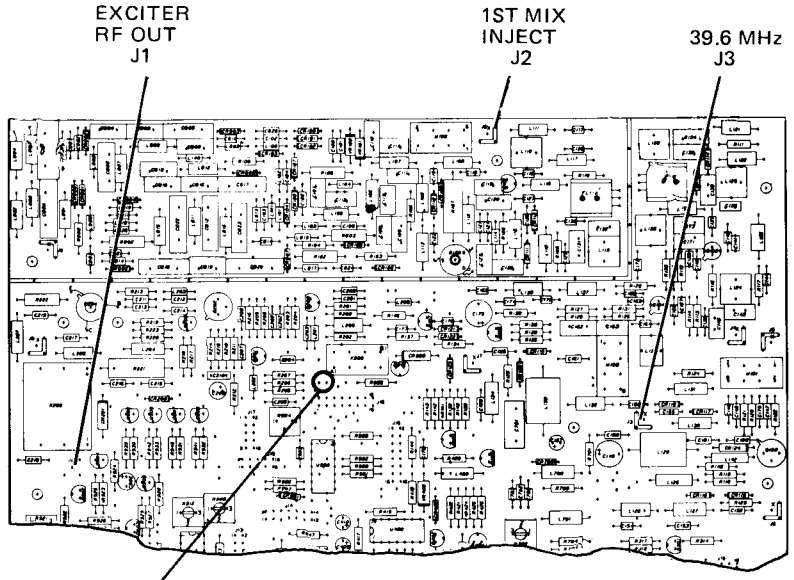


TPA-0771-011

Blower Assembly Power Cable
Figure 2



HF-281/HF-282 Component Locations
Figure 3



ALTHOUGH SOME COMPONENT LOCATIONS MAY DIFFER DUE TO CIRCUIT BOARD CHANGES, LOCATION OF ALC INHIBIT TERMINALS IS AS SHOWN HERE.

HF-380/KWM-380 ALC Inhibit Terminals on Receiver-Exciter
Figure 4

Collins Telecommunications Products Division/Rockwell International
Cedar Rapids, Iowa 52498

523-0769661-002218 8-1-80 Printed in USA

Rockwell International

HF accessories

Collins AC-2810 and AC-2811 Vertical Antenna Kits

1. DESCRIPTION

The AC-2810 and AC2811 Vertical Antenna Kits, Collins part number 622-3553-001 and 622-3554-001, respectively, are fixed vertical antennas.

The AC-2810 is a 4.9-m (16-ft) vertical antenna that will tune down to 2.0 MHz. Included in the kit is a base insulator assembly, three antenna sections, clamps, and a guy ring with nonconductive rope for single-point guying.

The AC-2811 is an 11-m (36-ft) vertical antenna that will tune down to 1.6 MHz. Included in the kit is a base insulator assembly, seven antenna sections, clamps, and two guy rings with nonconductive rope for two-point guying.

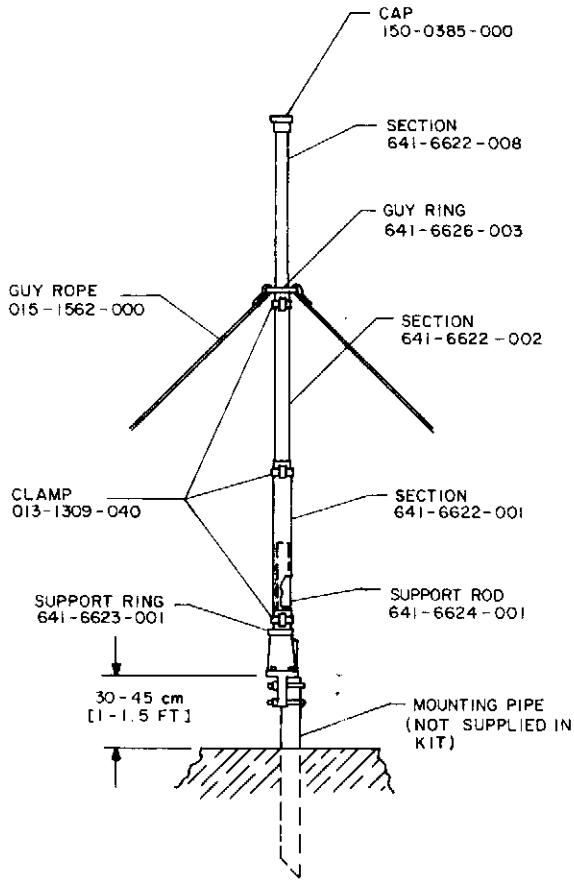
Also required, but not supplied with either kit, are tie points for securing the guy ropes to the mounting surface and a support to which the base insulator assembly will be attached.

For a roof top installation, a ground-plane radial system is required. The AC-2820 Ground Radial Kit (Collins part number 622-3563-001) is recommended. This kit is also recommended for use with antennas installed on the ground. If the radial system is not used for ground installations, some type of grounding system must be used. The AC-2819 Grounding Kit (Collins part number 622-3562-001) is recommended for this use.

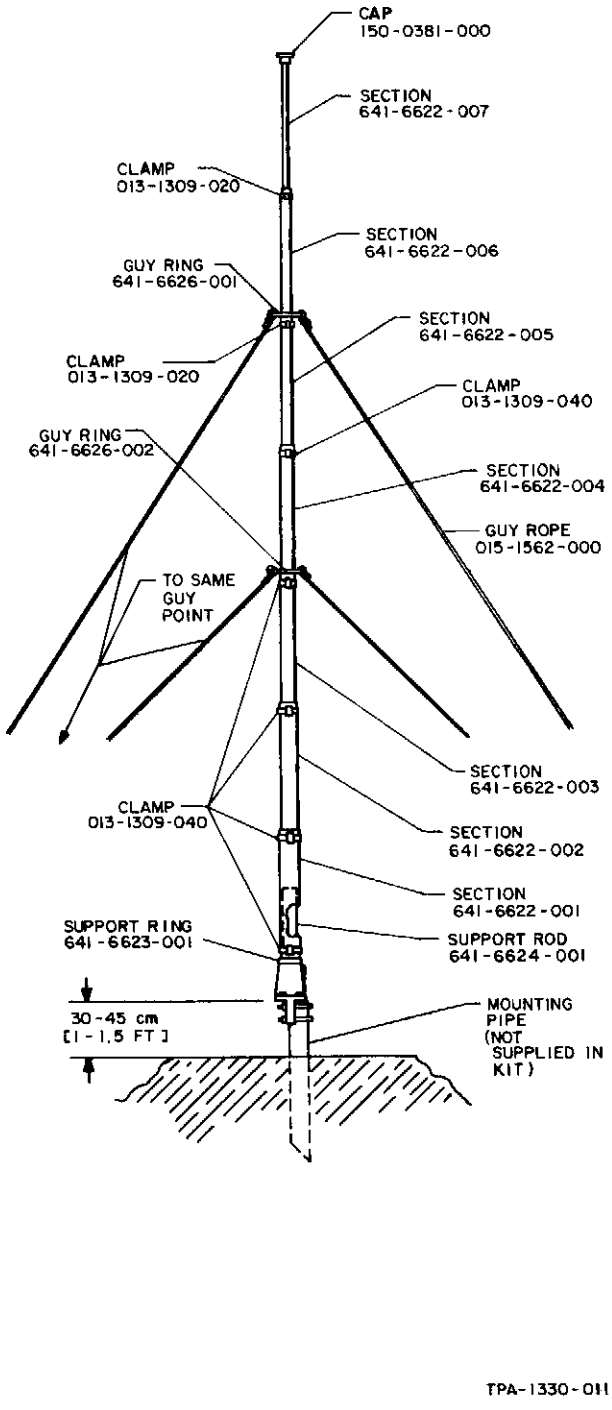
2. ANTENNA ASSEMBLY

Refer to figure 1 or 2, as applicable, and assemble the antenna according to the following.

a. Position insulating portion of base assembly on base assembly casting. Place two short screws through insulator and into tapped holes in casting. Four remaining screws, lockwashers, and nuts secure insulator to casting at edges.



Typical Ground Installation of AC-2810
Figure 1



Typical Ground Installation of AC-2811
Figure 2

b. Slide support rod into insulator, making sure it rests against bottom. Secure rod to insulator with two setscrews through tapped holes in side of insulator.
c. Place two U-bolts through holes in base casting. Orient bolt so U is next to grooved U-section of casting. Start, but do not tighten, four lockwashers and nuts on U-bolts.
d. Place support ring over support rod. Slide largest-diameter section of antenna onto support rod and against support ring.
e. Slide two of larger clamps onto antenna section. Locate one clamp at support-ring end of section and tighten.
f. Slide next smaller antenna section into end of previous section to depth of 305 mm (1 ft). Secure in place by tightening clamp on end of larger section.
g. 1. Continue assembling antenna sections in this manner. Each section extends into previous section to depth of 305 mm (1 ft). Final assembled length of AC-2810 should be 4.9 m (16 ft), measured from top of cast portion of base assembly to top end of last antenna section. Length of AC-2811 should be 11 m (36 ft) measured between same two points.
   2. For AC-2810, place guy ring on top of second section from bottom.
   3. For AC-2811, place one guy ring on top of third section and one on top of fifth section from bottom.
h. Press cap into place over end of top section.

3. INSTALLATION

WARNING

Be exceedingly careful when erecting antennas. Do not permit — under any circumstances — the antenna, its supports or guys, or any other related wires or cables to contact electrical power wires. Death could result!

Do not erect or work on or near antennas when a thunderstorm is in the vicinity. Antennas are often targets for direct lightning strikes. Contact with, or proximity to an antenna during a lightning strike can cause severe electrical burns or death.

Do not touch antenna or coupler-to-antenna rf feedline when transmitter is keyed. Dangerous rf burns can result.

Where possible, the antenna should be located in the open, free of electrical wires, buildings, and heavily wooded areas.

Install the base mounting support. For ground-mounted antennas, this support can be a pipe approximately 40 mm (1.5 in) in diameter and approximately 1 m (3.3 ft) long driven into the ground approximately 0.8 m (2.5 ft). For roof-mounted antennas, a mounting support suitable for the individual location will have to be fabricated.

Install the three guy rope tie-points 120 degrees apart and approximately 3 m (12 ft) from the base mounting support for the AC-2810, or approximately 8.23 m (27 ft) from the support for the AC-2811.

Note

Guy lengths may vary with the individual installation. Make any length adjustments necessary from the nominal lengths given in the following paragraphs.

For the AC-2810, cut the guy rope into three lengths approximately 6.1 m (20 ft) long.

For the AC-2811, cut the guy rope into six lengths; three approximately 10.4 m (34 ft) and three approximately 12.2 m (40 ft) long.

Secure one end of each of the guy ropes to an opening in the guy ring. (The longer ropes go to the AC-2811 top guy.)

With assistance, carefully raise the antenna into position and set the base insulator assembly into place on the mounting post.

Secure the guys to the tie points. Do not overstress the antenna by excessive tightening of the guy ropes.

Secure the base assembly to the mounting post by tightening the four nuts on the U-bolts.

Connect the rf feed line (from the antenna coupler) to the antenna by loosening the lower clamp, inserting the end of the feed line between the antenna section and the clamp, then retightening the clamp. Use not more than 0.3 m (1 ft) of rf feed line.

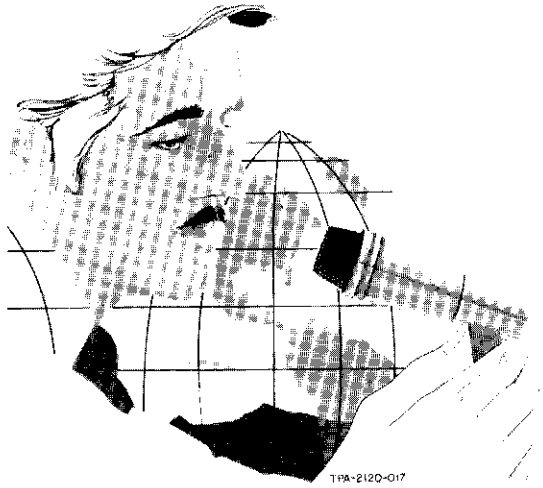
If the installation is on a roof, install radials and attach to the base assembly casting. (Refer to instructions with the AC-2820 Ground Radials Kit.) Connect the antenna base to the antenna coupler ground stud with as short a length of braided wire strap as practical.

If the installation is on the ground, a ground radial system is also recommended. If such a system is not used, as a minimum, install a grounding system adjacent to the antenna coupler and connect to the grounding system with a short section of braided wire strap. (Refer to instructions with the AC-2819 Grounding Kit.)

4. PARTS LIST

The following table lists parts in the AC-2810 and AC-2811 Vertical Antenna Kits.

QUANTITY		DESCRIPTION	COLLINS PART NUMBER
AC-2810	AC-2811		
1	1	Base assembly	013-1625-010
22.8 m (75 ft)	68.6 m (225 ft)	Guy rope	015-1562-000
1	1	Cap	150-0385-000
1	1	Support ring	641-6623-001
1	1	Support rod	641-6624-001
1		Guy ring	641-6626-003
	1	Guy ring	641-6626-002
	1	Guy ring	641-6626-001
3	5	Clamp	013-1309-040
	2	Clamp	013-1309-020
1	1	Antenna section	641-6622-001
1	1	Antenna section	641-6622-002
	1	Antenna section	641-6622-003
	1	Antenna section	641-6622-004
	1	Antenna section	641-6622-005
	1	Antenna section	641-6622-006
	1	Antenna section	641-6622-007
1		Antenna section	641-6622-008



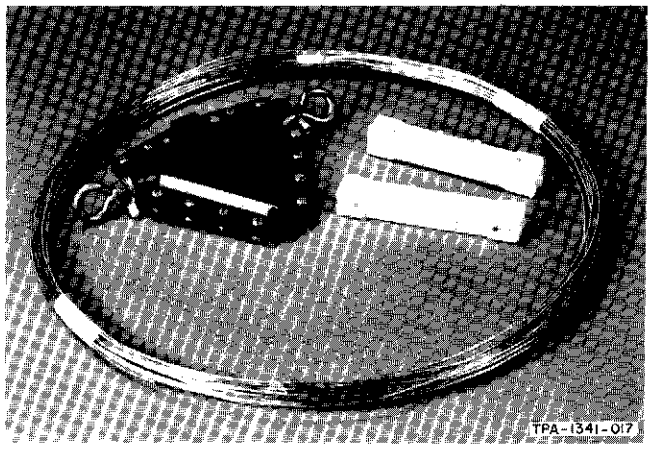
Rockwell International

HF accessories

Collins AC-2812 and AC-2813 Dipole Antenna Kits

1. DESCRIPTION

The AC-2812 and AC-2813 Dipole Antenna Kits, Collins part number 622-3555-001 and 622-3556-001, respectively, are used to construct resonant dipole antennas for HF-280, KWM-380, and HF-380 installations. A typical kit is shown in figure 1.



Dipole Antenna Kit
Figure 1

The selected operating frequency of the transceiver determines the length to which the kit wire is cut to form a dipole. A different dipole is required for each operating frequency. The AC-2817 antenna switch allows up to six dipoles, selected one at a time, to be connected to the transceiver.

The AC-2812 Dipole Antenna Kit, part number 622-3555-001, is used for frequencies from 1.6 to 30 MHz and includes 91.4 metres (300 feet) of number 14 AWG stranded copper wire, an antenna center feed insulator, and two ceramic end insulators.

The AC-2813 Dipole Antenna Kit, part number 622-3556-001, is used for frequencies from 3.2 to 30 MHz and includes 45.7 metres (150 feet) of number 14 AWG stranded copper wire, an antenna center feed insulator and two ceramic end insulators.

2. ASSEMBLY

Perform the following procedures for assembly of the dipole antenna.

a. Cut antenna wire to length required for transceiver operating frequency.

Note

Antenna length per side (ℓ) =

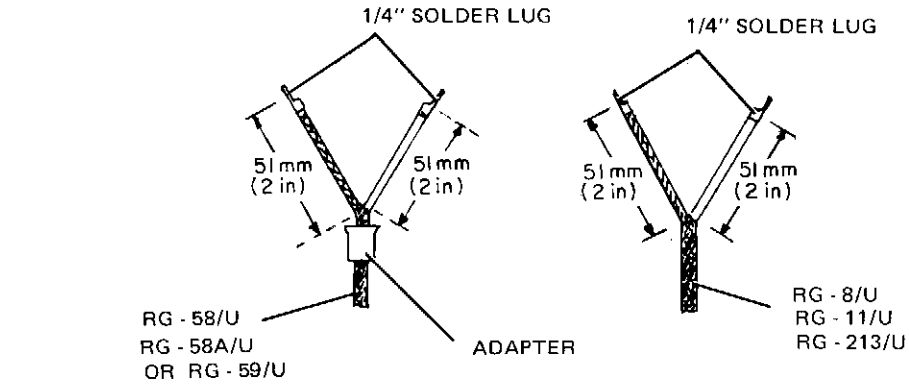
$$\frac{71.3}{\text{freq (in MHz)}} \text{ metres}$$

or

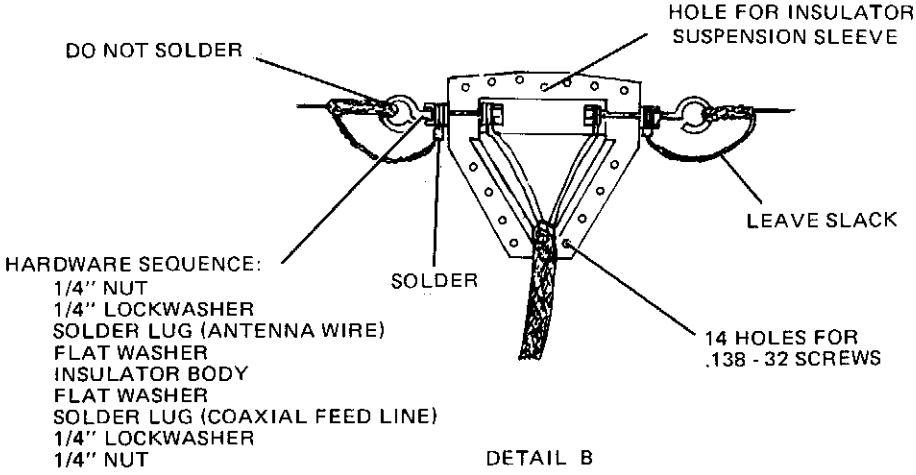
$$\frac{234}{\text{freq (in MHz)}} \text{ feet}$$

Allow enough extra wire at both ends to permit attaching to insulators. (See figure 2, detail B.)

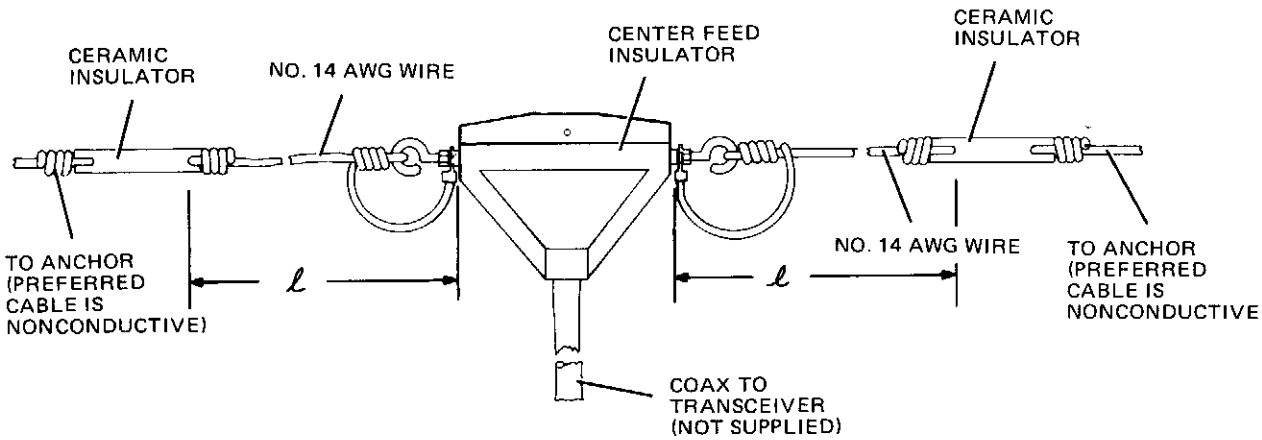
b. Cut and trim coaxial cable as shown in figure 2, detail A, and attach and solder lugs as indicated.



DETAIL A



DETAIL B



DETAIL C

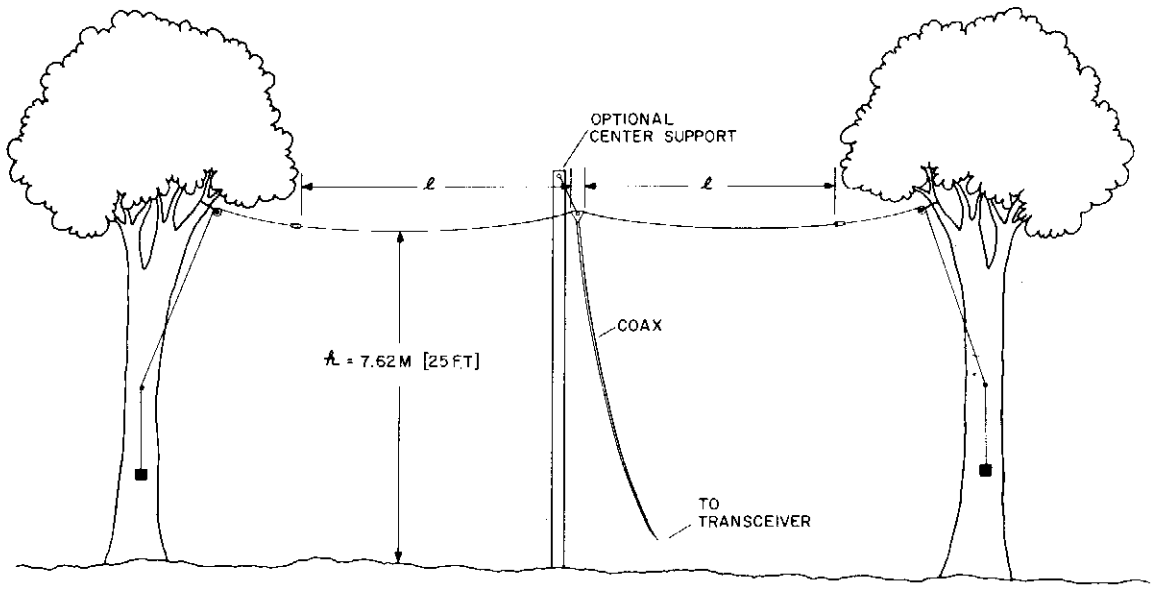
TPA-0784-019

Antenna Assembly Details
Figure 2

c. Attach antenna ends to each eyebolt leaving end long enough to allow attaching to insulator without tension, as shown in figure 2, detail B. Attach solder lugs to antenna wire and solder.
d. Assemble hardware to eyebolts in sequence shown in figure 2, detail B, and place in one half of the center-feed insulator body. Apply silicone grease, vaseline or a similar water-resistant coating to all mating surfaces.
e. Mate other half of center-feed insulator body to first half and secure using 0.138-32 machine screws and nuts.
f. Hold eyebolt and insulator body to prevent turning and tighten each external 1/4-inch nut firmly. Do not rotate eyebolt to tighten 1/4-inch nut.
g. Complete assembly of dipole antenna by attaching end insulators and support ropes, as shown in figure 2, detail C. (Support rope is not supplied with the kit. Use any nonconductive rope having sufficient strength to support the antenna.)

3. INSTALLATION

The height (h in figure 3) of the dipole above ground and the orientation (direction) determine the radiation pattern of the antenna. At dipole heights of 6.62 metres (25 ft) to 12.2 metres (40 ft), the AC-2812/AC-2813 provides short-range skywave communication at frequencies up to approximately 10 MHz. Operation at higher frequencies provides bidirectional azimuthal coverages (nulls off ends of wire) for ranges of approximately 4.83 km (300 mi) to 1,610 km (1000 mi). Refer to any reference book on hf antenna theory for more detailed information, for example, The A.R.R.L. Antenna Book published by the Amateur Radio Relay League; Newington, Connecticut, USA.



TPA-1124-018

Typical Antenna Installation
Figure 3

A typical dipole installation is shown in figure 3.

WARNING

Be exceedingly careful when erecting antennas. Do not permit — under any circumstances — the antenna, its supports or guys, or any other related wires or cables to contact electrical power wires. Death could result!

Do not erect or work on or near antennas when a thunderstorm is in the vicinity. Antennas are often targets for direct lightning strikes. Contact with or proximity to an antenna during a lightning strike can cause severe electrical burns or death.

Note

Care should be taken when installing the dipole to allow a certain amount of slack (sag) to exist. When installing a dipole whose length is greater than approximately 23 m (75 ft), a center support for the antenna should be used as shown in figure 3. This prevents the weight of the coaxial feedline from pulling the dipole to the ground.

If trees are used as supporting structures, be sure to take into consideration guy length changes due to tree sway in the wind. Provision should be made to keep the antenna wire taut during tree movement. This can be done with weighted guy ropes operating through pulleys attached to the trees.

4. PARTS LIST

The following table lists parts in the AC-2812 and AC-2813 Dipole Antenna Kits.

AC-2812 QTY	AC-2813 QTY	DESCRIPTION	PART NUMBER
91.4 m (300 ft)	45.7 m (150 ft)	Wire, stranded copper, #14 AWG (1.9 mm (0.075 in))	431-0697-010
2	2	Ceramic insulator	013-1619-010
1	1	Center insulator	013-1622-010

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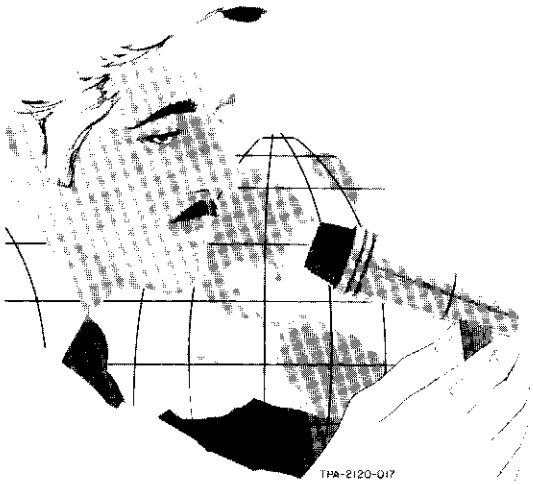


Rockwell International

HF accessories

Collins AC-2814 and AC-2815 Long-wire Antenna Kits

1. DESCRIPTION

The AC-2814 and AC-2815 Long-wire Antenna Kits, part numbers 622-3557-001 and 622-3558-001, respectively, make long-wire antennas for use at frequencies from 1.6 to 30 MHz. Included in the kits are 15.3 metres (50 ft) for the AC-2814, or 30.6 metres (100 ft) for the AC-2815 of number 14 AWG stranded copper wire, three ceramic insulators, and a solder lug.

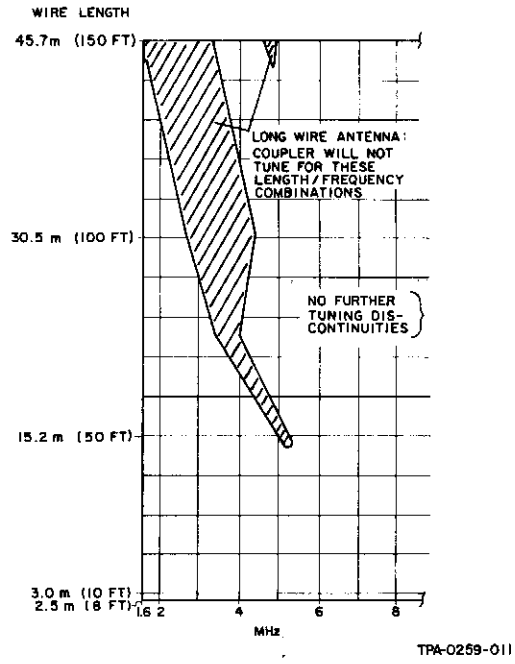
The CU-281, CU-282, or CU-380 Antenna Coupler (for up to 6 or up to 20 different frequencies, respectively) must be used with the long-wire antenna.

The longest length of wire that will tune all frequencies to be used should be erected. Figure 1 shows certain antenna length/frequency combinations that cannot be tuned with the CU-281, CU-282, or CU-380 Antenna Coupler.

2. PREPARATION

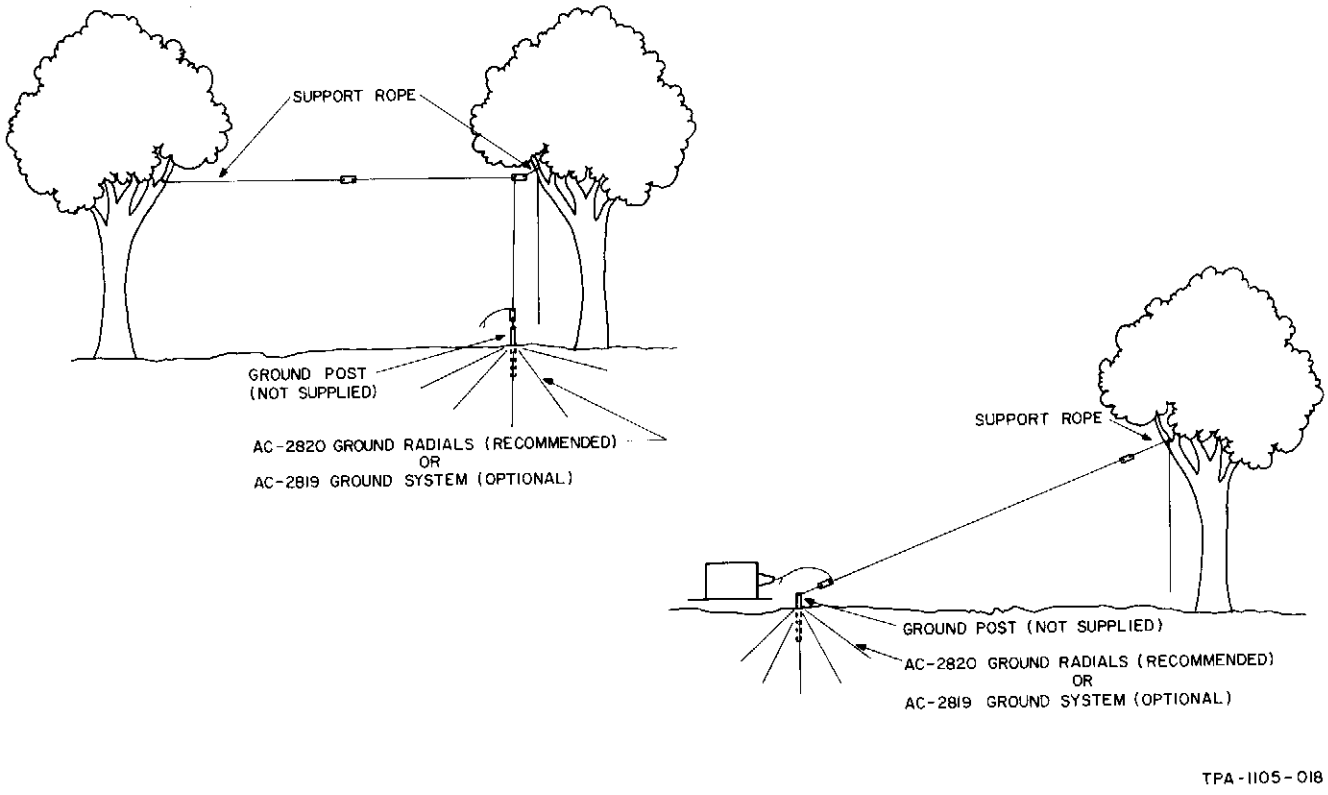
The AC-2814 or AC-2815 can be mounted in several different ways. Careful planning should be done prior to any installation. The most advantageous antenna orientation is one that allows the longest section to be mounted vertically. Other mounting options are shown in figure 2. Where possible, the antenna should be located in the open, free of electrical wires, buildings, and heavily wooded areas.

Operation of the AC-2814 or AC-2815 Long-wire Antennas is directly dependent on antenna coupler placement and the type of ground system used. The coupler should be mounted at ground level if at all possible.



Tuning "Holes" for Long-wire Antenna and CU-281 or CU-282 Antenna Coupler
Figure 1

Radiation patterns may vary between installations and frequencies used. This can cause direction of maximum signal strength to be different at different frequencies, using the same antenna. A further discussion of these effects can be found in any reference book covering hf antennas, for example, The A.R.R.L. Antenna Book published by the Amateur Radio Relay League; Newington, Connecticut, USA).



Optional Long-wire Antenna Mounting Orientations
Figure 2

3. ASSEMBLY

After determining the specific length (by reference to figure 1) and mounting arrangement, assemble the antenna as follows:

a. Using one insulator and the solder lug, construct the base end of the antenna as shown in figure 3, detail A.
b. Measure the length of antenna wire corresponding to the height of the next mounting point. Mount an insulator to the wire at this position, as shown in figure 3, detail B.
c. If a third insulator is required, due to the shape of the antenna, attach one end of the insulator to the antenna and the other end to a nonconductive supporting rope.

Figure 4 is a detailed diagram of the antenna, insulators, and supporting rope connections.

4. ANTENNA ERECTION

WARNING

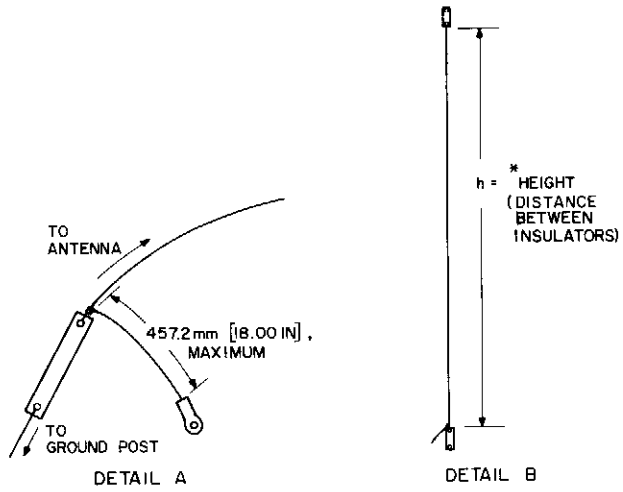
Be exceedingly careful when erecting antennas. Do not permit — under any circumstances — the antenna, its supports or guys, or any other related wires or cables to contact electrical power wires. Death could result!

Do not erect or work on or near antennas when a thunderstorm is in the vicinity. Antennas are often targets for direct lightning strikes. Contact with or proximity to an antenna during a lightning strike can cause severe electrical burns or death.

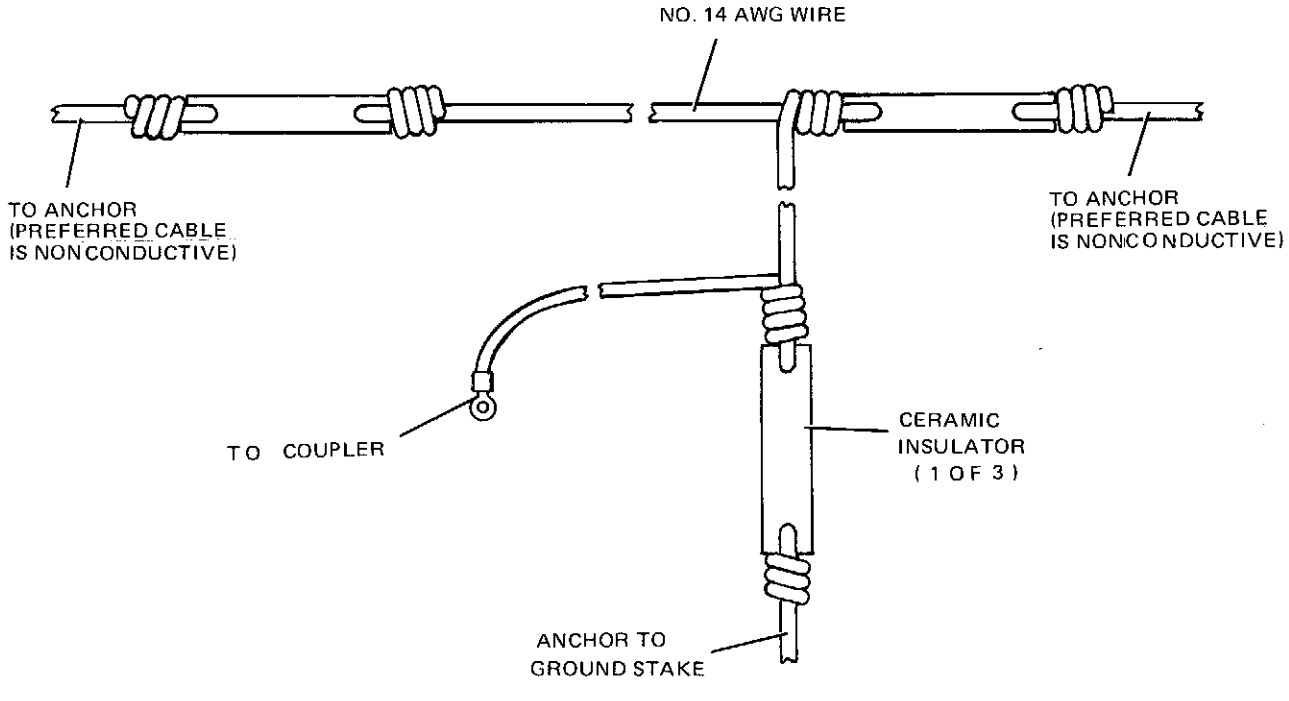
Secure the antenna base insulator to the ground. Extend the antenna upward and secure the second insulator to the supporting structure. If a third insulator is required to extend the antenna wire, secure that insulator to its supporting structure. Nonconductive rope should be used between the free end of each insulator and the related support.

Use care to not overstress the antenna wire. Do not use the antenna coupler output connector as one antenna support.

If trees are used as supporting structures, be sure to take into consideration guy length changes due to tree sway in the wind. Provision should be made to keep the antenna wire taut during tree movement. This can be done with weighted support ropes operating through pulleys attached to the trees.



Long-wire Antenna Assembly
Figure 3



Detailed View of Insulator/Antenna Connections
Figure 4

5. PARTS LIST

The following table lists parts in the AC-2814 and AC-2815 Long-wire Antenna Kits.

AC-2814 QTY	AC-2815 QTY	DESCRIPTION	PART NUMBER
1	1	Solder lug	304-0008-000
3	3	Ceramic insulator	013-1619-010
15.3 m (50 ft)	30.6 m (100 ft)	Wire, stranded copper, #14 (25.5 mm (0.075 in))	431-0697-010

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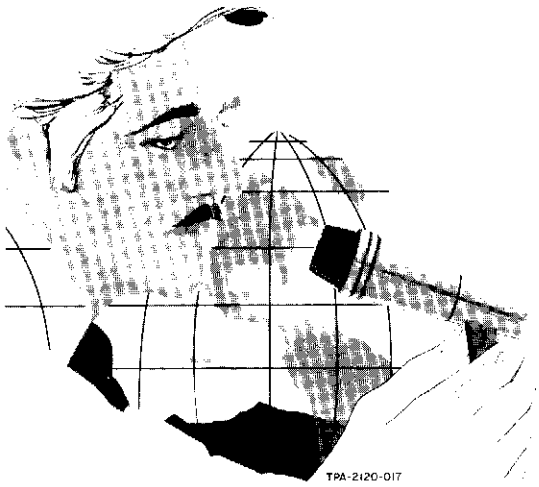


Rockwell International

HF accessories

Collins AC-2818 Lightning Arrester

1. DESCRIPTION

The AC-2818 Lightning Arrester, Collins part number 622-3561-001, discharges to ground high-voltage current surges on the inner conductor of attached coaxial cables. Such surges can be produced by direct or nearby lightning strikes.

The AC-2818 is designed for insertion in 52- to 72-Ω coaxial cable and operates at frequencies up to 300 MHz with minimum insertion loss. Surrounding the arrester is an integral bulkhead mounting plate. The coaxial fittings are type SO-239 for mating with type PL-259 connectors.

An earth ground is required for the AC-2818. The AC-2819 Grounding Kit is recommended.

2. INSTALLATION

Note

The lightning arrester should be replaced when the resistance between the center conductor and outer case is 10 MΩ or less.

Perform the following for installation of the lightning arrester.

a. Refer to figure 1 for dimensions and cut an opening in the wall through which the arrester is to be installed.

Note

It is recommended that the arrester be mounted through a metal plate approximately 150 x 150 mm (6 x 6 in) by 1.5 mm (0.06 in) thick.

b. (1) If the recommended metal plate is used, secure the arrester to it with four machine screws, lockwashers, and nuts, or with four sheet-metal screws.
   (2) Firmly secure the wire to the external grounding system (AC-2819 recommended) to the metal plate.

c. (1) If the metal plate is not used, firmly secure the wire to the external grounding system (AC-2819 recommended) to one corner of the arrester with a machine screw, flat washer, lockwasher, and nut.
   (2) Secure the arrester to the wall with appropriate fasteners through the other three holes in the arrester mounting flange.

d. Connect the outside rf cable (from an associated antenna coupler or antenna) to the arrester coaxial connector.

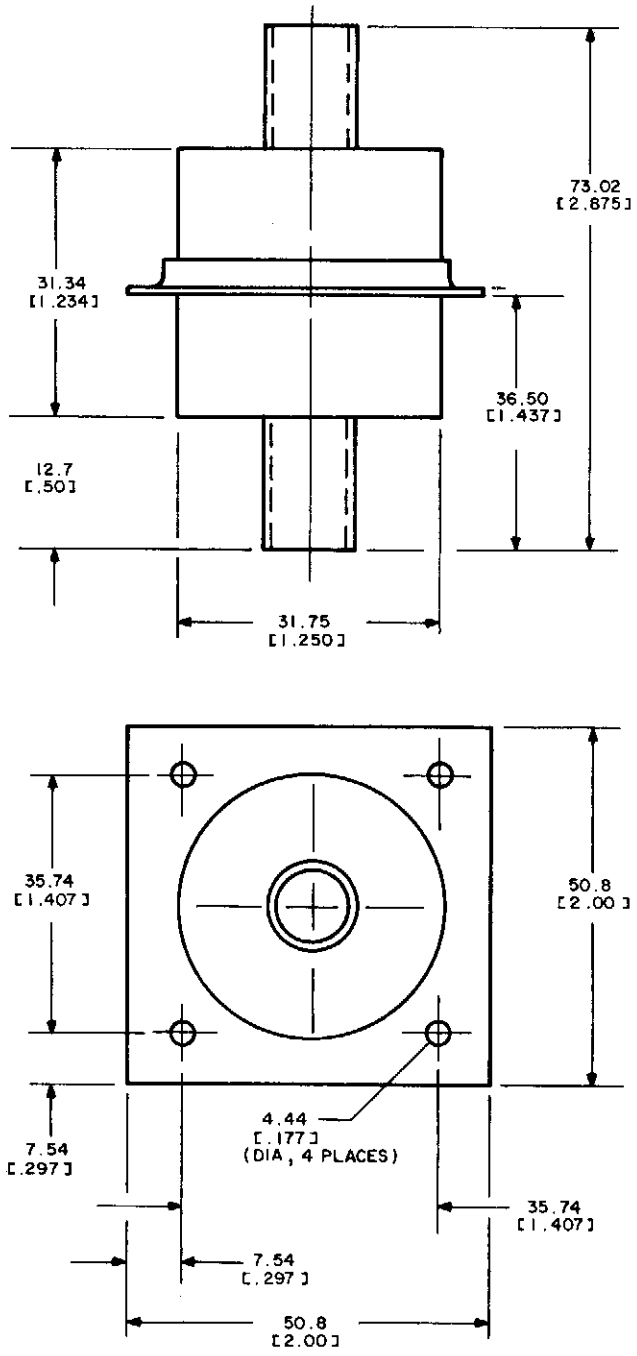
e. Weatherproof the outside part of the arrester and coaxial cable connection by covering with sealant such as silicon rubber (Dow-Corning RTV 140, for example) or spraying with an aerosol-propelled lacquer.

f. Connect the rf cable from the associated transceiver to the inside connector of the connector.

g. Make sure the grounding system to which the arrester is connected is an earth ground. (Instructions are supplied with the AC-2819 Grounding Kit for installing such a ground system.)

3. PARTS LIST

The instruction sheet and one lightning arrester, Collins part number 013-1268-010, are the only parts in the AC-2818 kit.



NOTE: DIMENSIONS ARE IN MILLIMETRES [INCHES].

TPA-1333-011

AC-2818 Lightning Arrester Dimensions
Figure 1

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HF accessories

Collins AC-2819 Grounding Kit

1. DESCRIPTION

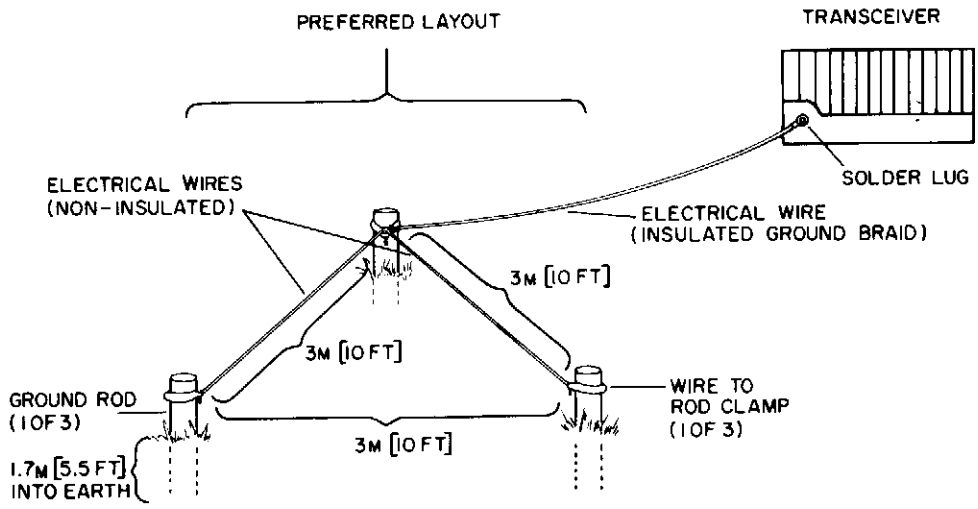
The AC-2819 Grounding Kit, Collins part number 622-3562-001, contains parts for making electrical ground to earth. Included in the kit are three 1.8-metre (6-ft) copper-clad steel ground rods, three wire-to-rod clamps, 12.2 metres (40 ft) of electrical wire, and a solder lug.

2. INSTALLATION

The ground system should be as close to the equipment to be grounded as possible. Therefore, during installation, minimize the wire length from ground rods to equipment.

Perform the following procedures for installation of the grounding kit:

a. Drive 1.8-metre (6-ft) rods 1.7 metres (5.5 ft) into ground in triangular pattern as illustrated in figure 1.
b. Cut uninsulated wire into two 3-metre (10-ft) lengths. Clamp wire ends to ground rods as shown in figure 1.
c. Attach one end of insulated wire to common ground rod where uninsulated wires meet.
d. Using as short a length as is practical for installation, attach other end of insulated wire to equipment to be grounded.



Typical Grounding Kit Installation
Figure 1

3. PARTS LIST

The following table lists parts in the AC-2819 Grounding Kit.

QTY	DESCRIPTION	COLLINS PART NUMBER
1	Solder lug	304-0008-000
6 m (20 ft)	Wire, insulated, #10 AWG, copper	439-0350-000
6 m (20 ft)	Wire, uninsulated, #10 AWG, copper	421-1020-000
3	Clamps	013-1454-040
3	Ground rods, steel, copper-clad, 1.8 m (6 ft)	013-1114-050

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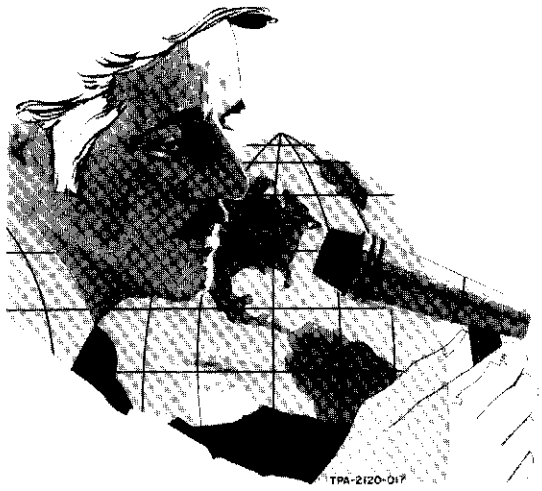
523-0769645-001218 6-1-79 Printed in USA



Rockwell International

HF accessories

Collins AC-2820 Ground Radial Kit

1. DESCRIPTION

The AC-2820 Ground Radial Kit, Collins part number 622-3563-001, is to make an electrical ground plane for use with a vertical antenna. Included in the kit are 91.4 m (300 ft) of #14 AWG stranded copper wire and 10 solder lugs.

2. INSTALLATION

a. For optimum performance, the following conditions should be met while installing the ground radial kit.
   1. Transmitting on multiple frequencies requires the radials to be cut to lengths determined by the lowest frequency of operation.
   2. A minimum of four radials per installation is recommended.
   3. Frequencies below 3.2 MHz require an additional ground radial kit to obtain the proper amount of wire needed.
   4. Ground radials for one installation should not overlap any ground radials from another installation.

b. Perform the following procedure for assembly and installation of ground radials.
   1. Cut antenna radials to length according to desired frequency selected by this formula:

$$\text{antenna length} = \frac{81.3}{\text{Freq (in MHz)}} \text{ metres}$$

or

$$= \frac{234}{\text{Freq (in MHz)}} \text{ feet}$$

Note

Cut as many lengths as possible from wire supplied.

   2. Solder a solder lug to one end of each length.
   3. Lay out radials evenly to resemble spokes of a wheel with solder lug end at center.
   4. Distributing the radials around the coupler, connect each solder lug to one of the six coupler mounting screws.
   5. For ground-mounted installations, bend each radial 90 degrees downward approximately 75 mm (3 in) from free end and push end into ground.
   6. If required, bury radials no deeper than 152 mm (6 in) below surface of soil.
   7. For roof-mounted installations, use nails or other fasteners to secure radials in place.

3. PARTS LIST

The AC-2820 Ground Radial Kit is made up of the following parts.

QTY	DESCRIPTION	COLLINS PART NUMBER
10	Solder lug	304-0008-000
91.4 m (300 ft)	Wire, copper stranded 2 mm (0.075 in)	431-0697-010

Rockwell International

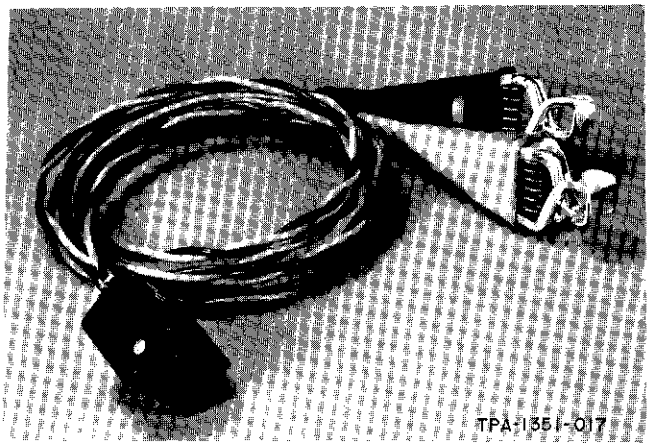
HF accessories

Collins AC-2821 DC Power Cable

1. DESCRIPTION

The AC-2821 DC Power Cable, part number 622-3564-001, is a cable for connecting an HF-281, HF-282, HF-380, KWM-380 Transceivers or a 451S-1 Receiver to a 12-volt storage battery for emergency operation. The battery must be supplied by the user.

The cable consists of a power connector, two battery clamps, and 2 m (6.5 ft) of cable, as shown in figure 1.



AC-2821 DC Power Cable
Figure 1

2. INSTALLATION

Perform the following procedure for installation of dc power cable.

CAUTION

Do not attempt to jumper a transceiver dc power cable to an ac source. Equipment damage would likely result. The connectors are wired differently internally.

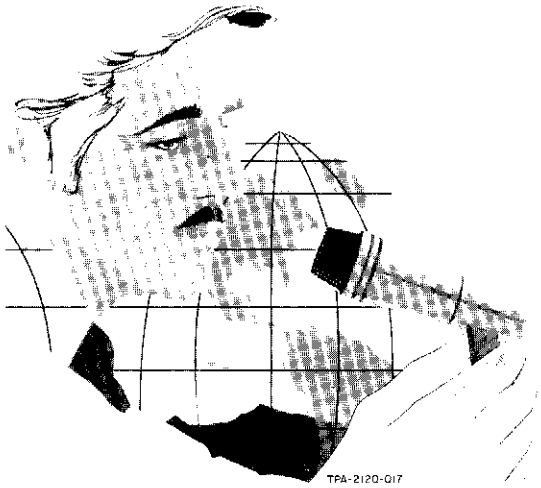
a. Connect multipin connector of dc power cable to transceiver power input connector.
b. Connect black battery clamp to negative (-) terminal on storage battery and red clamp to positive (+) terminal on battery.

To ensure emergency power is available when needed, be sure to keep the battery properly maintained. This includes being fully charged, having proper electrolyte (fluid) level, and keeping corrosion off the terminal connections.

3. PARTS LIST

The AC-2821 kit consists of this instruction sheet and one cable. The cable is made up of the following:

QTY	DESCRIPTION	PART NUMBER
1	Transceiver power connector (internally jumpered between pins 8 and 10)	365-0068-010
1	Battery clamp (marked +)	362-0017-000
1	Battery clamp (unmarked)	362-0018-000
1	Clamp insulator, red	362-0021-000
1	Clamp insulator, black	362-0022-000
2 m (6.6 ft)	Wire, stranded copper, #10 AWG, red insulated	422-4979-000
2 m (6.6 ft)	Wire, stranded copper, #10 AWG, black insulated	422-4965-000



Rockwell International

HF accessories

Collins AC-2828 Foot Switch Kit

1. DESCRIPTION

The AC-2828 Foot Switch Kit, Collins part number 634-8546-001, consists of a foot switch and interconnecting parts (figure 1) for use with the HF-281, HF-282, KWM-380, or HF-380 transceivers. The foot-activated switch allows the operator to key the transceiver without having to push the PTT switch. The foot switch is weighted and has a skid-proof base pad to prevent unintentional movement.

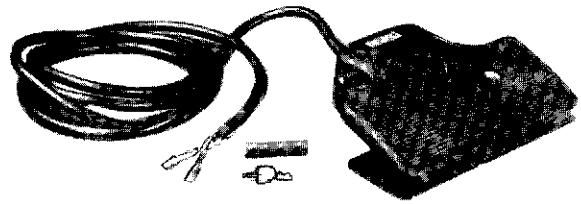
2. INSTALLATION

If the foot switch is to be used with the HF-281 or HF-282 transceivers, proceed as follows:

a. Place the foot switch in a convenient position.
b. Connect the foot switch cable terminations to the LINE AUDIO terminal strip on the rear of the transceiver. The black wire connects to the PTT terminal and the white wire to the GND terminal.

When the foot switch is to be used with the KWM-380 or HF-380, the cable termination must be changed from two terminal lugs to a plug. The modification procedure is as follows:

a. Cut the black wire off directly behind the red lug.
b. Strip the black wire back 11/16 inch and tin the exposed wire.
c. Cut the white wire off 7/8 inch behind the red lug.
d. Strip the white wire back 9/32 inch and tin the exposed wire.
e. Insert the black wire into the plug probe as far as possible and solder to the tip of the probe.
f. Cut off any excess wire at the top of the probe and make sure that the solder does not extend beyond the normal outside diameter of the probe.



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AC-2828 Foot Switch Kit
Figure 1

g. Crimp the two inside crimp lugs of the plug to the exposed portion of the white wire and solder.
h. Crimp the two outside crimp lugs to the insulated portion of the white wire.
i. Slide the heat shrink sleeve over the modified area. One end of the sleeve should cover the rear shoulder of the plug. Shrink the sleeving by applying heat from either a heat gun or from close proximity to a soldering iron (do not actually touch the iron to the sleeving).
j. Place the foot switch in a convenient position and insert the plug into the PTT jack on the rear of the KWM-380 or HF-380 transceiver.

3. PARTS LIST

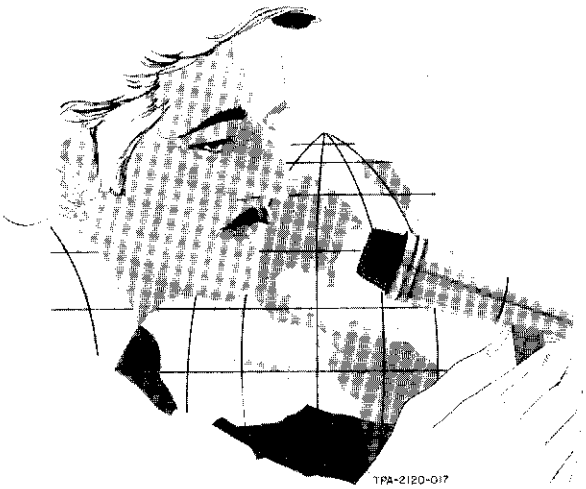
The following table lists parts contained in the AC-2828 Foot Switch Kit.

AC-2828 foot switch kit

QTY	DESCRIPTION	COLLINS PART NUMBER
1	Foot switch	266-0226-010
2.01 m (6.6 ft)	Cable (attached to foot switch)	424-0009-000
2	Solder lug (attached to cable)	304-0127-000
44.45 mm (1.75 in)	Heat shrink sleeving	152-3586-000
1	Plug	361-0062-000

Collins Telecommunications Products Division/Rockwell International
Cedar Rapids, Iowa 52406

523-0770747-001218 8-15-80 Printed in USA



Rockwell International

HF accessories

Collins AC-2832 Transceiver-to-Coupler Control Cable

1. DESCRIPTION

The AC-2832 Transceiver-to-Coupler Control Cable, part number 651-7638-XXX, is a multiconductor cable for HF-282, KWM-380, and HF-380 transceiver-to-coupler control signals to the CU-380 Antenna Coupler. The weather-resistant cable is supplied with connectors and terminals attached. The cable is available in lengths ranging from 1 to 60 metres (3.3 to 200 feet). Refer to table 1.

2. INSTALLATION

Perform the following steps for installation of the control cable.

a. Connect multipin connector on cable to control interface connector on the rear of the transceiver or to J2 of the AC-3809 Interface Adapter, if it is being used.
b. Remove six screws from around edges of CU-380 coupler cover and remove cover.
c. Loosen bushing locknut and insert control cable through bushing.

Table 1. AC-2832 Cable Length to Part Number.

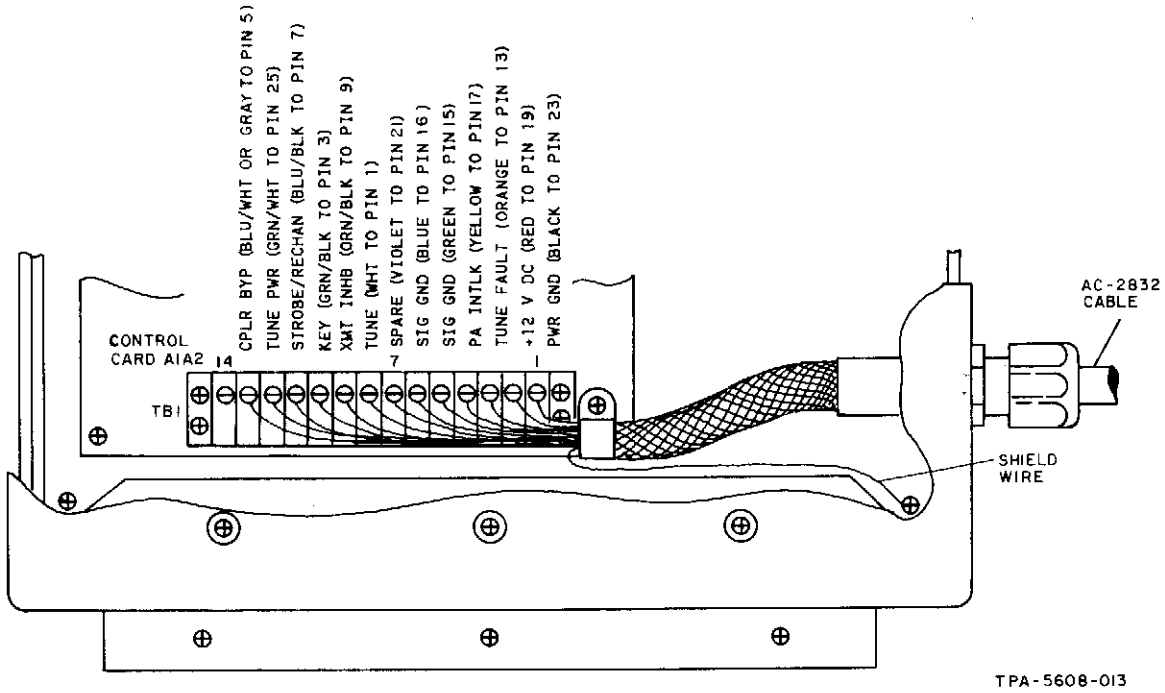
CABLE LENGTH	PART NUMBER
m/ft	651-7638-XXX
1/33	001
3/10	002
10/33	003
20/66	004
30/100	005
40/131	006
50/164	007
60/200	008
70/230	009
80/263	010
90/300	011
100/328	012
110/361	013
120/400	014

d. Connect control cable terminals to coupler terminal strip TB1 as listed in table 2 and shown in figure 1.
e. Tighten locknut until cable cannot be pulled from bushing.
f. Replace cover and six screws onto coupler.

AC-2832 transceiver-to-coupler control cable

Table 2. Coupler to Transceiver Control Cable Wiring.

FROM TRANSCEIVER JACK PIN NO	WIRE COLOR	TERMINATION AT COUPLER TB1
23	Black	1
19	Red	2
13	Orange	3
17	Yellow	4
15	Green	5
16	Blue	6
21	Violet	7
1	White	8
9	Orange/black	9
3	Green/black	10
7	Blue/black	11
2	Green/white	12
5	Blue/white or gray	13
	No Connection	14
24	Shield of cable	Chassis ground



Transceiver-to-Antenna Coupler Cable Wiring
Figure 1

3. PARTS LIST

The AC-2832 cable is preassembled using the following parts.

QUANTITY	DESCRIPTION	PART NUMBER
12	Terminal lug	304-1531-030
2	Terminal lug	304-1531-050
1	Connector	371-0170-000
1	Hood, connector	371-0396-100
1	Cable	424-0929-010
2	Adapter	306-1001-000