



**Rockwell
International**

Collins instruction book

HF-380 Transceiver

This instruction book includes:

<i>Description</i>	<i>523-0772523</i>
<i>Installation</i>	<i>523-0772524</i>
<i>Operation</i>	<i>523-0772525</i>
<i>Theory</i>	<i>523-0772526</i>
<i>Maintenance</i>	<i>523-0772527</i>
<i>Parts List</i>	<i>523-0772528</i>
<i>Diagrams</i>	<i>523-0772529</i>
<i>Power Amplifier</i>	<i>523-0771739</i>
<i>Low-Pass Filter</i>	<i>523-0772530</i>
<i>Receiver-Exciter</i>	<i>523-0771741</i>
<i>Passband Tuning and Passband Tuning Option</i>	<i>523-0771742</i>
<i>Synthesizer</i>	<i>523-0771743</i>
<i>Oscillator</i>	<i>523-0772531</i>
<i>Control</i>	<i>523-0771745</i>
<i>Noise Blanker</i>	<i>523-0771746</i>
<i>Speech Processor</i>	<i>523-0771747</i>
<i>Control Interface</i>	<i>523-0771748</i>
<i>Audio Low-Pass Filter</i>	<i>523-0771761</i>
<i>Options</i>	
AC-3801 Noise Blanker	<i>523-0770570</i>
AC-3802 Speech Processor	<i>523-0770571</i>
AC-3803 Control Interface	<i>523-0770572</i>

AC-3805 and AC-3805A Keypads	<i>523-0772588</i>
AC-3809 Interface Adapter	<i>523-0772589</i>
AC-3810, AC-3811, AC-3812, AC-3813, and AC-3814	<i>523-0770573</i>
Filters	
AC-3821, AC-3822, and AC-3823 Transceiver-to- Coupler RF Cable	<i>523-0772590</i>
AC-2801 Rack Mount	<i>523-0769622</i>
AC-2808 Blower	<i>523-0769661</i>
AC-2810 and AC-2811 Vertical Antenna	<i>523-0769651</i>
AC-2812 and AC-2813 Dipole Antenna	<i>523-0769632</i>
AC-2814 and AC-2815 Long-Wire Antenna	<i>523-0769641</i>
AC-2818 Lightning Arrester	<i>523-0769646</i>
AC-2819 Grounding	<i>523-0769645</i>
AC-2820 Ground Radial	<i>523-0769639</i>
AC-2821 DC Power Cable	<i>523-0769643</i>
AC-2828 Foot Switch	<i>523-0770747</i>
AC-2832 Transceiver-to- Coupler Control Cable	<i>523-0772591</i>

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Cedar Rapids, Iowa 52498**

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.

Please be advised that completion of the enclosed Automatic Distribution Service Card and return to Rockwell International ensures you of manual revisions and service bulletin modifications to your equipment. Without the return of this card, Rockwell International bears no responsibility to forward this information to you.

We welcome your comments concerning this instruction book. Although every effort has been made to keep it free of errors, some may occur. When reporting a specific problem, please describe it briefly and include the instruction book part number, the paragraph or figure number, and the page number.

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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

<u>SB/SIL</u>	<u>DESCRIPTION</u>	<u>ISSUE DATE</u>	<u>SB/SIL</u>	<u>DESCRIPTION</u>	<u>ISSUE DATE</u>
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 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 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 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
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	SIL 1-81	Describes method for providing a mute function for an external receiver.	3-1-81
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	SIL 2-81	Describes a method of connecting S-line 312B-4 and 312B-5 phone patches to the transceiver.	8-1-81
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 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 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 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 7 and Rev 1	Prevents excessive cmi (revr 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 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

<u>SB/SIL</u>	<u>DESCRIPTION</u>	<u>ISSUE DATE</u>
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 to relay to switch into transmit before rf is present.	10-1-82

HF-380 Transceiver



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description

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table of contents

<i>Paragraph</i>	<i>Page</i>
1. <i>General</i>	1
2. <i>Equipment Supplied</i>	1
3. <i>Associated Equipment</i>	4
4. <i>Accessories</i>	4
5. <i>Options</i>	7
6. <i>Equipment Specifications</i>	8

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

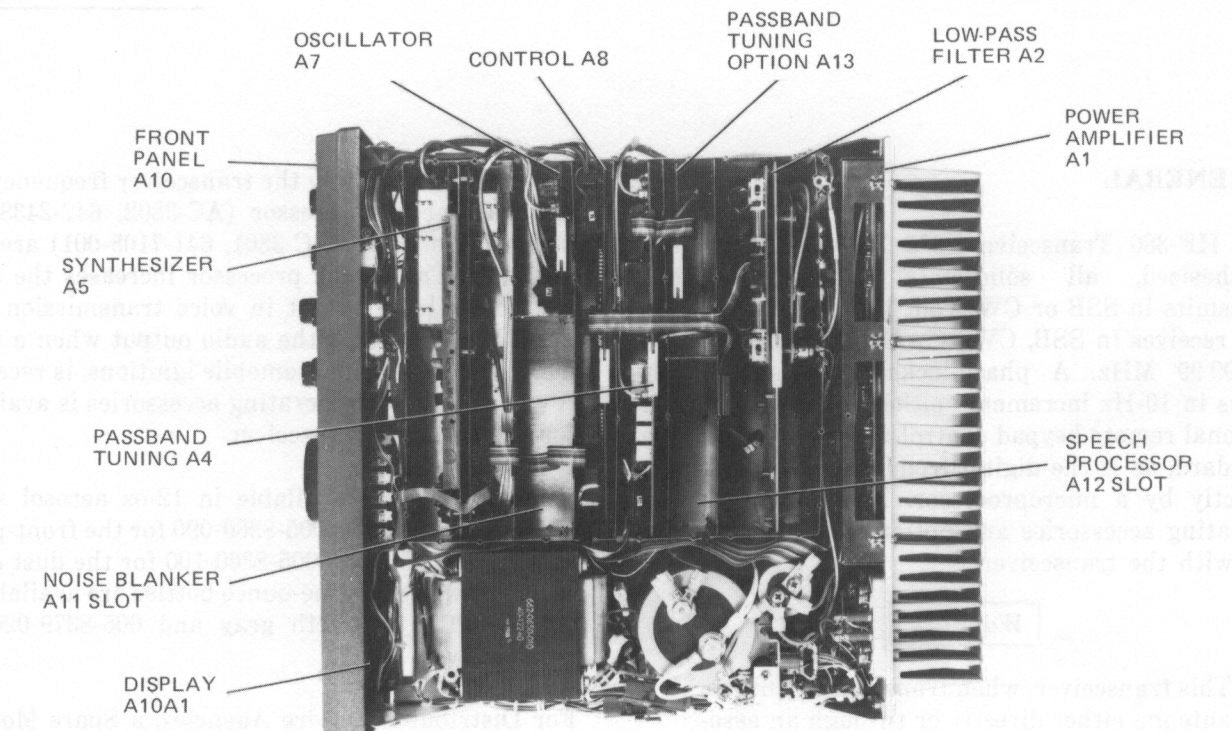
keypad for controlling the transceiver frequency. An optional speech processor (AC-3802, 642-2438-001) and noise blanker (AC-3801, 641-7105-001) are also available. The speech processor increases the average power level output in voice transmission. The noise blanker quiets the audio output when a noise 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.

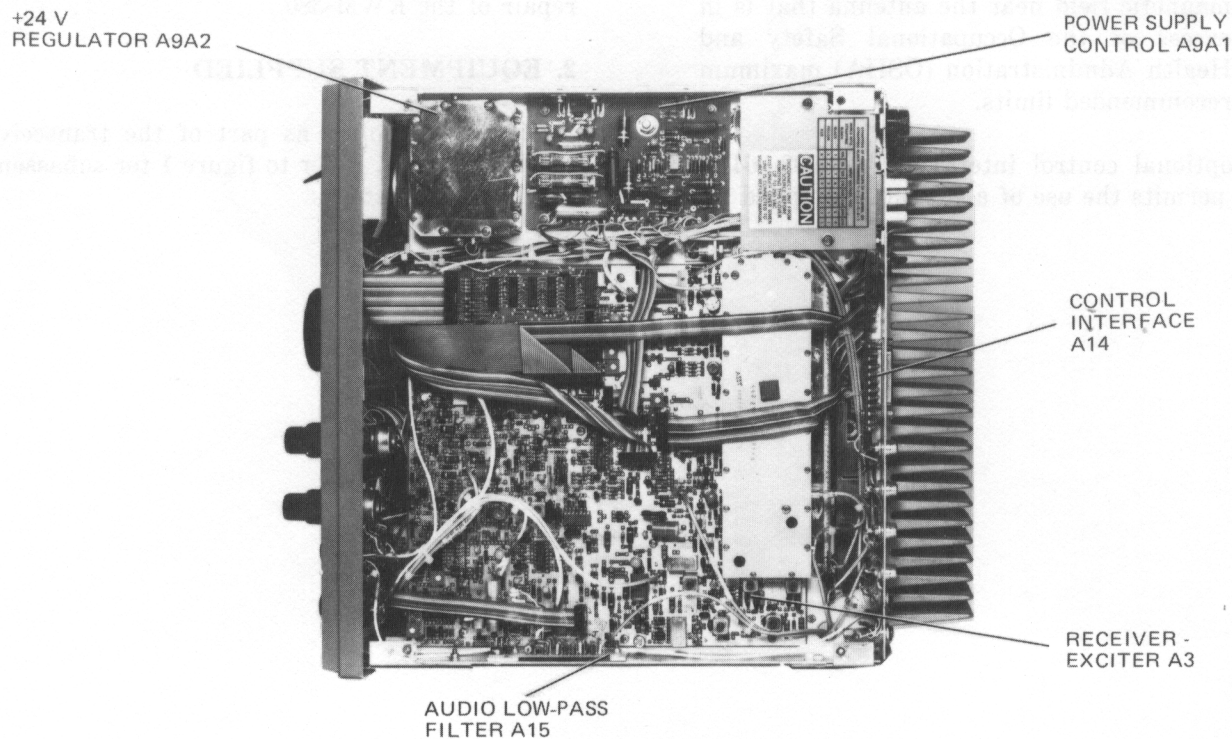
For Distributor/Service Agencies, a Spare Modules Kit, part number 642-9630-001, and Spare Parts Kit, part number 642-9629-001, are available to facilitate repair of the KWM-380.

2. EQUIPMENT SUPPLIED

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



TOP VIEW



BOTTOM VIEW

Circuit Card/Subassembly Location
Figure 1

TPA-5267-017

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 Adapter	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 Arrestor	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

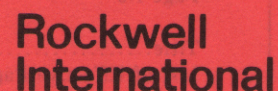
Table 5 lists electrical, environmental, and physical specifications of the transceiver.

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 $\pm 5\%$, 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" μ V measurement)	0.5 μ V or better for 10 dB (s+n)/n, 2.0 to 30.0 MHz, SSB and CW; 1.0 μ V or better for 1.8 to 2.0 MHz						
Selectivity (3-dB bandwidth)	Selectable: <table> <tr> <td>8 kHz</td><td>*1.7 kHz</td></tr> <tr> <td>*6 kHz</td><td>*360 Hz</td></tr> <tr> <td>2.1 kHz</td><td>*140 Hz</td></tr> </table> *Optional filters	8 kHz	*1.7 kHz	*6 kHz	*360 Hz	2.1 kHz	*140 Hz
8 kHz	*1.7 kHz						
*6 kHz	*360 Hz						
2.1 kHz	*140 Hz						
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- μ V 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



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table of contents

<i>Paragraph</i>	<i>Page</i>
1. General	1
2. Unpacking	1
3. Power Transformer Installation	1
4. Preinstallation Check/Requirements	2
4.1 Operating Location.....	2
4.2 Antennas	2
4.3 Grounding	2
4.4 Primary Power Requirements	2
4.4.1 AC Voltage Operation.....	2
4.4.2 DC Voltage Operation	3
4.4.3 Transceiver Connectors Signal Parameters	3
5. Installation Procedures	7
6. Postinstallation Procedures	7

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.

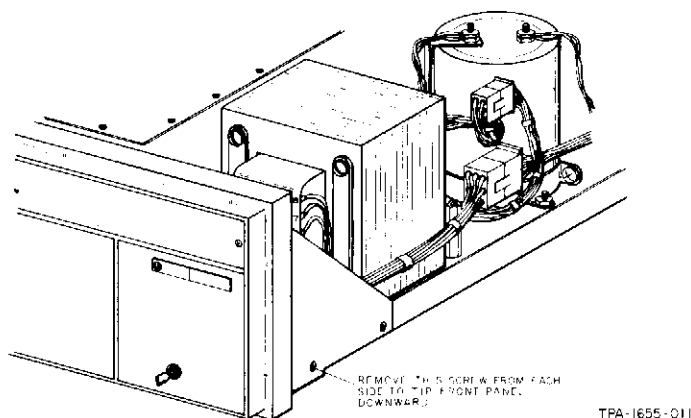
2. UNPACKING

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.

- 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.
- 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.
- 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.
- Using the wrench and nutdriver, secure the transformer to the studs with the four lockwashers and hexposts.
- 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

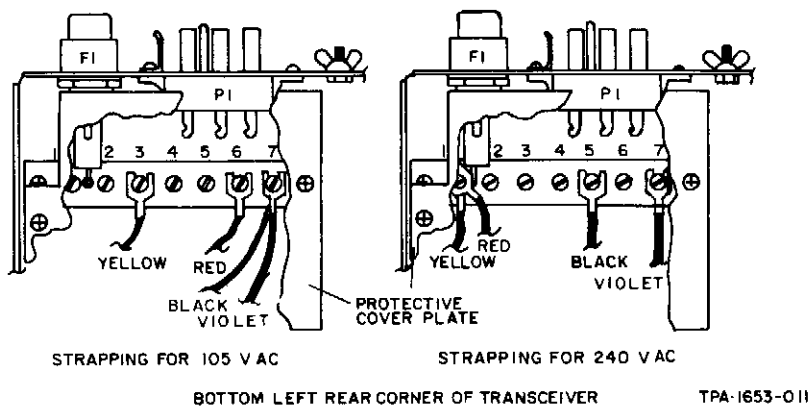
Do not attempt to change voltage strapping while primary power is applied. Electrical shock will occur. Disconnect the primary power cable from the power source or the transceiver first.

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



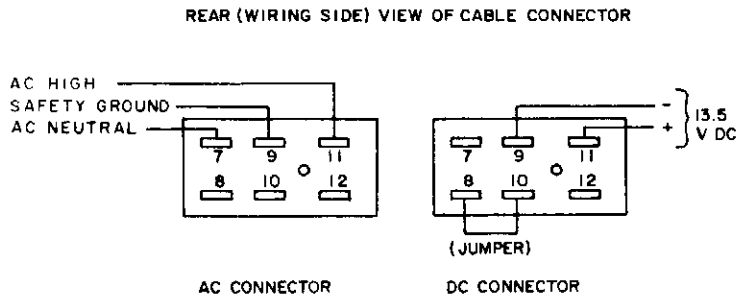
TB1 Strapping for 105 Volts or 240 Volts
Figure 2

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.



TPA-1654-011

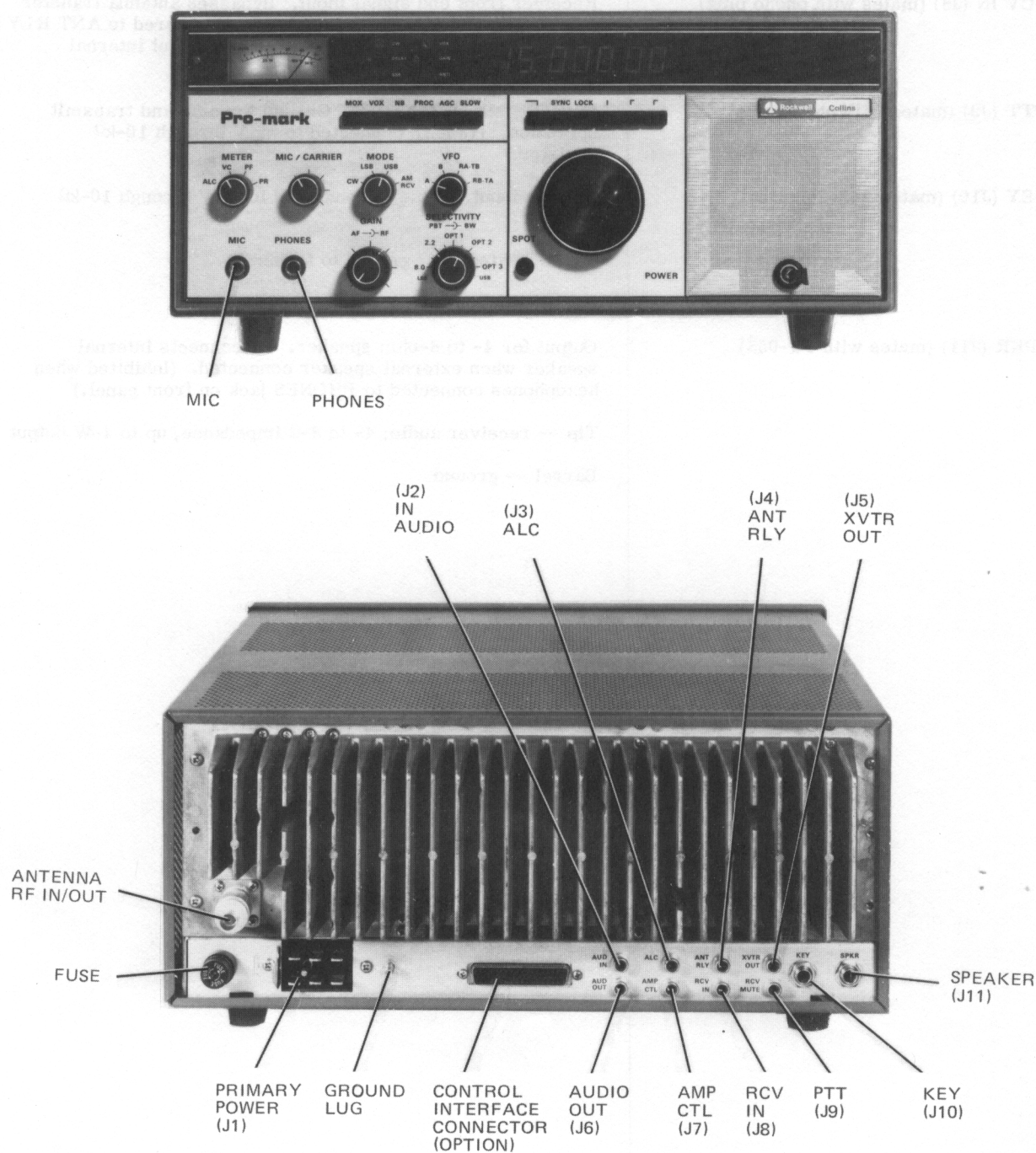
Power Connector Strapping for AC or DC Operation
Figure 3

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
AIC (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-k Ω resistor.)
KEY (J10) (mates with PJ-055)	CW key input. (Line is connected to +5 V through 10-k Ω 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



TPA-5254-017

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.

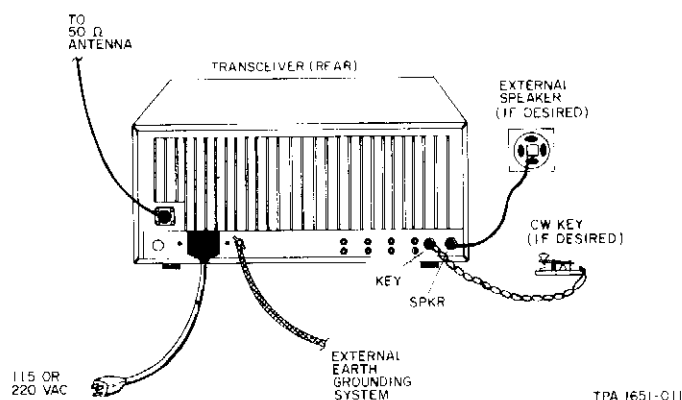
Refer to the phone patch manufacturer's instructions for interconnect information.

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

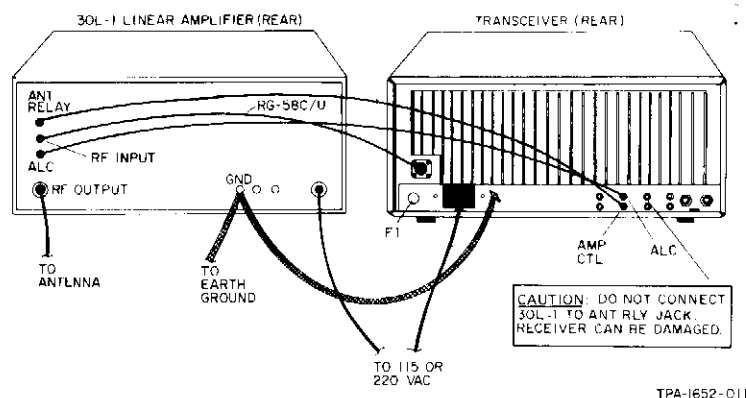
Before using a water-pipe ground, check to make sure that no plastic, rubber, or other such insulating sections will interrupt the electrical continuity to ground. Install a jumper around any insulating sections found. Use heavy copper wire or ground braid and metal pipe clamps.

6. POSTINSTALLATION PROCEDURES

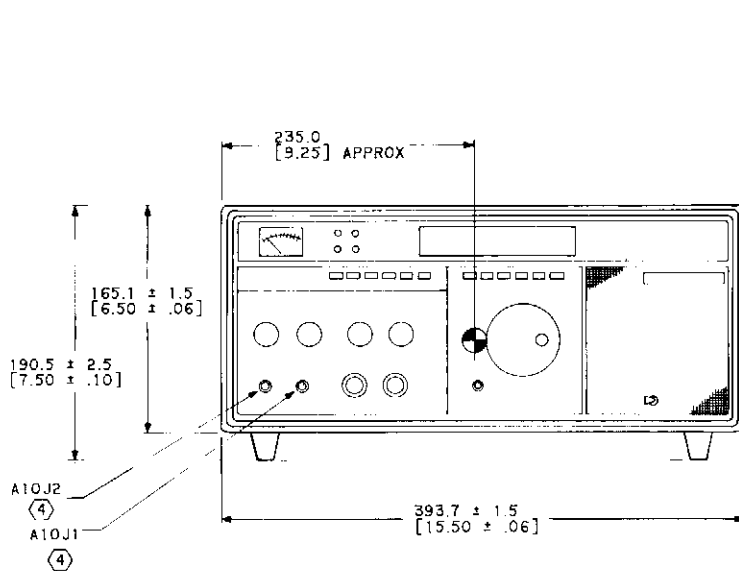
Perform operating procedures as outlined in the operation section.



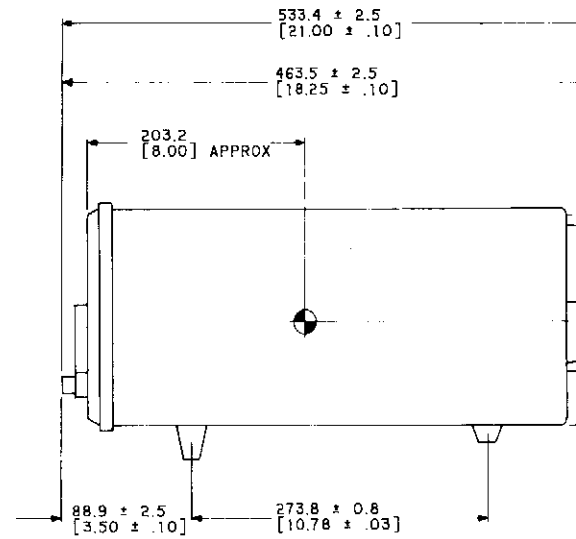
Transceiver Installation Connections
Figure 5



Transceiver and Linear Power Amplifier
Installation Connections
Figure 6



FRONT VIEW

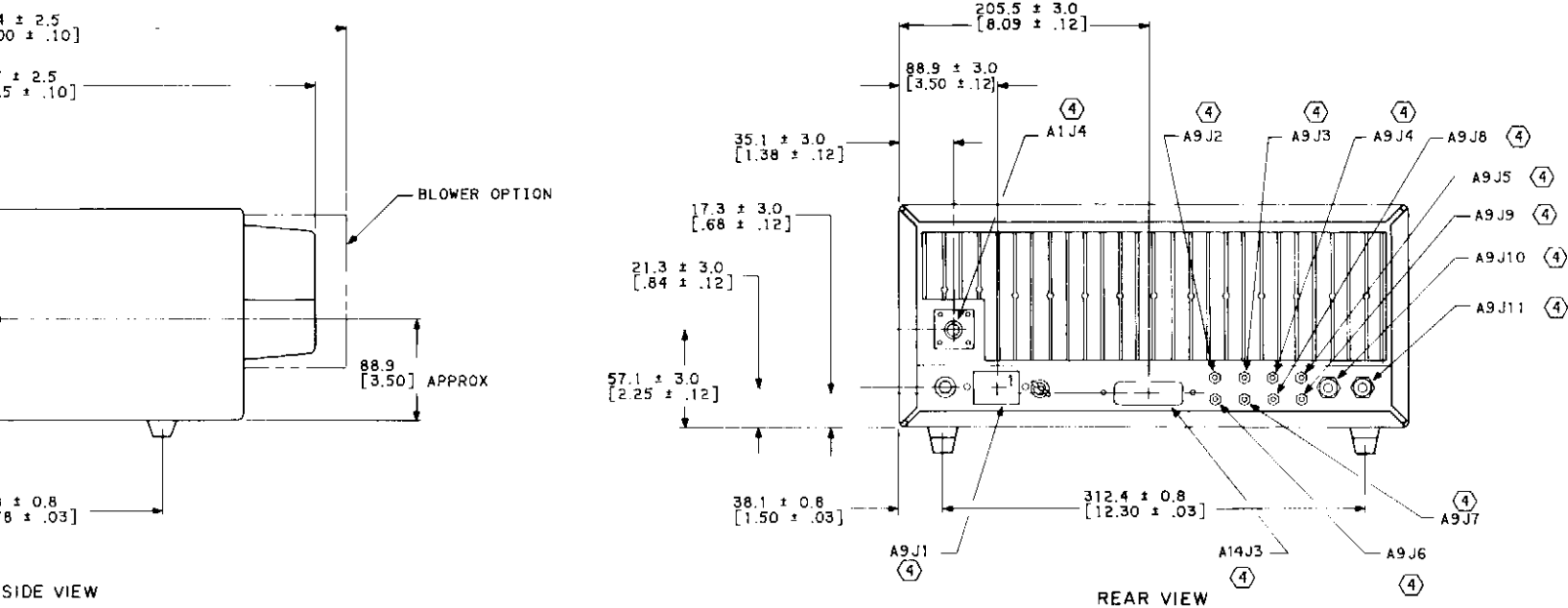


SIDE VIEW

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 NO
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
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



Rockwell International

operation

Collins Telecommunications Products Division

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1 August 1982

HF-380 Transceiver

Printed in USA

table of contents

<i>Paragraph</i>	<i>Page</i>
1. General	1
2. Controls and Indicators	1
3. Operating Procedures	4
3.1 Preoperational Check	4
3.2 Frequency Selection	4
3.3 Function Selection	5
3.4 Gain Controls	5
3.5 Selectivity	5
3.6 MIC/CARRIER Control	6
3.7 Operations	6
3.7.1 CW Operation	6
3.7.2 SSB Operation	7
3.7.3 RTTY Operation	7
3.7.4 AM Operation (Receive Only)	7

operation

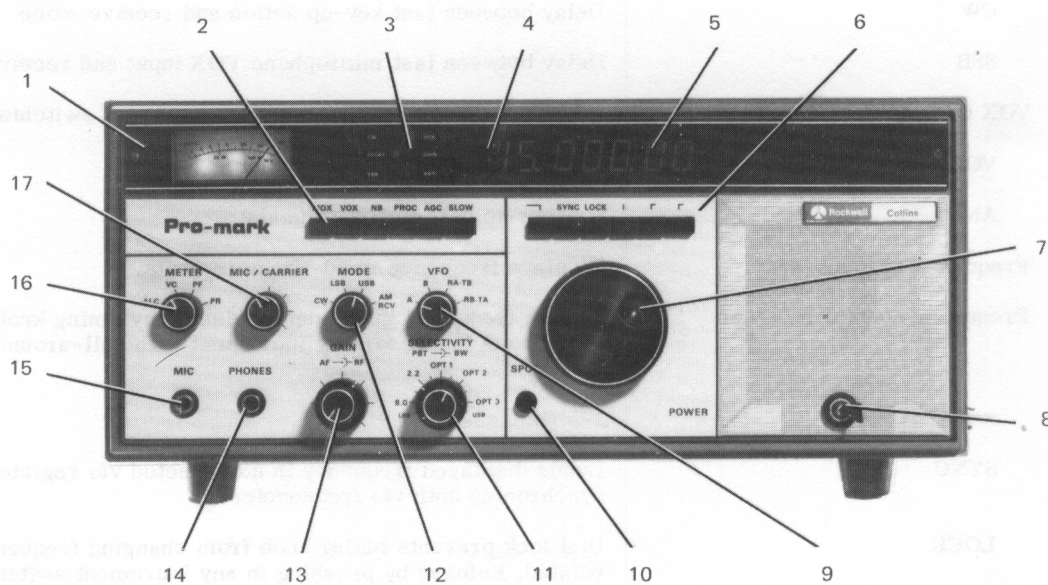
1. GENERAL

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 necessary 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 μ V "hard" (50 μ V "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
	ANT1	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.
		1-MHz increments
	SYNC	Loads displayed frequency in nonselected vfo register to synchronize both vfo frequencies.
	LOCK	Dial lock prevents tuning knob from changing frequency when rotated. Release by pressing in any increment switch.
		1-kHz increments
	 (left)	100-Hz increments
	 (right)	10-Hz increments
7	Frequency tuning knob	Frequency selection control (Provides 200 increments per revolution for all except MHz steps at 10 increments per revolution.) Works in conjunction with switches above knob.

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 select 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 } Lower sideband } Receive sideband determined by setting of PBT control.
	LSB	
	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-k Ω 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

- Check that all interconnect cables are properly connected to the transceiver.
- 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

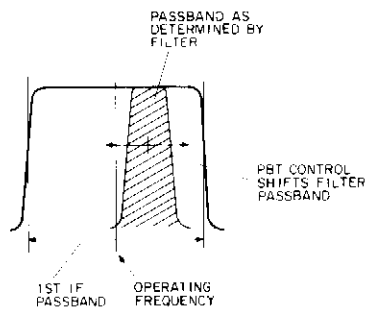
The large (rear) BW switch controls the receive bandwidth by selecting any one of the installed filters. Filter installation information is given in the maintenance section. The 6-kHz AM filter (AC-8313) is particularly recommended for critical AM listening.

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

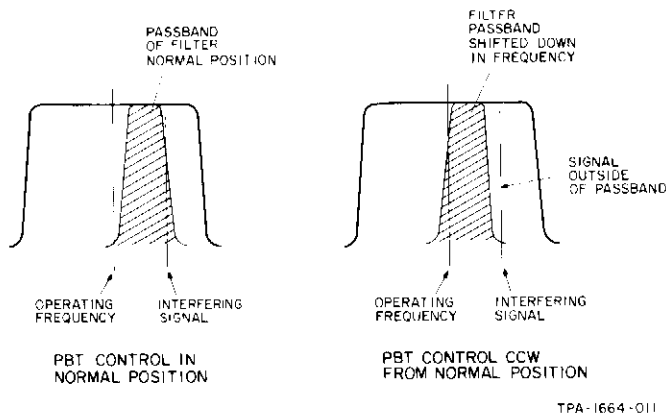
The MODE switch does not determine which sideband is received. It only selects the desired transmit passband.

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.



TPA-1665-011

Filter Passband Positioning with PBT Control
Figure 2



TPA-1664-011

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

- Set the POWER switch to ON.
- Set the MODE switch to CW position.
- Set the VFO switch to A or B positions.
- Adjust RF and AF GAIN controls to desired levels.
- Set the SELECTIVITY BW switch to desired bandwidth position.
- Set the SELECTIVITY PBT control to midrange (vertical position).
- Select unused frequency near desired operating frequency.
- Set METER switch to ALC position.
- 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.



**Rockwell
International**

theory

HF-380 Transceiver

Collins Telecommunications Products Division

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table of contents

<i>Paragraph</i>	<i>Page</i>
1. General	1
2. Theory	1
2.1 Overall Unit	1
2.2 RF System	2
2.2.1 Transmit	2
2.2.2 Receive	7
2.3 Frequency Generation	8
2.4 Power Supply	11
2.4.1 Primary Power Input	11
2.4.2 +14-V Regulator	11
2.4.3 +5- and +9-V Regulators	12
2.4.4 +24-V Regulator (Subassembly A9A2)	12
2.5 Display Card A10A1	12

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.

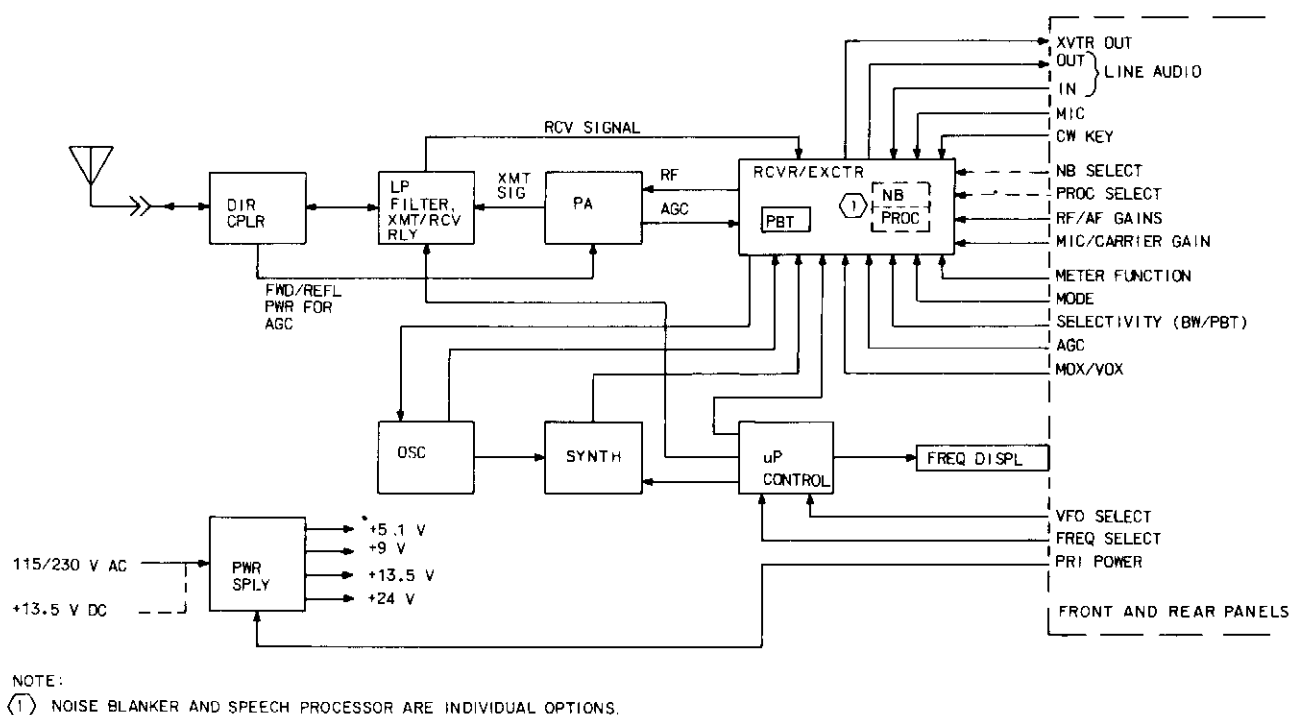
2. THEORY

2.1 Overall Unit

The transceiver is a double-conversion superhetrodyne 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



TPA-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 forward 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 relay, to the low-pass filter assembly. (In receive, the 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

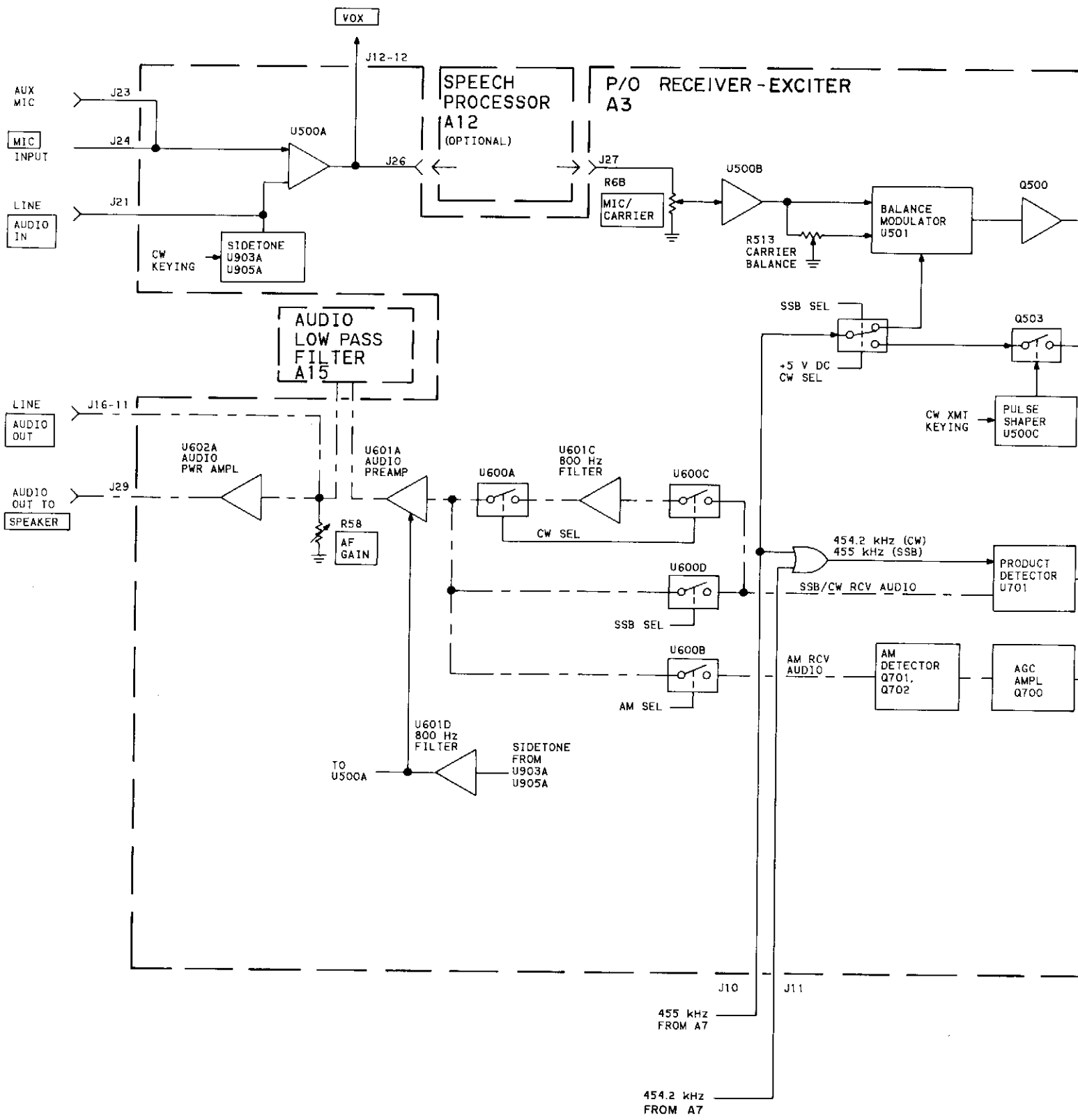
The transmit rf signal path starts at microphone preamplifier U500A. The audio input to U500A is either through J24 (microphone) or J21 (line audio). The third input to U500A is from sidetone generator U903A/U905G. The sidetone signal, normally generated during CW keying, is nominally an 800-Hz tone. 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.

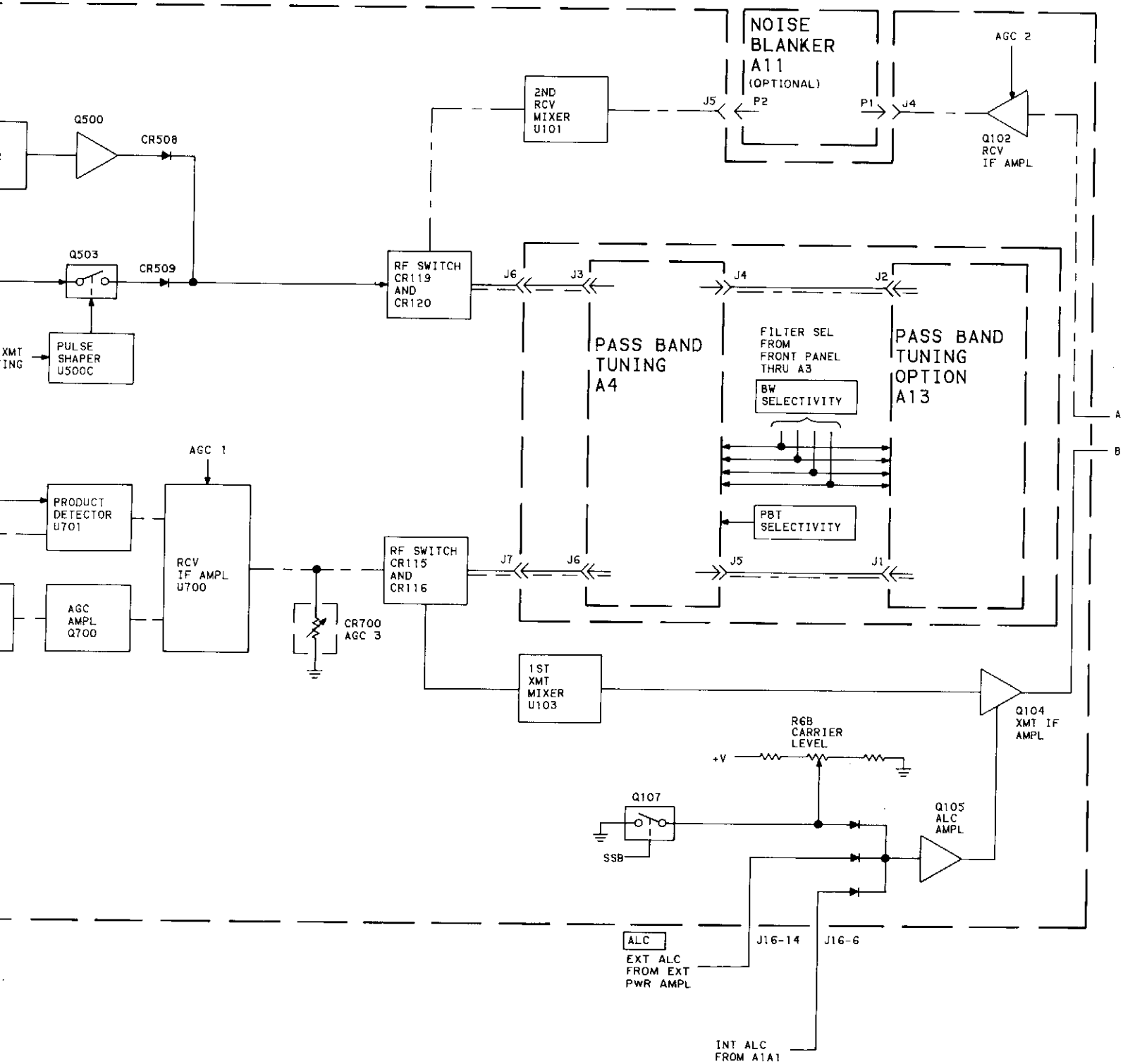
The output of U500A is applied to the VOX circuit and to MIC/CARRIER potentiometer R6B. The audio tapped from R6B, amplified by amplifier U500A, is applied to balance modulator U501. The audio input to U501 modulates the 455-kHz signal in sideband mode. R513 (carrier balance) is adjusted for minimum 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 applied 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

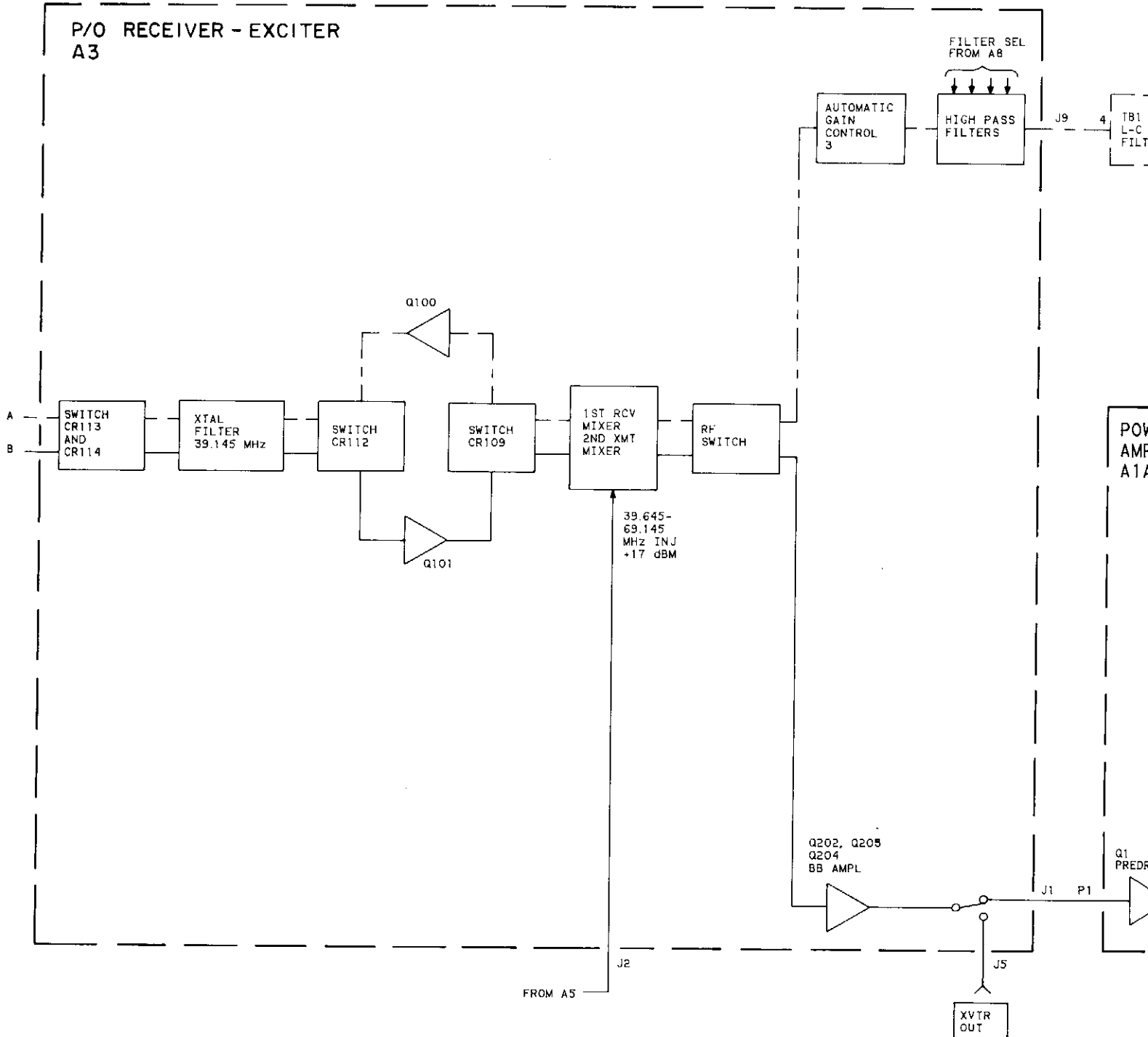


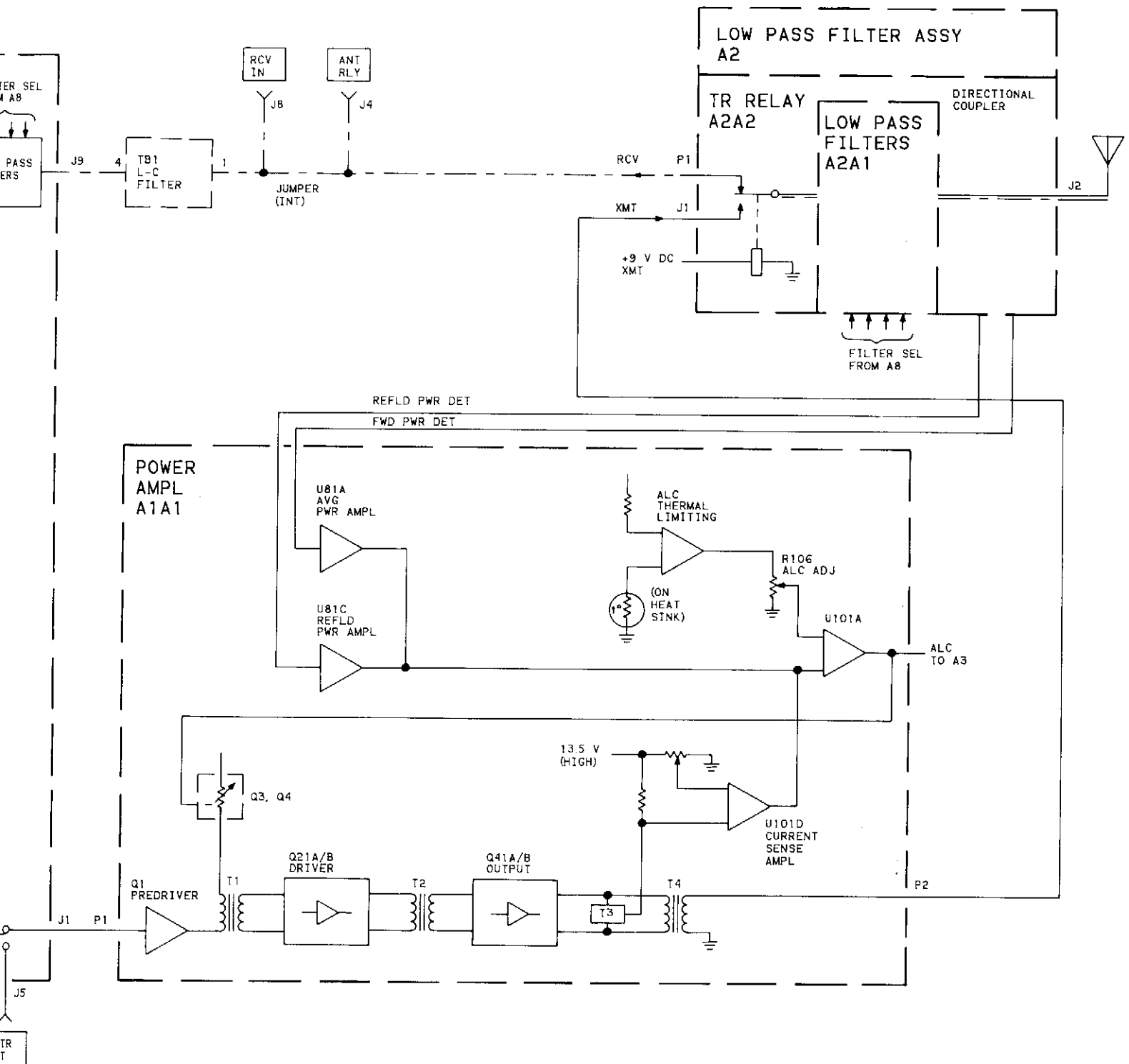


TPA-4543-024

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

P/O RECEIVER - EXCITER
A3





TPA-4543-024

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 pass-band 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 transceiver, 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.

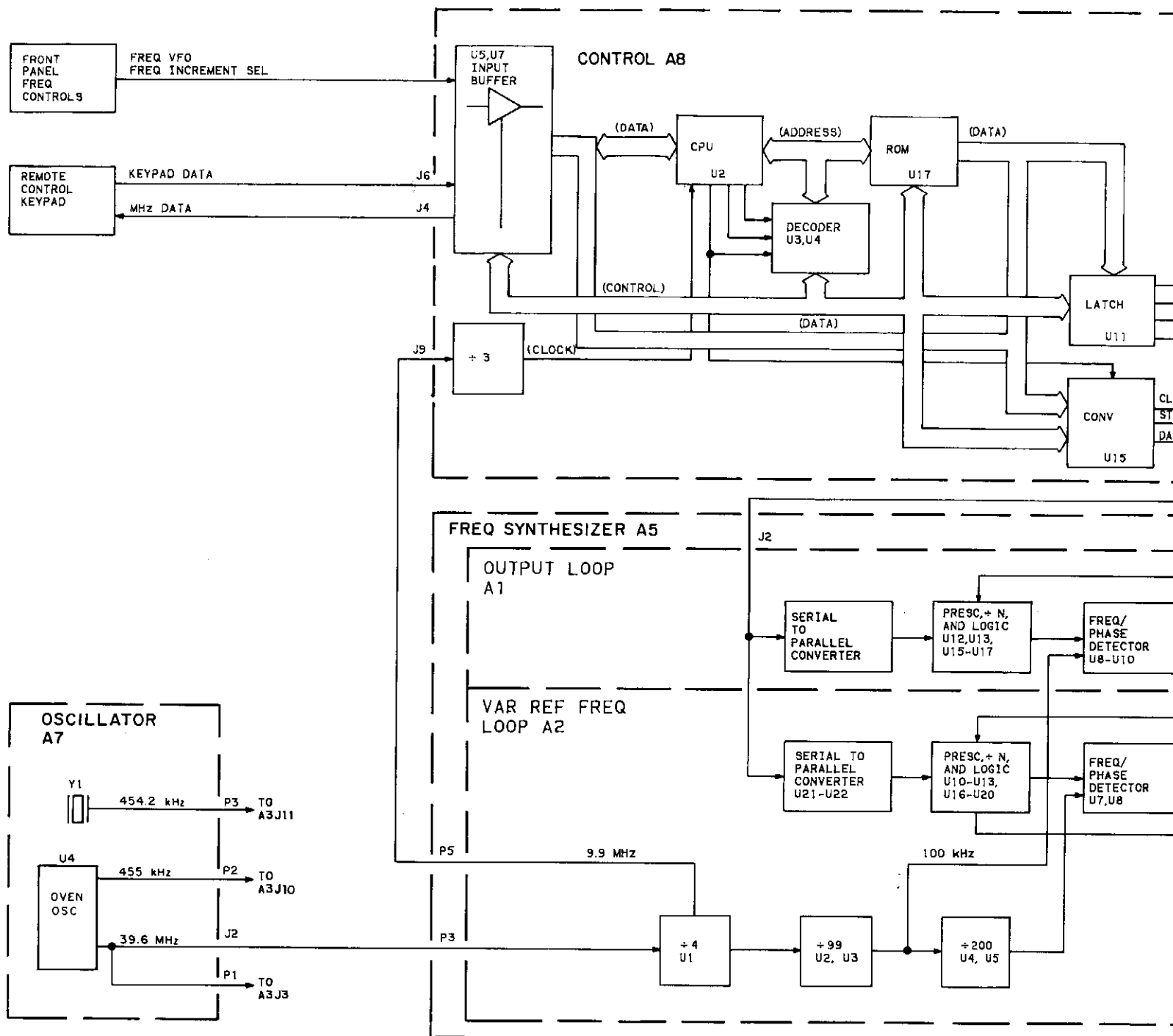
The 39.6 MHz is divided by four, producing a 9.9-MHz output. The 9.9-MHz output is applied to control A8 to use as a clock signal. The 9.9 MHz is divided by 99 to produce a 100-kHz signal for use by the synthesizer loop 2 reference frequency, and the 100-kHz signal is divided by 200 to produce a 500-Hz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

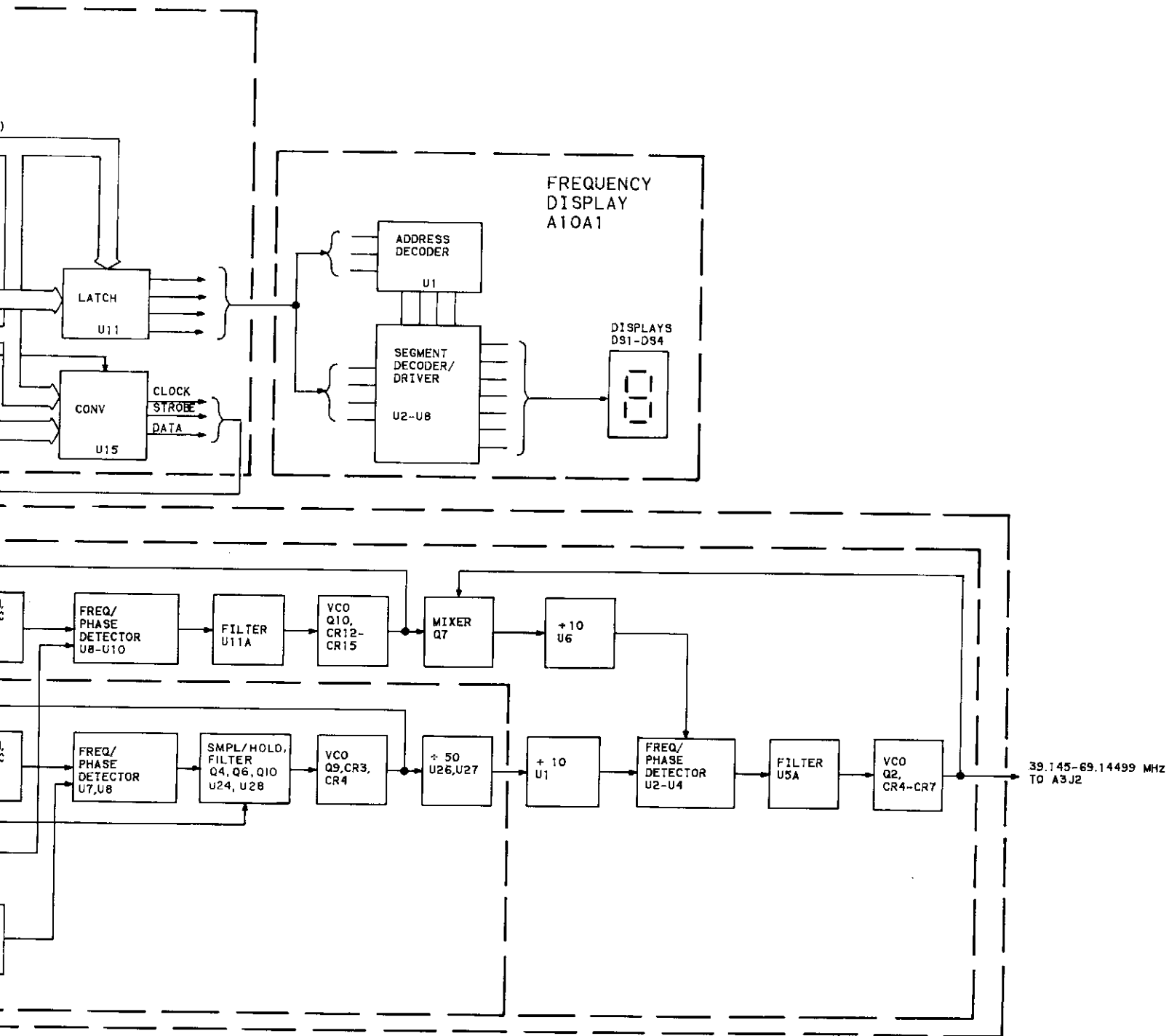
The frequency data, clock, and strobe from control A8 determine the frequency output to the receiver-exciter at A5A1P1.

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 $\div N$ 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- $\div N$ divider. Operation of the variable reference loop is





TPA-5531-014

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 $\pm N$ 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.

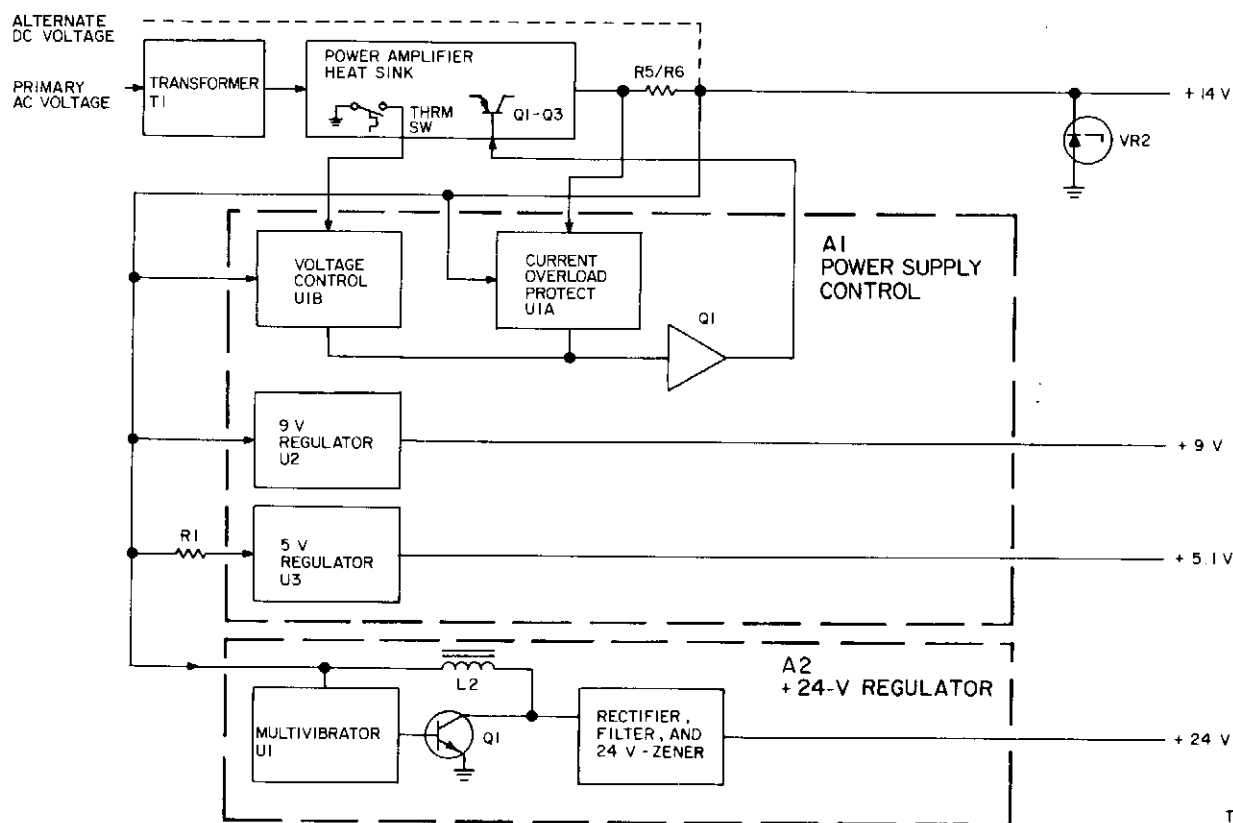
Caution

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



TPA-0831-013

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

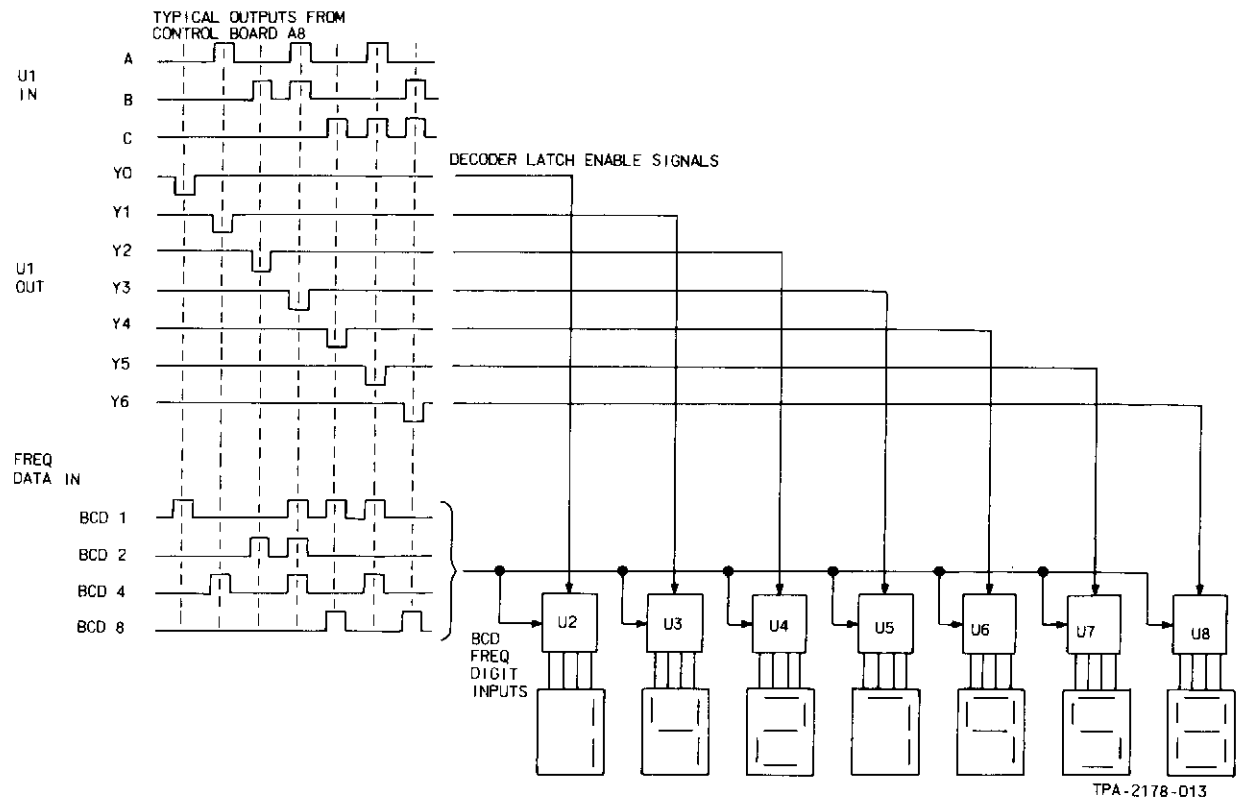
collapsing field about L2 causes the voltage boost. Astable multivibrator U1 switches Q1. The switching frequency is determined by C2, R1, R2, and R3, with R3 an adjustment for the frequency and consequently the resulting regulator output voltage.

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



**Rockwell
International**

maintenance

HF-380 Transceiver

Collins Telecommunications Products Division

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table of contents

<i>Paragraph</i>	<i>Page</i>
1. General	1
2. Test Equipment and Tools	1
3. Testing and Troubleshooting	3
3.1 General	3
3.2 Test Setup	3
3.3 Testing and Troubleshooting Procedures	3
4. Adjustments	20
4.1 Receiver-Exciter Sidetone and Spot Potentiometer Adjustments	20
4.2 39.6-MHz and 455-kHz Oscillator Adjustments	20
5. Disassembly/Assembly	21
5.1 Replaceable Fuses and Lamps	21
6. Repair	21
6.1 General	21
6.2 Electrostatic Discharge Sensitive Devices Precautions	21
6.2.1 Handling of ESDS Devices	22
6.2.2 Storage of ESDS Devices	22
6.2.3 Testing of Subassemblies Containing ESDS Devices	22
6.2.4 Replacement of ESDS Devices	22

maintenance

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- μ V 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- μ s-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 $\pm 10^\circ$, 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 μ s/ 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 cw position. a. Connect signal generator to transceiver rf connector through rf fuscholder 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 cw 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. 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.	10 dB or better for any frequency greater than 1.6 MHz Same as test 2.b.	Refer to table 3. Same as test 2.b.
(Cont)			

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.) g. Depress SPOT pushbutton and listen to speaker output. Release SPOT pushbutton. h. Switch BW SELECTIVITY switch through all positions having installed filters. Note speaker output. 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.	800-Hz tone (Any variation from 800 Hz will be caused by mismatch between signal generator and transceiver frequency.) 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.) Signal present for each installed-filter position. 1-kHz AM signal is heard.	Refer to table 3. Refer to table 2 test 5.d., and figure 1. Refer to table 3. Refer to table 3.
3. Frequency control switches	a. Depress each of the tuning increment switches ($\square$, $\square$, $\square$, $\square$) and rotate tuning knob to step associated display digits through entire range. b. Depress LOCK switch and rotate tuning knob. Note display. c. Release LOCK switch (to out position) by pressing in any of the tuning increment switches.	Digits increase in value with cw rotation of tuning knob and decrease in value with ccw rotation through entire range of associated display digits. Display digits do not change as knob is rotated.	Refer to table 3. Check LOCK switch A10S6C.
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. c. Rotate tuning knob to change frequency of VFO B. Note frequency.	Displayed frequency is same as that noted for VFO A.	Check VFO select switch A10S3 and receiver-exciter A3.
(Cont)			

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. g. Switch out MOX and note frequency display. h. Set VFO to RB-TA and note frequency display. i. Switch in MOX and note frequency display. j. Switch out MOX. k. Connect CW key to KEY jack and switch in VOX. Set CW DELAY control to max cw 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. 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.) 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 cw 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. o. Switch MODE switch to LSB and repeat steps m and n to check lower sideband operation.	VFO B frequency VFO A frequency VFO B frequency VFO A frequency Meter indicates rf output while key is closed and no rf when key is open. 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. 80 to 100 W 80 to 100 W	Check VFO select switch A10S3 and receiver-exciter A3. Same as test 5.f. Same as test 5.f. Check MOX function switch A10S7 and receiver-exciter A3. Refer to table 3. Same as test 5.k. Same as test 5.k. Same as test 5.k.
(Cont)			

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 $\pm$ 0.7 V	Adjust A9A1R23; refer to table 4.
	c. Measure voltage between A9A1TP2 (+) and gnd (-).	+9 $\pm$ 0.1 V	Adjust A9A1R12; refer to table 4.
	d. Measure voltage between A9A1TP1 (+) and gnd (-).	+5.1 $\pm$ 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 $\pm$ 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 $\pm$ 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 $\pm$ 200 Hz	Refer to oscillator instructions.
	h. Reconnect A7P3 to A3J11.		
4. Synthesizer A5	a. Set transceiver frequency to 15.000 00 MHz.		
	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.
(Cont)			

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. d. Reconnect A5A1P1 to A3J2. e. Momentarily ground A5A2TP2. Measure voltage between A5A2J1-6 (U6A-6) and gnd (-). f. Remove ground from A5A2TP2.	54.144 99 MHz ±3 Hz Rapid beeping in speaker. Logic 0 at A5A2J1-6 (U6A-6).	Refer to synthesizer A5 instructions. Refer to synthesizer A5 instructions and check loss-of-lock signal.
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 ff 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 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.
(Cont)			

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. f. Set reference level on distortion analyzer, then note signal level output and vary AF GAIN control, then RF GAIN control.	Approx 1-kHz tone heard with level adjustable by AF GAIN control. Level does not change with AF GAIN but does with RF GAIN adjustments.	Refer to receiver-exciter A3 instructions. 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. <table><thead><tr><th><u>TRANSCEIVER</u></th><th><u>SIGNAL GENERATOR</u></th></tr></thead><tbody><tr><td>1.995</td><td>1.996</td></tr><tr><td>3.999</td><td>4.000</td></tr><tr><td>9.999</td><td>10.000</td></tr><tr><td>19.999</td><td>20.000</td></tr><tr><td>29.699</td><td>29.700</td></tr></tbody></table>	<u>TRANSCEIVER</u>	<u>SIGNAL GENERATOR</u>	1.995	1.996	3.999	4.000	9.999	10.000	19.999	20.000	29.699	29.700	10 dB or better for each frequency	Refer to receiver-exciter A3 instructions.
<u>TRANSCEIVER</u>	<u>SIGNAL GENERATOR</u>														
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. 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 70 dB Not less than 80 dB	Refer to receiver-exciter A3 instructions. 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. 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. Reduced power occurs in 20 ±10 seconds. Full power is not less than 90 watts for any frequency.	Adjust PA ALC pot for 100 watts. If ineffective, refer to power amplifier A1A1 and receiver-exciter A3 instructions. 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.	Output power increases smoothly from 0 to not less than 90 watts.	Refer to receiver-exciter A3 instructions.
	b. Switch in MOX and, while observing power meter, rotate MIC/CARRIER control to max cw position.		
12. Modulation	a. Switch out MOX. Rotate MIC/CARRIER control to max ccw position. Set MODE switch to USB.	Output power increases smoothly from 0 to not less than 90 watts.	Refer to receiver-exciter A3 instructions.
	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 varies with voice input.	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.	Note that louder voice level is required to switch in VOX.	Refer to receiver-exciter A3 instructions.
	b. Observe power meter and speak into microphone.		
	c. Rotate VOX GAIN control counterclockwise. Speak into microphone in voice loud enough to cause output power indication on power meter.	Delay between stopping speaking and switching to receive is longer than in test 13.f.	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.		
	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.		
(Cont)			

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. 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.	Transceiver switches between transmit and receive, as indicated by fluctuating power meter indication.	Same as test 13.f.
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. f. Turn off and disconnect equipment.	Noise pulses heard until NB switched in; then pulses, if heard, are at reduced level.	Refer to noise blanker A11 instructions.
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.

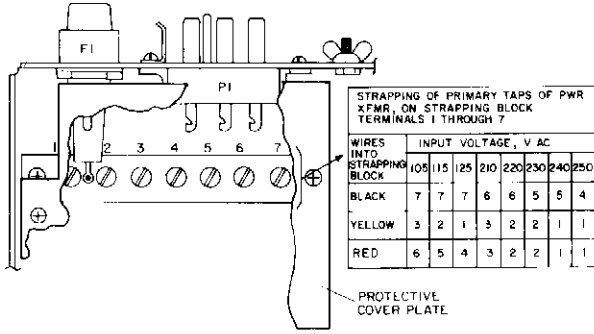
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL																																				
1. Initial setup	a. Before connecting primary power, check strapping and fuse F1 for correct values. (Refer to schematic diagram and figure below.) Restrap and refuse, if necessary, for bench primary power.  STRAPPING OF PRIMARY TAPS OF PWR XFMR, ON STRAPPING BLOCK, TERMINALS 1 THROUGH 7 <table><tr><th>WIRE INTO STRAPPING BLOCK</th><th>105</th><th>115</th><th>125</th><th>210</th><th>220</th><th>230</th><th>240</th><th>250</th></tr><tr><td>BLACK</td><td>7</td><td>7</td><td>7</td><td>6</td><td>6</td><td>5</td><td>5</td><td>4</td></tr><tr><td>YELLOW</td><td>3</td><td>2</td><td>1</td><td>3</td><td>2</td><td>2</td><td>1</td><td>1</td></tr><tr><td>RED</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>2</td><td>1</td><td>1</td></tr></table> PROTECTIVE COVER PLATE BOTTOM LEFT REAR CORNER OF TRANSCEIVER 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.	WIRE INTO STRAPPING BLOCK	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		
WIRE INTO STRAPPING BLOCK	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																															
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 (-)). 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.	+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. If A9A1R16 adjustments ineffective, check A9A1U1A.																																				

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 $\pm$ 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 $\pm$ 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 $\pm$ 0.2-V	Check A10U1.
	c. On card cage, adjacent to A9C1, measure voltage between A9U1-2 and gnd (-).	+5.0 $\pm$ 0.2-V	Check A9U1.
6. +24-V output	Measure voltage between feedthrough A9A2C5 and gnd (-).	+24 $\pm$ 2-V	Adjust A9A2R3 for 33.5 $\pm$ 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)			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.
(Cont)			

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 2 1 J1-5, -7, -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 4 2 1) J1-8, -10, -4, -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 1	0 thru 1	1 1	0 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

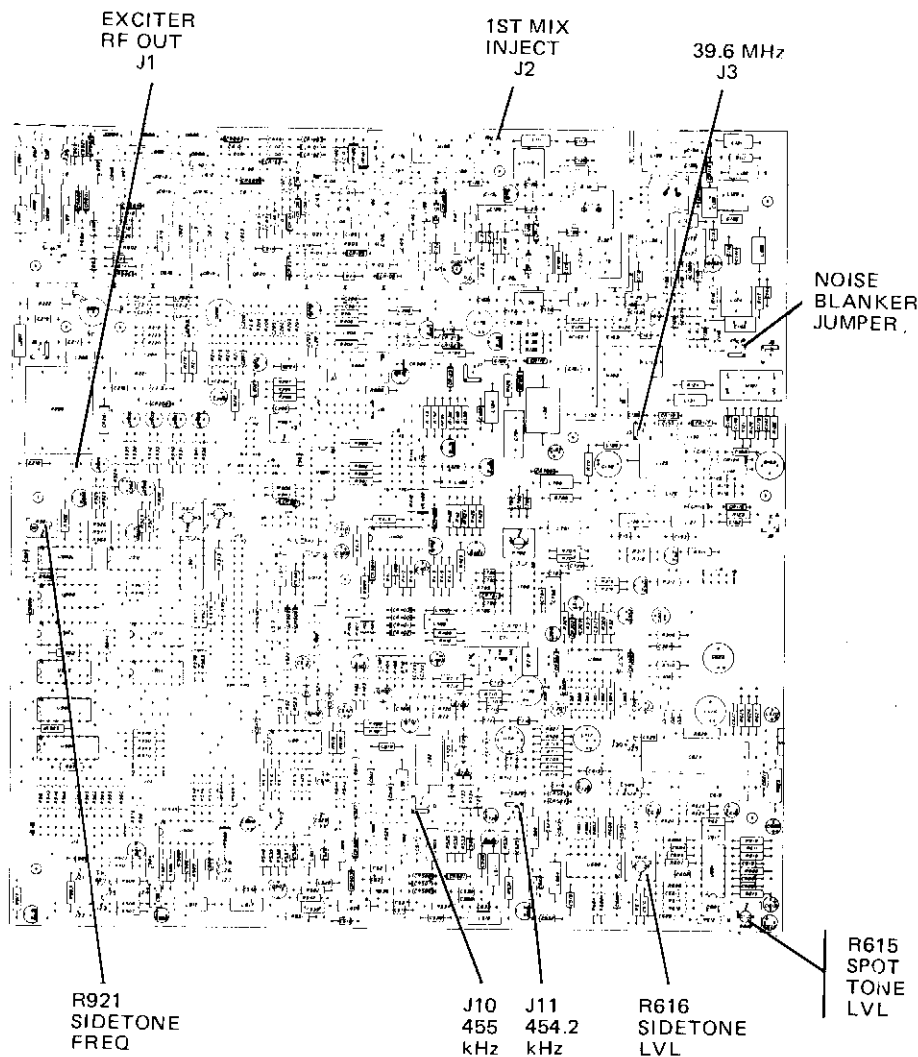
Do not make any other adjustments on the receiver-exciter board without the instruc-

tions 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.

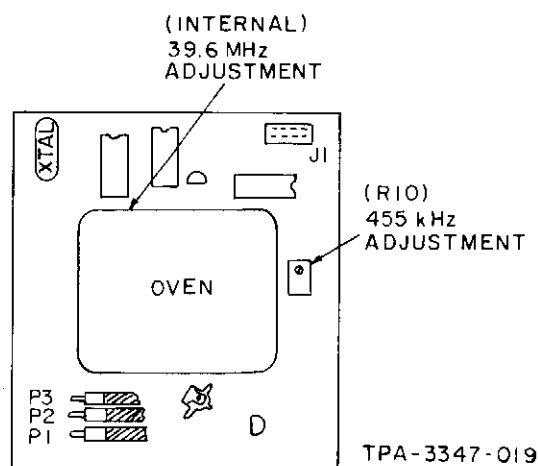
The test for off-frequency operation and corrective adjustment procedures are as follows:



TPA-1683-019

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. Conduc-

tive 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.

Observe the following precautions 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.



Rockwell
International

parts list

HF-380

Receiver-Transmitter

Collins Telecommunications Products Division

Printed in USA

523-0772528-001218

1 August 1982

list of illustrations

<i>Figure</i>	<i>Page</i>
1 HF-380 Receiver-Transmitter	5
2 Chassis A9	10
3 Power Supply Control, Circuit Card A9A1	15
4 24-Volt Regulator A9A2	19
5 Front Panel A10	21
6 Display A10A1	25

parts list

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
-------	---

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
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

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
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 ELSTON 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	SEAELECTRO 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

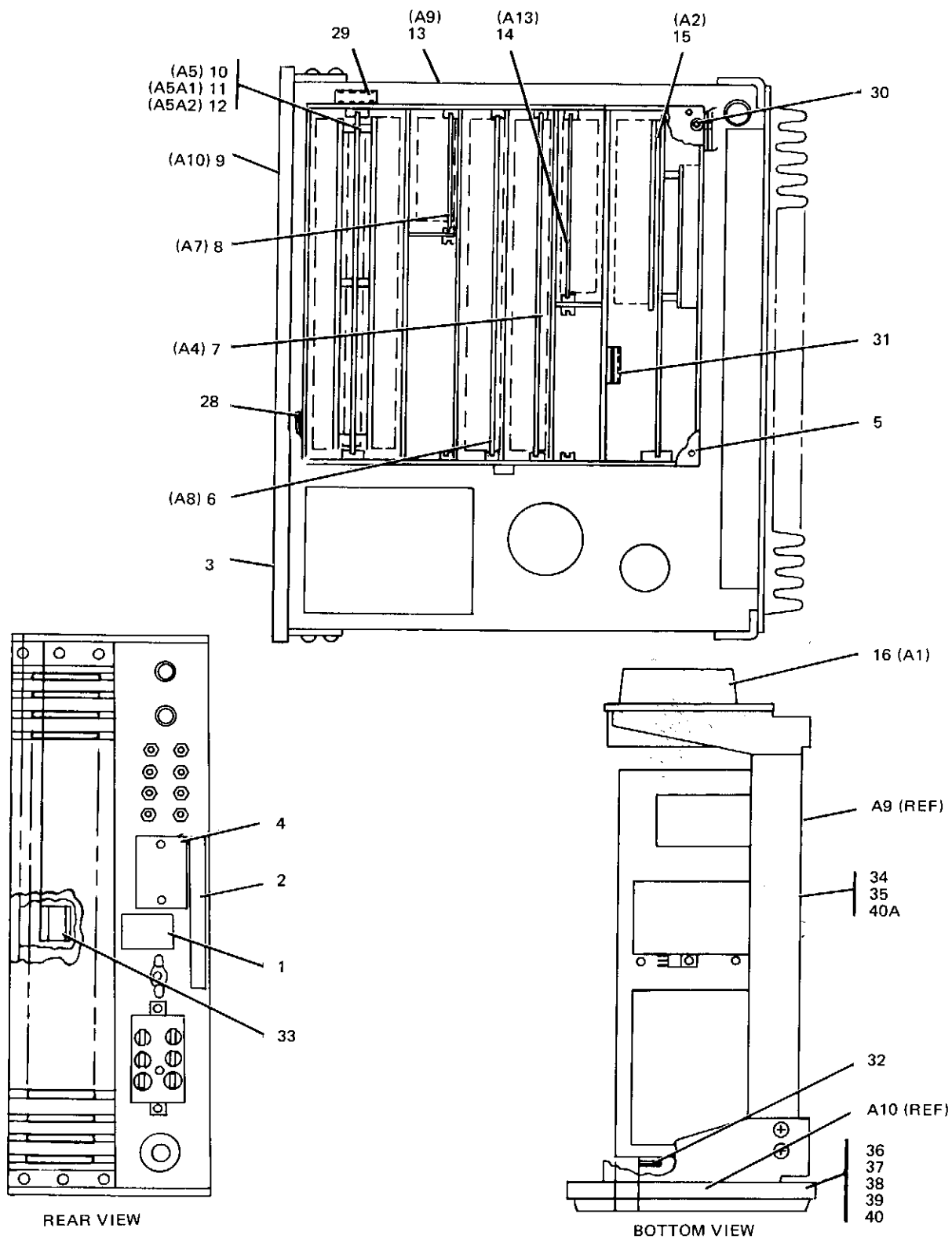
<u>PREFIX</u>	<u>UNIT PART NUMBER</u>	<u>FIG- ITEM</u>
A9A2	638-6275-001	4
A9A2	638-6275-002	4
A10	641-7104-001	5
A10A1	638-6931-001	6

1.8 Configuration Identifiers

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

<u>CI/ REV LTR</u>	<u>UNIT PART NUMBER</u>	<u>FIG- ITEM</u>
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

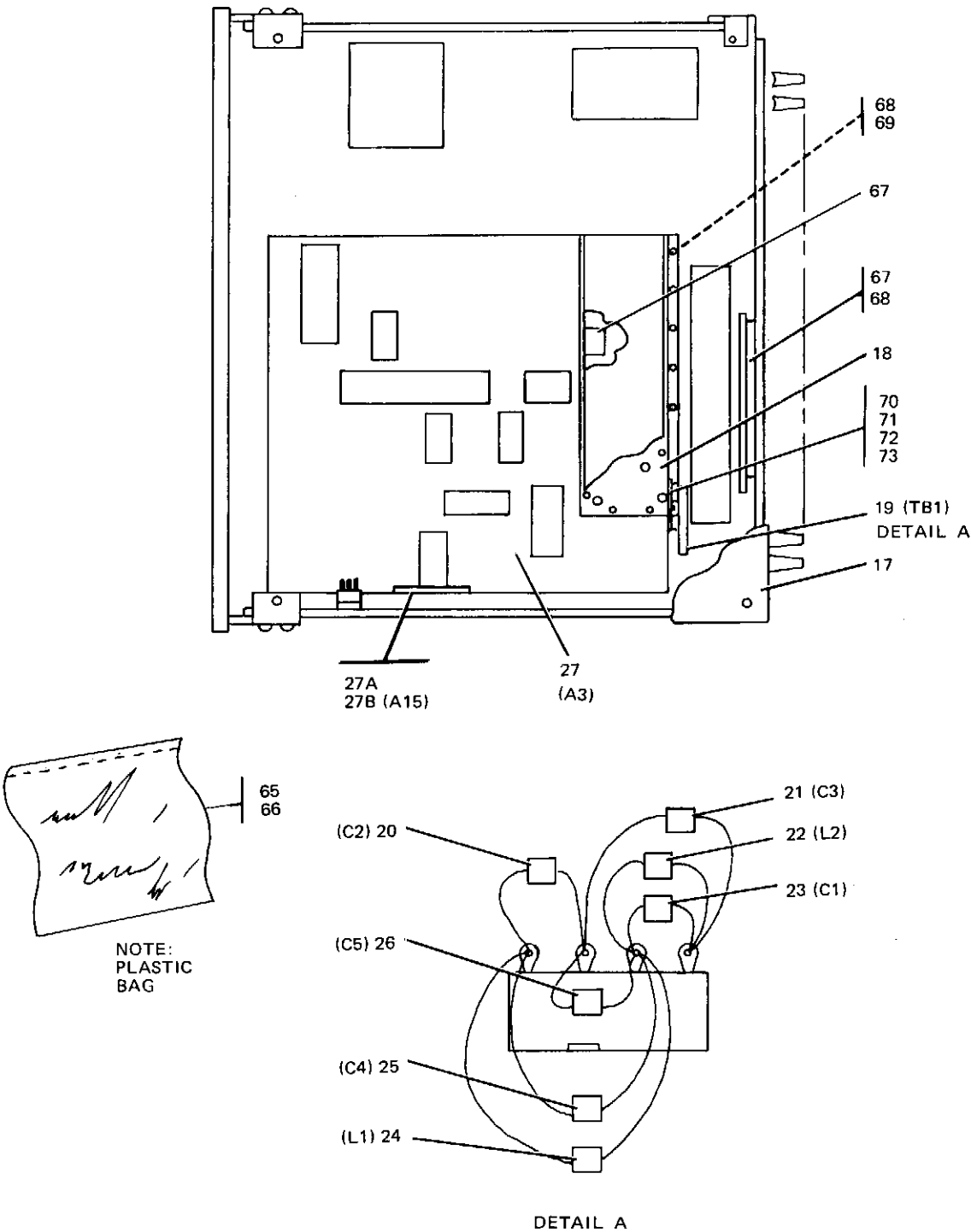
2. GROUP ASSEMBLY PARTS LIST



TPA-2149-039

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

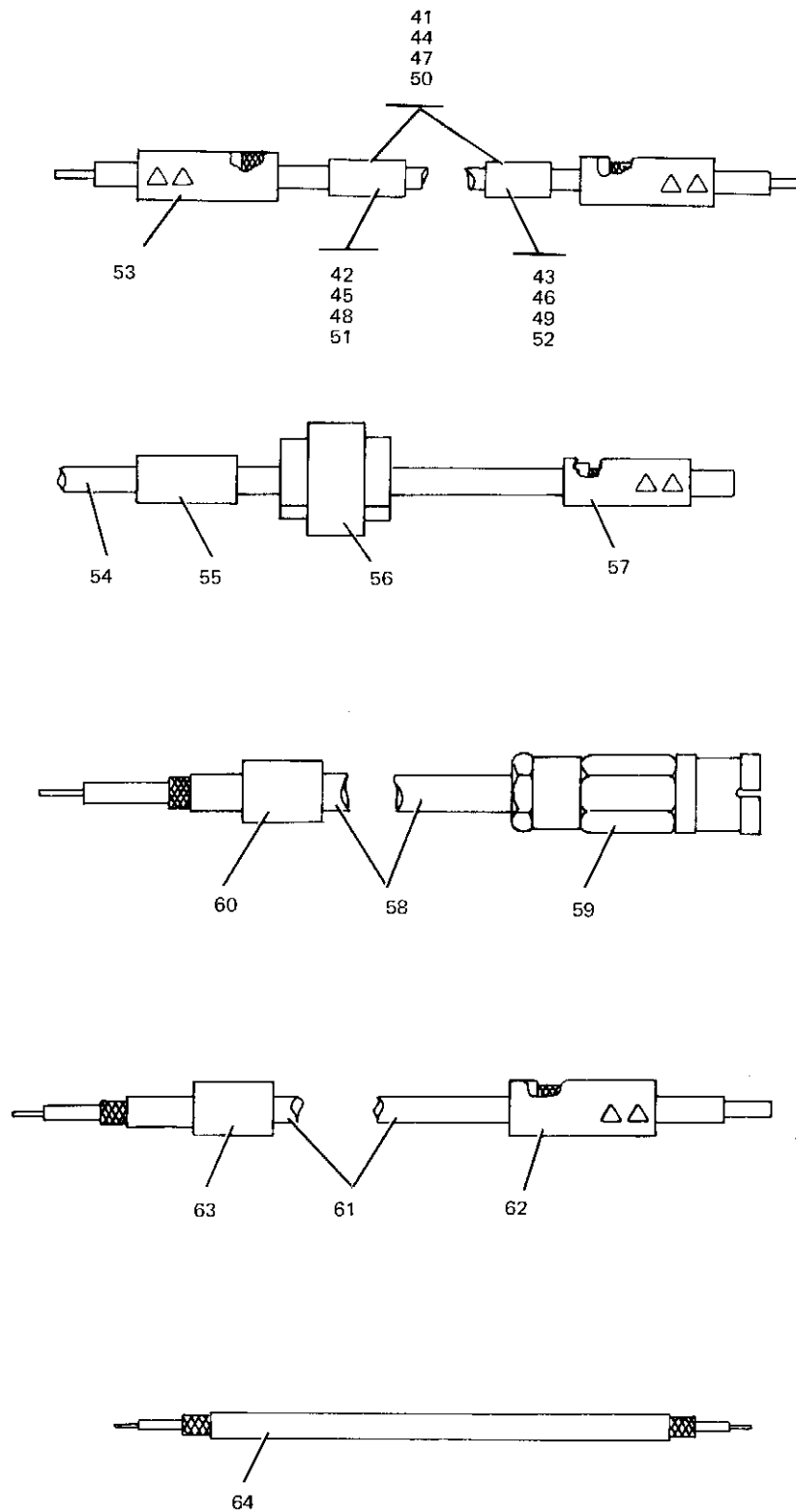
GROUP ASSEMBLY PARTS LIST



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)

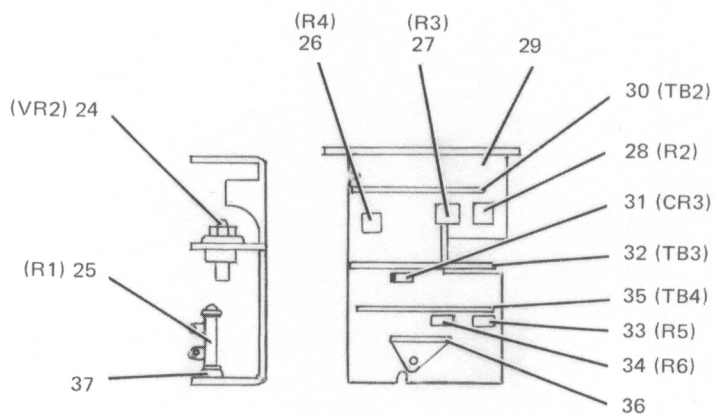
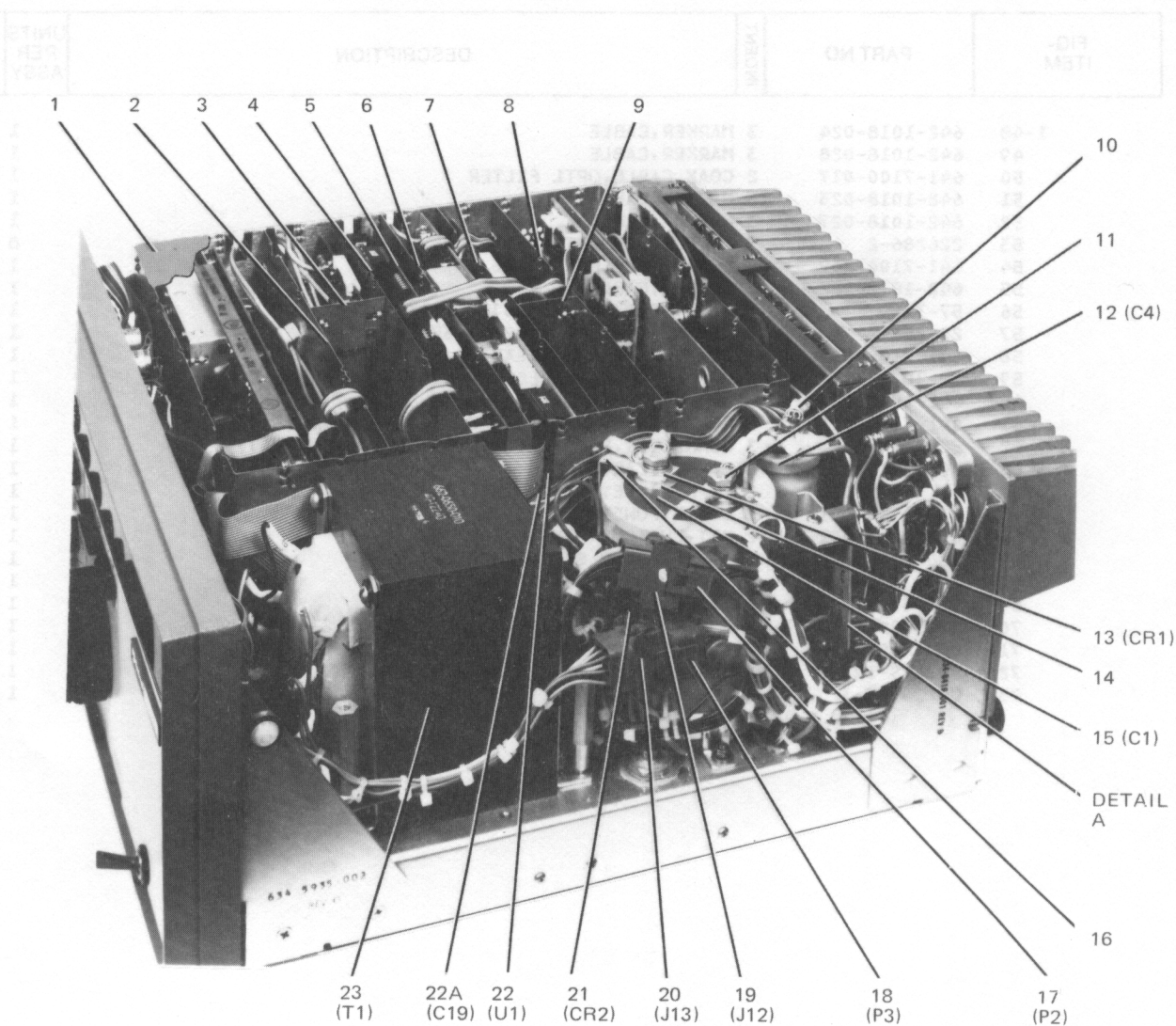
GROUP ASSEMBLY PARTS LIST

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 DIEI, 33PF, 5%, 500V (81349) 912-3848-000 C2	1	
21	CM04ED820J03	2	CAPACITOR,FXD MICA DIEI, 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 DIEI, 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 DIEI, 100PF, 5%, 500V (81349) 912-3879-000 C4	1	
26	CM05FD151J03	2	CAPACITOR,FXD MICA DIEI, 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 BR5, 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

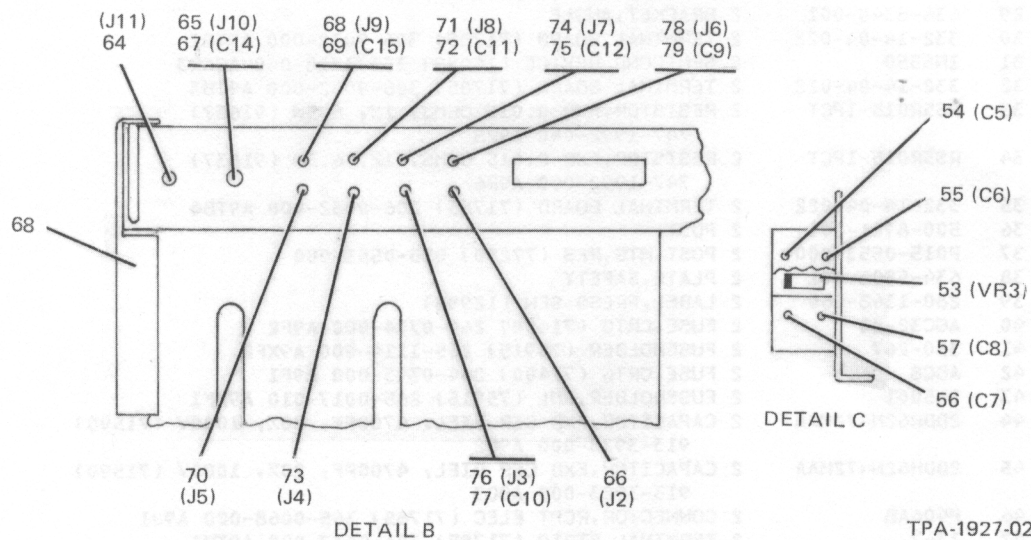
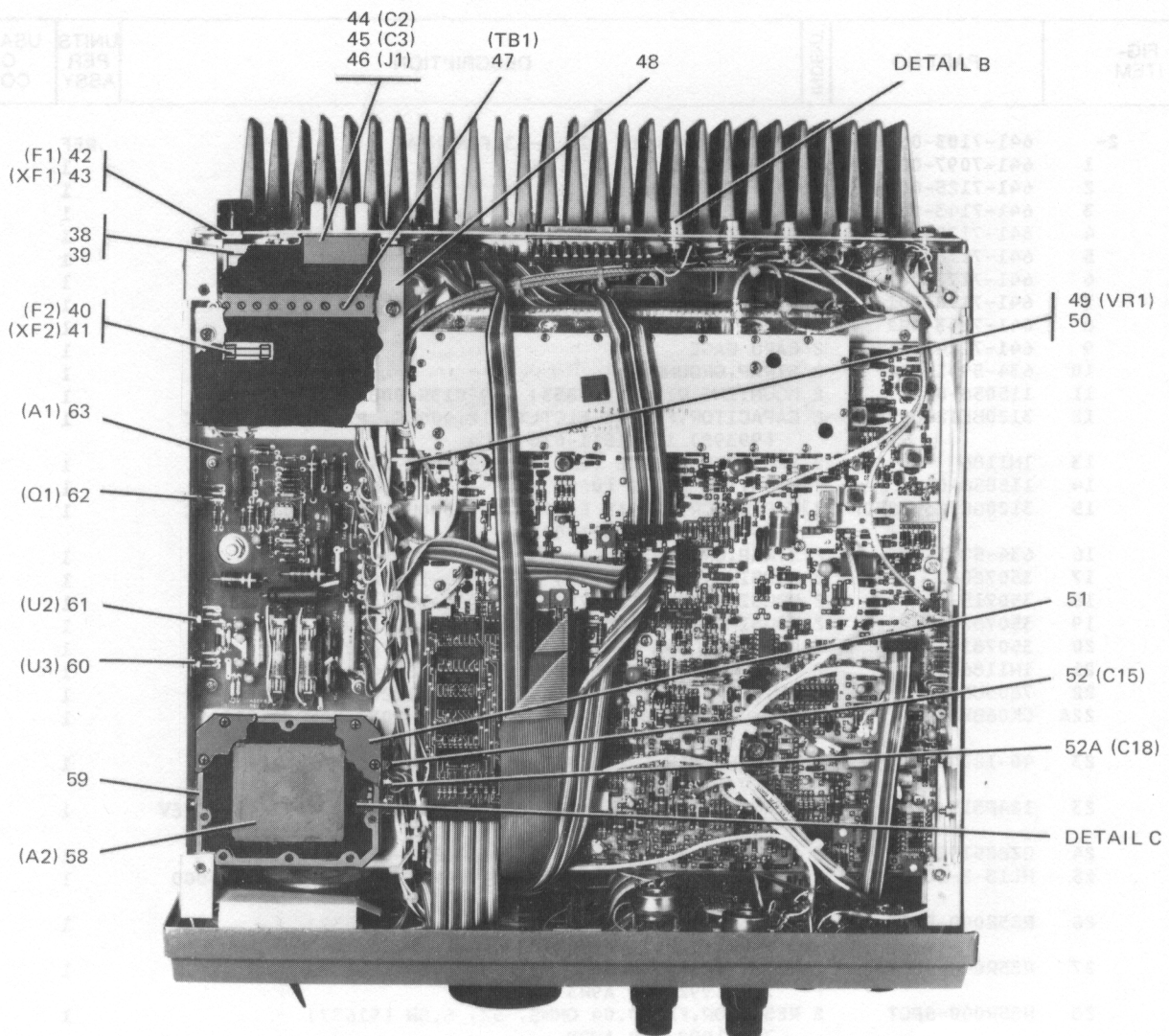


DETAIL A

TPA-1927-027

Chassis A9
Figure 2 (Sheet 1 of 2)

GROUP ASSEMBLY PARTS LIST



Chassis A9
Figure 2 (Sheet 2)

TPA-1927-027

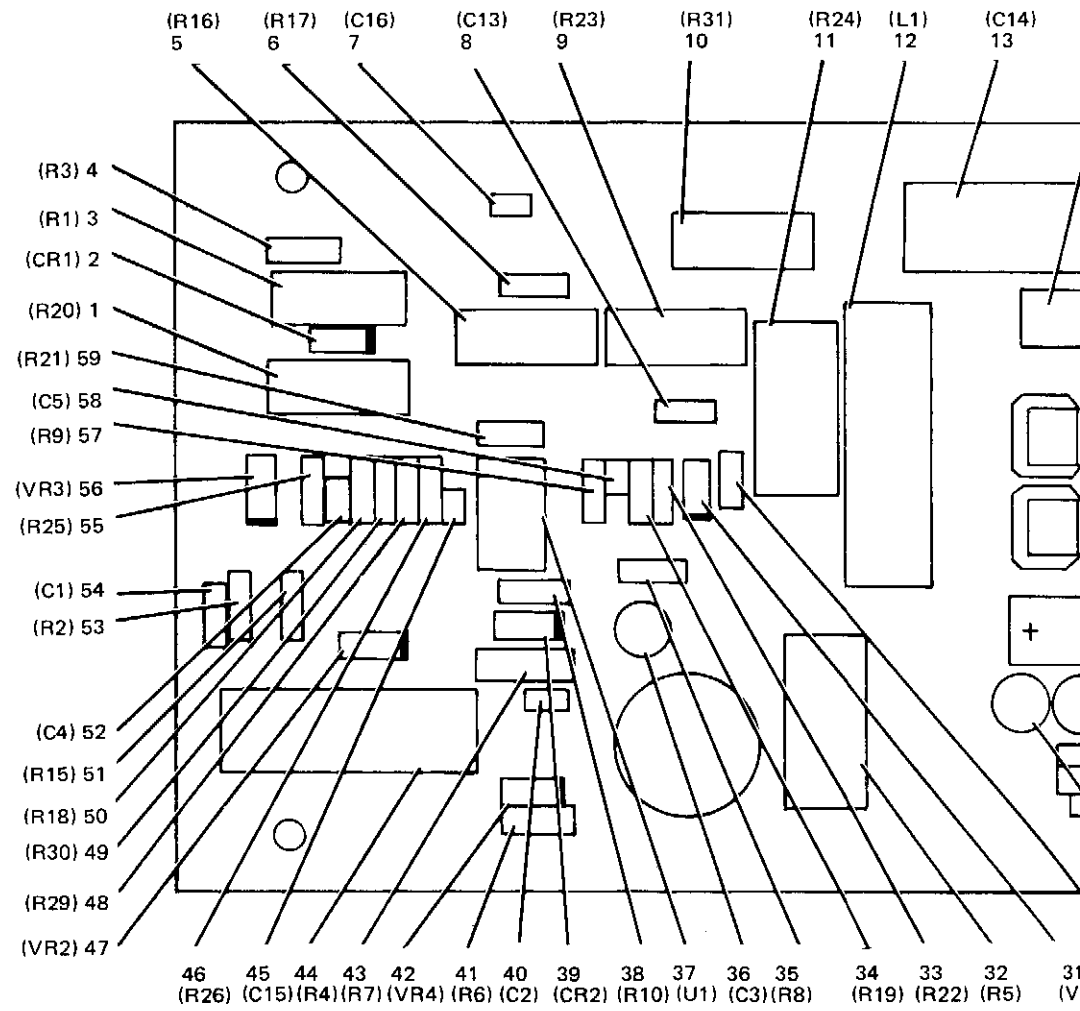
GROUP ASSEMBLY PARTS LIST

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, P75XM10%, 25VDC (99392) 183-1511-010 A9C4	1	
13	1N1186	2	SEMICONV 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, P75XM10%, 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	SEMICONV 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	SEMICONV 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	SEMICONV 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	

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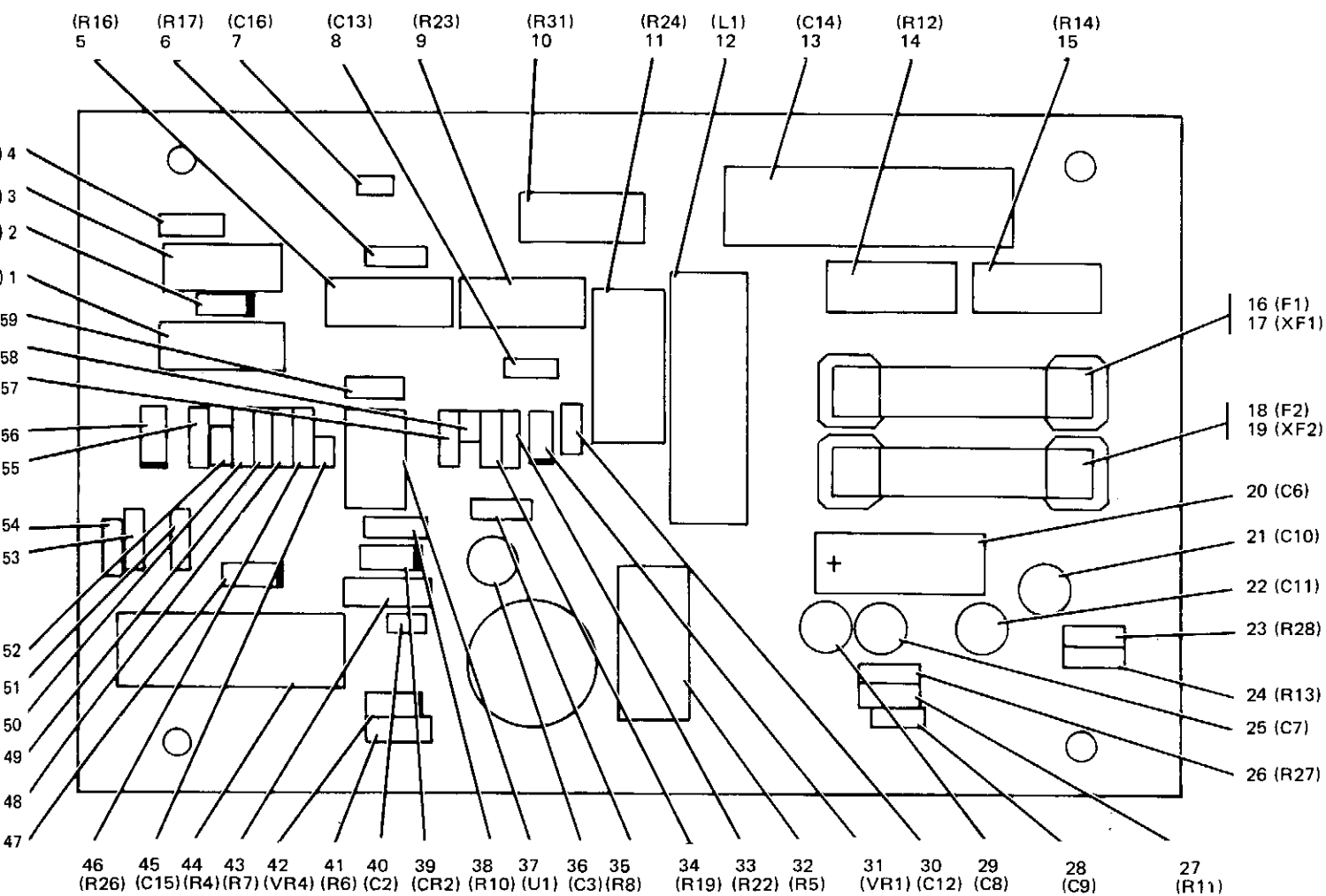
FIG- ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
2-48	540-9221-003	2	POST,ELEC-MECH	2	
49	1N3998RA	2	SEMICONO DEVICE (04713) 353-3648-040 A9VR1	1	
50	634-8281-001	2	BRACKET,DIODE	1	
51	634-5955-001	2	COVER,CHASSIS	1	
52	199D474X0035AB1	2	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V (56289) 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	SEMICONO 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	

GROUP ASSEMBLY PARTS L



Power

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TPA-5233-019

Power Supply Control, Circuit Card A9A1
Figure 3

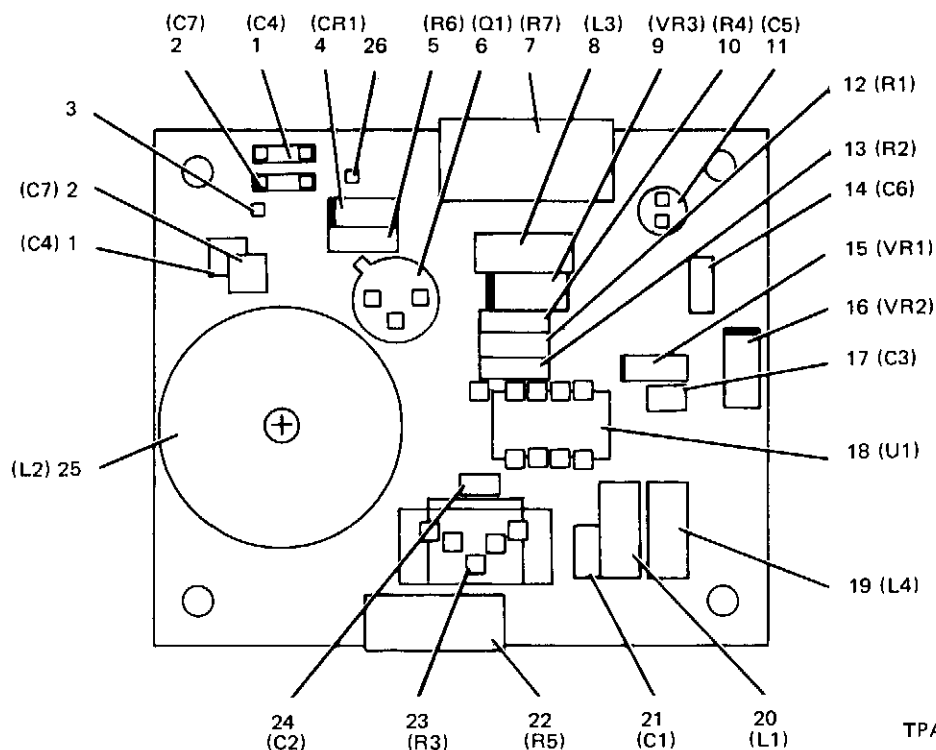
GROUP ASSEMBLY PARTS LIST

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	SEMICONV 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 DIEI, 0.001UF, P80XM20%, 50VDC (56289) 913-3331-010 A9A1C16	1	
8	292CY5U104Z050C	2	CAPACITOR,FXD CER DIEI, 0.10UF, P80XM20%, 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, P75XM10%, 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, P75XM10%, 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 DIEI, 0.10UF, P80XM20%, 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 DIEI, 0.10UF, P80XM20%, 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	SEMICONV 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 TNFLM 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	SEMICONV 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	SEMICONV 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	SEMICONV 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	SEMICONV 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	

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TPA-5234-019

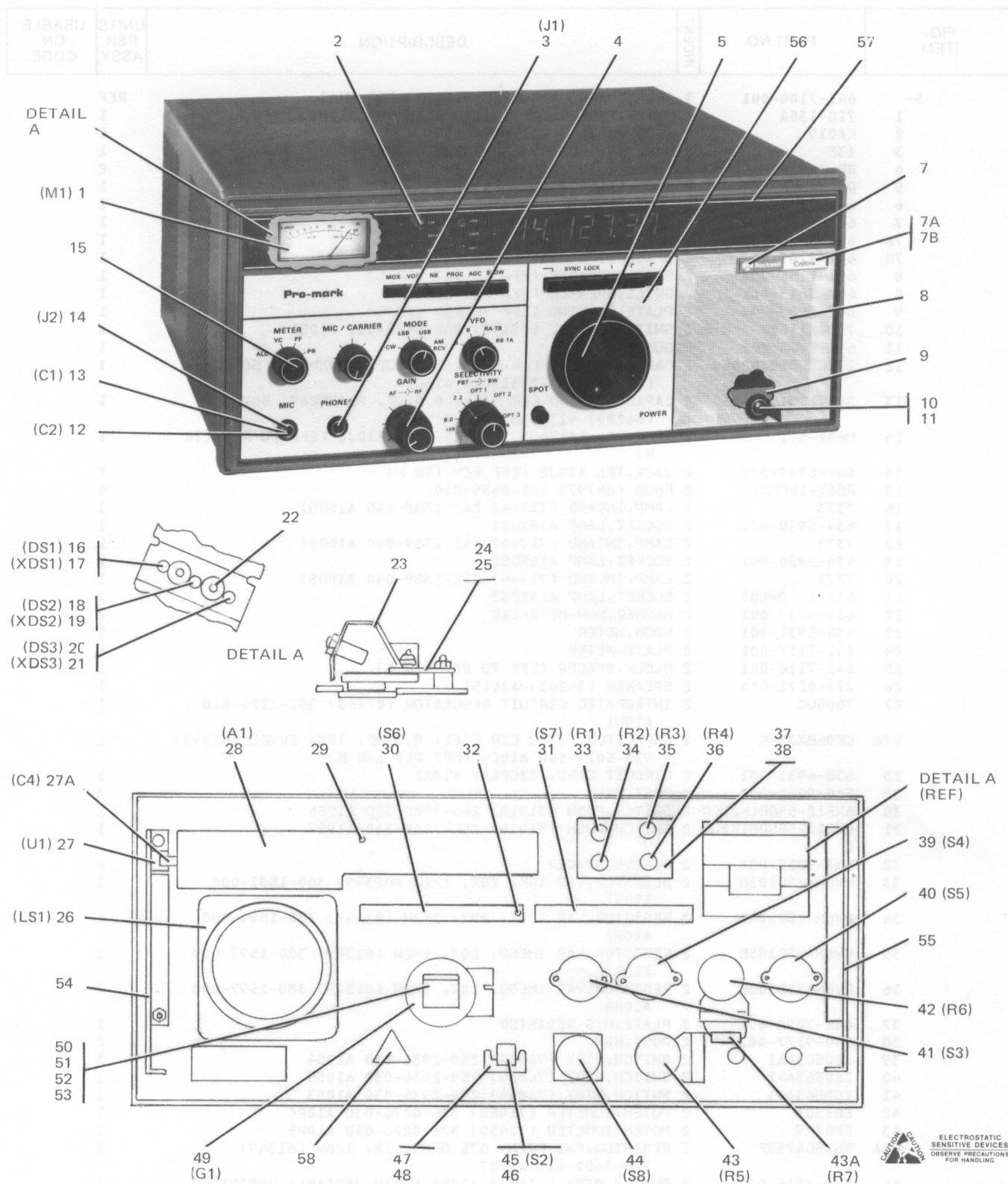
24-Volt Regulator A9A2
Figure 4

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	CAS01SP100-230-4	2	CONNECTOR,HDR (52072) 372-2656-130 30	2 B	
4	SC5615	2	SEMICONV 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	SEMICONV DEVICE (04713) 353-6550-310 A9A2VR3	1	B
10	RCR076222KS	2	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W (81349) 745-0761-000 A9A2R4	1	
11	199D475X0035DB1	2	CAPACITOR,FXD TMTLM ELCTLT, 4.7UF, 20%, 35V (56289) 184-9102-390 A9A2C5	1	
12	RN5502741F	2	RESISTOR,FXD FILM, 2.74K, 1%, 1/8W (81349) 705-1017-000 A9A2R1	1	
13	RCR076102KS	2	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W (81349) 745-0749-000 A9A2R2	1	
14	292CY5U104Z050C	2	CAPACITOR,FXD CER DIEI, 0.10UF, P80%M20%, 50VDC (56289) 913-3331-030 A9A2C6	1	
15	1N821A	2	SEMICONV DEVICE (12954) 353-3261-000 A9A2VR1	1	
16	1N5359B	2	SEMICONV DEVICE (04713) 353-6550-270 A9A2VR2	1	B
17	292CY5U103Z050B	2	CAPACITOR,FXD CER DIEI, 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 DIEI, 0.10UF, P80%M20%, 50VDC (56289) 913-3331-030 A9A2C1	1	
22	RCR326561KS	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 DIEI, 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

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Front Panel A10
Figure 5

ELECTROSTATIC SENSITIVE DEVICES
OBSERVE PRECAUTIONS FOR HANDLING

TPA-1931-017

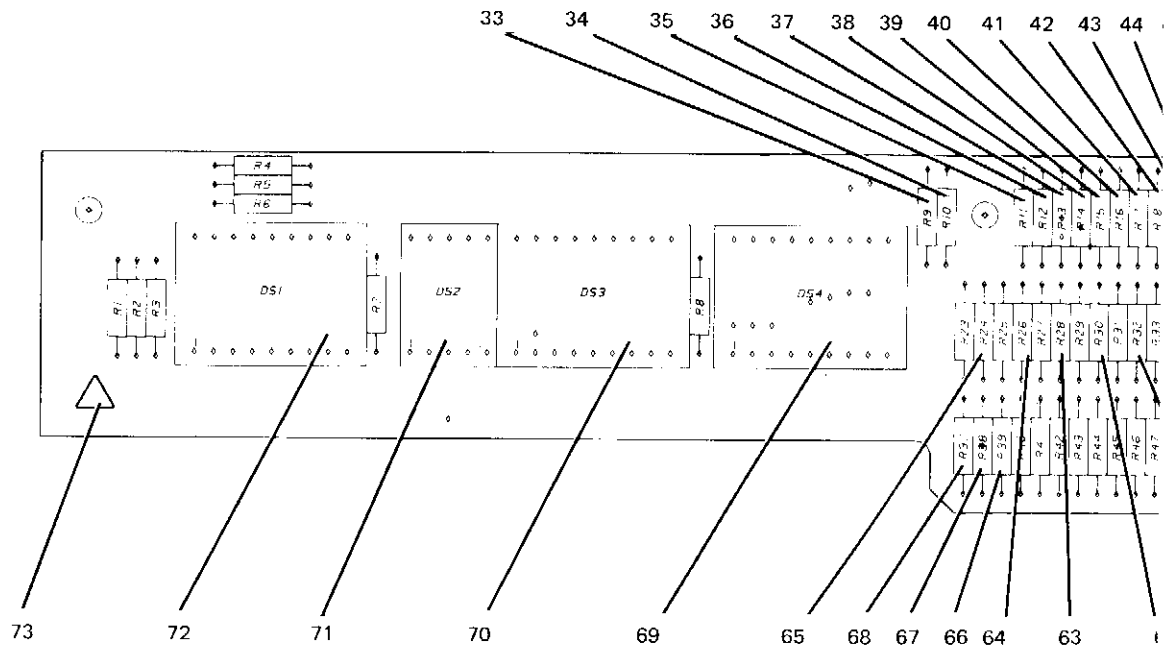
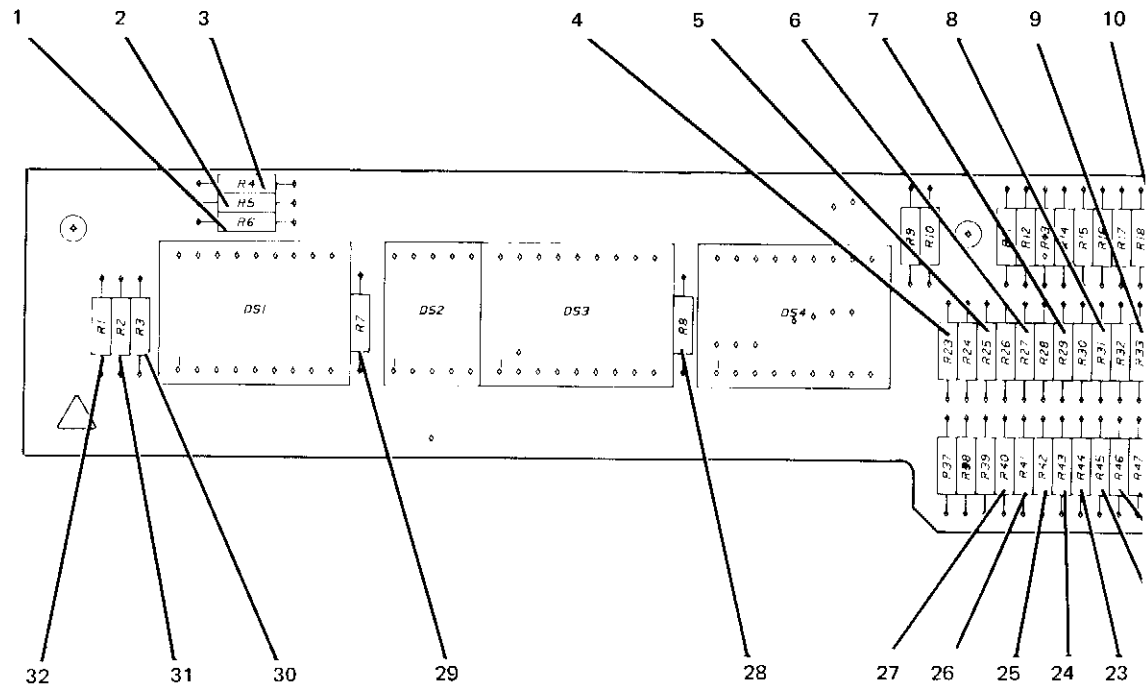
GROUP ASSEMBLY PARTS LIST

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	RB67-5MXSPC	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 DIEI, 0.001UF, P80%M20%, 50VDC (56289) 913-3331-010 A10C2	1	
13	292CY5U103D8050	2	CAPACITOR,FXD CER DIEI, 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	RB67-10CMXL	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 DIEI, 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	2	SWITCH,PUSH (31918) 266-7508-340 A10S7	1	
32	541-5955-002	2	SLEEVE,SPACER	4	
33	RV6NAYS0103B	2	RESISTOR,VAR 10K, 20%, 1/2W (81349) 380-1591-000 A10R1	1	
34	RV6NAYS0104B	2	RESISTOR,VAR 100K, 20%, 1/2W (81349) 380-1594-000 A10R2	1	
35	RV6NAYS0105B	2	RESISTOR,VAR 1MEGO, 20%, 1/2W (81349) 380-1597-000 A10R3	1	
36	RV6NAYS0105B	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

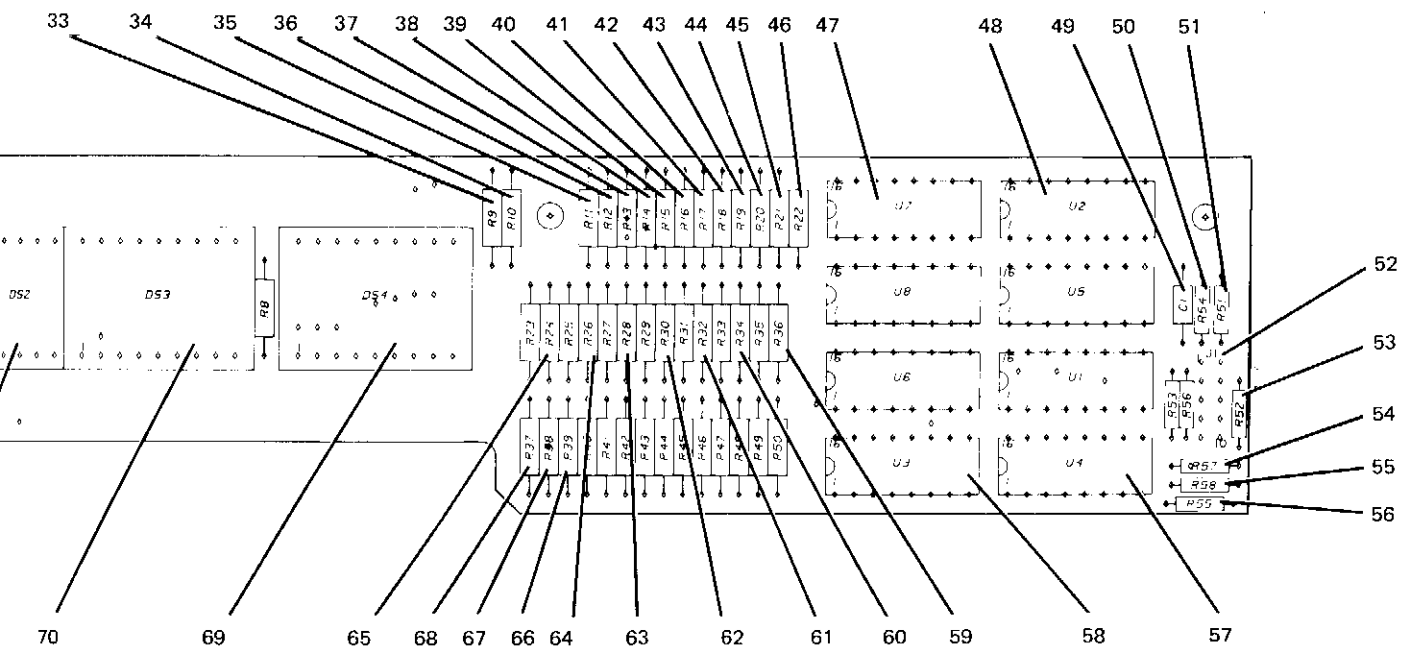
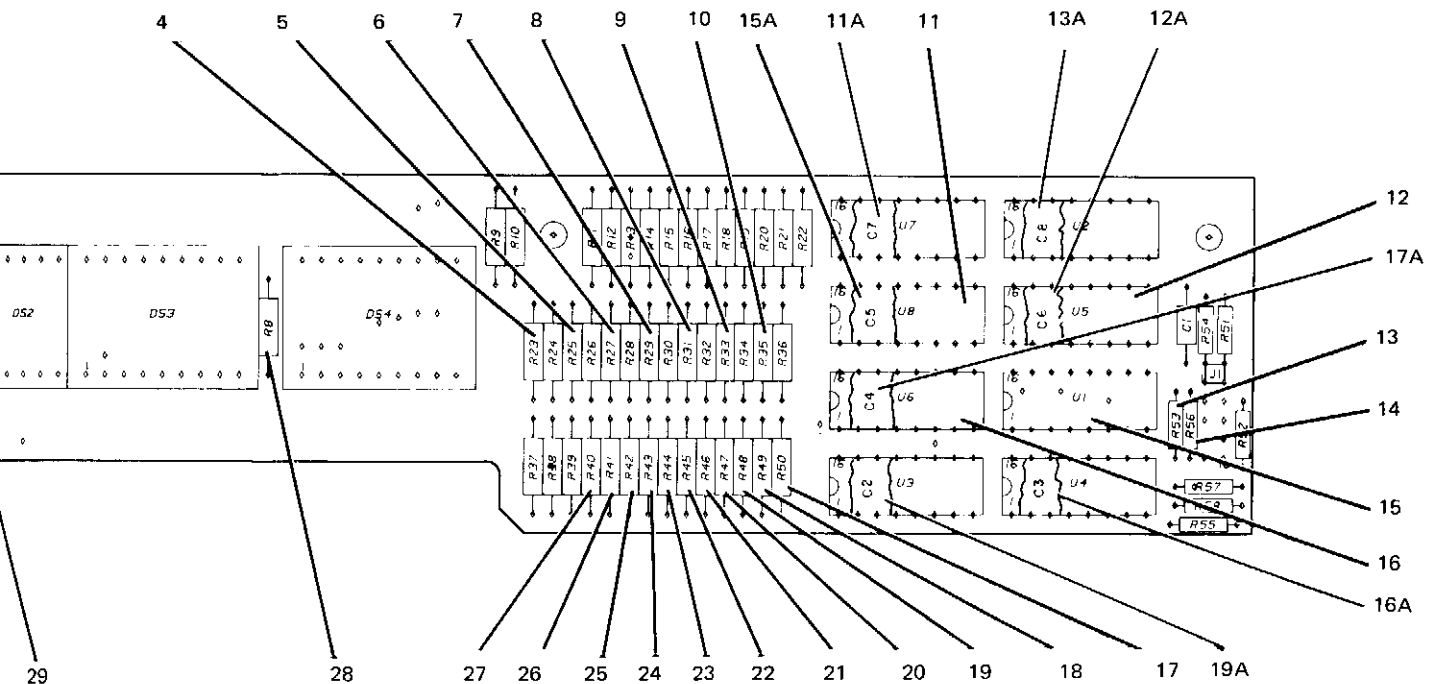
FIG-ITEM	PART NO	INDENT	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
5-46	FGBLACK	2	BUTTON,SW (31918) 266-7508-130	1	
47	01-0003-00	2	SWITCH,PUSH (31918) 266-7508-120	1	
48	540-5955-002	2	SLEEVE,SPACER	1	
49	PC66D200-5	2	ENCODER,SHAFT (15686) 229-9702-010 A10G1	1	
50	641-7160-001	2	CABLE,FRONT PANEL NO.1	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	

GROUP AS



638-6931-001

GROUP ASSEMBLY PARTS LIST



638-6931-001

CAUTION
ELECTROSTATIC
SENSITIVE DEVICES
OBSERVE PRECAUTIONS
FOR HANDLING
TPA-5300-018

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 DIEI, 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 DIEI, 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 DIEI, 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 DIEI, 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 DIEI, 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 DIEI, 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 DIEI, 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	CAD10SP100-230-4 30	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	

3. NUMERICAL INDEX

PART NUMBER	FIG-ITEM	TTL REQ	PART NUMBER	FIG-ITEM	TTL REQ
ABC8	2-42	1	M641-12-1	2-65	1
AGC250-2	3-16		M641-5-1	5-14	1
	3-18	2	PC660200-5	5-49	1
AGC32-30	2-40	1	P015-0553-000	2-37	1
CAD105P100-230-4	6-52	1	P313-0140-000	1-27B	1
30			P406AB	2-46	1
CAS015P100-230-4	4-3	2	RB67-1DCMXL	5-15	4
30			RB67-2AP1M	5-4	2
CK05BX103K	4-24	1	RB67-5MXSPC	5-5	1
CK05BX471K	6-11A		RCR05G103KS	6-14	
	6-12A			6-54	
	6-13A			6-55	
	6-15A			6-56	4
	6-16A		RCR05G104KS	6-13	
	6-17A			6-50	
	6-19A	7		6-51	
CK06BX105K	4-1			6-53	4
	4-1		RCR07G101KS	3-38	
	4-2			3-55	
	4-2	4		4-5	3
CK06BX334K	2-22A		RCR07G102KS	3-57	
	2-52A			4-13	2
	5-27A	3	RCR07G103KS	3-41	1
CK63AW103M	2-75	1	RCR07G104KS	3-35	1
CM04ED330J03	1-20		RCR07G105KS	3-50	1
	1-23	2	RCR07G222KS	4-10	1
CM04ED820J03	1-21	1	RCR07G271KS	6-1	
CM04FD101J03	1-25	1		6-2	
CM05FD151J03	1-26	1		6-3	
DBM-25P	1-71	1		6-4	
DB110963-3	1-73	1		6-5	
D20419-18	1-72	1		6-6	
EB1309	5-42	1		6-7	
FF6719	5-43	1		6-8	
FGBLACK	5-46	1		6-9	
GZ82519E	2-24	1		6-10	
HL15-3-50HMS5PCT	2-25	1		6-17	
KA019	5-2	4		6-18	
LM317T	2-60			6-19	
	2-61	2		6-20	
LM555CN	4-18	1		6-21	
LR2664E	6-69			6-22	
	6-70			6-23	
	6-72	3		6-24	
LR2668E	6-71	1		6-25	
MLM358U	3-37	1		6-26	
MS18130-1	1-24	1		6-27	
MS35338-98	1-27B	1		6-28	
MS51957-26	1-27B	1		6-29	
MS51957-28	1-27B	1		6-30	
MS51957-30	4-25	1		6-31	
MS75083-06	1-22	1		6-32	
MS75089-15	4-8	1		6-33	
MS75089-3	4-19			6-34	
	4-20	2		6-35	
M24308/26-1	1-70	1		6-36	

NUMERICAL INDEX

PART NUMBER	FIG-ITEM	TTL REQ	PART NUMBER	FIG-ITEM	TTL REQ
RCR07G271KS	6-37		015-0553-000	2-37	1
	6-38		1FA20A	5-45	1
	6-39		1N1186	2-13	
	6-40			2-21	2
	6-41		1N3998RA	2-49	1
	6-42		1N4002	3-2	
	6-43			3-39	2
	6-44		1N4104	3-56	1
	6-45		1N4617	3-42	1
	6-46		1N4750A	3-47	1
	6-59		1N5359B	2-53	
	6-60			4-16	2
	6-61		1N5363B	4-9	1
	6-62		1N5550	2-31	1
	6-63		1N821A	3-31	
	6-64			4-15	2
	6-65		101T10000	3-9	1
	6-66		101T200R0	3-14	
	6-67			3-15	2
	6-68	50	101T20000	4-23	1
RCR07G471KS	3-4	1	101T500R0	3-5	1
RCR20G222KS	3-43	1	102071	3-17	
RCR32G152KS	3-1	1		3-19	2
RCR32G561KS	4-22	1	115058-01	2-14	1
RCR42G150KS	3-32	1	115058-06	2-11	1
RCR42G181KS	4-7	1	12375B	4-25	1
RCR42G271KS	3-11	1	124P315	2-23	1
RN55D1400F	3-27	1	13E	2-64	
RN55D1401F	3-6			5-3	2
	3-46	2	139-0135-000	2-11	1
RN55D2490F	3-51	1	139-0139-000	2-14	1
RN55D2741F	4-12	1	17-7	2-47	1
RN55D2870F	3-24	1	183-1510-020	3-20	1
RN55D3013F	3-59	1	183-1510-070	3-13	1
RN55D3831F	3-33	1	183-1511-010	2-12	1
RN55D4750F	5-43A	1	183-1511-030	2-15	1
RN55D5621F	3-34	1	184-9102-330	2-52	1
RN55D6811F	3-48			3-21	
	3-49	2		3-22	
RN55D7500F	3-23			3-25	
	3-26	2		3-29	
RN60D3833F	3-59	1		3-36	
RS5R015-1PCT	2-33			4-11	6
	2-34	2	184-9102-960	4-1	
RS5R040-5PCT	2-26			4-2	2
	2-27		199D155X0050CE3	4-1	
	2-28	3		4-2	2
RV6NAYSD103B	5-33	1	199D474X0035AB1	2-52	1
RV6NAYSD104B	5-34	1	199D475X0035DB1	3-21	
RV6NAYSD105B	5-35			3-22	
	5-36	2		3-25	
RW67V470	3-44	1		3-29	
RW69V1R5	3-10	1		3-36	
RW69V821	3-3	1		4-11	6
SC5615	4-4	1	2-332070-3	4-26	1
SN74LS138N	6-15	1	20DH62N472MAA	2-44	
TIP31A	2-62	1		2-45	2
X201R102B	3-9	1	2N2219A	4-6	1
X201R251B	3-5		226286-2	1-53	
	3-14			1-57	9
	3-15	3	229-9702-010	5-49	1
X201R252B	4-23	1	240-0261-000	4-25	1
01-0003-00	5-47	1	240-0879-010	3-12	1

NUMERICAL INDEX

PART NUMBER	FIG-ITEM	TTL REQ	PART NUMBER	FIG-ITEM	TTL REQ
240-1562-000	1-24	1	292CY5U104Z050C	4-21	
240-2016-000	1-22	1		6-49	7
240-2715-290	4-19		306-0037-000	2-47	1
	4-20	2	306-9032-000	1-19	
240-2715-410	4-8	1		2-30	
259-2936-030	5-39			2-32	
	5-40			2-35	4
	5-41	3	310-0096-000	1-27B	1
259-8018-030	5-44	1	3120BE123U025BP	2-12	1
262-1389-040	5-16		3120GE723U025DP	2-15	1
	5-18		313-0140-000	1-27B	1
	5-20	3	332-14-04-022	1-19	
262-1485-020	6-69			2-30	
	6-70			2-32	
	6-72	3		2-35	4
262-1485-030	6-71	1	343-0167-000	1-27B	1
264-0395-000	2-42	1	343-0169-000	1-27B	1
264-0723-000	3-16		343-0171-000	4-25	1
	3-18	2	345001	2-43	1
264-0734-000	2-40	1	350-267	2-41	1
265-0017-010	2-43	1	3501FP	2-66	
265-1041-010	3-17			2-68	
	3-19	2		2-70	
265-1114-000	2-41	1		2-71	
266-5424-010	5-10	1		2-73	
266-7508-110	5-45	1		2-74	
266-7508-120	5-47	1		2-76	
266-7508-130	5-46	1		2-78	15
266-7508-340	5-31	1	350715-1	2-18	1
266-7508-350	5-30	1	350720-1	2-17	1
271-0271-010	5-26	1	350781-1	2-20	1
280-1368-560	2-39	1	350782-1	2-19	1
280-2745-020	1-67		351-1120-010	2-22	
	5-58	2		5-27	2
280-2745-040	6-73	1	351-1137-020	4-18	1
280-3821-010	1-69	1	351-1211-040	3-37	1
280-3821-020	1-68	1	351-1271-010	2-60	
280563AA1	5-39			2-61	2
	5-40		351-1526-030	6-15	1
	5-41	3	351-8804-020	6-11	
281-0160-000	5-2	4		6-12	
281-0659-010	5-15	4		6-16	
281-0659-020	5-5	1		6-47	
281-0659-040	5-4	2		6-48	
288-1337-050	1-56	1		6-57	
292CX7R102M050B	3-7			6-58	7
	3-40		352-0661-010	4-6	1
	3-52	3	352-1156-010	2-62	1
292CY5U102D8050	2-72		353-0325-010	2-24	1
	2-79		353-3261-000	3-31	
	5-12	3		4-15	2
292CY5U103D8050	2-67		353-3591-060	3-56	1
	2-69		353-3591-410	3-42	1
	2-77		353-3648-040	2-49	1
	5-13	4	353-3718-040	2-31	1
292CY5U103Z050B	3-45		353-6442-020	3-2	
	3-58			3-39	2
	4-17	3	353-6478-040	2-13	
292CY5U104Z050C	3-8			2-21	2
	3-28		353-6481-450	3-47	1
	3-30		353-6496-020	4-4	1
	3-54		353-6550-270	2-53	
	4-14			4-16	2

NUMERICAL INDEX

PART NUMBER	FIG-ITEM	TTL REQ	PART NUMBER	FIG-ITEM	TTL REQ
353-6550-310	4-9	1	6XF12-5FSDBLK2UE	5-31	1
357-0067-010	1-53		E		
	1-57	9	6XF12-5SDBLK2UGR	5-30	1
357-7207-010	1-59		622-3580-001	1-	1
	1-62	2	623-9008-001	5-7	1
358-0014-000	2-65	1	632-5234-001	5-7A	1
358-1050-000	5-14	1	634-5903-003	1-4	1
360-0079-120	4-26	1	634-5908-001	2-38	1
360-0136-000	2-64		634-5930-001	5-17	
	5-3	2		5-19	
360-0148-000	2-66			5-21	3
	2-68		634-5931-001	5-23	1
	2-70		634-5935-001	5-55	1
	2-71		634-5935-002	5-54	1
	2-73		634-5941-001	2-16	1
	2-74		634-5941-002	2-10	1
	2-76		634-5943-001	1-17	1
	2-78	15	634-5952-001	2-59	1
365-0068-020	2-46	1	634-5955-001	2-51	1
371-0040-020	1-72	1	634-8281-001	2-50	1
371-0062-000	1-70	1	634-8340-001	2-29	1
371-0170-000	1-71	1	634-8481-003	1-16	1
371-0392-030	1-73	1	634-8498-001	1-65	1
372-0064-130	2-18	1	634-8939-001	5-22	2
372-0064-140	2-20	1	638-6275-001	2-58	1
372-0064-150	2-17	1		4-	REF
372-0064-160	2-19	1	638-6275-002	2-58	1
372-2656-100	6-52	1		4-	REF
372-2656-130	4-3	2	638-6825-001	2-63	1
376-0274-020	3-5			3-	REF
	3-14		638-6908-002	1-27	1
	3-15	3	638-6912-002	1-7	1
376-0274-040	3-9	1	638-6914-002	1-14	1
376-0274-050	4-23	1	638-6916-002	1-11	1
376-0276-030	5-42	1	638-6918-001	1-8	1
376-0276-050	5-43	1	638-6920-001	1-12	1
380-1591-000	5-33	1	638-6929-002	1-6	1
380-1594-000	5-34	1	638-6929-004	1-6	1
380-1597-000	5-35		638-6931-001	5-28	1
	5-36	2		6-	REF
382-0038-020	3-14		641-3700-001	1-1	1
	3-15	2	641-6773-001	5-11	1
382-0038-030	3-5	1	641-7097-001	1-5	1
382-0038-040	3-9	1	641-7097-002	2-1	1
382-0038-050	4-23	1	641-7098-001	5-37	1
40-12240	2-23	1	641-7099-001	1-10	1
450-0158-020	5-1	1	641-7099-002	1-10	1
500-8921-001	2-36	1	641-7100-001	1-41	1
500D336G025BB5	3-20	1	641-7100-002	1-44	1
500D337G0250F5	3-13	1	641-7100-007	1-54	1
52-307-3188	1-59		641-7100-008	1-47	1
	1-62	2	641-7100-014	1-58	1
54-794-010-102P	2-54		641-7100-015	1-61	1
	2-55		641-7100-016	1-64	1
	2-56		641-7100-017	1-50	1
	2-57	4	641-7101-001	5-6	1
540-5955-002	5-48	1	641-7103-001	1-13	1
540-9041-003	5-29	3		2-	REF
540-9177-003	5-38	2	641-7104-001	1-9	1
540-9221-003	2-48	2		5-	REF
541-5955-002	5-32	4	641-7109-001	5-7B	1
57-1559	1-56	1	641-7114-001	5-56	1
			641-7115-001	1-3	1

NUMERICAL INDEX

PART NUMBER	FIG-ITEM	TTL REQ	PART NUMBER	FIG-ITEM	TTL REQ
641-7116-001	5-25	1	705-1024-000	3-33	1
641-7117-001	5-24	1	705-1032-000	3-34	1
641-7119-001	5-57	1	705-1036-000	3-48	
641-7120-001	2-81	1		3-49	2
641-7123-001	1-34	1	705-1115-000	3-59	1
641-7123-002	1-35	1	705-3600-810	5-43A	1
641-7123-003	1-36	1	705-6720-000	3-59	1
641-7123-004	1-37	1	710-135A	5-1	1
641-7123-005	1-38	1	7360K11C27	5-10	1
641-7123-006	1-39	1	7373	5-16	
641-7123-007	1-40	1		5-18	
641-7123-008	1-40A	1		5-20	3
641-7124-001	2-9	1	745-0713-000	3-38	
641-7125-001	2-2	1		3-55	
641-7132-001	1-15	1		4-5	3
641-7140-001	1-18	1	745-0728-000	6-1	
641-7143-001	2-3	1		6-2	
641-7143-002	2-8	1		6-3	
641-7155-001	5-8	1		6-4	
641-7160-001	5-50	1		6-5	
641-7161-001	5-51	1		6-6	
641-7162-001	2-80	1		6-7	
641-7164-001	5-52	1		6-8	
641-7165-001	5-53	1		6-9	
641-7166-001	1-28	1		6-10	
641-7167-001	1-29	1		6-17	
641-7168-001	1-32	1		6-18	
641-7169-001	1-31	1		6-19	
641-7170-001	1-33	1		6-20	
641-7173-001	1-30	1		6-21	
641-7175-001	2-4	1		6-22	
641-7176-001	2-5	1		6-23	
641-7177-001	2-6	1		6-24	
641-7178-001	2-7	1		6-25	
641-7181-001	1-66	1		6-26	
642-0028-000	1-2	1		6-27	
642-1018-019	1-43	1		6-28	
642-1018-020	1-46	1		6-29	
642-1018-021	1-63	1		6-30	
642-1018-022	1-55	1		6-31	
642-1018-023	1-42	1		6-32	
642-1018-024	1-48	1		6-33	
642-1018-025	1-51	1		6-34	
642-1018-026	1-45	1		6-35	
642-1018-027	1-52	1		6-36	
642-1018-028	1-49	1		6-37	
642-1018-030	1-60	1		6-38	
642-2520-001	5-9	1		6-39	
646-5802-001	1-27A	1		6-40	
647-2739-001	5-14	1		6-41	
647-2843-001	5-8	1		6-42	
647-2924-001	1-27B	1		6-43	
662-0650-010	2-23	1		6-44	
662-0650-020	2-23	1		6-45	
705-0701-000	3-53	1		6-46	
705-0955-000	3-27	1		6-59	
705-0967-000	3-51	1		6-60	
705-0970-000	3-24	1		6-61	
705-0990-000	3-23			6-62	
	3-26	2		6-63	
705-1003-000	3-6			6-64	
	3-46	2		6-65	
705-1017-000	4-12	1		6-66	

NUMERICAL INDEX

PART NUMBER	FIG-ITEM	TTL REQ	PART NUMBER	FIG-ITEM	TTL REQ
745-0728-000	6-67		913-3331-020	5-13	7
	6-68	50	913-3331-030	3-8	
745-0737-000	3-4	1		3-28	
745-0749-000	3-57			3-30	
	4-13	2		3-54	
745-0761-000	4-10	1		4-14	
745-0785-000	3-41	1		4-21	
745-0821-000	3-35	1		6-49	7
745-0857-000	3-50	1	913-3923-000	2-44	
745-1366-000	3-43	1		2-45	2
745-2377-000	6-14		913-4014-000	6-11A	
	6-54			6-12A	
	6-55			6-13A	
	6-56	4		6-15A	
745-2413-000	6-13			6-16A	
	6-50			6-17A	
	6-51			6-19A	7
	6-53	4	913-5019-200	4-24	1
745-3342-000	4-22	1	913-5019-500	2-22A	
745-3359-000	3-1	1		2-52A	
745-5575-000	3-32	1		5-27A	3
745-5621-000	4-7	1	913-5019-560	4-1	
745-5628-000	3-11	1		4-1	
747-0715-000	2-25	1		4-2	
747-1992-040	2-33			4-2	4
	2-34	2			
747-1992-070	2-26				
	2-27				
	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			
8804-020	6-11				
	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				

4. REFERENCE DESIGNATION INDEX

REFERENCE DESIGNATION	FIG-ITEM	PART NUMBER	REFERENCE DESIGNATION	FIG-ITEM	PART NUMBER
A1	1-16	634-8481-003	A10AIR45	6-22	RCR07G271KS
A10	1-9	641-7104-001	A10AIR46	6-21	RCR07G271KS
A10	5-	641-7104-001	A10AIR47	6-20	RCR07G271KS
A10A1	5-28	638-6931-001	A10AIR48	6-19	RCR07G271KS
A10A1	6-	638-6931-001	A10AIR49	6-18	RCR07G271KS
A10A1C1	6-49	292CY5U104Z050C	A10AIR50	6-17	RCR07G271KS
A10A1C2	6-19A	CK05BX471K	A10AIR51	6-51	RCR05G104KS
A10A1C3	6-16A	CK05BX471K	A10AIR52	6-53	RCR05G104KS
A10A1C4	6-17A	CK05BX471K	A10AIR53	6-13	RCR05G104KS
A10A1C5	6-15A	CK05BX471K	A10AIR54	6-50	RCR05G104KS
A10A1C6	6-12A	CK05BX471K	A10AIR55	6-56	RCR05G103KS
A10A1C7	6-11A	CK05BX471K	A10AIR56	6-14	RCR05G103KS
A10A1C8	6-13A	CK05BX471K	A10AIR57	6-54	RCR05G103KS
A10A1DS1	6-72	LR2664E	A10AIR58	6-55	RCR05G103KS
A10A1DS2	6-71	LR2668E	A10AIR7	6-29	RCR07G271KS
A10A1DS3	6-70	LR2664E	A10AIR8	6-28	RCR07G271KS
A10A1DS4	6-69	LR2664E	A10AIR9	6-33	RCR07G271KS
A10A1J1	6-52	CAD10SP100-230-430	A10AIU1	6-15	SN74LS138N
A10AIR1	6-32	RCR07G271KS	A10AIU2	6-48	8804-020
A10AIR10	6-34	RCR07G271KS	A10AIU3	6-58	8804-020
A10AIR11	6-35	RCR07G271KS	A10AIU4	6-57	8804-020
A10AIR12	6-36	RCR07G271KS	A10AIU5	6-12	8804-020
A10AIR13	6-37	RCR07G271KS	A10AIU6	6-16	8804-020
A10AIR14	6-38	RCR07G271KS	A10AIU7	6-47	8804-020
A10AIR15	6-39	RCR07G271KS	A10AIU8	6-11	8804-020
A10AIR16	6-40	RCR07G271KS	A10C1	5-13	292CY5U103D8050
A10AIR17	6-41	RCR07G271KS	A10C2	5-12	292CY5U102D8050
A10AIR18	6-42	RCR07G271KS	A10C4	5-27A	CK06BX334K
A10AIR19	6-43	RCR07G271KS	A10DS1	5-16	7373
A10AIR2	6-31	RCR07G271KS	A10DS2	5-18	7373
A10AIR20	6-44	RCR07G271KS	A10DS3	5-20	7373
A10AIR21	6-45	RCR07G271KS	A10G1	5-49	PC66D200-5
A10AIR22	6-46	RCR07G271KS	A10J1	5-3	13E
A10AIR24	6-65	RCR07G271KS	A10J2	5-14	M641-5-1
A10AIR25	6-5	RCR07G271KS	A10J2	5-14	647-2739-001
A10AIR26	6-64	RCR07G271KS	A10LS1	5-26	271-0271-010
A10AIR27	6-6	RCR07G271KS	A10M1	5-1	710-135A
A10AIR28	6-63	RCR07G271KS	A10R1	5-33	RV6NAYS0103B
A10AIR29	6-7	RCR07G271KS	A10R2	5-34	RV6NAYS0104B
A10AIR3	6-30	RCR07G271KS	A10R23	6-4	RCR07G271KS
A10AIR30	6-62	RCR07G271KS	A10R3	5-35	RV6NAYS0105B
A10AIR31	6-8	RCR07G271KS	A10R4	5-36	RV6NAYS0105B
A10AIR32	6-61	RCR07G271KS	A10R4	6-3	RCR07G271KS
A10AIR33	6-9	RCR07G271KS	A10R5	5-43	FF6719
A10AIR34	6-60	RCR07G271KS	A10R5	6-2	RCR07G271KS
A10AIR35	6-10	RCR07G271KS	A10R6	5-42	EB1309
A10AIR36	6-59	RCR07G271KS	A10R6	6-1	RCR07G271KS
A10AIR37	6-68	RCR07G271KS	A10R7	5-43A	RN55D4750F
A10AIR38	6-67	RCR07G271KS	A10S1	5-10	7360K11C27
A10AIR39	6-66	RCR07G271KS	A10S2	5-45	1FA20A
A10AIR40	6-27	RCR07G271KS	A10S3	5-41	280563AA1
A10AIR41	6-26	RCR07G271KS	A10S4	5-39	280563AA1
A10AIR42	6-25	RCR07G271KS	A10S5	5-40	280563AA1
A10AIR43	6-24	RCR07G271KS	A10S6	5-30	6XF12-5SDBLK2UGR
A10AIR44	6-23	RCR07G271KS	A10S7	5-31	6XF12-5FSDBLK2UE
					E

REFERENCE DESIGNATION INDEX

REFERENCE DESIGNATION	FIG-ITEM	PART NUMBER	REFERENCE DESIGNATION	FIG-ITEM	PART NUMBER
A10S8	5-44	259-8018-030	A9A1R24	3-11	RCR42G271KS
A10U1	5-27	7805UC	A9A1R25	3-55	RCR07G101KS
A10XDS1	5-17	634-5930-001	A9A1R26	3-46	RN55D1401F
A10XDS2	5-19	634-5930-001	A9A1R27	3-26	RN55D7500F
A10XDS3	5-21	634-5930-001	A9A1R28	3-23	RN55D7500F
A13	1-14	638-6914-002	A9A1R29	3-48	RN55D6811F
A15	1-27A	646-5802-001	A9A1R3	3-4	RCR07G471KS
A2	1-15	641-7132-001	A9A1R30	3-49	RN55D6811F
A3	1-27	638-6908-002	A9A1R31	3-10	RW69V1R5
A4	1-7	638-6912-002	A9A1R4	3-44	RW67V470
A5	1-10	641-7099-001	A9A1R5	3-32	RCR42G150KS
A5	1-10	641-7099-002	A9A1R6	3-41	RCR07G103KS
A5A1	1-11	638-6916-002	A9A1R7	3-43	RCR20G222KS
A5A2	1-12	638-6920-001	A9A1R8	3-35	RCR07G104KS
A7	1-8	638-6918-001	A9A1R9	3-57	RCR07G102KS
A8	1-6	638-6929-002	A9A1U1	3-37	MLM358U
A8	1-6	638-6929-004	A9A1VR1	3-31	1N821A
A9	1-13	641-7103-001	A9A1VR2	3-47	1N4750A
A9	2-	641-7103-001	A9A1VR3	3-56	1N4104
A9A1	2-63	638-6825-001	A9A1VR4	3-42	1N4617
A9A1	3-	638-6825-001	A9A2	2-58	638-6275-001
A9A1CR1	3-2	1N4002	A9A2	2-58	638-6275-002
A9A1CR2	3-39	1N4002	A9A2	4-	638-6275-001
A9A1C1	3-54	292CY5U104Z050C	A9A2	4-	638-6275-002
A9A1C10	3-21	199D475X0035DB1	A9A2CR1	4-4	SC5615
A9A1C11	3-22	199D475X0035DB1	A9A2C1	4-21	292CY5U104Z050C
A9A1C12	3-30	292CY5U104Z050C	A9A2C2	4-24	CK05BX103K
A9A1C13	3-8	292CY5U104Z050C	A9A2C3	4-17	292CY5U103Z050B
A9A1C14	3-13	500D337G025DF5	A9A2C4	4-1	199D155X0050CE3
A9A1C15	3-45	292CY5U103Z050B	A9A2C4	4-1	CK06BX105K
A9A1C16	3-7	292CX7R102M050B	A9A2C4	4-1	CK06BX105K
A9A1C2	3-40	292CX7R102M050B	A9A2C5	4-11	199D475X0035DB1
A9A1C3	3-36	199D475X0035DB1	A9A2C6	4-14	292CY5U104Z050C
A9A1C4	3-52	292CX7R102M050B	A9A2C7	4-2	199D155X0050CE3
A9A1C5	3-58	292CY5U103Z050B	A9A2C7	4-2	CK06BX105K
A9A1C6	3-20	500D336G025B85	A9A2C7	4-2	CK06BX105K
A9A1C7	3-25	199D475X0035DB1	A9A2L1	4-20	MS75089-3
A9A1C8	3-29	199D475X0035DB1	A9A2L2	4-25	12375B
A9A1C9	3-28	292CY5U104Z050C	A9A2L3	4-8	MS75089-15
A9A1F1	3-16	AGC250-2	A9A2L4	4-19	MS75089-3
A9A1F2	3-18	AGC250-2	A9A2Q1	4-6	2N2219A
A9A1L1	3-12	240-0879-010	A9A2R1	4-12	RN55D2741F
A9A1R1	3-3	RW69V821	A9A2R2	4-13	RCR07G102KS
A9A1R10	3-38	RCR07G101KS	A9A2R3	4-23	X201R252B
A9A1R11	3-27	RN55D1400F	A9A2R3	4-23	101T20000
A9A1R12	3-14	X201R251B	A9A2R4	4-10	RCR07G222KS
A9A1R12	3-14	101T200R0	A9A2R5	4-22	RCR32G561KS
A9A1R13	3-24	RN55D2870F	A9A2R6	4-5	RCR07G101KS
A9A1R14	3-15	X201R251B	A9A2R7	4-7	RCR42G181KS
A9A1R14	3-15	101T200R0	A9A2TP1	4-26	2-332070-3
A9A1R15	3-51	RN55D2490F	A9A2U1	4-18	LM555CN
A9A1R16	3-5	X201R251B	A9A2VR1	4-15	1N821A
A9A1R16	3-5	101T500R0	A9A2VR2	4-16	1N5359B
A9A1R17	3-6	RN55D1401F	A9A2VR3	4-9	1N5363B
A9A1R18	3-50	RCR07G105KS	A9CR1	2-13	1N1186
A9A1R19	3-34	RN55D5621F	A9CR2	2-21	1N1186
A9A1R2	3-53	705-0701-000	A9CR3	2-31	1N5550
A9A1R20	3-1	RCR32G152KS	A9C1	2-15	3120GE723U0250P
A9A1R21	3-59	RN55D3013F	A9C10	2-77	292CY5U103D8050
A9A1R21	3-59	RN60D3833F	A9C11	2-72	292CY5U102D8050
A9A1R22	3-33	RN55D3831F	A9C12	2-75	CK63AW103M
A9A1R23	3-9	X201R102B	A9C13	2-69	292CY5U103D8050
A9A1R23	3-9	101T10000	A9C14	2-67	292CY5U103D8050

REFERENCE DESIGNATION INDEX

REFERENCE DESIGNATION	FIG- ITEM	PART NUMBER	REFERENCE DESIGNATION	FIG- ITEM	PART NUMBER
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	CM04F0101J03			
C5	1-26	CM05F0151J03			
L1	1-24	MS18130-1			
L2	1-22	MS75083-06			
TB1	1-19	332-14-04-022			
XF1	3-17	102071			
XF2	3-19	102071			



**Rockwell
International**

diagrams

Collins Telecommunications Products Division

HF-380 Transceiver

Printed in USA

523-0772529-001218

1 August 1982

list of illustrations

<i>Figure</i>	<i>Page</i>
1 Ribbon Cable Wiring Diagram.....	3
2 Shielded Wire Wiring Diagram.....	5
3 Coax Cable Wiring Diagram	7
4 Transceiver, Interconnect Diagram	9
5 Power Supply, Schematic Diagram	19
6 Display A10A1, Schematic Diagram.....	21

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.

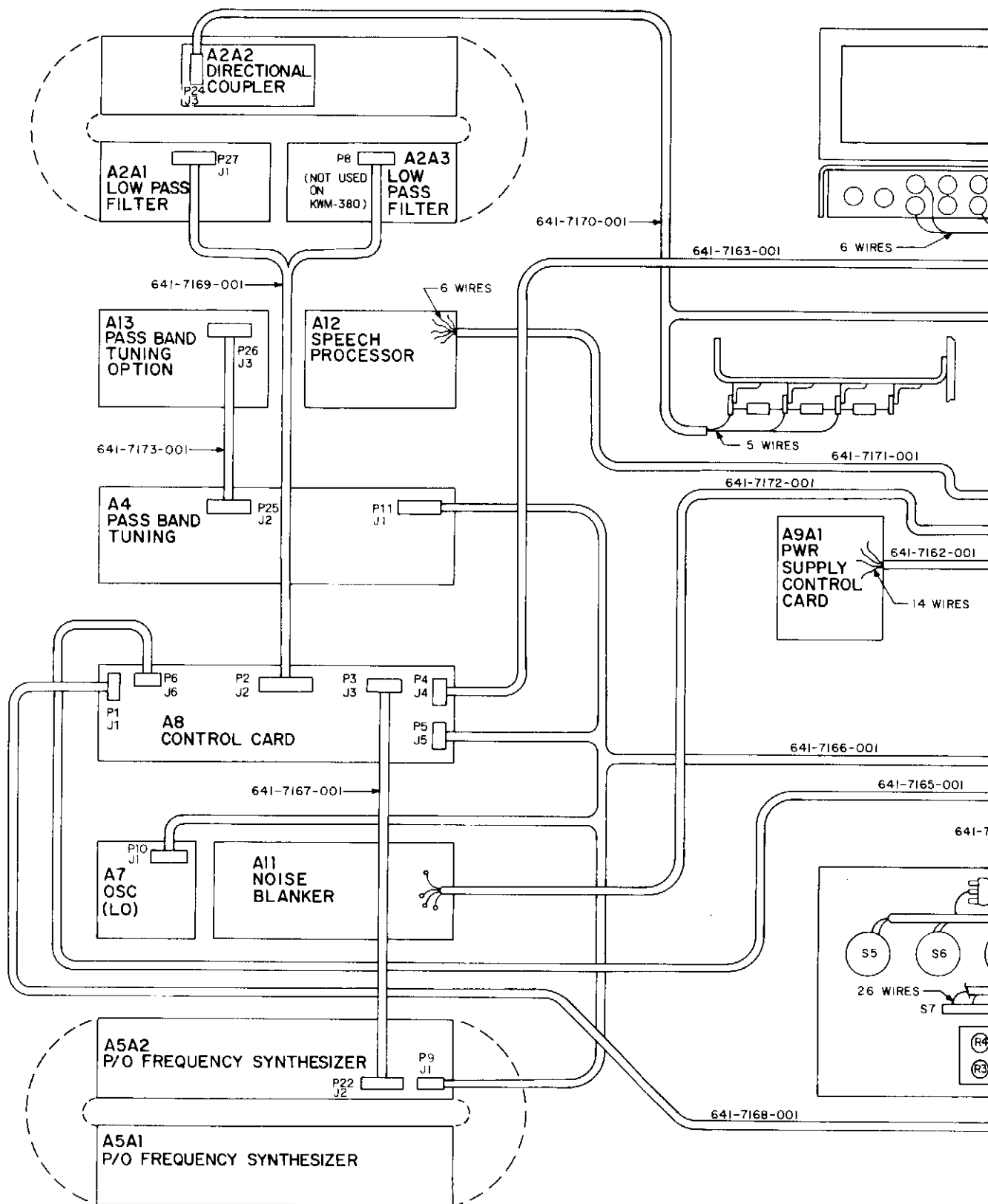
Only alphabetic identifiers that result in schematic changes are covered in this section. Therefore, if a unit or subassembly has an alphabetic identifier that falls between identifiers on the schematic changes page, or after the last identifier on the schematic changes page up to and including the latest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

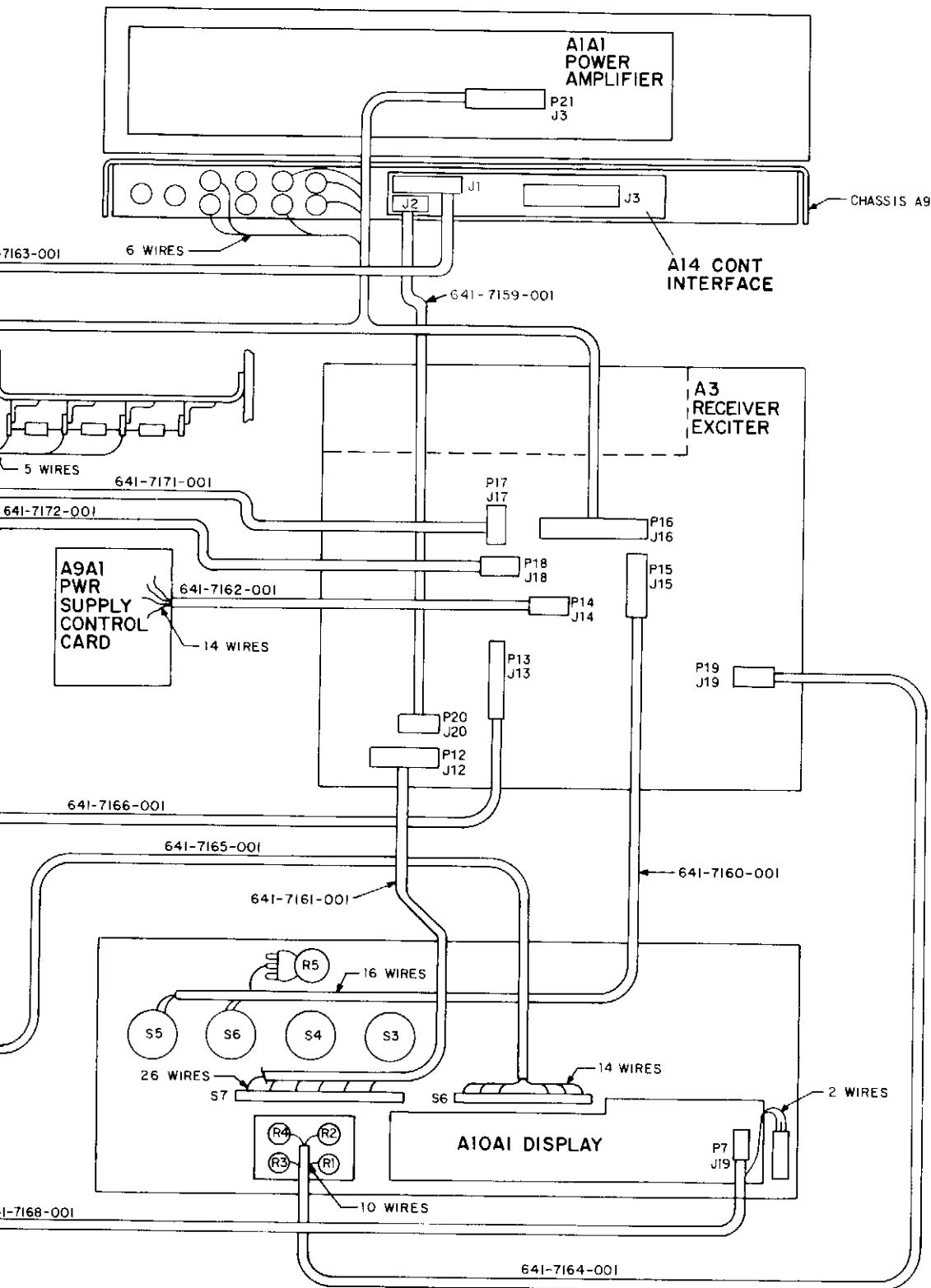
2. CONFIGURATION EFFECTIVITY

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.

<u>UNIT/SUBASSEMBLY</u>	<u>COLLINS PART NUMBER</u>	<u>LATEST EFFECTIVITY</u>
IIF-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



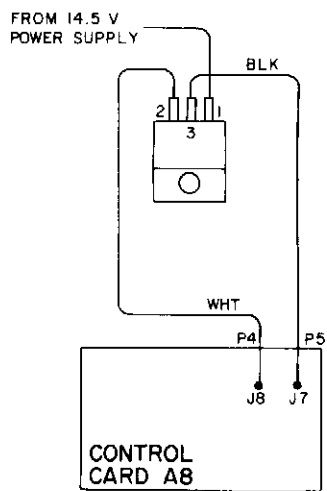


NOTE:

REFER TO PARTS LOCATION
DIAGRAMS FOR CONNECTOR
PIN LOCATIONS.

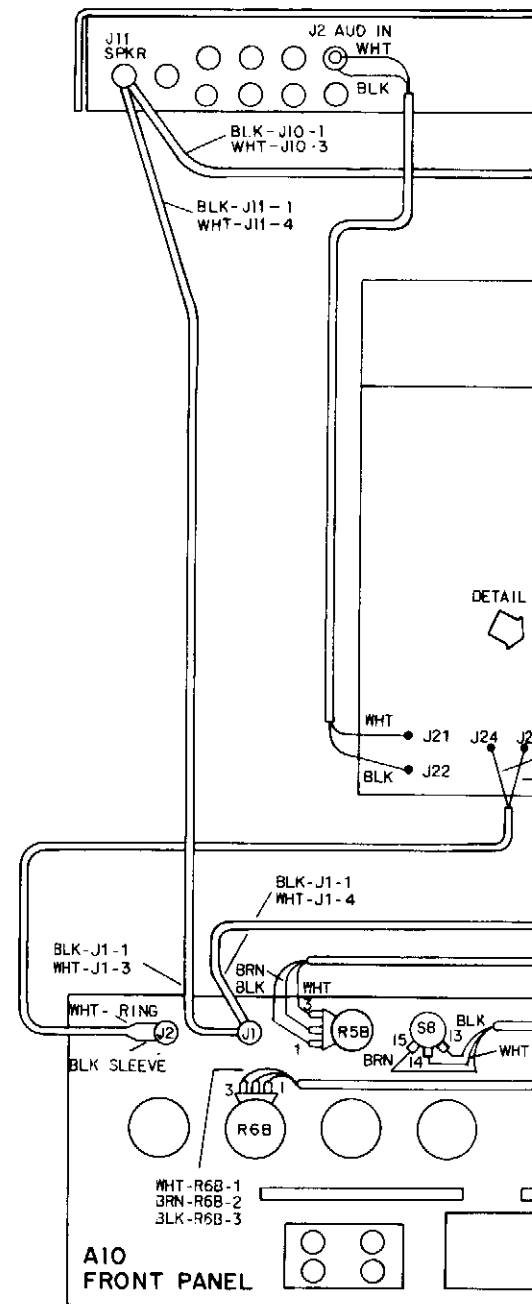
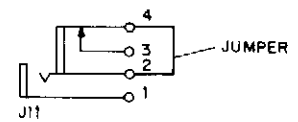
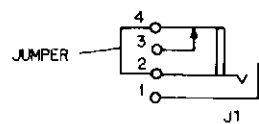
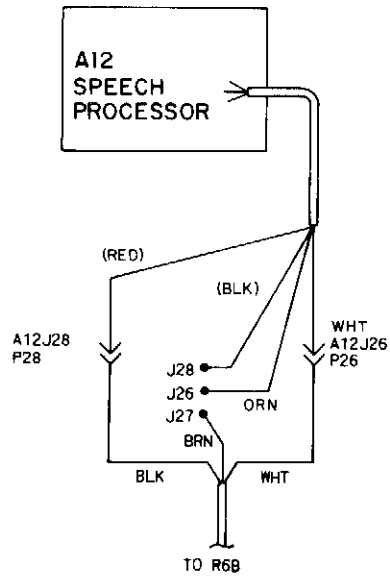
634-6958
TPA-2366-014

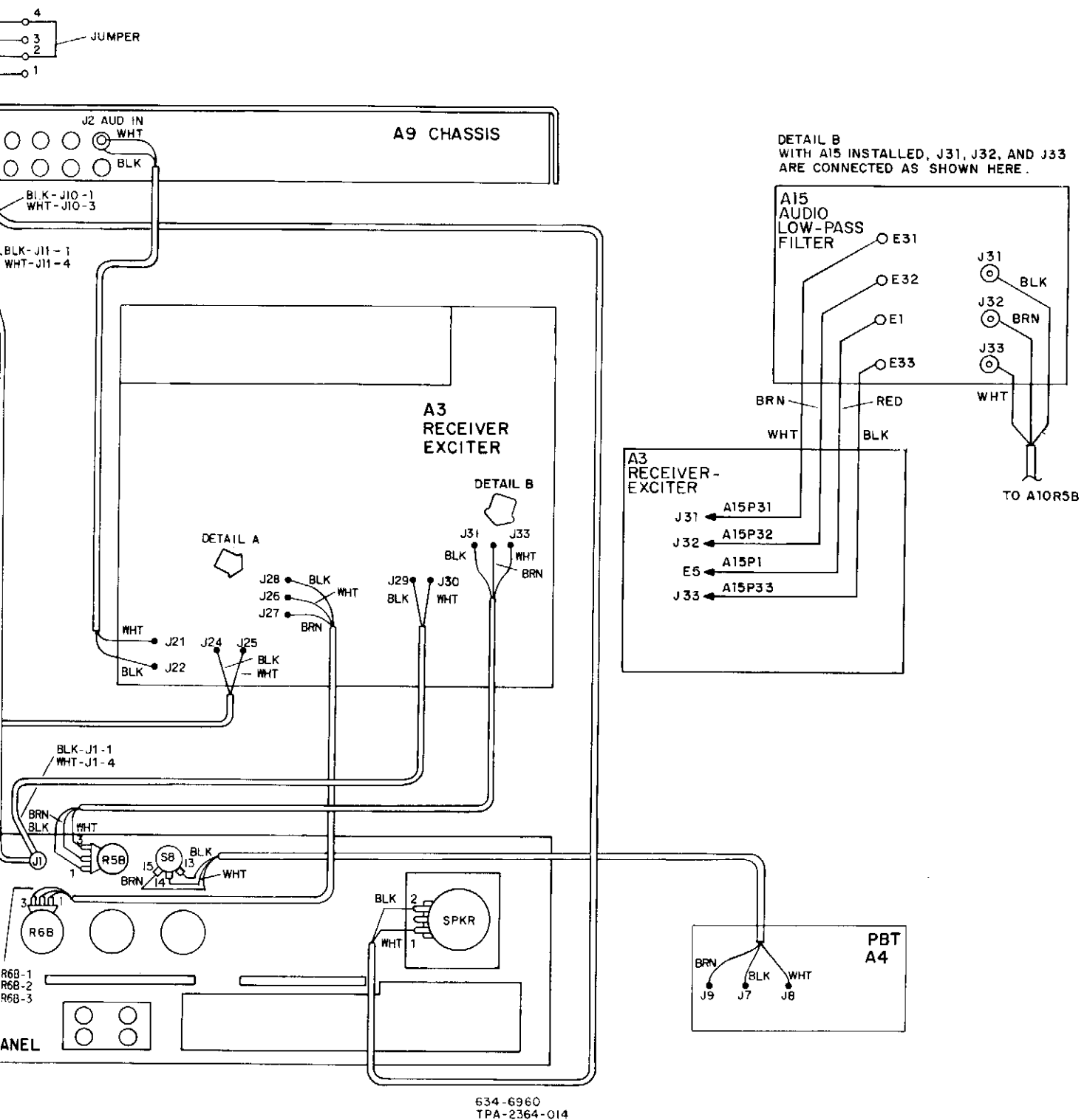
Ribbon Cable Wiring Diagram
Figure 1



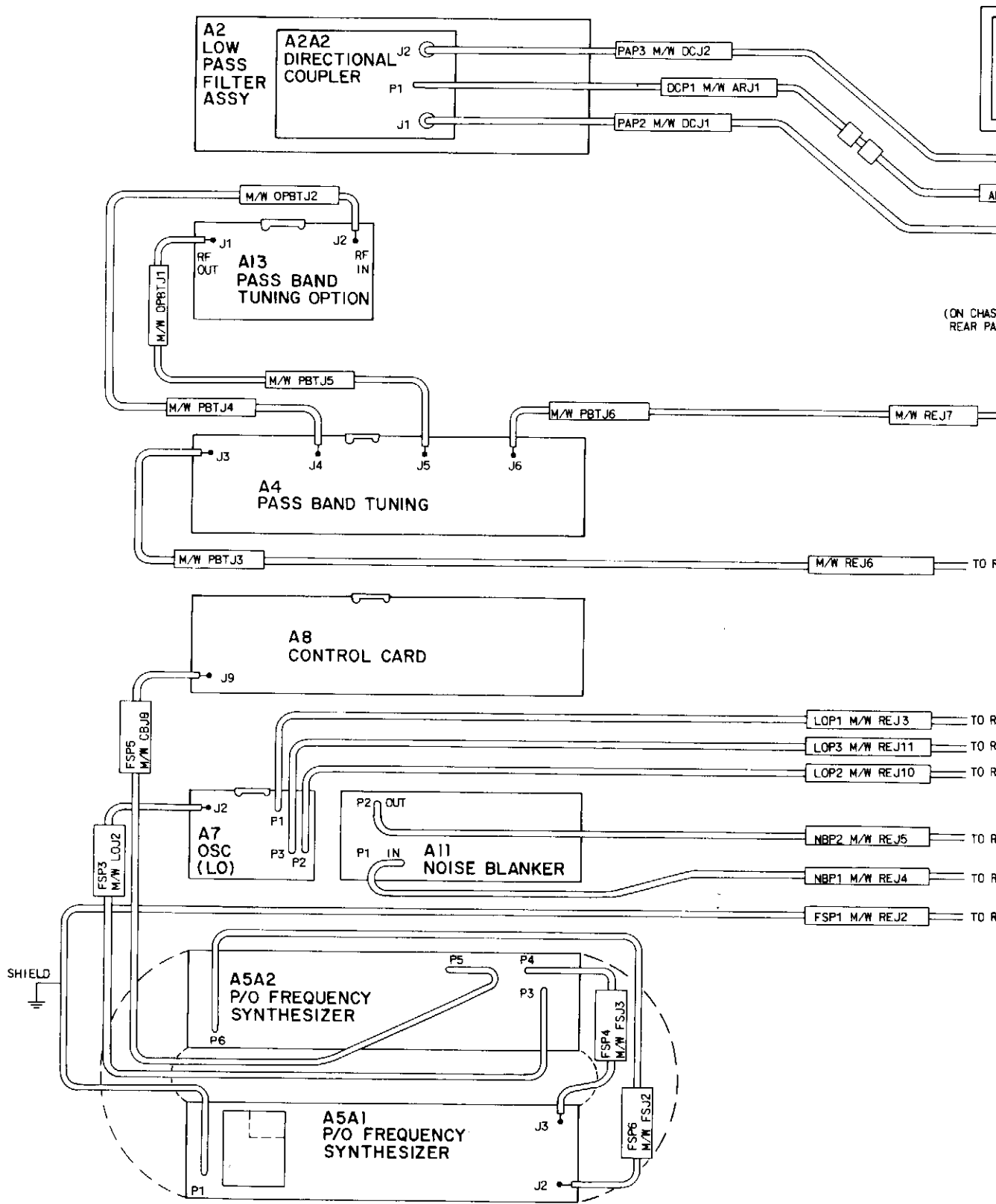
MISCELLANEOUS WIRING

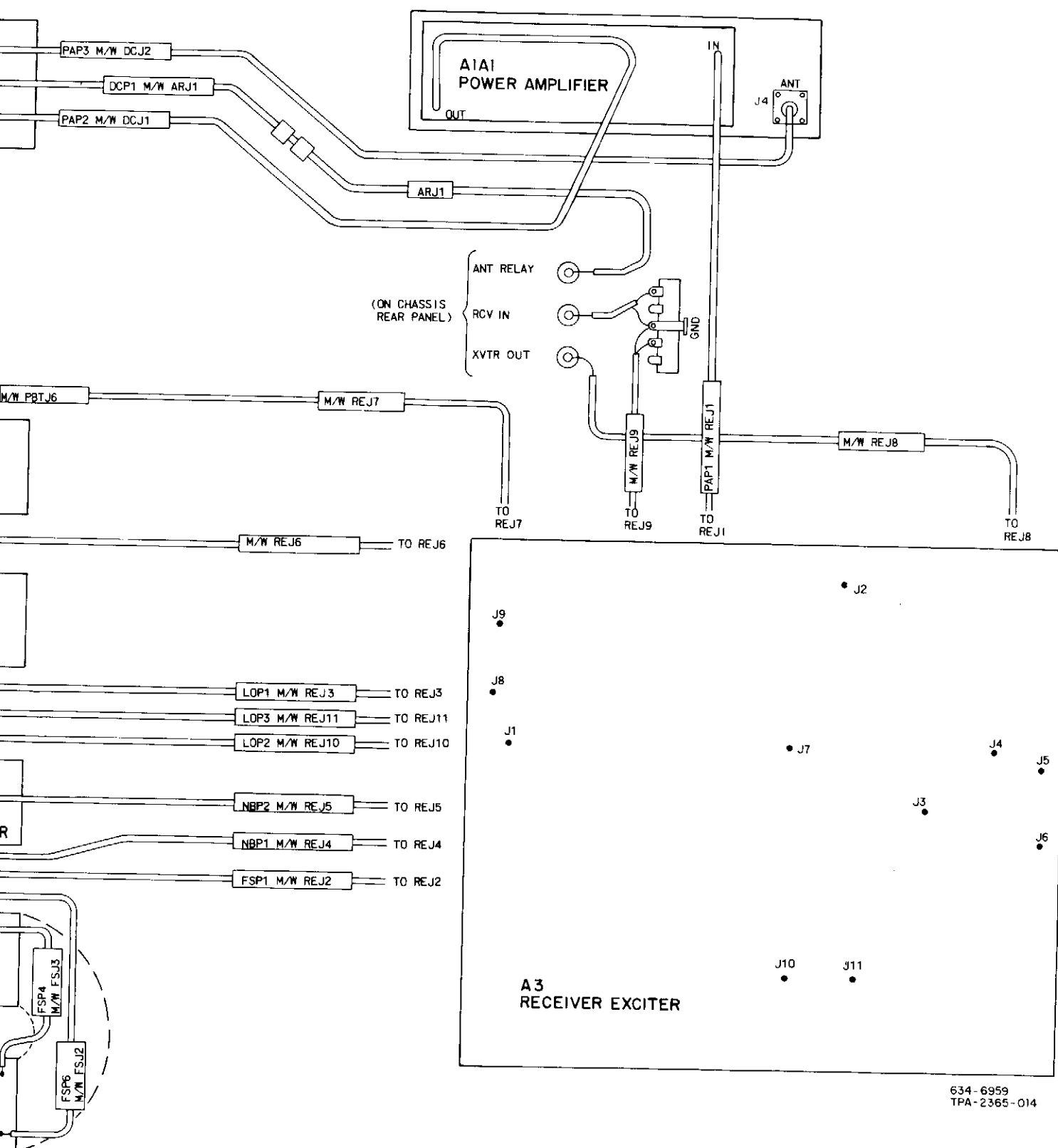
DETAIL A
WITH A12 INSTALLED, J26-J28 ARE
CONNECTED AS SHOWN HERE.





Shielded Wire Wiring Diagram
Figure 2

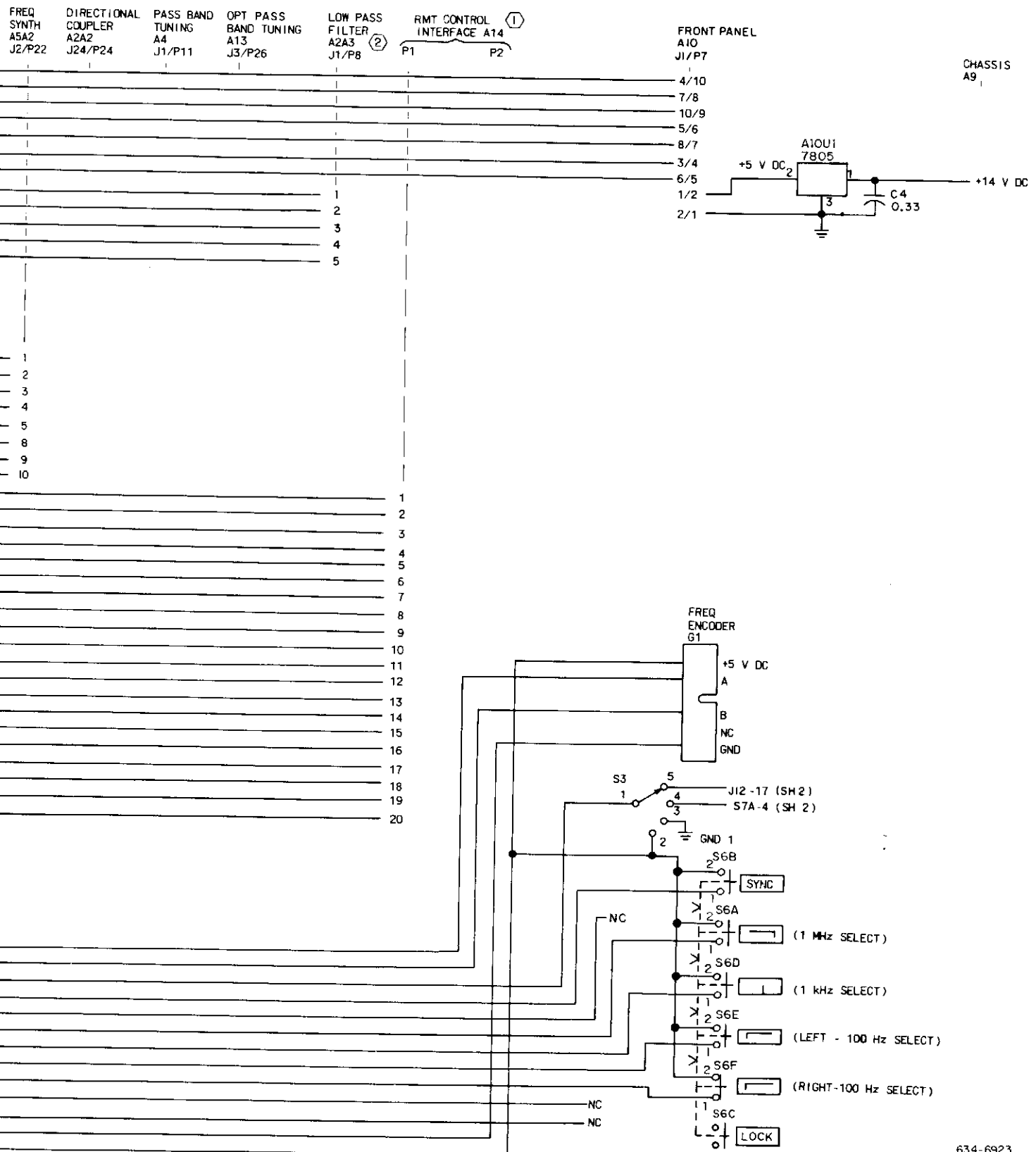




Coax Cable Wiring Diagram
Figure 3

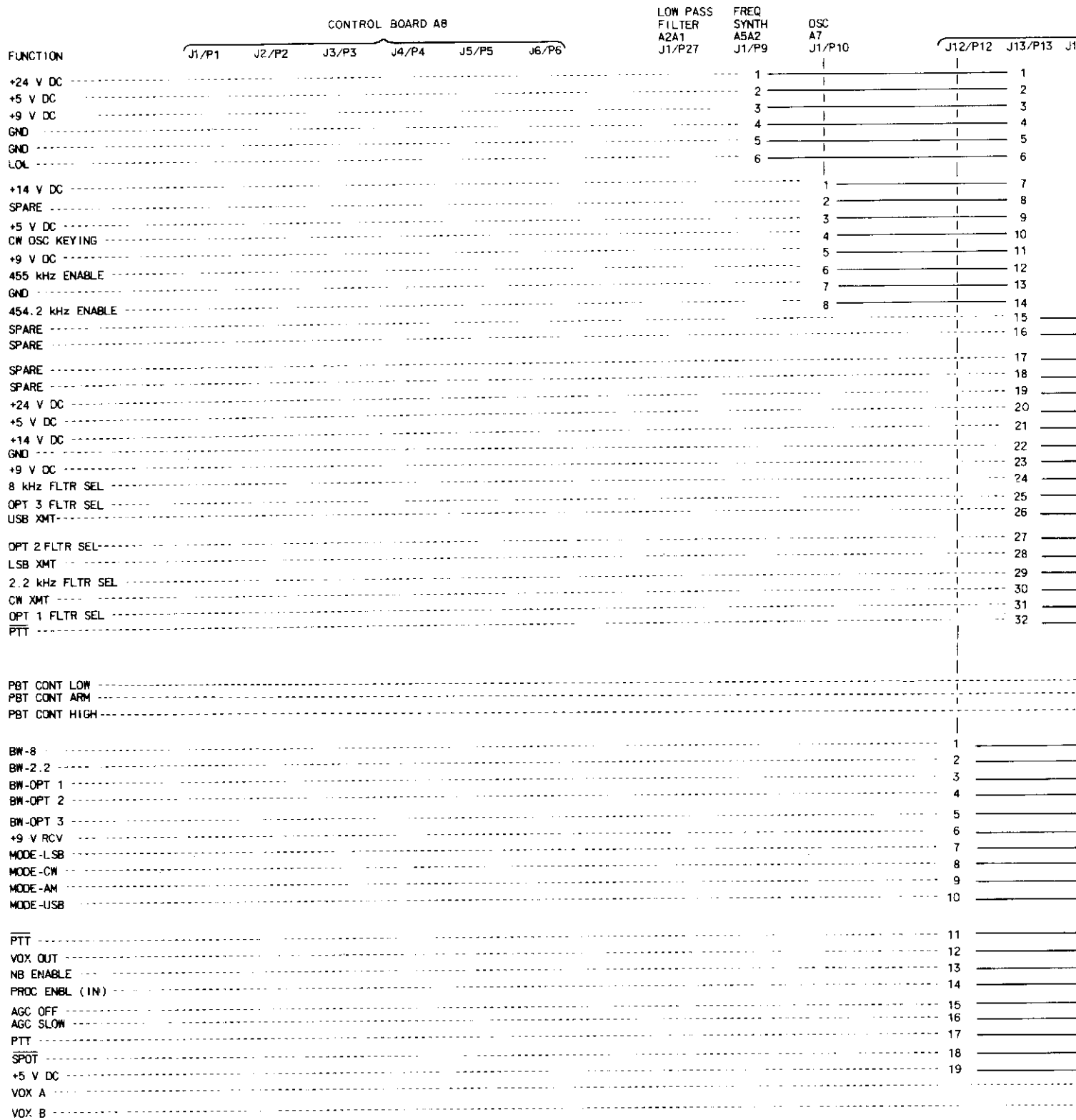
CONTROL BOARD A8						LOW PASS FILTER A2A1 J1/P27	FREQ SYNTH A5A2 J1/P9	OSC A7 J1/P10	J12/P12	J13/P13
FUNCTION	J1/P1	J2/P2	J3/P3	J4/P4	J5/P5	J6/P6				
BCD 4	9									
BCD 8	7									
ADR 1	10									
BCD 1	5									
ADR 2	8									
BCD 2	3									
ADR 4	6									
LPF 2		1								
LPF 4		2								
LPF 5		3								
LPF 7		4								
		5								
LPF 1		6					6			
LPF 3		7					7			
LPF 6		8					8			
LPF 8		9					9			
LPF 9		10					10			
GND			1							
STROBE			2							
DATA			3							
CLOCK			4							
SPARE			5							
SPARE			8							
SPARE			9							
SPARE			10							
PAD R1				1						
PAD R2				2						
PAD R3				3						
PAD R4				4						
PAD C1				5						
PAD C2				6						
PAD C3				7						
PAD C4				8						
+5 V DC				9						
GND				10						
STROBE				11						
10'S - 2				12						
10'S - 1				13						
1'S - 8				14						
1'S - 4				15						
1'S - 2				16						
1'S - 1				17						
SPARE				18						
REMOTE +5 VCC STBY				19						
SPARE				20						
SPARE				1						33
+14 V DC				2						34
B6				3						35
B8				4						36
B9				5						37
CTTL				7						39
GND				8						40
FREQ ENCODER A				1						
FREQ ENCODER B				2						
VFO SELECT				3						
SYNC				5						
SPARE				6						
1 MHz SELECT				7						
1 kHz SELECT				8						
100 Hz SELECT				9						
10 Hz SELECT				10						
SPARE				11						
SPARE				12						
GND				13						
+5 V DC				14						

[illegible]



634-6923
TPA-2232-055

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



RECEIVER EXCITER A3

POWER
AMPLIFIER
A1A1
J3/P21

FREQ
SYNTH
A5A2
J2/P22

DIRECTIONAL
COUPLER
A2A2
J24/P24

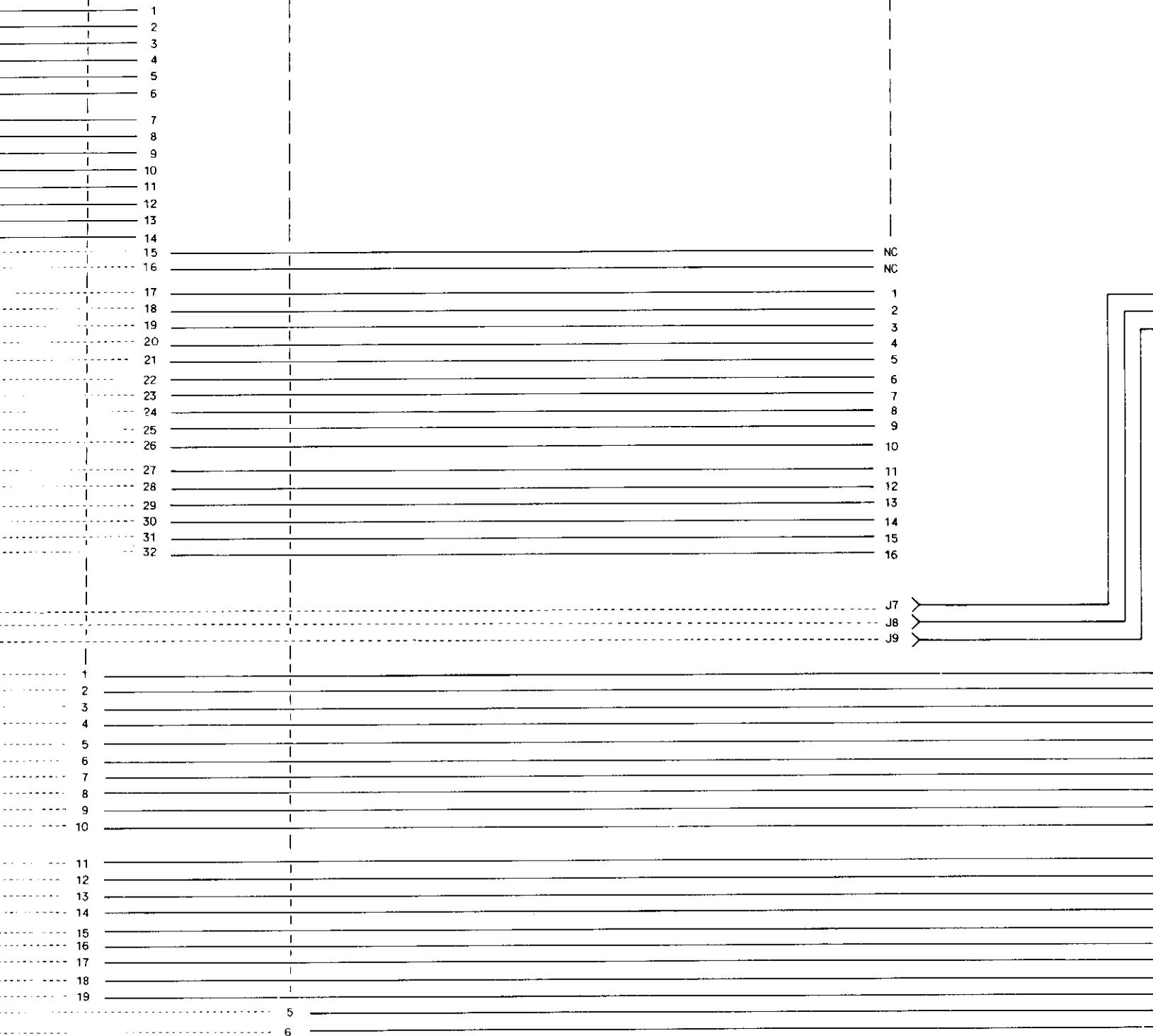
PASS BAND
TUNING
A4
J1/P11

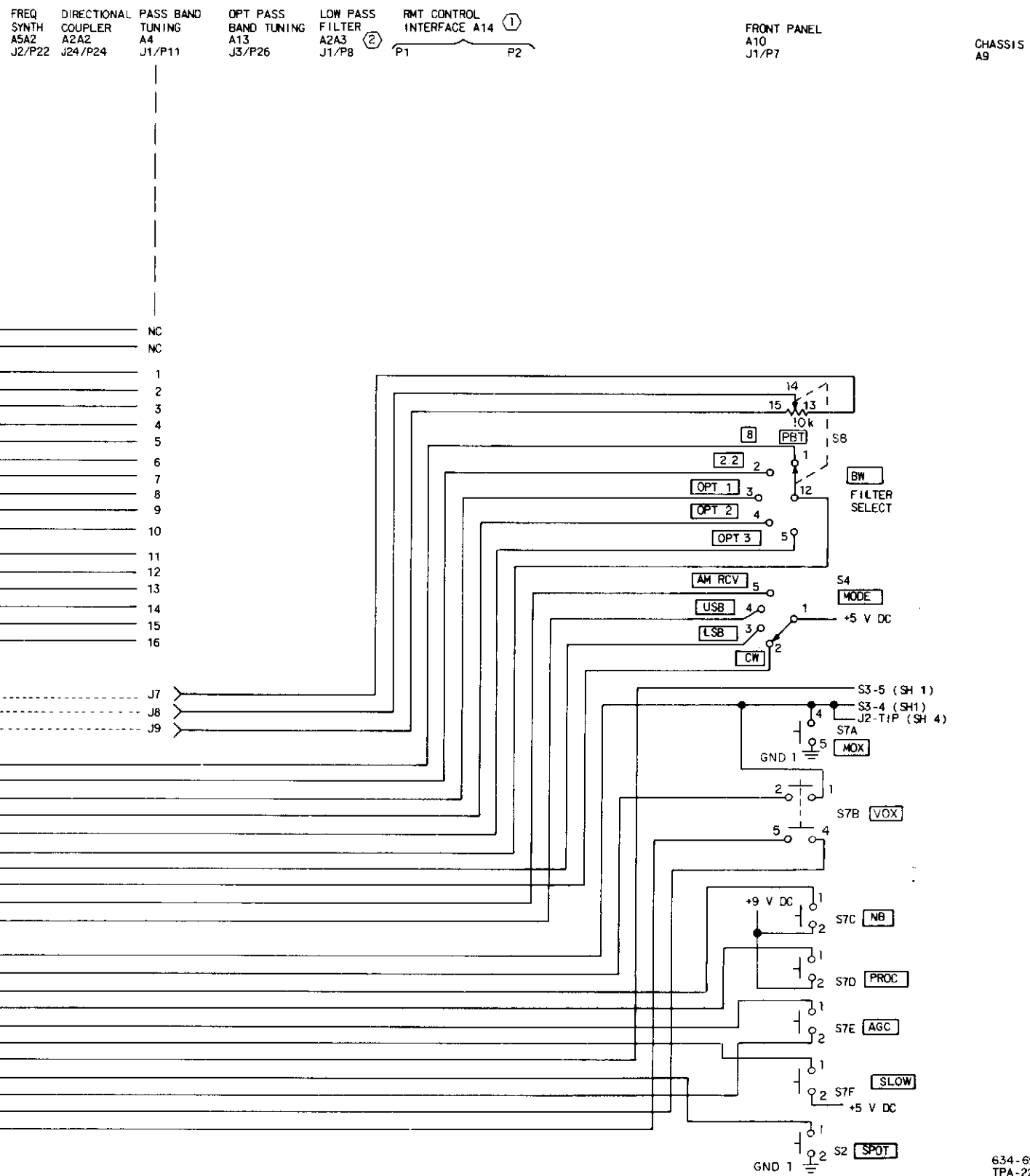
OPT PASS
BAND TUNING
A13
J3/P26

LOW PASS
FILTER
A2A3
J1/P8

RMT
INT
P1

J12/P12 J13/P13 J14/P14 J15/P15 J16/P16 J17/P17 J18/P18 J19/P19 J20/P20





634-6923
TPA-2232-055

Transceiver, Interconnect Diagram
Figure 4 (Sheet 2)

FUNCTION	(1) NOISE BLANKER A11	(1) SPEECH PROCESSOR A12	LOW PASS FILTER A2A1 J1/P27	FREQ SYNTH A5A2 J1/P9	OSC A7 J1/P10	J12/P12	J13/P13	J14/P14
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		1						
GND		2						
+14 V DC		3						
+5 V DC		NC						
+9 V DC		NC						
		4						
		5						
NB ENABLE	E2							
+9 V DC	E3							
GND	E1							

RECEIVER EXCITER A3

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

RMT
INTS

J12/P12 J13/P13 J14/P14 J15/P15 J16/P16 J17/P17 J18/P18 J19/P19 J20/P20

1
2
3
5
6
10
11
12
13
14

J1
J2

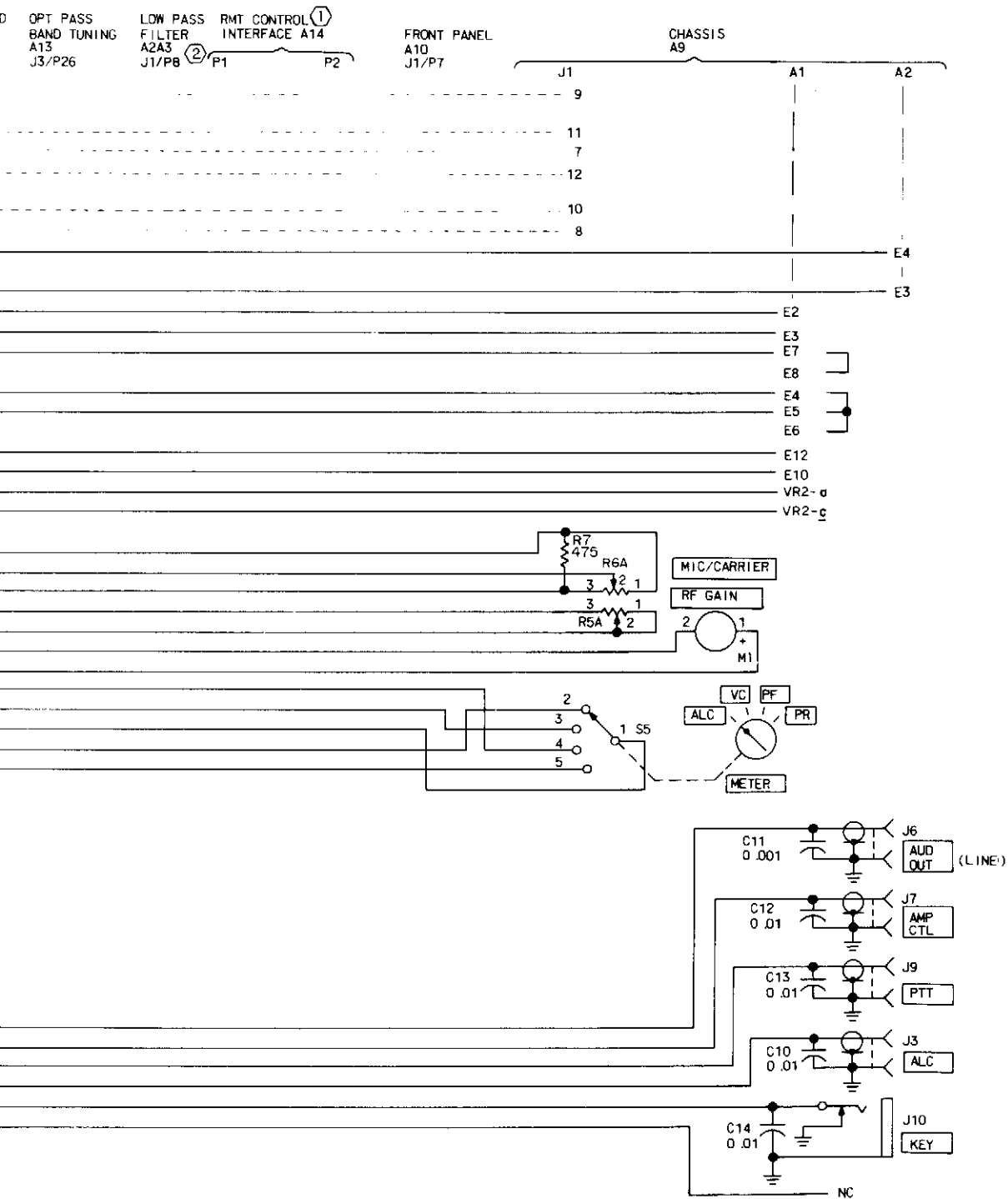
1
2
3
7
8
10
11
12
13
14
15
16

J3/P21

1 6
2 16
3 7
4 17
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6 18
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10 20
11
12
13
14
15
16

1
2
3
4
5

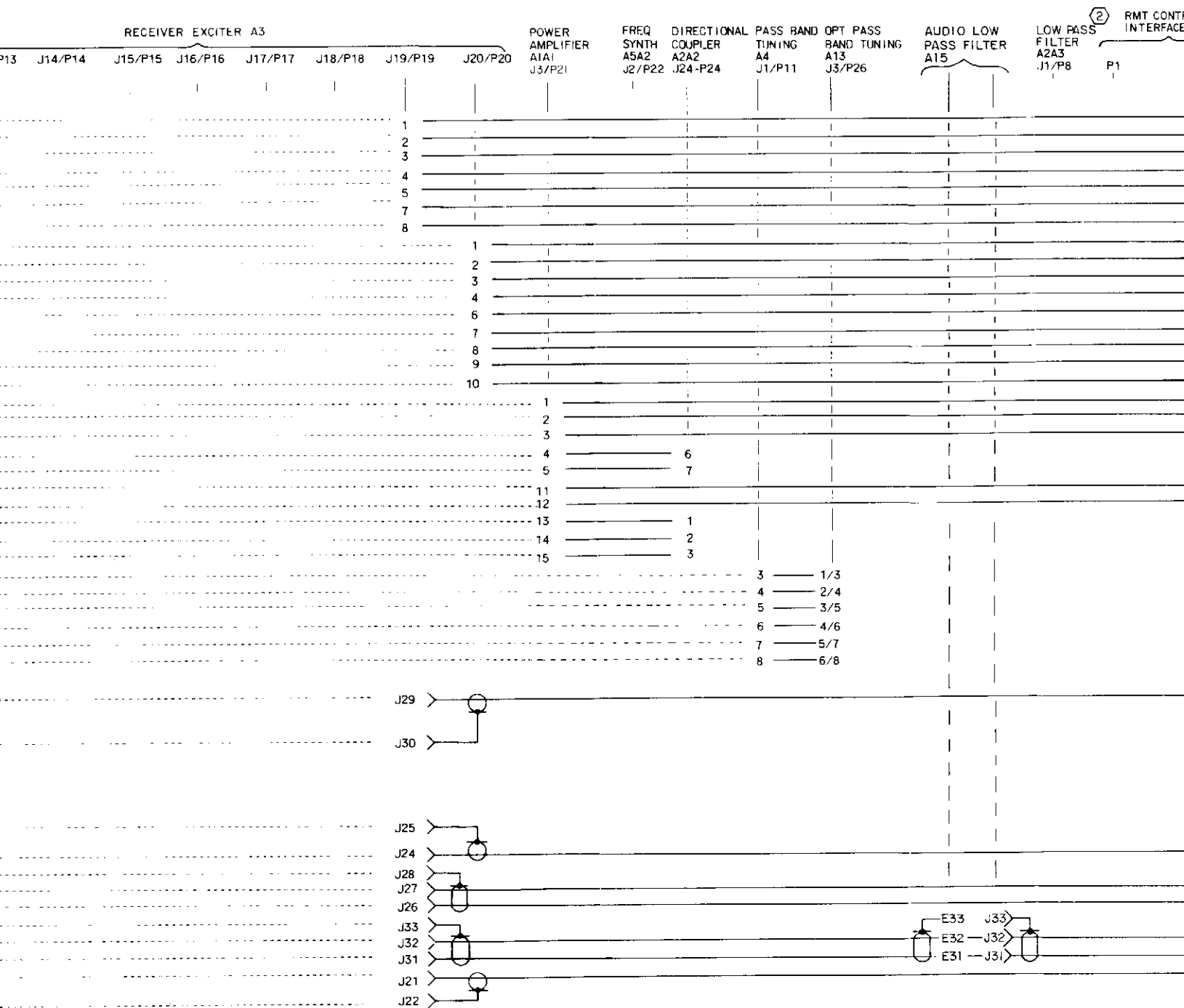
1
2
4

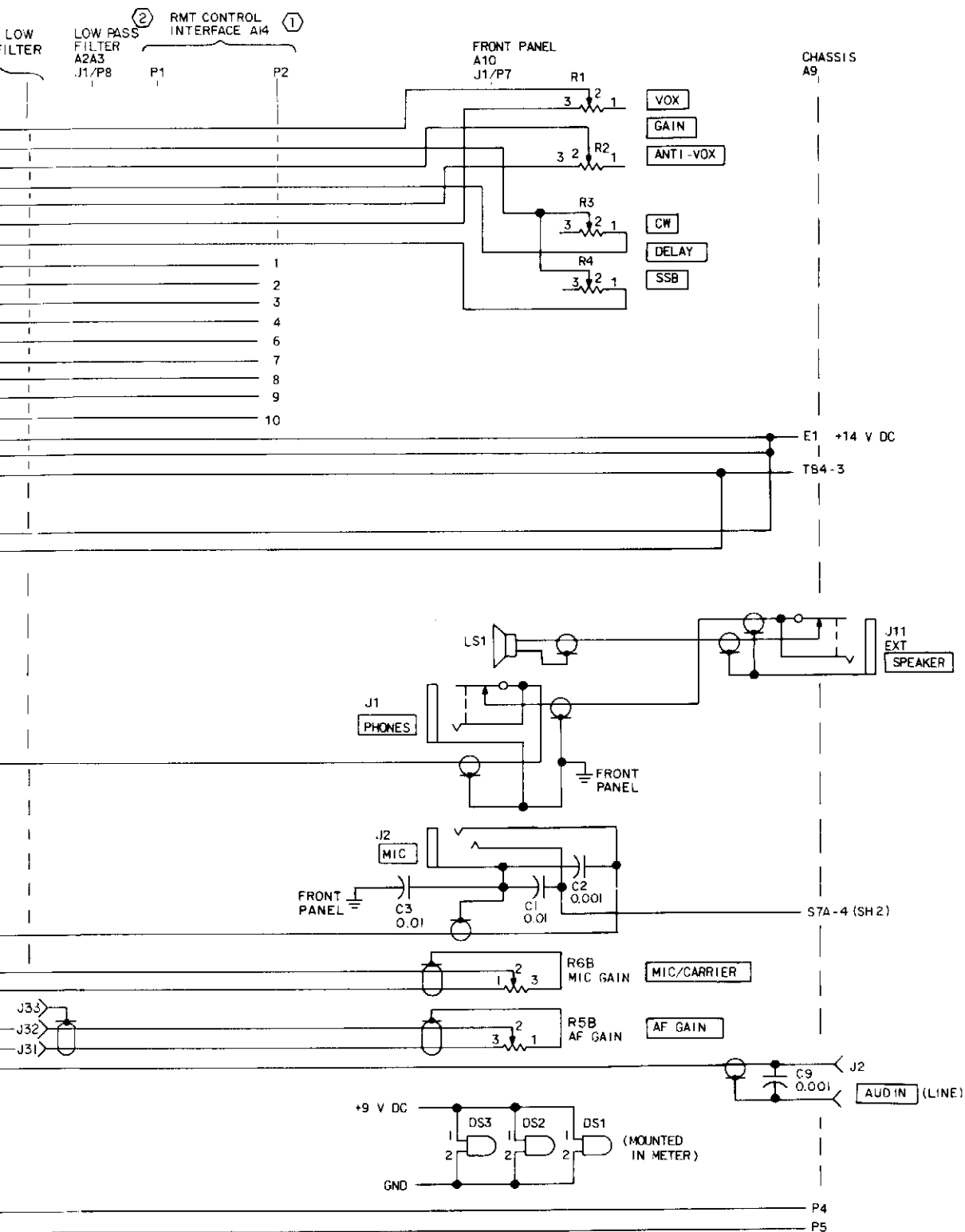


634-6923
TPA-2232-055

Transceiver, Interconnect Diagram
Figure 4 (Sheet 3)

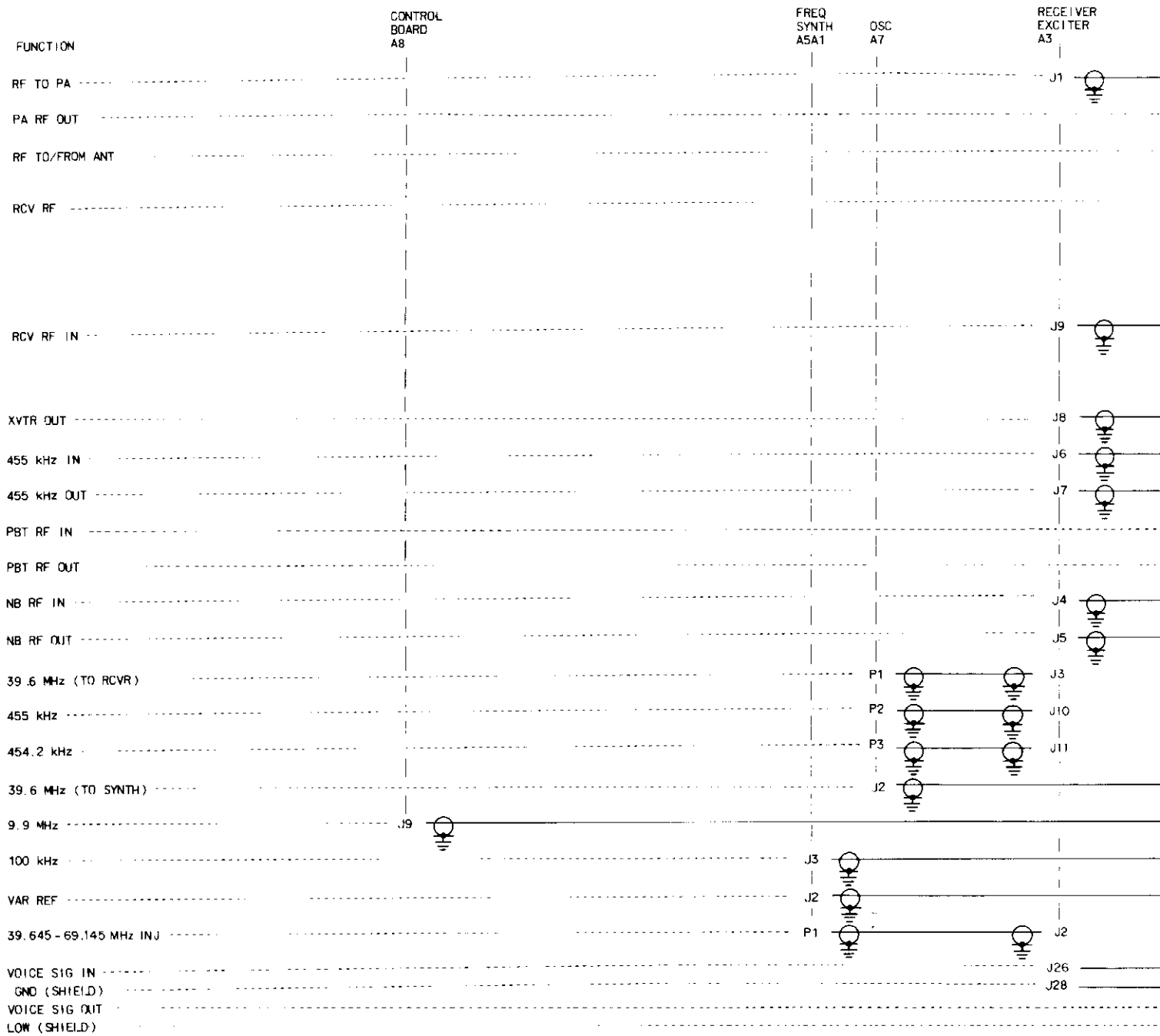
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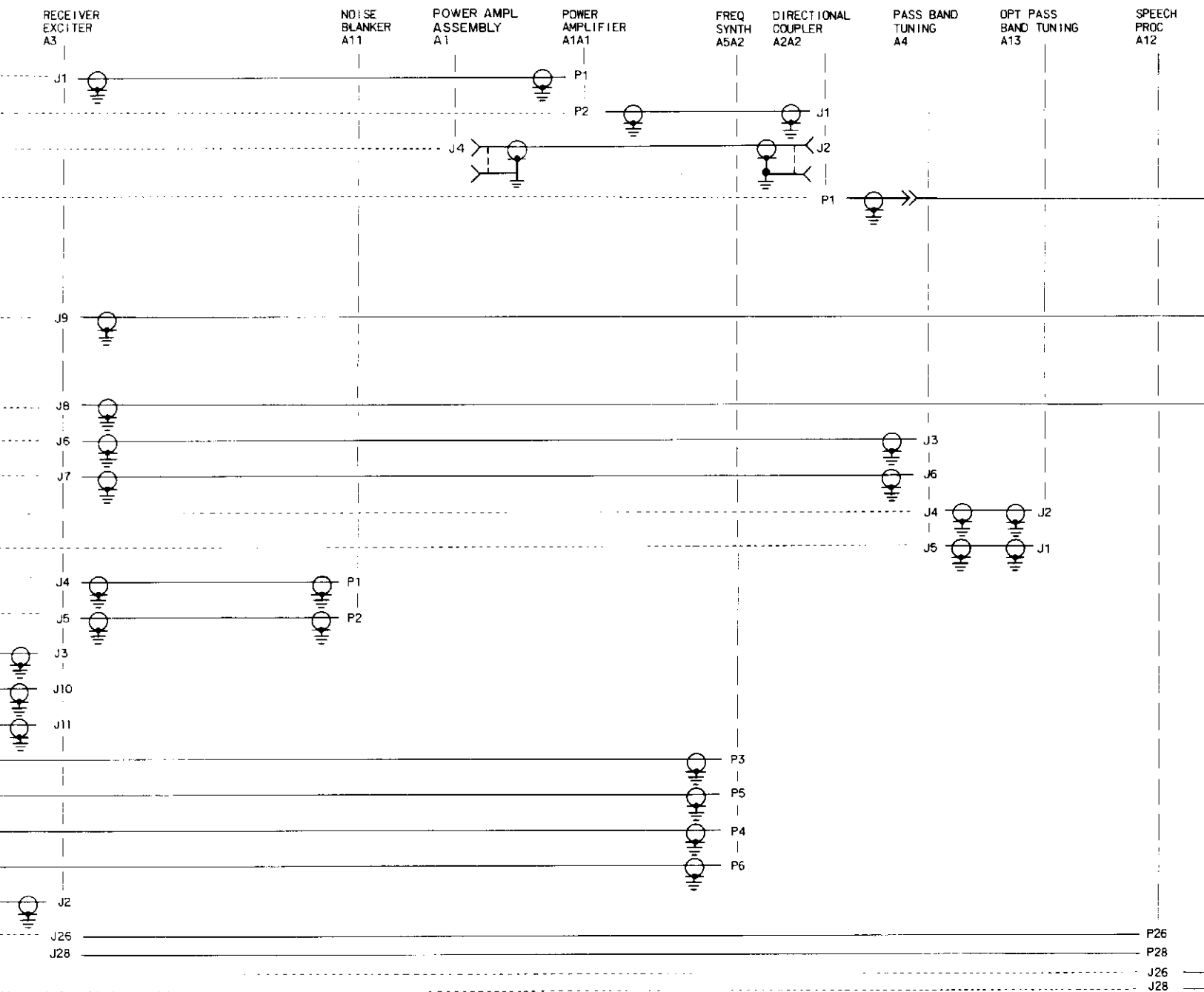




634-6923
TPA-2232-055

Transceiver, Interconnect Diagram
Figure 4 (Sheet 4)





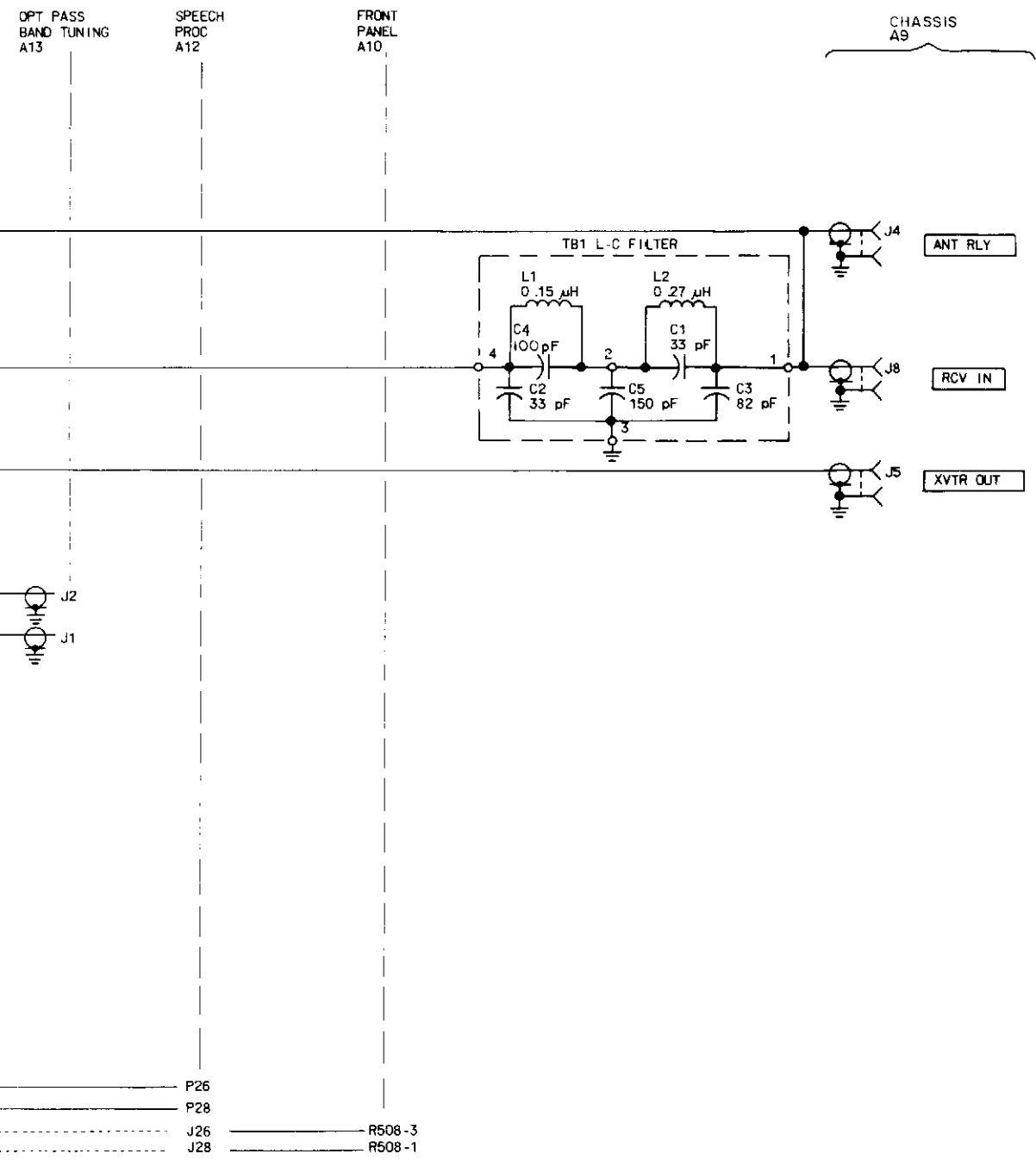
NOTES:

① OPTION

② NOT USED IN KWM - 380

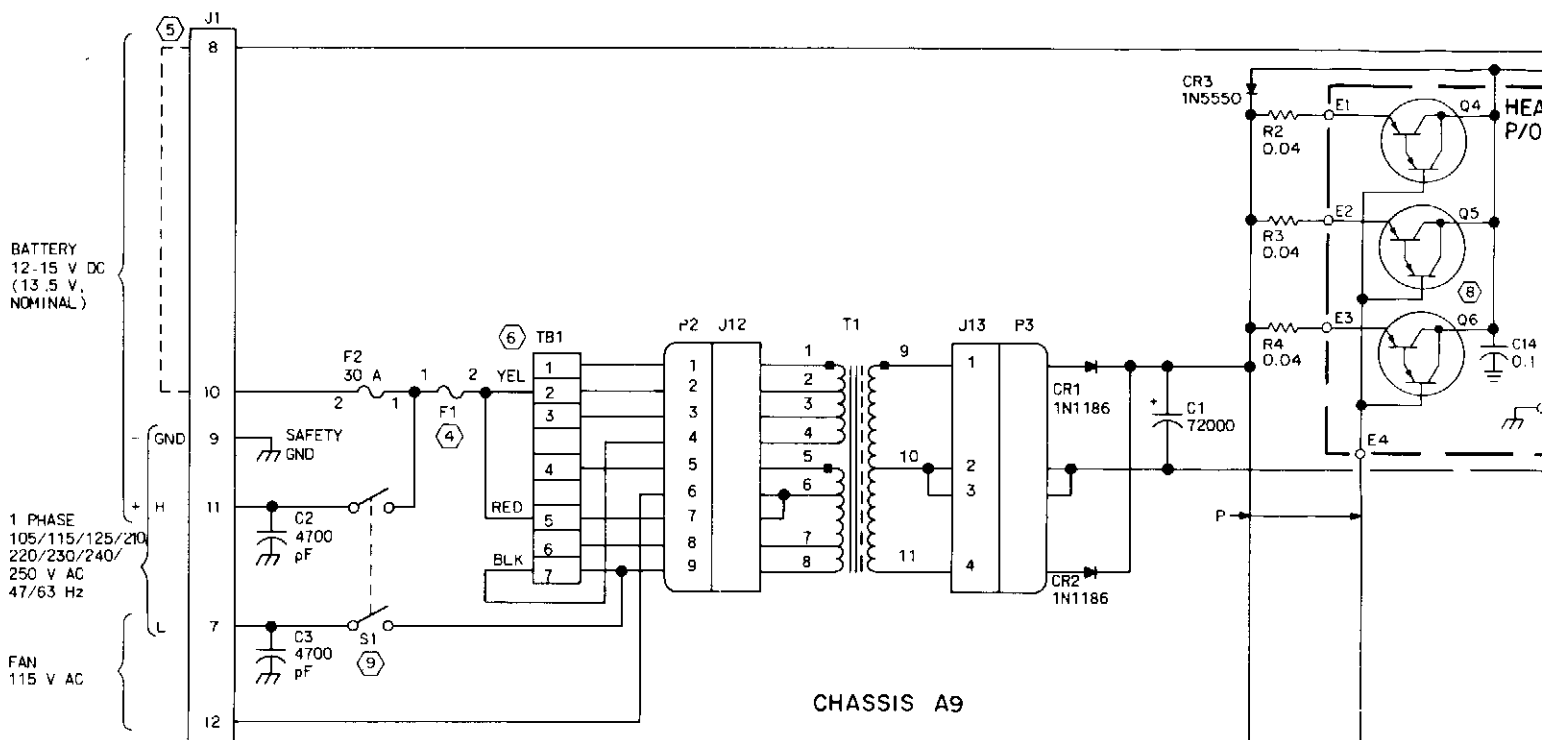
③ UNLESS OTHERWISE SPECIFIED; CAPACITANCE VALUES ARE IN MICROFARADS

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



634-6923
TPA-2232-055

Transceiver, Interconnect Diagram
Figure 4 (Sheet 5)

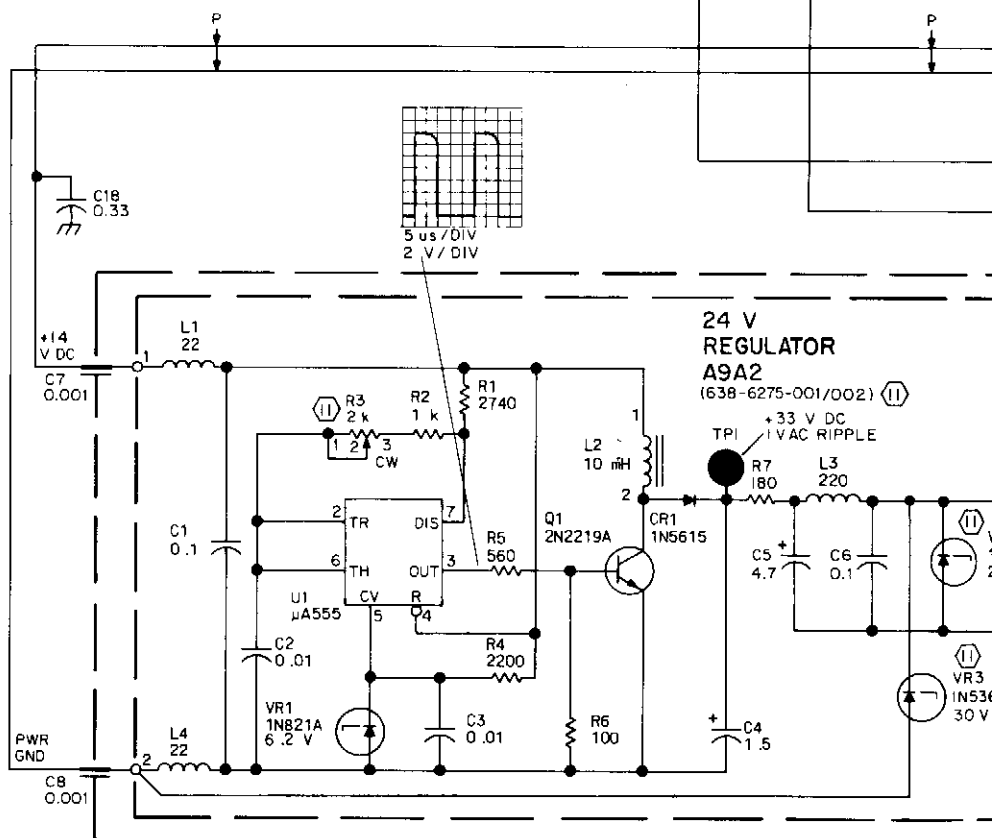


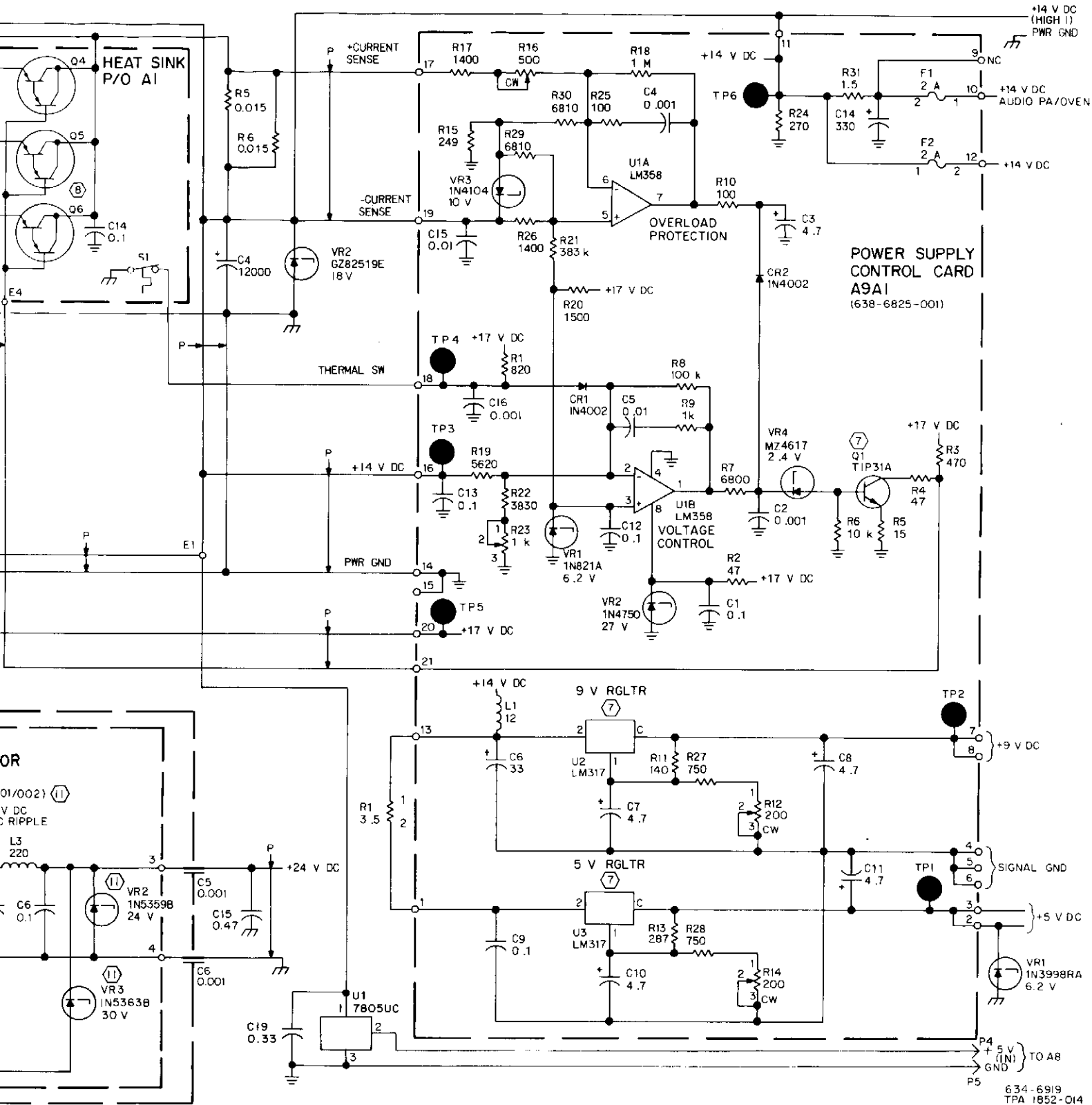
NOTES:

- 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 ASU1, 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:

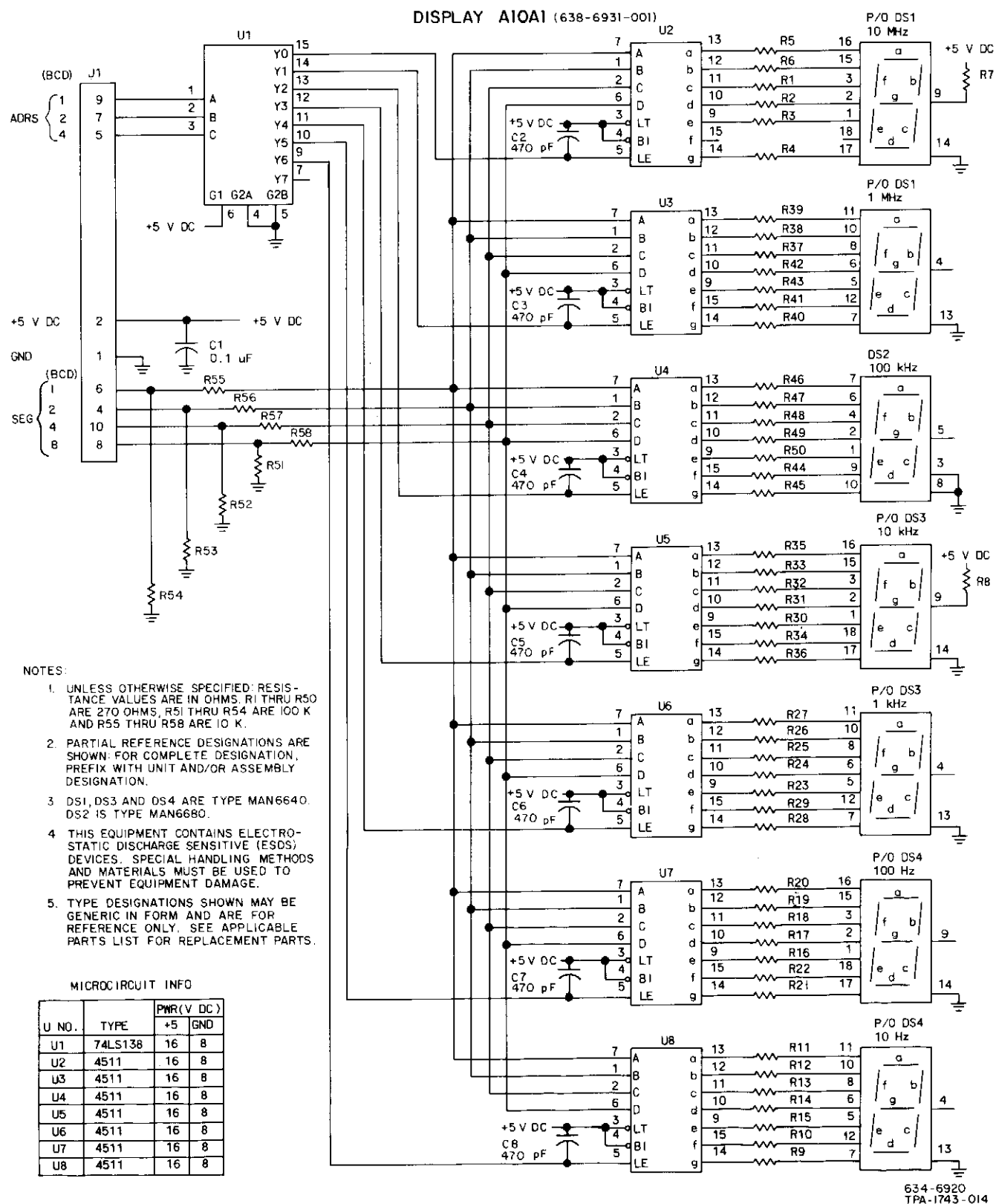
	105	115	125	210	220	230	240	250
BLACK	7	7	7	6	6	5	5	4
YELLOW	3	2	1	3	2	2	1	1
RED	6	5	4	3	2	2	1	1

- 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.



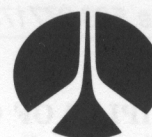


Power Supply, Schematic Diagram
Figure 5



634-6920
TPA-1743-014

Display A10A1, Schematic Diagram
Figure 6


**Rockwell
International**
instructions

Collins Telecommunications Products Division

523-0771739-001211

1 August 1982

Power Amplifier (634-8481-003)

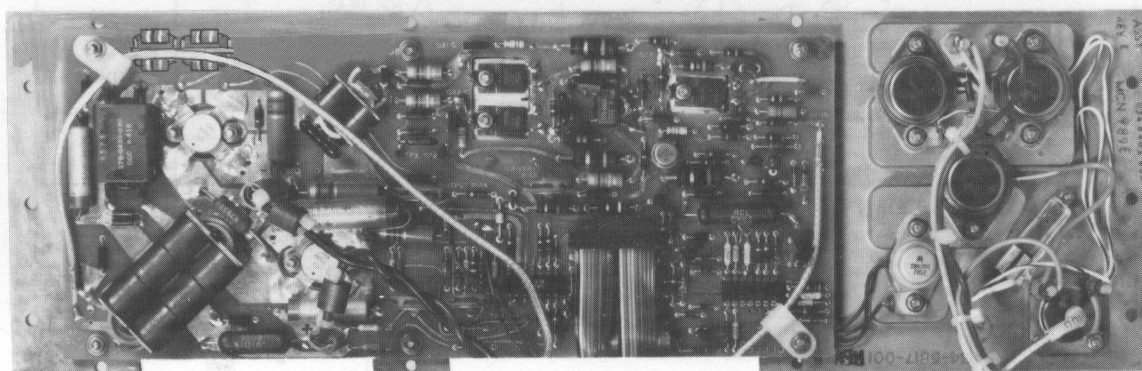
Printed in USA

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.

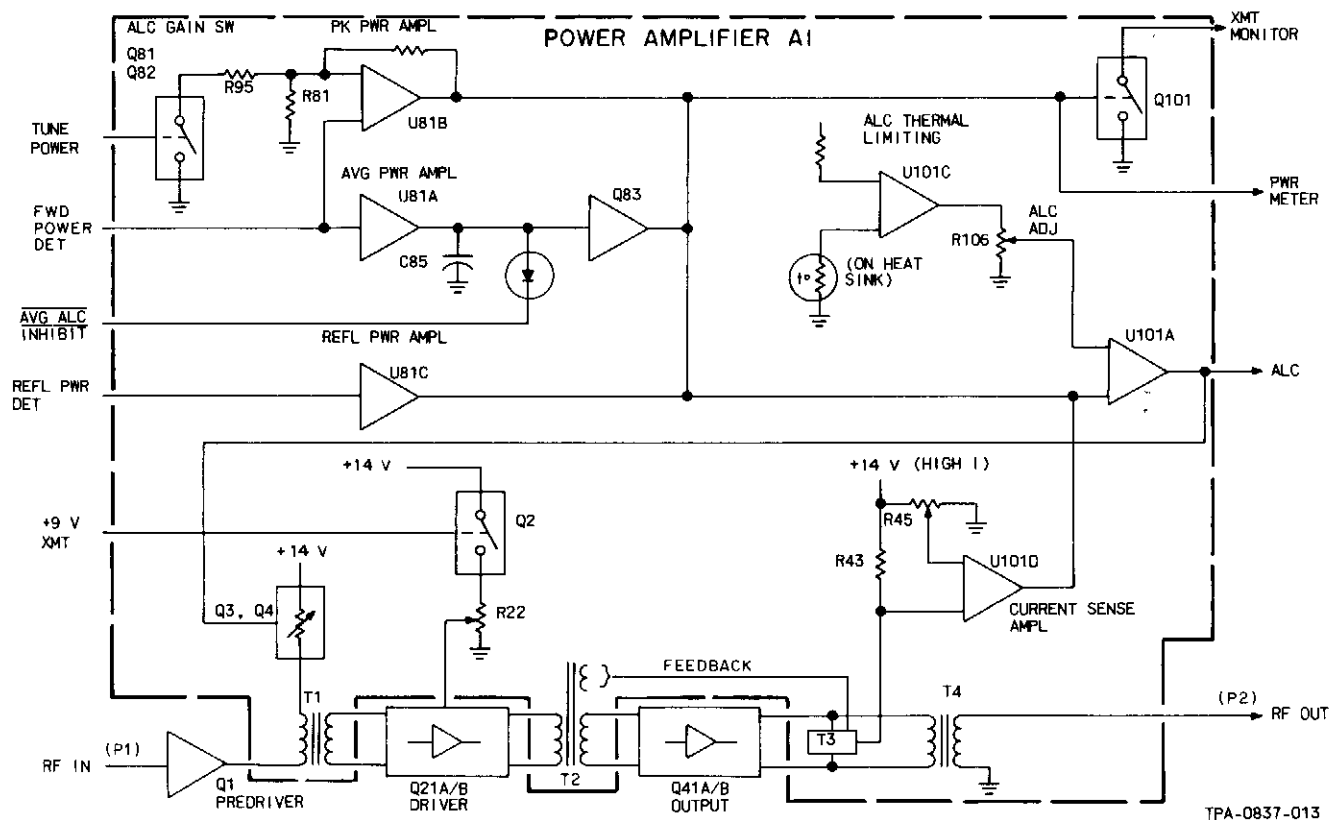
The output from Q41A/B is coupled across A1T4 at a nominal 50-ohm output impedance. Transformer A1T3 provides a dc path for the Q41A/B collectors while keeping rf from the power supply.

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. b. Measure dc voltage at A1TP1 (Q1 idle current). c. Switch in MOX to key transmitter and measure +14-V high-current level. Switch out MOX. d. Connect voltmeter (must not be grounded) across A1TP2 and A1TP3. Switch in MOX and measure voltage. Switch out MOX.	10 mA, maximum 835 $\pm$ 85 mV dc 200 $\pm$ 10 mA +28 $\pm$ 1.0 mV dc	Check Q41A/B. Check Q1, A1Q3, and A1Q4. Adjust A1R63 as required. Check A1Q2, A1U101B, and Q61. Adjust A1R22 as required. Check Q21A/B.
3. ALC threshold	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- $\pm$ 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 $\pm$ 0.3 V	Adjust A1R106 as required. Check A1U101A, A1U101C, and A1U81B.
4. Current limit ALC	Switch out MOX. 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 $\pm$ 0.5 A. Let current stabilize approx two seconds; then measure ALC voltage (A1J3-18). 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.	+1.0 to +2.0 V dc	Adjust A1R45 as necessary.
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. e. Switch out MOX.	0.6 to 2.3 V rf (as indicated on signal generator)	Check Q1, Q21A/B, and Q41A/B for low gain.
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. e. Switch out MOX and remove ground from A1J3-8.	+1.5 $\pm$ 0.5 V	Check A1Q81, A1Q82, A1U81B, A1U101A, A1Q3 and A1Q4.
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. Note If AC-2808 Blower has been installed, ALC INHIBIT signal has been disabled and amplifier will not automatically reduce power output level.	10 to 30 seconds (rf output should be 50 to 60 W)	Check A1U81A, A1C85, and A1Q83.
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 $\pm$1-watt output. Adjust ALC REF adjust A1R106 to obtain 1.0 $\pm$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 $\pm$100 Hz at frequencies listed below to obtain ALC voltage of 1.0 $\pm$0.3 V dc measured at A1J3-18. g. Switch out MOX; turn off power; and disconnect test equipment.	3rd and 5th order products NLT -25 dB below either tone	Check Q41A/B and associated circuit.

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 MANUFACTURER'S NAME
CODE 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

MFR
CODE

MANUFACTURER'S NAME
AND ADDRESS

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

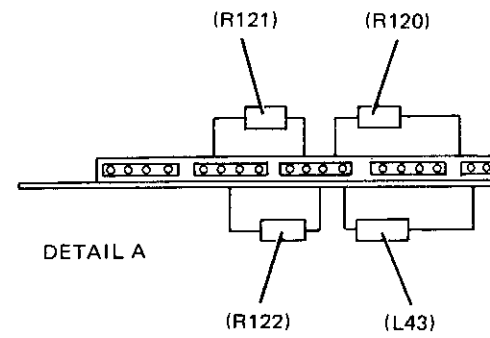
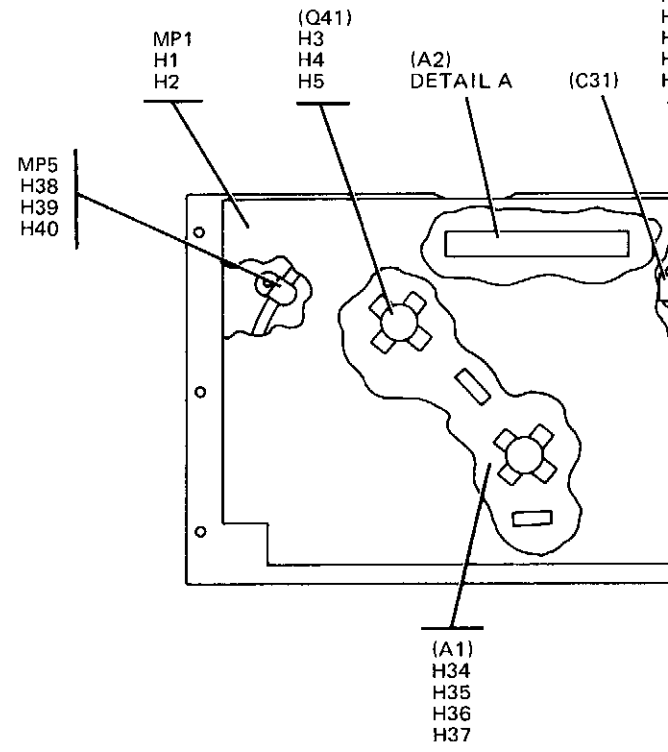
96906 MILITARY STANDARD

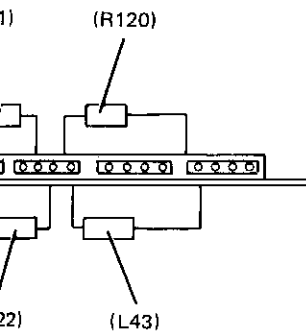
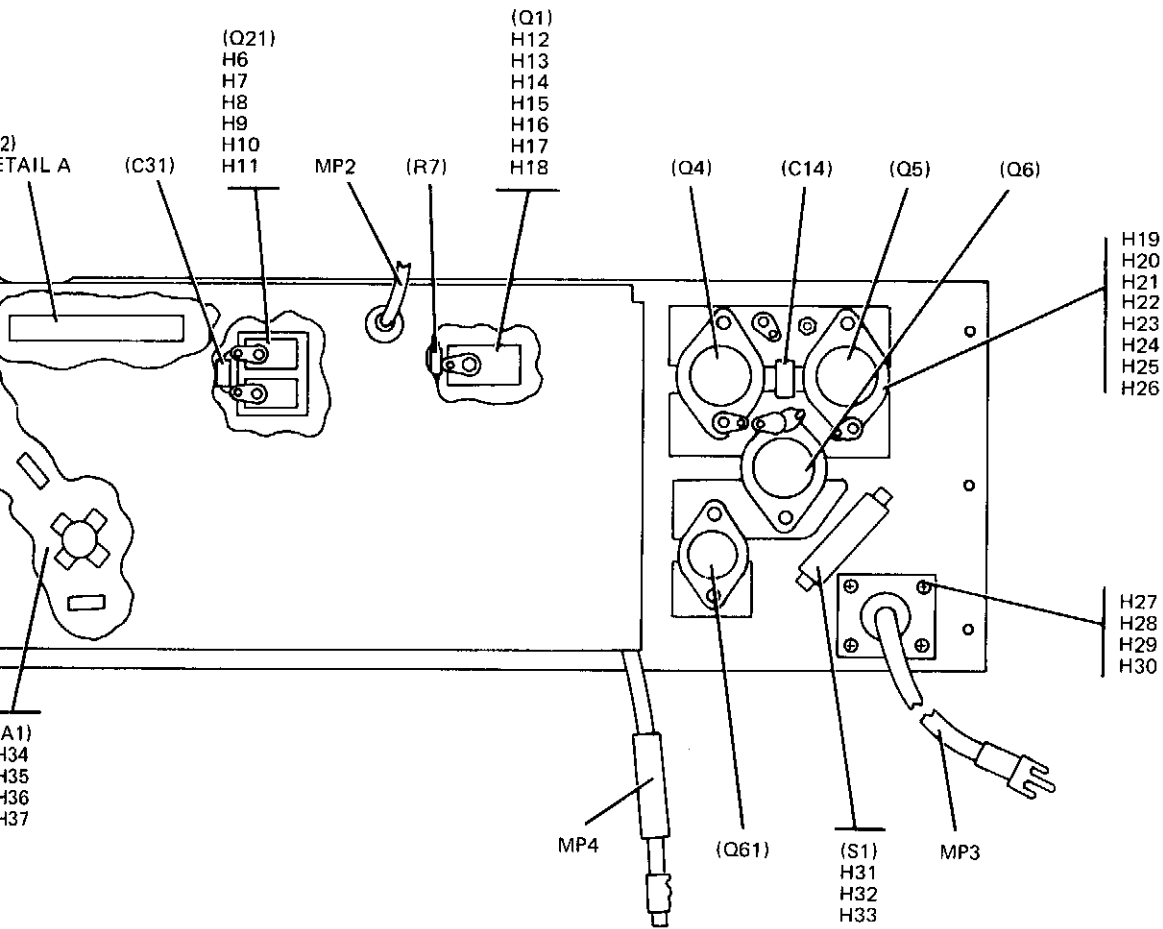
99800 AMERICAN PRECISION INDUSTRIES INC
DELEVAN DIV
270 QUAKER RD
EAST AURORA NY 14052

5.3 Equipment Covered

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

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

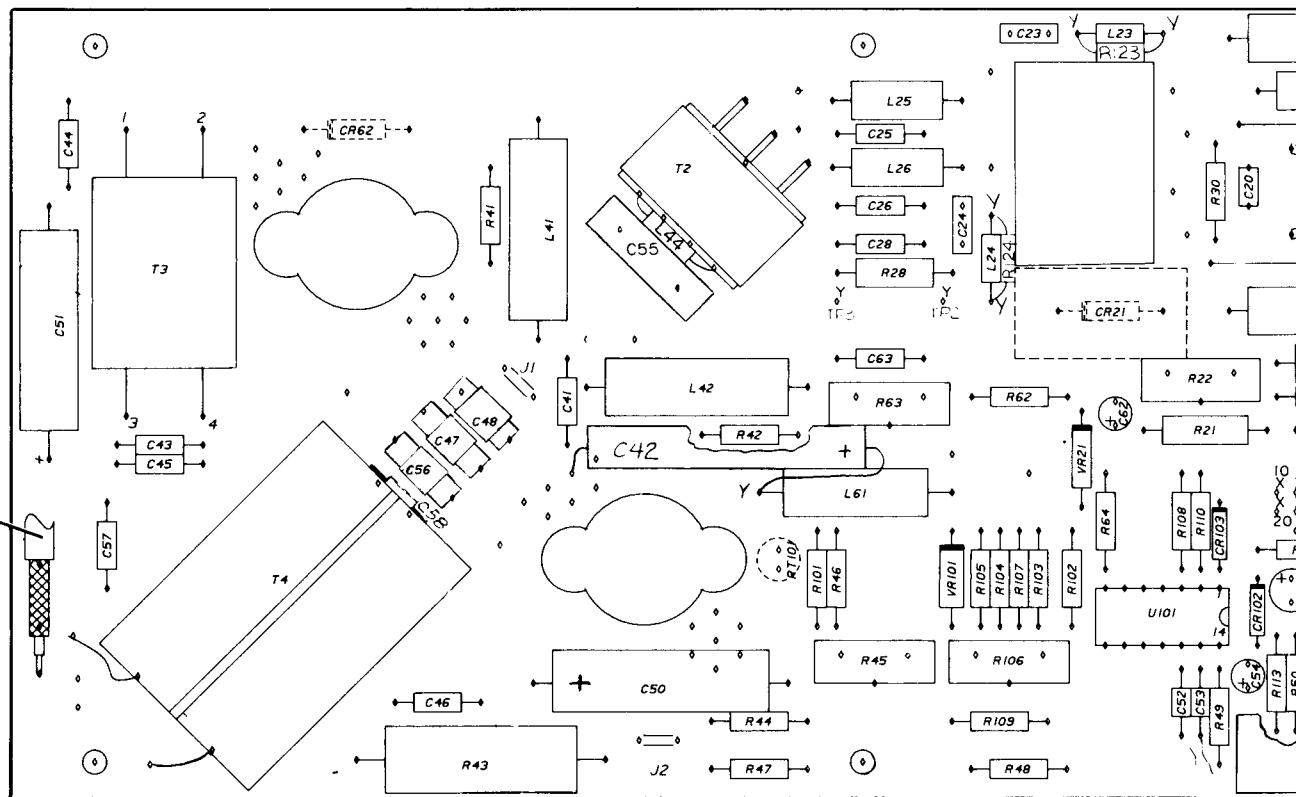




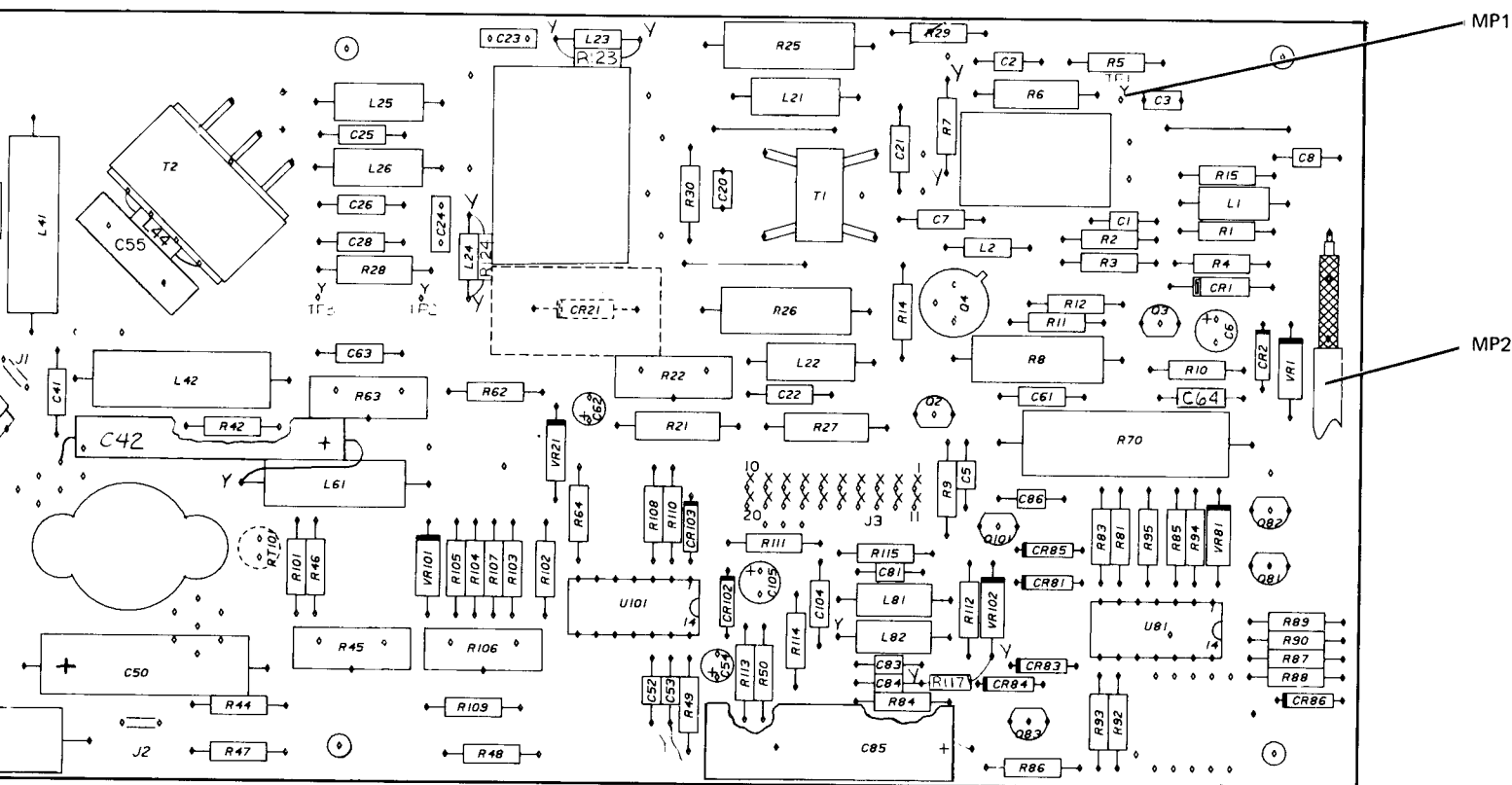
TPA-5290-028

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

MP3



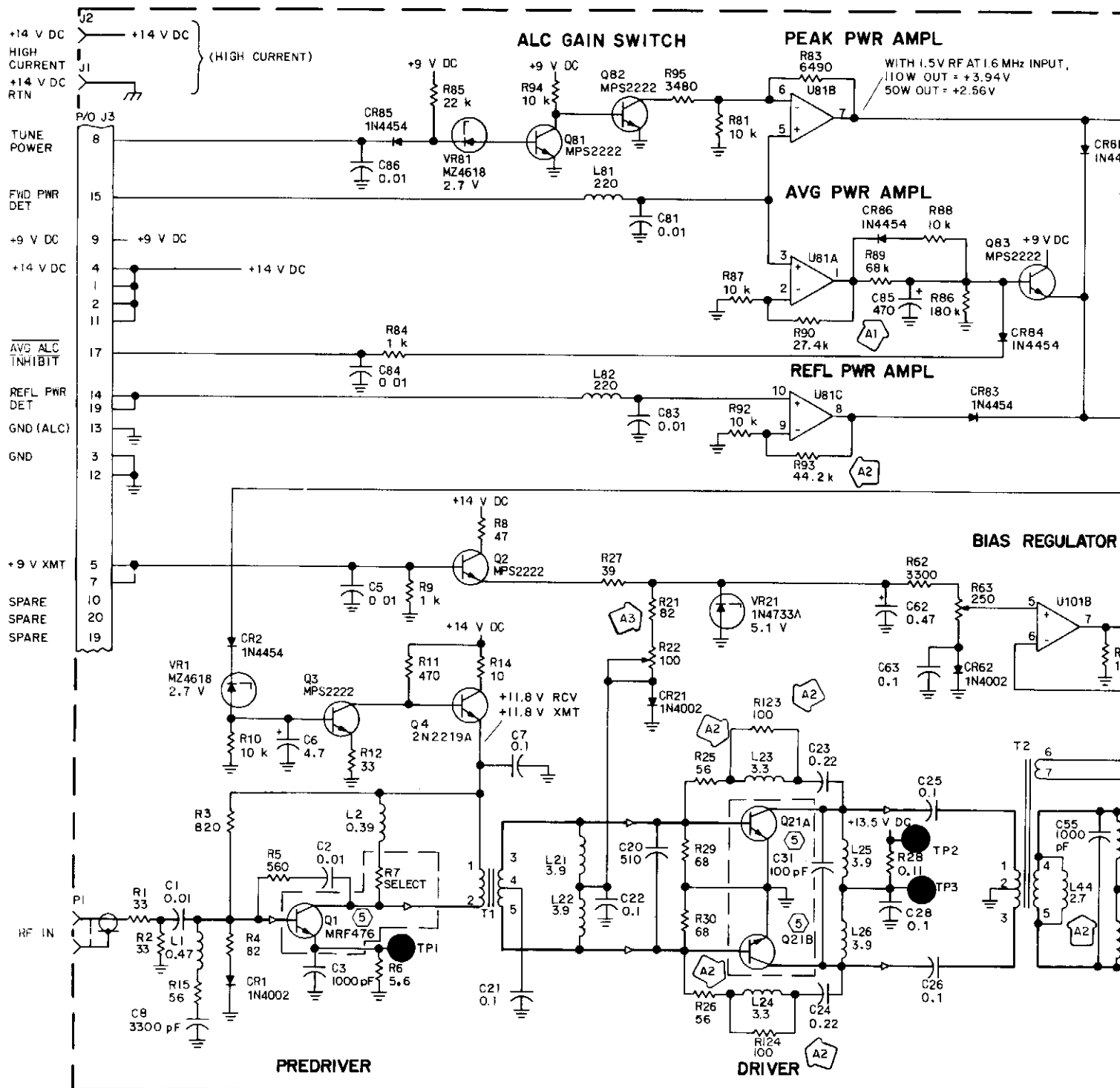
638-6775-001

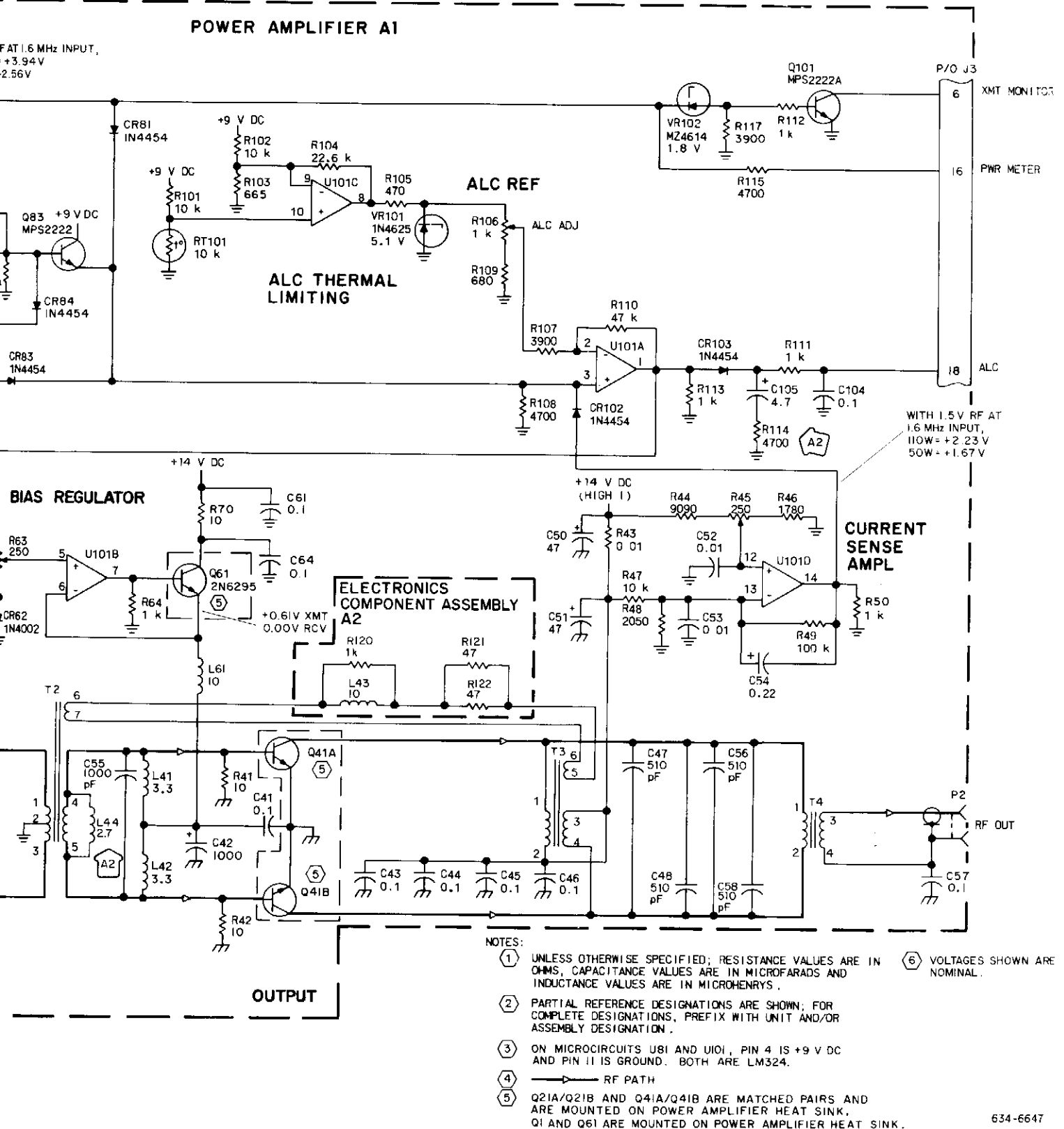


638-6775-001

TPA-5290-028

Power Amplifier, Parts Location
Figure 3 (Sheet 3)





Power Amplifier, Schematic Diagram
Figure 4



**Rockwell
International**

instructions

Collins Telecommunications Products Division

523-0772530-001211

1 August 1982

Low-Pass Filter (641-7132-001)

Printed in USA

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 filter 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 transmitter.

3.1 Test Equipment Required

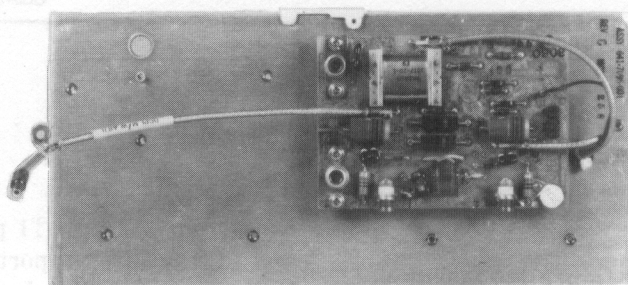
Table 1 lists the equipment required to perform the tests. A suggested type is given; however, if that specific equipment is not available, any that meets or



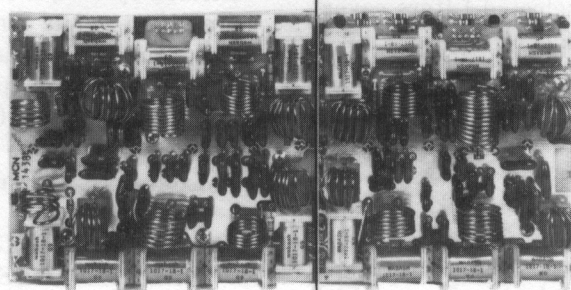
Rockwell
International

instructions

523-0772530-001211
1 August 1982



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 $\pm 10^\circ$, 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.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL																																																				
1. Test setup	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.																																																						
2. Filter tuning impedance measurement	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><thead><tr><th><u>FILTER</u></th><th><u>DIAL FREQ</u></th></tr></thead><tbody><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></tbody></table> (2) Slowly sweep meter frequency across filter band while noting input impedance and maximum phase angle for each filter. <table><thead><tr><th><u>FREQ RANGE (MHz)</u></th><th><u>FILTER</u></th></tr></thead><tbody><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></tbody></table>	<u>FILTER</u>	<u>DIAL FREQ</u>	A2 L11/L12	1.95	A3 L11/L12	2.50	A2 L21/L22	3.55	A3 L21/L22	4.50	A3 L31/L32	6.00	A2 L31/L32	7.15	A3 L41/L42	12.00	A2 L41/L42	14.15	A2 L51/L52	29.00	<u>FREQ RANGE (MHz)</u>	<u>FILTER</u>	1.6-2	A1 L11/L12	2-3	A3 L11/L12	3-4	L1 L21/L22	4-5	A3 L21/L22	5-7	A3 L31/L32	7-10	A1 L31/L32	10-14	A3 L41/L42	14-20	A1 L41/L42	20-30	A1 L51/L52	Maximum phase angle, θ, for any filter is $\pm 10^\circ$. Impedance, Ω, as indicated for max phase deviation. <table><thead><tr><th><u>IF PHASE IS NMT</u></th><th><u>IMPED-ANCE RANGE IS</u></th></tr></thead><tbody><tr><td>$\pm 10^\circ$</td><td>46-55</td></tr><tr><td>$+8^\circ$</td><td>44-57</td></tr><tr><td>$\pm 6^\circ$</td><td>43-58</td></tr><tr><td>$\pm 4^\circ$</td><td>42-59</td></tr><tr><td>$\pm 2^\circ$</td><td>42-60</td></tr></tbody></table>	<u>IF PHASE IS NMT</u>	<u>IMPED-ANCE RANGE IS</u>	$\pm 10^\circ$	46-55	$+8^\circ$	44-57	$\pm 6^\circ$	43-58	$\pm 4^\circ$	42-59	$\pm 2^\circ$	42-60	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.
<u>FILTER</u>	<u>DIAL FREQ</u>																																																						
A2 L11/L12	1.95																																																						
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$\pm 2^\circ$	42-60																																																						
3. Stop band attenuation	b. Unkey transmitter and disconnect vector impedance meter and 50-ohm load.																																																						
(Cont)	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).																																																						

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. <table><tr><td><u>FILTER (MHz)</u></td><td><u>DIAL FREQ</u></td><td><u>SIG GEN FREQ (MHz)</u></td></tr><tr><td>1.6-2</td><td>1.9</td><td>3.2</td></tr><tr><td>2-3</td><td>2.5</td><td>4.0</td></tr><tr><td>3-4</td><td>3.5</td><td>6.0</td></tr><tr><td>4-5</td><td>4.5</td><td>8.0</td></tr><tr><td>5-7</td><td>6.0</td><td>10.0</td></tr><tr><td>7-10</td><td>8.0</td><td>14.0</td></tr><tr><td>10-14</td><td>12.0</td><td>20.0</td></tr><tr><td>14-20</td><td>15.0</td><td>28.0</td></tr><tr><td>20-30</td><td>28.0</td><td>40.0</td></tr></table> f. Unkey transceiver. Disconnect signal generator, voltmeter, and load. Reconnect coax between power amplifier P1 and receiver-exciter J1.	<u>FILTER (MHz)</u>	<u>DIAL FREQ</u>	<u>SIG GEN FREQ (MHz)</u>	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	Rf voltage through filter is not more than 0.056-V.	Check for correct component values and possible coil damage.
<u>FILTER (MHz)</u>	<u>DIAL FREQ</u>	<u>SIG GEN FREQ (MHz)</u>																															
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																															

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 $+2.2 \pm 0.2$-V dc and reflected power detected output is 0.0 V dc. - Remove assembly A2 from transceiver. - Temporarily connect coax jumper between P2 and P3 on A2. - Connect 50-ohm load to (Bird 8135) A2J2. - Connect 30-MHz, 100-watt output source to A2P1. Turn on source. - Using digital voltmeter measure dc voltage at: - A2J3-2 - A2J3-3 - Turn off rf source. Connect source to A2J2 and load to A2P1. Turn on source. - Using digital voltmeter, measure dc voltage at: - A2J3-2 - A2J3-3 - Turn off rf source.	Not more than $+0.1$-V dc $+2.2 \pm 0.2$-V dc $+2.2 \pm 0.2$-V dc Not more than $+0.1$-V dc	Adjust A2C1 for null, not more than $+0.1$-V dc. Adjust A2C2 for correct voltage. Adjust A2C1 for correct voltage. Adjust A2C2 for null, not more than $+0.1$-V dc
2. Output	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 $0 \pm 10^\circ$ 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 A2J3-3 d. Turn off rf power source and disconnect test equipment.	0.45 to 0.7-V dc 2.3 to 2.7-V dc	Check reflected power detector circuit. Check forward power detector circuit.
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. c. Momentarily connect +9-V dc input to A2J3-7 (+9 V XMT). d. Disconnect test equipment.	Voltmeter indicates 1.0 $\pm$ 0.2-V rms Voltmeter indicates 0 V rms	Check A2K1. Check A2K1 and associated circuit.
4. Coax inter lock	a. Enable transmit input (pin 7). b. Check for dc continuity to ground from J2 center conductor.	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.	

4. REPAIR

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

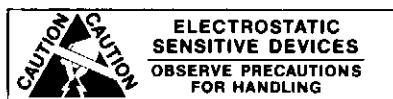
5. PARTS LIST/DIAGRAMS

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.

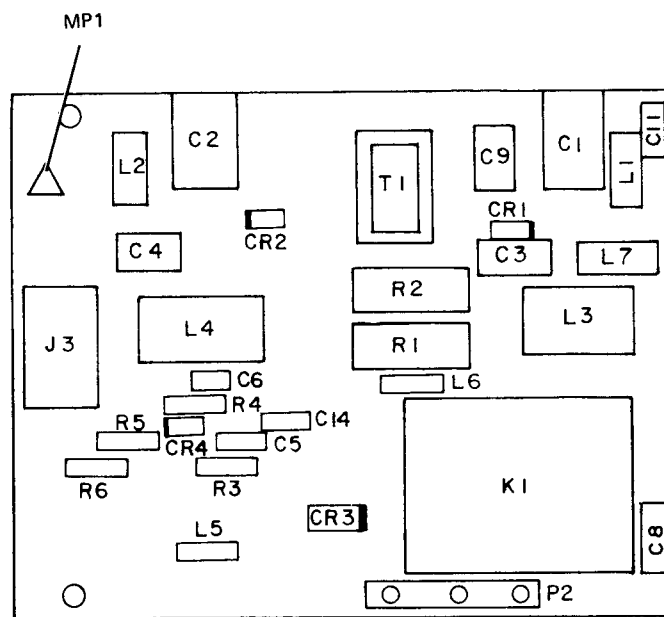
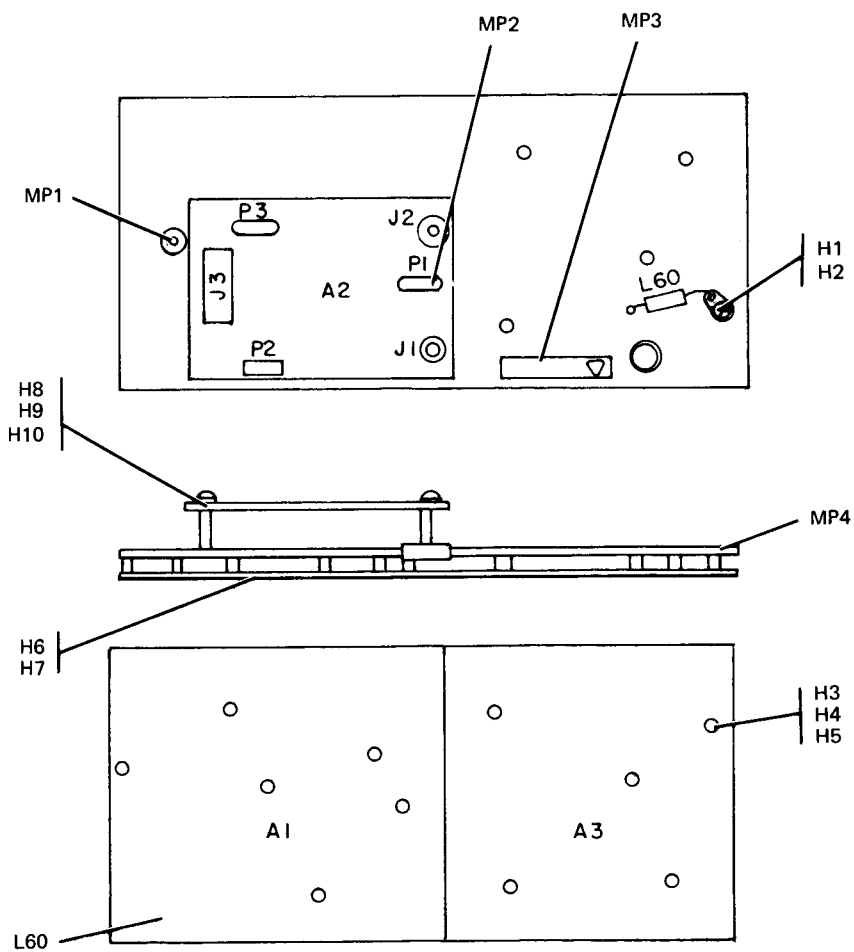
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00779	AMP INC P O BOX 3608 HARRISBURG PA 17105
02113	COILCRAFT INC 1102 SILVER LAKE RD CARY IL 60013
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025
13499	ROCKWELL INTERNATIONAL 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

<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
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	SEAELECTRO CORP 225 HOYT MAMARONECK NY 10544

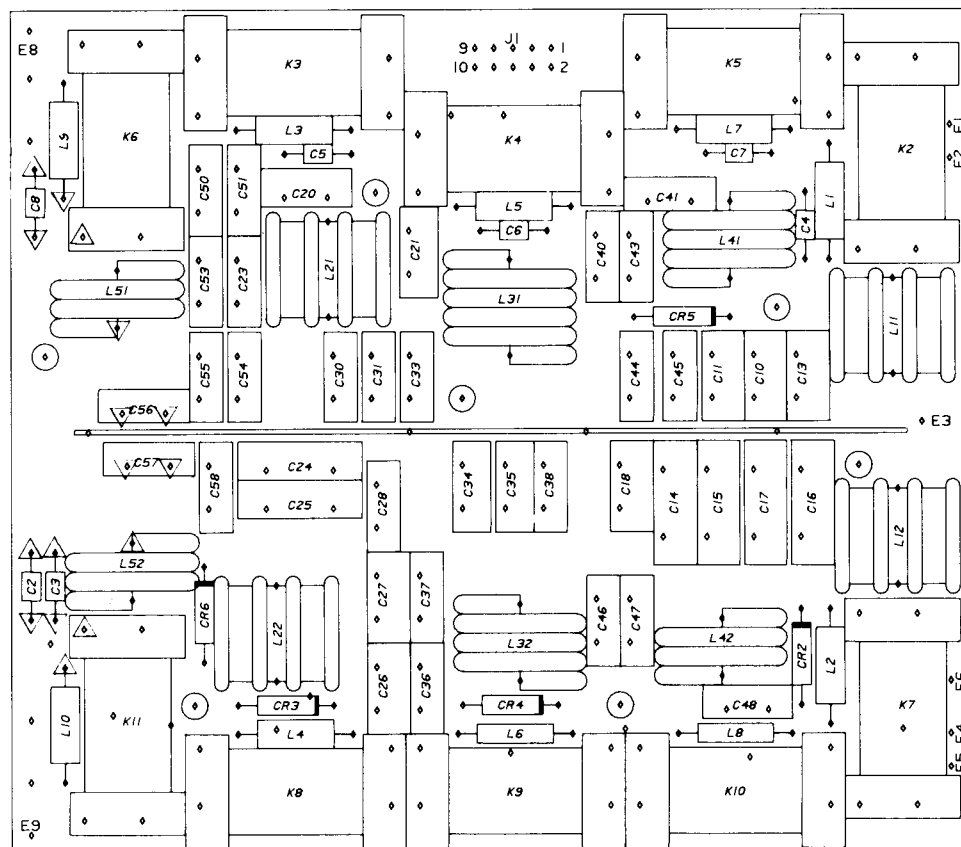
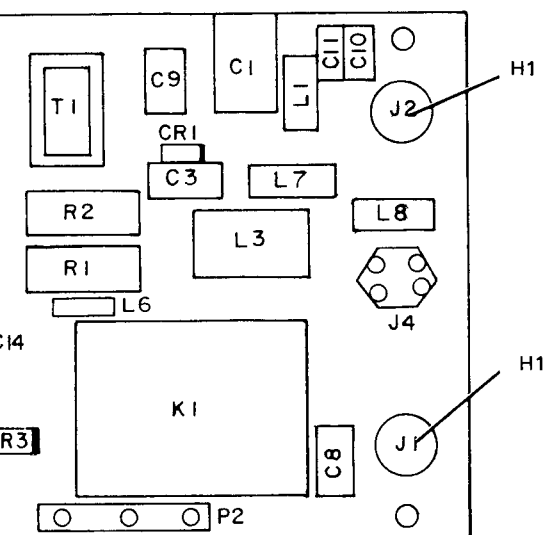
5.3 Equipment Covered

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

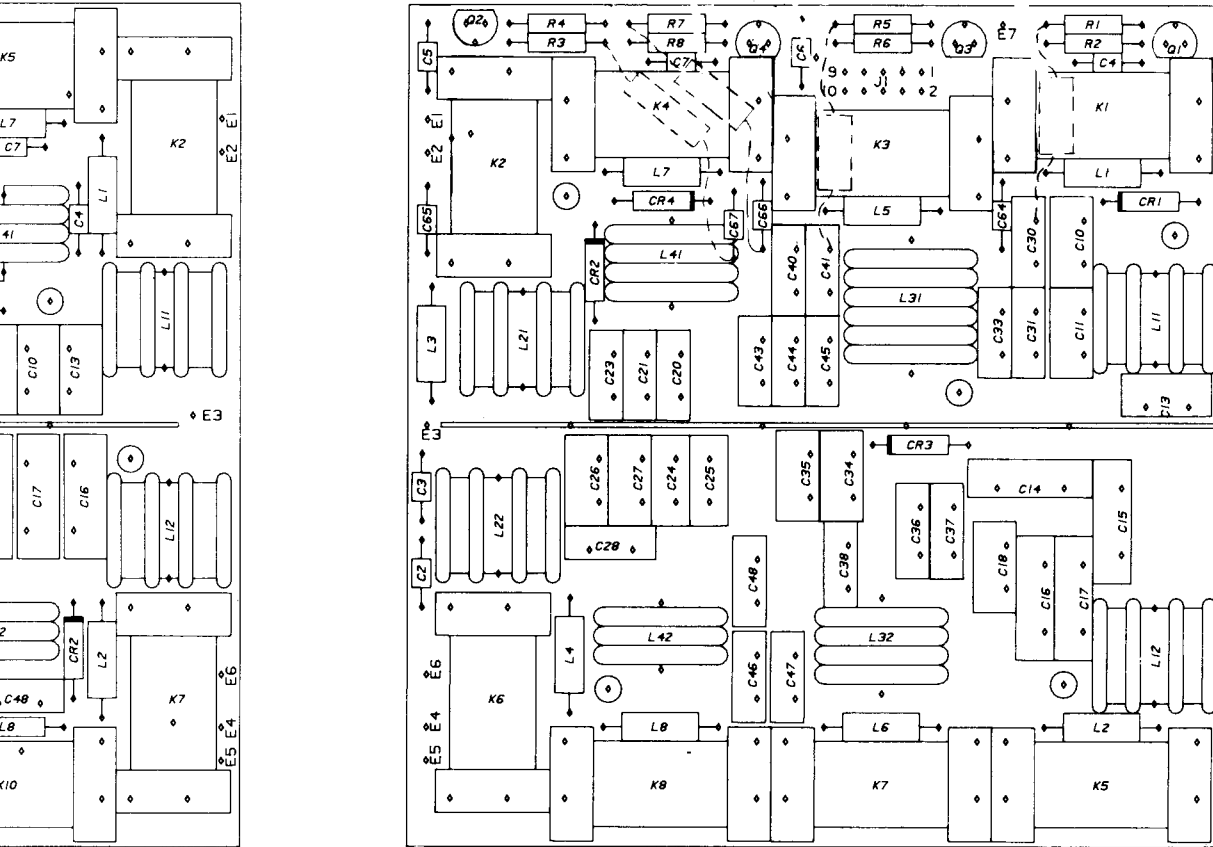
<u>CIRCUIT CARD/ SUBASSEMBLY</u>	<u>COLLINS PART NUMBER</u>	<u>LATEST EFFECTIVITY</u>
Low-Pass Filter	641-7132-001	REV D
Low-Pass Filter Circuit Card	638-6904-001	REV J
Standard Low-Pass Filter Circuit Card	638-6900-001	REV F
Directional Coupler	638-6788-001	REV N



638-6788-001
A2



638-6900-001
A1



638-6904-001
A3



TPA-5535-018

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

PARTS LIST

PARTS LIST (Co

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	SMR CODE	REF DES	DESCRIPTION	COLLINS PART NUMBER
	LOW PASS FILTER	641-7132-001					R8	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-
H1	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 1)	310-0279-000		96906	MS35338-135			STANDARD LOW PASS FILTER CIRCUIT CARD	638-
H2	NUT,PLAIN,HEX SST, 4-40 (QTY 1)	313-0132-000		77250	P313-0132-000		CR1	NOT USED	353-
H3	SCREW,MACH STL, 4-40 X 1/2 (QTY 1)	343-0137-000		96906	MS51957-17		CR2-CR6	SEMICONV DEVICE	353-
H4	WASHER,FLAT CRES, 0.125ID X 0.250 OD	310-0779-030		96906	MS15795-803		C1	NOT USED	913-
H5	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 5)	310-0279-000		96906	MS35338-135		C2-C8	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	912-
H6	SCREW,MACH SST, 4-40 X 5/16 (QTY 11)	343-0134-000		96906	MS51957-14		C9	NOT USED	912-
H7	WASHER,FLAT CRES, 0.125ID X 0.250 OD (QTY 7)	310-0779-030		96906	MS15795-803		C10	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 500V	912-
H8	SCREW,MACH STL, 4-40 X 1/2 (QTY 5)	343-0137-000		96906	MS51957-17		C11	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-
H9	WASHER,FLAT CRES, 0.125ID X 0.250 OD (QTY 5)	310-0779-030		96906	MS15795-803		C12	NOT USED	912-
H10	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 5)	310-0279-000		96906	MS35338-135		C13	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-
L60	COIL,RF 2200UH	240-2715-530		96906	MS75089-27		C14	CAPACITOR,FXD MICA DIEL, 1000PF, 5%, 500V	912-
MP1	GROMMET,RUBBER	201-0001-000		96906	MS35489-4		C15,C16	CAPACITOR,FXD MICA DIEL, 820PF, 5%, 500V	912-
MP2	CABLE	641-7100-013		641-7100-013			C17	CAPACITOR,FXD MICA DIEL, 510PF, 5%, 500V	912-
MP3	LABEL,PRESS SENS (ESDS)	280-2745-020		12998	280-2745-020		C18	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 500V	912-
MP4	MOUNT,FILTER	641-7130-001					C19	NOT USED	912-
A2A3	LOW PASS FILTER- OPT	638-6904-001					C20,C21	CAPACITOR,FXD MICA DIEL, 240PF, 5%, 500V	912-
A2A1	LOW PASS FILTER	638-6900-001					C22	NOT USED	912-
A2A2	DIRECTIONAL COUPLER	638-6788-001			638-6788-001		C23	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 500V	912-
A2A3	LOW PASS FILTER CIRCUIT CARD	638-6904-001					C24	CAPACITOR,FXD MICA DIEL, 470PF, 5%, 500V	912-
CR1-CR4	SEMICONV DEVICE	353-6442-020		04713	1N4002		C25	CAPACITOR,FXD MICA DIEL, 430PF, 5%, 500V	912-
C1	NOT USED						C26	CAPACITOR,FXD MICA DIEL, 360PF, 5%, 500V	912-
C2-C7	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050		C27	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 500V	912-
C8,C9	NOT USED						C28	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-
C10	CAPACITOR,FXD MICA DIEL, 430PF, 5%, 500V	912-2861-000		72136	DM15F431J300HVAC		C29	CAPACITOR,FXD MICA DIEL, 91PF, 5%, 500V	912-
C11	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-2858-000		81349	CM05FD391J03		C30-C32	NOT USED	912-
C12	NOT USED						C33	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-
C13	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 500V	912-2846-000		81349	CM05FD271J03		C34,C35	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 500V	912-
C14,C15	CAPACITOR,FXD MICA DIEL, 680PF, 5%, 500V	912-2989-000		81349	CM06FD681J03		C36,C37	CAPACITOR,FXD MICA DIEL, 130PF, 5%, 500V	912-
C16	CAPACITOR,FXD MICA DIEL, 510PF, 5%, 500V	912-2980-000		81349	CM06FD511J03		C38	CAPACITOR,FXD MICA DIEL, 75PF, 5%, 500V	912-
C17	CAPACITOR,FXD MICA DIEL, 470PF, 5%, 500V	912-2974-000		81349	CM06FD471J03		C39	NOT USED	912-
C18	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 500V	912-2852-000		81349	CM05FD331J03		C40	CAPACITOR,FXD MICA DIEL, 43PF, 5%, 500V	912-
C19	NOT USED						C41	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V (A2)	912-
C20,C21	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 500V	912-2840-000		81349	CM05FD221J03		C41	CAPACITOR,FXD MICA DIEL, 36PF, 5%, 500V	912-
C22	NOT USED						C42	NOT USED	912-
C23	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-000		81349	CM05FD151J03		C43	CAPACITOR,FXD MICA DIEL, 36PF, 5%, 500V (A2)	912-
C24,C25	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-2858-000		81349	CM05FD391J03		C43	CAPACITOR,FXD MICA DIEL, 39PF, 5%, 500V	912-
C26,C27	CAPACITOR,FXD MICA DIEL, 240PF, 5%, 500V	912-2843-000		81349	CM05FD241J03		C44	CAPACITOR,FXD MICA DIEL, 82PF, 5%, 500V	912-
C28	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-000		81349	CM05FD151J03		C45	CAPACITOR,FXD MICA DIEL, 91PF, 5%, 500V	912-
C29	NOT USED						C46	CAPACITOR,FXD MICA DIEL, 62PF, 5%, 500V (A1)	912-
C30,C31	CAPACITOR,FXD MICA DIEL, 120PF, 5%, 500V	912-2822-000		81349	CM05FD121J03		C46	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-
C32	NOT USED						C47	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-
C33	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-2816-000		81349	CM05FD101J03		C48	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 500V	912-
C34,C35	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 500V	912-2846-000		81349	CM05FD271J03		C49	NOT USED	912-
C36	CAPACITOR,FXD MICA DIEL, 200PF, 5%, 500V	912-2837-000		81349	CM05FD201J03		C50,C51	CAPACITOR,FXD MICA DIEL, 30PF, 5%, 500V (A1)	912-
C37	CAPACITOR,FXD MICA DIEL, 180PF, 5%, 500V	912-2834-000		81349	CM05FD181J03		C50,C51	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 500V	912-
C38	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-2816-000		81349	CM05FD101J03		C52	NOT USED	912-
C39	NOT USED						C53	CAPACITOR,FXD MICA DIEL, 22PF, 5%, 500V	912-
C40,C41	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-2804-000		81349	CM05ED680J03		C54	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 500V (A1)	912-
C42	NOT USED						C54	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-
C43	CAPACITOR,FXD MICA DIEL, 43PF, 5%, 500V	912-2789-000		81349	CM05ED430J03		C55	CAPACITOR,FXD MICA DIEL, 62PF, 5%, 500V	912-
C44	CAPACITOR,FXD MICA DIEL, 130PF, 5%, 500V	912-2825-000		81349	CM05FD131J03		C56	CAPACITOR,FXD MICA DIEL, 39PF, 5%, 500V	912-
C45	CAPACITOR,FXD MICA DIEL, 120PF, 5%, 500V	912-2822-000		81349	CM05FD121J03		C57	CAPACITOR,FXD MICA DIEL, 43PF, 5%, 500V	912-
C46	CAPACITOR,FXD MICA DIEL, 91PF, 5%, 500V	912-2813-000		81349	CM05FD910J03		C58	CAPACITOR,FXD MICA DIEL, 22PF, 5%, 500V (A1)	912-
C47	CAPACITOR,FXD MICA DIEL, 82PF, 5%, 500V	912-2810-000		81349	CM05ED820J03		C58	CAPACITOR,FXD MICA DIEL, 27PF, 5%, 500V	912-
C48	CAPACITOR,FXD MICA DIEL, 56PF, 5%, 500V	912-2798-000		81349	CM05ED560J03		J1	CONNECTOR,HDR	372-
C49-C63	NOT USED						K1	NOT USED	410-
C64-C67	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050		K2-K11	RELAY,REED,RF	240-
C68	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050		L1-L10	COIL,RF 47UH	278-
C69	NOT USED						L11	COIL,RF 3.8UH	278-
C70	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050		L12	COIL,RF 2.2UH	278-
C71	NOT USED						L13-L20	NOT USED	278-
C72	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050		L21	COIL,RF 2.0UH	278-
C73	NOT USED						L22	COIL,RF 1.05UH	278-
C74	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050		L23-L30	NOT USED	278-
J1	CONNECTOR,HDR	372-2656-100		52072	CAD105P100-230-4		L31	COIL,RF AIR WND, 8 1/2 TURNS	278-
K1-K8	RELAY,REED,RF	410-0585-010		18542	1017-18-1		L32	COIL,RF AIR WND, 6 TURNS	278-
L1-L8	COIL,RF 47UH	240-2043-000		96906	MS75085-03		L33-L40	NOT USED	278-
L9,L10	NOT USED						L41	COIL,RF AIR WND, 5 1/2 TURNS	278-
L11	COIL,RF 2.9UH	278-0449-050		20462	278-0449-050		L42	AIR WND, 4 TURNS	278-
L12	COIL,RF 1.6UH	278-0449-060		20462	278-0449-060		L43-L50	NOT USED	278-
L13-L20	NOT USED						L51	AIR WND, 4 TURNS	278-
L21	COIL,RF 1.7UH	278-0449-070		20462	278-0449-070		L52	AIR WND, 3 1/2 TURNS	278-
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		CR1,CR2	DIRECTIONAL COUPLER CIRCUIT CARD	638-
L32	AIR WND, 7 1/2 TURNS	278-0846-460		02113	278-0846-460		CR3	SEMICONV DEVICE	353-
L33-L40	NOT USED						CR4	SEMICONV DEVICE (A1)	353-
L41	COIL,RF AIR WND, 6 TURNS	278-0846-470		02113	278-0846-470		C1,C2	CAPACITOR,VAR AIR DIEL, 0.8 TO 10PF, 250V	922-
L42	COIL,RF AIR WND, 5 TURNS	278-0846-480		02113	278-0846-480		C3,C4	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 300V	912-
Q1-Q4	TRANSISTOR	352-5035-010		04713	MPSA14		C5,C6	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-
R1	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR076473KS		C7	NOT USED	912-
R2	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR076104KS		C8,C9	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-
R3	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR076473KS		C10,C11	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-
R4	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR076104KS				
R5	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR076473KS		C12,C13	NOT USED	913-
R6	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR076104KS		C14	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC (A1)	913-
R7	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR076473KS				

PARTS LIST (Cont)

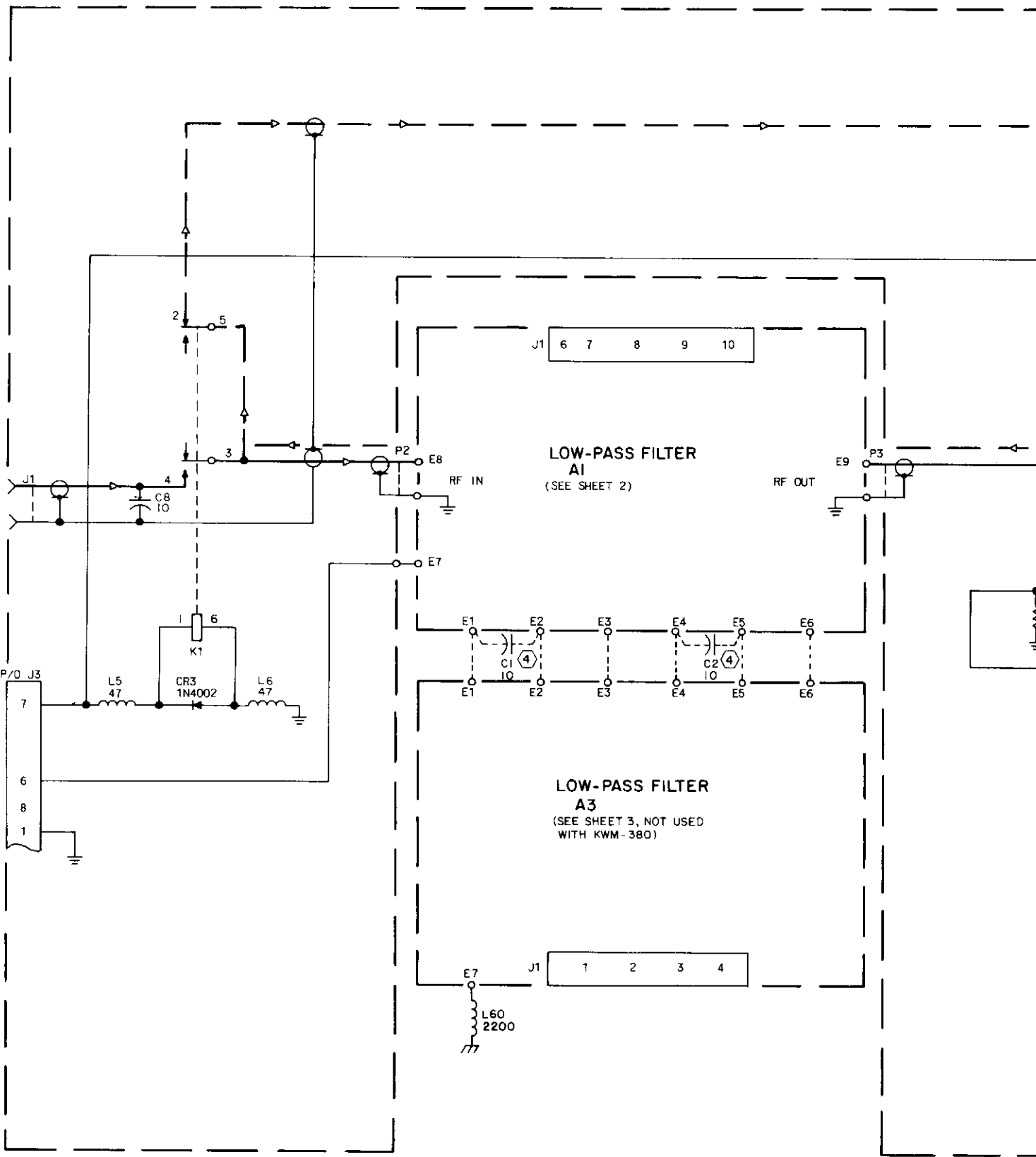
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%, 1/4W	745-0821-000		81349	RCR07G104KS	
CARD	638-6900-001				
	353-6442-020		04713	1N4002	
20%P80%,50V	913-3331-020		56289	292CY5U103D8050	
5%, 500V	912-2855-000		81349	CM05FD361J03	
5%, 500V	912-2858-000		81349	CM05FD391J03	
5%, 500V	912-2858-000		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	CM05CD100003	
10%, 100VDC	913-5019-440		81349	CK06BX104K	
P80%M20%,	913-3331-020		56289	292CY5U103Z050B	

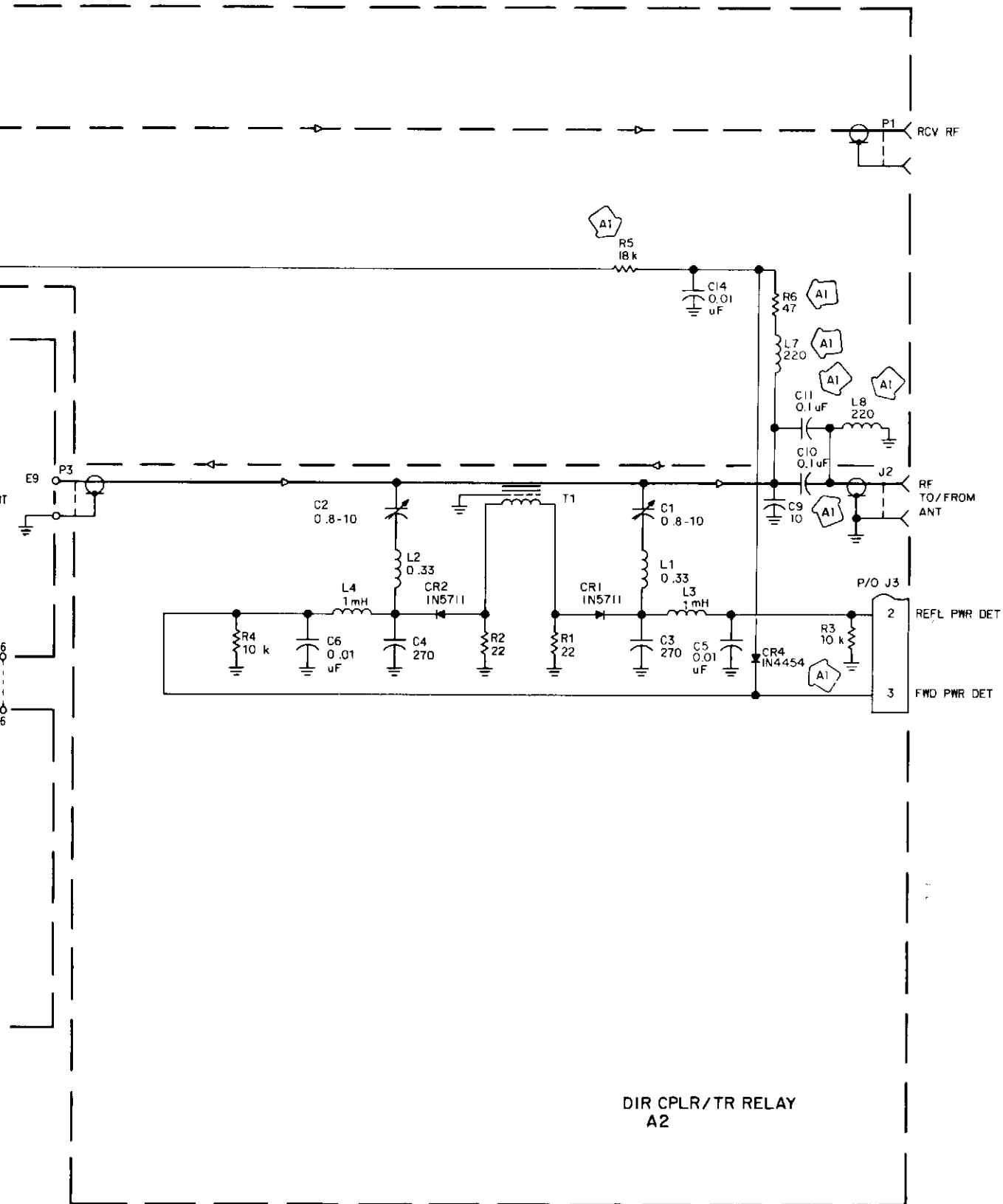
PARTS LIST (Cont)

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	RCR07G103KS	
T1	XHFR, DIR COUP	641-6745-001			641-6745-001	

MODIFICATION HISTORY

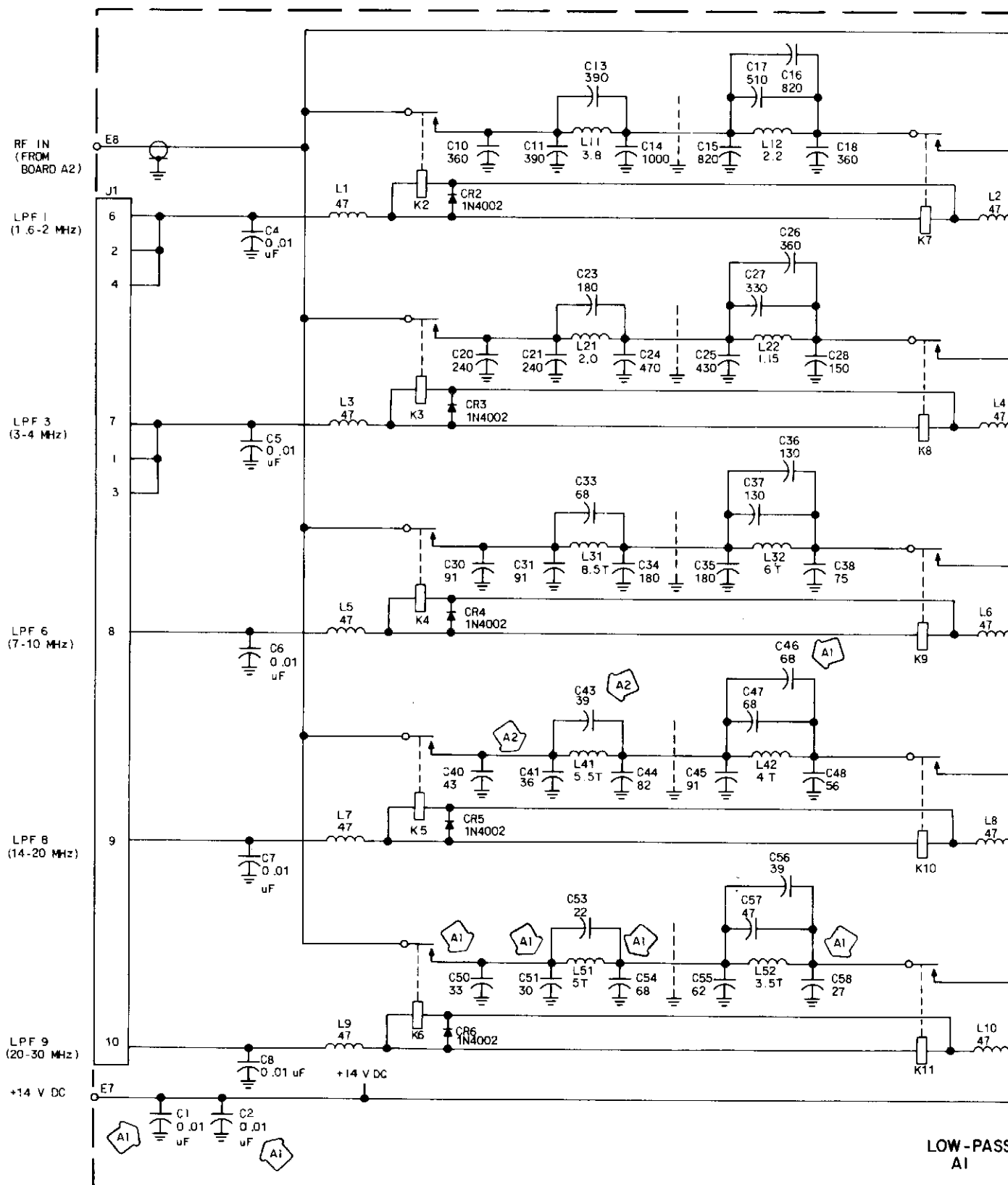
REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
	638-6900-001	
A1	C46 Changed from 68 pF to 62 pF. C50, C51 changed from 33 pF to 30 pF. C54 changed from 68 pF to 56 pF. C58 changed from 27 pF to 22 pF.	REV D
A2	C43 changed from 39 pF to 36 pF. C41 changed from 36 pF to 47 pF.	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

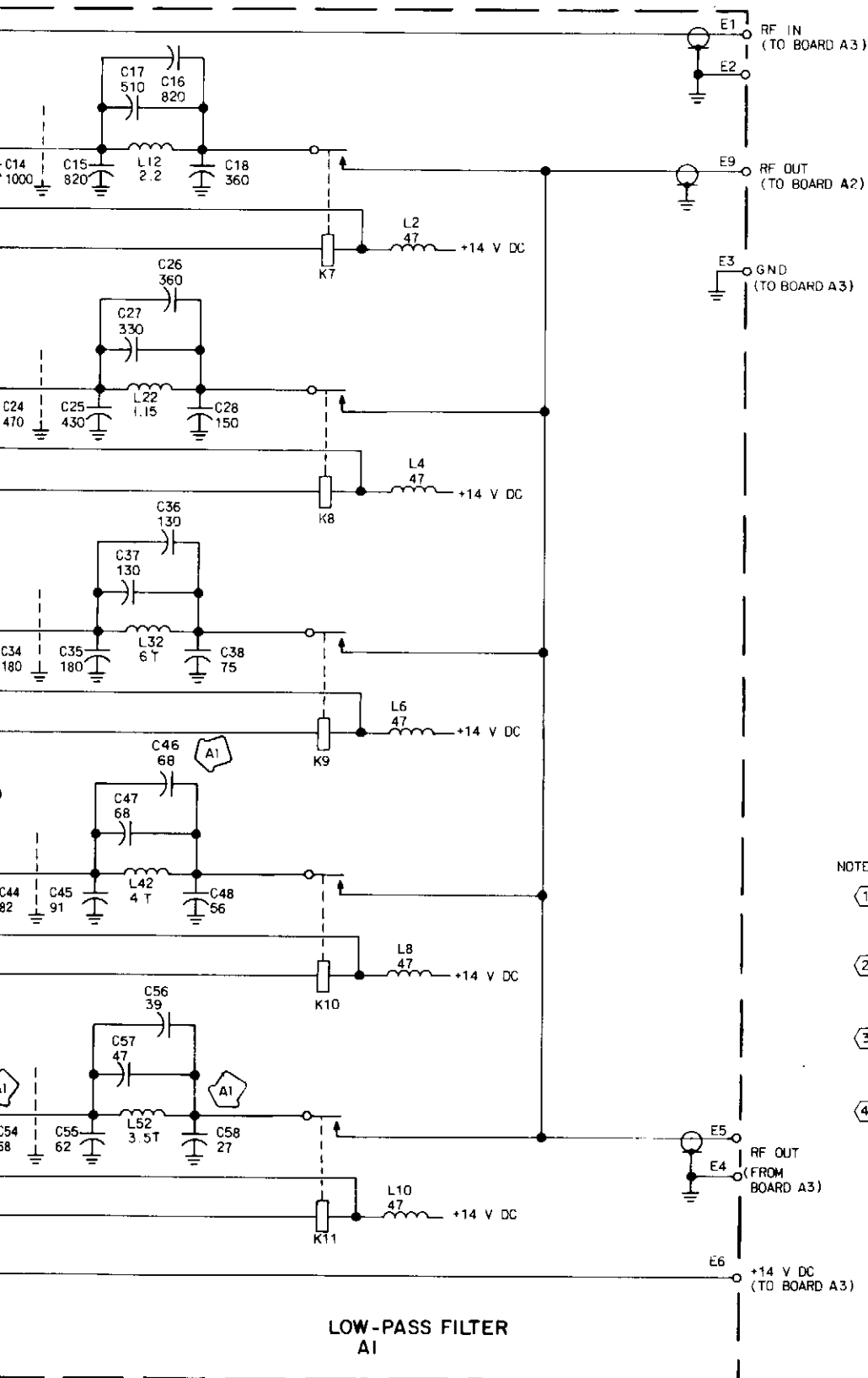




Low-Pass Filter, Schematic Diagram
Figure 3 (Sheet 1 of 3)

634-6912
TPA-1686-034



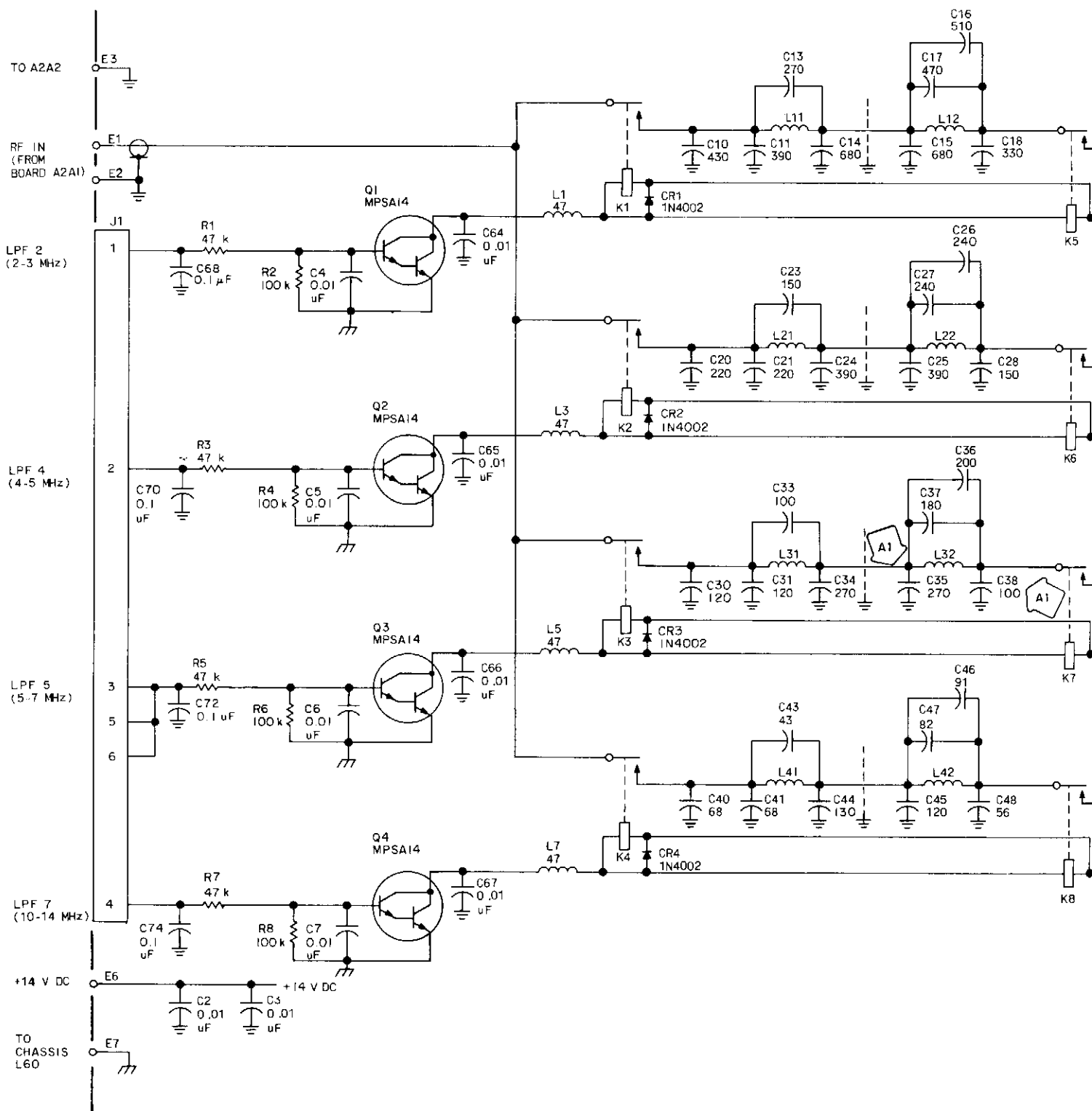


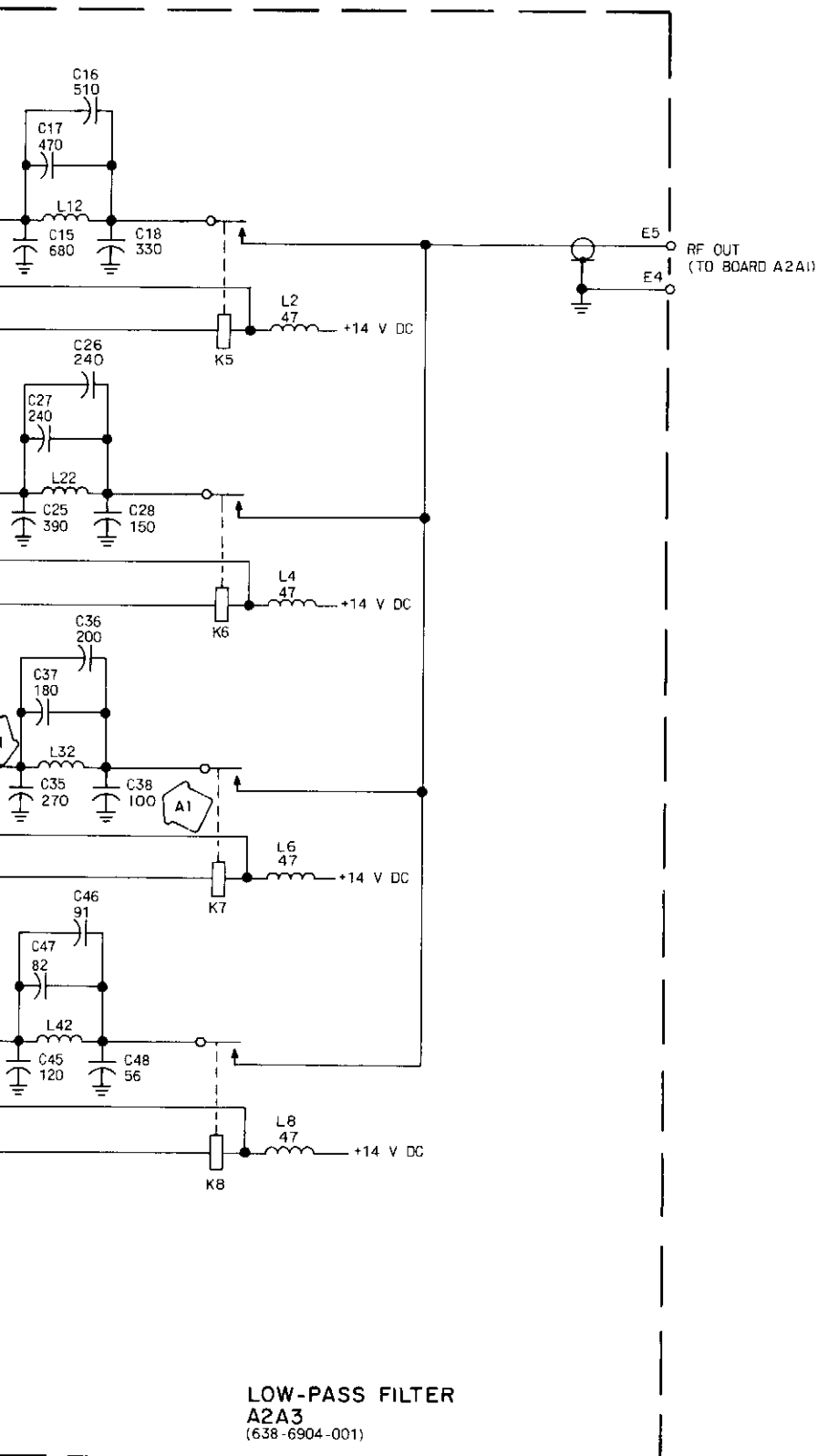
NOTES:

- ① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN PICO FARADS 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)





634 6912
 TPA-1686-034

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



**Rockwell
International**

instructions

Collins Telecommunications Products Division

523-0771741-001211

1 August 1982

**Receiver-Exciter
(638-6908-002)**

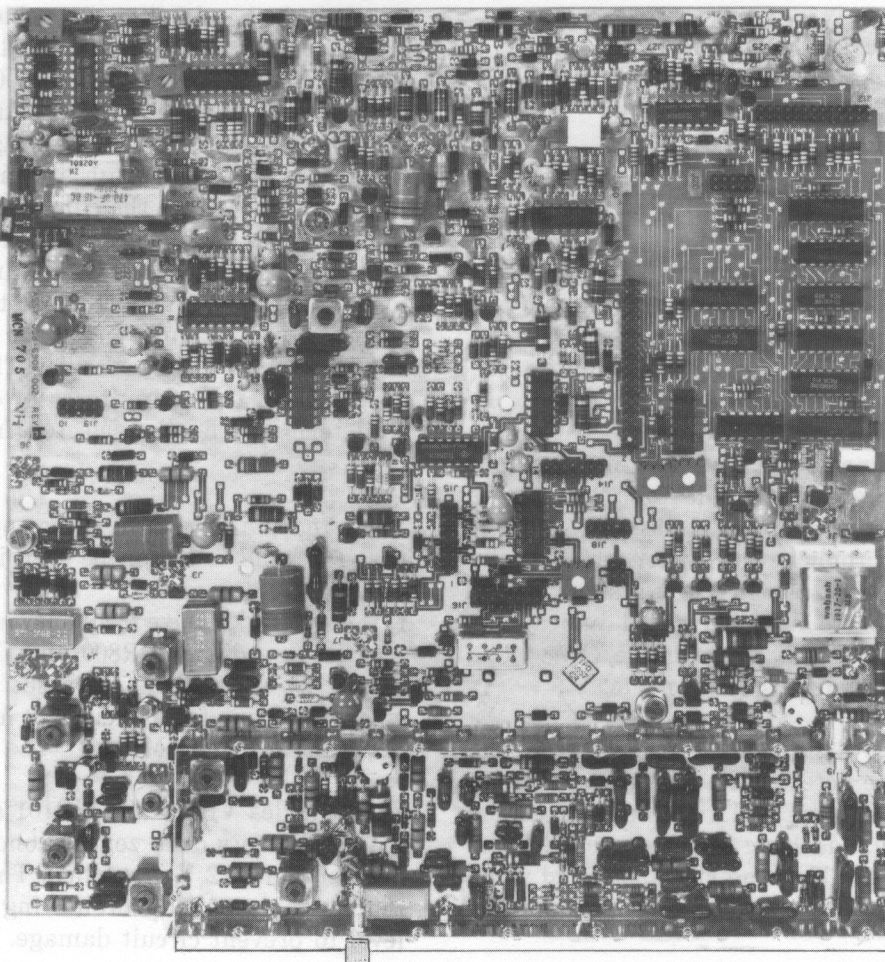
Receiver-Exciter (638-6908-002)

Printed in USA

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

523-0771741-001211

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)

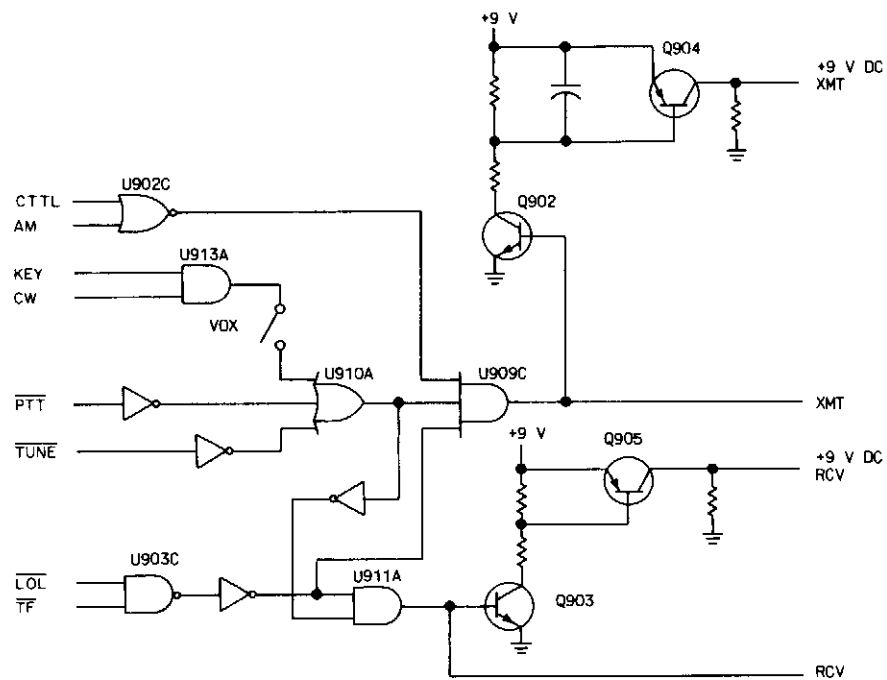
The rf signal path in the receiver is enabled when the +9 V DC RCV voltage is present. This voltage is developed by the logic circuits in the receiver-exciter and is present any time the transceiver is not in a transmit mode. (Refer to paragraph 2.1 for an explanation of the logic circuits.) The dc voltage 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.

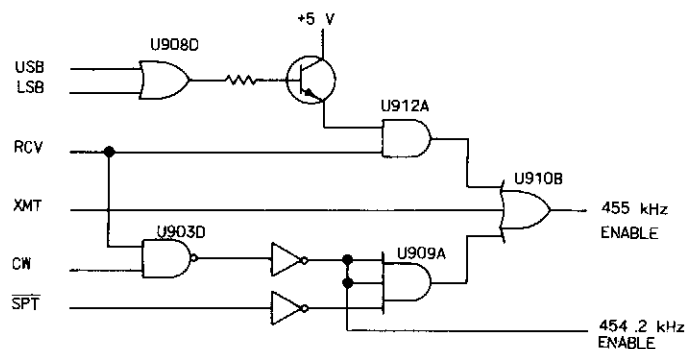


		USB	LSB	CW	AM	SPT	KT	CTTL	PTT	TUNE	LOL	TF	KEY
XMT (AND +9 V DC XMT)	=0	-	-	X	X	-	-	1	X	X	X	X	X
		-	-	X	X	1	-	-	X	X	X	O	X
		-	-	X	X	-	-	X	X	X	X	O	X
		-	-	O	X	-	-	X	1	1	X	X	X
		-	-	X	X	-	-	X	1	1	X	X	O
	*	-	-	X	X	-	-	X	1	1	X	X	X
XMT (AND +9 V DC XMT)	=1	-	-	X	O	-	-	O	X	O	1	1	X
		-	-	X	O	-	-	O	O	X	1	1	X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

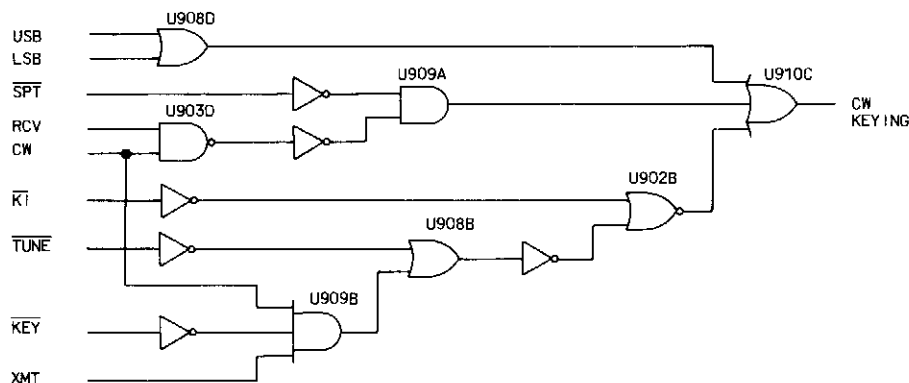


		USB	LSB	CW	AM	SPT	TXI	PTT	TUNE	LOL	TF	KEY	XMT	RCV
455 kHz ENABLE	=0	0	0	0	-	X	-	-	-	-	-	-	0	X
		X	X	X	-	1	-	-	-	-	-	-	0	0
455 kHz ENABLE	=1	X	X	X	-	X	-	-	-	-	-	-	1	X
		1	X	X	-	X	-	-	-	-	-	-	X	1
		X	1	X	-	X	-	-	-	-	-	-	X	1
		X	X	1	-	0	-	-	-	-	-	-	X	1
454.2 kHz ENABLE	=1	-	-	1	-	-	-	-	-	-	-	-	-	1
	=0	-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

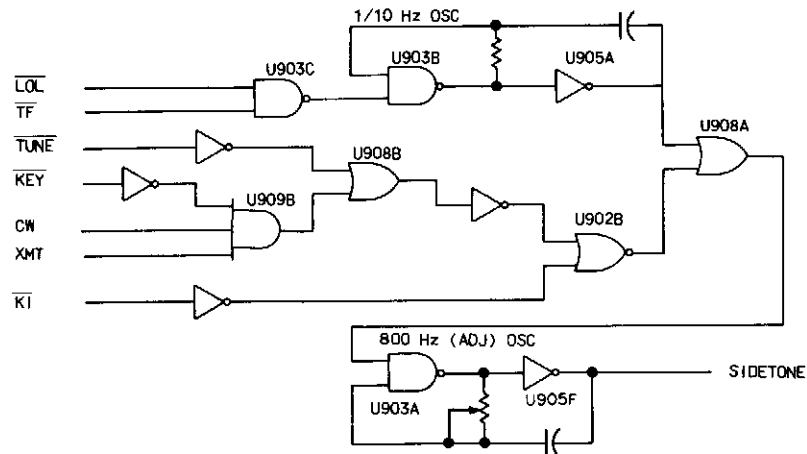


		USB	LSB	CW	AM	SPT	KI	TXI	PTT	TUNE	LOL	TF	KEY	XMT	RCV
CW KEYING	=0	CW KEYING=0 UNDER ALL CONDITIONS EXCEPT FOR CW KEYING = 1 BELOW.													
CW KEYING	=1	1	X	X	-	X	X	-	-	X	-	-	X	X	X
		X	1	X	-	X	X	-	-	X	-	-	X	X	X
		X	X	1	-	0	X	-	-	X	-	-	X	X	1
		X	X	X	-	X	1	-	-	1	-	-	X	X	X
		X	X	1	-	X	X	-	-	X	-	-	0	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	1	X	X	-
	-	-	0	-	-	0	-	-	X	1	1	1	X	X	-
	-	-	X	-	-	X	-	-	1	1	1	1	X	X	-
	-	-	X	-	-	0	-	-	X	1	1	1	X	X	-
	-	-	X	-	-	X	-	-	1	1	1	1	X	0	-
SIDETONE (PULSED) (CONSTANT UNLESS TF OR LOL=0)=1	-	-	X	-	-	X	-	-	X	0	X	X	X	X	-
	-	-	X	-	-	X	-	-	X	X	0	X	X	X	-
	-	-	X	-	-	1	-	-	0	•	•	X	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.

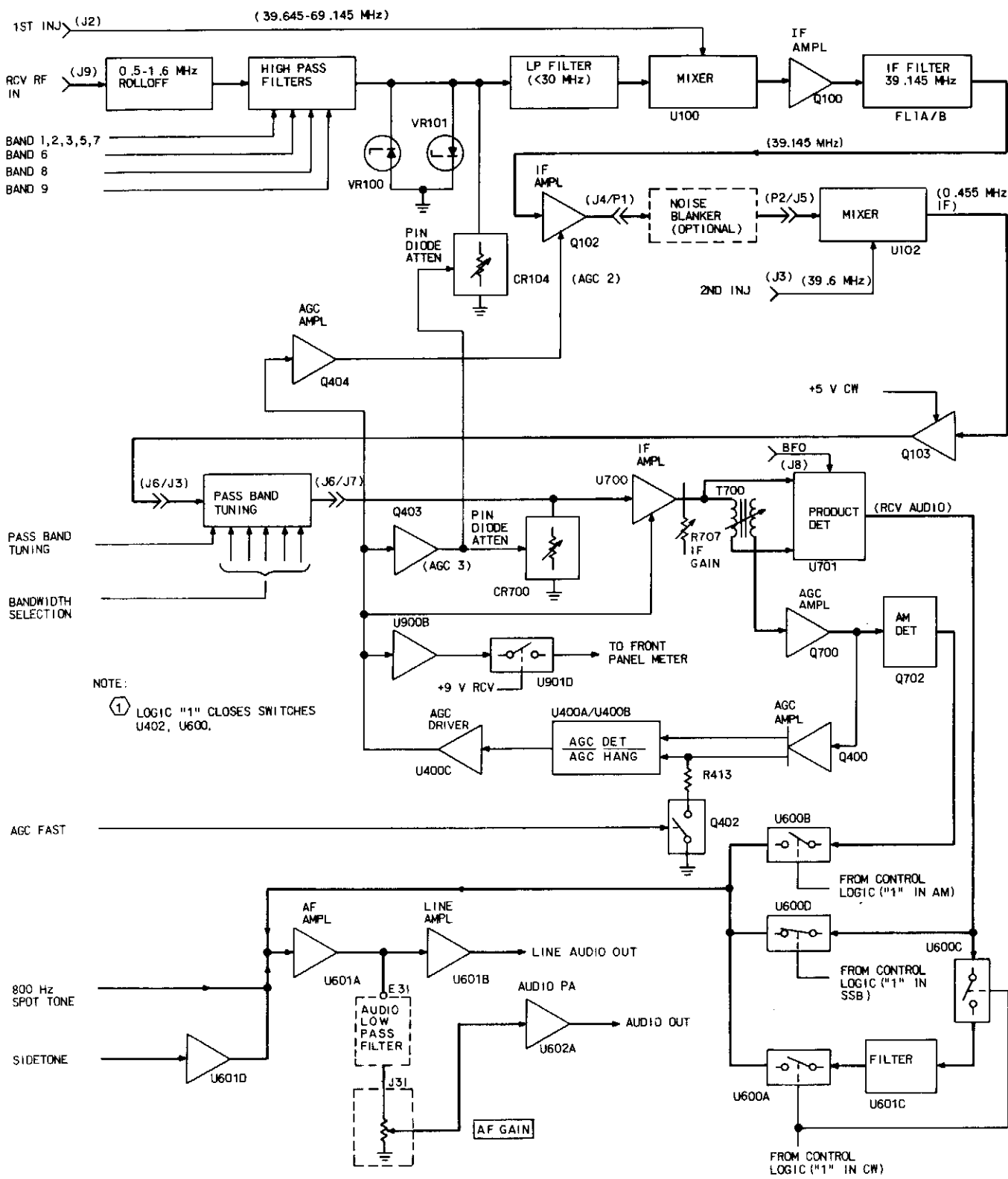
The first receive mixer is a balanced-diode type. The local oscillator injection frequency is from the synthesizer and within the range of 39.645 to 69.145 MHz, depending on the selected receive frequency. The mixer resulting output is 39.145 MHz, the first if frequency.

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.)

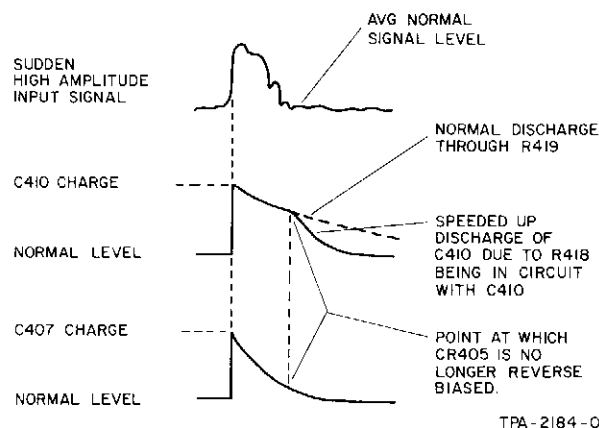
When the AGC is turned off (front-panel AGC switch in the out position), Q401 conducts. This grounds the Q400 output at C402 to prevent an AGC signal from being applied to the AGC detector circuit. In this condition, AGC 1, AGC 2, and AGC 3

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 μ V 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-k Ω 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.

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.

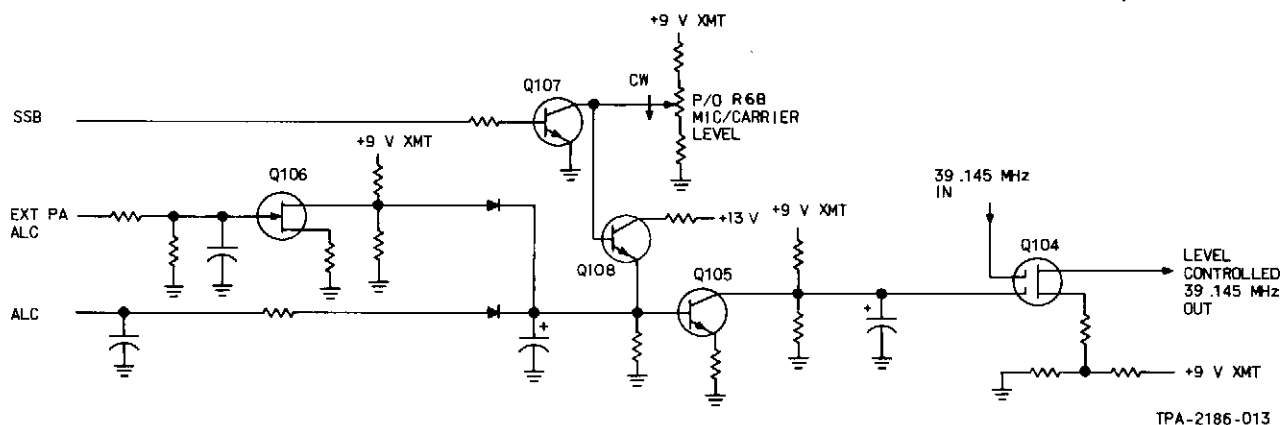
The filtered 455-kHz output from the passband tuning assembly is applied through forward-biased

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 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



TPA-2186-013

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 μ V 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 cw 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 USB LSB CW POINT-OF-TEST U912-11 U912-10 U912-4 c. Release MOX to unkey exciter.	Logic 1 (+5 V dc) Logic 1 (+5 V dc) Logic 1 (+5 V dc)	Check U912. Check U912. Check U912.
3. Bandwidth selectivity	a. Set BW SELECTIVITY to 2.2. b. Measure dc voltage at U908-10. 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.	Logic 1 (+5 $\pm$ 1 V).	Check U908.
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.) d. Tune transceiver to 1.850 00 MHz. e. Measure dc voltage at Q904-C.	Not more than +2 V dc (Prevents transmission.) +8 $\pm$ 1 V dc (Permits transmission.)	Check Q904, Q902, U902, and U909. 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 $\pm$ 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	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.		
(Cont)			

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. 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. g. Apply 5-mV, 1-kHz signal at mic input. 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. 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.	Output at J1 into a 50-ohm load should be a maximum of NLT +20 dBm. Flat passband should be obtained in LSB and USB. 20 dB at J1 in USB Less than 1 μV for 10 dB s+n/n ratio at audio output	Adjust L110, L119, L120, L135, and L136 for a maximum output using a spectrum analyzer. Adjust L119 and L120. 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. Adjust L114 and L123 if necessary to provide flattest response over frequency range of 39.145 $\pm$ 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). <table><thead><tr><th>XCVR FREQ</th><th>SIG GEN FREQ</th><th>OUTPUT LEVEL</th></tr></thead><tbody><tr><td>2.0000</td><td>2.0010</td><td>1</td></tr><tr><td>3.5000</td><td>3.5010</td><td>10</td></tr><tr><td>7.0000</td><td>7.0010</td><td>1</td></tr><tr><td>7.0000</td><td>7.0010</td><td>10</td></tr><tr><td>14.0000</td><td>14.0010</td><td>1</td></tr><tr><td>14.0000</td><td>14.0010</td><td>10</td></tr><tr><td>20.0000</td><td>20.0010</td><td>1</td></tr><tr><td>29.9990</td><td>30.0000</td><td>1</td></tr></tbody></table> Note Measurement is $\frac{\text{signal} + \text{noise} + \text{distortion}}{\text{noise} + \text{distortion}}$and is a more sensitive measurement than (s+n)/n.	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	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. 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																												
(Cont)																														

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 μ V 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 μ V 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. c. Reduce signal generator output to 6 μ V and repeat test b.	Not less than -26 dB Not less than -10 dB	Check Q700 and Q702. 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. d. Vary front-panel AF GAIN control and note speaker output. 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. h. Repeat test 13.g for 3-W output (3.46 V ac).	-15 dB mW $\pm$ 5 dB Output volume varies proportionally to AF GAIN. Not less than -35 dB Not less than -20 dB	Check U701 and U601. Check R622 (AF GAIN) on front panel and U602. Check U601 and U602. 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 μ V. b. Make sure AGC is switched in. Note S-meter indication. c. Set signal generator output to 100 mV. Note S-meter indication.	S9 +60 dB	Adjust R912 for proper S-meter indication. Check meter and U901. 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 μ V. b. Press SPOT switch and compare amplitudes of received and spot tones.	800-Hz tone heard in speaker 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. e. Switch out MOX and set MODE to USB. Set MIC/CARRIER to max cw position. f. Connect audio oscillator to AUD IN 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.	Not more than 0 dB mW	Check Q104, Q105.
	i. Switch in MOX and measure transverter output signal. j. Switch out MOX and remove rf choke from XVTR.	Not less than +20 dB mW	Check K200 and C218.
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. 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. f. Switch out MOX.	Not less than +20 dB mW	
		Not less than 10 dB difference between tests 19.c and e	Check Q104, Q105, Q106, and Q108.
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. f. Connect rf signal generator to rf fuse-holder and 6-dB attenuator. Connect attenuator to rf connector on rear panel of transceiver.		
(Cont)			

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- μ V 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. k. Release CW key. l. Connect frequency meter across 4- Ω speaker. m. Hold CW key closed and measure audio frequency. n. Release CW key and switch out VOX.	Same level ± 3 dB 800 ± 10 Hz	Adjust R616 to set audio output level. Check U601. Adjust R921 to set audio frequency. Check U903, U905.
22. VOX	a. Set MODE to USB, VOX GAIN to max cw 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. d. Adjust audio input to 8 mV rms and note VOX action. e. Adjust audio input to 30 mV rms. Remove signal (disconnect mic plug) and note time until VOX switches to receive. 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. i. Increase audio input to 16 mV and note VOX action.	VOX does not switch from receive to transmit. VOX switches from receive to transmit. 1 to 4 seconds VOX does not switch from receive to transmit. 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 LAWDALE CA 90260
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75265

MFR MANUFACTURER'S NAME
CODE 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

MFR MANUFACTURER'S NAME
CODE AND ADDRESS

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

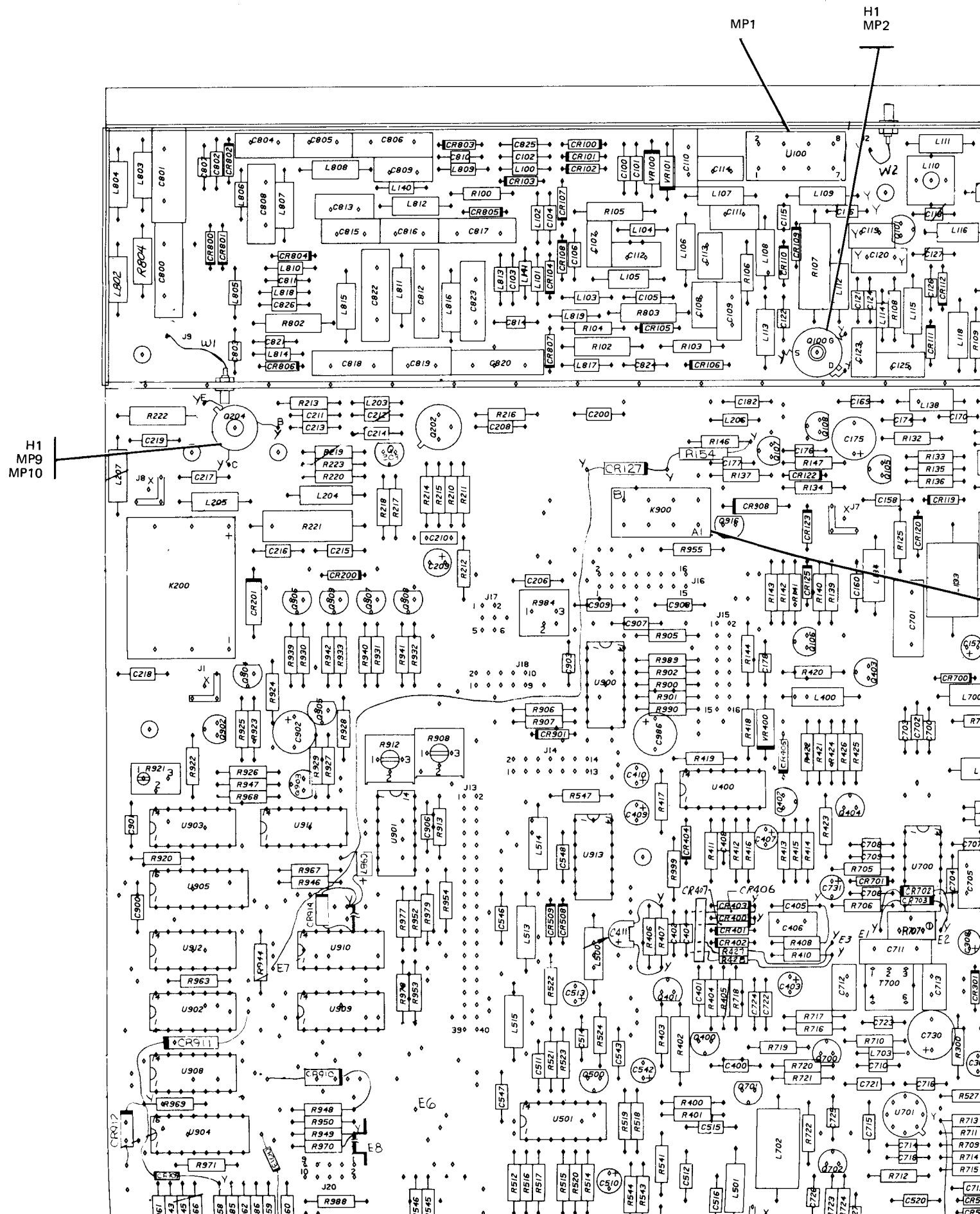
81349 MILITARY SPECIFICATIONS

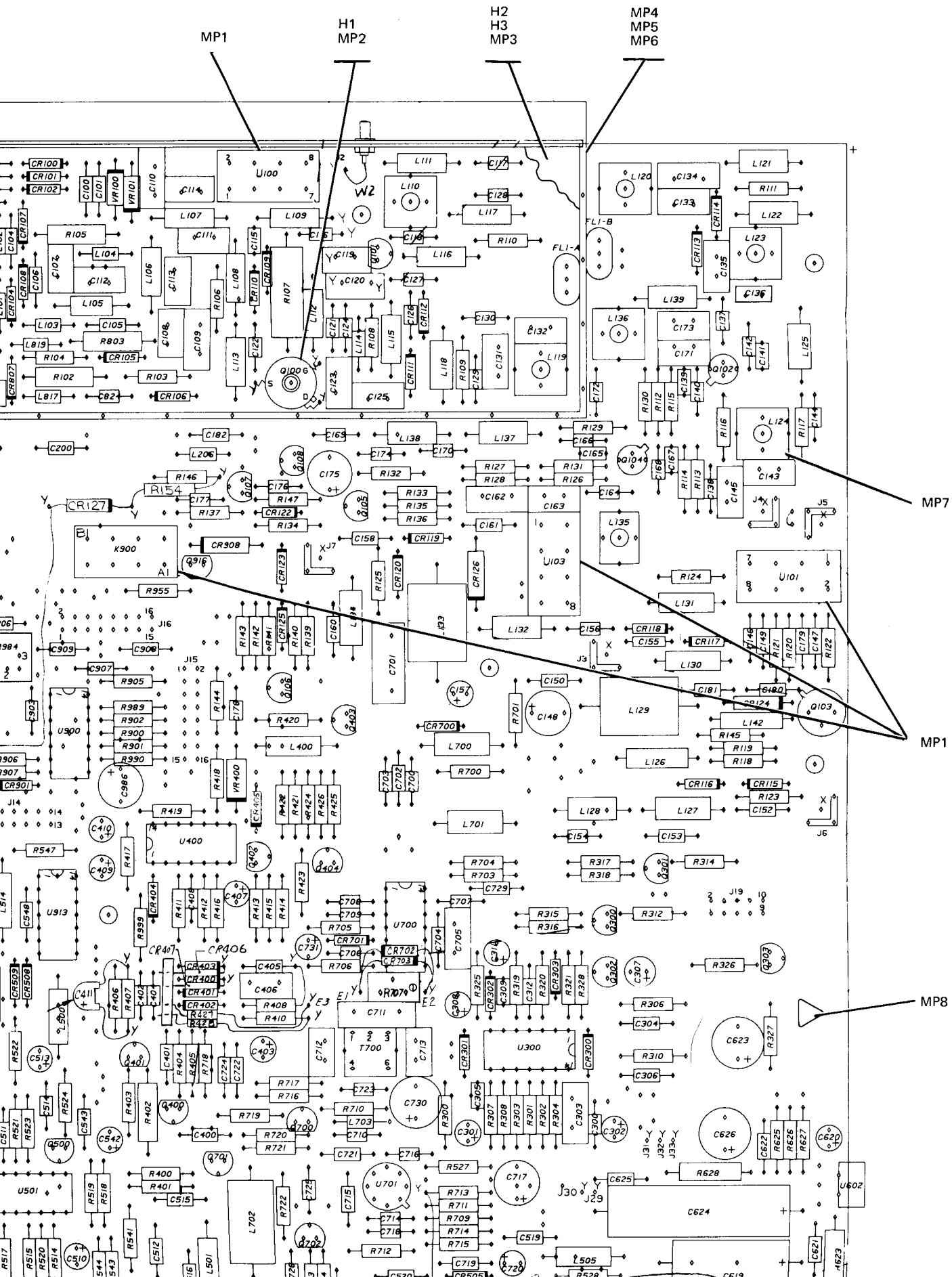
<u>MFR</u> <u>CODE</u>	<u>MANUFACTURER'S NAME</u> <u>AND ADDRESS</u>
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054
91637	DALE ELECTRONICS INC P O BOX 609 COLUMBUS NE 68601
96906	MILITARY STANDARD
98291	SEAELECTRO CORP 225 HOYT HAMARONECK NY 10544
98978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

5.3 Equipment Covered

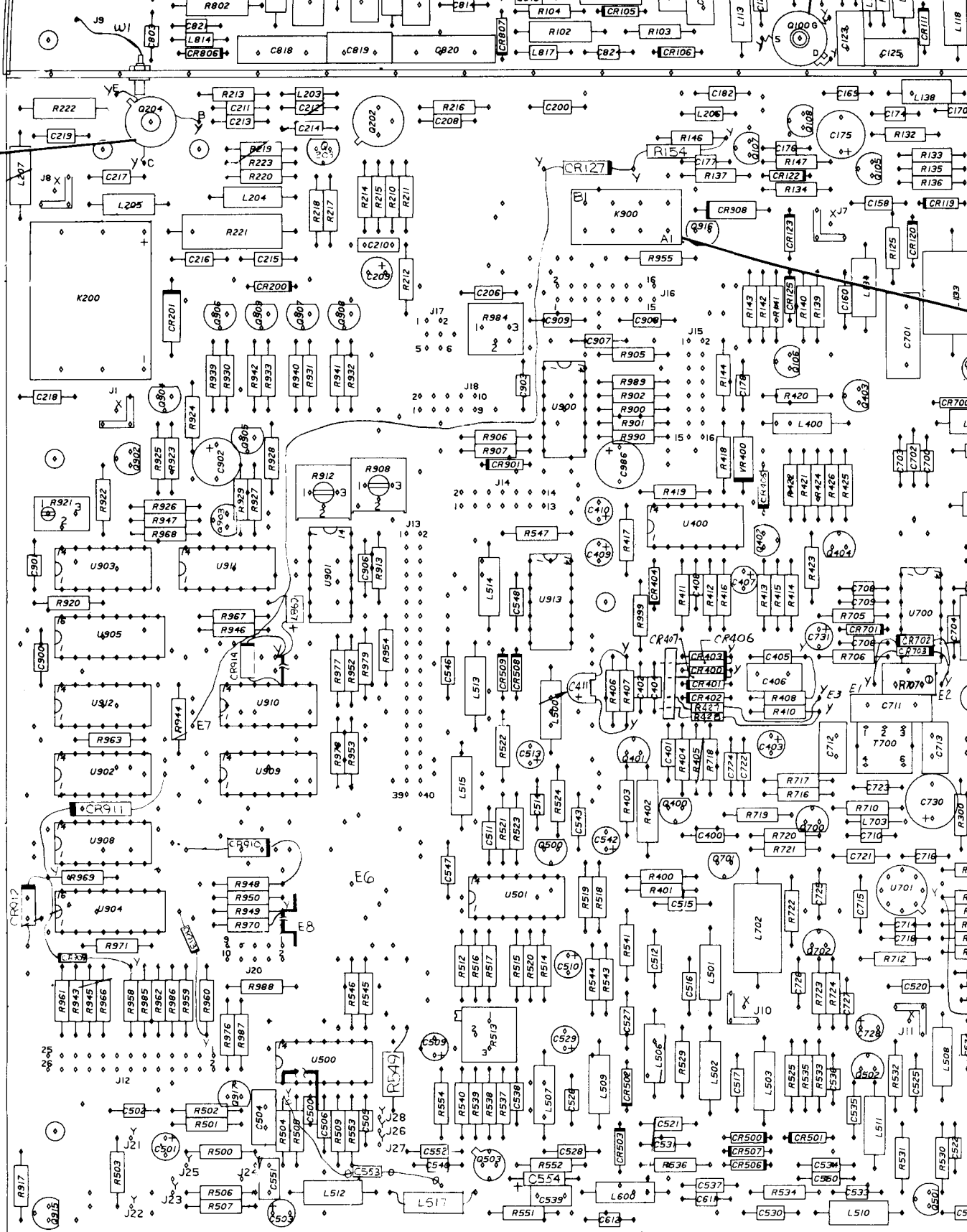
Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

<u>CIRCUIT CARD/ SUBASSEMBLY</u>	<u>COLLINS PART NUMBER</u>	<u>LATEST EFFECTIVITY</u>
Receiver-Exciter	638-6908-002	REV U

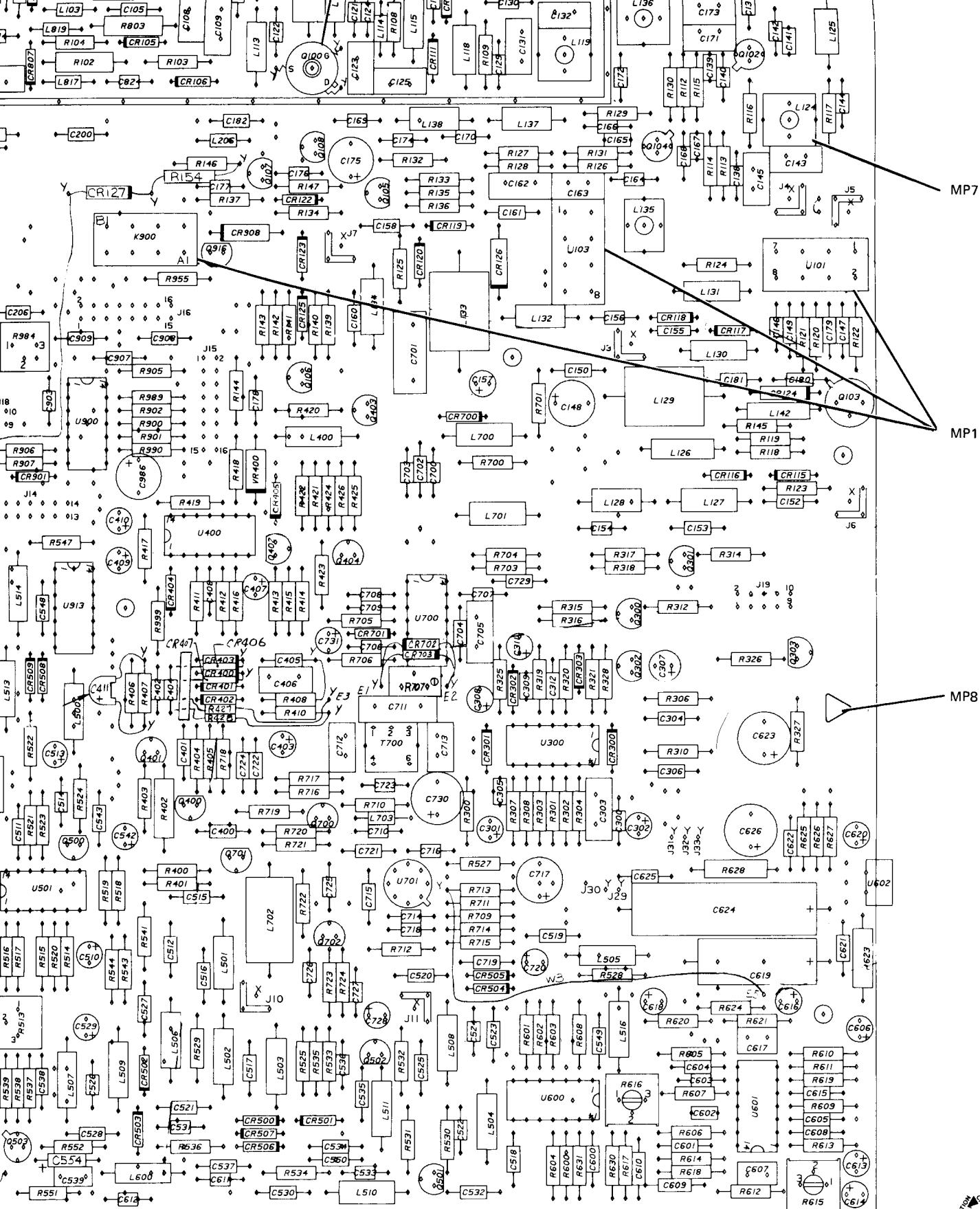




H1
MP9
MP10



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
CR100-	RECEIVER/EXCITER	638-6908-002			
CR103	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR104	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR105-	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR108					
CR109-	SEMICOND DEVICE	353-3733-010		28480	HP3168
CR114					
CR115-	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR120					
CR121	NOT USED				
CR122,	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR123					
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-	NOT USED				
CR199					
CR200	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR201	SEMICOND DEVICE	353-6442-020		04713	1N4002
CR202-	NOT USED				
CR299					
CR300-	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR303					
CR304-	NOT USED				
CR399					
CR303	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR304-	NOT USED				
CR399					
CR400-	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR405					
CR406-	NOT USED				
CR499					
CR500-	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR510					
CR511-	NOT USED				
CR699					
CR700	SEMICOND DEVICE	922-6119-010		28480	1N5767
CR701	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR702,	SEMICOND DEVICE	353-3644-010		31433	1N4454
CR703					
CR704-	NOT USED				
CR799					
CR800,	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR801					
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-	NOT USED				
CR900					
CR901	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
CR902-	NOT USED				
CR907					
CR908	SEMICOND DEVICE	353-6442-020		04713	1N4002
CR909-	SEMICOND DEVICE (A7)	353-3644-010		31433	1N4454
CR914					
CR915	SEMICOND DEVICE (A8)	353-3644-010		31433	1N4454-1
C100,	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U10408050
C101					
C102,	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U47308050
C103					
C104	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030		56289	292CY5U10408050
C105,	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U47308050
C106					
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,	CAPACITOR,FXD MICA DIEL, 120PF, 5%, 500V	912-2822-000		81349	CM05FD121J03
C110					
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	CM05B47K
C116	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U10208050
C117	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U10308050
C118	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U10208050
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,	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U10208050
C122					
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	292CY5U10308050
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-	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U10208050
C128					
C129	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U10308050

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,	CAPACITOR,FXD MICA DIEL, 22PF, 5%, 500V	912-3842-000
C133		
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,	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010
C138		
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,	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C150		
C151	NOT USED	
C152,	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C153		
C154	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010
C155,	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C156		
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,	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C161		
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,	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010
C170		
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-	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020
C178		
C179-	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C181		
C183	CAPACITOR,FXD CER DIEL, 0.001UF, P80%M20%, 50VDC (A1)	913-3331-010
C184-	NOT USED	
C199		
C200	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040
C201	NOT USED	
C206,	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040
C207		
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-	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040
C2117		
C218,	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C219		
C220-	NOT USED	
C299		
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 TMTLM 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 TMTLM ELCTLT, 0.22UF, 20%, 35V	184-9102-310
C312	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C313-	NOT USED	
C315		
C400,	CAPACITOR,FXD CER DIEL, 0.10UF,M20%P80%,50V	913-3331-030
C401		
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	292CY5U102D0050
, 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, FORM 0.5PF, 300V	912-4141-110		72136	DMSC0800300NV
0.001UF, M20%P80%, 50V	913-3331-010		56289	292CY5U102D0050
470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050
470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050
, 12PF, 5%, 500V	912-3838-000		81349	CM04CD120J03
0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050
, 12PF, 5%, 500V	912-3838-000		81349	CM04CD120J03
0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050
0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050
7UF, 20%, 20V	184-9102-190		56289	196D239
0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050
0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050
0.001UF, M20%P80%, 50V	913-3331-010		56289	292CY5U102D0050
0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050
47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1
0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050
0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050
, 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	292CY5U103D0050
470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050
470PF, 10%, 200V	913-4014-000		81349	CK05BX471K
0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050
0.001UF, M20%P80%, 50V	913-3331-010		56289	292CY5U102D0050
, 10PF, FORM 0.5PF,	912-3837-000		81349	CM04CD100D03
0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050
, 10PF, FORM 0.5PF,	912-3837-000		81349	CM04CD100D03
0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050
3UF, 20%, 35V	184-9102-880		56289	196D247A
0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050
0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050
0.001UF, P80%M20%,	913-3331-010		56289	292CX7R102M050B
0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D0050
0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D0050
0.047UF, P80%M20%, 50V	913-3331-040		56289	292CY5U473D0050
2UF, 20%, 15V	184-9102-140		56289	199D226X00150B1
0.22UF, FORM 10%, 50V	913-5019-480		81349	CK06BX224K
0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D0050
0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050
1000PF, FORM 5%, 100V	913-3281-270		18796	8121-100C06102J
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	292CY5U104D0050
.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	292CY5U104D0050

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REF DES
C408	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050	C62
C409	CAPACITOR,FXD ELCTLT, 3.3UF, 20%, 35V (A6)	184-9102-380		56289	199D335X0035CB1	C69
C409	CAPACITOR,FXD TMTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1	C70
C410	CAPACITOR,FXD ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X00150B1	C70
C411	CAPACITOR,FXD TMTLM ELCTLT, 100UF, 20%, 10V (A2)	184-9102-100		56289	196D235	C70
C412-	NOT USED					C70
C499						C70
C500	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V (A3)	913-4014-000		81349	CK05BX471K	C70
C500	CAPACITOR,FXD CER DIEL, 2200PF, 10%, 100V (A3)	913-5019-120		81349	CK05BX222K	C71
C501	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1	C71
C502	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050	C71
C503	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1	C71
C504	CAPACITOR,FXD MICA DIEL, 15PF, 5%, 500V	912-3839-000		81349	CM04CD150J03	C71
C505	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050	C71
C506	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C71
C507,	NOT USED					C71
C508						C71
C509	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V (A6)	184-9102-350		56289	199D105X0035BB1	C71
C509	CAPACITOR,FXD TMTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1	C71
C510	CAPACITOR,FXD ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X00150B1	C71
C511,	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C72
C512						C72
C513	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1	C72
C514	CAPACITOR,FXD CER DIEL, 0.001UF, M20%P80%, 50V	913-3331-010		56289	292CY5U102D0050	C72
C515-	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%,	913-3331-030		56289	292CY5U104Z050C	C72
C522	50VDC					C72
C522	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%,	913-3331-020		56289	292CY5U103Z050B	C72
C523	50VDC					C72
C524	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C72
C525	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050	C72
C526	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C73
C527,	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050	C73
C528	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D0050	C73
C529	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1	C80
C530	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C80
C531	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050	C80
C532	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C80
C533	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050	C80
C534,	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C80
C535						C80
C536	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050	C80
C537,	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C80
C538						C80
C539	CAPACITOR,FXD CER DIEL, 0.47UF, 20%, 50V	913-3279-250		16546	CY30C474H	C80
C540	CAPACITOR,FXD CER DIEL, 0.001UF, M20%P80%, 50V	913-3331-010		56289	292CY5U102D0050	C80
C541	NOT USED					C80
C542	CAPACITOR,FXD ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X00150B1	C80
C543	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V	913-3331-040		56289	292CY5U473D0050	C80
C544	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V (A7)	913-3331-030		56289	292CY5U104D0050	C80
C545	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%,	913-3331-040		56289	292CY5U473D0050	C80
C546-	50V (A7)					C80
C550	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C80
C551	CAPACITOR,FXD CER DIEL, 0.47UF, 20%, 50V	913-3279-250		16546	CY30C474H	C80
C552	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%,	913-3331-030		56289	292CY5U104Z050C	C80
C553	50VDC					C80
C553	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%,	913-3331-030		56289	292CY5U104Z050C	C80
C554	50VDC (A6)					C80
C554	CAPACITOR,FXD TMTLM ELCTLT, 0.22UF, 20%, 35V (A7)	184-9102-310		56289	199D224X0035AB1	C80
C555-	NOT USED					C80
C599						C80
C600,	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C80
C601						C80
C602	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K	C90
C603	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 100V	913-4778-000		81349	CK12BX102K	C90
C604,	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C90
C605						C90
C606	CAPACITOR,FXD ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X00150B1	C90
C607	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 500V	912-3848-000		81349	CM04ED330J03	C90
C608	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	C90
C609,	CAPACITOR,FXD CER DIEL, 10,000PF, 10%, 100V	913-5020-430		81349	CK13BX103K	C90
C610						C90
C611,	CAPACITOR,FXD CER DIEL, 0.01UF, M20%P80%, 50V	913-3331-020		56289	292CY5U103D0050	C90
C612						C90
C613,	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1	FL
C614						FL
C615	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	H1
C616	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1	H1
C617	CAPACITOR,FXD MICA DIEL, 68PF, 5%, 500V	912-3867-000		81349	CM04ED680J03	H2
C618	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1	H3
C619	CAPACITOR,FXD ELCTLT, 100UF, 10%, 20V	184-9086-610		81349	M39003-1-01-231	J1
C620	CAPACITOR,FXD ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1	J2
C621,	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	J3
C622						J9
C623	CAPACITOR,FXD ELCTLT, 330UF, 20%, 6V	184-9102-060		56289	196D234	J10
C624	CAPACITOR,FXD AL ELCTLT, 470UF, P75%M10%, 16V	183-1510-040		56289	500D47760160F5	J10
C625	CAPACITOR,FXD CER DIEL, 0.10UF, M20%P80%, 50V	913-3331-030		56289	292CY5U104D0050	J10
C626	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239	J10

PARTS LIST (Cont)

QTY	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	1990335X0035CB1		C699					
56289	1990105X0035BB1		C700	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
56289	1990226X0015DB1		C701	CAPACITOR,FXD MICA DIEL, 1500PF, 5%, 500V	912-3327-000		14655	DM20FD152J04CR
56289	1960235		C702	CAPACITOR,FXD CER DIEL, 0.01UF,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, 0.01UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
			C705	CAPACITOR,FXD MICA DIEL, 330PF, 5%, 500V	912-2852-000		81349	CM05FD331J03
			C706-	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
81349	CK05BX471K		C710					
81349	CK05BX222K		C711	CAPACITOR,FXD MICA DIEL, 510PF, 5%, 500V	912-2980-000		81349	CM06FD511J03
56289	1990474X0035AB1		C712,	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 500V	912-3848-000		81349	CM04ED330J03
56289	292CY5U103D8050		C713					
56289	1990475X0035DB1		C714	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
81349	CM04CD0150J03		C715	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
56289	292CY5U103D8050		C716	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
56289	292CY5U104D8050		C717	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	1960239
			C718	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C719	CAPACITOR,FXD CER DIEL, 0.047UF, M20%P80%, 50V (A3)	913-3331-040		56289	292CY5U473D8050
56289	1990105X0035BB1							
56289	1990475X0035DB1		C719	CAPACITOR,FXD CER DIEL, 0.033UF, 10%, 100VDC	913-5019-380		81349	CK06BX333K
56289	1990226X0015DB1		C720	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	1990474X0035AB1
56289	292CY5U104D8050		C721,	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
			C722					
56289	1990106X0020CB1		C723	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
56289	292CY5U102D8050		C724	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
56289	292CY5U104Z050C		C725	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C726	CAPACITOR,FXD CER DIEL, 0.001UF,M20%P80%,50V	913-3331-010		56289	292CY5U102D8050
56289	292CY5U103Z050B		C727	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C728	CAPACITOR,FXD ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	1990474X0035AB1
56289	292CY5U104D8050		C729	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
56289	292CY5U103D8050		C730	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	1960239
56289	292CY5U104D8050		C731	CAPACITOR,FXD ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	1990105X0035BB1
56289	292CY5U473D8050		C732-	NOT USED				
			C799					
56289	1990105X0035BB1		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, 0.01UF,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
			C808	CAPACITOR,FXD MICA DIEL, 560PF, 5%, 500V	912-2983-000		81349	CM06FD561J03
16546	CY30C474M		C809	CAPACITOR,FXD MICA DIEL, 150PF, 5%, 500V	912-2828-000		81349	CM05FD151J03
56289	292CY5U102D8050		C810,	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C811					
56289	1990226X0015DB1		C812	CAPACITOR,FXD MICA DIEL, 1000PF, 5%, 500V	912-3315-000		14655	DM20FD102J04CR
56289	292CY5U473D8050		C813	CAPACITOR,FXD MICA DIEL, 270PF, 5%, 500V	912-2846-000		81349	CM05FD271J03
56289	292CY5U104D8050		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
			C819	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-2858-000		81349	CM05FD391J03
16546	CY30C474M		C820	CAPACITOR,FXD MICA DIEL, 1000PF, 5%, 500V	912-3315-000		14655	DM20FD102J04CR
56289	292CY5U104Z050C		C821	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			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	1990224X0035AB1		C824	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C825,	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
			C826					
			C827-	NOT USED				
			C899					
56289	292CY5U104D8050		C900	CAPACITOR,FXD CER DIEL, 0.01UF,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	1960239
56289	292CY5U104D8050		C903	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-020		56289	292CY5U103D8050
			C904,	NOT USED				
			C905					
56289	1990226X0015DB1		C906-	CAPACITOR,FXD CER DIEL, 0.01UF,M20%P80%,50V	913-3331-030		56289	292CY5U104D8050
81349	CM04ED330J03		C909					
56289	292CY5U104D8050		C910-	NOT USED				
81349	CK13BX103K		C985					
56289	292CY5U103D8050		C986	CAPACITOR,FXD ELCTLT, 47UF, 20%, 20V	184-9102-630		56289	19901022
			C987	CAPACITOR,FXD INTLM ELCTLT, 0.47UF, 20%, 35V (A7)	184-9102-330		56289	1990474X0035AB1
56289	1990474X0035AB1		FL1-A,	FILTER,BP,XTAL	293-1332-010		75378	293-1332-010
			FL1-B					
56289	292CY5U104D8050		H1	WASHER,LOCK SST, 0.088 ID X 0.172 OD (QTY 2)	310-0275-000		96906	M535338-134
56289	1990106X0020CB1		H2	SCREW,MACH STL, 4-40 X 3/16 (QTY 2)	343-0132-000		96906	M551957-12
81349	CM04ED680J03		H3	SCREW,MACH CD PL STL, 2-56 X 5/16 (QTY 20)	343-0125-000		96906	M551957-4
56289	1990474X0035AB1		J1	CONNECTOR,RCPT ELEC	357-0067-020		00779	226287-2
81349	H39001-01-2301		J2	CONNECTOR,RCPT ELEC	357-7207-100		98291	52-046-0000
56289	1990106X0020CB1		J3-J8	CONNECTOR,RCPT ELEC	357-0067-020		00779	226287-2
56289	292CY5U104D8050		J9	CONNECTOR,RCPT ELEC	357-7207-100		98291	52-046-0000
			J10,J11	CONNECTOR,RCPT ELEC	357-0067-020		00779	226287-2
56289	1960234		J12		372-2856-050			
56289	50004776016DF5		J13	CONNECTOR,HDR	372-2656-240		52072	CAD40SP100-230-430
56289	292CY5U104D8050							
56289	1960239							

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

PARTS LIST (Cont)

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	CA501SP100-230-4 30
K200 K201- K899	RELAY,REED,RF NOT USED	410-0585-020		18542	1017-20-1
K900 L100- L104	RELAY,ARM COIL,RF 100UH (A9)	974-1076-430 240-2047-000		81349 96906	M39016-6-116L 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,PLMR	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
R100	RESISTOR,FXD CHPSN, 220 OHMS, 10%, 1/2W	745-1324-0
R101	NOT USED	
R102	RESISTOR,FXD CHPSN, 27 OHMS, 10%, 1/2W	745-1286-0
R103, R104	RESISTOR,FXD CHPSN, 1K, 10%, 1/4W	745-0749-0
R105	RESISTOR,FXD CHPSN, 220 OHMS, 10%, 1/2W	745-1324-0
R106	RESISTOR,FXD CHPSN, 1K, 10%, 1/4W	745-0749-0
R107	RESISTOR,FXD CHPSN, 47 OHMS, 10%, 1W	745-3296-0
R108	RESISTOR,FXD CHPSN, 100 OHMS, 10%, 1/4W	745-0713-0
R109	RESISTOR,FXD CHPSN, 1K, 10%, 1/4W	745-0749-0
R110	RESISTOR,FXD CHPSN, 100 OHMS, 10%, 1/4W	745-0713-0
R111	RESISTOR,FXD CHPSN, 1K, 10%, 1/4W	745-0749-0
R112	RESISTOR,FXD CHPSN, 4.7K, 10%, 1/4W	745-0773-0
R113	RESISTOR,FXD CHPSN, 470 OHMS, 10%, 1/4W	745-0737-0
R114	RESISTOR,FXD CHPSN, 150 OHMS, 10%, 1/4W	745-0719-0
R115	RESISTOR,FXD CHPSN, 180 OHMS, 10%, 1/4W	745-0722-0
R116	RESISTOR,FXD CHPSN, 47 OHMS, 10%, 1/4W	745-0701-0
R117	RESISTOR,FXD CHPSN, 10K, 10%, 1/4W	745-0785-0
R118	RESISTOR,FXD CHPSN, 680 OHMS, 10%, 1/4W	745-0743-0
R119	RESISTOR,FXD CHPSN, 1K, 10%, 1/4W	745-0749-0
R120	RESISTOR,FXD CHPSN, 10 OHMS, 10%, 1/4W	745-0677-0
R121	RESISTOR,FXD CHPSN, 220 OHMS, 10%, 1/4W	745-0725-0
R122	RESISTOR,FXD CHPSN, 240 OHMS, 5%, 1/4W	745-0726-0
R123	RESISTOR,FXD CHPSN, 1K, 10%, 1/4W	745-0749-0
R124	RESISTOR,FXD CHPSN, 470 OHMS, 10%, 1/4W	745-0737-0
R125	RESISTOR,FXD CHPSN, 1K, 10%, 1/4W	745-0749-0

PARTS LIST (Cont)

COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REF DES	DESCRIPTION
240-1577-000		96906	MS14046-1	R126	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
240-2047-000		96906	MS75085-07	R127	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W
				R128	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W
240-2723-050		96906	MS75085-16	R129	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
240-1565-000		96906	MS16130-4	R130	RESISTOR,FXD CMPSN, 47 OHMS, 10%, 1/4W
240-1567-000		96906	MS16130-7	R131	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W
240-2047-000		96906	MS75085-07	R132	RESISTOR,FXD FILM, 4.22K, 1%, 1/8W
				R133	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W
240-1566-000		96906	MS16130-6	R134	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
240-1568-000		96906	MS16130-8	R135	RESISTOR,FXD FILM, 2.43K, 1%, 1/8W
240-2047-000		96906	MS75085-07	R136	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W
				R137	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W
240-1569-000		96906	MS16130-9	R138	NOT USED
240-1571-000		96906	MS16130-11	R139	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W
240-2047-000		96906	MS75085-07	R140	
				R141	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W (A3)
240-2723-050		96906	MS75085-16	R142	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
				R143	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W
150-0684-060		19080	RCRP800060-4A	R144	RESISTOR,FXD FILM, 715 OHMS, 1%, 1/8W
352-9984-030		98978	TXB2P032-025B	R145	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W
352-1041-010		17856	U322	R146	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W
352-5502-010		17856	J310	R147	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W
352-1140-010		01295	3N201	R148	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/8W (A1)
352-0671-010		02735	2N3866	R149	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W (A1)
352-1140-010		01295	3N201	R151	
352-5501-010		04713	MPS2222A	R152	RESISTOR,FXD CMPSN, 18 OHMS, 10%, 1/8W (A1)
352-5505-010		17896	2N5486	R153	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/8W (A1)
352-5501-010		04713	MPS2222A	R154	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W (A7)
				R155-	NOT USED
				R207	
				R208	RESISTOR,FXD CMPSN, 220 OHMS, 10%, 1/4W
352-0671-010		02735	2N3866	R209	RESISTOR,FXD CMPSN, 4.7 OHMS, 5%, 1/4W
352-5500-010		04713	MPS2907A	R210	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/4W
352-1138-010		01281	PT5701	R211	
				R212	RESISTOR,FXD CMPSN, 82 OHMS, 10%, 1/4W
				R213	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W
352-5501-010		04713	MPS2222A	R214	RESISTOR,FXD CMPSN, 4.7 OHMS, 5%, 1/4W
				R215	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W
				R216	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W
				R217	RESISTOR,FXD CMPSN, 3.3K, 10%, 1/4W
352-5501-010		04713	MPS2222A	R218	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W
				R219	
				R220	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W
				R221	RESISTOR,FXD CMPSN, 22 OHMS, 5%, 1W
352-5501-010		04713	MPS2222A	R222	RESISTOR,FXD CMPSN, 6.8 OHMS, 10%, 1/2W
352-5505-010		17856	2N5486	R223	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W
				R224-	NOT USED
352-1140-010		01295	3N201	R229	
				R300	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
				R301	RESISTOR,FXD CMPSN, 8.2K, 10%, 1/4W
352-5501-010		04713	MPS2222A	R302	RESISTOR,FXD CMPSN, 0.22MEGO, 10%, 1/4W
				R303	
				R304	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
				R305	NOT USED
352-5035-010		04713	MPSA14	R306	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W
				R307	RESISTOR,FXD CMPSN, 0.12MEGO, 10%, 1/4W
352-5500-010		04713	MPS2907A	R308	RESISTOR,FXD CMPSN, 2.2MEGO, 10%, 1/4W
				R309	NOT USED
352-5035-010		04713	MPSA14	R310	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
				R311	NOT USED
				R312	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
				R313	NOT USED
352-5501-010		04713	MPS2222A	R314	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
352-5035-010		04713	MPSA14	R315-	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
				R318	
352-5501-010		04713	MPS2222A	R319	RESISTOR,FXD CMPSN, 10MEGO, 10%, 1/4W
745-1324-000		81349	RCR206221KS	R320	RESISTOR,FXD CMPSN, 0.33MEGO, 10%, 1/4W
				R321	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
745-1286-000		81349	RCR206270KS	R322-	NOT USED
745-0749-000		81349	RCR076102KS	R324	
				R325	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W
745-1324-000		81349	RCR206221KS	R326	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
745-0749-000		81349	RCR076102KS	R327	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
745-3296-000		81349	RCR326470KS	R328	
745-0713-000		81349	RCR076101KS	R329-	NOT USED
745-0749-000		81349	RCR076102KS	R399	
745-0713-000		81349	RCR076101KS	R400	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W
745-0749-000		81349	RCR076102KS	R401	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W
745-0773-000		81349	RCR076472KS	R402	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1/2W
745-0737-000		81349	RCR076471KS	R403	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W
745-0719-000		81349	RCR076151KS	R404	RESISTOR,FXD CMPSN, 56 OHMS, 10%, 1/4W
745-0722-000		81349	RCR076181KS	R405	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W
745-0701-000		81349	RCR076470KS	R406	RESISTOR,FXD CMPSN, 8.2K, 10%, 1/4W
745-0785-000		81349	RCR076103KS	R407	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W
745-0743-000		81349	RCR076681KS	R408	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W
745-0749-000		81349	RCR076102KS	R409	NOT USED
745-0677-000		81349	RCR076100KS	R410	RESISTOR,FXD CMPSN, 1.8K, 10%, 1/4W
745-0725-000		81349	RCR076221KS	R411	RESISTOR,FXD CMPSN, 2.2MEGO, 10%, 1/4W
745-0726-000		81349	RCR076241JS	R412	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
745-0749-000		81349	RCR076102KS	R413	RESISTOR,FXD CMPSN, 0.56MEGO, 10%, 1/4W
745-0737-000		81349	RCR076471KS	R414	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W
745-0749-000		81349	RCR076102KS	R415	RESISTOR,FXD CMPSN, 47K, 10%, 1/4W

PARTS LIST (Cont)

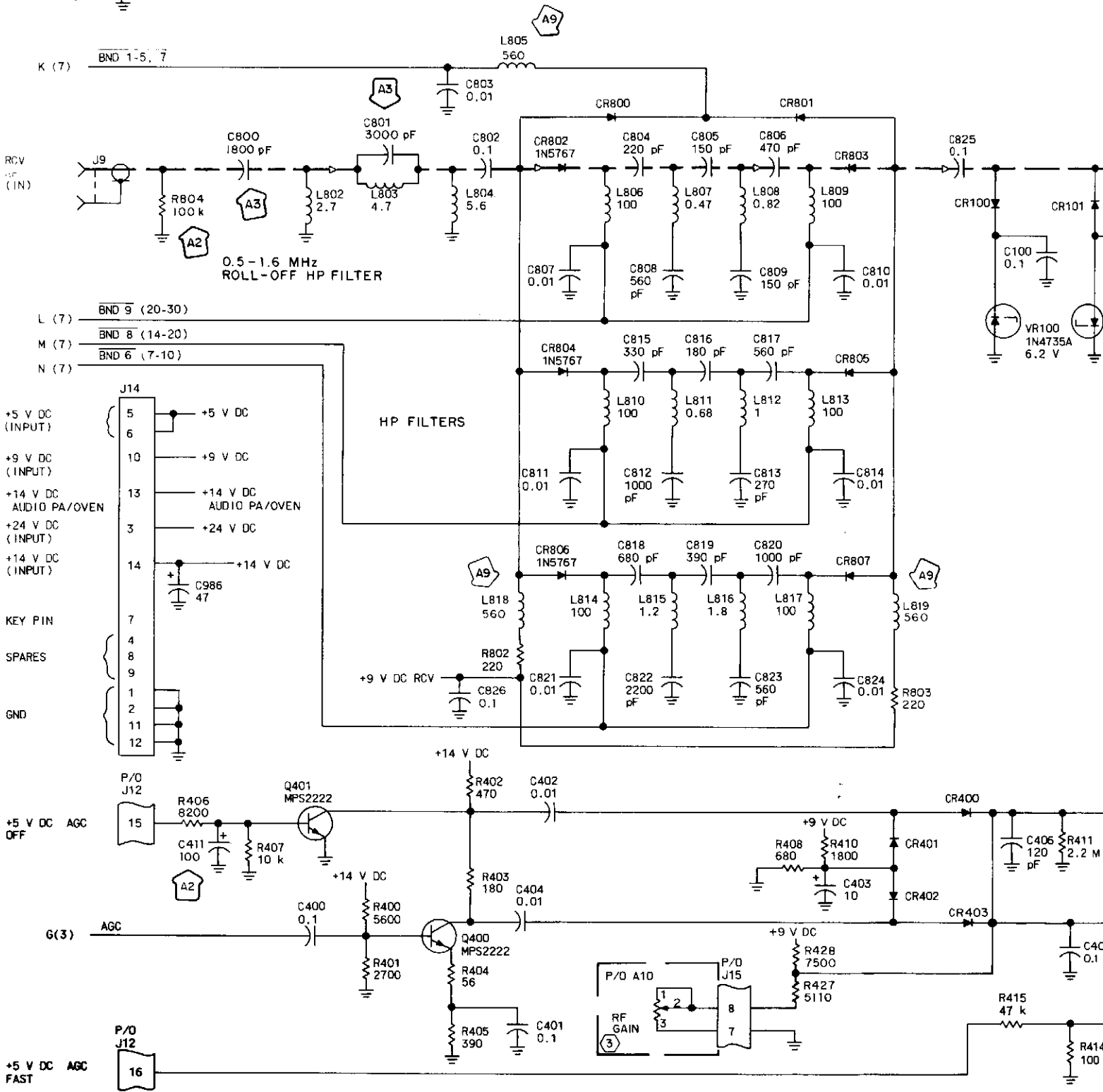
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745-0821-000		81349	RCR076104KS	R416	RES
745-0737-000		81349	RCR076471KS	R416	RES
745-0719-000		81349	RCR076151KS	R417	RES
745-0785-000		81349	RCR076103KS	R417	RES
745-0701-000		81349	RCR076470KS	R418	RES
745-0713-000		81349	RCR076101KS	R418	RES
705-1026-000		81349	RN55D4221F	R419	RES
705-1025-000		81349	RN55D4021F	R420	RES
745-0821-000		81349	RCR076104KS	R421	RES
705-3605-180		81349	RN55D2431F	R422	RES
745-0737-000		81349	RCR076471KS	R423	RES
745-0749-000		81349	RCR076102KS	R424	RES
745-0761-000		81349	RCR076222KS	R425	RES
				R426	RES
				R427-	NOT
				R499	
745-0725-000		81349	RCR076221KS	R500	RES
745-0785-000		81349	RCR076103KS	R501	RES
745-0749-000		81349	RCR076102KS	R501	RES
705-0989-000		81349	RN55D7150F	R502	RES
745-0713-000		81349	RCR076101KS	R503	RES
745-0833-000		81349	RCR076224KS	R504	RES
745-0719-000		81349	RCR076151KS	R505	RES
745-2277-000		81349	RCR056180KS	R506,R50	RES
745-2320-000		81349	RCR056271KS	7	
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745-2277-000		81349	RCR056180KS	R509	RES
745-2320-000		81349	RCR056271KS	R510	NOT
745-0821-000		81349	RCR076104KS	R511	
				R512	RES
				R513	RES
745-0725-000		81349	RCR076221KS	R514	RES
745-4382-000		81349	RCR0764R7JS	R515	RES
745-0737-000		81349	RCR076471KS	R516	
				R517	RES
745-0710-000		81349	RCR076820KS	R518	RES
745-0713-000		81349	RCR076101KS	R519	RES
745-4382-000		81349	RCR0764R7JS	R520	RES
745-0704-000		81349	RCR076560KS	R521	RES
745-0731-000		81349	RCR076331KS	R522	RES
745-0767-000		81349	RCR076332KS	R523	RES
745-0749-000		81349	RCR076102KS	R524	RES
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745-0731-000		81349	RCR076331KS	R526	RES
745-3281-000		81349	RCR326220JS	R527	RES
745-1549-000		81349	RCR2064R8KS	R528	RES
745-0731-000		81349	RCR076331KS	R529	RES
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				R531	RES
745-0785-000		81349	RCR076103KS	R532	RES
745-0782-000		81349	RCR076822KS	R533	RES
745-0833-000		81349	RCR076224KS	R534	RES
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745-0821-000		81349	RCR076104KS	R536	RES
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745-0713-000		81349	RCR076101KS	R538	RES
745-0824-000		81349	RCR076124KS	R539	RES
745-0869-000		81349	RCR076225KS	R540	RES
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745-0785-000		81349	RCR076103KS	R542	RES
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745-0785-000		81349	RCR076103KS	R544	RES
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745-0785-000		81349	RCR076103KS	R546	RES
745-0821-000		81349	RCR076104KS	R547	RES
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745-0893-000		81349	RCR076106KS	R549	RES
745-0839-000		81349	RCR076334KS	R550	NOT
745-0821-000		81349	RCR076104KS	R551	RES
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745-0857-000		81349	RCR076105KS	R554	RES
745-0785-000		81349	RCR076103KS	R555-	NOT
745-0821-000		81349	RCR076104KS	R599	RES
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				R603	
745-0776-000		81349	RCR076562KS	R604	RES
745-0764-000		81349	RCR076272KS	R605	RES
745-1338-000		81349	RCR206471KS	R606	RES
745-0722-000		81349	RCR076181KS	R607	
745-0704-000		81349	RCR076560KS	R608	RES
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745-0782-000		81349	RCR076822KS	R610	RES
745-0785-000		81349	RCR076103KS	R611	
745-0743-000		81349	RCR076681KS	R612	RES
				R613	RES
745-0758-000		81349	RCR076182KS	R614	RES
745-0869-000		81349	RCR076225KS	R615	RES
745-0821-000		81349	RCR076104KS	R616	
745-0848-000		81349	RCR076564KS	R617	RES
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745-0809-000		81349	RCR076473KS	R619	RES

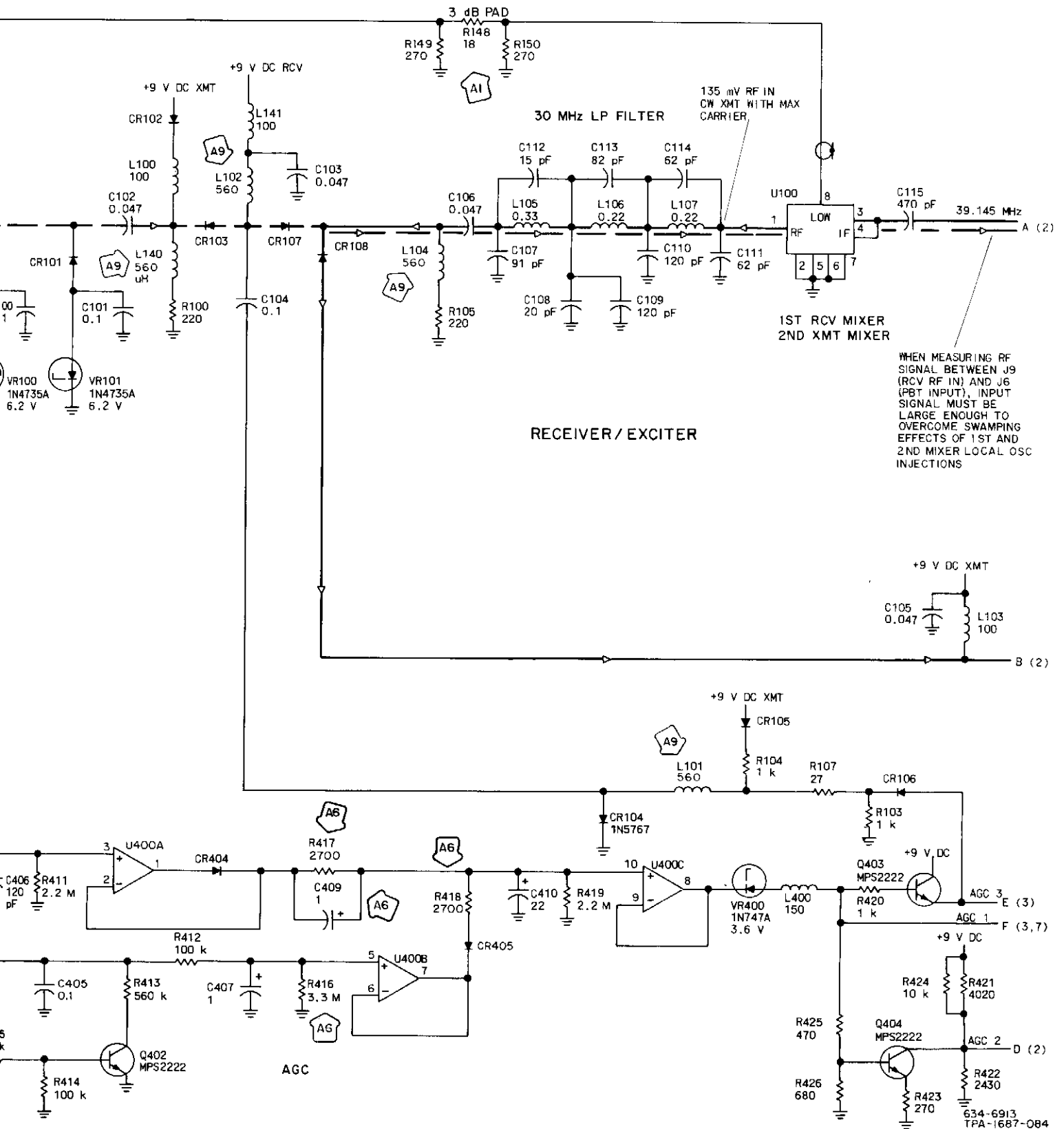
PARTS LIST (Cont)

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,R50 7	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, 6.8K, 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)

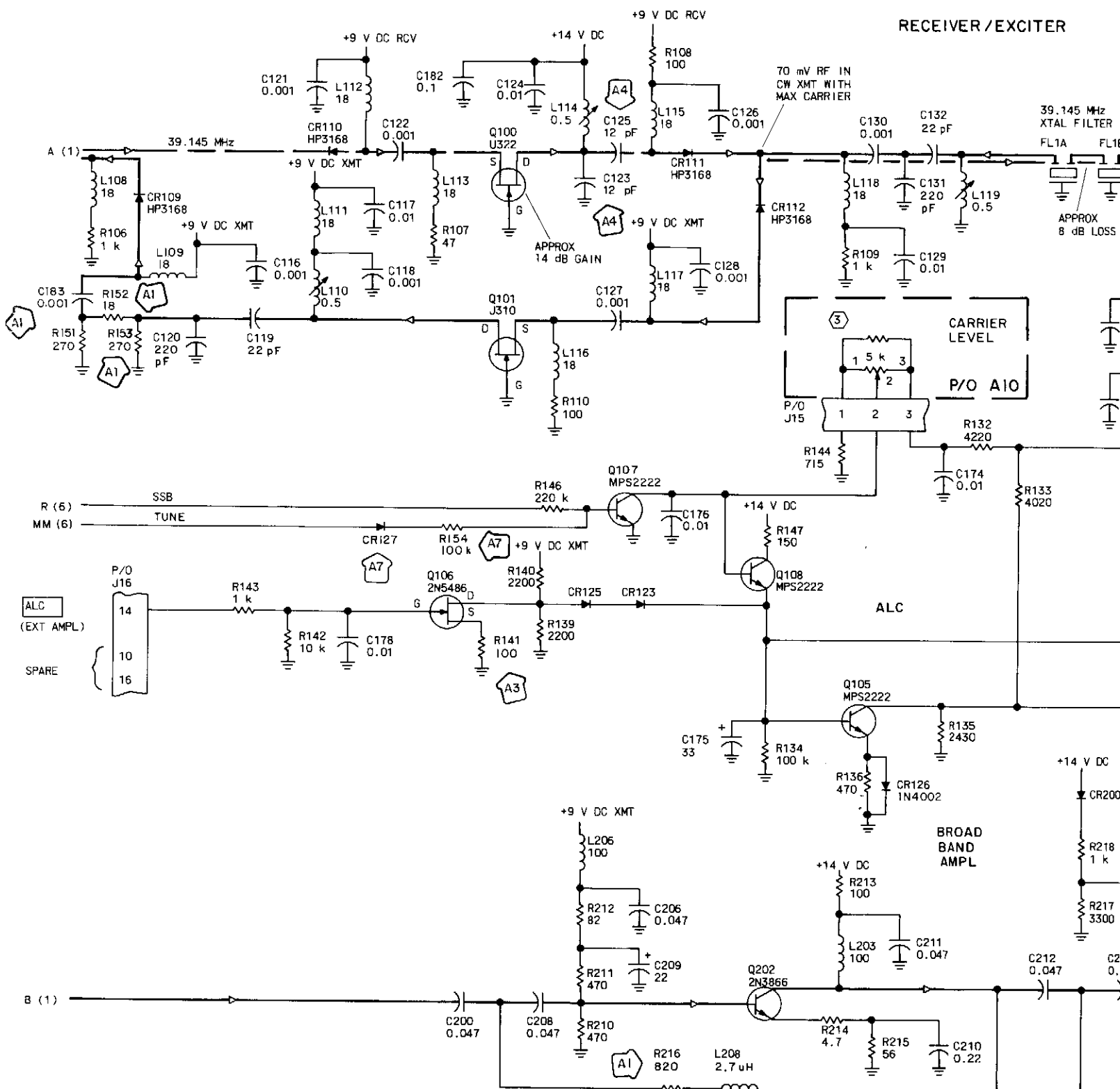
39.645-
69.145
MHz INJ
+20 dBm

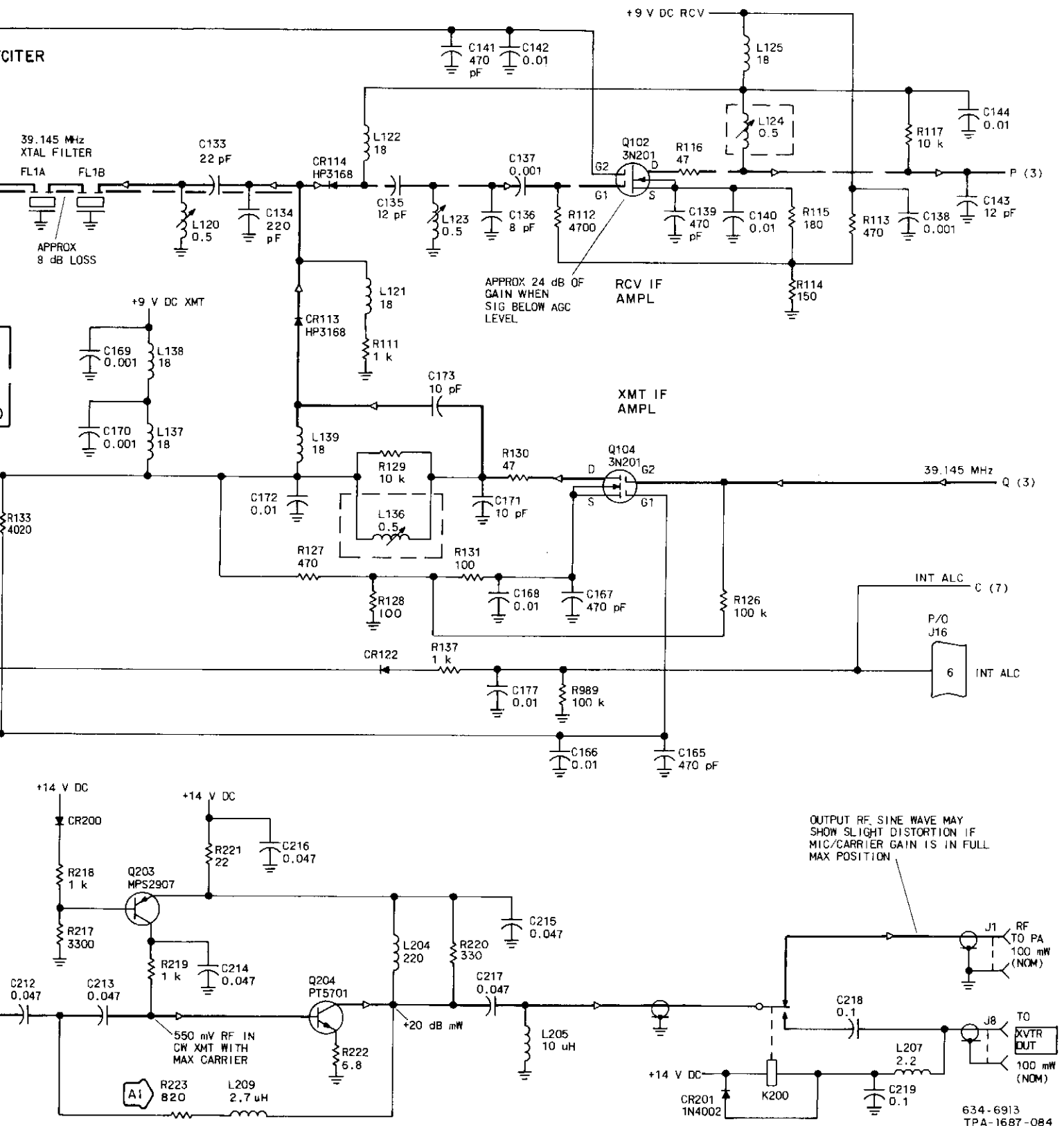




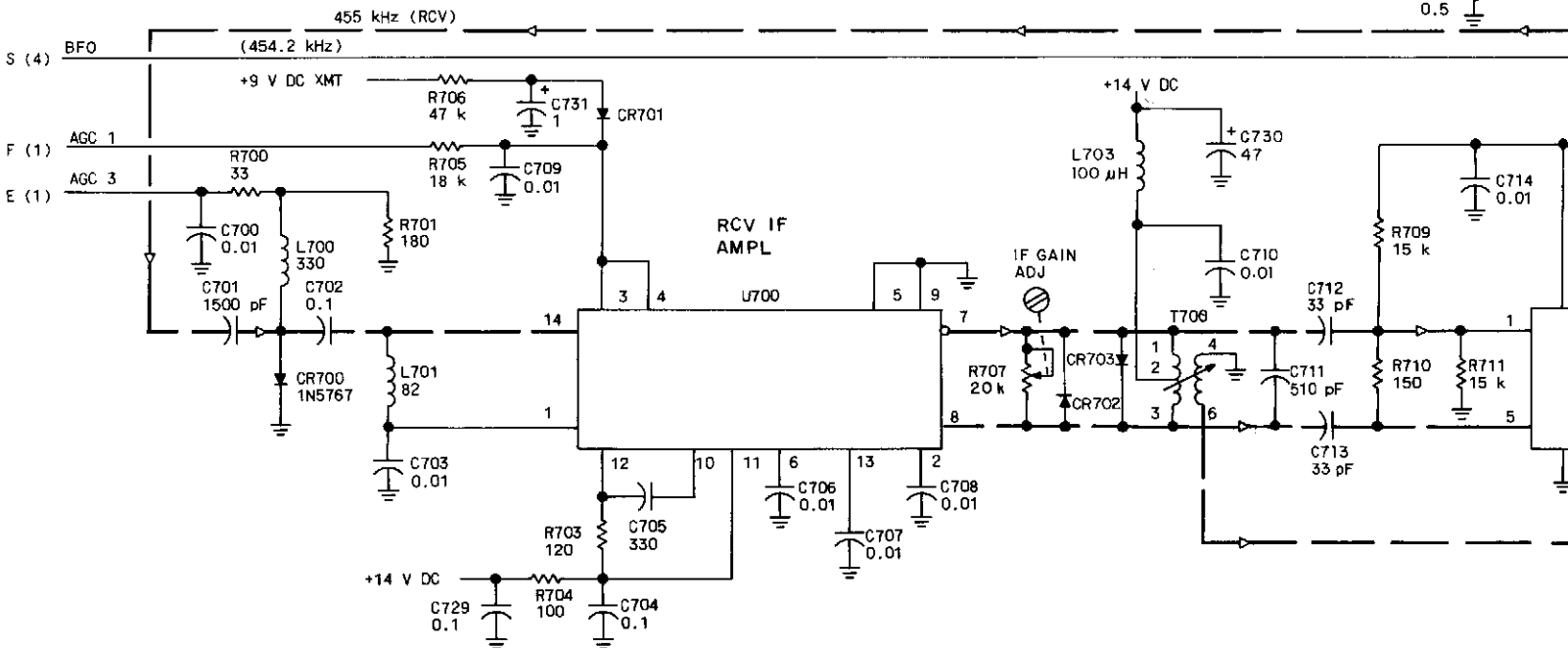
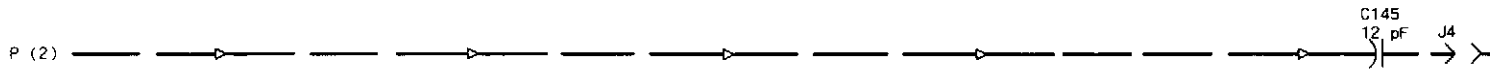
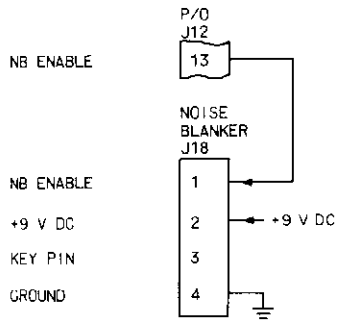
Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 1 of 8)

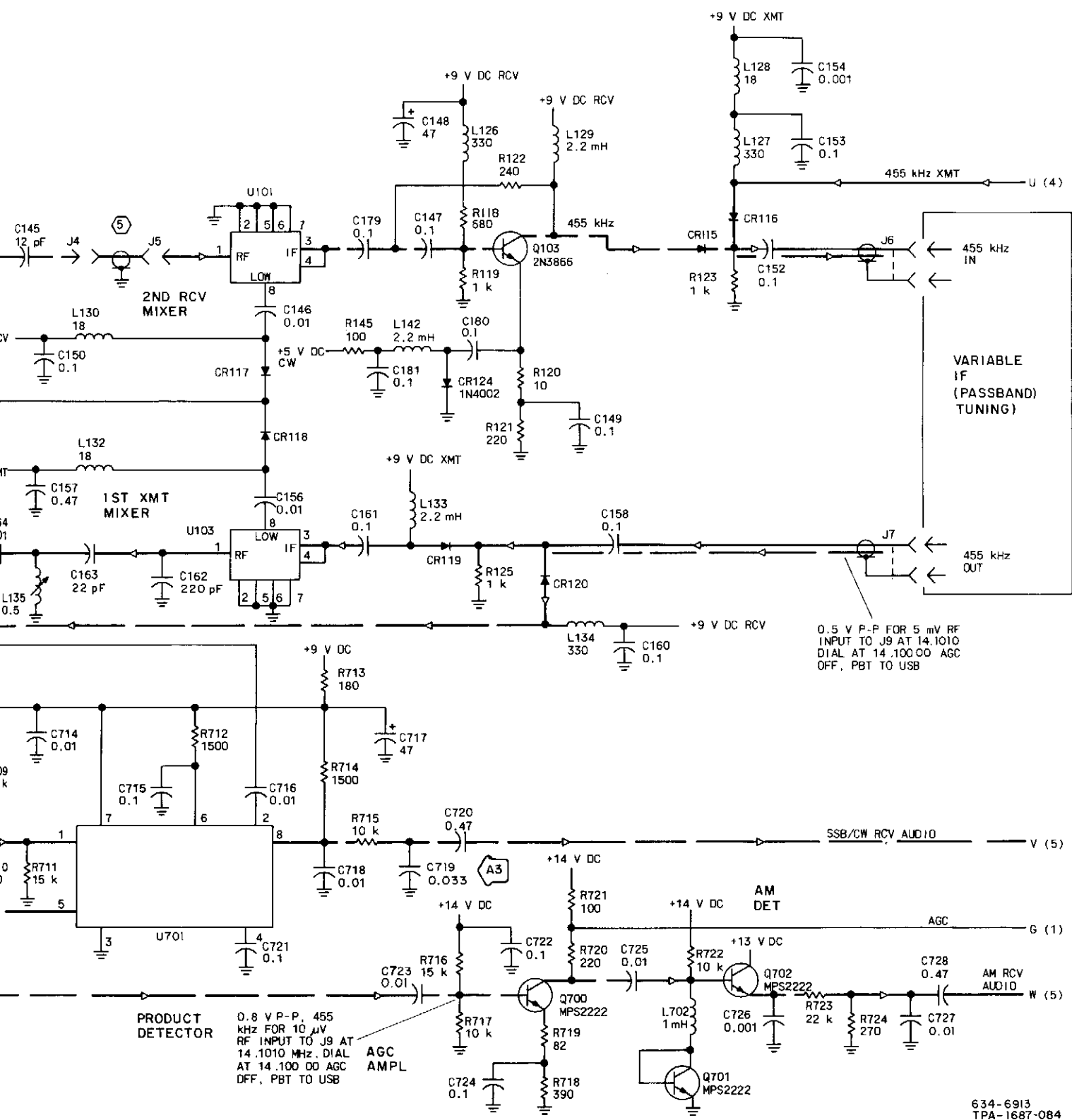
RECEIVER/EXCITER



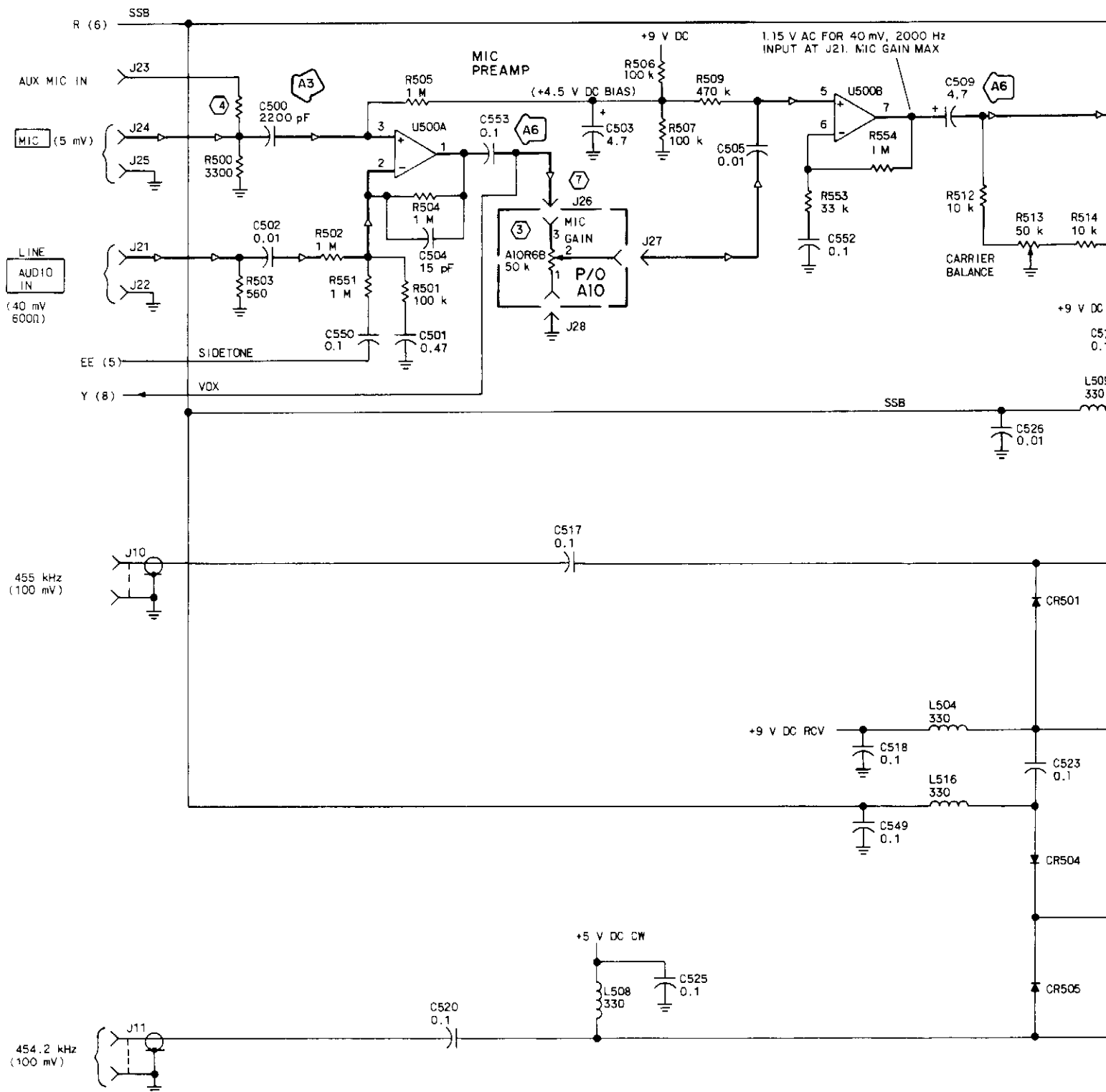


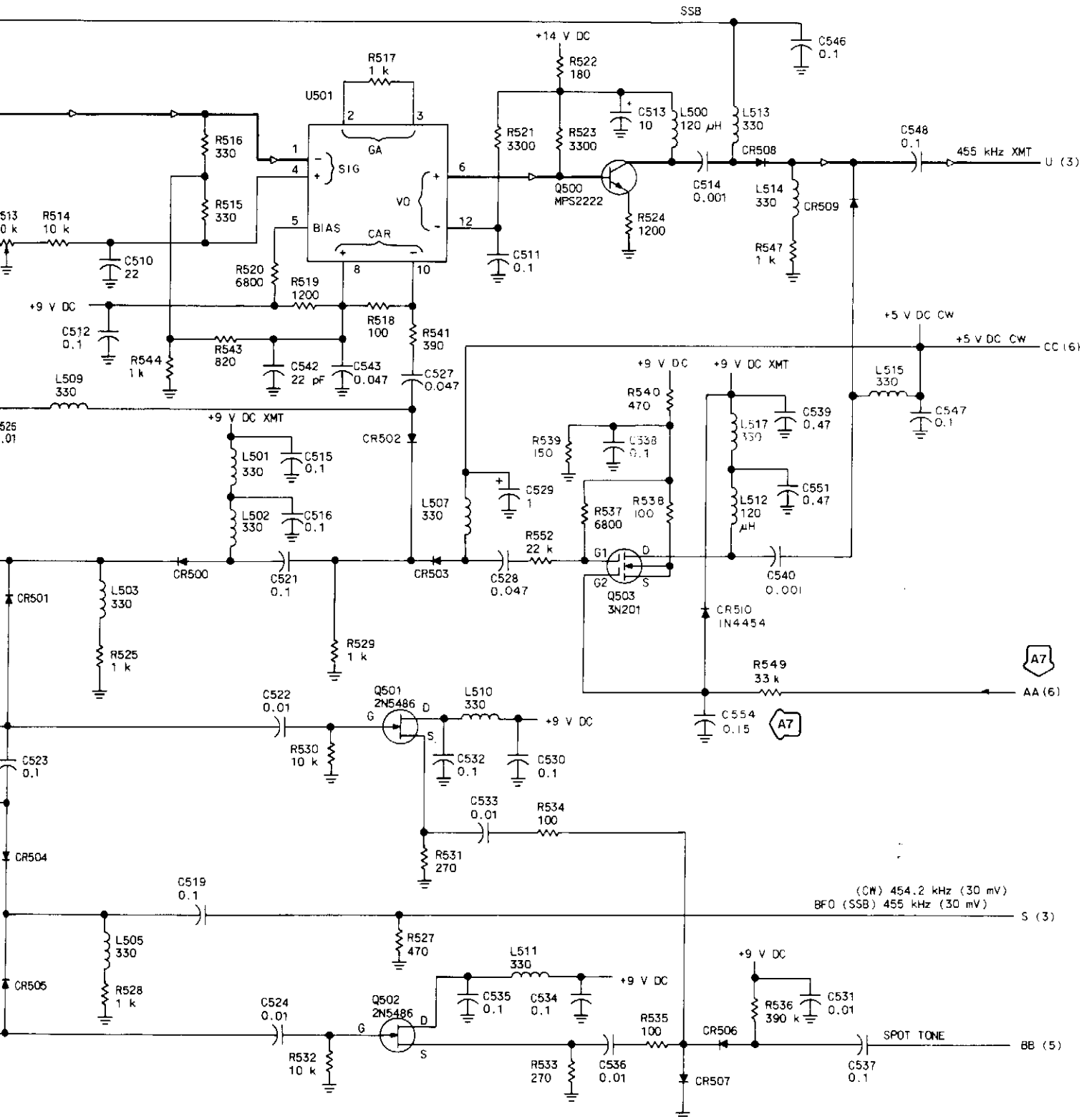
Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 2)





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

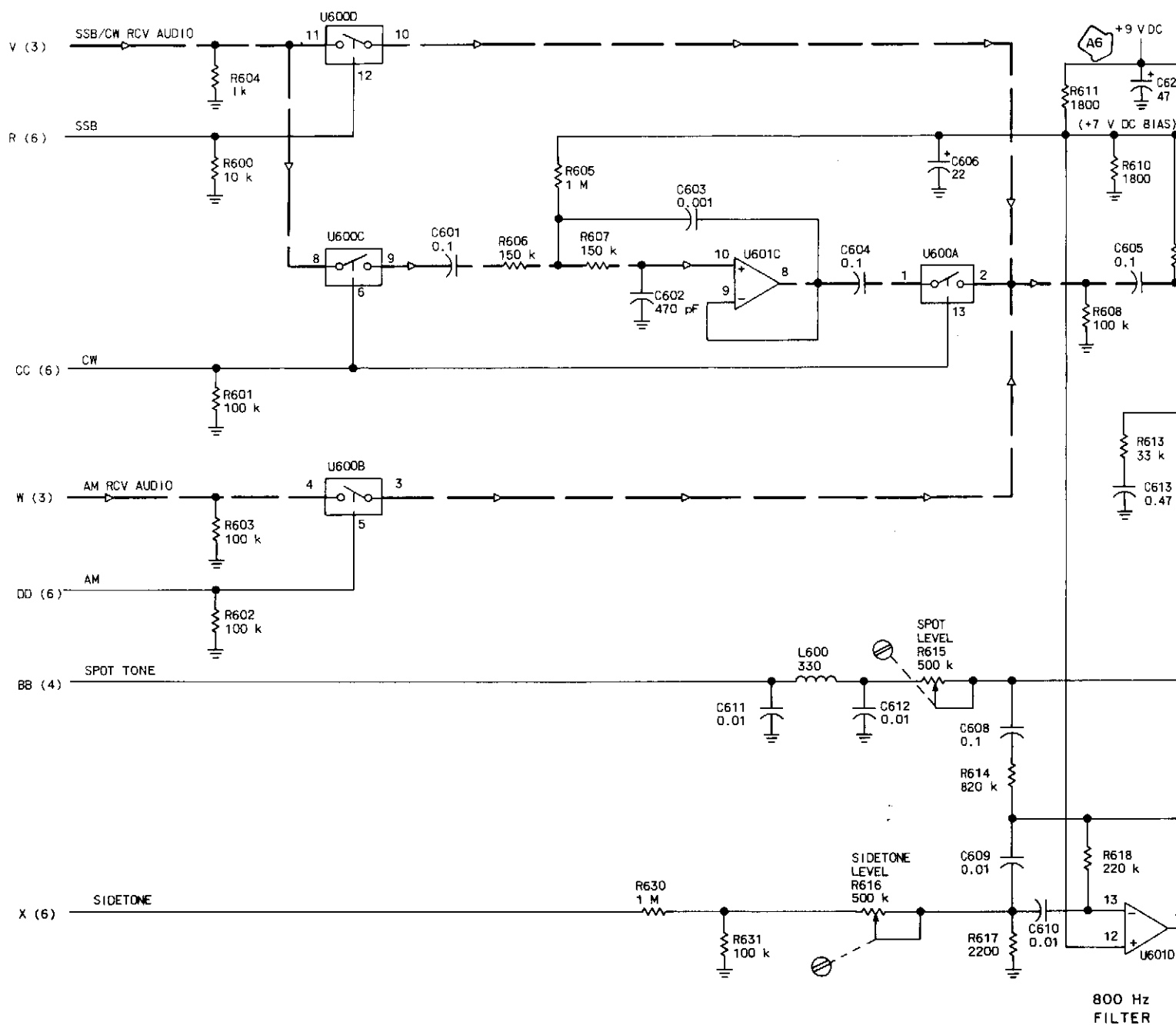




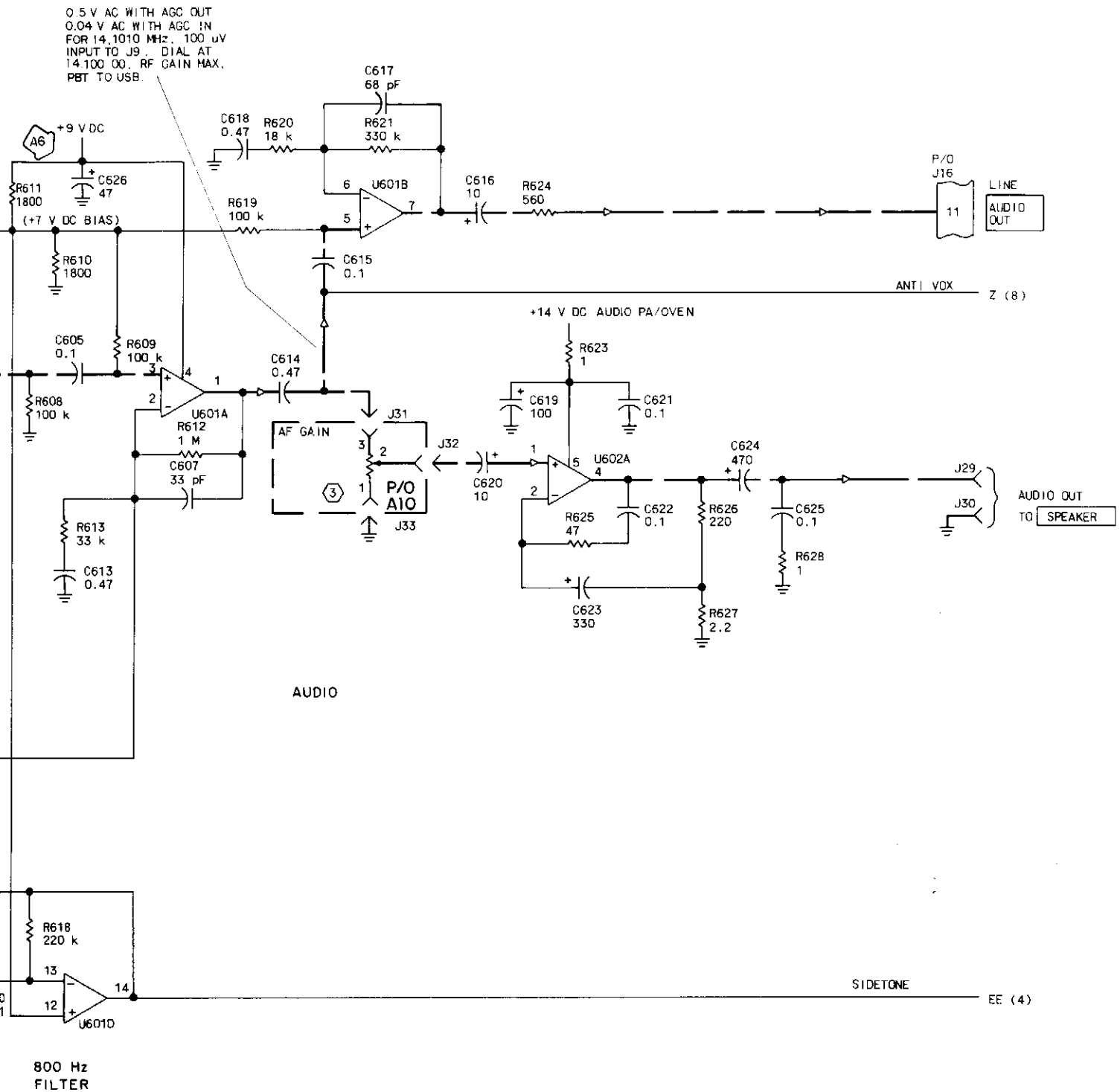
634-6913
TPA-1687-084

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

0.5 V AC
0.04 V AC
FOR 14.1
INPUT TO
14.100 0
PBT TO U

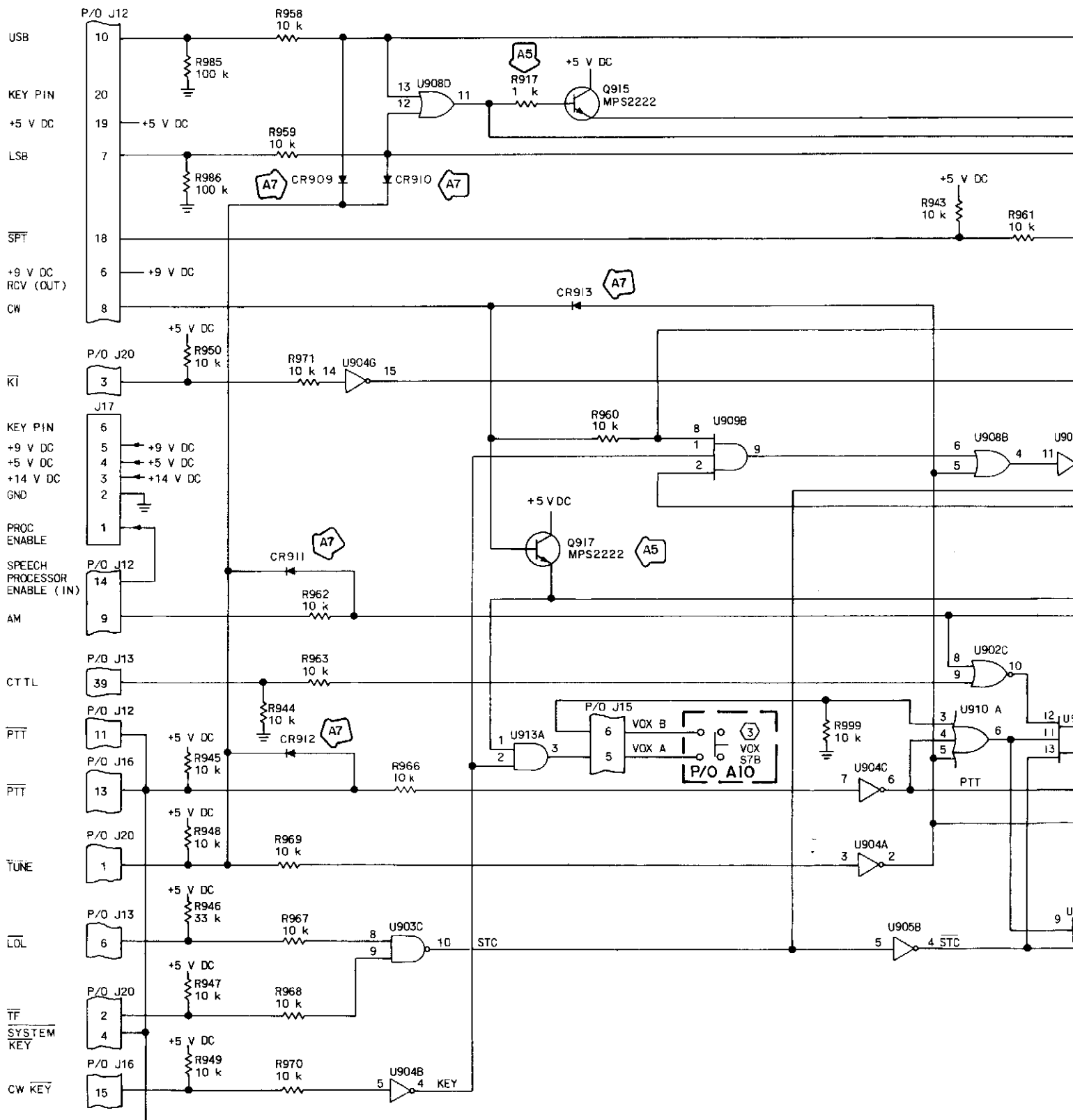


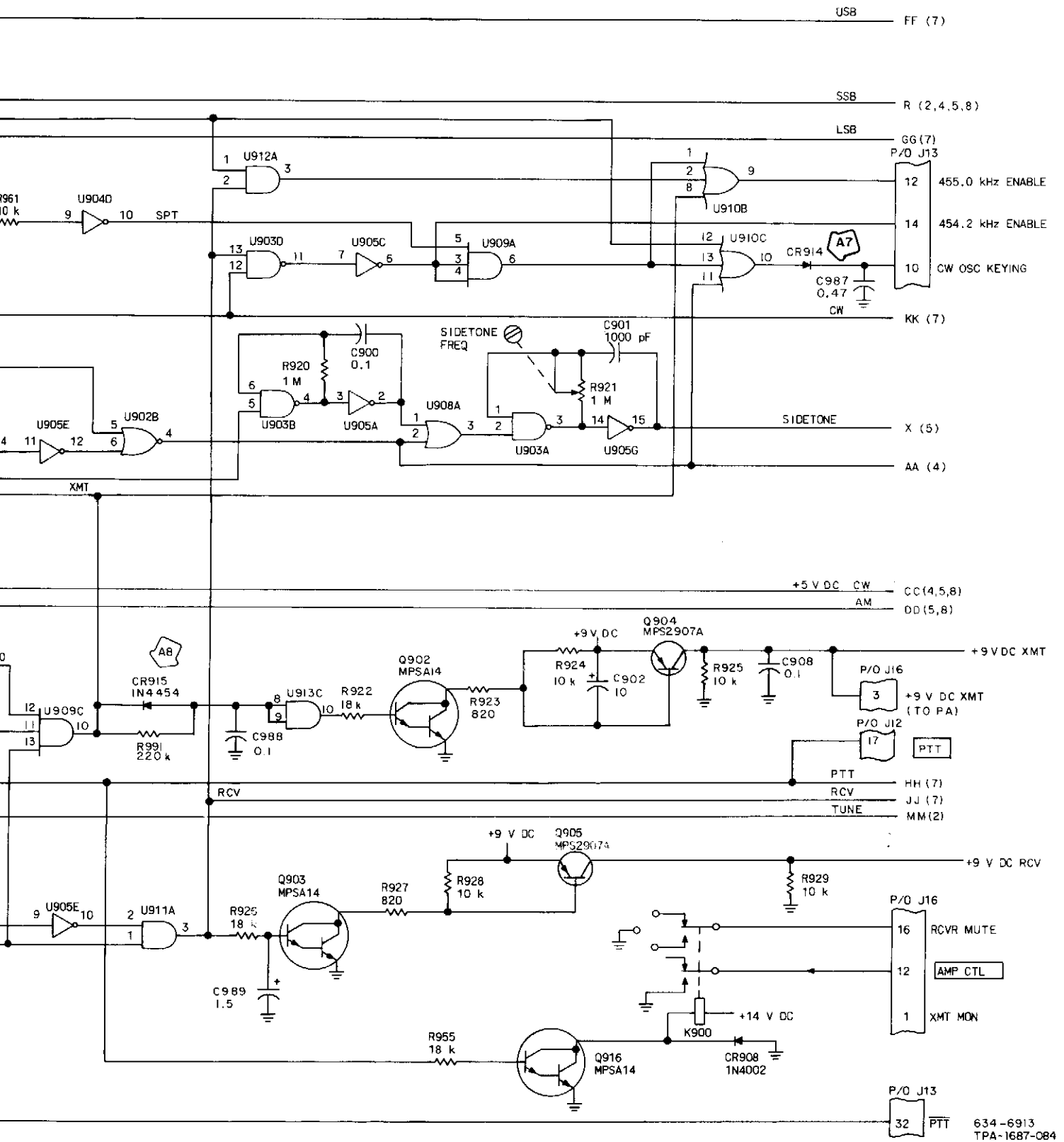
800 Hz
FILTER



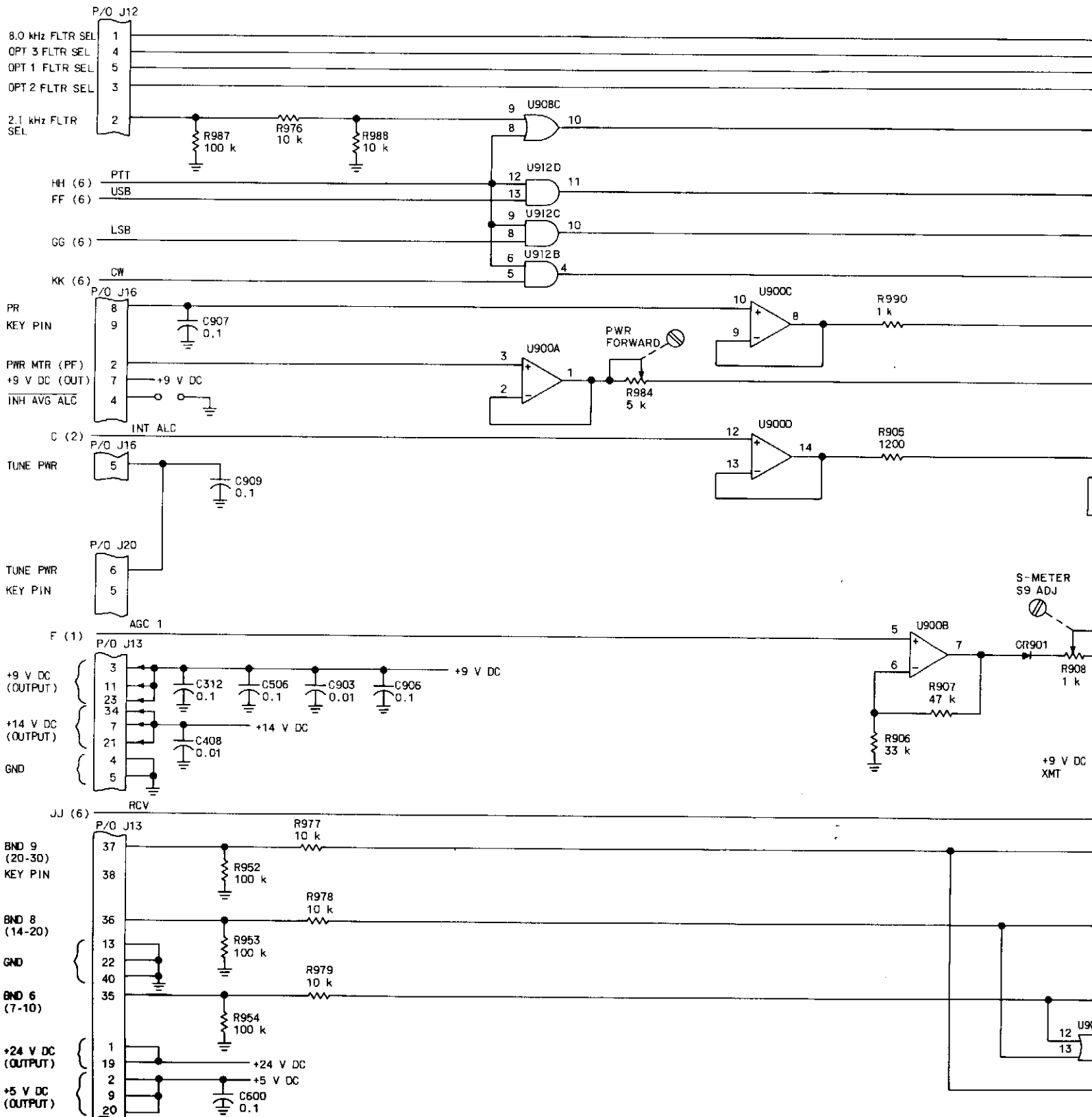
634-6913
TPA-1687-084

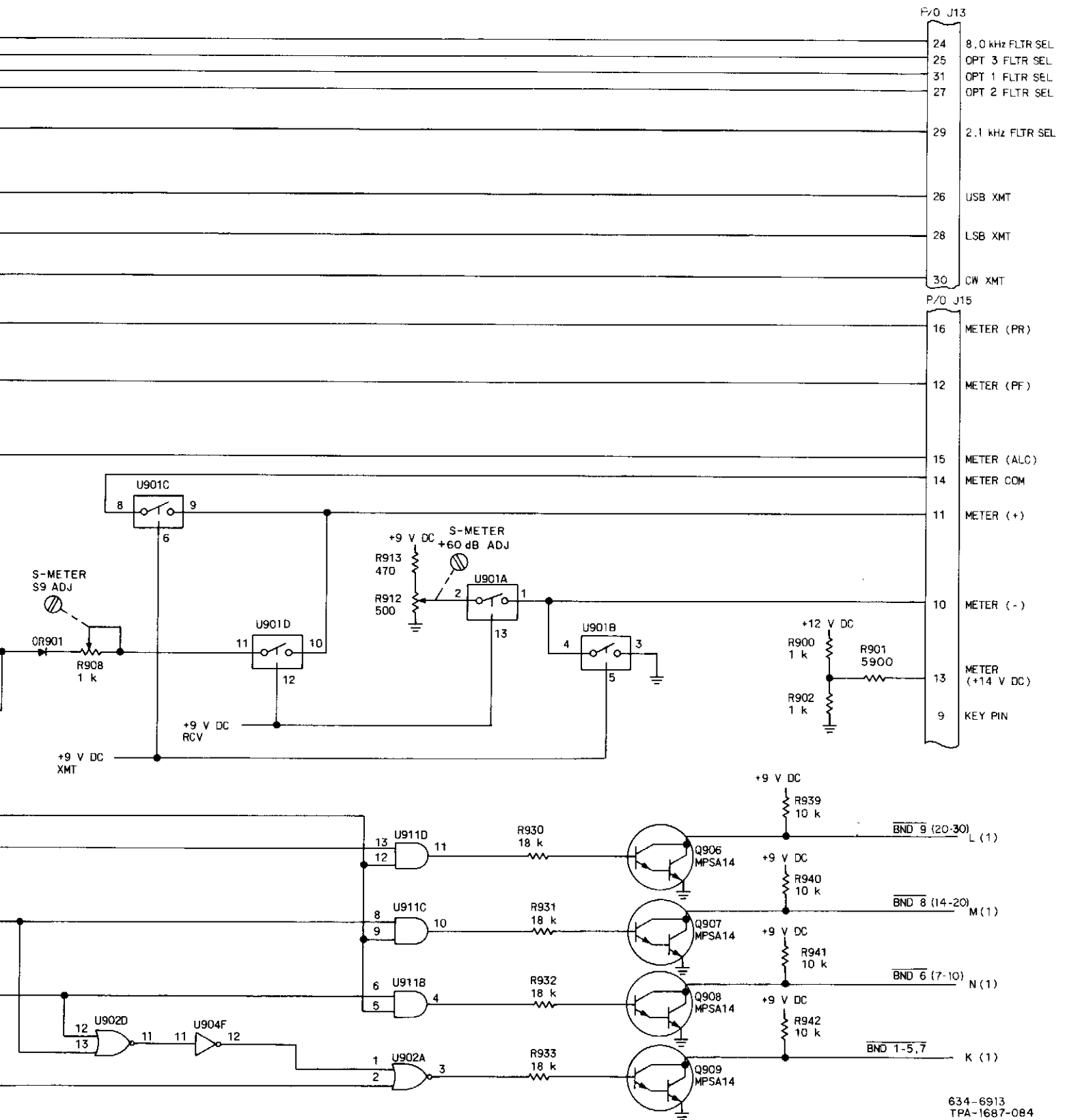
Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 5)



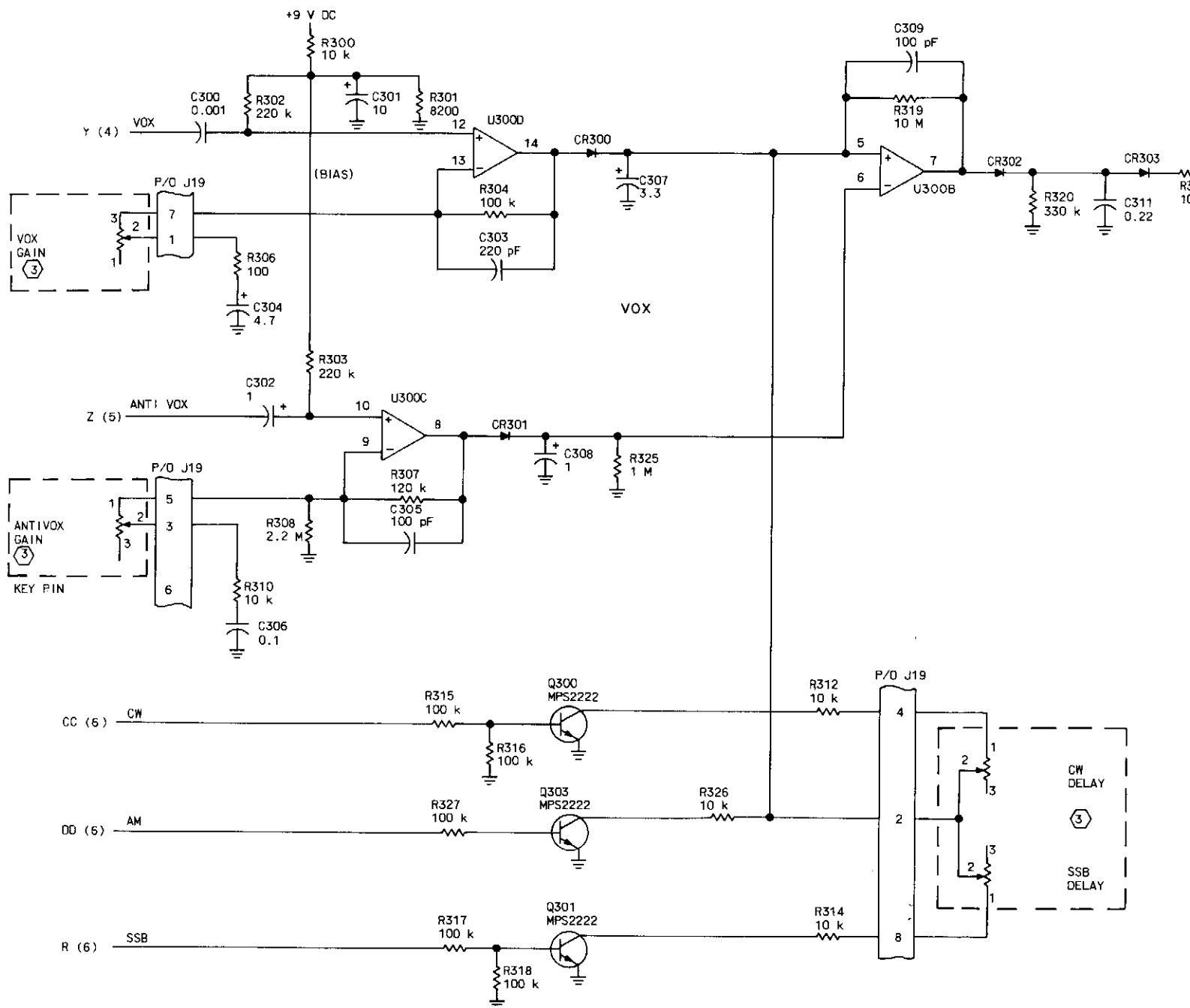


Receiver-Exciter, Schematic Diagram
Figure 11 (Sheet 6)





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





NOTES:

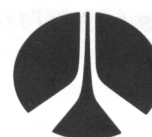
- ① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, INDUCTANCE VALUES ARE IN MICROHENRYS AND DIODES ARE TYPE 1N4454.
- ② PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
- ③ RF GAIN, AF 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 JUMPED 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)				SPARES
		+14	+9	+5	GND	
U100	SRA-1H					
U101	SBL-1					
U103	SBL-1					
U300	TLO 84		4		11	
U400	TLO 84	4			11	D
U500	TLO 84		4		11	
U501	1496				14	
U600	4066			14	7	
U601	TLO 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)



**Rockwell
International**

instructions

Collins Telecommunications Products Division

523-0771742-001211

1 August 1982

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

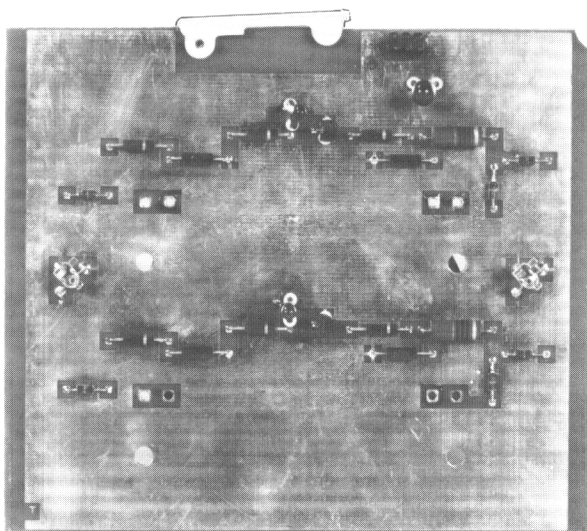
Printed in USA

1. DESCRIPTION

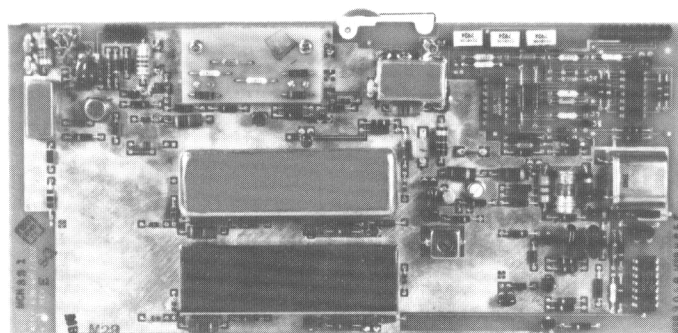
Passband Tuning 638-6912-XXX has three positions for three filters, FL1 through FL3, and Passband Tuning Option 638-6914-002 has positions for two filters, FL4 and FL5. The circuit cards are shown in figure 1. Table 1 lists the filter configuration for each circuit card dash number.

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.

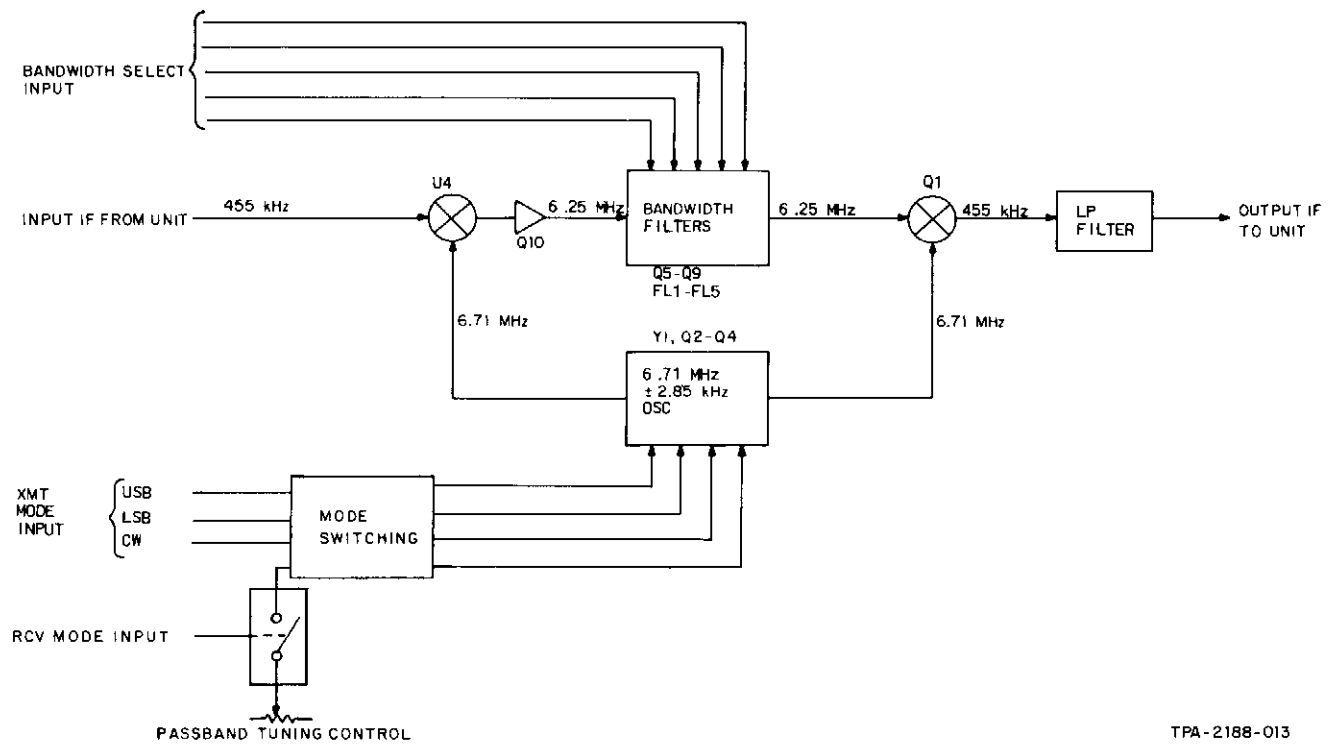
The 455-kHz receive if and the 6.71-MHz PBT oscillator signals are mixed by U4 to produce a PBT if of 6.255 MHz. (These frequencies are nominal values, as explained in a following paragraph.) Amplifier Q10 increases the PBT if signal level to compensate for bandwidth filter insertion loss. The bandwidth 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.

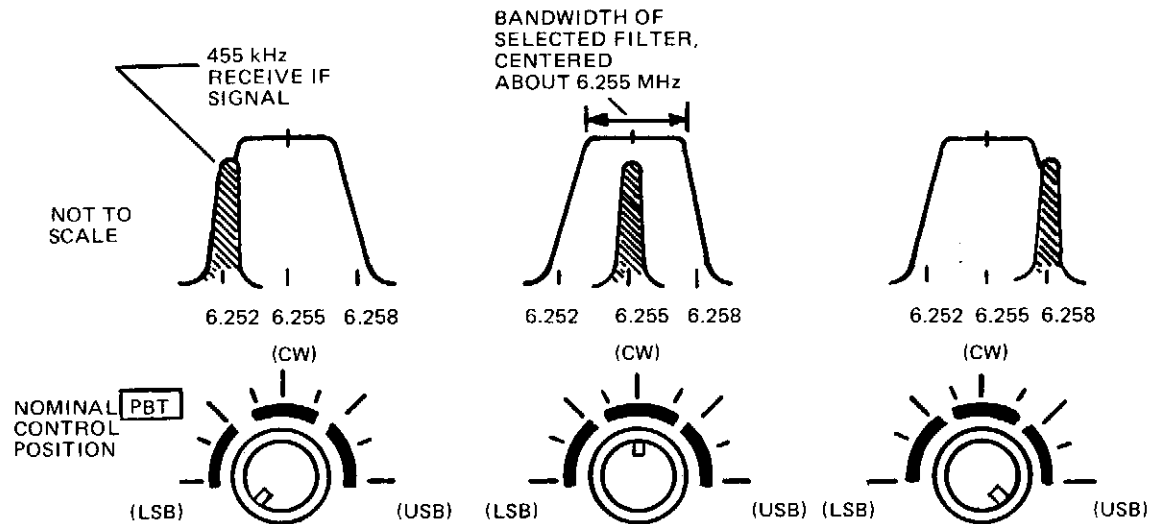
The PBT oscillator circuit is Q2, Y1, CR13, and associated components. Capacitor C16 is adjusted to set the oscillator output to 6.7100 MHz when the transceiver is in the receive mode and the PBT control is in midposition. In the counterclockwise position (low end of voltage range), the oscillator output 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



TPA-2188-013

Passband Tuning, Block Diagram
Figure 2



TPA-2187-011

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 $\pm$ 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 $\pm$ 3 kHz, 1- to 1000- μ V 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 $\pm$ 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. d. Adjust PBT control to maximum ccw position. Measure frequency at Q4 emitter. e. Adjust PBT control to maximum cw position. Measure frequency. Note Steps f through m apply to receiver-exciter units only.	6.71 MHz $\pm$10 Hz 6.707 500 MHz $\pm$200 Hz 6.712 700 MHz $\pm$300 Hz	Adjust C16 for correct frequency. Check U3D, U1D, CR13, and Q2-Q4. Check R37, R38, R54, R55, and front-panel PBT potentiometer. 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 $\pm$10 Hz. g. Depress MOX switch to key transmitter. h. Measure frequency at Q4 emitter. i. Release MOX switch. Set MODE to LSB. j. Key transmitter and measure frequency at Q4 emitter. k. Unkey transmitter and set MODE to CW. l. Key transmitter and measure frequency at Q4 emitter. m. Unkey transmitter.	6.711 500 MHz $\pm$10 Hz 6.708 500 MHz $\pm$10 Hz 6.710 000 MHz $\pm$10 Hz	Adjust R28 for correct frequency. Check U3A, R27-R34, and R36. Adjust R34 for correct frequency. Check U3A, R27-R34, and R36. Adjust R31 for correct frequency. Check U3B, R27-R34, and R36.
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. 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.	L4 set for max rf output from J6 9.5 $\pm$2.5 dB	Adjust L4 as required. Check Q1 and output filter. 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 $\pm$ 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

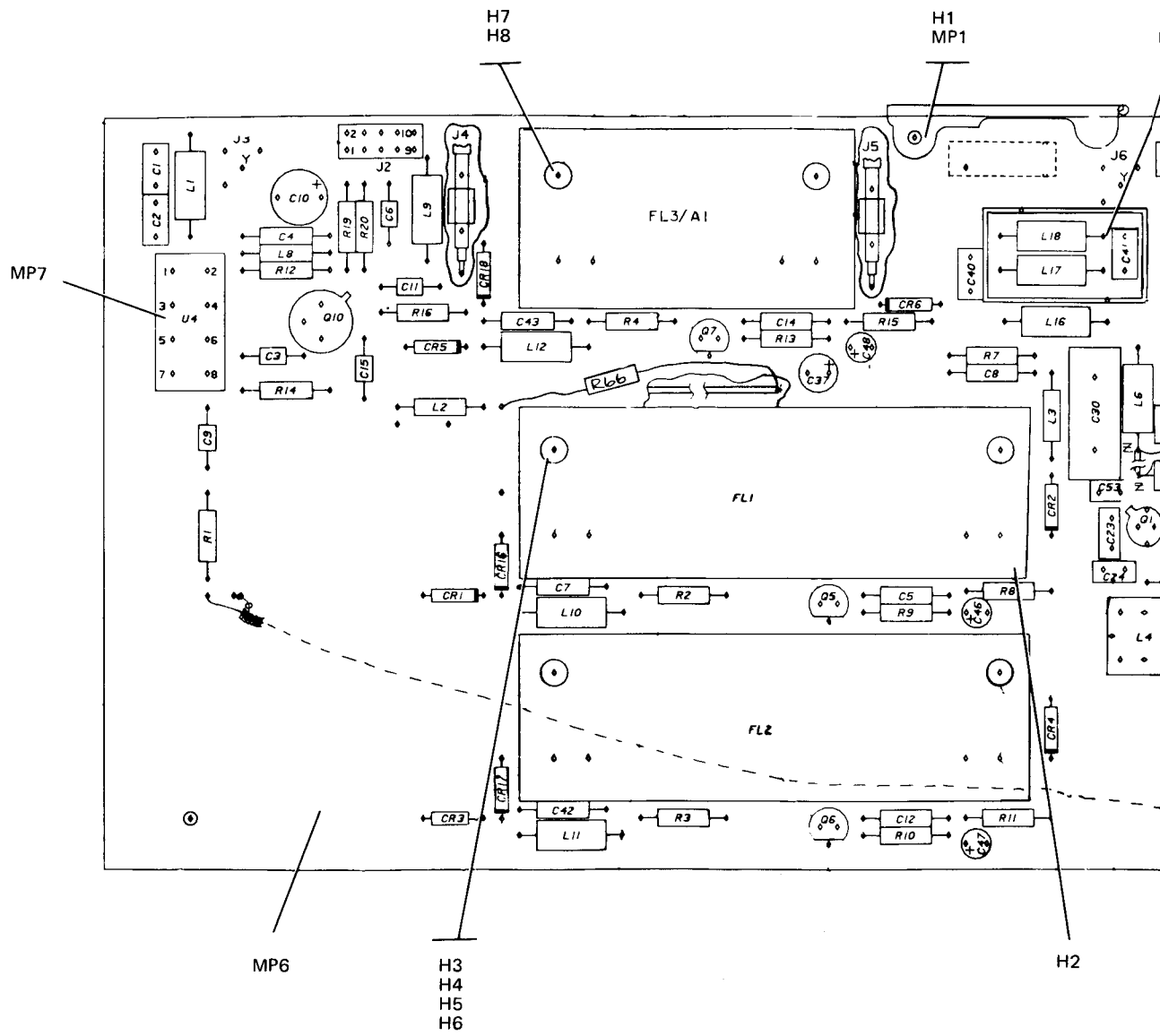
<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
18741	KILOVAC CORP P O BOX 4422 SANTA BARBARA CA 93103
18796	ERIE TECHNOLOGICAL PRODUCTS INC STATE COLLEGE DIV 1900 W COLLEGE 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

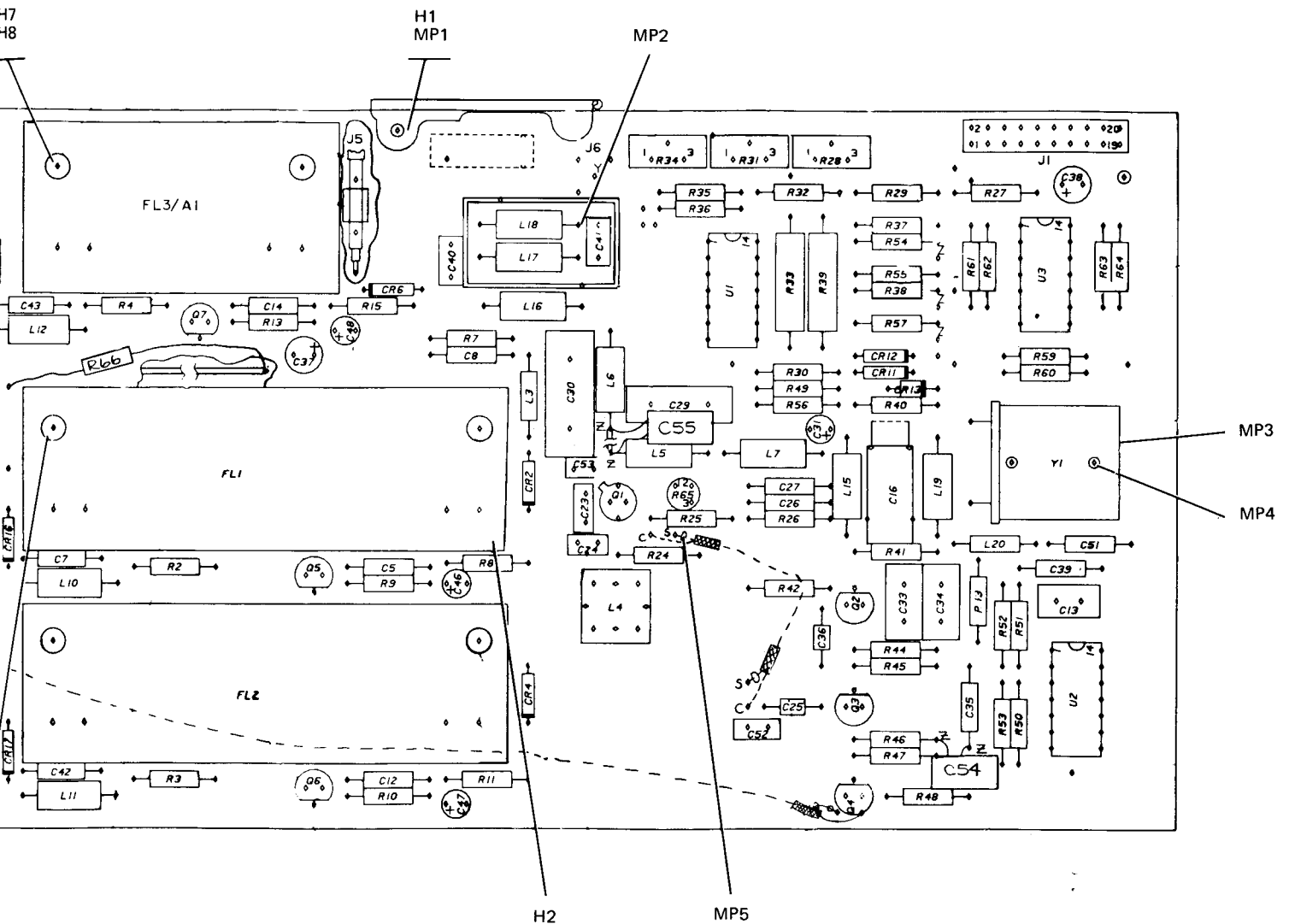
<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
80294	BOURNS INSTRUMENTS INC 6135 MAGNOLIA AVE RIVERSIDE CA 92506
81349	MILITARY SPECIFICATIONS
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
96214	TEXAS INSTRUMENTS INC EQUIPMENT 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.

<u>CIRCUIT CARD/ SUBASSEMBLY</u>	<u>COLLINS PART NUMBER</u>	<u>LATEST EFFECTIVITY</u>
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





TPA-5701-018

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

PARTS LIST

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REF DES	DESCRIPTION	COLLINS PART NUMBER
CR1-CR6 CR7-CR10	PASS BAND TUNING	638-6912-002			638-6912-002	L5	COIL,RF 1000UH	240-2715-490
	PASS BAND TUNING	638-6912-003			638-6912-003	L6	COIL,RF 180UH	240-2715-400
	CIRCUIT CARD ASSEMBLY	642-3578-001				L7	COIL,RF 1000UH	240-2715-490
	SEMICOND DEVICE	353-3644-010		03508	1N4454GE	L8	COIL,RF 15UH	240-2037-000
	NOT USED					L9	COIL,RF 150UH	240-2520-000
	SEMICOND DEVICE	353-3644-010		03508	1N4454GE	L10-L12 L13,L14	COIL,RF 100UH	240-2715-370
CR11, CR12	SEMICOND DEVICE	922-6131-020		12954	BB109-6131-020	L15	COIL,RF 18UH	240-1583-000
CR14, CR15	NOT USED					L16	COIL,RF 10UH	240-2715-250
CR16- CR18	SEMICOND DEVICE	353-3644-010		03508	1N4454GE	L17	COIL,RF 18UH	240-2715-280
C1,C2	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100C0G332K	L18	COIL,RF 10UH	240-2715-250
C3	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	L19	COIL,RF 12UH	240-2715-260
C4,C5	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C	L20	COIL,RF 330UH	240-2715-430
C6	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	MP1	HANDLE	789-2348-001
C7,C8	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C	MP2	CONTACT,ELEC (QTY 15)	372-2601-030
C9	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	MP5	SHIELD	641-7128-001
C10	CAPACITOR,FXD TMTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239	MP4	CLIP,SPR TNSN	139-3003-010
C11	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	MP3	RIVET,TUBULAR CS, 0.061 DIA X 0.125 (QTY 2)	305-1701-000
C12	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C	MP6	LABEL,PRESS SENS (ESDS)	280-2745-040
C13	CAPACITOR,FXD MICA DIEL, 100PF, 5%, 500V	912-3879-000		81349	CM04FD101J03	MP7	INSULATOR	150-0684-060
C14	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C	Q1	TRANSISTOR,FET (ESDS)	352-1140-010
C15	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	Q2-Q4	TRANSISTOR	352-0723-010
C16	CAPACITOR,VAR GL DIEL, 0.8 TO 8.5PF, 750V	922-0486-000		73899	VC96W	Q5-Q7	TRANSISTOR	352-5501-010
C17-C22	NOT USED					Q8,Q9	NOT USED	
C23	CAPACITOR,FXD MICA DIEL, 1000PF, 5%, 100V	912-2093-240		00853	D71F102J0	Q10	TRANSISTOR	352-0671-010
C24	CAPACITOR,FXD MICA DIEL, 62PF, 5%, 50V	912-4141-320		93790	C05EY620J0	R1	RESISTOR,FXD FILM, 680 OHMS, 1%, 750V	705-0701-000
C25	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	R2-R4	RESISTOR,FXD CHPSN, 150 OHMS, 10%, 1/4W	745-0719-000
C26,C27	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C	R5,R6	NOT USED	
C28	NOT USED					R7	RESISTOR,FXD CHPSN, 470 OHMS, 10%, 1/4W	745-0737-000
C29	CAPACITOR,FXD CER DIEL, 820PF, 5%, 100V	913-1098-480		72982	8121M101C0G0-821 J	R8	RESISTOR,FXD CHPSN, 15K, 10%, 1/4W	745-0791-000
C30	CAPACITOR,FXD CER DIEL, 6800PF, PORM5%, 100V	913-3281-390		18796	8141M100C0G682J	R9,R10	RESISTOR,FXD CHPSN, 0.10MEGO, 10%, 1/4W	745-0821-000
C31	CAPACITOR,FXD CER DIEL, 0.047UF, 10%, 100VDC (A1)	913-5019-400		81349	CK06BX473K	R11	RESISTOR,FXD CHPSN, 15K, 10%, 1/4W	745-0791-000
C32	NOT USED					R12	RESISTOR,FXD CHPSN, 680 OHMS, 10%, 1/4W	745-0743-000
C33,C34	CAPACITOR,FXD MICA DIEL, 390PF, 5%, 500V	912-2858-000		81349	CM05FD391J03	R13	RESISTOR,FXD CHPSN, 0.10MEGO, 10%, 1/4W	745-0821-000
C35	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C	R14	RESISTOR,FXD CHPSN, 1K, 10%, 1/4W	745-0749-000
C36	CAPACITOR,FXD CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	R15	RESISTOR,FXD CHPSN, 15K, 10%, 1/4W	745-0791-000
C37	CAPACITOR,FXD TMTLM ELCTLT, 10UF, 20%, 20V	184-9102-170		56289	199D106X0020CB1	R16	RESISTOR,FXD CHPSN, 330 OHMS, 10%, 1/4W	745-0731-000
C38	CAPACITOR,FXD TMTLM ELCTLT, 22UF, 20%, 10V	184-9102-080		56289	199D226X0010CB1	R17,R18	NOT USED	
C39	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C	R19	RESISTOR,FXD CHPSN, 4.3 OHMS, 5%, 1/4W	745-4381-000
C40,C41	RELAY,AHT CER DIEL, 3900PF, PORM10%, 100V	913-3281-180		18741	H1855	R20	RESISTOR,FXD CHPSN, 220 OHMS, 10%, 1/4W	745-0725-000
C42,C43	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C	R21-R23	NOT USED	
C44,C45	NOT USED					R24	RESISTOR,FXD CHPSN, 22K, 10%, 1/4W	745-0797-000
C46-C48	CAPACITOR,FXD TMTLM ELCTLT, 0.47UF, 20%, 35V	184-9102-330		56289	199D474X0035AB1	R25	RESISTOR,FXD CHPSN, 10K, 10%, 1/4W	745-0785-000
C49,C50	NOT USED					R26	RESISTOR,FXD CHPSN, 82 OHMS, 5%, 1/4W	745-0709-000
C51	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U104Z050C	R27	RESISTOR,FXD FILM, 2.43K, 1%, 1/8W (A3)	705-3605-180
C52	CAPACITOR,FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450		93790	C05FY221J0	R28	RESISTOR,FXD FILM, 976 OHMS, 1%, 1/8W	705-3600-960
C53	CAPACITOR,FXD MICA DIEL, 33PF, 5%, 50V	912-4141-220		93790	C05EY330J0	R29	RESISTOR,FXD FILM, 1K, 1%, 1/8W (A3)	705-0996-000
C54	CAPACITOR,FXD MICA DIEL, 1000PF, 5%, 100V (A4)	912-2093-240		00853	D71F102J0	R30	RESISTOR,FXD FILM, 3.09K, 1%, 1/4W	705-3605-230
C55	CAPACITOR,FXD CER DIEL, 0.1UF, 10%, 100VDC (A1)	913-5019-440		81349	CK06BX104K	R31	RESISTOR,VAR 10K, 20%, 1/2W	705-3601-230
FL1	FILTER,BP.XTAL	293-1337-060		25120	293-1337-060	R32	RESISTOR,FXD FILM, 866 OHMS, 1%, 1/8W	705-0993-000
H1	PIN,SPRING SST, 0.078 DIA X 1/4 (QTY 1)	311-0355-000		96906	MS16562-199	R33	RESISTOR,FXD FILM, 523K, 1%, 1/4W	705-3601-330
H2	INSULATOR,WASHER MICA, 0.063 ID X 0.323 OD (QTY 4)	302-0640-070		08289	HM323-63	R34	RESISTOR,VAR 10K, 20%, 1/2W	382-0038-360
H3	WASHER,FLAT BRS, 0.125 ID X 0.312 OD (QTY 6)	310-0054-000		79807	310-0054-000	R35	RESISTOR,FXD FILM, 3.40K, 1%, 1/8W	705-3600-870
H4	NUT,PLAIN,HEX NP BRS, 4-40 (QTY 8)	313-0051-000		77250	P313-0051-000	R36	RESISTOR,FXD FILM, 1.24K, 1%, 1/8W	705-3605-040
H5	WASHER,FLAT CRES, 0.125ID X 0.250 OD (QTY 6)	310-0779-030		96906	MS15795-803	R37	RESISTOR,FXD FILM, 316K, 1%, 1/4W	705-6716-000
H6	WASHER,LOCK SST, 0.115 ID X 0.209 OD (QTY 4)	310-0279-000		96906	MS35338-135	R40	RESISTOR,FXD CHPSN, 0.10MEGO, 10%, 1/4W	745-0821-000
H7	SCREW,MACH STL, 4-40 X 5/8 (QTY 2)	343-0138-000		96906	MS51957-18	R41	RESISTOR,FXD CHPSN, 10K, 10%, 1/4W	745-0785-000
H8	POST (QTY 2)	541-5966-002				R42	RESISTOR,FXD CHPSN, 6.8K, 10%, 1/4W (A2)	745-0779-000
J1	CONNECTOR,HDR	372-2656-090		52072	CAD20SP100-230-4 30	R43	RESISTOR,FXD CHPSN, 820 OHMS, 10%, 1/4W	745-0746-000
J2	CONNECTOR,HDR	372-2656-100		52072	CAD10SP100-230-4 30	R44	RESISTOR,FXD CHPSN, 560 OHMS, 10%, 1/4W	745-0740-000
J3-J6	CONNECTOR,RCPT	357-0067-020		00779	226287-2	R45	RESISTOR,FXD CHPSN, 18K, 10%, 1/4W	745-0794-000
J4	CABLE, COAX	641-7100-022				R46	RESISTOR,FXD CHPSN, 220 OHMS, 10%, 1/4W	745-0725-000
J5	CABLE, COAX	641-7100-023				R47	RESISTOR,FXD CHPSN, 330 OHMS, 10%, 1/4W	745-0731-000
J7-J9	CONNECTOR,HDR	372-2656-130		52072	CAS01SP100-230-4 30	R48	RESISTOR,FXD CHPSN, 220 OHMS, 10%, 1/4W	745-0725-000
L1	COIL,RF 15UH	240-1582-000		96906	MS14046-6	R49	RESISTOR,FXD FILM, 287K, 1%, 1/8W	705-1114-000
L2,L3	COIL,RF 100UH	240-2047-000		96906	MS75085-07	R50	RESISTOR,FXD CHPSN, 0.10MEGO, 10%, 1/4W	745-0821-000
L4	INDUCTOR,RF	242-0441-070		20462	242-0441-070	R51	RESISTOR,FXD CHPSN, 10 OHMS, 10%, 1/4W	745-0677-000
						R52	RESISTOR,FXD FILM, 107K, 1%, 1/8W (A3)	705-3604-020
						R53	RESISTOR,FXD FILM, 110K, 1%, 1/8W	705-1094-000
						R54	RESISTOR,FXD FILM, 71.5K, 1%, 1/8W	705-1085-000
						R55	RESISTOR,FXD FILM, 4.12K, 1%, 1/8W	705-3605-290
						R56	RESISTOR,FXD FILM, 3.48K, 1%, 1/8W	705-1022-000
						R57	RESISTOR,FXD CHPSN, 0.10MEGO, 10%, 1/4W	745-0821-000
						R58	RESISTOR,FXD FILM, 24.9K, 1%, 1/8W	705-1063-000
						R59	NOT USED	
						R60	RESISTOR,FXD CHPSN, 4.7K, 10%, 1/4W	745-0773-000
						R61-R64	RESISTOR,FXD CHPSN, 1K, 10%, 1/4W	745-0749-000
						R65	RESISTOR,FXD CHPSN, 0.47MEGO, 10%, 1/4W	745-0845-000
						R66	RESISTOR,VAR 200 OHMS, 10%, 0.5W	382-0027-050
						TP3-TP6	RESISTOR,FXD CHPSN, 47 OHMS, 10%, 1/4W (A1)	745-0701-000
						U1	JACK-TIP	360-0079-190
						U2	INTEGRATED CIRCUIT (ESDS)	351-8252-020
						U2	INTEGRATED CIRCUIT V RGLTR (A3)	351-1035-060
						U3	INTEGRATED CIRCUIT V RGLTR	351-1035-040
						U4	INTEGRATED CIRCUIT COMPARATOR	351-1122-010
						Y1	MIXER,RF	277-0405-010
							CRYSTAL UNIT,QTZ 6.71MHZ	289-7338-010

PARTS LIST (Cont)

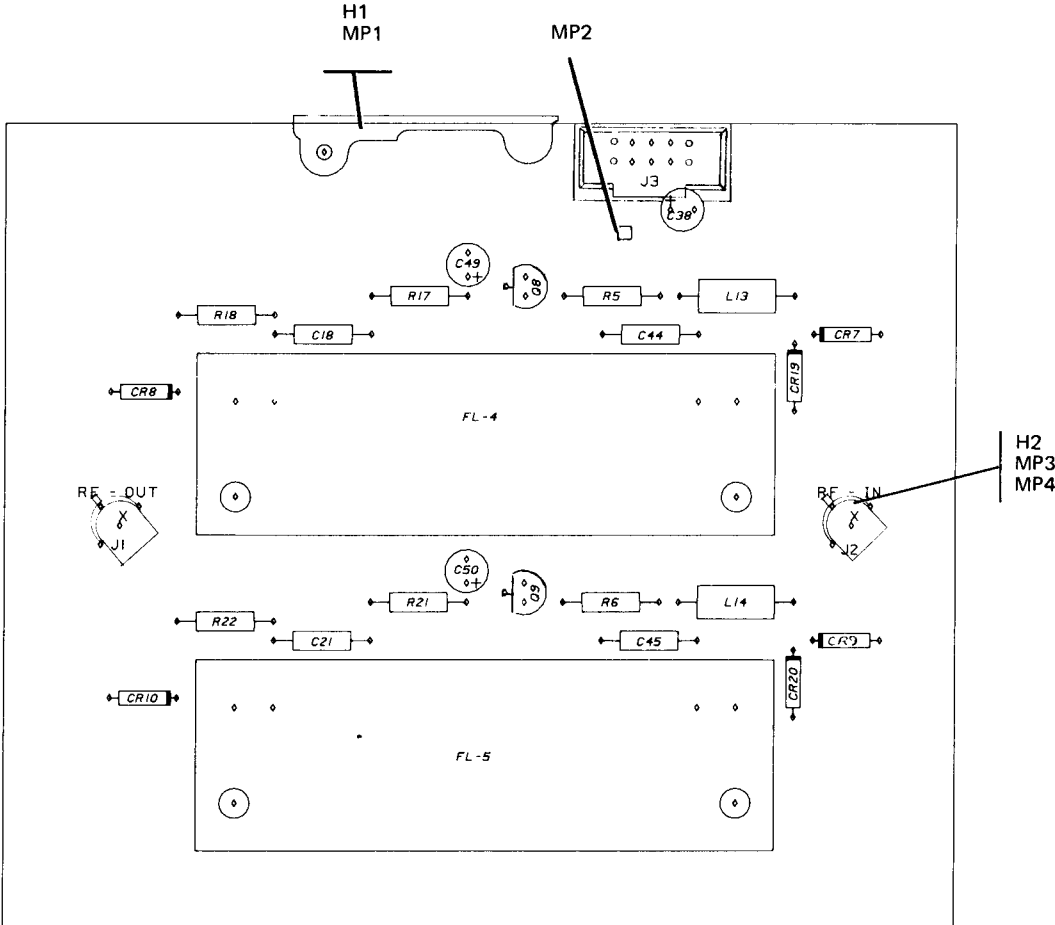
	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	240-2715-490		96906	MS75089-23
	240-2715-400		96906	MS75089-14
	240-2715-490		96906	MS75089-23
	240-2037-000		96906	MS75084-14
	240-2520-000		96906	MS90538-16
	240-2715-370		96906	MS75089-11
	240-1583-000		96906	MS14046-7
	240-2715-250		96906	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
	305-1701-000		96906	MS16535-2
	280-2745-040		12998	280-2745-040
	150-0684-060		19080	RCR800060-4A
	352-1140-010		01295	3N201
	352-0723-010		04713	MPS918
	352-5501-010		04713	MPS2222A
0.125 (QTY 2)	352-0671-010		02735	2N3866
	705-0701-000		96214	705-0701-000
	745-0719-000		81349	RCR07G151KS
%, 750V	745-0737-000		81349	RCR07G471KS
10%, 1/4W	745-0791-000		81349	RCR07G153KS
1/4W	745-0821-000		81349	RCR07G104KS
10%, 1/4W	745-0791-000		81349	RCR07G153KS
1/4W	745-0743-000		81349	RCR07G681KS
10%, 1/4W	745-0821-000		81349	RCR07G104KS
10%, 1/4W	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
1/4W	705-3601-230		81349	RN60D3093F
	382-0038-360		73138	72XR10K
%, 1/8W	705-0993-000		81349	RN55D8660F
1/4W	705-3601-330		81349	RN60D5233F
	382-0038-360		73138	72XR10K
1/8W	705-1003-000		81349	RN55D1401F
1/8W	705-3605-250		81349	RN55D3401F
%, 1/8W	705-3600-870		81349	RN55D6340F
1/8W	705-3605-040		81349	RN55D1241F
1/4W	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
1/8W	705-1114-000		81349	RN55D2873F
10%, 1/4W	745-0821-000		81349	RCR07G104KS
0%, 1/4W	745-0677-000		81349	RCR07G100KS
1/8W (A3)	705-3604-020		81349	RN55J1073F
1/8W	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
1/4W	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
C1	CIRCUIT CARD ASSEMBLY CAPACITOR,FXD CER DIE, 0.10UF, P80/M20%, 50VDC	642-3578-001 913-3331-030			642-3578-001 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



638-6914-002

TPA-5296-019

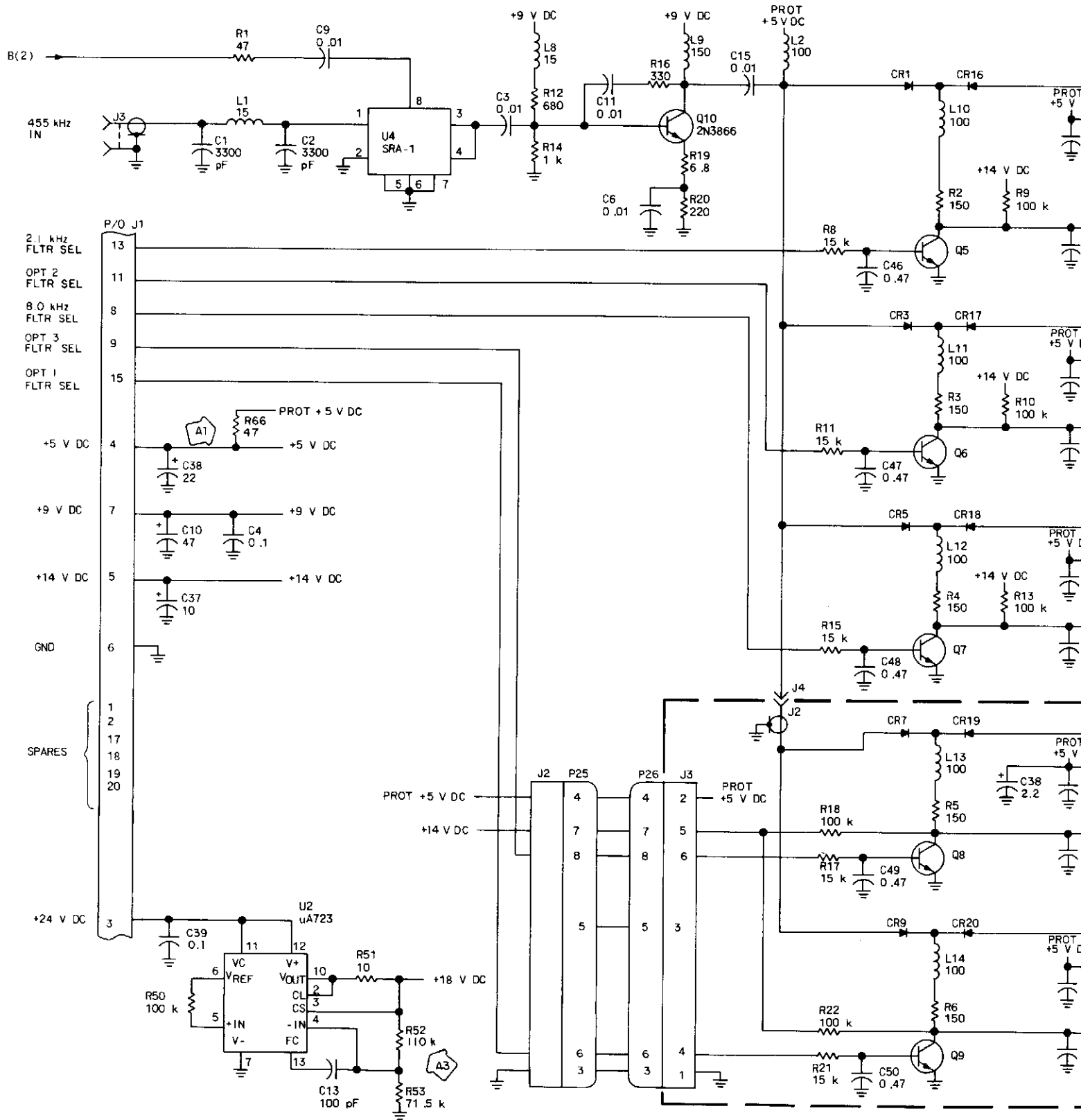
Passband Tuning Option, Parts Location
Figure 5 (Sheet 1 of 2)

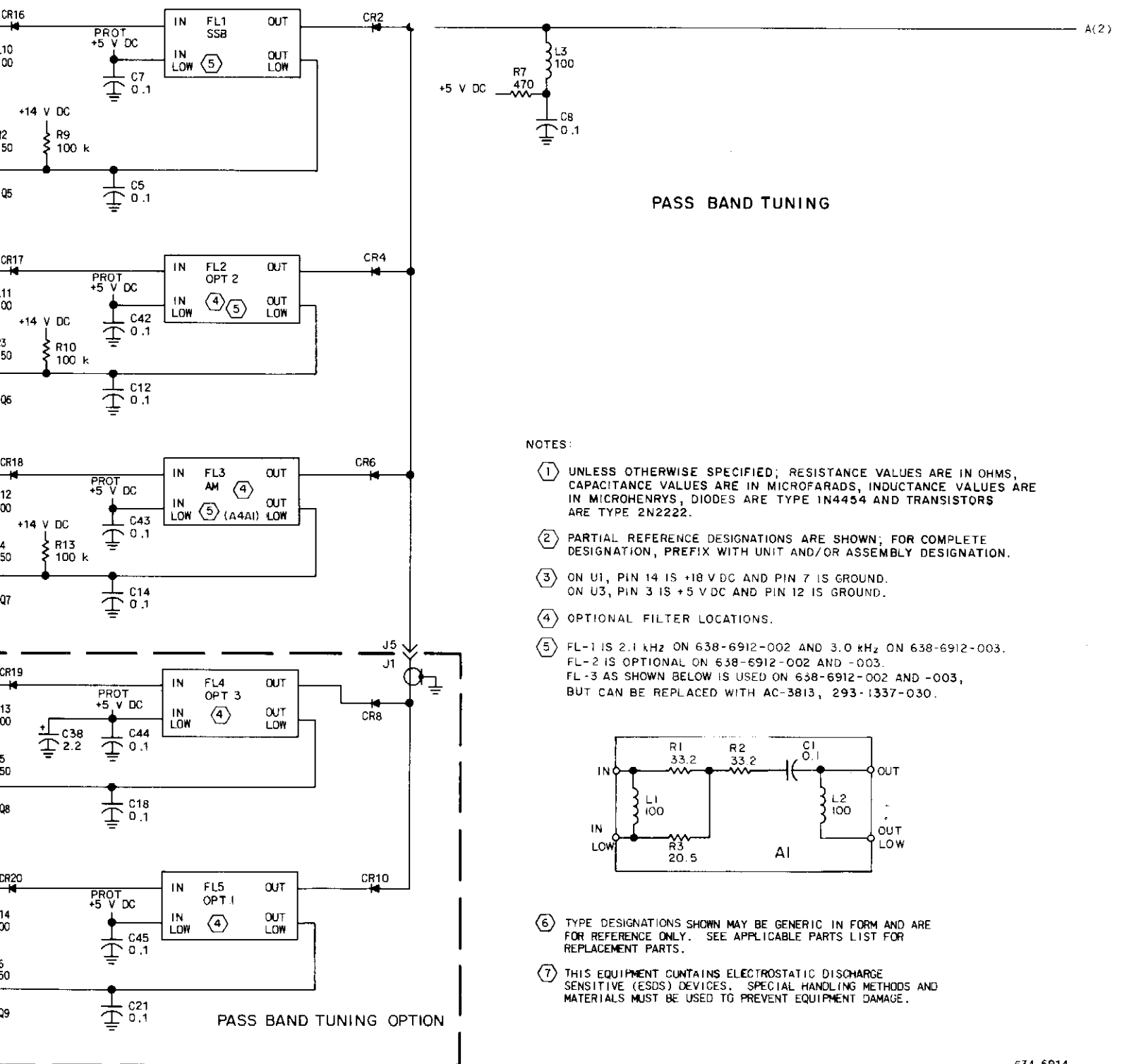
PARTS LIST

MODIFICATION HISTORY

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVE
CR1-CR6	PASS BAND TUNING	638-6914-002					638-6914-002	
CR7-CR10	NOT USED							
CR11-	SEMICOND DEVICE	353-3644-010		03508	1N4454GE			
CR18	NOT USED					A1	J3 changed to 372-0043-330	REV D
CR19,CR2	SEMICOND DEVICE	353-3644-010		03508	1N4454GE			
0								
C1-C17	NOT USED							
C18	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U10408050			
C19,C20	NOT USED							
C21	CAPACITOR,FXD CER DIEL, 0.10UF, P80%M20%, 50VDC	913-3331-030		56289	292CY5U10408050			
C22-C37	NOT USED							
C38	CAPACITOR,FXD THTLM 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	292CY5U10408050			
C46-C48	NOT USED							
C49,C50	CAPACITOR,FXD THTLM 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			

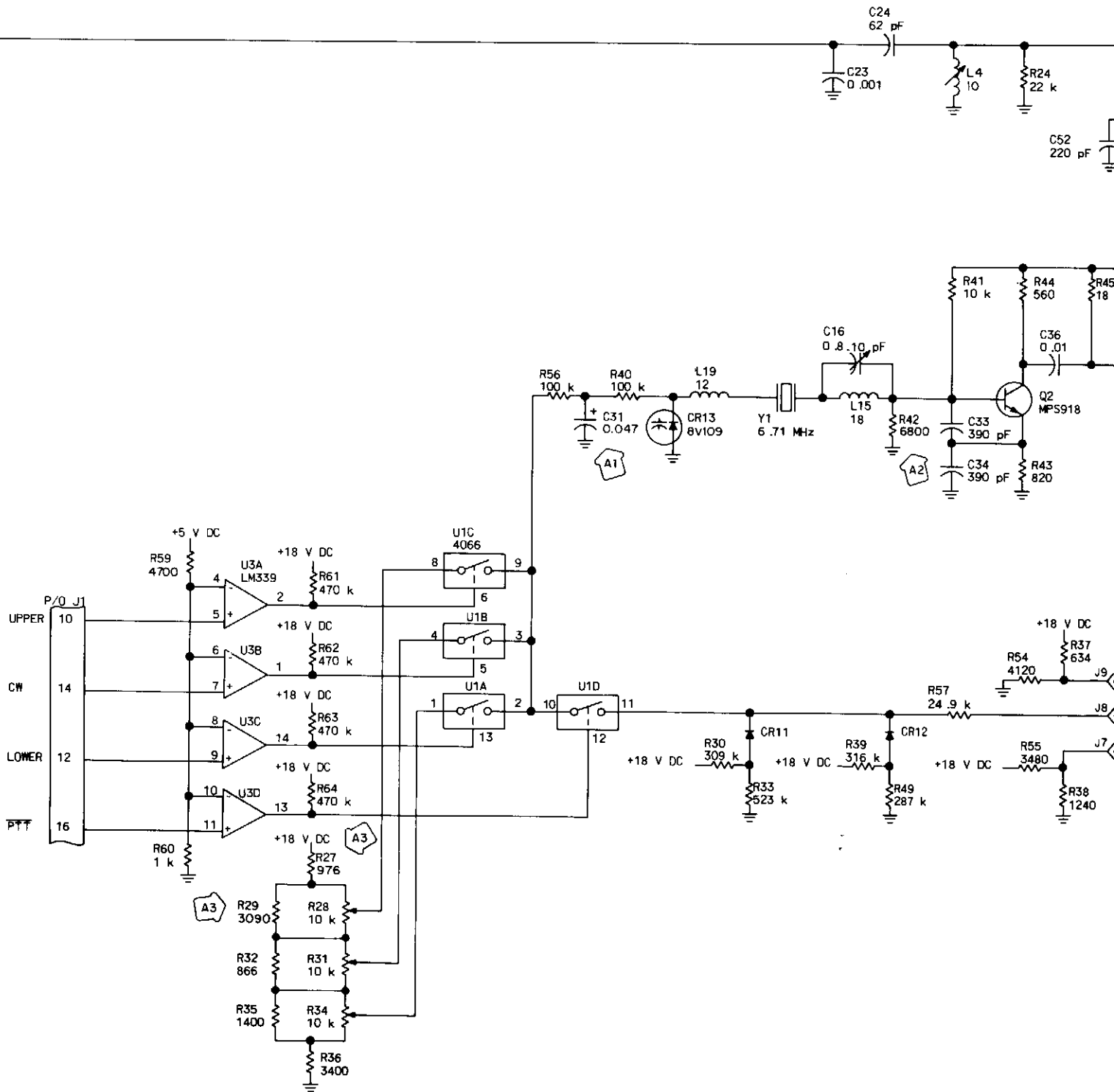
Passband Tuning Option, Parts Location
Figure 5 (Sheet 2)

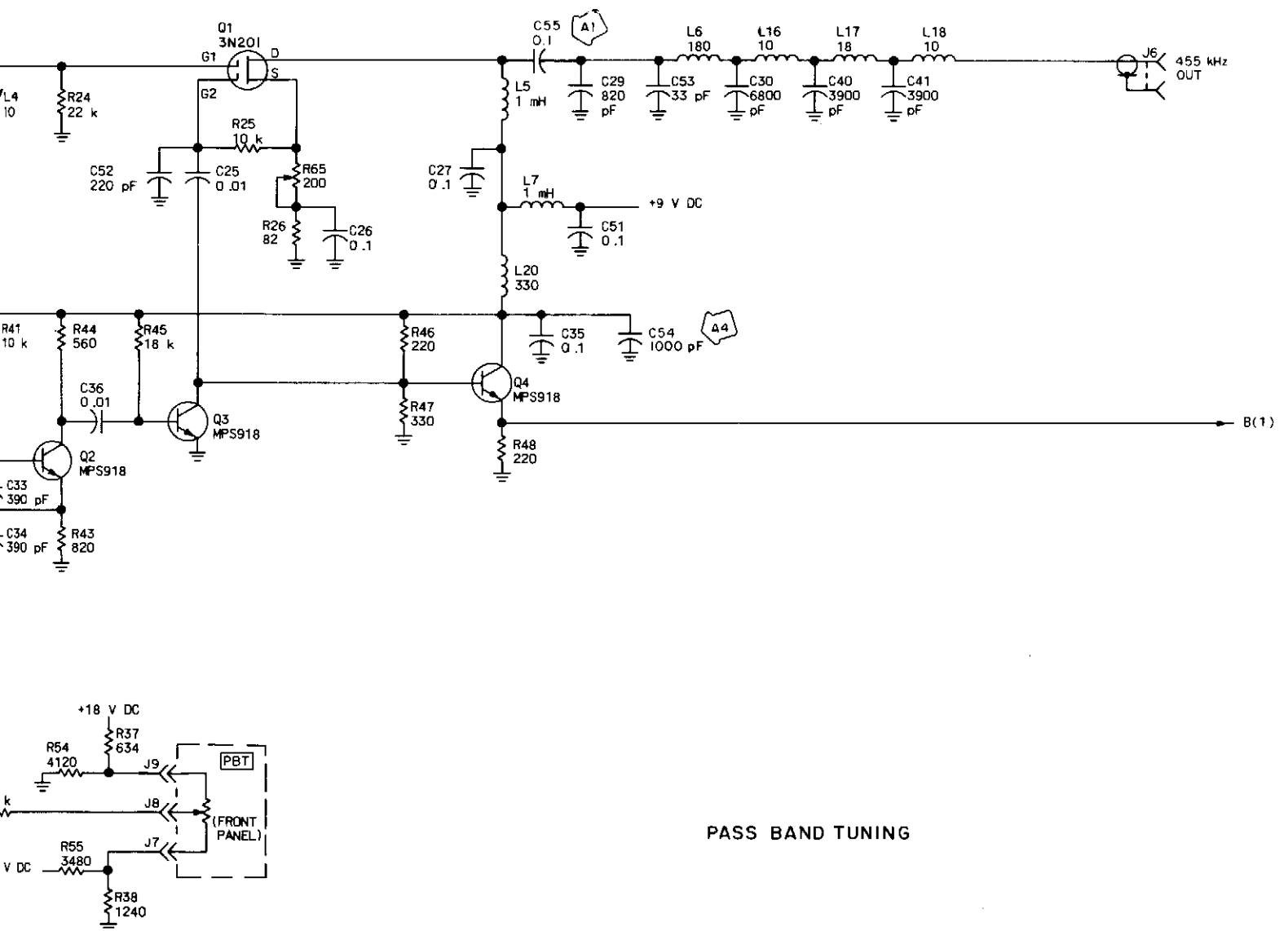




**Passband Tuning and Passband Tuning Option,
Schematic Diagram
Figure 6 (Sheet 1 of 2)**

A(1)





PASS BAND TUNING

634-6914
TPA-1723-024

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



**Rockwell
International**

instructions

Synthesizer (641-7099-XXX)

Collins Telecommunications Products Division

523-0771743-001211

1 August 1982

Printed in USA

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 (com-

parator) 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.

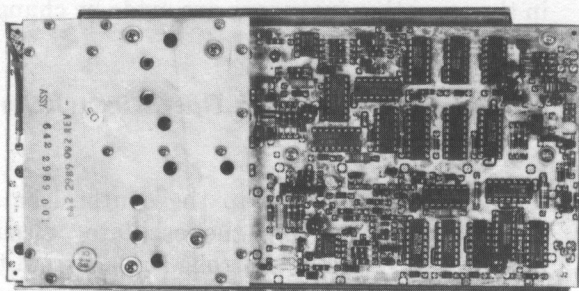
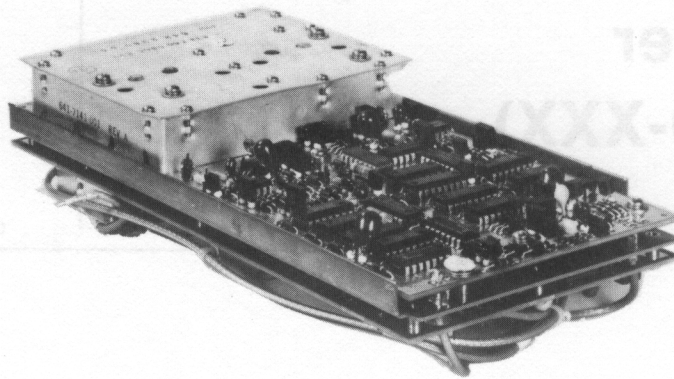
2.2 Overall Synthesizer Operation (Refer to figure 3)

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.

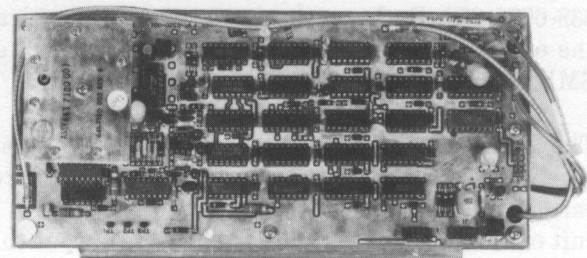
The 39.6-MHz input is divided down to 9.9 MHz and returned to the control card for use as a clock signal; to 100 kHz for the synthesizer loop 2 reference frequency; and to 500 Hz for the variable reference loop reference frequency.

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



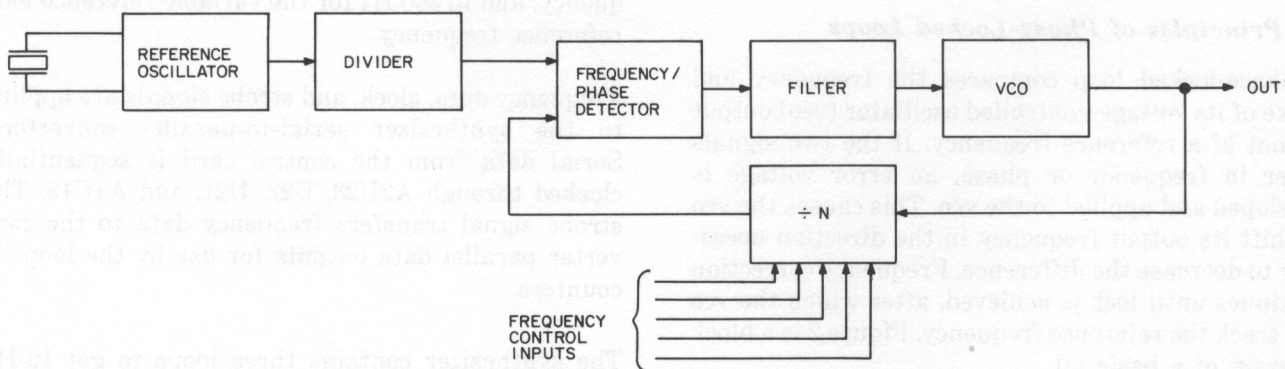
A1



A2

TPA-5271-017

Synthesizer
Figure 1



Basic Phase-Locked Loop, Block Diagram
Figure 2

TPA- 0832 - 013

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 $\div N$ 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 $\div N$ 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 $\div N$ 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 $\div N$ 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.

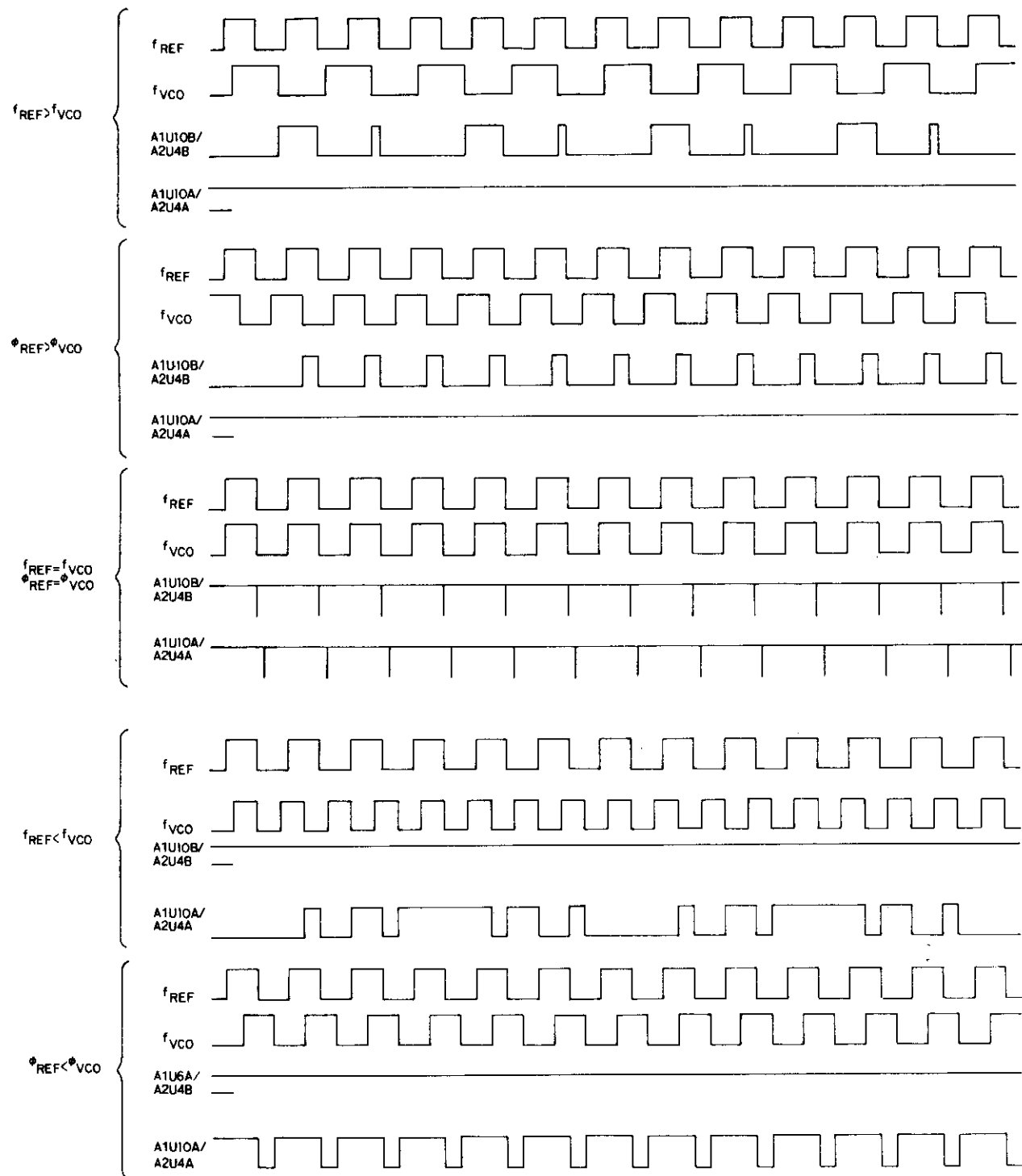
A tracking voltage is output from U11A in loop 2 through R61 and R88 to the vco input of loop 1. This signal ensures that the frequency of loop 1 is always higher than that of loop 2. The tracking voltage is the primary control voltage for the vco of loop 1. The filter output of loop 1 provides fine 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 $\div N$ 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 $\div 10$ 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 $\div N$ 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

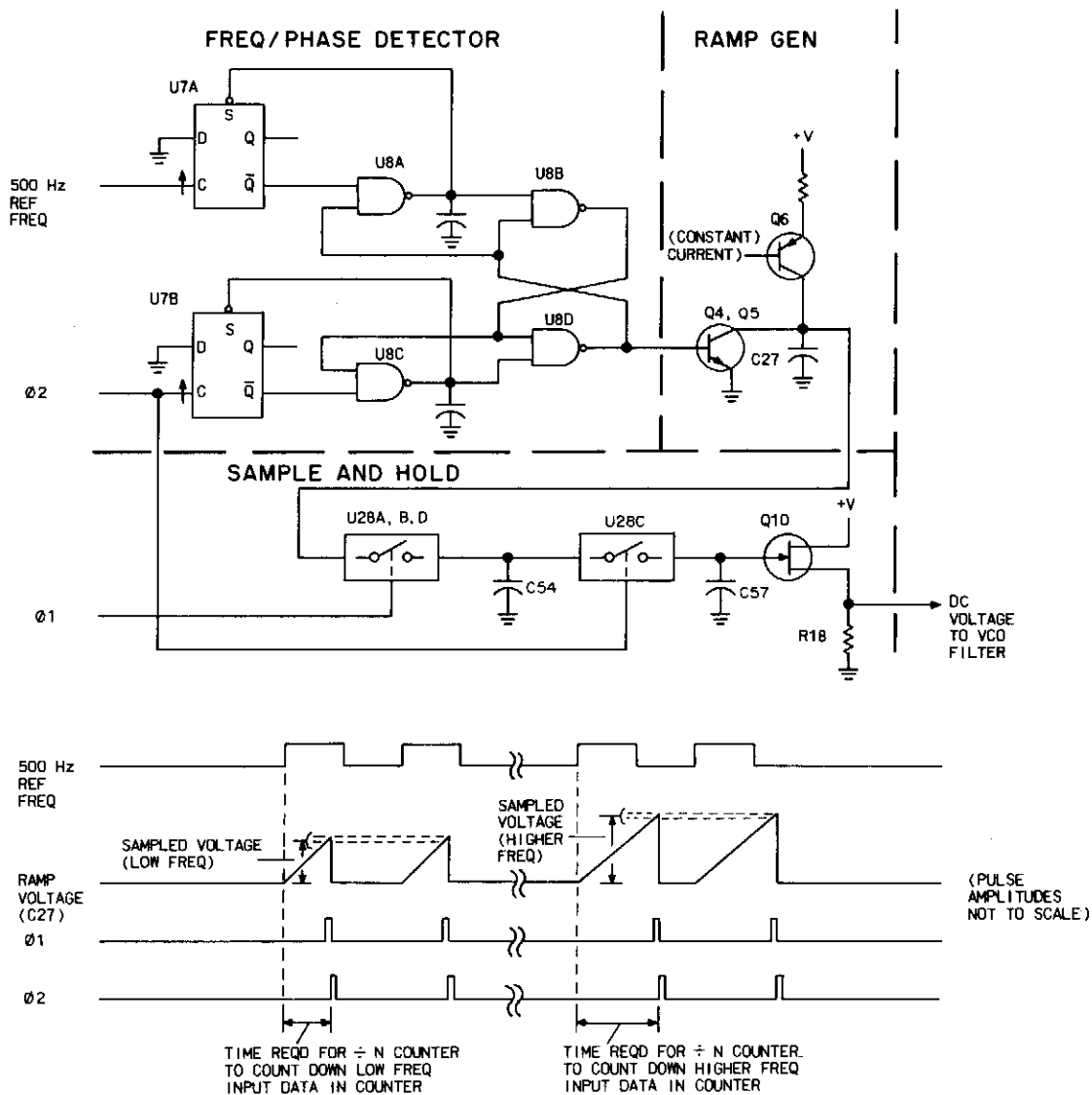
bed equivalent of the respective frequency digits. It has been modified by the microprocessor in the control circuit card.) The serial data is strobed to the converter outputs in parallel format for application to counters U16 through U20. At the time the counter load line is a logic 0, data is loaded 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 $\div 20/21$ 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 $\div 20$ 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 $\emptyset 1$ and $\emptyset 2$ clock pulses for the frequency/phase detector, ramp generator, and sample and hold circuit. These pulses are 100- μ s wide with the $\emptyset 2$ pulse immediately following the $\emptyset 1$ pulse.

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



TPA-2190-014

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, caus-

ing 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 flop-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 $\div N$ 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 $\div 20/21$ 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 synthesizer 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 con- trol 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 μ s/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. <table><tr><td>00.000 00</td><td>39.145 00</td></tr><tr><td>00.999 99</td><td>40.144 99</td></tr><tr><td>12.000 00</td><td>51.145 00</td></tr><tr><td>12.999 99</td><td>52.144 99</td></tr><tr><td>13.000 00</td><td>52.145 00</td></tr><tr><td>13.999 99</td><td>53.144 99</td></tr><tr><td>14.000 00</td><td>53.145 00</td></tr><tr><td>29.000 00</td><td>68.145 00</td></tr><tr><td>29.999 99</td><td>69.144 99</td></tr></table>	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		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. f. Measure voltage at TP1.	+15.0 ±0.03 V	Adjust A1L12 as necessary.																		
(Cont)																					

Table 2. Synthesizer Test Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	g. Measure voltage at TP2.	+14.3 $\pm$ 0.03 V	Adjust A1L2 as necessary.
	h. Set transceiver dial to 12.500 00 MHz.		
	i. Measure voltage at TP1.	+15.0 $\pm$ 0.03 V	Adjust A1L11 as necessary.
	j. Measure voltage at TP2.	+14.3 $\pm$ 0.03 V	Adjust A1L1 as necessary.
	k. Set transceiver dial to 0.500 00 MHz.		
	l. Measure voltage at TP3.	+9.0 $\pm$ 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 $\pm$0.03 V at TP1. Set dial to 12.500 00 MHz and adjust L11 for +15.0 $\pm$0.03 V at TP1. Set dial to 0.500 00 MHz and measure voltage at TP3. If not 9.0 $\pm$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 $\pm$0.03 V at TP2. Set dial to 12.500 00 MHz and adjust L1 for +14.3 $\pm$0.03 V at TP2. Set dial to 0.500 00 MHz and measure voltage at TP3. If not +9.0 $\pm$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 $\pm$ 1.25 V dc	Check A2Q3, Q12, and U25A.
7. +18-V output	Measure voltage at A2TP2.	+17.4 $\pm$ 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.

BINARY WEIGHT	16	8	4	2	1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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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=

$$\begin{array}{r} 54321 + 294500 \\ \underline{20} \\ = \underline{348821} \\ \underline{20} \\ = 17439.05 \end{array}$$

-2
-2

BINARY EQUIV OF

THESE
BITS=1
OTHERS
=0

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

BITS 25-29= 0.05 x 20=1

BINARY EQUIV OF

THIS
BIT=1
OTHERS
=0

BINARY EQUIV OF

$$\left\{ \begin{array}{r} 1 \\ (\text{BIT } 29) \quad -1 \\ \hline 0 \end{array} \right.$$

BITS 30-32=0

EXAMPLE 15.00000 MHz

BITS 1-5= BINARY EQUIV OF

THESE
BITS=1
OTHERS
=0

(BIT 2)	-8
(BIT 3)	-4
(BIT 4)	-2
(BIT 5)	-1
	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	{	(BIT 11)	14723
			<u>-8192</u>
		(BIT 12)	6531
			<u>-4096</u>
		(BIT 13)	2435
			<u>-2048</u>
		(BIT 16)	387
			<u>-256</u>
		(BIT 17)	131
	<u>-128</u>		
		3	
		<u>-2</u>	
		1	
		<u>-1</u>	
		0	

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

BITS 30-32=0

EXAMPLE 29.99999 MHz

BITS 1-5 BINARY EQUIV OF

29

THESE
BITS=1
OTHERS
=0

$$\left\{ \begin{array}{r} \text{(BIT 1)} \quad -16 \\ \quad \quad \quad 13 \\ \text{(BIT 2)} \quad -8 \\ \quad \quad \quad 5 \\ \text{(BIT 3)} \quad -4 \\ \quad \quad \quad 1 \\ \text{(BIT 5)} \quad -1 \\ \quad \quad \quad 0 \end{array} \right.$$

BIT 6=1
BIT 7,8=0
BITS 9-24=

$$\begin{array}{r} 99999 + 294500 \\ \hline 20 \\ = 394499 \\ \hline 20 \\ = 19722.95 \end{array}$$

BINARY EQUIV OF

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

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

BITS 25-29 $0.95 \times 20 = 19$
BINARY EQUIV OF

THESE BITS = 1 OTHERS = 0	{	(BIT 25)	19
			-16
		(BIT 28)	3
			-2
		(BIT 29)	1
			-1
			0

BITS 30-32=0

TPA-2191-014

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. b. Measure frequency at A2P4. c. Measure frequency at A2U5B-13. Note Tests 3 through 7 are for loop 2 operation.	9.9000 MHz 100.0 kHz 500 Hz	Check A2U1A and U1B. Check A2U2 and U3. Check A2U4A, U4B and U5B.
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. 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.	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.	
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. -6 -7 -14 -13	Note Values in parentheses are for 15.000 00 MHz. Use appropriate values for frequency being checked. (1) (1) (1) (1)	Check A1U18.
(Cont)			

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. c. Increase voltage at A1R62 to +15.01 V. d. Measure frequency at A1R76. e. Tune transceiver to 12 MHz. f. Decrease voltage at A1R62 to +15.00 V. g. Measure frequency at A1R76. h. Decrease voltage at A1R62 to +5.35 V. i. Measure frequency at A1R76.	49.22 MHz (This is output frequency that is normally generated for 13.5-MHz dial frequency.) 65.21 MHz (This is output frequency that is normally generated for 29.5-MHz dial frequency.) 48.23 MHz (frequency normally generated for 12.5-MHz dial frequency) 36.21 MHz	Check loop-2 vco circuit. Check loop-2 vco circuit. Check bandswitch circuit Q8, Q9, CR11, L11. Check loop 2 vco circuit. 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. d. Remove power supply from A1R62/C57 and A5A1U11-2. Note Tests 8 through 13 are for variable reference frequency loop operation.	Logic 1 level with momentary negative-going spikes. (Refer to figure 4.)	Check A1Q13, Q14, U8, U9, and U10.
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.) 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.	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.	
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: A2U21-11 -12 -13 -14 -7 -6 -5 -4	Note Values in parentheses are for 15.000 00 MHz. Use appropriate values for frequency being checked. (0) (0) (1) (1) (1) (0) (0) (1)	Check A2U23.
(Cont)			

Table 4. Synthesizer Troubleshooting Procedures (Cont.).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	A2U22-11 -12 -13 -14 -7 -6 -5 -4 A2U23-11 -12 -13 -14 -7 -6 -5 -4	(1) (0) (0) (0) (0) (0) (1) (1) (0) (0) (0) (0) (0) (0) (0) (0)	Check A2U22. Check A2U21.
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. e. Apply +2.94 V to junction of A2R21/C51/R22. f. Measure frequency at P6. 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.)	3.955 MHz 4.039 MHz	Check A2Q9, Q7, and oscillator components. Check A2U26 and U27. Check A2CR3 and CR4.
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. 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.
(Cont)			

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 at 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
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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	STAVEL 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

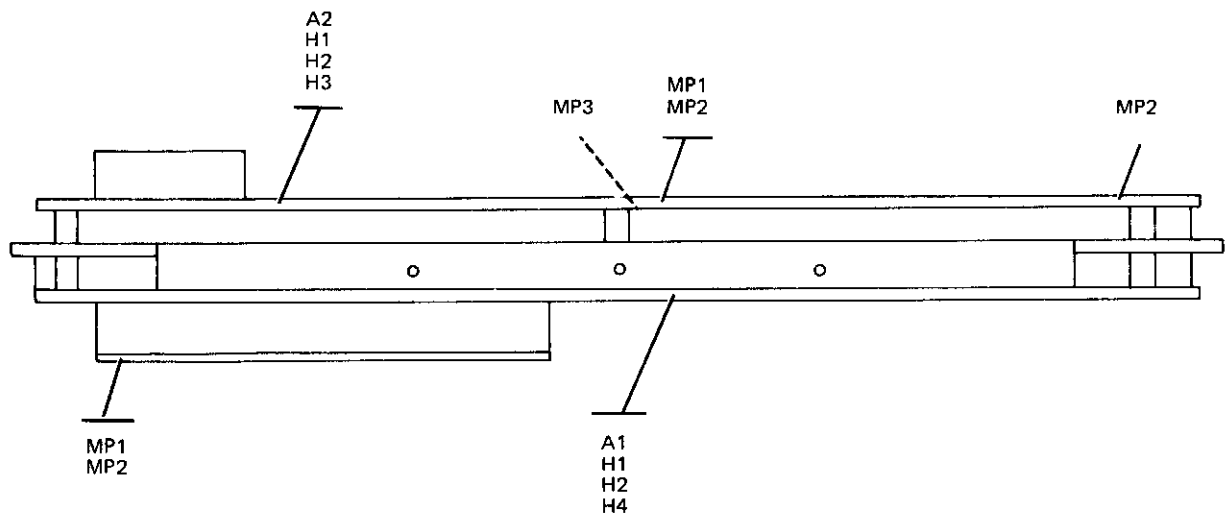
MFR CODE	MANUFACTURER'S NAME AND ADDRESS
12040	NATIONAL SEMICONDUCTOR CORP COMMERCE DR P O BOX 443 DANBURY CT 06810
12954	SIEMENS CORP COMPONENTS GROUP 8700 E THOMAS RD P O BOX 1390 SCOTTSDALE AZ 85252
12998	QUALITY NAME PLATE INC MILL ROAD EAST GLASTONBURY CT 06025
13499	ROCKWELL INTERNATIONAL CORP 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

<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
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	SEAELECTRO CORP 225 HOYT MAMARONECK NY 10544

5.3 Equipment Covered

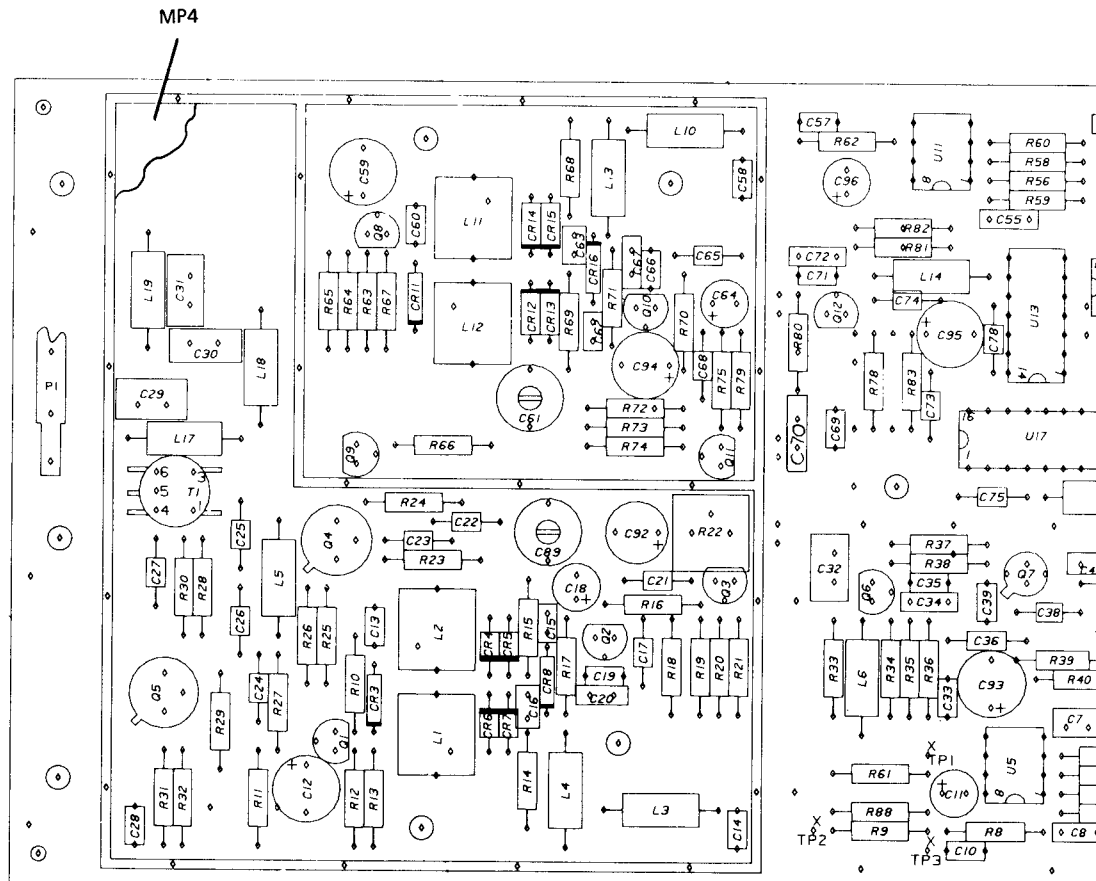
Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

<u>CIRCUIT CARD/ SUBASSEMBLY</u>	<u>COLLINS PART NUMBER</u>	<u>LATEST EFFECTIVITY</u>
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

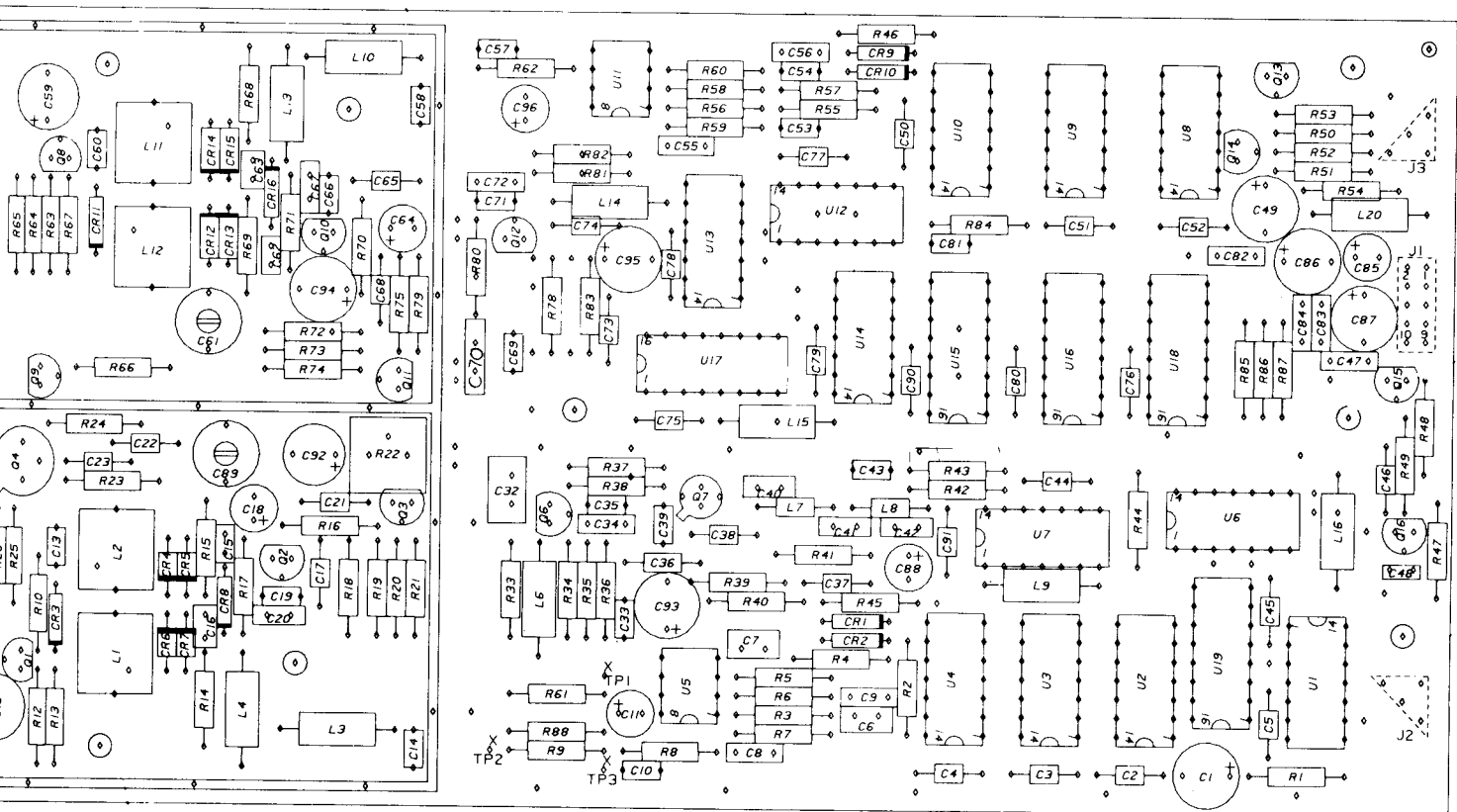


TPA-5297-049

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



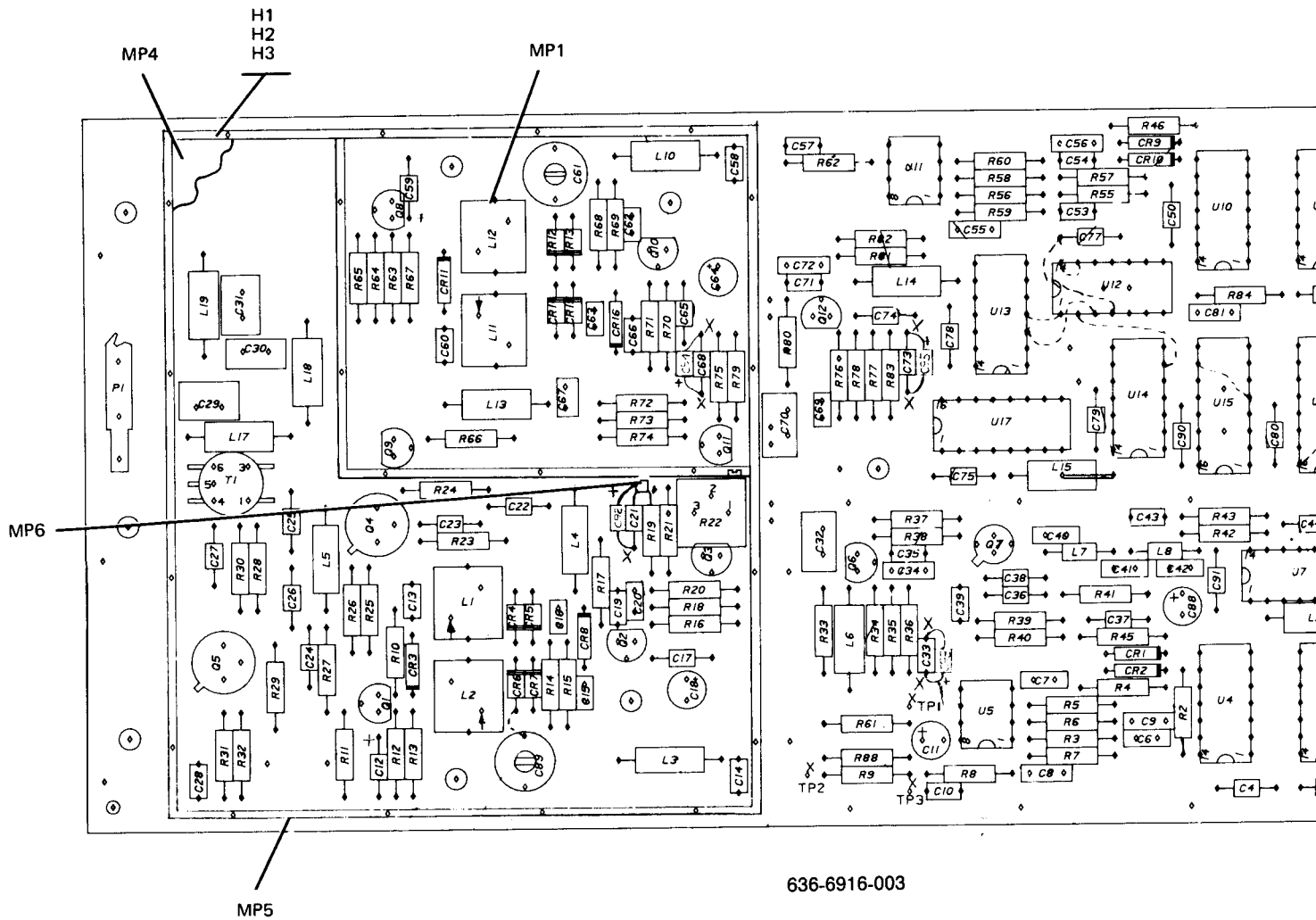
638-6916-002



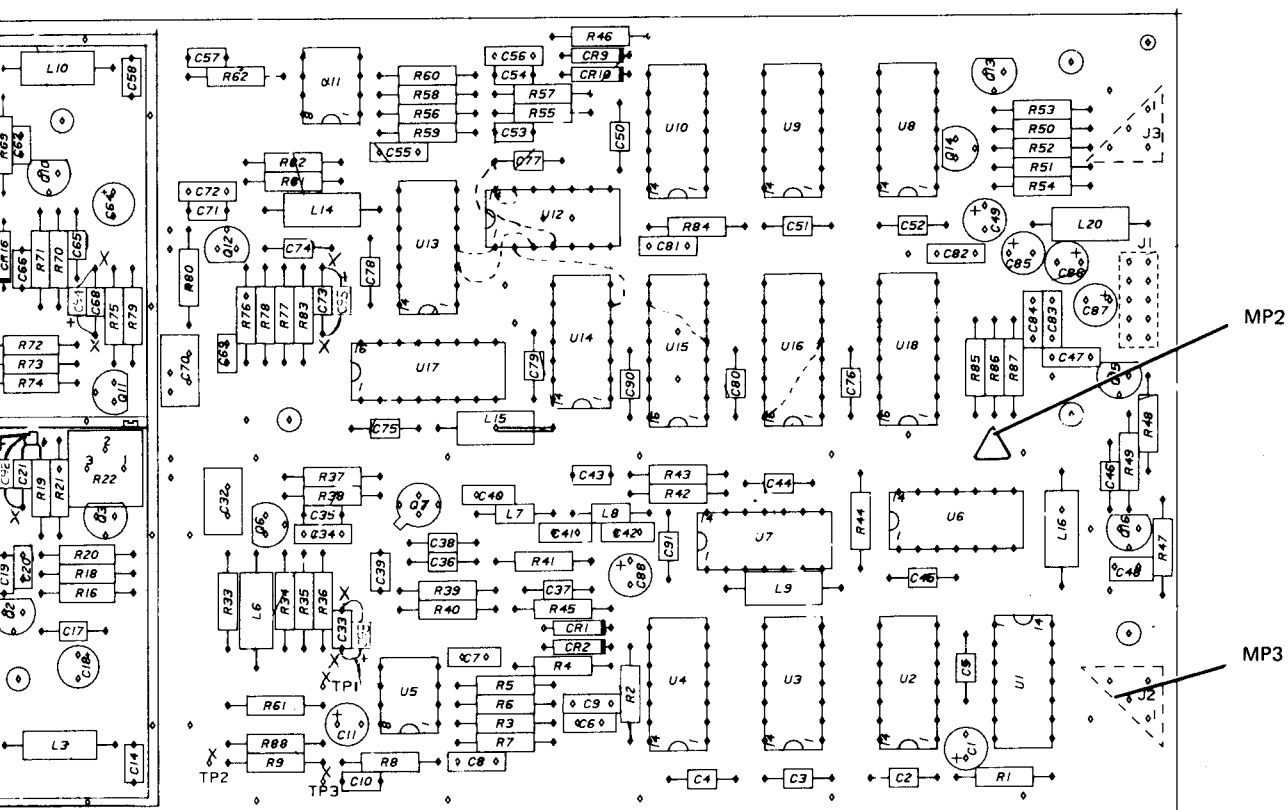
638-6916-002

TPA-5297-049

Synthesizer, Parts Location
Figure 6 (Sheet 2)



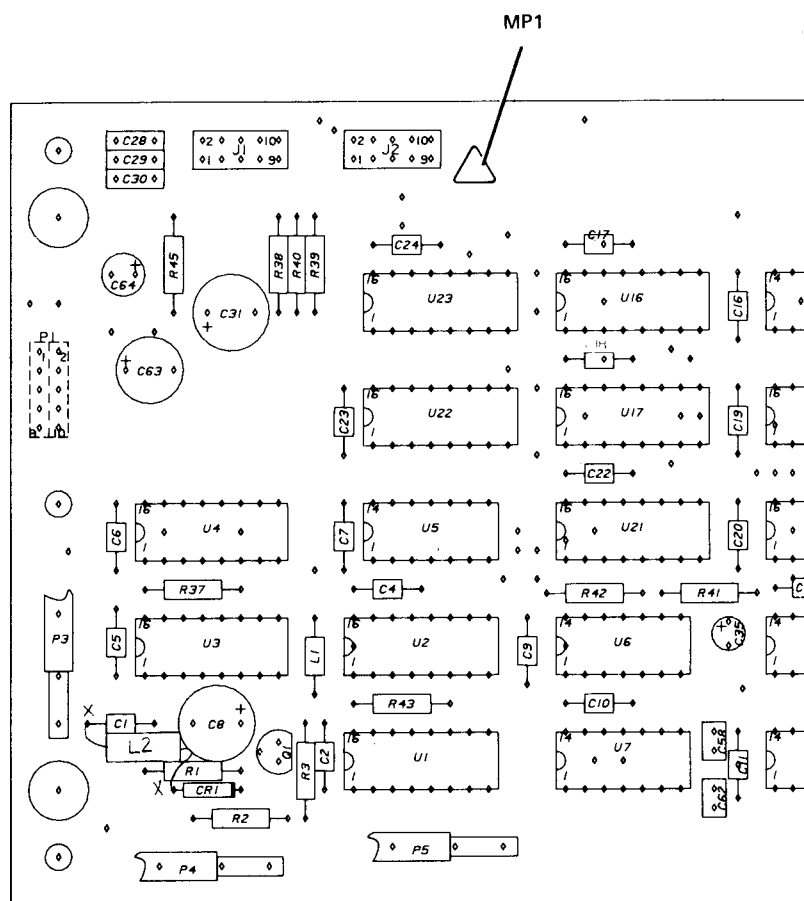
Synthesizer, Parts Loc
Figure 6 (Sheet 3)

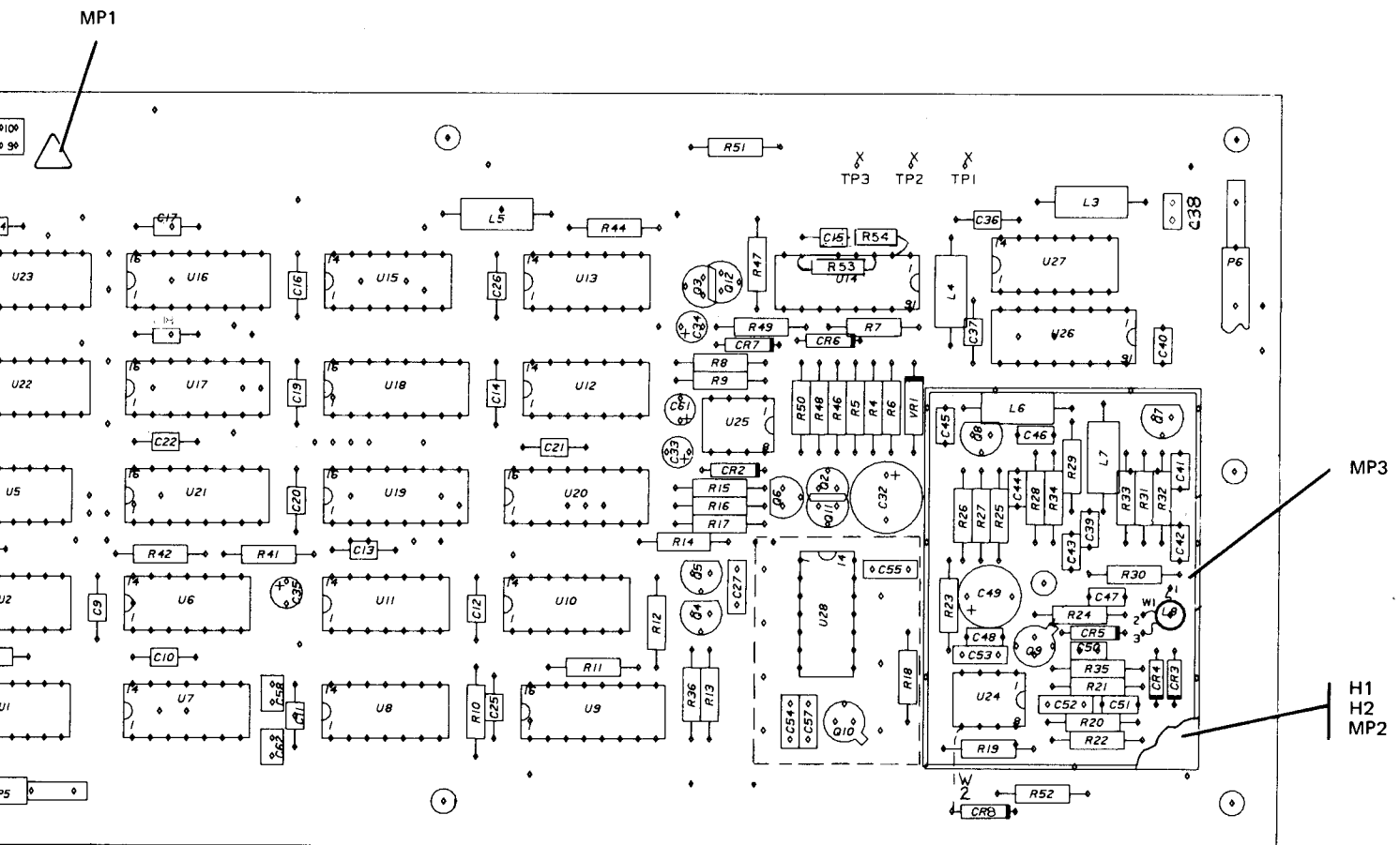


636-6916-003

TPA-5297-049

Synthesizer, Parts Location
Figure 6 (Sheet 3)





638-6920-001/002

TPA-5297-049

Synthesizer, Parts Location
Figure 6 (Sheet 4)

PARTS LIST

PARTS LIST (Co

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REF DES	DESCRIPTION
	SYNTHESIZER (ESDS)	641-7099-002 A			641-7099-002	C73-C80	CAPACITOR, FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC
	SYNTHESIZER (ESDS)	641-7099-003 B				C81	CAPACITOR, FIXED CER DIEL, 2200PF, 10%, 100V
	OUTPUT LOOP (ESDS)	638-6916-002 C			638-6916-002	C82-C84	CAPACITOR, FIXED CER DIEL, 0.1UF, 10%, 100VDC
	OUTPUT LOOP (ESDS)	638-6916-003 D				C85	CAPACITOR, FIXED TMTLM ELCTLT, 4.7UF, 20%, 35V
	VARIABLE LOOP (ESDS)	638-6920-001 E			638-6920-001	C86-C88	CAPACITOR, FIXED TMTLM ELCTLT, 22UF, 20%, 15V
	VARIABLE LOOP (ESDS)	638-6920-002 F				C89	CAPACITOR, VAR CER DIEL, 2 TO 8PF, 350V
H1	WASHER, FLAT SST, 0.125 ID X 0.312 OD (QTY 18)	310-0045-000		79807	310-0045-000	C90, C91	CAPACITOR, FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC
H2	WASHER, LOCK SST, 0.115 ID X 0.209 OD (QTY 20)	310-0279-000		96906	MS3338-135	C92-C95	CAPACITOR, FIXED TMTLM ELCTLT, 4.7UF, 20%, 20V
H3	SCREW, MACH STL, 4-40 X 1 (QTY 5)	343-0141-000		96906	MS51957-21	C96	CAPACITOR, FIXED TMTLM ELCTLT, 4.7UF, 20%, 35V
H4	SCREW, MACH SST, 4-40 X 5/16 (QTY 15)	343-0134-000		96906	MS51957-14	H1	WASHER, LOCK SST, 0.088 ID X 0.172 OD (QTY 15)
MP1	TERMINAL LUG	304-1089-000		79963	403	H2	WASHER, FLAT BRS, 0.105 ID X 1/4 OD (QTY 15)
MP2	TIE, CABLE	435-1169-100		96906	MS3367-4-9	H3	SCREW, MACH SST, 2-56 X 3/8 (QTY 15)
MP3	LABEL, PRESS SENS	280-2745-020		12998	280-2745-020	J1	CONNECTOR, HDR
	OUTPUT LOOP (ESDS)	638-6916-002 C			638-6916-002	J2, J3	CONNECTOR, RCPT ELEC
	OUTPUT LOOP (ESDS)	638-6916-003 D					CONNECTOR, RCPT ELEC
CR1, CR2	SEMICONV DEVICE	353-3644-050		03508	DA2779GE	L1	COIL, RF, VAR 0.253MIN UH TO 0.479MAX UH
CR3	SEMICONV DEVICE	353-3733-010		28480	HP-3168	L2	COIL, RF, VAR 0.315MIN UH TO 0.630MAX UH (A1)
CR4-CR7	SEMICONV DEVICE (OBSOLETE) (A3)	922-6131-010		12954	BB109-6131-010	L2	COIL, RF, VAR 0.315MIN UH TO 0.565MAX UH
CR4-CR7	SEMICONV DEVICE	922-6131-030		12954	BB409N	L3-L6	COIL, RF 4.70UH
CR8	SEMICONV DEVICE (ESDS)	353-3691-010		28480	1N5711	L7, L8	COIL, RF 68UH
CR9, CR10	SEMICONV DEVICE	353-3644-050		03508	DA2779GE	L9, L10	COIL, RF 4.70UH
CR11	SEMICONV DEVICE	353-3733-010		28480	HP-3168	L11	COIL, RF, VAR 0.253MIN UH TO 0.479MAX UH
CR12-CR15	SEMICONV DEVICE (OBSOLETE) (A3)	922-6131-010		12954	BB109-6131-010	L12	COIL, RF, VAR 0.315MIN UH TO 0.630MAX UH (A1)
CR12-CR15	SEMICONV DEVICE	922-6131-030		12954	BB409N	L12	COIL, RF, VAR 0.315MIN UH TO 0.565MAX UH
CR16	SEMICONV DEVICE (ESDS)	353-3691-010		28480	1N5711	L13, L14	COIL, RF 4.70UH
C1	CAPACITOR, FIXED TMTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239	L15	COIL, RF 2.70UH
C2-C5	CAPACITOR, FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	L16	COIL, RF 68UH
C6, C7	CAPACITOR, FXD MICA DIEL, 180PF, 5%, 50V	912-4141-430		93790	CD5FY181J0	L17-L19	COIL, RF 0.22UH
C8, C9	CAPACITOR, FIXED CER DIEL, 0.82UF, 10%, 50VDC	913-5019-550		81349	CK06BX824K	L20	COIL, RF 68UH
C10	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	L21	COIL, RF 4.70UH
C11	CAPACITOR, FIXED TMTLM ELCTLT, 2.2UF, 20%, 35V	184-9102-370		56289	199D225X0035CB1	MP1	CAN, SQUARE (QTY 4)
C12	CAPACITOR, FIXED TMTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239	MP2	LABEL, PRESS SENS (ESDS)
C13	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	MP3	JACK, TIP (QTY 2)
C14	CAPACITOR, FIXED CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K	MP4	COVER
C15	CAPACITOR, FIXED CER DIEL, 18PF, 10%, 100VDC	913-1098-030		72982	8101-100-COG-180 K	MP5	SHIELD
C16	CAPACITOR, FIXED CER DIEL, 100PF, PORM5%, 100V	913-3281-280		51642	200-100NP0-101J	MP6	CONNECTOR, HDR (QTY 5)
C17	CAPACITOR, FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	Q1	TRANSISTOR
C18	CAPACITOR, FIXED TMTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X00150B1	Q2	TRANSISTOR
C19	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	Q3	TRANSISTOR
C20	CAPACITOR, FXD MICA DIEL, 4PF, PORM 0.5PF, 300V	912-4141-080		93790	CD5CC040D0	Q4, Q5	TRANSISTOR
C21-C27	CAPACITOR, FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	Q6	TRANSISTOR
C28	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	Q7	TRANSISTOR, FET (ESDS)
C29-C31	CAPACITOR, FXD MICA DIEL, 47PF, 5%, 500V	912-3856-000		81349	CM04ED470J03	Q8	TRANSISTOR
C32	CAPACITOR, FIXED CER DIEL, 18PF, 10%, 100VDC	913-1098-030		72982	8101-100-COG-180 K	Q9	TRANSISTOR
C33	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	Q10	TRANSISTOR
C34	CAPACITOR, FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K	Q11, Q12	TRANSISTOR
C35	CAPACITOR, FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K	Q13-Q15	TRANSISTOR
C36-C38	CAPACITOR, FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	R1	RESISTOR, FXD CMPSN, 82 OHMS, 10%, 1/4W
C39	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	R2-R5	RESISTOR, FXD CMPSN, 4.7K, 10%, 1/4W
C40	CAPACITOR, FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4141-120		93790	CD5CC120D0	R6, R7	RESISTOR, FXD CMPSN, 390 OHMS, 10%, 1/4W
C41	CAPACITOR, FXD MICA DIEL, 36PF, 5%, 50V	912-4141-240		93790	CD5EY360J0	R8	RESISTOR, FXD CMPSN, 5.6K, 10%, 1/4W
C42	CAPACITOR, FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4141-120		93790	CD5CC120D0	R9	RESISTOR, FXD FILM, 154K, 1%, 1/8W
C43	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	R10	RESISTOR, FXD CMPSN, 560 OHMS, 10%, 1/4W
C44-C46	CAPACITOR, FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	R11	RESISTOR, FXD CMPSN, 10K, 10%, 1/4W
C47	CAPACITOR, FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K	R12	RESISTOR, FXD CMPSN, 2.7K, 10%, 1/4W
C48	CAPACITOR, FXD MICA DIEL, 220PF, 5%, 50V	912-4141-450		93790	CD5FY221J0	R13	RESISTOR, FXD CMPSN, 150 OHMS, 10%, 1/4W
C49	CAPACITOR, FIXED TMTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239	R14	RESISTOR, FXD FILM, 1.82K, 1%, 1/8W
C50-C52	CAPACITOR, FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	R15	RESISTOR, FXD FILM, 30.1K, 1%, 1/8W
C53, C54	CAPACITOR, FIXED CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K	R16	RESISTOR, FXD CMPSN, 560 OHMS, 10%, 1/4W
C55, C56	CAPACITOR, FIXED CER DIEL, 0.22UF, 10%, 50VDC	913-5019-480		81349	CK06BX224K	R17	RESISTOR, FXD CMPSN, 150 OHMS, 10%, 1/4W
C57	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	R18, R19	RESISTOR, FXD CMPSN, 4.7K, 10%, 1/4W
C58	CAPACITOR, FIXED CER DIEL, 470PF, 10%, 200V	913-4014-000		81349	CK05BX471K	R20	RESISTOR, FXD CMPSN, 100 OHMS, 10%, 1/4W
C59	CAPACITOR, FIXED TMTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239	R21	RESISTOR, FXD CMPSN, 82 OHMS, 10%, 1/4W
C60	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	R22	RESISTOR, VAR 200 OHMS, 20%, 1/2W
C61	CAPACITOR, VAR CER DIEL, 2 TO 8PF, 350V	917-1218-000		72982	538011C0P089R	R23	RESISTOR, FXD FILM, 243 OHMS, 1%, 1/8W
C62	CAPACITOR, FIXED CER DIEL, 18PF, 10%, 100VDC	913-1098-030		72982	8101-100-COG-180 K	R24	RESISTOR, FXD CMPSN, 2.7K, 10%, 1/4W
C63	CAPACITOR, FIXED CER DIEL, 100PF, PORM5%, 100V	913-3281-280		51642	200-100NP0-101J	R25	RESISTOR, FXD FILM, 10 OHMS, 1%, 1/8W
C64	CAPACITOR, FIXED TMTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X00150B1	R26	RESISTOR, FXD CMPSN, 100 OHMS, 10%, 1/4W
C65	CAPACITOR, FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	R27	RESISTOR, FXD FILM, 243 OHMS, 1%, 1/8W
C66	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	R28	RESISTOR, FXD CMPSN, 2.7K, 10%, 1/4W
C67	CAPACITOR, FXD MICA DIEL, 4PF, PORM 0.5PF, 300V	912-4141-080		93790	CD5CC040D0	R29	RESISTOR, FXD CMPSN, 3.3K, 10%, 1/4W
C68	CAPACITOR, FIXED CER DIEL, 0.01UF, P80%M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	R30	RESISTOR, FXD CMPSN, 1K, 10%, 1/4W
C69	CAPACITOR, FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K	R31	RESISTOR, FXD CMPSN, 10 OHMS, 1%, 1/8W
C70	CAPACITOR, FXD MICA DIEL, 8PF, PORM 0.5PF, 300V	912-4141-110		93790	CD5CC080D0	R32	RESISTOR, FXD CMPSN, 6.8 OHMS, 10%, 1/4W (A2)
C71	CAPACITOR, FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K	R33	RESISTOR, FXD CMPSN, 330 OHMS, 10%, 1/4W
C72	CAPACITOR, FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K	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, 50 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)

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REF DES	DESCRIPTION	COLLINS PART NUMBER
C73-C80	CAPACITOR, FIXED CER DIE, 0.01UF, P80/M20%, 50VDC	913-3331-020		56289	292CV5U1032050B	R41	RESISTOR, FXD CHPSN, 100 OHMS, 10%, 1/4W	745-0
C81	CAPACITOR, FIXED CER DIE, 2200PF, 10%, 100V	913-5019-120		81349	CK05BX222K	R42	RESISTOR, FXD CHPSN, 1.5K, 10%, 1/4W	745-0
C82-C84	CAPACITOR, FIXED CER DIE, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K	R43, R44	RESISTOR, FXD CHPSN, 1K, 10%, 1/4W	745-0
C85	CAPACITOR, FIXED TMTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1	R45	RESISTOR, FXD CHPSN, 22K, 10%, 1/4W	745-0
C86-C88	CAPACITOR, FIXED TMTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X0015DB1	R46	RESISTOR, FXD CHPSN, 33K, 10%, 1/4W	745-0
C89	CAPACITOR, VAR CER DIE, 2 TO 8PF, 350V	917-1218-000		72982	538011C0P089R	R47	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W	745-0
C90, C91	CAPACITOR, FIXED CER DIE, 0.01UF, P80/M20%, 50VDC	913-3331-020		56289	292CV5U1032050B	R48-R51	RESISTOR, FXD CHPSN, 10K, 10%, 1/4W	745-0
C92-C95	CAPACITOR, FIXED TMTLM ELCTLT, 47UF, 20%, 20V	184-9102-190		56289	196D239	R52, R53	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W	745-0
C96	CAPACITOR, FIXED TMTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X0035DB1	R54	RESISTOR, FXD CHPSN, 270 OHMS, 10%, 1/4W	745-0
H1	WASHER, LOCK SST, 0.088 ID X 0.172 OD (QTY 15)	310-0275-000		96906	MS35338-134	R55-R58	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W	745-0
H2	WASHER, FLAT BRS, 0.105 ID X 1/4 OD (QTY 15)	310-0130-000		05411	310-0130-000	R59, R60	RESISTOR, FXD CHPSN, 2.7K, 10%, 1/4W	745-0
H3	SCREW, MACH SST, 2-56 X 3/8 (QTY 15)	343-0126-000		96906	MS1957-5	R61	RESISTOR, FXD FILM, 1.82K, 1%, 1/8W	705-3
J1	CONNECTOR, HDR	372-2656-100		52072	CAD10SP100-230-430	R62	RESISTOR, FXD CHPSN, 5.6K, 10%, 1/4W	745-0
J2, J3	CONNECTOR, RCPT ELEC	357-0067-020	A, C, E	00779	226287-2	R63	RESISTOR, FXD CHPSN, 150 OHMS, 10%, 1/4W	745-0
L1	COIL, RF, VAR 0.253MIN UH TO 0.479MAX UH	357-7405-010	B, D, F	98291	51-051-0000	R64	NOT USED	
L2	COIL, RF, VAR 0.315MIN UH TO 0.630MAX UH (A1)	242-0439-070		02113	115CLWMDW9-STURN S	R65	RESISTOR, FXD CHPSN, 10K, 10%, 1/4W	745-0
L2	COIL, RF, VAR 0.315MIN UH TO 0.565MAX UH	242-0439-090		02113	115CLWMDR11-5TU RNS	R66	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W	745-0
L3-L6	COIL, RF 4.70UH	240-1576-000		02113	115CLWMDR11-5TU RNS	R67	RESISTOR, FXD CHPSN, 560 OHMS, 10%, 1/4W	745-0
L7, L8	COIL, RF 68UH	240-2045-000		02113	115CLWMDR11-5TU RNS	R68	RESISTOR, FXD FILM, 1.82K, 1%, 1/8W	705-3
L9, L10	COIL, RF 4.70UH	240-1576-000		02113	115CLWMDW9-STURN S	R69	RESISTOR, FXD FILM, 30.1K, 1%, 1/8W	705-1
L11	COIL, RF, VAR 0.253MIN UH TO 0.479MAX UH	242-0439-070		02113	115CLWMDR11-5TU RNS	R70	RESISTOR, FXD CHPSN, 560 OHMS, 10%, 1/4W	745-0
L12	COIL, RF, VAR 0.315MIN UH TO 0.630MAX UH (A1)	242-0439-040		02113	115CLWMDR11-5TU RNS	R71	RESISTOR, FXD CHPSN, 150 OHMS, 10%, 1/4W	745-0
L12	COIL, RF, VAR 0.315MIN UH TO 0.565MAX UH	242-0439-090		02113	115CLWMDR11-5TU RNS	R72, R73	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W	745-0
L13, L14	COIL, RF 4.70UH	240-1576-000		96906	MS18130-16	R74, R75	RESISTOR, FXD CHPSN, 100 OHMS, 10%, 1/4W	745-0
L15	COIL, RF 2.70UH	240-2715-180		96906	MS75088-6	R76, R77	RESISTOR, FXD CHPSN, 68 OHMS, 10%, 1/4W	745-0
L16	COIL, RF 68UH	240-2715-350		96906	MS75089-9	R78	RESISTOR, FXD CHPSN, 270 OHMS, 10%, 1/4W	745-0
L17-L19	COIL, RF 0.22UH	240-1563-000		96906	MS18130-2	R79	RESISTOR, FXD CHPSN, 180 OHMS, 10%, 1/4W	745-0
L20	COIL, RF 68UH	240-2715-350		96906	MS75089-9	R80	RESISTOR, FXD CHPSN, 330 OHMS, 10%, 1/4W	745-0
L21	COIL, RF 4.70UH	240-1576-000		96906	MS18130-16	R81	RESISTOR, FXD CHPSN, 6.8K, 10%, 1/4W	745-0
MP1	CAN, SQUARE (QTY 4)	141-0941-010		04232	307440	R82	NOT USED	
MP2	LABEL, PRESS SENS (ESDS)	280-2745-040		12998	280-2745-040	R83	RESISTOR, FXD CHPSN, 100 OHMS, 10%, 1/4W	745-0
MP3	JACK, TIP (QTY 2)	360-0079-190		00779	2-332095-4	R84	RESISTOR, FXD CHPSN, 560 OHMS, 10%, 1/4W	745-0
MP4	COVER	642-2989-001				R85-R87	RESISTOR, FXD CHPSN, 10K, 10%, 1/4W	745-0
MP5	SHIELD	641-7141-001		52072	CAS01SP100-230-430	R88	RESISTOR, FXD FILM, 24.9K, 1%, 1/8W	705-1
MP6	CONNECTOR, HDR (QTY 5)	372-2656-130				T1	TRANSFORMER, RF	278-0
Q1	TRANSISTOR	352-5500-010		04713	MP52907A	U1	INTEGRATED CIRCUIT DECADE COUNTER	351-1
Q2	TRANSISTOR	352-5505-020		17856	2N5485	U2	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
Q3	TRANSISTOR	352-0723-010		04713	MP5918	U3	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
Q4, Q5	TRANSISTOR	352-0766-010		04713	2N5109	U4	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
Q6	TRANSISTOR	352-0723-010		04713	MP5918	U5	INTEGRATED CIRCUIT OPRTNL AMPLIFIER	351-1
Q7	TRANSISTOR, FET (ESDS)	352-1140-020		01295	3N202	U6	INTEGRATED CIRCUIT DECADE COUNTER	351-1
Q8	TRANSISTOR	352-5500-010		04713	MP52907A	U7	INTEGRATED CIRCUIT LOGIC GATE	351-1
Q9	TRANSISTOR	352-5015-010		04713	MP52369	U8	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
Q10	TRANSISTOR	352-5505-020		17856	2N5485	U9	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
Q11, Q12	TRANSISTOR	352-0723-010		04713	MP5918	U10	INTEGRATED CIRCUIT DGTL MOS (ESDS)	351-8
Q13-Q15	TRANSISTOR	352-5015-010		04713	MP52369	U11	INTEGRATED CIRCUIT OPRTNL AMPLIFIER, DUAL	351-1
Q16	TRANSISTOR	352-5500-010		04713	MP52907A	U12, U13	INTEGRATED CIRCUIT FLIP-FLOP	351-1
R1	RESISTOR, FXD CHPSN, 82 OHMS, 10%, 1/4W	745-0710-000		81349	RCR076820KS	U14	INTEGRATED CIRCUIT LOGIC GATE	351-1
R2-R5	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR076472KS	U15, U16	INTEGRATED CIRCUIT COUNTER	351-1
R6-R7	RESISTOR, FXD CHPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR076391KS	U17	INTEGRATED CIRCUIT DIGITAL ARRAY	351-1
R8	RESISTOR, FXD CHPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR076562KS	U18	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8
R9	RESISTOR, FXD FILM, 154K, 1%, 1/8W	705-1101-000		81349	RN5501543F	U19	INTEGRATED CIRCUIT LEVEL SHIFTER (ESDS)	351-8
R10	RESISTOR, FXD CHPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR076561KS		VARIABLE LOOP (ESDS) (ESDS)	638-6
R11	RESISTOR, FXD CHPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR076103KS	CR1, CR2	SEMICONV DEVICE	638-6
R12	RESISTOR, FXD CHPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR076272KS	CR3, CR4	SEMICONV DEVICE (OBSOLETE) (A4)	922-6
R13	RESISTOR, FXD CHPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR076151KS	CR5	SEMICONV DEVICE (ESDS)	353-3
R14	RESISTOR, FXD FILM, 1.82K, 1%, 1/8W	705-3605-120		81349	RN5501821F	CR6-CR8	SEMICONV DEVICE	353-3
R15	RESISTOR, FXD FILM, 30.1K, 1%, 1/8W	705-1067-000		81349	RN5503012F	C1, C2	CAPACITOR, FIXED CER DIE, 0.01UF, P80/M20%, 50VDC	913-3
R16	RESISTOR, FXD CHPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR076561KS	C3	NOT USED	
R17	RESISTOR, FXD CHPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR076151KS	C4-C7	CAPACITOR, FIXED CER DIE, 0.01UF, P80/M20%, 50VDC	913-3
R18, R19	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR076472KS	C8	CAPACITOR, FIXED TMTLM ELCTLT, 33UF, 20%, 35V	184-9
R20	RESISTOR, FXD CHPSN, 100 OHMS, 10%, 1/4W	745-0710-000		81349	RCR076820KS	C9-C26	CAPACITOR, FIXED CER DIE, 0.01UF, P80/M20%, 50VDC	913-3
R21	RESISTOR, FXD CHPSN, 82 OHMS, 10%, 1/4W	745-0710-000		91637	101T200R0	C27-C30	CAPACITOR, FIXED CER DIE, 0.47UF, 10%, 50VDC	913-5
R22	RESISTOR, VAR 200 OHMS, 20%, 1/2W	382-0038-020		81349	RCR076102KS	C31, C32	CAPACITOR, FIXED TMTLM ELCTLT, 33UF, 20%, 35V	184-9
R23	RESISTOR, FXD CHPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR076102KS	C33	CAPACITOR, FIXED TMTLM ELCTLT, 22UF, 20%, 15V	184-9
R24	RESISTOR, FXD FILM, 243 OHMS, 1%, 1/8W	705-3600-670		81349	RN5502430F	C34, C35	CAPACITOR, FIXED TMTLM ELCTLT, 4.7UF, 20%, 35V	184-9
R25	RESISTOR, FXD CHPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR076272KS	C36, C37	CAPACITOR, FIXED CER DIE, 0.01UF, P80/M20%, 50VDC	913-3
R26	RESISTOR, FXD FILM, 10 OHMS, 1%, 1/8W	705-0900-000		81349	RN55010R0F	C38	CAPACITOR, FIXED CER DIE, 100PF, PORM5%, 100V	913-3
R27	RESISTOR, FXD CHPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR076101KS	C39-C48	CAPACITOR, FIXED CER DIE, 1000PF, 10%, 200V (A1)	913-4
R28	RESISTOR, FXD FILM, 243 OHMS, 1%, 1/8W	705-3600-670		81349	RN5502430F	C39	CAPACITOR, FIXED CER DIE, 1000PF, 10%, 200V	913-4
R29	RESISTOR, FXD CHPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR076272KS	C40	CAPACITOR, FXD MICA DIE, 12PF, PORM 0.5PF, 300V	912-4
R30	RESISTOR, FXD CHPSN, 3.3K, 10%, 1/4W	745-0767-000		81349	RCR076332KS	C41-C44	CAPACITOR, FIXED CER DIE, 1000PF, 10%, 200V	913-4
R31	RESISTOR, FXD FILM, 10 OHMS, 1%, 1/8W	705-0900-000		81349	RN55010R0F	C45	CAPACITOR, FXD MICA DIE, 12PF, PORM 0.5PF, 300V	912-4
R32	RESISTOR, FXD CHPSN, 68 OHMS, 10%, 1/4W (A2)	745-0707-000		81349	RCR076680KS	C46-C48	CAPACITOR, FIXED CER DIE, 1000PF, 10%, 200V	913-4
R33	RESISTOR, FXD CHPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR076331KS	C49	CAPACITOR, FIXED TMTLM ELCTLT, 100UF, 20%, 10V	184-9
R34	RESISTOR, FXD CHPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR076682KS	C50	CAPACITOR, FIXED CER DIE, 47PF, 10%, 100VDC	913-10
R35	RESISTOR, FXD CHPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR076272KS			
R36	RESISTOR, FXD CHPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR076101KS			
R37	RESISTOR, FXD CHPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR076560KS			
R38	RESISTOR, FXD CHPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR076271KS			
R39	RESISTOR, FXD CHPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR076102KS			
R40	RESISTOR, FXD CHPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR076152KS			

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	RCR076101KS
			R42	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR076152KS
	81349	CK05BX222K	R43,R44	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR076102KS
	81349	CK06BX104K	R45	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR076223KS
	56289	199D475X00350B1	R46	RESISTOR,FXD CMPSN, 33K, 10%, 1/4W	745-0803-000		81349	RCR076333KS
	56289	199D226X00150B1	R47	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR076472KS
	72982	538011C0P089R	R48-R51	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR076103KS
	56289	292CY5U103Z050B	R52,R53	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR076472KS
			R54	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR076271KS
	56289	196D239	R55-R58	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR076472KS
	56289	199D475X00350B1	R59,R60	RESISTOR,FXD CMPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR076272KS
	96906	MS35338-134	R61	RESISTOR,FXD FILM, 1.82K, 1%, 1/8W	705-3605-120		81349	RN5501821F
	05411	310-0130-000	R62	RESISTOR,FXD CMPSN, 5.6K, 10%, 1/4W	745-0776-000		81349	RCR076562KS
	96906	MS51957-5	R63	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR076151KS
	52072	CAD10SP100-230-4	R64	NOT USED				
		30	R65	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR076103KS
	00779	226287-2	R66	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR076472KS
A,C,E	98291	51-051-0000	R67	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR076561KS
B,D,F	02113	115CLWDBR11-5TURN	R68	RESISTOR,FXD FILM, 1.82K, 1%, 1/8W	705-3605-120		81349	RN5501821F
		S	R69	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W	705-1067-000		81349	RN5503012F
	02113	115CLWDBR11-5TU	R70	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR076561KS
		RNS	R71	RESISTOR,FXD CMPSN, 150 OHMS, 10%, 1/4W	745-0719-000		81349	RCR076151KS
	02113	115CLWDBR11-5TU	R72,R73	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR076472KS
		RNS	R74,R75	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR076101KS
	96906	MS18130-16	R76,R77	RESISTOR,FXD CMPSN, 68 OHMS, 10%, 1/4W	745-0707-000		81349	RCR076680KS
	96906	MS75085-05	R78	RESISTOR,FXD CMPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR076271KS
	96906	MS18130-16	R79	RESISTOR,FXD CMPSN, 180 OHMS, 10%, 1/4W	745-0722-000		81349	RCR076181KS
	02113	115CLWDBR11-5TURN	R80	RESISTOR,FXD CMPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR076331KS
		S	R81	RESISTOR,FXD CMPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR076682KS
	02113	115CLWDBR11-5TU	R82	NOT USED				
		RNS	R83	RESISTOR,FXD CMPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR076101KS
	02113	115CLWDBR11-5TU	R84	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR076561KS
		RNS	R85-R87	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR076103KS
	96906	MS18130-16	R88	RESISTOR,FXD FILM, 24.9K, 1%, 1/8W	705-1063-000		81349	RN5502492F
	96906	MS75088-6	T1	TRANSFORMER,RF	278-0430-220		03550	22490
	96906	MS75089-9	U1	INTEGRATED CIRCUIT DECADE COUNTER	351-1636-010		01295	SN74LS90N
	96906	MS18130-2	U2	INTEGRATED CIRCUIT DCTL MOS (ESDS)	351-8159-340		31019	SCL4011BE
	96906	MS75089-9	U3	INTEGRATED CIRCUIT DCTL MOS (ESDS)	351-8159-350		31019	SCL4012BE
	96906	MS18130-16	U4	INTEGRATED CIRCUIT DCTL MOS (ESDS)	351-8159-360		31019	SCL4023BE
	04232	307A40	U5	INTEGRATED CIRCUIT OPRTNL AMPLIFIER	351-1071-070		07263	UA1458TC
	04232	307A40	U6	INTEGRATED CIRCUIT DECADE COUNTER	351-1636-010		01295	SN74LS90N
	12986	280-2745-040	U7	INTEGRATED CIRCUIT LOGIC GATE	351-1523-090		04713	SN74LS04N
	00779	2-332095-4	U8	INTEGRATED CIRCUIT DCTL MOS (ESDS)	351-8159-340		31019	SCL4011BE
			U9	INTEGRATED CIRCUIT DCTL MOS (ESDS)	351-8159-350		31019	SCL4012BE
			U10	INTEGRATED CIRCUIT DCTL MOS (ESDS)	351-8159-360		31019	SCL4023BE
	52072	CAS01SP100-230-4	U11	INTEGRATED CIRCUIT OPRTNL AMPLIFIER,DUAL	351-1370-010		27014	LF353AN
		30	U12,U13	INTEGRATED CIRCUIT FLIP-FLOP	351-1525-040		04713	SN74LS74AN
	04713	MPS2907A	U14	INTEGRATED CIRCUIT LOGIC GATE	351-1523-250		04713	SN74LS27N
	17856	2N5485	U15,U16	INTEGRATED CIRCUIT COUNTER	351-1527-030		34335	SN74LS191N
	04713	MPS918	U17	INTEGRATED CIRCUIT DIGITAL ARRAY	351-1653-020		07263	11C90DC
	04713	2N5109	U18	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8346-010		02735	CD4094BE
	04713	MPS918	U19	INTEGRATED CIRCUIT LEVEL SHIFTER (ESDS)	351-8458-010		02735	CD40109BE
	01295	3N202						
	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	SEMICONV DEVICE	353-3644-050		03508	DA2779GE
	04713	MPS918	CR3,CR4	SEMICONV DEVICE (OBSOLETE) (A4)	922-6131-010		12954	BB109-6131-010
	04713	MPS2369	CR3,CR4	SEMICONV DEVICE	922-6131-030		12954	BB409N
	04713	MPS2907A	CR5	SEMICONV DEVICE (ESDS)	353-3691-010		28480	1N5711
	81349	RCR076820KS	CR6-CR8	SEMICONV DEVICE	353-3644-050		03508	DA2779GE
	81349	RCR076472KS	C1,C2	CAPACITOR,FIXED CER DIEL, 0.01UF, P80/M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
	81349	RCR076391KS	C3	NOT USED				
	81349	RCR076562KS	C4-C7	CAPACITOR,FIXED CER DIEL, 0.01UF, P80/M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
	81349	RCR076103KS	C8	CAPACITOR,FIXED TNYLM ELCTLT, 33UF, 20%, 35V	184-9102-880		56289	196D247A
	81349	RCR076272KS	C9-C26	CAPACITOR,FIXED CER DIEL, 0.01UF, P80/M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
	81349	RCR076151KS						
	81349	RN5501821F	C27-C30	CAPACITOR,FIXED CER DIEL, 0.47UF, 10%, 50VDC	913-5019-520		81349	CK06BX474K
	81349	RN5503012F	C31,C32	CAPACITOR,FIXED TNYLM ELCTLT, 33UF, 20%, 35V	184-9102-880		56289	196D247A
	81349	RCR076561KS	C33	CAPACITOR,FIXED TNYLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	199D226X00150B1
	81349	RCR076151KS	C34,C35	CAPACITOR,FIXED TNYLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	199D475X00350B1
	81349	RCR076472KS	C36,C37	CAPACITOR,FIXED CER DIEL, 0.01UF, P80/M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B
	81349	RCR076101KS						
	81349	RCR076820KS	C38	CAPACITOR,FIXED CER DIEL, 100PF, PORM5%, 100V	913-3281-280		51642	200-100NP0-101J
	91637	101T200R0	C39-C40	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V (A1)	913-4018-000		81349	CK05BX102K
	81349	RCR076102KS						
	81349	RN5502430F	C39	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
	81349	RCR076272KS	C40	CAPACITOR,FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4141-120		93790	CD5CC120D0
	81349	RN55010R0F						
	81349	RCR076101KS	C41-C44	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
	81349	RN5502430F	C45	CAPACITOR,FXD MICA DIEL, 12PF, PORM 0.5PF, 300V	912-4141-120		93790	CD5CC120D0
	81349	RCR076272KS						
	81349	RCR076332KS	C46-C48	CAPACITOR,FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
	81349	RN55010R0F	C49	CAPACITOR,FIXED TNYLM ELCTLT, 100UF, 20%, 10V	184-9102-135		56289	196D235
	81349	RCR076680KS	C50	CAPACITOR,FIXED CER DIEL, 47PF, 10%, 100VDC (A3)	913-1098-020		72982	8111-100-C06-470 K
	81349	RCR076331KS						
	81349	RCR076682KS	C50	CAPACITOR,FIXED CER DIEL, 27PF, 10%, 100VDC	913-1098-570		72982	8111-100-C06-270 K
	81349	RCR076272KS						
	81349	RCR076101KS						
	81349	RCR076560KS	C51	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC	913-5019-200		81349	CK05BX103K
	81349	RCR076271KS	C52	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K
	81349	RCR076102KS	C53	CAPACITOR,FIXED CER DIEL, 0.033UF, 10%, 100VDC	913-5019-380		81349	CK06BX333K
	81349	RCR076152KS	C54,C55	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 100VDC	913-5019-440		81349	CK06BX104K

Synthesizer, Parts Location
Figure 6 (Sheet 5)

ion

PARTS LIST (Cont)

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REF DES	DESCRIPTION
C56	NOT USED					U21-U23	INTEGRATED CIRCUIT REGISTER (ESDS)
C57	CAPACITOR, FIXED CER DIE, 0.022UF, 10%, 100VDC	913-5019-360		81349	CK06BX223K	U24, U25	INTEGRATED CIRCUIT OPRTNL AMPLIFIER
C58	CAPACITOR, FIXED CER DIE, 100PF, 5%, 100V	913-3281-280		51642	200-100NP0-101J	U26	INTEGRATED CIRCUIT DIGITAL ARRAY
C59, C60	NOT USED					U27	INTEGRATED CIRCUIT
C61	CAPACITOR, FIXED TMTLM ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	1990475X00350B1	U28	INTEGRATED CIRCUIT MOS ARRAY (ESDS)
C62	CAPACITOR, FIXED CER DIE, 100PF, 5%, 100V	913-3281-280		51642	200-100NP0-101J	VR1	SEMICONV DEVICE
C63	CAPACITOR, FIXED TMTLM ELCTLT, 100UF, 20%, 10V	184-9102-100		56289	196D235		
C64	CAPACITOR, FIXED TMTLM ELCTLT, 22UF, 20%, 15V	184-9102-140		56289	1990226X00150B1		
H1	WASHER, FLAT BRS, 0.105 10 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		
I1	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	CA05STL101WM		
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		
P6	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 CHPSN, 820 OHMS, 10%, 1/4W	745-0746-000		81349	RCR07G821KS		
R2	RESISTOR, FXD CHPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS		
R3	RESISTOR, FXD CHPSN, 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 CHPSN, 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 CHPSN, 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 CHPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS		
R14	RESISTOR, FXD CHPSN, 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 CHPSN, 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 CHPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS		
R25	RESISTOR, FXD CHPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS		
R26	RESISTOR, FXD CHPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS		
R27	RESISTOR, FXD CHPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS		
R28	RESISTOR, FXD CHPSN, 56 OHMS, 10%, 1/4W	745-0704-000		81349	RCR07G560KS		
R29, R30	RESISTOR, FXD CHPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS		
R31	RESISTOR, FXD CHPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS		
R32	RESISTOR, FXD CHPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS		
R33	RESISTOR, FXD CHPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS		
R34	RESISTOR, FXD CHPSN, 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 CHPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS		
R37-R41	RESISTOR, FXD CHPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS		
R42	RESISTOR, FXD CHPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS		
R43, R44	RESISTOR, FXD CHPSN, 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 CHPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS		
R53, R54	RESISTOR, FXD CHPSN, 270 OHMS, 10%, 1/8W (A2)	745-2320-000		81349	RCR05G271KS		
TP1-TP3	CONNECTOR, HDR	372-2656-130		52072	CA501SP100-230-4		
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	451880M		
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		

PARTS LIST (Cont)						MODIFICATION HISTORY		
MFR PART NUMBER	REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE
K06BX223K	U21-U23	INTEGRATED CIRCUIT REGISTER (ESDS)	351-8346-010		02735	CD4094BE		
00-100NP0-101J	U24,U25	INTEGRATED CIRCUIT OPRTNL AMPLIFIER,DUAL	351-1370-010		27014	LF353AN		638-6916-002
	U26	INTEGRATED CIRCUIT DIGITAL ARRAY	351-1653-020		07263	11C900C		
990475X0035DB1	U27	INTEGRATED CIRCUIT	351-7566-010		27014	0M74196N		
00-100NP0-101J	U28	INTEGRATED CIRCUIT MOS ARRAY (ESDS)	351-8179-010		27014	CD4016MJ	A1	Changed L2 from 242-0439-040 to 242-0439-090
96D235	VR1	SEMICOND DEVICE	353-3591-500		04713	1N4626		Changed L12 from 242-0439-040 to 242-0439-090
990226X00150B1							NA	Data change only
10-0130-000								
IS11957-5							A2	Deleted R32
IS75085-07								
IS18130-1								
IS75088-6								
IS18130-8							A3	Changed CR4-CR7 from 922-6131-010 to 922-6131-030
IS75083-1								Changed CR12-CR15 from 922-6131-010 to 922-6131-030
42-0596-010								
80-2745-040								
A05STL101MM								638-6920-001
41-7100-004								
41-7100-005							A1	Changed C40 from 1000PF to 12PF
41-7100-009								Changed C45 from 1000PF to 12PF
41-7100-006							A2	Changed R24 154 ohms to 56 ohms
PS2369								
PS2222A							A3	Changed C50 from 47PF to 27PF
PS2369								Changed L6, L7 from 1UH to .100UH
PS2907A								Changed Q9 from 352-0756-010 to 352-0998-010-2N5397
PS918								
F50095								
N5397							A4	Changed CR3, CR4 from 922-6131-001 to 922-6131-030
H4393								
CR076821KS								
CR076123KS								
CR076821KS								
N5503481F								
N5509091F								
N5504321F								
CR076682KS								
N5509091F								
N5503741F								
CR076103KS								
N5504321F								
CR076152KS								
CR076560KS								
N5503481F								
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CR076271KS								
CR076272KS								
CR076682KS								
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CR076682KS								
CR076560KS								
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CR076103KS								
CR076104KS								
CR076102KS								
N55010R0F								
N55020R5F								
N5501001F								
CR076104KS								
R056271KS								
S01SP100-230-4								
74S112N								
74LS668AN								
18BDM								
L4013BE								
74LS74AN								
74LS00N								
40109BE								
74LS27N								
74S74N								
C900C								
74S00N								
74LS191N								

TS LIST (Cont)

	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	351-8346-010		02735	CD4094BE
	351-1370-010		27014	LF353AN
	351-1653-020		07263	11C900C
	351-7566-010		27014	DM74196N
	351-8179-010		27014	CD4016MJ
	353-3591-500		04713	1N4626

MODIFICATION HISTORY

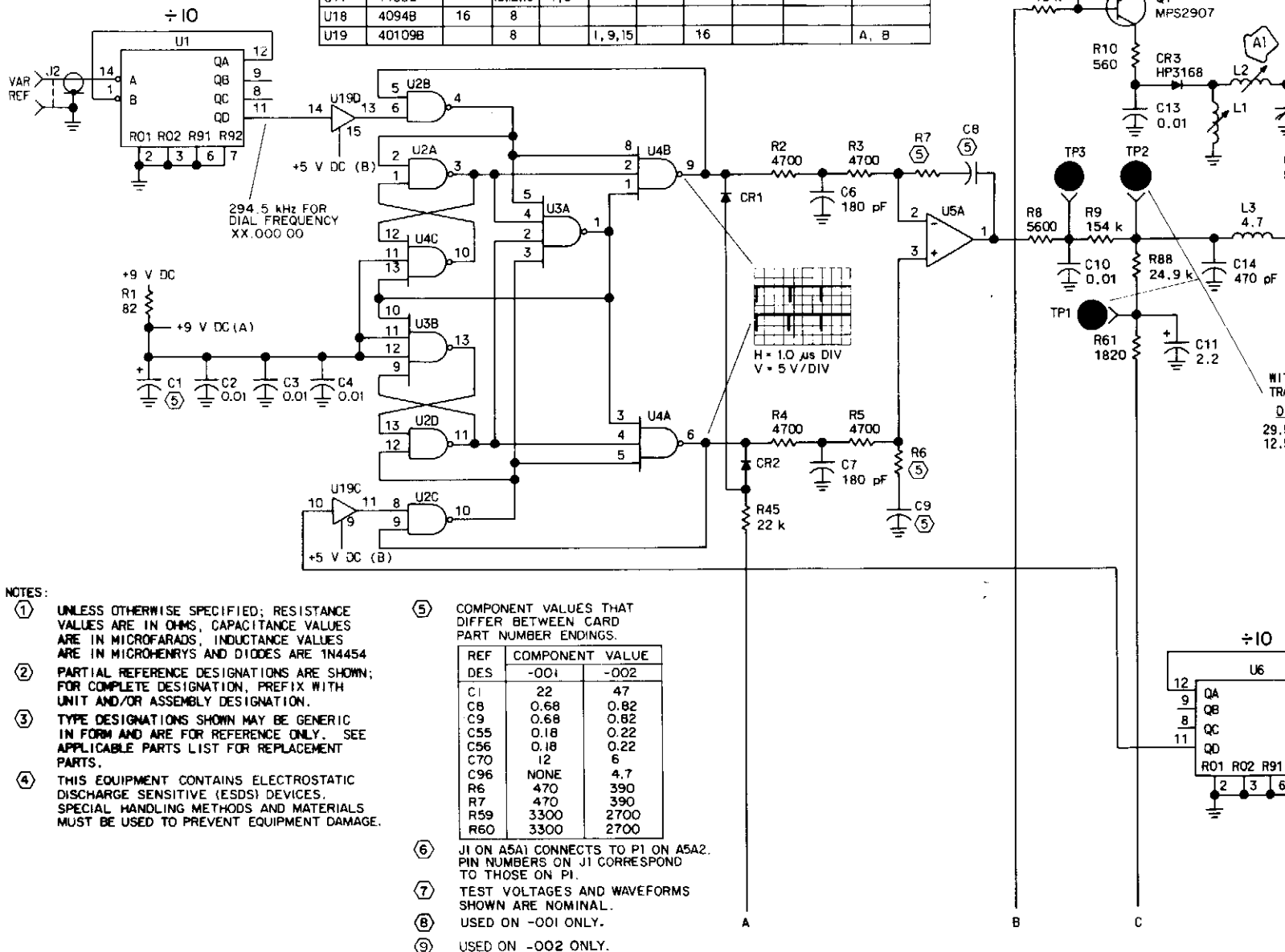
REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
	638-6916-002	
A1	Changed L2 from 242-0439-040 to 242-0439-090 Changed L12 from 242-0439-040 to 242-0439-090	REV H
NA	Data change only	REV J
A2	Deleted R32	REV K
A3	Changed CR4-CR7 from 922-6131-010 to 922-6131-030 Changed CR12-CR15 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)

MICROCIRCUIT INFORMATION FOR A5A1

U NO.	TYPE	PWR (V DC)							SPARE SECTIONS
		+5	GND	+5 (A)	+5 (B)	+5 (C)	+9 (A)	+9 (B)	
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					B
U13	74LS74		7	14					
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

FREQUENCY SYNTHESIS OUTPUT LOOP A1



NOTES:

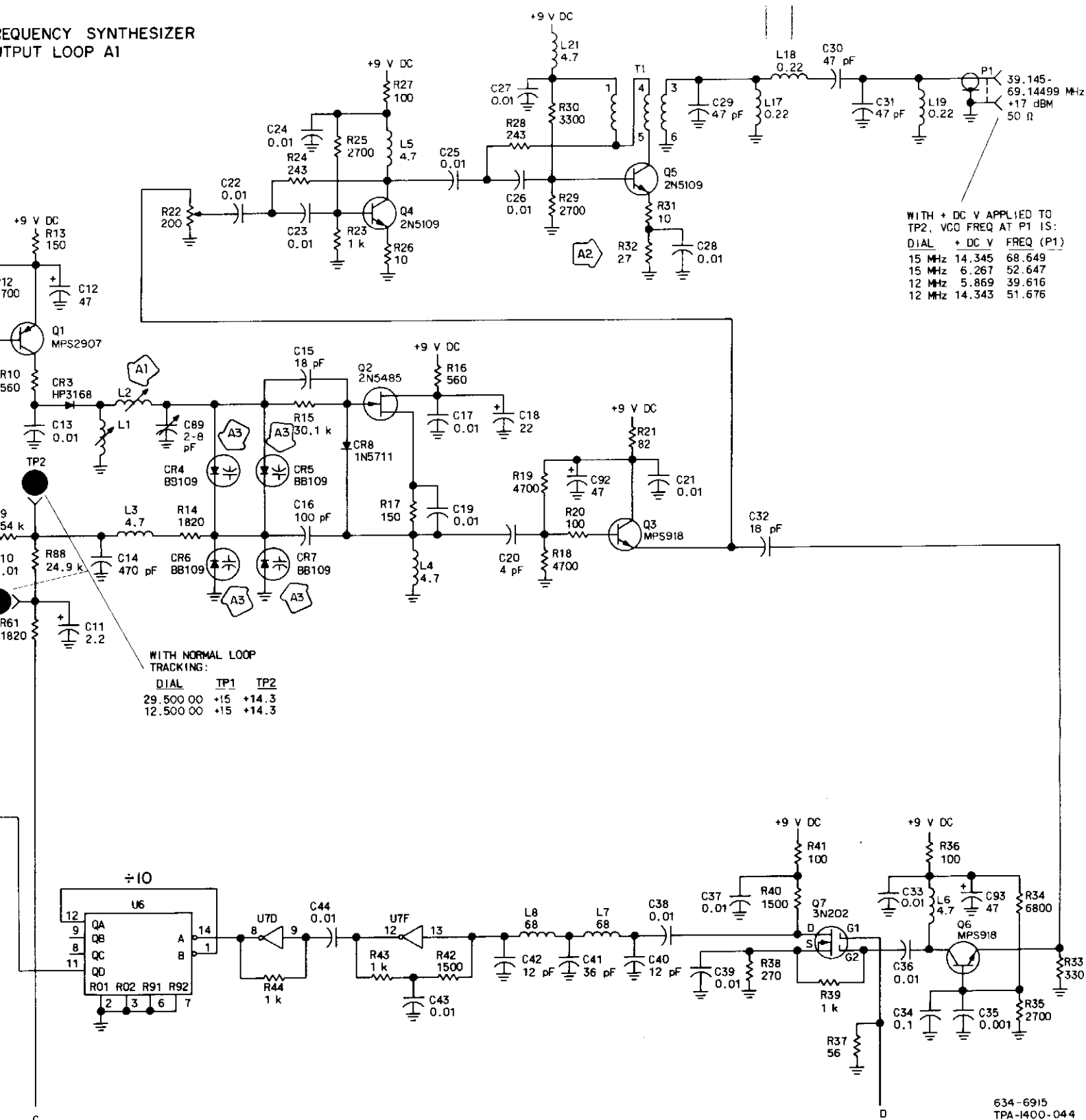
- UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, INDUCTANCE VALUES ARE IN MICROHENRYS AND DIODES ARE 1N4454
- PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
- TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE APPLICABLE PARTS LIST FOR REPLACEMENT PARTS.
- THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.

- COMPONENT VALUES THAT DIFFER BETWEEN CARD PART NUMBER ENDINGS.

REF	COMPONENT VALUE	
DES	-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

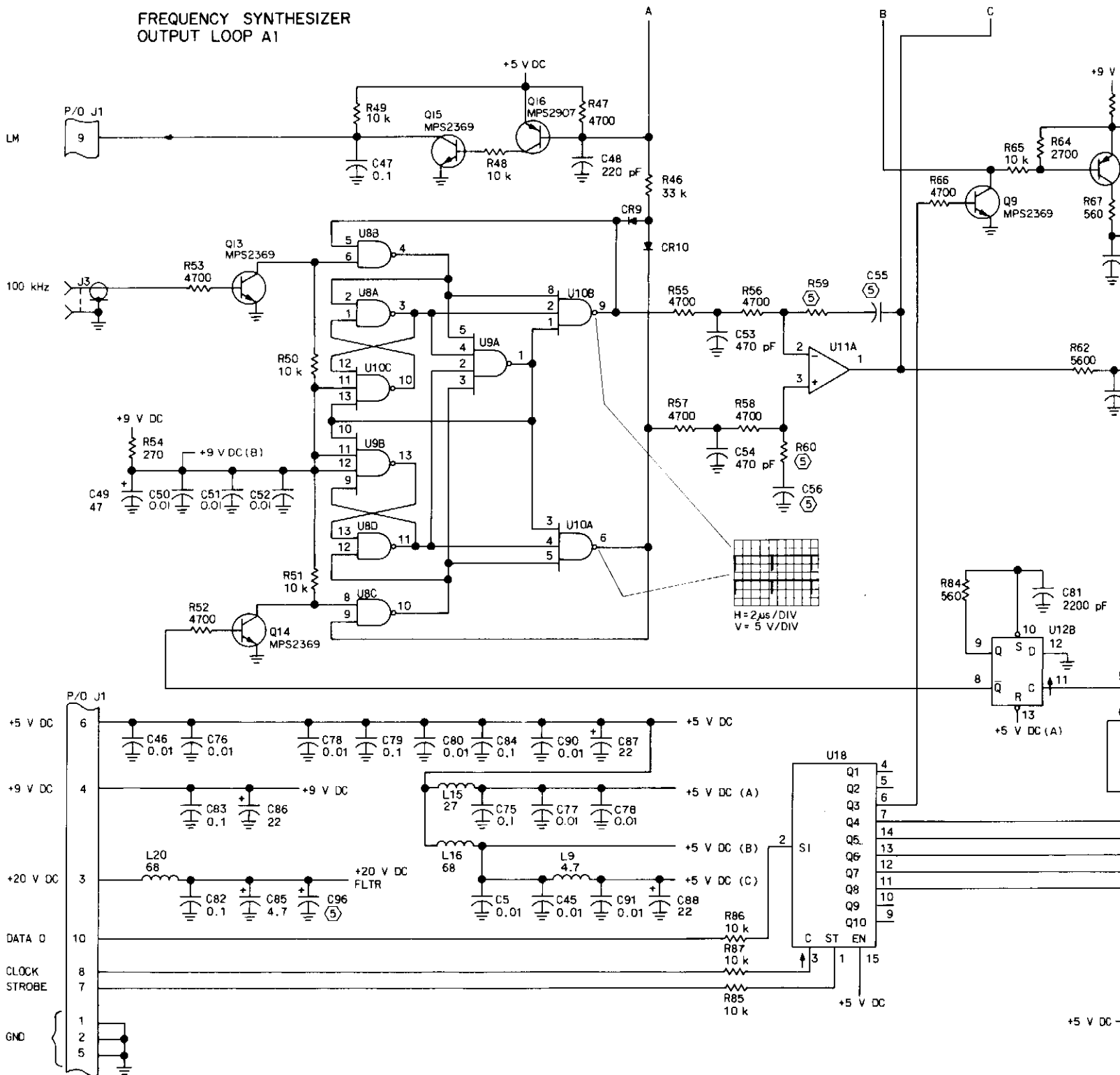
- J1 ON A5A1 CONNECTS TO P1 ON A5A2. PIN NUMBERS ON J1 CORRESPOND TO THOSE ON P1.
- TEST VOLTAGES AND WAVEFORMS SHOWN ARE NOMINAL.
- USED ON -001 ONLY.
- USED ON -002 ONLY.

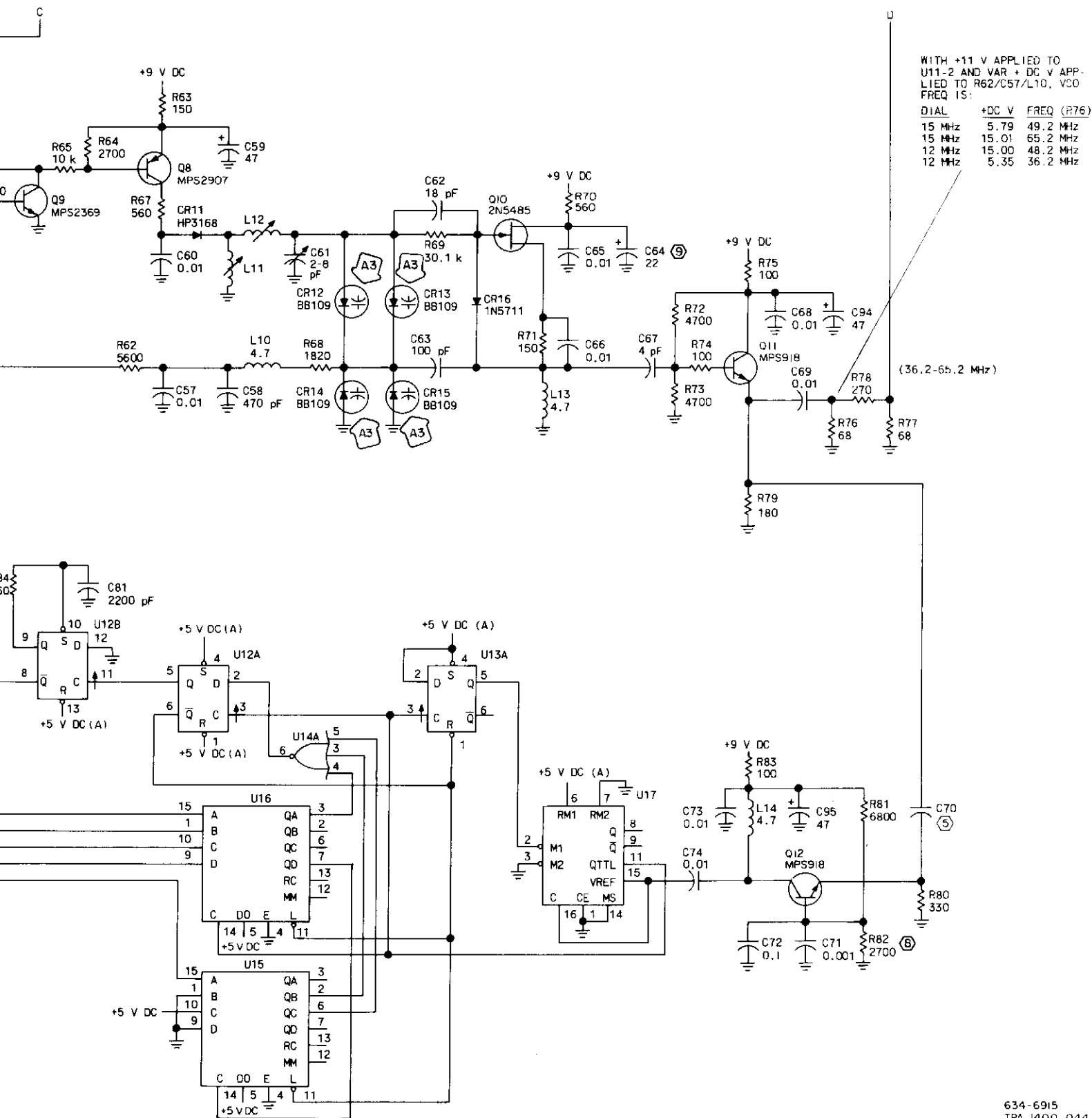
FREQUENCY SYNTHESIZER OUTPUT LOOP A1



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

FREQUENCY SYNTHESIZER OUTPUT LOOP A1

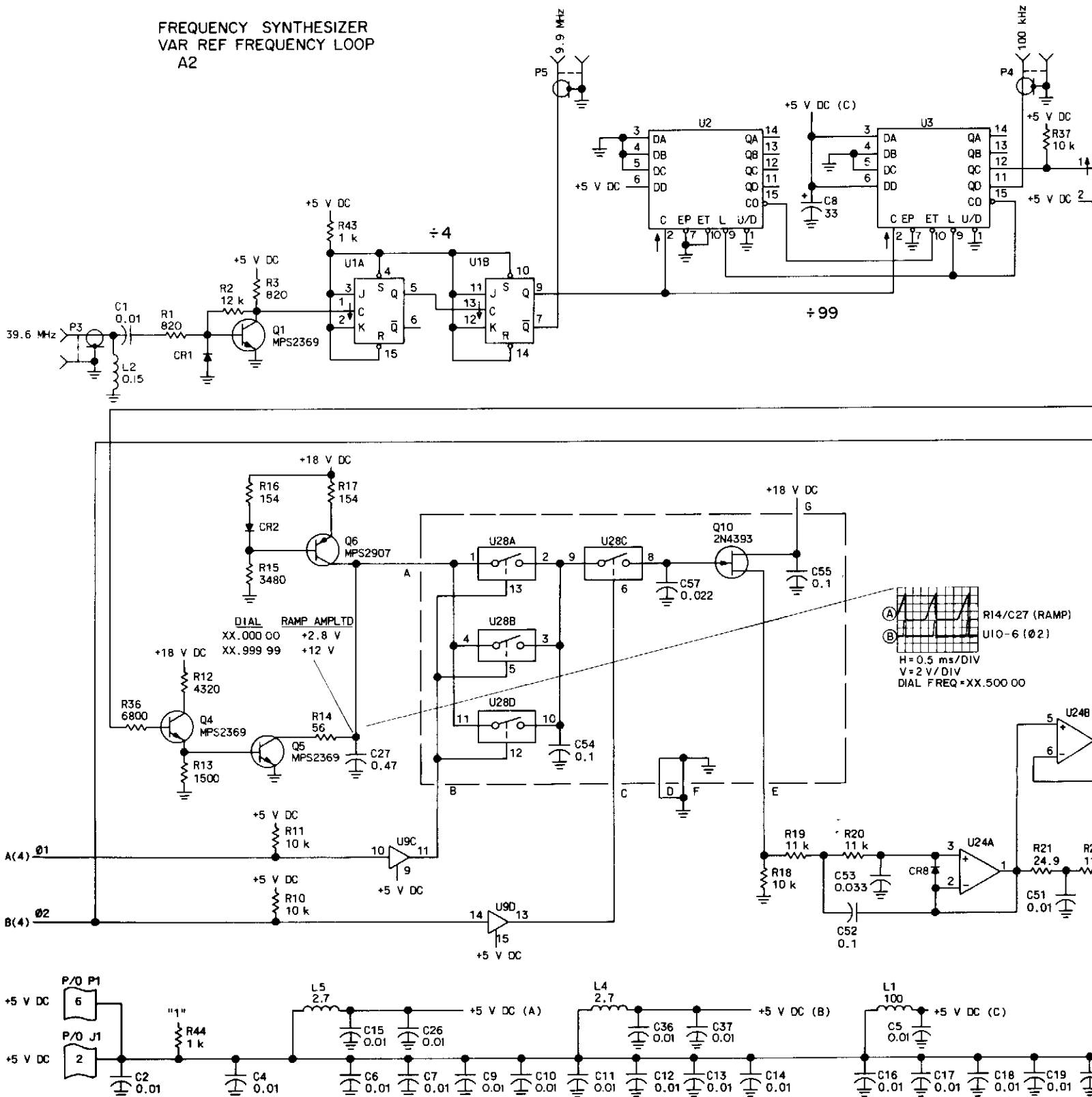


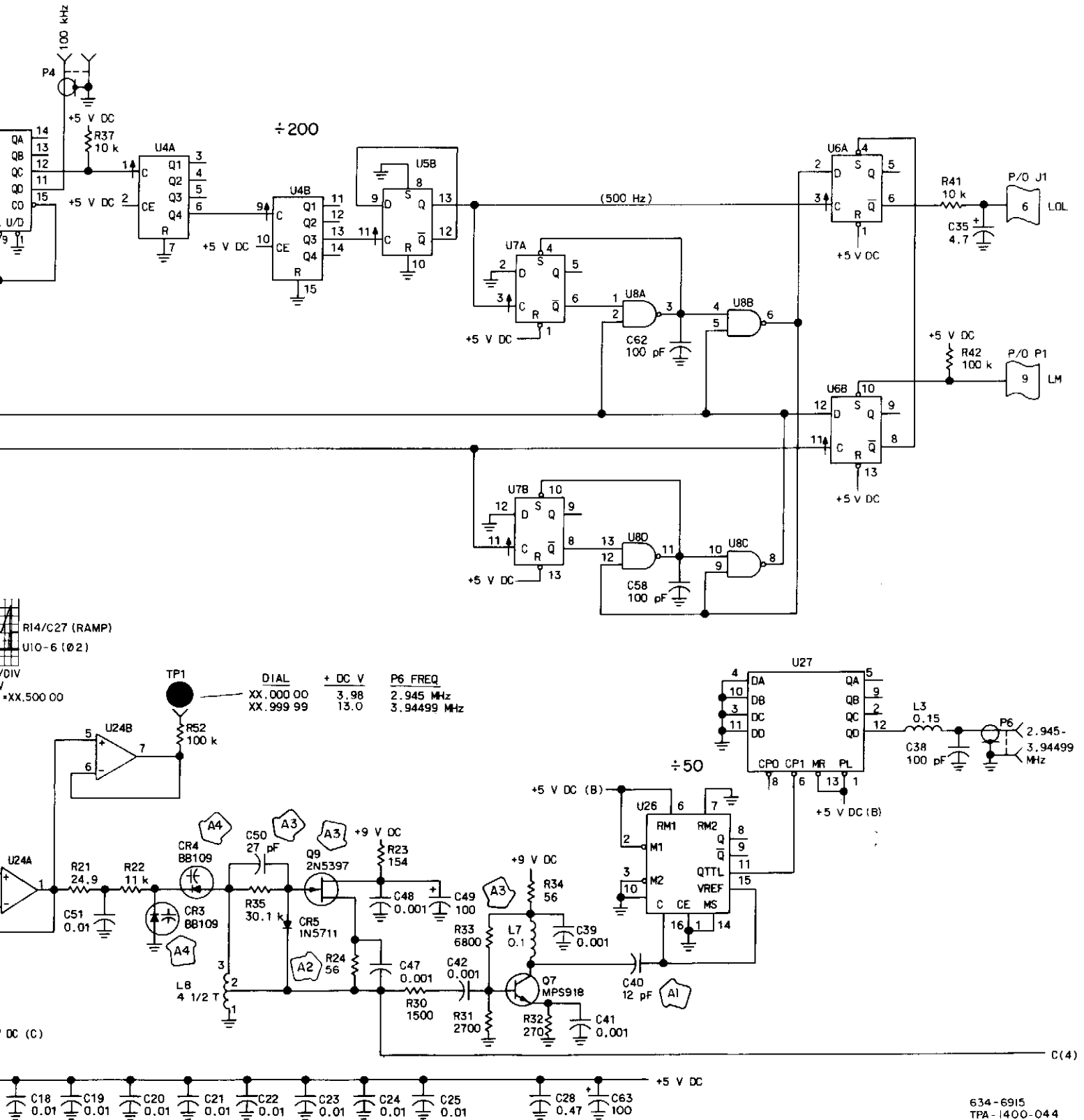


Synthesizer, Schematic Diagram
Figure 7 (Sheet 2)

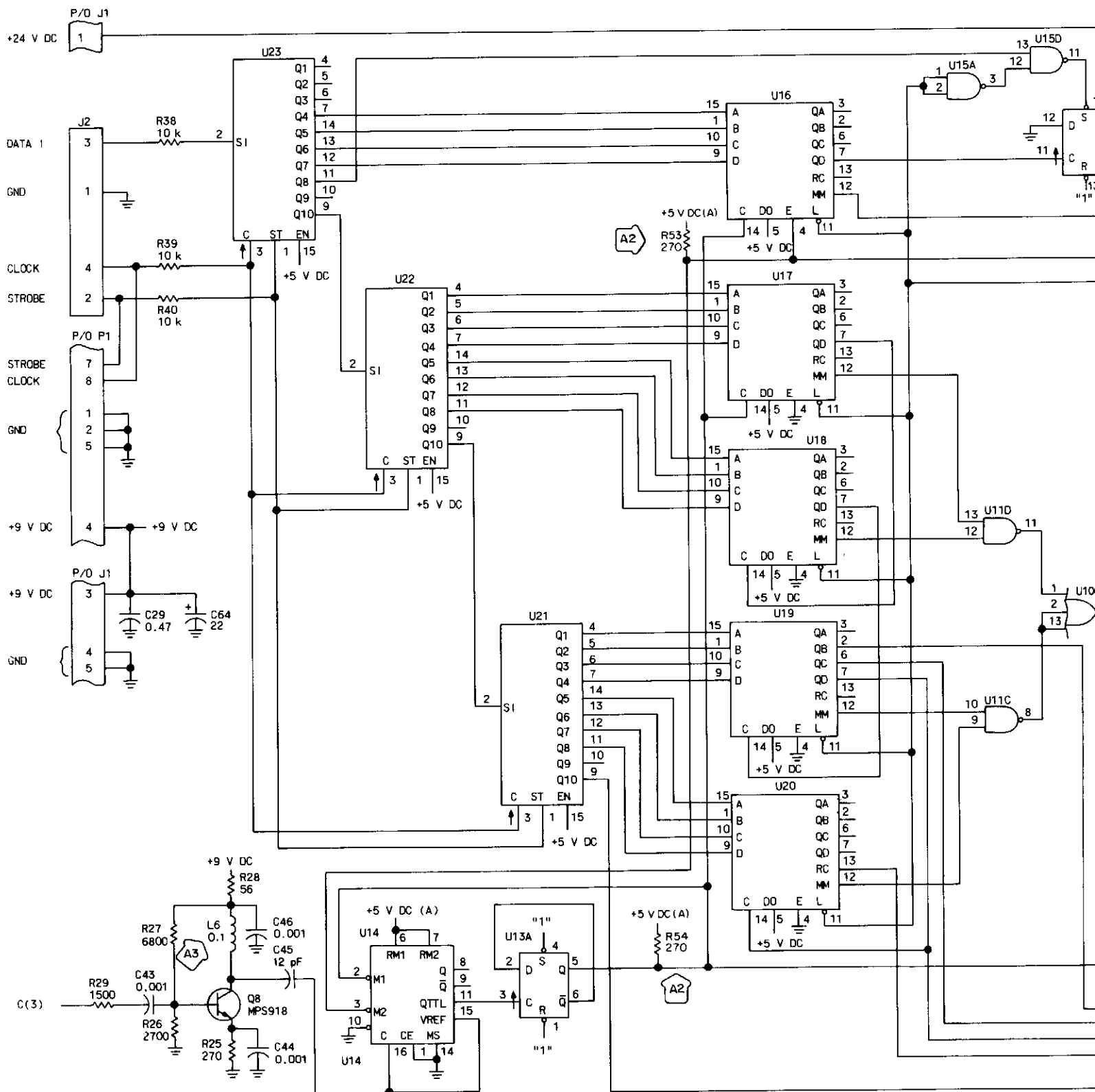
634-6915
TPA-1400-044

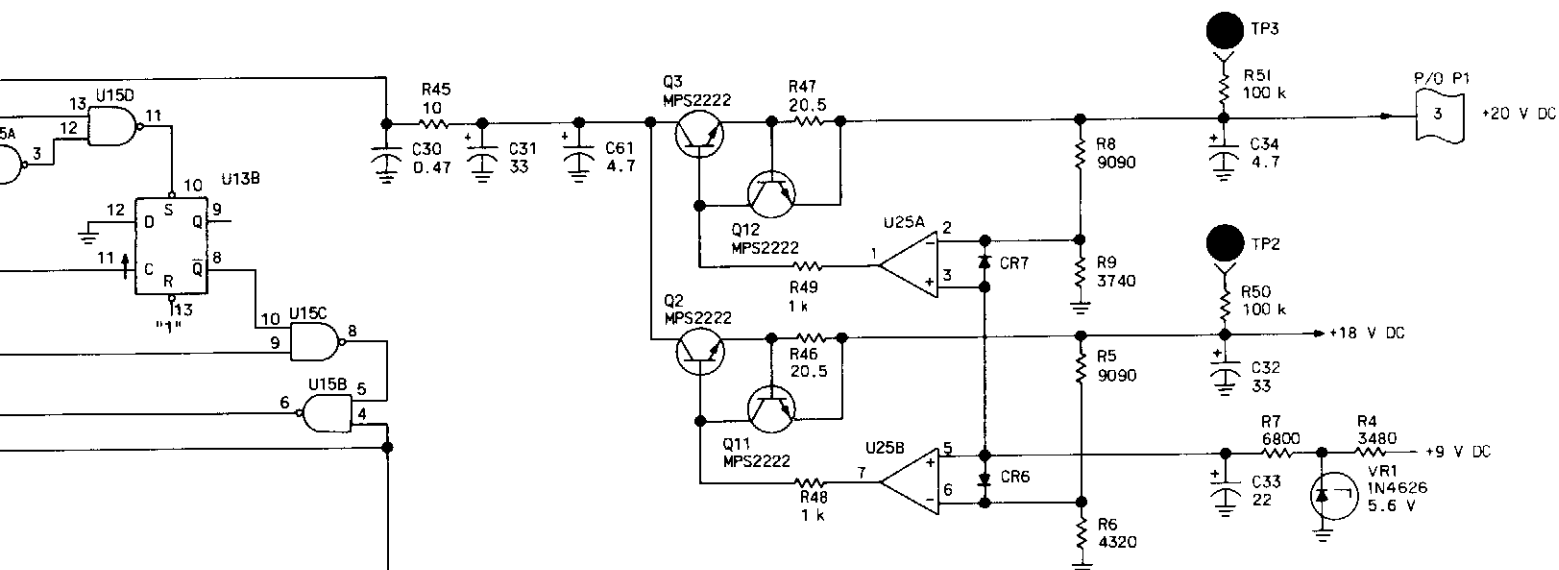
FREQUENCY SYNTHESIZER VAR REF FREQUENCY LOOP A2



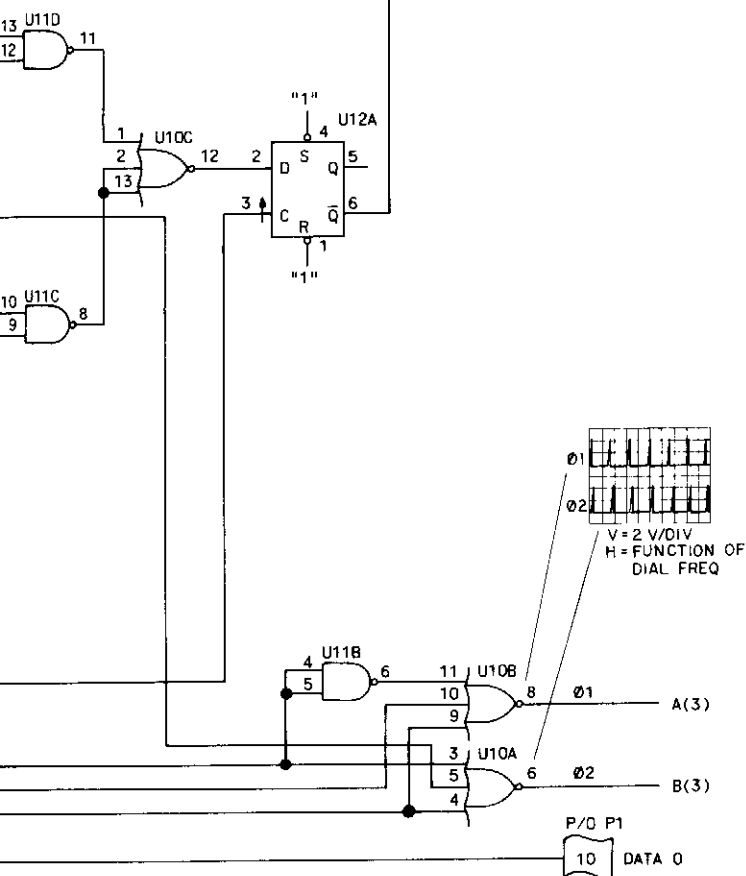


Synthesizer, Schematic Diagram
Figure 7 (Sheet 3)





FREQUENCY SYNTHESIZER
VAR REF FREQUENCY LOOP
A2

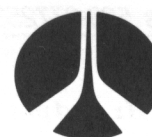


MICROCIRCUIT INFORMATION FOR A5A2

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)



**Rockwell
International**

instructions

Collins Telecommunications Products Division

523-0772531-001211
15 October 1982

Printed in USA

Oscillator (638-6918-001, -002)

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.

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

2.1 Oven Oscillator

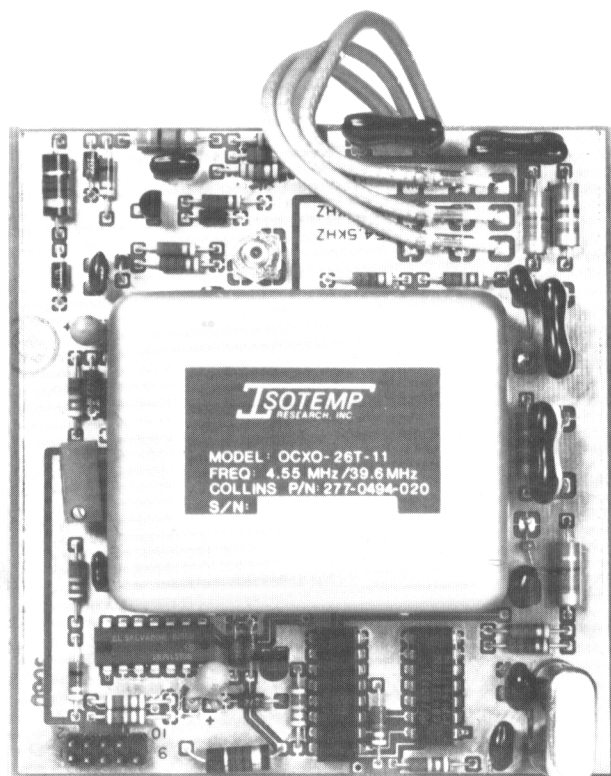
Plus 14.0-V oven voltage for the oscillator is continuously present when power is applied to the unit. The oven temperature is internally controlled and has been factory set. There is no further need for adjustment. The oscillator takes approximately 20 minutes to warm up to achieve the specified frequency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



TPA-5550-017

Oscillator
Figure 1

2.1.2 455-kHz Output

The 455-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 455-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. b. Using high-impedance probe on rf voltmeter, measure 39.6-MHz output level of P1. (Leave oscillator connected to unit.) c. Depress SPOT switch (on unit front panel) and measure 455-kHz output level at P2. d. Measure 454.2-kHz output level at P3.	400 mV rms, or greater 300 mV rms, or greater 10 mV rms, or greater 30 mV rms or greater	Check U4 and associated components. Check Q1 and associated components. Check U4, U2E, Q2, U3, U1A, U2F and associated components. 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. b. Depress SPOT switch and measure frequency at P2. c. Measure frequency at P3.	39.600 00 MHz ± 20 Hz 455.000 kHz ± 20 Hz 454.2 kHz ± 200 Hz	Adjust R10 for correct frequency. Check U1. Adjust for correct frequency. Check U4, Q2, U12E, U3, U1A, U2F. 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. 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 turned off when MODE not in CW. Oscillator output is off until turned on by SPOT switch.	Check U1D. If no malfunction present, check receiver-exciter logic circuits.

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
-------	--

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
-------	---

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
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96906	MILITARY STANDARD
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98291	SEAELECTRO CORP 225 HOYT MAMARONECK NY 10544
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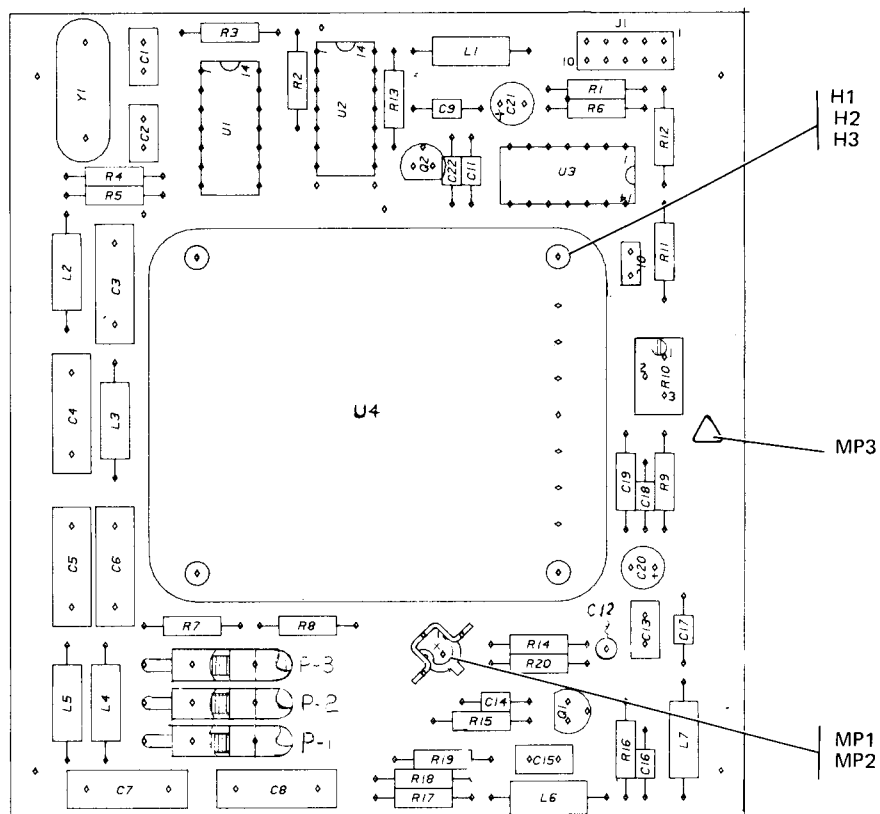
5.3 Usable On Codes

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



TPA-5534-019

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

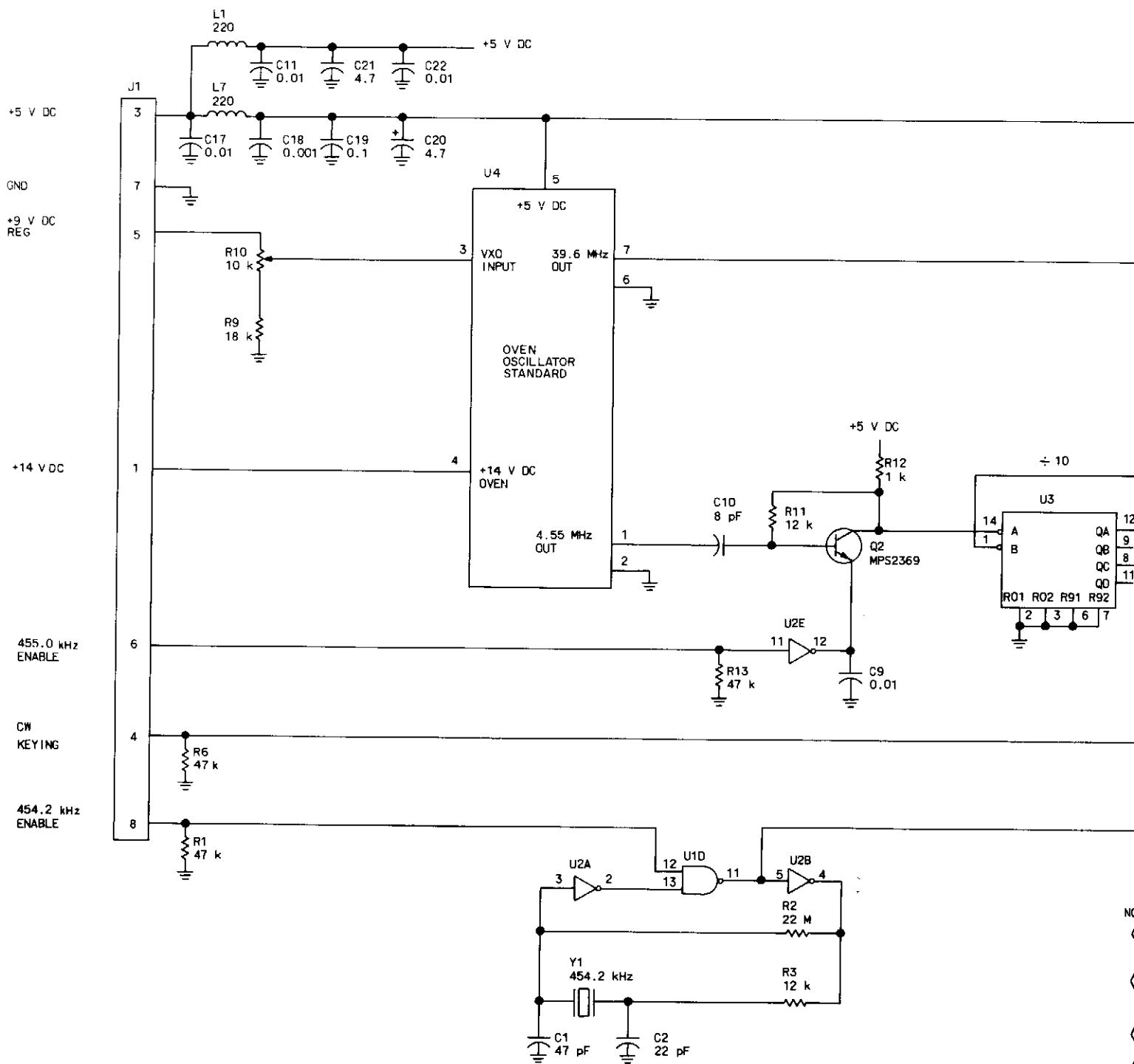
PARTS LIST

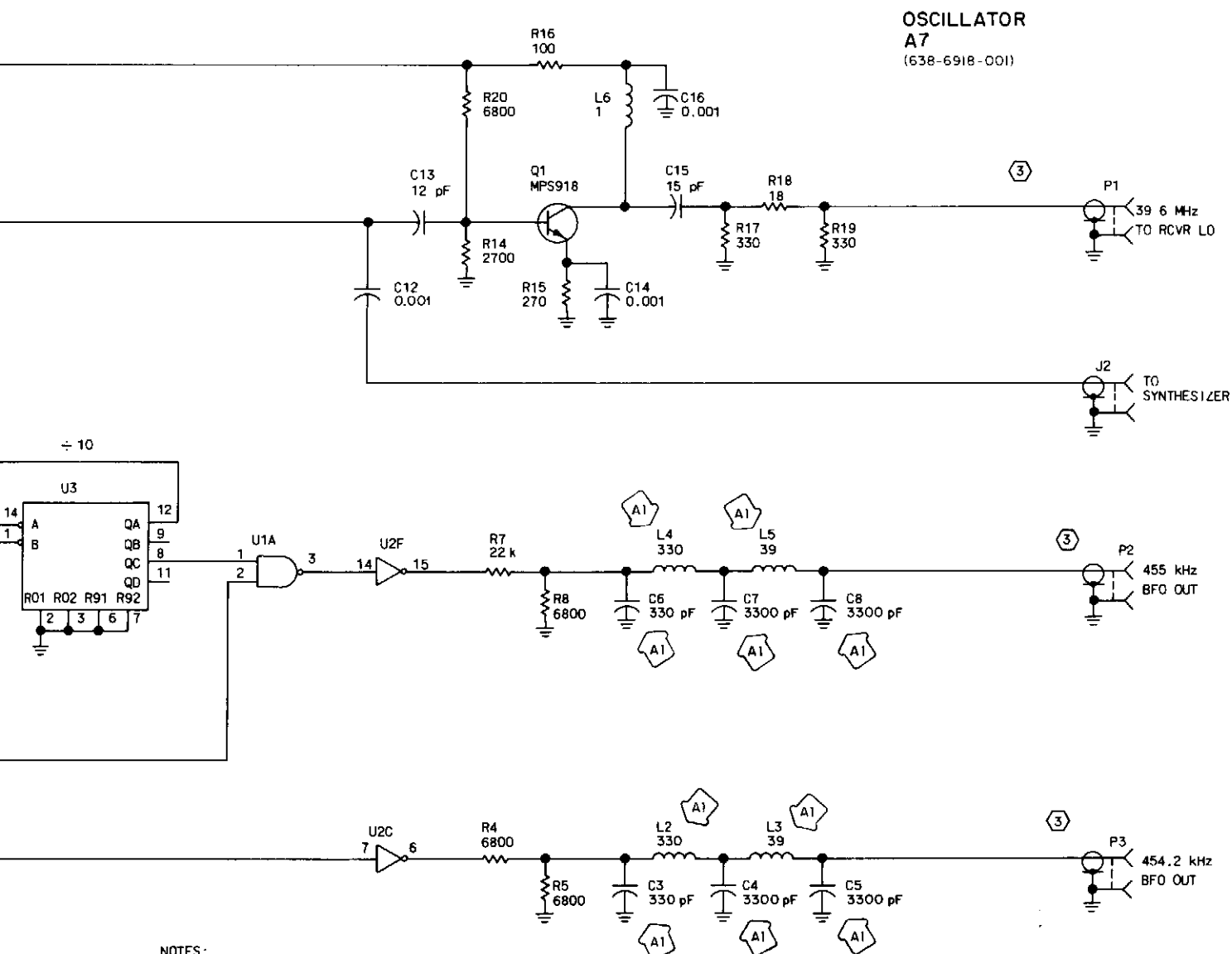
MODIFICATION HISTORY

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE
	OSCILLATOR	638-6918-001 A				A1	Changed C3 from 1200 to 330 pF.
	OSCILLATOR	638-6918-002 B			638-6918-002		Changed C4 from 1500 to 3300 pF.
C1	CAPACITOR,FXD MICA DIEL, 47PF, 5%, 500V	912-3856-000		81349	CM04ED0470J03		Changed C6 from 1200 to 330 pF.
C2	CAPACITOR,FXD MICA DIEL, 22PF, 5%, 500V	912-3842-000		81349	CM04ED220J03		Changed C7 from 1500 to 3300 pF.
C3	CAPACITOR,FXD MICA DIEL, 1200PF, 5%, 500V (A1)	912-3321-000		00853	D205F122J0		Changed L2 from 220 to 330 μ H.
C3	CAPACITOR,FXD MICA DIEL, 1200PF, 5%, 500V (A1)	912-3321-000		00853	D205F122J0		Changed L3 from 220 to 39 μ H.
C4	CAPACITOR,FXD MICA DIEL, 1500PF, 5%, 500V (A1)	912-3327-000		00853	D205F152J0		Changed L4 from 220 to 330 μ H.
C4,C5	CAPACITOR,FXD MICA DIEL, 3300PF, 5%, 500V	912-3354-000		57582	KD20332J501		Changed L5 from 220 to 39 μ H.
C5,C6	CAPACITOR,FXD MICA DIEL, 1200PF, 5%, 500V (A1)	912-3321-000		00853	D205F122J0		
C6	CAPACITOR,FXD MICA DIEL, 3300PF, 5%, 500V	912-3354-000		57582	KD20332J501		
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	NA	Data change only.
C9	CAPACITOR,FXD CER DIEL, 0.01UF,M20/P80%,50V	913-3331-020		56289	292CY5U10308050		
C10	CAPACITOR,FXD MICA DIEL, 8PF, PORM 0.5PF, 300V	912-4141-110		72136	DMSC0800300MV	NA	Data change only.
C11	CAPACITOR,FXD CER DIEL, 0.001UF,M20/P80%,50V	913-3331-010		56289	292CY5U10208050		
C12	CAPACITOR,FXD CER DIEL, 0.001UF,M20/P80%,50V	913-3331-010		56289	292CY5U10208050		
C13	CAPACITOR,FXD MICA DIEL, 12PF, 5%, 500V	912-3838-000		81349	CM04CD120J03	NA	Data change only.
C14	CAPACITOR,FXD CER DIEL, 0.001UF,M20/P80%,50V	913-3331-010		56289	292CY5U10208050		
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	292CY5U10208050		
C17	CAPACITOR,FXD CER DIEL, 0.01UF,M20/P80%,50V	913-3331-020		56289	292CY5U10308050		
C18	CAPACITOR,FXD CER DIEL, 0.001UF,M20/P80%,50V	913-3331-010		56289	292CY5U10208050		
C19	CAPACITOR,FXD CER DIEL, 0.10UF,M20/P80%,50V	913-3331-030		56289	292CY5U10408050		
C20,C21	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 35V	184-9102-390		56289	1990475X00350B1		
C22	CAPACITOR,FXD CER DIEL, 0.001UF,M20/P80%,50V (A1)	913-3331-010		56289	292CY5U10208050		
C22	CAPACITOR,FXD CER DIEL, 0.01UF, P80/M20%, 50VDC	913-3331-020		56289	292CY5U1032050B		
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-39012/95-001		
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 CHPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS		
R2	RESISTOR,FXD CHPSN, 22MEGO, 10%, 1/4W	745-0905-000		81349	RCR07G226KS		
R3	RESISTOR,FXD CHPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS		
R4,R5	RESISTOR,FXD CHPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS		
R6	RESISTOR,FXD CHPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS		
R7	RESISTOR,FXD CHPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS		
R8	RESISTOR,FXD CHPSN, 6.8K, 10%, 1/4W	745-0779-000		81349	RCR07G682KS		
R9	RESISTOR,FXD CHPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS		
R10	RESISTOR,VAR WM, 5K, PORM5%, 3/4W	381-1721-300		81349	RT22C2M503		
R11	RESISTOR,FXD CHPSN, 12K, 10%, 1/4W	745-0788-000		81349	RCR07G123KS		
R12	RESISTOR,FXD CHPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS		
R13	RESISTOR,FXD CHPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR07G473KS		
R14	RESISTOR,FXD CHPSN, 2.7K, 10%, 1/4W	745-0764-000		81349	RCR07G272KS		
R15	RESISTOR,FXD CHPSN, 270 OHMS, 10%, 1/4W	745-0728-000		81349	RCR07G271KS		
R16	RESISTOR,FXD CHPSN, 100 OHMS, 10%, 1/4W	745-0713-000		81349	RCR07G101KS		
R17	RESISTOR,FXD CHPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS		
R18	RESISTOR,FXD CHPSN, 18 OHMS, 10%, 1/4W	745-0686-000		81349	RCR07G180KS		
R19	RESISTOR,FXD CHPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G331KS		
R20	RESISTOR,FXD CHPSN, 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	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 μ H. Changed L3 from 220 to 39 μ H. Changed L4 from 220 to 330 μ H. Changed L5 from 220 to 39 μ H.	REV B
NA	Data change only.	REV C
NA	Data change only.	REV D
NA	Data change only.	REV E





NOTES:

- ① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICRORHENRYS.
- 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
U1	4011	14	7
U2	4049	1	8
U3	74LS90	5	10

634-6917
TPA-1401-014

Oscillator, Schematic Diagram
Figure 3



**Rockwell
International**

instructions

Control

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

Collins Telecommunications Products Division

523-0771745-001211

1 August 1982

Printed in USA

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

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.

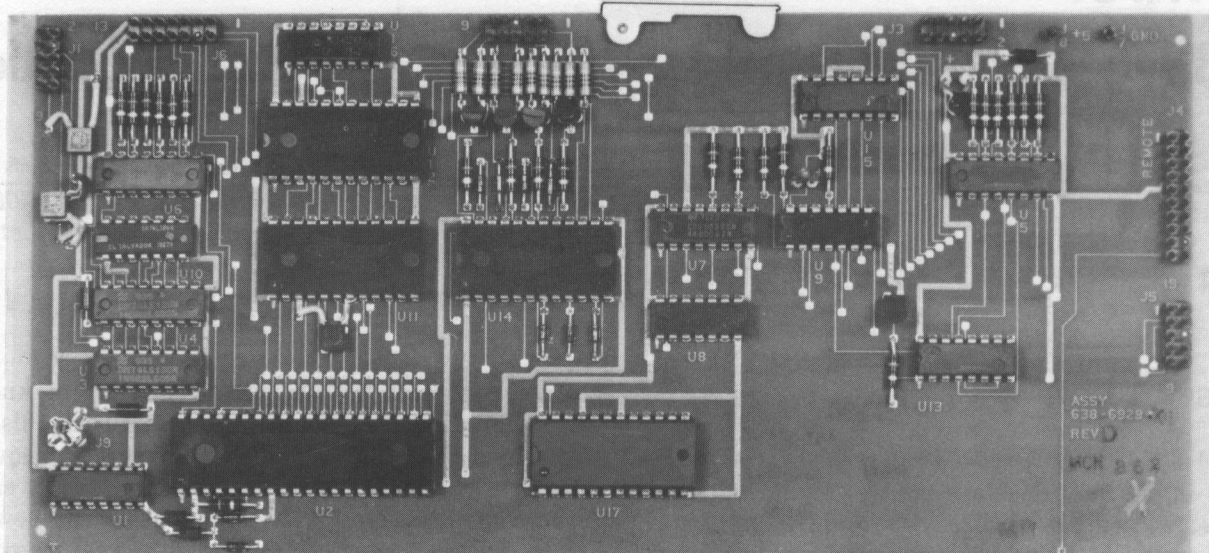
2. PRINCIPLES OF OPERATION

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 ($\phi 2$), 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.

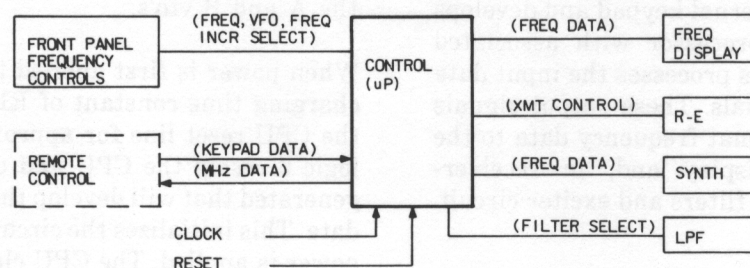
When power is first applied to the control card, the charging time constant of R1/C2 keeps a logic 0 on the CPU reset line for approximately 1 second. The logic 0 resets the CPU and causes an output to be generated that will develop the 15.000 00-MHz output data. This initializes the circuits to 15 MHz 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 $\phi 2$.

523-0771745-001211



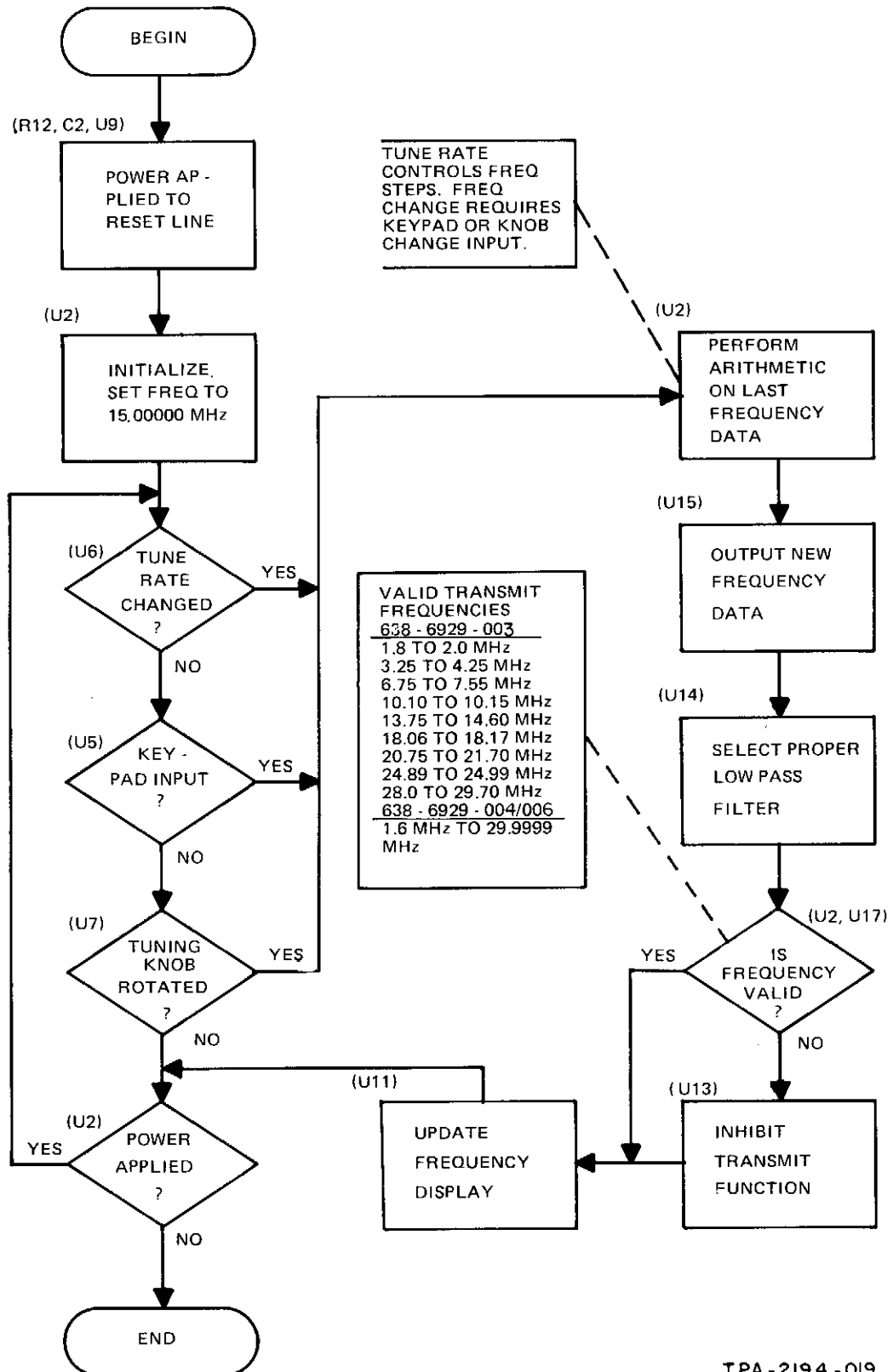
TPA-5274-017

Control
Figure 1

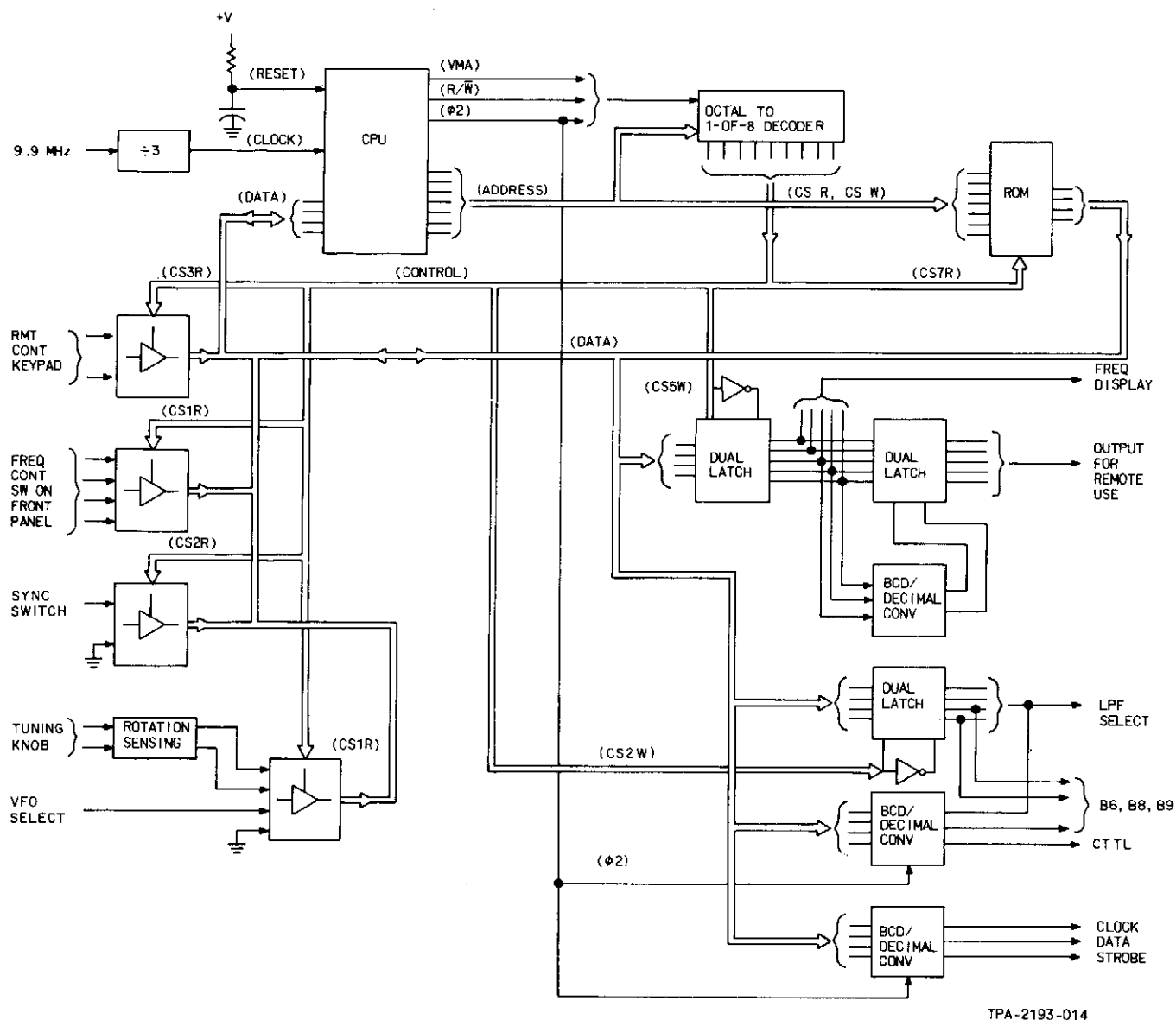


TPA-2192-013

Control, Simplified Block Diagram
Figure 2



Microprocessor Basic Flow Diagram
Figure 3



TPA-2193-014

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.

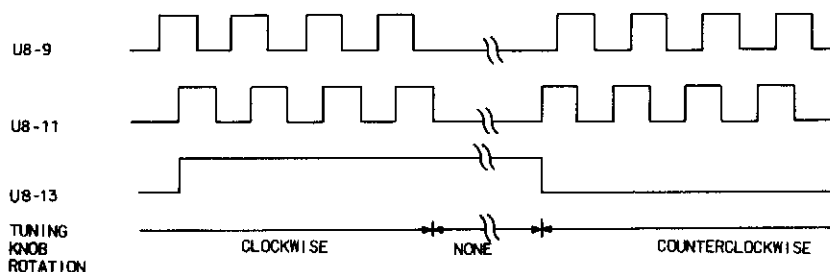
The frequency tuning knob input is developed from an optical encoder. As the knob is rotated, light beams are chopped into pulses that are applied to flip-flop U8B. Input pulse A (J6-1) will precede pulse B (J6-2) if the tuning knob is rotated clockwise, and vice versa for counterclockwise. Clockwise 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



TPA-2195-013

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. b. Press in second-from-right frequency control switch. Observe frequency display while rotating tuning knob. c. Press in third-from-right frequency control switch. Observe frequency display while rotating tuning knob. d. Press in leftmost 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. 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. 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. 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. <table><thead><tr><th>MHz</th><th>J2-PIN</th></tr></thead><tbody><tr><td>1.6</td><td>6</td></tr><tr><td>2.5</td><td>1</td></tr><tr><td>3.5</td><td>7</td></tr><tr><td>4.5</td><td>2</td></tr><tr><td>6</td><td>3</td></tr><tr><td>9</td><td>8</td></tr><tr><td>12</td><td>4</td></tr><tr><td>20</td><td>10</td></tr></tbody></table>	MHz	J2-PIN	1.6	6	2.5	1	3.5	7	4.5	2	6	3	9	8	12	4	20	10	<u>VOLTAGE</u> +2 V or less +4 V or more +2 V or less +4 V or more +4 V or more +2 V or less +4 V or more +2 V or less	Check Q1. Check U14. Check Q2. Check U14. Check U14. Check Q2. Check U14. Check Q2. If output transistors are not faulty, return card to repair center or factory.
MHz	J2-PIN																				
1.6	6																				
2.5	1																				
3.5	7																				
4.5	2																				
6	3																				
9	8																				
12	4																				
20	10																				
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. <table><thead><tr><th>MHz</th><th>J2-PIN</th></tr></thead><tbody><tr><td>1</td><td>6</td></tr><tr><td>2</td><td>7</td></tr><tr><td>4</td><td>8</td></tr><tr><td>10</td><td>9</td></tr><tr><td>20</td><td>10</td></tr></tbody></table>	MHz	J2-PIN	1	6	2	7	4	8	10	9	20	10	<u>VOLTAGE</u> +2 V or less +2 V or less +2 V or less +2 V or less +2 V or less	Check Q1. Check Q2. Check Q3. Check Q4. Check Q5.						
MHz	J2-PIN																				
1	6																				
2	7																				
4	8																				
10	9																				
20	10																				
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)	<u>FREQUENCY BAND</u> 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. b. Record frequency displayed on transceiver. c. On keypad, depress following keys in sequence indicated: 1 , 2 , . , 3 , 4 , 5 , 0 , 6 . d. Observe transceiver frequency display. e. Depress STO , 1 . Observe transceiver frequency display. f. Depress RCL , 1 . Observe transceiver frequency display. g. Depress following keys in sequence indicated. 3 , . , 5 , 1 , STO , 2 , then 2 , 9 , . , 6 , 3 , STO , 3 . h. Depress STEP and note frequency display. i. Depress STEP and note frequency display. j. Depress STEP and note frequency display.	Display is 12.345 06, but operating frequency has not changed. Display is that initially recorded in first step. Display is 12.345 06. Operating frequency also goes to this. Frequency display remains at 12.345 06. Display is 3.510 00 MHz. Operating frequency also goes to this. Display is 29.630 00 MHz. Operating frequency also goes to this. Display is 12.345 06 MHz. Operating frequency also goes to this.	This test assumes keypad functions properly. If results not correct for any step, check control interface for malfunctions.
(Cont)			

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. l. Depress 3, ., 5, CLR. Note frequency display. m. Depress 3, ., 4, 5, ENT. Note frequency display. n. Turn off power and disconnect equipment.	Display and operating frequency is 29.630 00 MHz. (Control skips memory locations loaded with blank data.) Display shows 3.500 00 until CLR depressed, then clears and returns to last frequency used. Display and operating frequency goes to 3.450 00 MHz.	

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.

<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
-----------------	--

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
-------	--

<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
-----------------	--

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
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81349	MILITARY SPECIFICATIONS
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96906	MILITARY STANDARD
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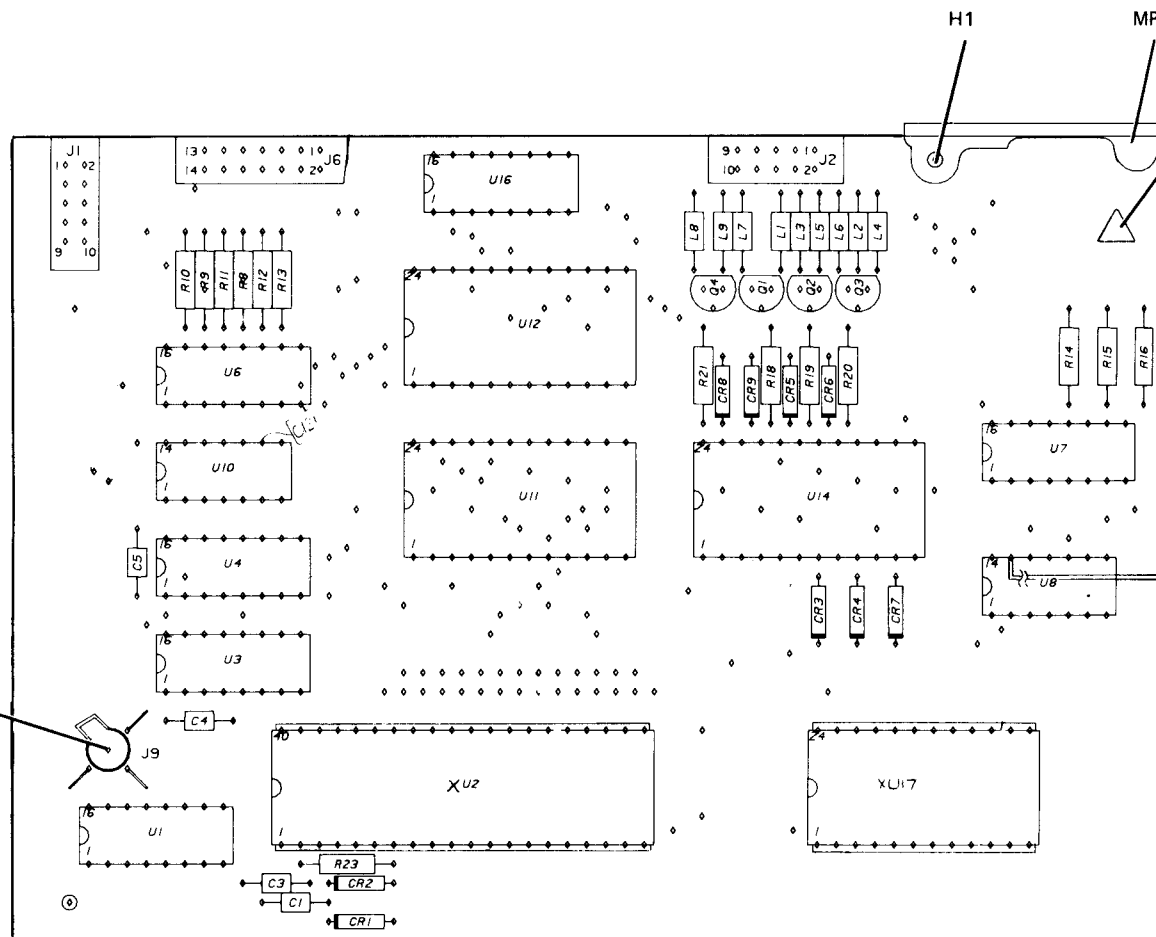
98291	SEAELECTRO CORP 225 HOYT MAMARONECK NY 10544
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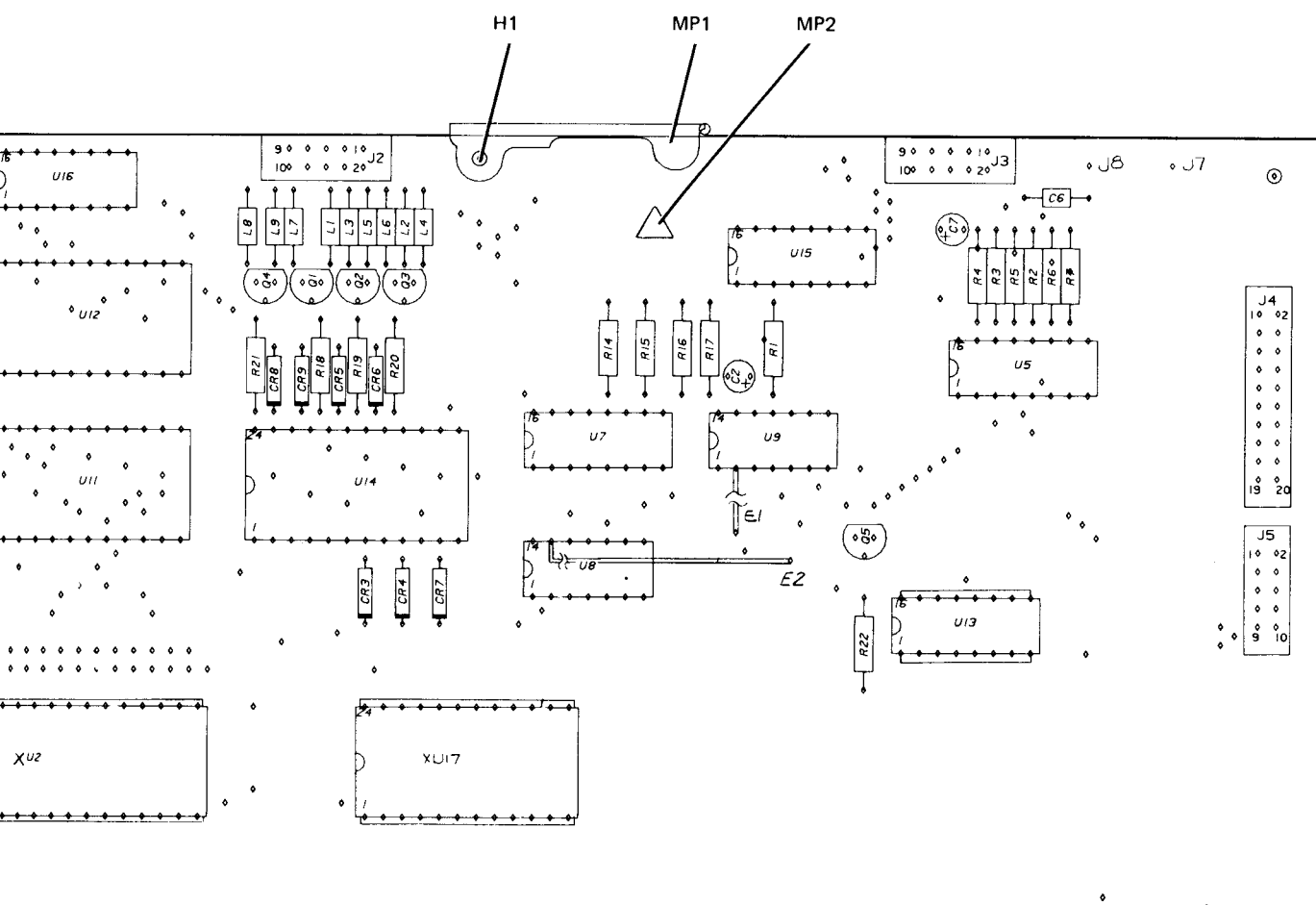
5.3 Equipment Covered

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

<u>CIRCUIT CARD/ SUBASSEMBLY</u>	<u>COLLINS PART NUMBER</u>	<u>LATEST EFFECTIVITY</u>
Control	638-6929-003	REV M
Control	638-6929-004	REV M
Control	638-6929-006	REV M

MP3





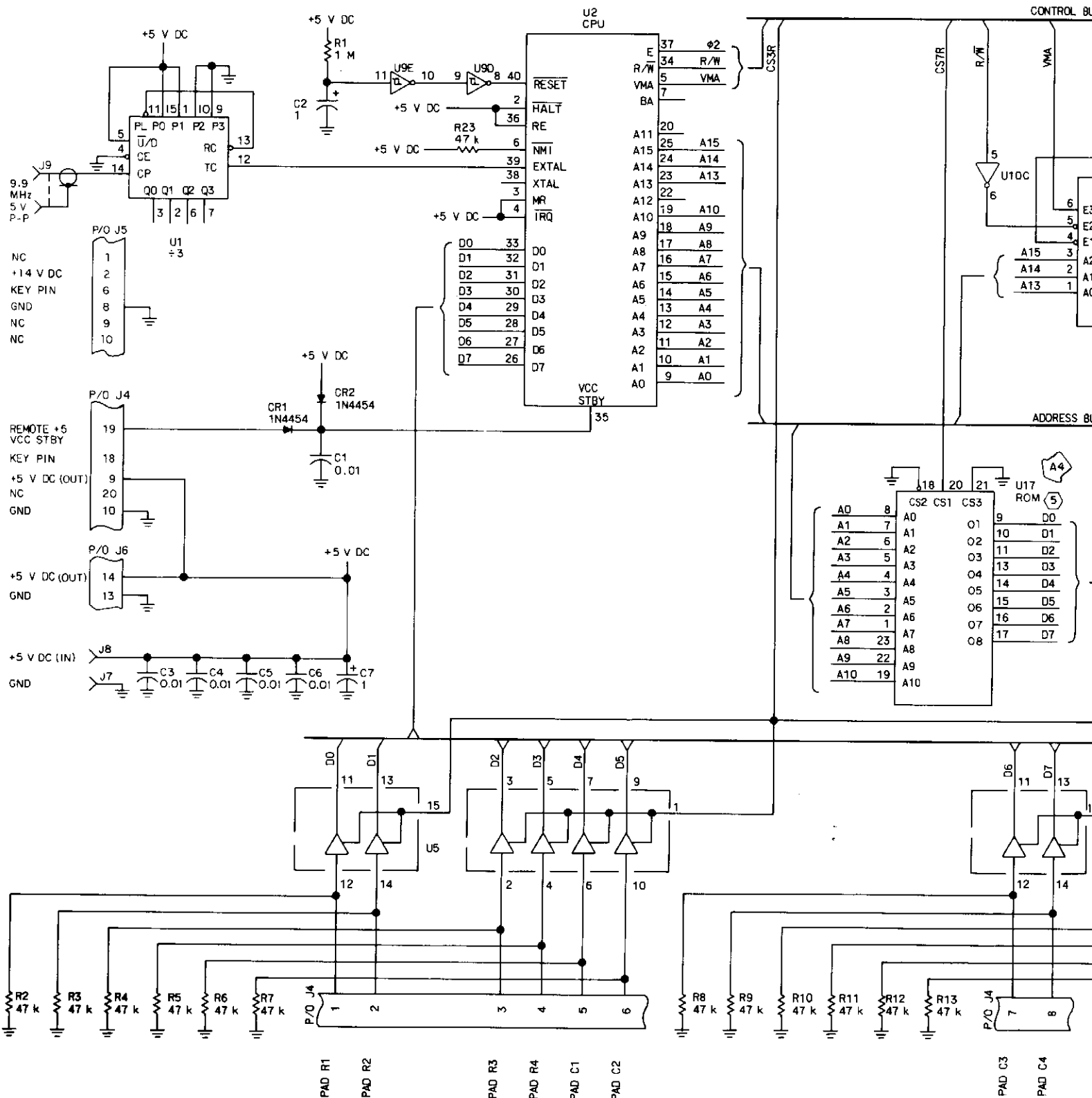
TPA-5299-018

Control, Parts Location
Figure 6 (Sheet 1 of 2)

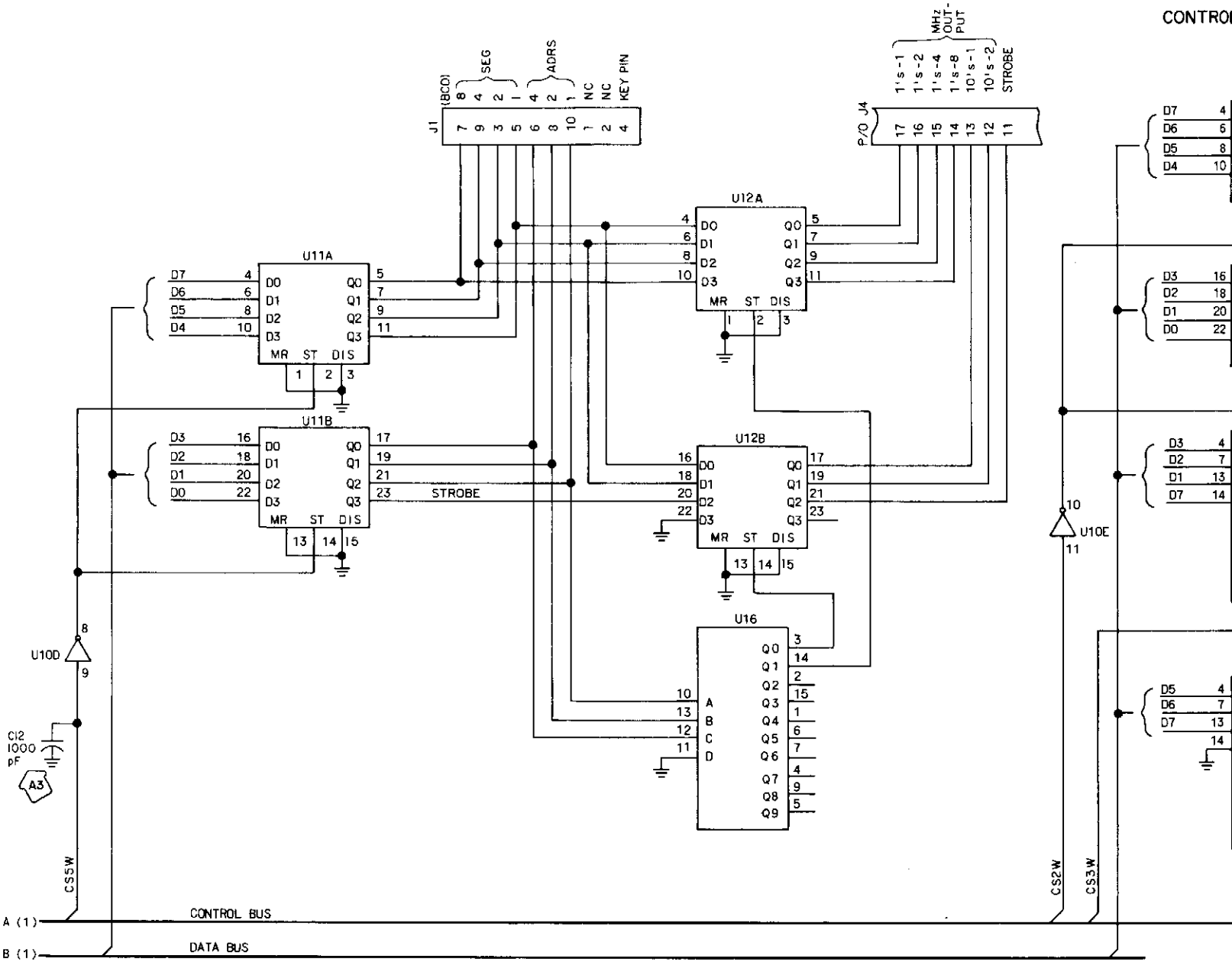
PARTS LIST

MODIFICATION HISTORY

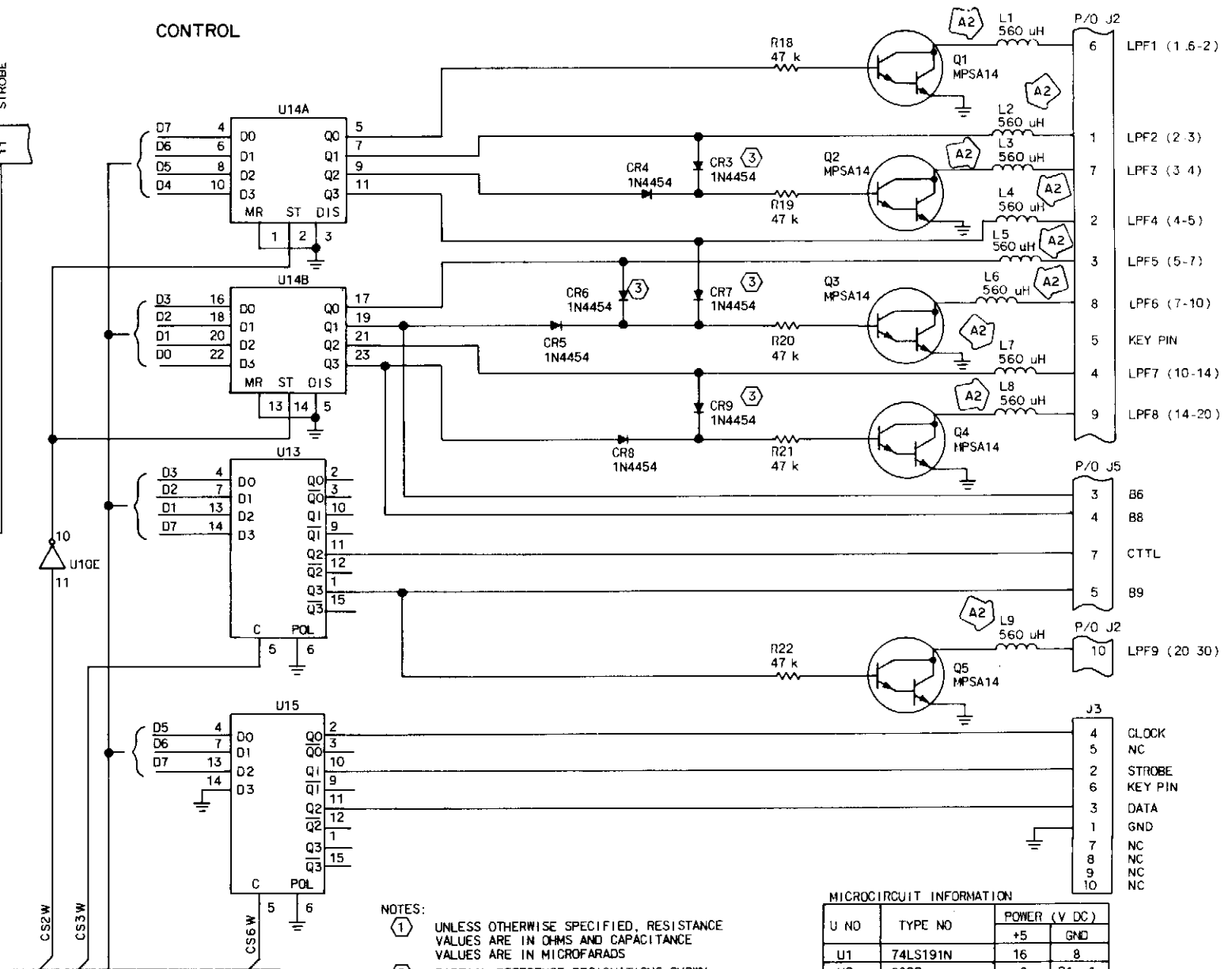
REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVE DATE
	CONTROL (ESDS)	638-6929-003	A		638-6929-003		638-6929-003, -004, -006	
	CONTROL (ESDS) (A6)	638-6929-004	B		638-6929-004			
	CONTROL (ESDS)	638-6929-006	C					
CR1-CR9	SEMICONV DEVICE	353-3644-010	A	31433	1N4454	A1	Deleted C8-C11 Added C12-913-4778-000 1000pF	REV E
CR1,CR2	SEMICONV DEVICE	353-3644-010	B,C	31433	1N4454-1			
CR3	NOT USED		B,C					
CR4,CR5	SEMICONV DEVICE	353-3644-010	B,C	31433	1N4454-1	A2	Changed L1-L9 from 100μH to 560μH	REV F
CR6,CR7	NOT USED		B,C					
CR8	SEMICONV DEVICE	353-3644-010	B,C	31433	1N4454-1			
C1	CAPACITOR,FXD CER DIEL, 0.01UF, P80/M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B	A3	Changed C12 from 1000pF to 330pF	REV G
C2	CAPACITOR,FXD TMTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1	A4	Changed U17 from 351-8870-010 to TO 351-8870-050	REV H
C3-C6	CAPACITOR,FXD CER DIEL, 0.01UF, P80/M20%, 50VDC	913-3331-020		56289	292CY5U103Z050B			
C7	CAPACITOR,FXD TMTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1			
C8-C11	CAPACITOR,FXD CER DIEL, 470PF, 10%, 200V (A1)	913-4014-000		81349	CK05BX471K	A5	Added X2-220-0075-070	REV J
H1	PIN,SPRING SST, 0.078 DIA X 1/4	311-0355-000		96906	MS16562-199		Added X17-220-0075-050	
J1-J3	CONNECTOR,HDR	372-2656-100		52072	CAD10SP100-230-4 30	NA	Data change only	REV K
J4	CONNECTOR,HDR	372-2656-090		52072	CAD20SP100-230-4 30			
J5	CONNECTOR,HDR	372-2656-100		52072	CAD10SP100-230-4 30	A6	Added 003 Status	REV L
J6	CONNECTOR,HDR	372-2656-200		52072	CAD14SP100-230-4 30	NA	Change pn of sleeving	REV M
J7,J8	CONNECTOR,HDR	372-2656-130		52072	CAS01SP100-230-4 30			
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	MP5A14			
R1	RESISTOR,FXD CHPSN, 1MEGΩ, 10%, 1/4W	745-0857-000		81349	RCR076105KS			
R2-R23	RESISTOR,FXD CHPSN, 47K, 10%, 1/4W	745-0809-000		81349	RCR076473KS			
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	MC14504BCP			
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			



CONTROL



CONTROL



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 RI453-11. FOR -002, U17 IS RI451-11. FOR -003, U17 IS RI453-12. FOR -004, U17 IS RI451-12.
- 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	74LS133	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		24	12

634-6918
TPA-1403-024

Control, Schematic Diagram
Figure 7 (Sheet 2)



**Rockwell
International**

instructions

Collins Telecommunications Products Division

523-0771746-001211

1 August 1982

**Noise Blanker
(641-7146-001)**

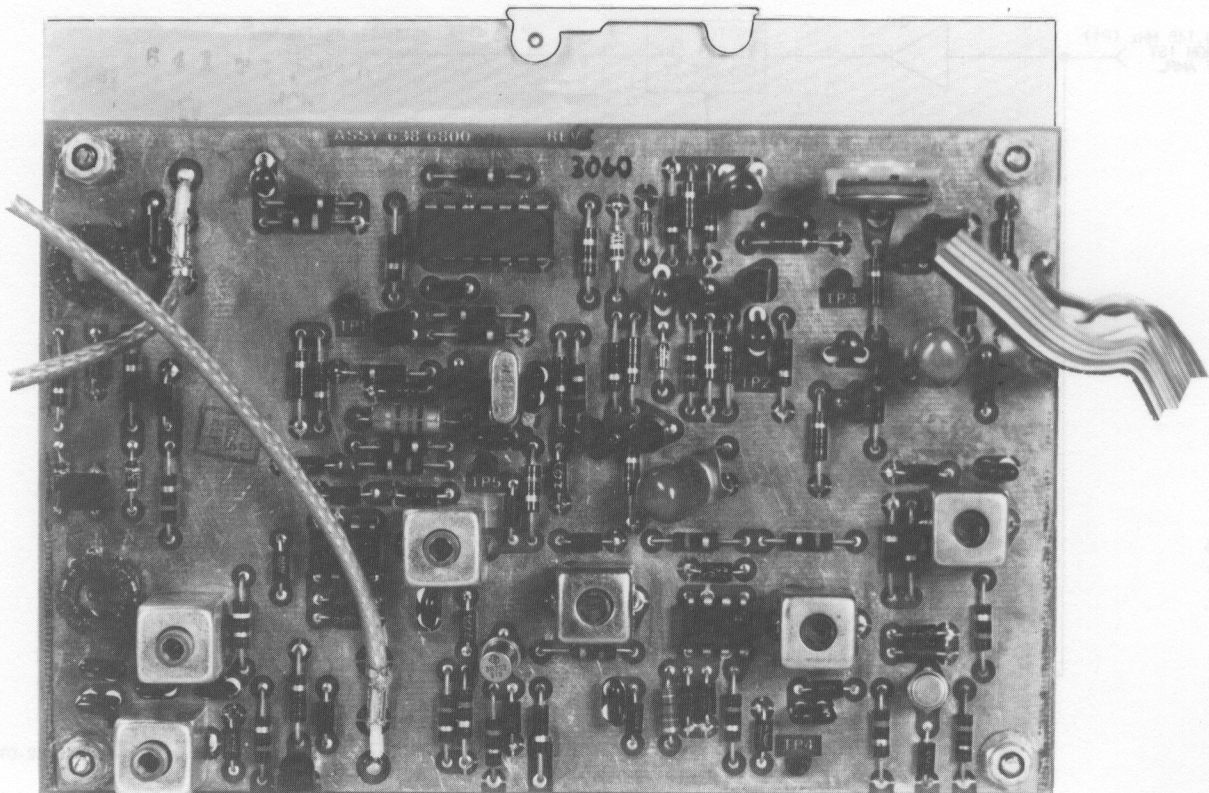
Noise Blanker (641-7146-001)

Printed in USA

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.



TPA-5277-017

Noise Blanker
Figure 1

523-0771746-001211

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.

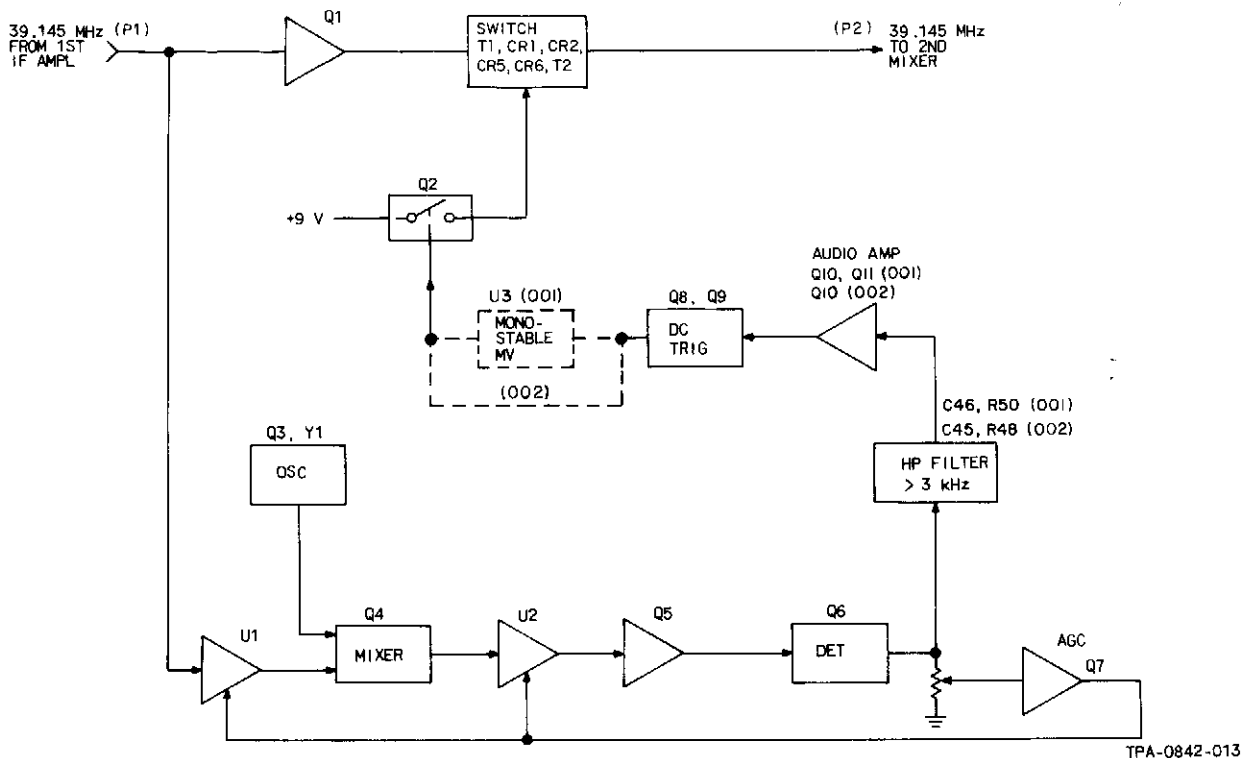
In the noise detection/switch control circuit, the input signal is amplified by U1 and applied to mixer Q4.

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- μ s 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 μ V; 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 μ s/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 $\pm$ 0.005 MHz, without modulation. Adjust output to -20 dB mW. b. Connect rf voltmeter to P2. Note output signal level.	-20 $\pm$ 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 $\pm$ 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 μ V.	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 $10\,000 \pm 1000\text{-}\mu\text{V}$ 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 $370 \pm 75\text{ }\mu\text{s}$ 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 $10\,000 \pm 1000\text{-}\mu\text{V}$, 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 $10\,000 \pm 1000\text{ }\mu\text{V}$, 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

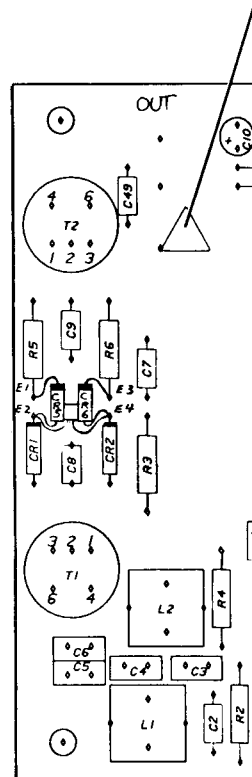
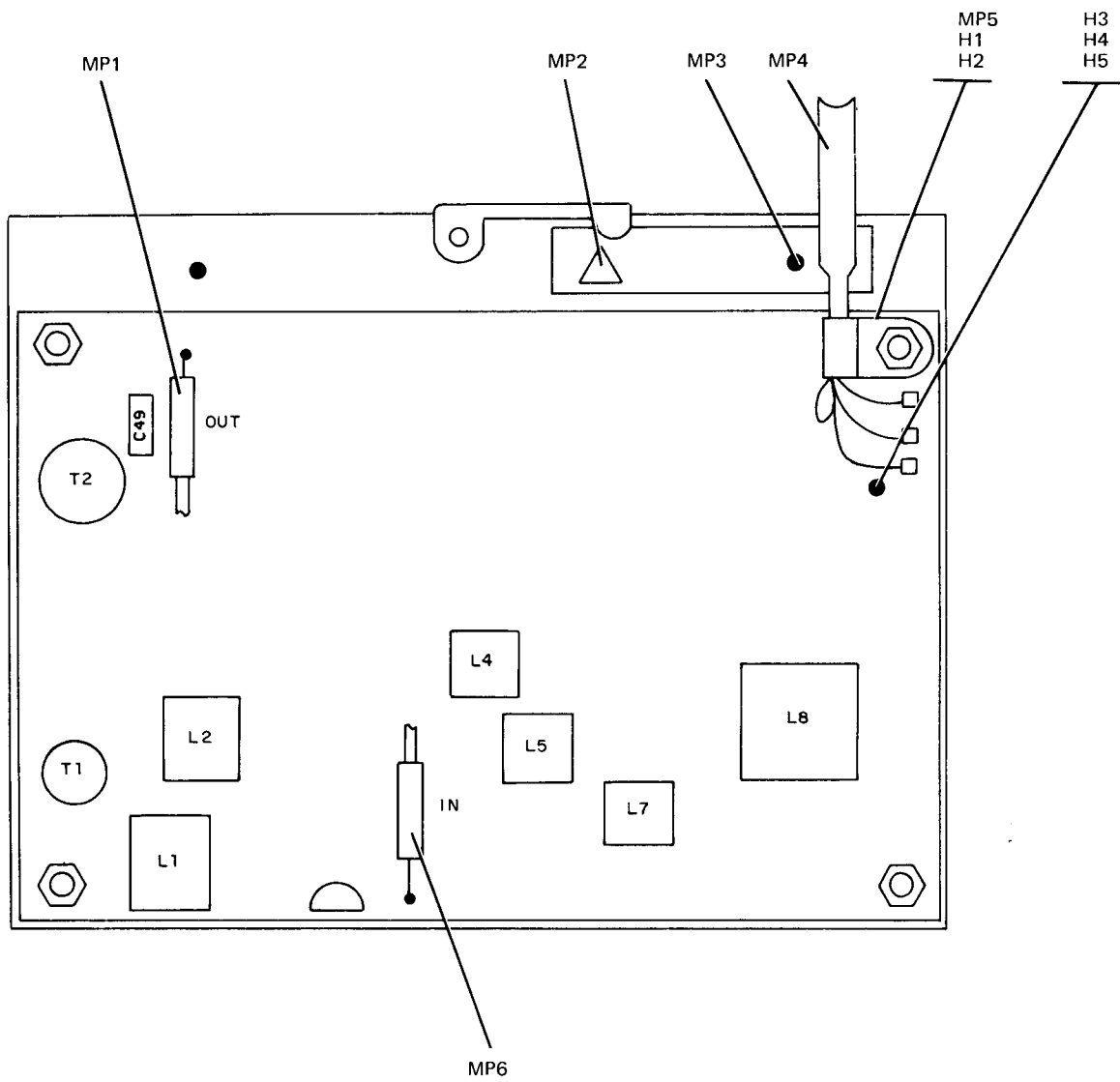
<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
13499	ROCKWELL INTERNATIONAL CORP COLLINS TELECOMMUNICATIONS PRODUCTS DIV 855 35TH ST NE P O BOX 728 CEDAR RAPIDS IA 52498
17856	SILICONIX INC 2201 LAURELWOOD RD SANTA CLARA CA 95054
20462	PREM ENTERPRISES INC 3519 N CHAPEL HILL MC HENRY IL 60050
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

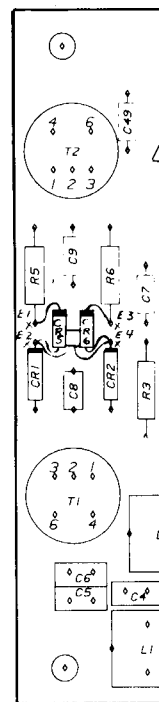
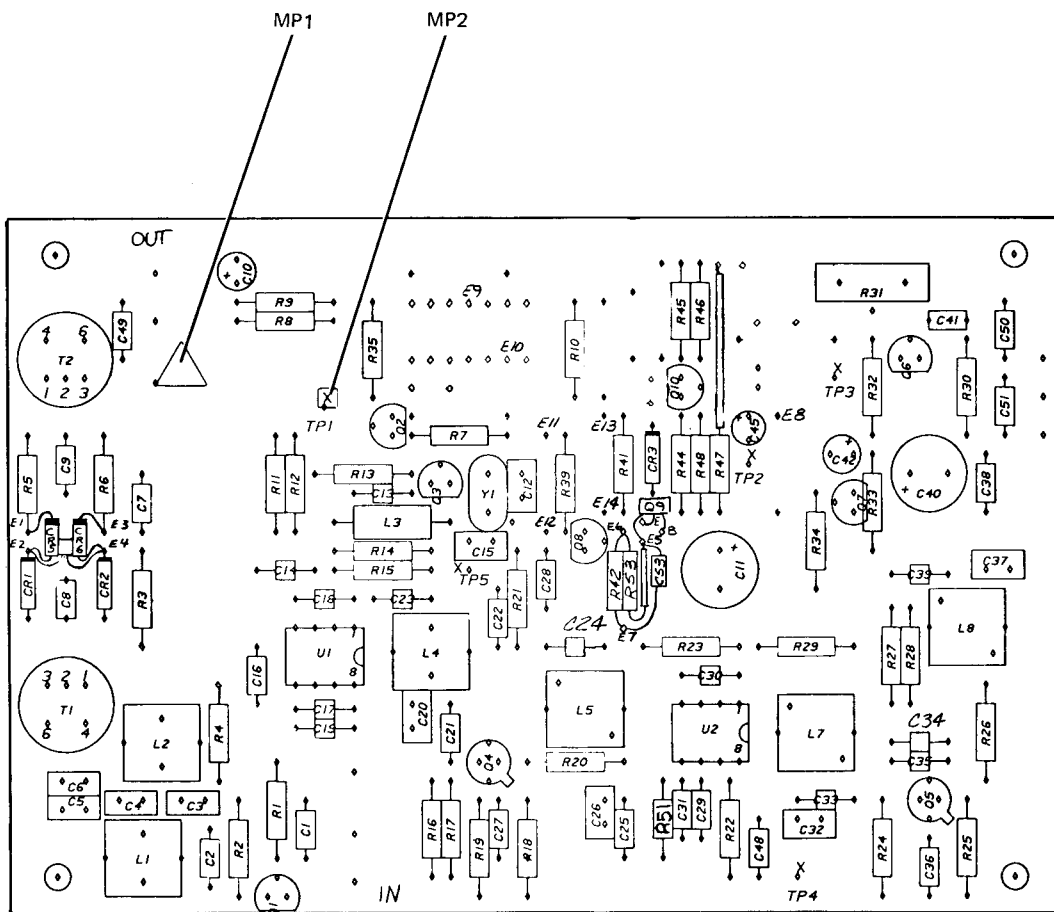
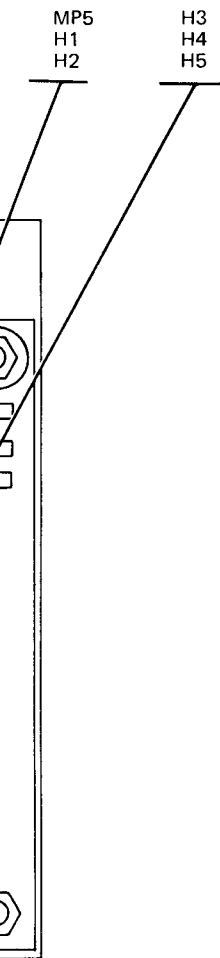
<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
71450	CTS CORP 905 N WEST BLVD ELKHART IN 46514
72962	ESNA DIV OF AMERACE CORP 2330 VAUXHALL ROAD UNION NJ 07083
81349	MILITARY SPECIFICATIONS
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
96906	MILITARY STANDARD

5.3 Equipment Covered

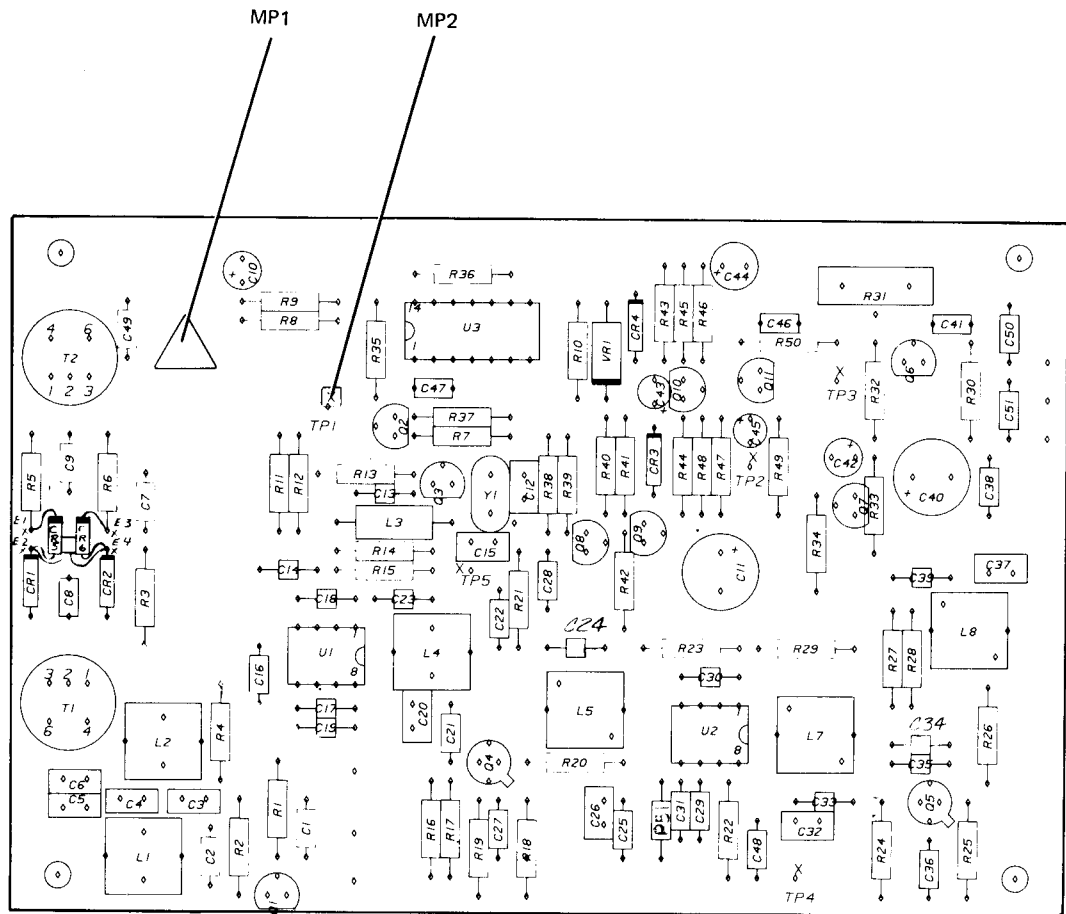
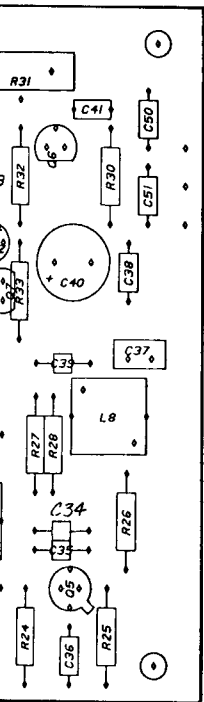
Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

<u>CIRCUIT CARD/ SUBASSEMBLY</u>	<u>COLLINS PART NUMBER</u>	<u>LATEST EFFECTIVITY</u>
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





638-6800-001



638-6800-002



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	REF DES	DESCRIPTION
	NOISE BLANKER (ESDS)	641-7146-001			641-7146-001	C53	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC
	NOISE BLANKER CIRCUIT CARD (ESDS)	638-6800-001 A			638-6800-001	E1-E4	CONNECTOR, HDR
H1	NOISE BLANKER CIRCUIT CARD (ESDS)	638-6800-002 B				L1, L2	COIL, RF, VAR 0.525MIN UH TO 1.020MAX UH
H2	SCREW, MACH STL, 4-40 X 5/8 (QTY 1)	343-0138-000		96906	M551957-18	L3	COIL, RF 1.50UH
H3	WASHER, FLAT CRES, 0.164ID X 0.320 OD (QTY 1)	310-0779-050		96906	M515795-805	L4	COIL, RF, VAR 0.525MIN UH TO 1.020MAX UH
H4	POST (QTY 4)	541-5964-002			541-5964-002	L5	INDUCTOR, RF
H5	NUT, SLFLKG, HEX AL, 4-40 (QTY 4)	333-0346-000		72962	69NM40	L6	NOT USED
MP1	SCREW, MACH STL, 4-40 X 1/2 (QTY 4)	343-0137-000		96906	M551957-17	L7, L8	INDUCTOR, RF
MP2	CABLE, COAX	641-7100-019			641-7100-019	MP1	LABEL, PRESS SENS (ESDS)
MP3	LABEL, PRESS SENS (ESDS)	280-2745-040		12998	280-2745-040	MP2	CONNECTOR, HDR (QTY 9)
MP4	PLATE, NOISE BLANKER	641-7131-001				MP2	CONNECTOR, HDR (QTY 12)
MP5	CABLE, COAX	641-7172-001					
MP6	CLAMP, LOOP	150-1554-000		55943	610-0002		
	CABLE, COAX	641-7100-018			641-7100-018		
	NOISE BLANKER CIRCUIT CARD (ESDS)	638-6800-001 A			638-6800-001		
CR1, CR2	NOISE BLANKER CIRCUIT CARD (ESDS)	638-6800-002 B					
CR3	SEMICOND DEVICE	353-3733-010 A		28480	HP-3168	Q1	TRANSISTOR, JFET
CR3, CR4	SEMICOND DEVICE	353-3644-010 B		31433	1N4454	Q2	TRANSISTOR
CR5, CR6	SEMICOND DEVICE	353-3644-010 A		31433	1N4454	Q3	TRANSISTOR
C1, C2	CAPACITOR, FIXED CER DIEL, 0.001UF, P80% 50VDC	913-3331-010		28480	HP-3168	Q4	TRANSISTOR, FET (ESDS)
C3	CAPACITOR, FXD MICA DIEL, 18PF, PORM 0.5PF, 100V	912-4141-140		56289	292CX7R102M050B	Q5	TRANSISTOR, FET (ESDS)
C4	CAPACITOR, FXD MICA DIEL, 1PF, PORM 0.5PF, 300V	912-4141-060		93790	CD5CA1800D0	Q6	TRANSISTOR
C5	CAPACITOR, FXD MICA DIEL, 15PF, PORM 0.5PF, 300V	912-4141-130		93790	CD5CC0100D0	Q7	TRANSISTOR (ESDS)
C6	CAPACITOR, FXD MICA DIEL, 6PF, PORM 0.5PF, 300V	912-4141-090		93790	CD5CC0600D0	Q8	TRANSISTOR
C7	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	Q9	TRANSISTOR
C8	CAPACITOR, FIXED CER DIEL, 2200PF, 10%, 100V	913-5019-120		81349	CK05BX222K	Q10	TRANSISTOR
C9	CAPACITOR, FIXED CER DIEL, 0.001UF, P80% 50VDC	913-3331-010		56289	292CX7R102M050B	Q11	TRANSISTOR (ESDS)
C10	CAPACITOR, FIXED TMTL ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1	R1	RESISTOR, FXD CHPSN, 150 OHMS, 10%, 1/4W
C11	CAPACITOR, FIXED TMTL ELCTLT, 100UF, 20%, 20V	184-9102-640		56289	196D240A	R2, R3	RESISTOR, FXD CHPSN, 47 OHMS, 10%, 1/4W
C12	CAPACITOR, FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0	R4	RESISTOR, FXD CHPSN, 3.9K, 10%, 1/4W
C13, C14	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R5, R6	RESISTOR, FXD CHPSN, 10 OHMS, 10%, 1/4W
C15	CAPACITOR, FXD MICA DIEL, 39PF, 2%, 50V	912-4141-040		93790	CD5EY390G0	R7	RESISTOR, FXD CHPSN, 10K, 10%, 1/4W
C16-C19	CAPACITOR, FIXED CER DIEL, 0.001UF, P80% 50VDC	913-3331-010		56289	292CX7R102M050B	R8	RESISTOR, FXD CHPSN, 560 OHMS, 10%, 1/4W
C20	CAPACITOR, FXD MICA DIEL, 15PF, PORM 0.5PF, 300V	912-4141-130		93790	CD5CC1500D0	R9	RESISTOR, FXD CHPSN, 2.2K, 10%, 1/4W
C21, C22	CAPACITOR, FIXED CER DIEL, 0.001UF, P80% 50VDC	913-3331-010		56289	292CX7R102M050B	R10	RESISTOR, FXD CHPSN, 2.2K, 10%, 1/4W
C23	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R11, R12	RESISTOR, FXD CHPSN, 47 OHMS, 10%, 1/4W
C24	CAPACITOR, FIXED CER DIEL, 0.047UF, P80% 50V	913-3331-040		56289	292CY5U473Z050C	R13	RESISTOR, FXD CHPSN, 10K, 10%, 1/4W
C25	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R14, R15	RESISTOR, FXD CHPSN, 2.2K, 10%, 1/4W
C26	CAPACITOR, FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0	R16	RESISTOR, FXD CHPSN, 47 OHMS, 10%, 1/4W
C27	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R17	RESISTOR, FXD CHPSN, 2.7K, 10%, 1/4W
C28	CAPACITOR, FIXED CER DIEL, 0.047UF, P80% 50V	913-3331-040		56289	292CY5U473Z050C	R18	RESISTOR, FXD CHPSN, 10K, 10%, 1/4W
C29	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R19	RESISTOR, FXD CHPSN, 270 OHMS, 10%, 1/4W
C30	CAPACITOR, FIXED CER DIEL, 0.047UF, P80% 50V	913-3331-040		56289	292CY5U473Z050C	R20, R21	RESISTOR, FXD CHPSN, 47 OHMS, 10%, 1/4W
C31	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R22	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W
C32	CAPACITOR, FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0	R23	RESISTOR, FXD CHPSN, 47 OHMS, 10%, 1/4W
C33, C34	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R24	RESISTOR, FXD CHPSN, 2.7K, 10%, 1/4W
C35	CAPACITOR, FIXED CER DIEL, 0.001UF, P80% 50VDC	913-3331-010		56289	292CX7R102M050B	R25	RESISTOR, FXD CHPSN, 270 OHMS, 10%, 1/4W
C36	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R26	RESISTOR, FXD CHPSN, 47 OHMS, 10%, 1/4W
C37	CAPACITOR, FXD MICA DIEL, 150PF, 5%, 50V	912-4141-400		93790	CD5FY151J0	R27	RESISTOR, FXD CHPSN, 47 OHMS, 10%, 1/4W
C38	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R28	RESISTOR, FXD CHPSN, 15K, 10%, 1/4W
C39	CAPACITOR, FIXED CER DIEL, 0.047UF, P80% 50V	913-3331-040		56289	292CY5U473Z050C	R29	RESISTOR, FXD CHPSN, 47 OHMS, 10%, 1/4W
C40	CAPACITOR, FIXED TMTL ELCTLT, 100UF, 20%, 20V	184-9102-640		56289	196D240A	R30	RESISTOR, FXD CHPSN, 2.7K, 10%, 1/4W
C41	CAPACITOR, FIXED CER DIEL, 0.022UF, 10%, 50VDC (A1)	913-5019-240		81349	CK05BX223K	R31	RESISTOR, VARIABLE 5K, 30%, 0.25 TO 0 W
C41	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020 A		56289	292CY5U103Z050B	R32	RESISTOR, FXD CHPSN, 0.10MEGO, 10%, 1/4W
C42	CAPACITOR, FIXED TMTL ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1	R33	RESISTOR, FXD CHPSN, 1MEGO, 10%, 1/4W
C43	CAPACITOR, FIXED TMTL ELCTLT, 1UF, 20%, 35V	184-9102-350 A		56289	199D105X0035BB1	R34	RESISTOR, FXD CHPSN, 1K, 10%, 1/4W
C44	CAPACITOR, FIXED TMTL ELCTLT, 4.7UF, 20%, 35V	184-9102-390 A		56289	199D475X0035BB1	R35	RESISTOR, FXD CHPSN, 10K, 10%, 1/4W
C45	CAPACITOR, FIXED TMTL ELCTLT, 1UF, 20%, 35V	184-9102-350 A		56289	199D105X0035BB1	R36	RESISTOR, FXD CHPSN, 0.10MEGO, 10%, 1/4W
C46, C47	CAPACITOR, FIXED CER DIEL, 1000PF, 10%, 200V	913-4018-000 A		81349	CK05BX102K	R37	RESISTOR, FXD CHPSN, 0.15MEGO, 10%, 1/4W
C48	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R38	RESISTOR, FXD CHPSN, 0.10MEGO, 10%, 1/4W
C49	CAPACITOR, FIXED CER DIEL, 0.001UF, P80% 50VDC	913-3331-010		56289	292CX7R102M050B	R39	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W
C50, C51	CAPACITOR, FIXED CER DIEL, 0.01UF, P80% 50VDC	913-3331-020		56289	292CY5U103Z050B	R40	RESISTOR, FXD CHPSN, 1K, 10%, 1/4W
C52	CAPACITOR, FXD MICA DIEL, 15PF, PORM 0.5PF, 300V (A1)	912-4141-130		93790	CD5CC1500D0	R41	RESISTOR, FXD CHPSN, 150 OHMS, 10%, 1/4W
						R42	RESISTOR, FXD CHPSN, 10 OHMS, 10%, 1/4W
						R43	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W
						R44	RESISTOR, FXD CHPSN, 10K, 10%, 1/4W
						R45	RESISTOR, FIXED CHPSN, 22K, 10%, 1/4W
						R46	RESISTOR, FXD CHPSN, 4.7K, 10%, 1/4W
						R47	RESISTOR, FXD CHPSN, 0.12MEGO, 10%, 1/4W
						R48	RESISTOR, FXD CHPSN, 47K, 10%, 1/4W
						R49	RESISTOR, FXD CHPSN, 15K, 10%, 1/4W
						R50	RESISTOR, FXD CHPSN, 0.22MEGO, 10%, 1/4W
						R51	RESISTOR, FXD CHPSN, 1.5K, 10%, 1/4W
						R52	RESISTOR, FXD CHPSN, 22K, 10%, 1/4W
						R53	RESISTOR, FXD CHPSN, 10 OHMS, 10%, 1/4W
						T1	NOT USED
						U1, U2	RESISTOR, FIXED CHPSN, 10K, 10%, 1/4W
						U3	TRANSFORMER, RF
						VR1	INTEGRATED CIRCUIT AMPLIFIER
						Y1	MICROCIRCUIT (ESDS)
							SEMICOND DEVICE
							CRYSTAL UNIT, QZ 31.00000MHZ

PARTS 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	MS15957-18
	310-0779-050		96906	MS15795-805
	541-5964-002			541-5964-002
	333-0346-000		72962	69NM40
	343-0137-000		96906	MS15957-17
	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
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	912-4141-060		93790	CD5CC0100D
	912-4141-130		93790	CD5CC1500D
	912-4141-090		93790	CD5CC0600D
	913-3331-020		56289	292CY5U103Z050B
	913-5019-120		81349	CK05BX222K
	913-3331-010		56289	292CX7R102M050B
	184-9102-350		56289	1990105X0035BB1
	184-9102-640		56289	196D240A
	912-4141-400		93790	CD5FY151J0
	913-3331-020		56289	292CY5U103Z050B
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	913-3331-040		56289	292CY5U473Z050C
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	184-9102-390 A		56289	1990475X0035DB1
	184-9102-350 A		56289	1990105X0035BB1
	913-4018-000 A		81349	CK05BX102K
	913-3331-020		56289	292CY5U103Z050B
	913-3331-010		56289	292CX7R102M050B
	913-3331-020		56289	292CY5U103Z050B
	912-4141-130		93790	CD5CC1500D

PARTS LIST (Cont)

COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
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240-1570-000		96906	MS18130-10
242-0439-060		02113	115CLWMDV17-5TUR NS
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242-0441-060		20462	242-0441-060
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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
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352-5501-010		04713	MPS2222A
352-0769-030 A		04713	2N5459
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745-0701-000		81349	RCR07G470KS
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278-0444-010		20462	2259
351-1142-010		04713	MC1350P
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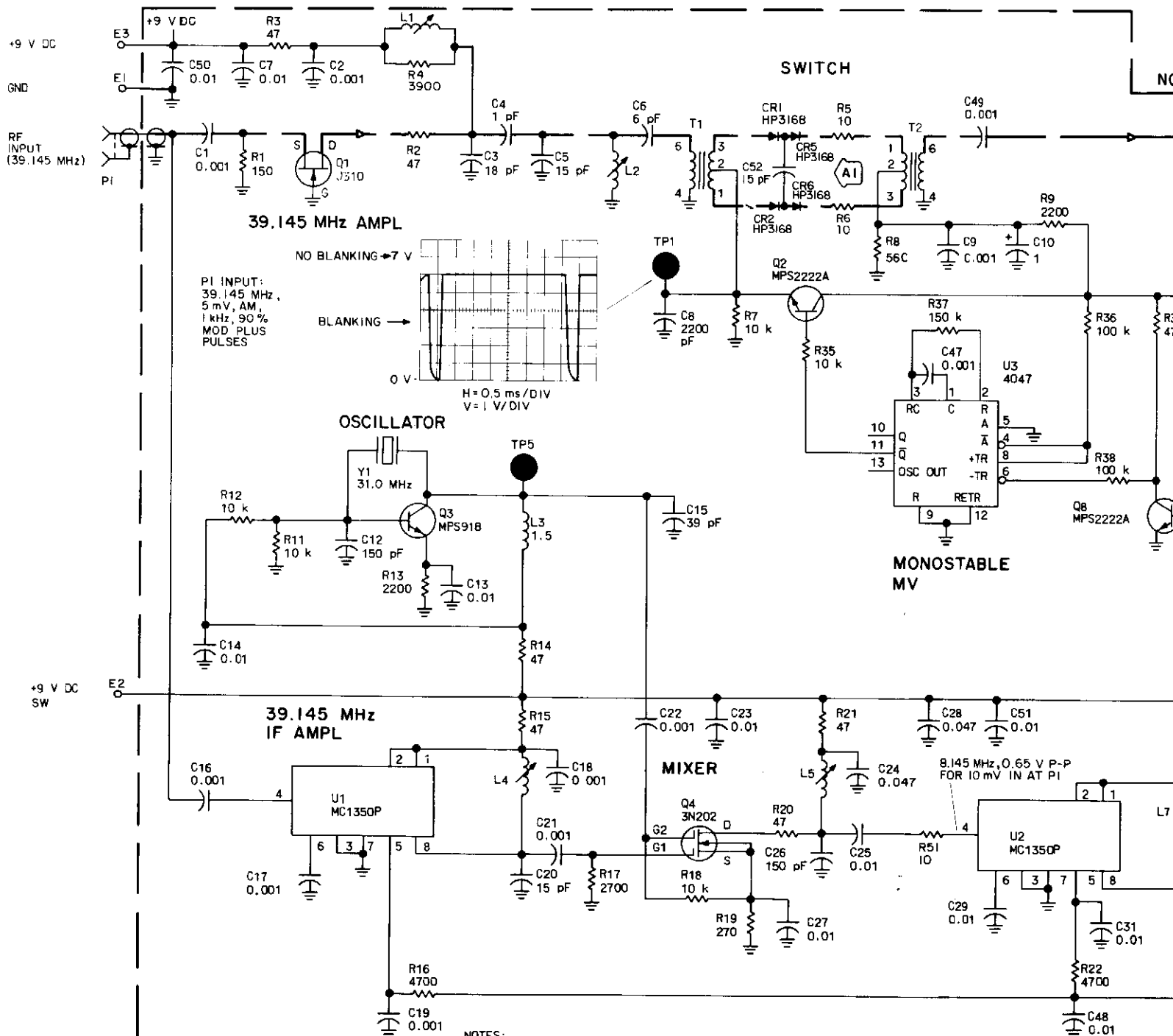
REVISION
IDENTNA
A1
638-6800-001
Changed
Added C

PARTS LIST (Cont)

	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
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	372-2656-130		52072	CAS01SP100-230-4 30
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AX UH	240-1570-000		96906	MS18130-10
	242-0439-060		02113	115CLWMDV17-5TUR 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
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	352-5502-010		17856	J310
	352-5501-010		04713	MPS2222A
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	352-5505-010		17856	2N5486
	352-0769-030		04713	2N5459
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4W	745-0755-000		81349	RCR07G152KS
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1/4W	745-0677-000		81349	RCR07G100KS
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MODIFICATION HISTORY

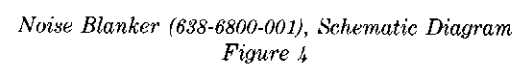
REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
NA	638-6800-001 replaced with 638-6800-002	REV C
A1	Changed C41 from 0.022 μ F to 0.01 μ F Added C52, P/N 912-4141-130 15 pF	REV E

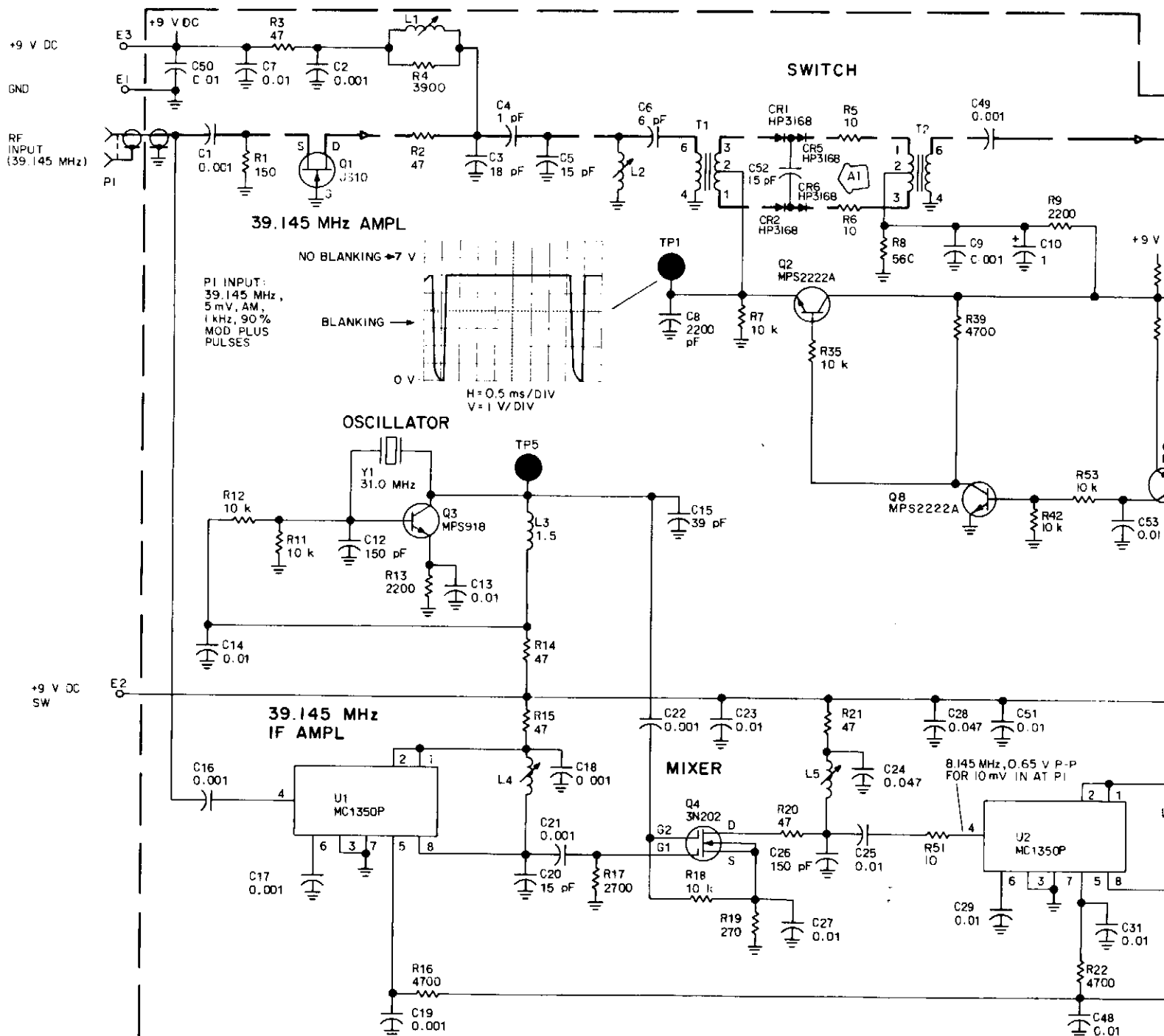


NOTES:

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

(4) WA
(5) TH
DE
PR





39.145 MHz AMPL

OSCILLATOR

39.145 MHz
IF AMPL

8.145 MHz, 0.65 V P-P
FOR 10 mV IN AT PI

- NOTES:

- 3 WAVEFORMS A
- 4 THIS EQUIPM
DEVICES. S
PREVENT EQ





**Rockwell
International**

instructions

Collins Telecommunications Products Division

523-0771747-001211

1 August 1982

**Speech Processor
(638-6933-001)**

Speech Processor (638-6933-001)

Printed in USA

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

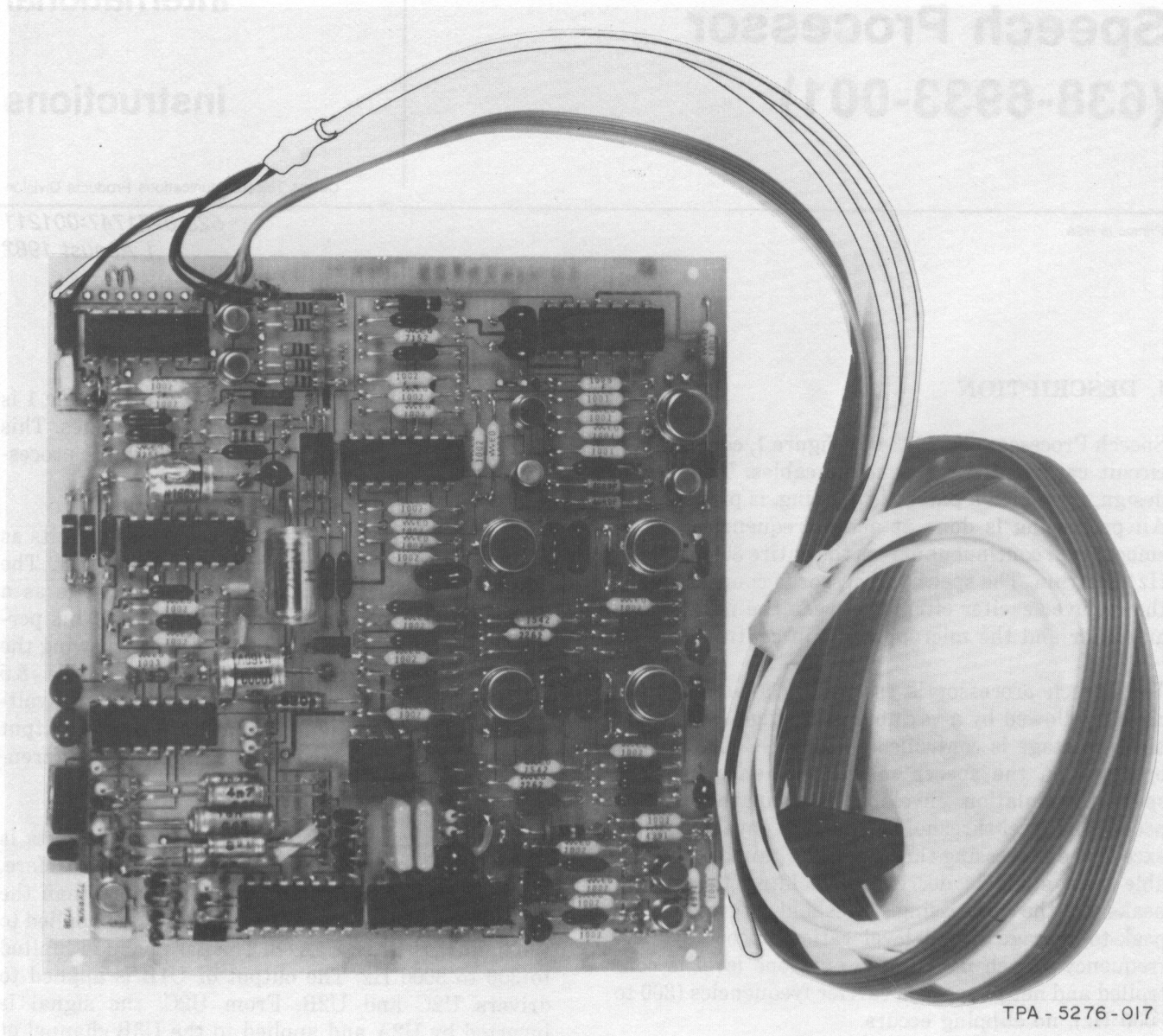
to U12C to open the switch. With Q2 on, a logic 1 is applied to U12A and B to close these switches. This condition routes the audio signal through the processor.

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.

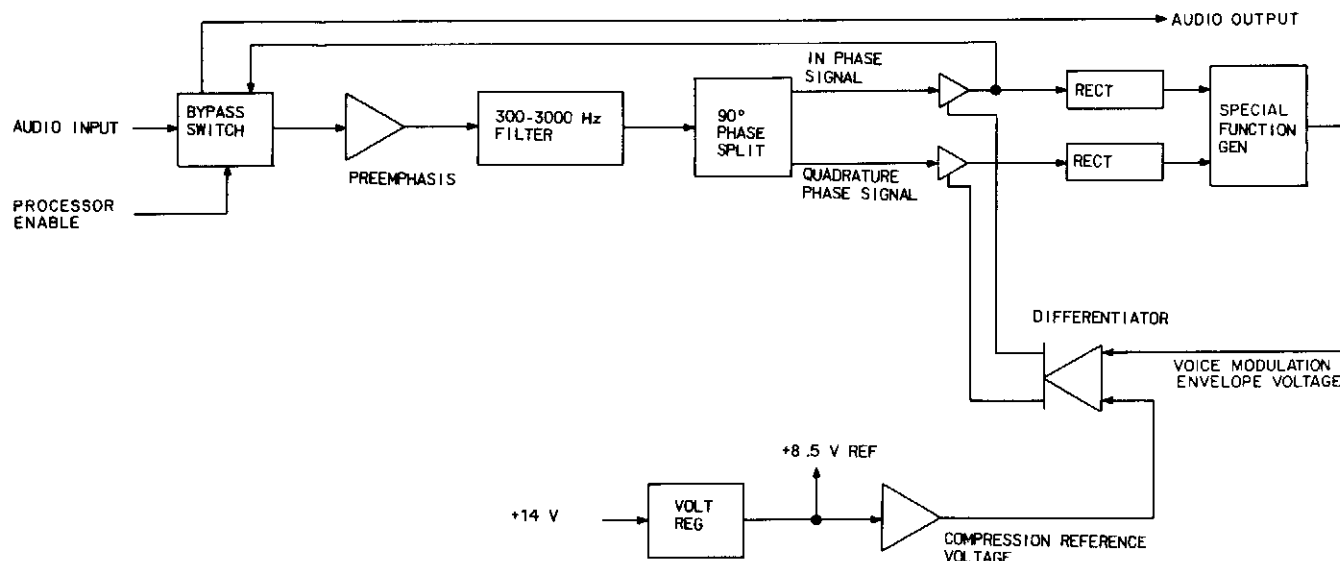
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Speech Processor
Figure 1

With a logic 0 on the CONT input line (C1-1), 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 connects 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

Outputs from the phase shifters are applied to gain controlled amplifiers U3A (1 channel) and U4B (2 channels). The amplifier outputs are further amplified by U3BQ2 and U3CQ3 and applied to precision full-wave rectifier circuits U5/U6 and U7/U8.



TPA-2196-013

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 (V_p^2). The special function circuit next takes the square root of the voltage value to convert the V_p^2 voltage to V_p .

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.

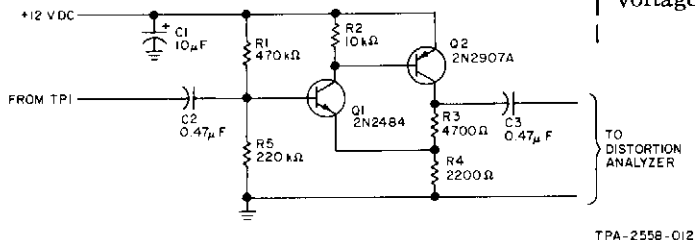
Testing and troubleshooting of the speech processor requires the speech processor be installed in the transceiver.

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. d. Switch in PROC. Adjust R31 for maximum signal output. e. Measure and record output signal level. f. Connect scope to TP1. g. Adjust audio oscillator output level to 0.5 mV rms. h. Adjust R94 for maximum output at TP1.	49 to 51 mV p-p 225 to 275 mV p-p	Check Q1, Q2, and U12. Check U1A, B, D; U2A, C; U3B; U4A, B; and Q8.
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. Check U4A, D.
	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	
	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/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
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

<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
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.

<u>CIRCUIT CARD/ SUBASSEMBLY</u>	<u>COLLINS PART NUMBER</u>	<u>LATEST EFFECTIVITY</u>
Speech Processor	638-6933-001	REV G

PARTS LIST

PARTS LIST (C

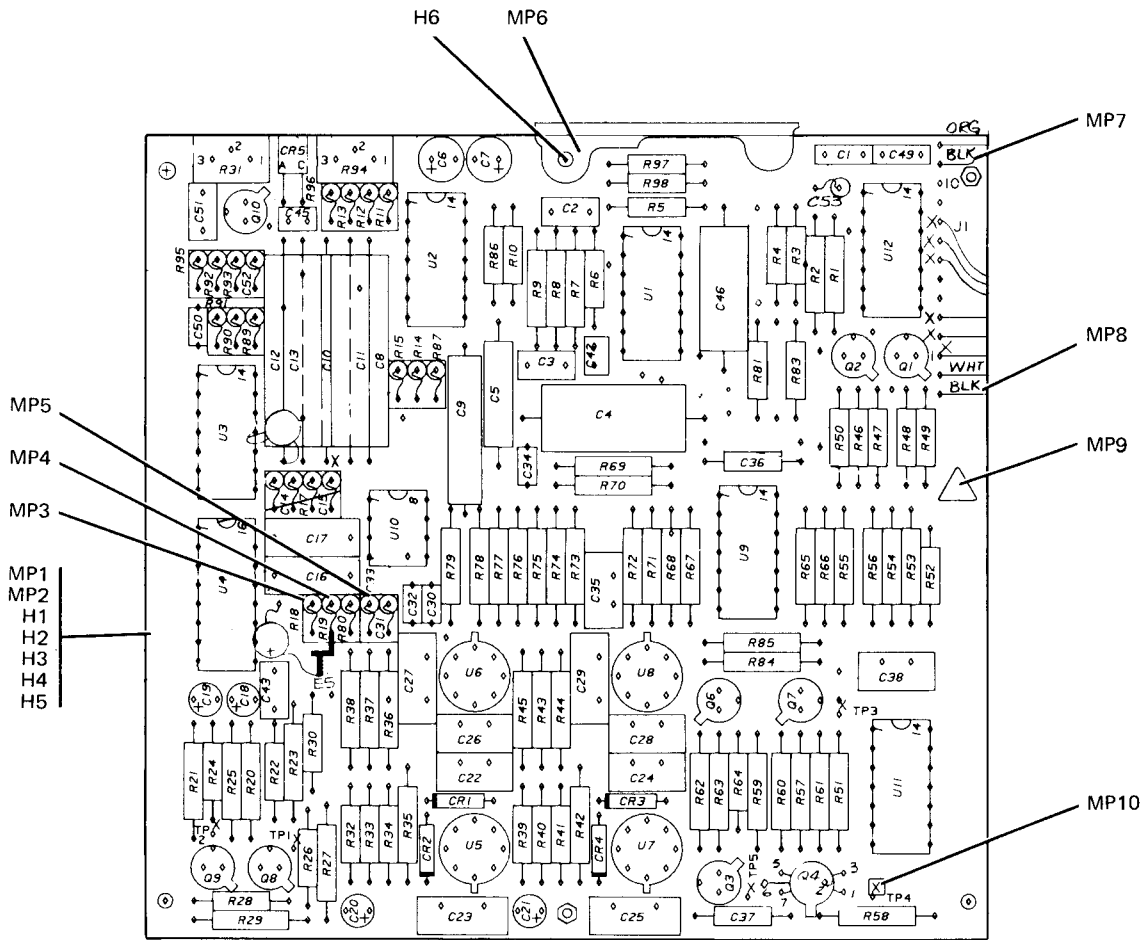
REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
CR1-CR4	SPEECH PROCESSOR	638-6933-001			
CR5	SEMICONO DEVICE	353-3644-010		03508	1N4454GE
C1	DIODE,LIGHT EMI	04404 5082-4484		04404	5082-4484
C2	CAPACITOR,FXD CER DIEL, 0.47UF, 20%, 50V	913-3279-250		16546	CY30C474M
C3	CAPACITOR,FXD CER DIEL, 3300PF, PORM10%, 100V	913-3281-170		18796	8131-100C0G332K
C4	CAPACITOR,FXD PLSTC ,20000PF, 2.5%, 160V	913-3281-140		18796	8131-100C0G152K
C5	CAPACITOR,FXD PLSTC DIEL, 10000PF, 2.5%, 160V	933-1408-740		25088	B33062-B1203-H
C6	CAPACITOR,FXD ELCTLT, 6.8UF, 20%, 25V	933-1408-470		25088	B33062-1000H160V
C7	CAPACITOR,FXD ELCTLT, 4.7UF, 20%, 35V	184-9102-230		56289	199068X0025CB1
C8	CAPACITOR,FXD PLSTC 3.300PF, 20%, 25V	184-9102-390		56289	1990475X0035DB1
		933-1455-040		56289	704C1AC332PF630A
C9	CAPACITOR,FXD PLSTC 82PF, 20%, 25V	933-1455-020		X	
				56289	704C1AB821PF251A
C10	CAPACITOR,FXD PLSTC 18.000PF, 20%, 25V	933-1455-070		X	
				56289	704C1FG183PF630A
C11	CAPACITOR,FXD PLSTC 4.700PF, 20%, 25V	933-1455-050		X	
				56289	704C1AC472PF630A
C12	CAPACITOR,FXD PLSTC 8.200PF, 20%, 25V	933-1455-060		X	
				56289	704C1FD822PF630A
C13	CAPACITOR,FXD PLSTC 1.800PF, 20%, 25V	933-1455-030		X	
				56289	704C1AB182PF161A
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	1990105X0035BB1
C22	CAPACITOR,FXD MICA DIEL, 10PF, PORM 0.5PF, 500V	912-3837-000		81349	CM04CD100003
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	CM04CD100003
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	CM04CD100003
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	CM04CD100003
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	CM04CD100003
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 TMTLM 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
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 TMTLM ELCTLT, 33UF, 20%, 10V (A2)	184-9102-090		56289	199D336X00100B1
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	NA5620C2
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	MS1957-6
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	CAS01SP100-230-430
R1,R2	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RH55D1002F

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 CHPSN, 82 OHMS, 5%, 1/2W (A2)
R89	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W
R90	RESISTOR,FXD FILM, 301K, 1%, 1/8W (A4)
R91	RESISTOR,FXD FILM, 221K, 1%, 1/8W
R92	RESISTOR,FXD FILM, 10K, 5%, 1/4W
R93	RESISTOR,FXD FILM, 61.9K, 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 CHPSN, 1NEGO, 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)

MODIFICATION HISTORY

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER	REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
R3,R4	RESISTOR,FXD FILM, 49.9K, 1%, 1/8W (A2)	705-3605-810		81349	RN5504992F		638-6933-001	
R3	RESISTOR,FXD FILM, 49.9K, 1%, 1/8W	705-3605-810		81349	RN5504992F			
R4	RESISTOR,FXD FILM, 150K, 1%, 1/8W	705-3604-090		81349	RN5501503F			
R5,R6	RESISTOR,FXD FILM, 24.3K, 1%, 1/8W	705-3605-660		81349	RN5502432F	A1	Changed R51 from 1K to 100K	REV D
R7	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F			
R8	RESISTOR,FXD FILM, 68.1K, 1%, 1/8W	705-1084-000		81349	RN5506812F	A2	Added C54-184-9102-090 33UF	REV E
R9	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F		Changed R4 from 49.9K to 150K	
R10	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN5501003F		Changed R56 from 1.27K to 2.67K	
R11	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN5501001F		Deleted R88	
R12	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN5501003F			
R13	RESISTOR,FXD FILM, 17.8K, 1%, 1/8W	705-1056-000		81349	RN5501782F			
R14	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN5501003F	A3	Changed R64 from 18.2K to 47.5K	REV F
R15	RESISTOR,FXD FILM, 17.8K, 1%, 1/8W	705-1056-000		81349	RN5501782F		Deleted R82-745-0910-630	
R16,R17	RESISTOR,FXD FILM, 40.2K, 1%, 1/8W	705-1073-000		81349	RN5504022F		Deleted C40-184-9102-350	
R18,R19	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN5501003F		Deleted C41-913-5020-390	
R20,R21	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F		Deleted C47-913-3331-030	
R22	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W	705-3605-800		81349	RN5504752F			
R23	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F			
R24	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W	705-3605-800		81349	RN5504752F			
R25	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F	A4	Changed R90 from 301K to 221K	REV G
R26	RESISTOR,FXD FILM, 4.99K, 1%, 1/8W	705-3605-330		81349	RN5504991F			
R27	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN5501001F			
R28	RESISTOR,FXD FILM, 4.99K, 1%, 1/8W	705-3605-330		81349	RN5504991F			
R29	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN5501001F			
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	RN5502002F			
R35	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F			
R36	RESISTOR,FXD FILM, 15.4K, 1%, 1/8W	705-1053-000		81349	RN5501542F			
R37	RESISTOR,FXD FILM, 22.6K, 1%, 1/8W	705-1061-000		81349	RN5502262F			
R38	RESISTOR,FXD FILM, 6.19K, 1%, 1/8W	705-1034-000		81349	RN5506191F			
R39-R41	RESISTOR,FXD FILM, 20K, 1%, 1/8W	705-3605-620		81349	RN5502002F			
R42	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F			
R43	RESISTOR,FXD FILM, 22.6K, 1%, 1/8W	705-1061-000		81349	RN5502262F			
R44	RESISTOR,FXD FILM, 15.4K, 1%, 1/8W	705-1053-000		81349	RN5501542F			
R45	RESISTOR,FXD FILM, 6.19K, 1%, 1/8W	705-1034-000		81349	RN5506191F			
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	RN5501001F			
R51	RESISTOR,FXD FILM, 100K, 1%, 1/8W	705-1092-000		81349	RN5501003F			
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	RN5501302F			
R54	RESISTOR,FXD FILM, 71.5K, 1%, 1/8W	705-1085-000		81349	RN5507152F			
R55	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F			
R56	RESISTOR,FXD FILM, 1.27K, 1%, 1/8W (A2)	705-1001-000		81349	RN5501271F			
R56	RESISTOR,FXD FILM, 2.67K, 1%, 1/8W	705-3605-200		81349	RN5502671F			
R57-R60	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN5501001F			
R61	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN5501001F			
R62,R63	RESISTOR,FXD FILM, 49.9 OHMS, 1%, 1/8W	705-3600-340		81349	RN5504999F			
R64	RESISTOR,FXD FILM, 18.2K, 1%, 1/8W (A3)	705-3605-600		81349	RN5501822F			
R64	RESISTOR,FXD FILM, 47.5K, 1%, 1/8W	705-3605-800		81349	RN5504752F			
R65-R68	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F			
R69,R70	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W	705-1025-000		81349	RN5504021F			
R71,R72	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F			
R73	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W	705-1025-000		81349	RN5504021F			
R74	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F			
R77,R78	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W	705-1025-000		81349	RN5504021F			
R79	RESISTOR,FXD FILM, 10K, 1%, 1/8W	705-1044-000		81349	RN5501002F			
R80	RESISTOR,FXD FILM, 4.02K, 1%, 1/8W	705-1025-000		81349	RN5504021F			
R81	RESISTOR,FXD FILM, 3.32K, 1%, 1/8W	705-1021-000		81349	RN5503321F			
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	RN5501002F			
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	RN5501001F			
R88	RESISTOR,FXD CHPSN, 82 OHMS, 5%, 1/2W (A2)	745-1040-000		81349	RC20BF820J			
R89	RESISTOR,FXD FILM, 30.1K, 1%, 1/8W	705-1067-000		81349	RN5503012F			
R90	RESISTOR,FXD FILM, 301K, 1%, 1/8W (A4)	705-1115-000		81349	RN5503013F			
R90	RESISTOR,FXD FILM, 221K, 1%, 1/8W	705-3604-170		81349	RN5502213F			
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	RN5506192F			
R93	RESISTOR,FXD FILM, 301K, 1%, 1/8W	705-1115-000		81349	RN5503013F			
R94	RESISTOR,VAR 10K, 20%, 1/2W	382-0038-360		73138	72XR10K			
R95	RESISTOR,FXD FILM, 20K, 1%, 1/8W	705-3605-620		81349	RN5502002F			
R96	RESISTOR,FXD FILM, 1K, 1%, 1/8W	705-0996-000		81349	RN5501001F			
R97,R98	RESISTOR,FXD CHPSN, 1MEG0, 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			



638-6933-001

CAUTION
ELECTROSTATIC
SENSITIVE DEVICES
OBSERVE PRECAUTIONS
FOR HANDLING
TPA-5301-019

Speech Processor, Parts Location
Figure 3

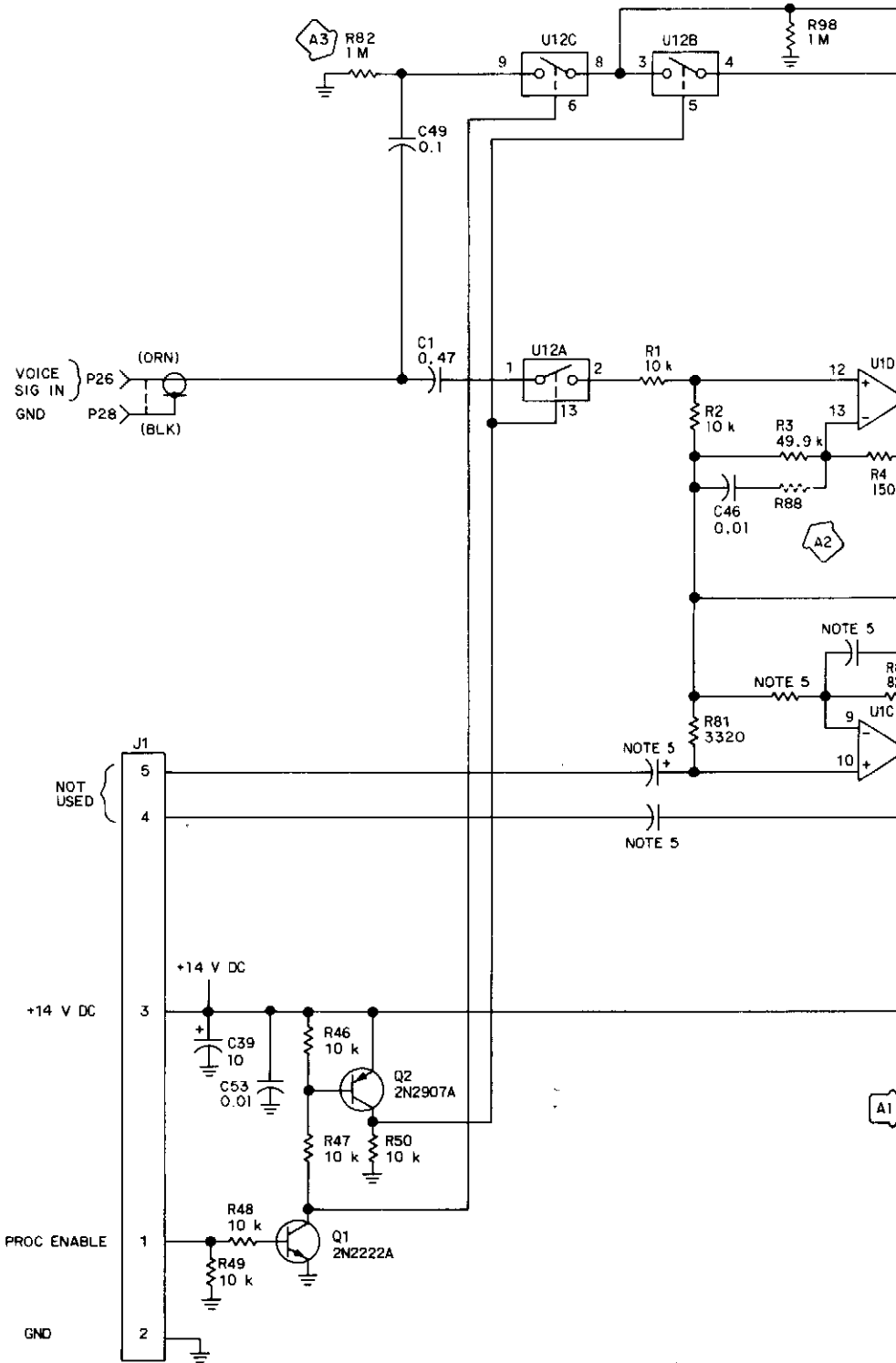
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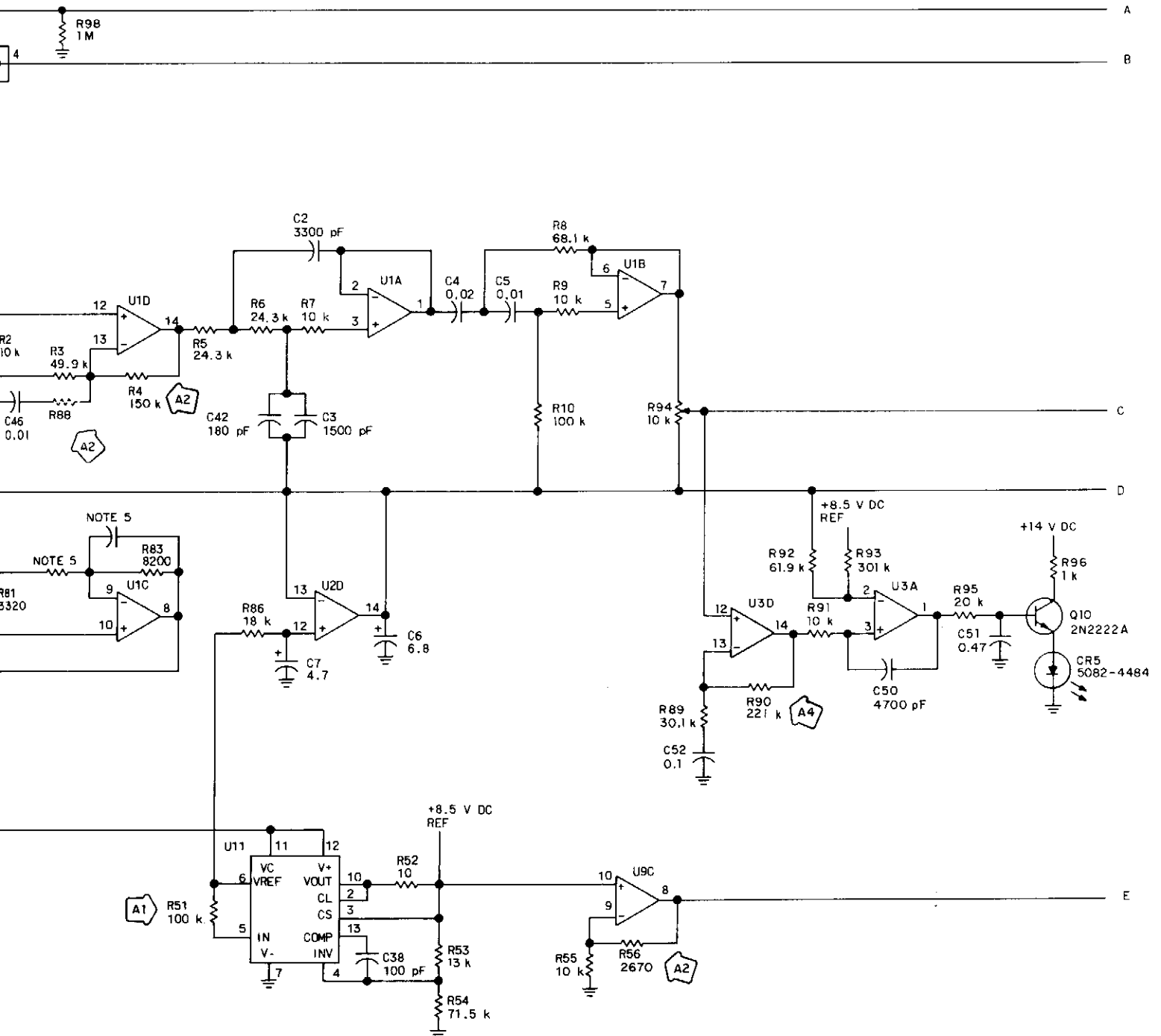
1. UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
3. TYPE DESIGNATIONS SHOWN MAY BE GENERIC IN FORM AND ARE FOR REFERENCE ONLY. SEE 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)		SPARE SECTIONS
		+14	GND	
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	CD4066	14	7	D

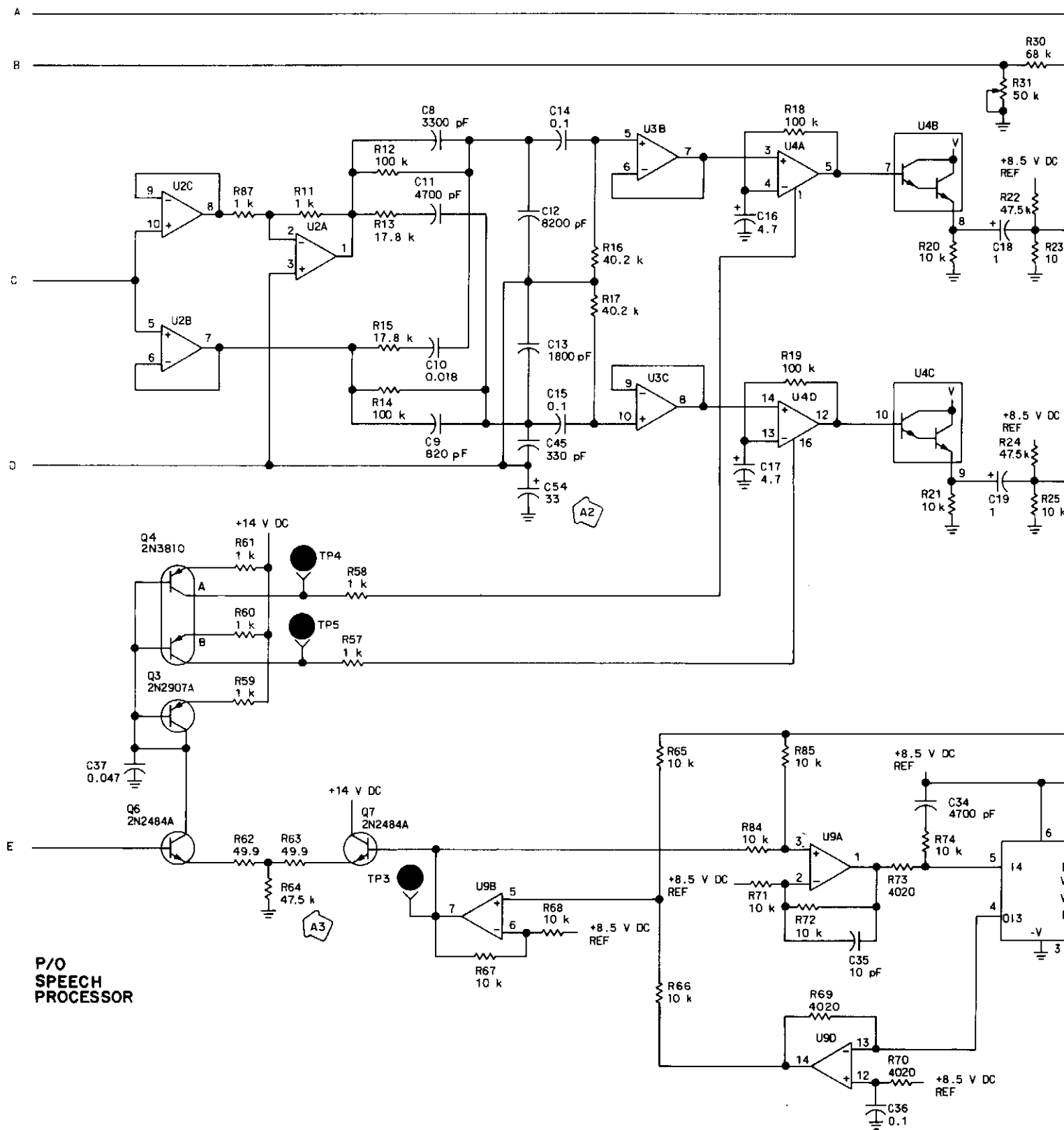
P/O
SPEECH
PROCESSOR

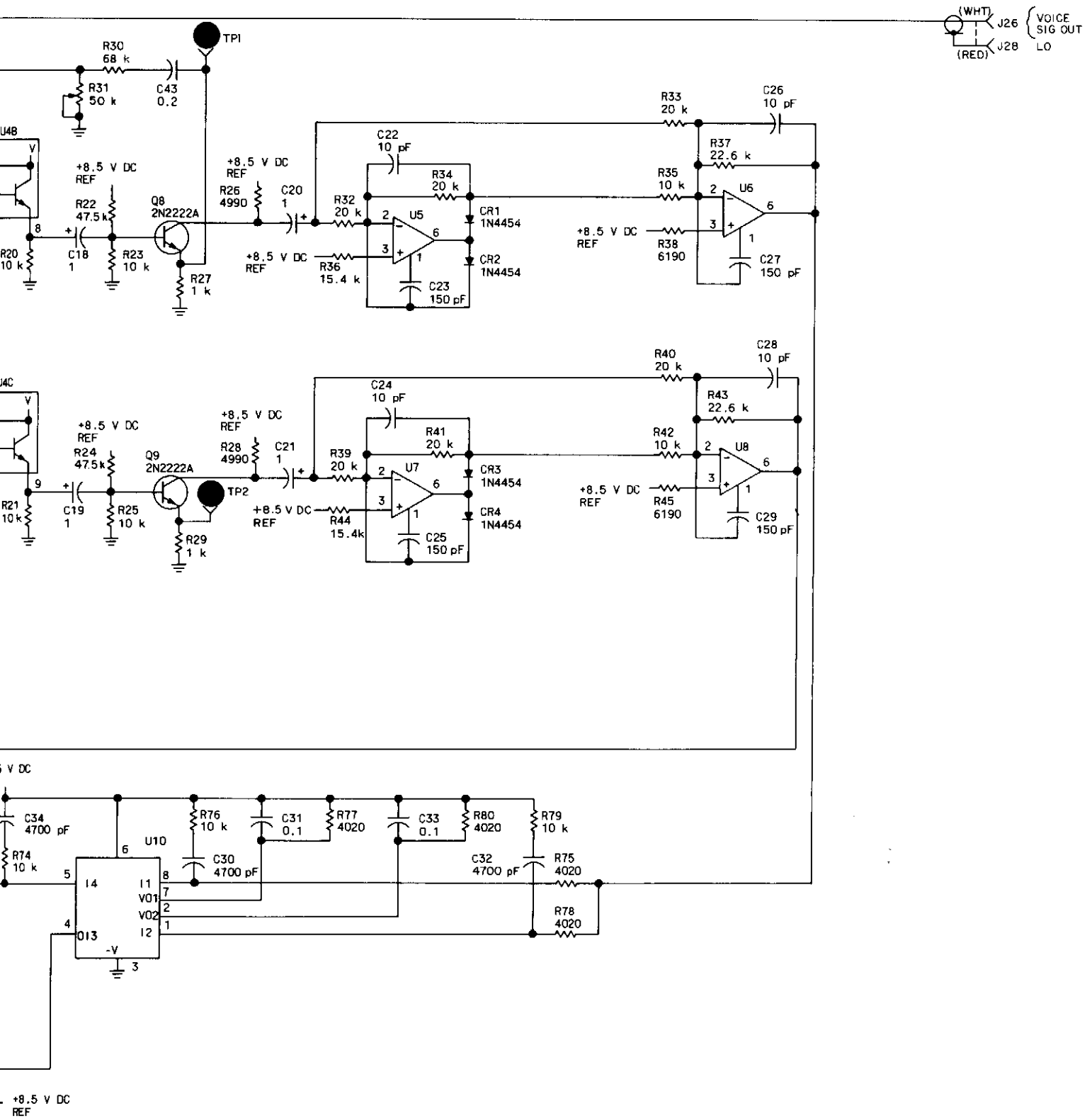




634-6921
TPA-2046-024

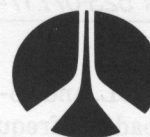
Speech Processor, Schematic Diagram
Figure 4 (Sheet 1 of 2)





634-6921
TPA-2046-024

Speech Processor, Schematic Diagram
Figure 4 (Sheet 2)



**Rockwell
International**

instructions

Collins Telecommunications Products Division

523-0771748-001211

1 August 1982

**Control Interface
(638-6910-001)**

Control Interface (638-6910-001)

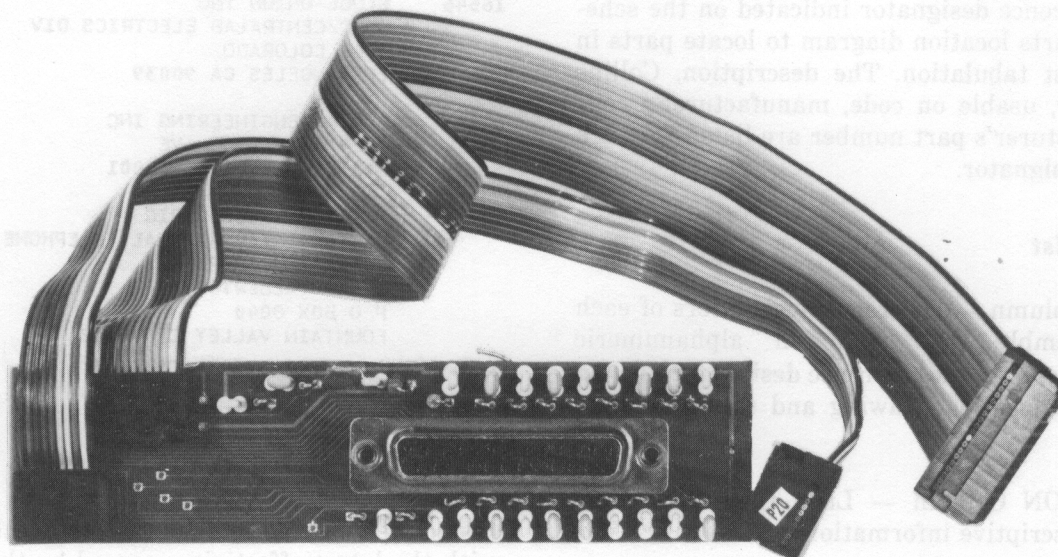
Printed in USA

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**

523-0771748-001211

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.

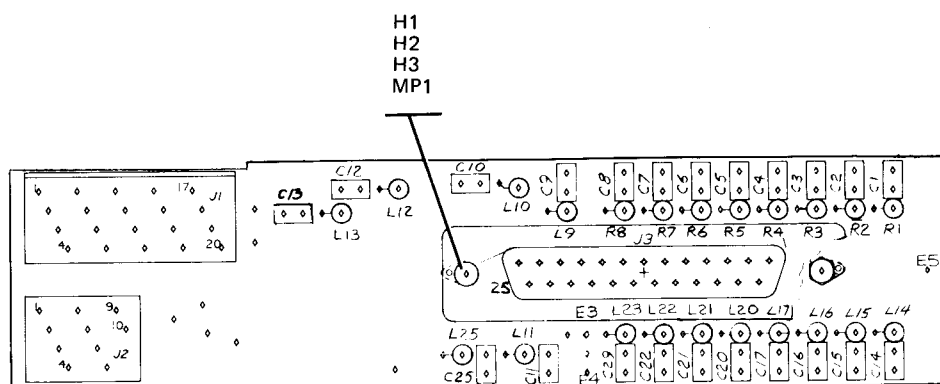
Listed below are manufacturer's names and addresses for the manufacturer's codes found in this parts list.

<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
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.

<u>CIRCUIT CARD/ SUBASSEMBLY</u>	<u>COLLINS PART NUMBER</u>	<u>LATEST EFFECTIVITY</u>
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
	CONTR 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 CHPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R9,R10	(A1)				
R10	RESISTOR,FIXED CHPSN, 10K, 10%, 1/4W (A1)(A3)	745-0785-000		81349	RCR07G103KS
R11-R17	RESISTOR,FXD CHPSN, 10K, 10%, 1/4W (A1)	745-0785-000		81349	RCR07G103KS
R18,R19	NOT USED				
R20-R25	RESISTOR,FXD CHPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS

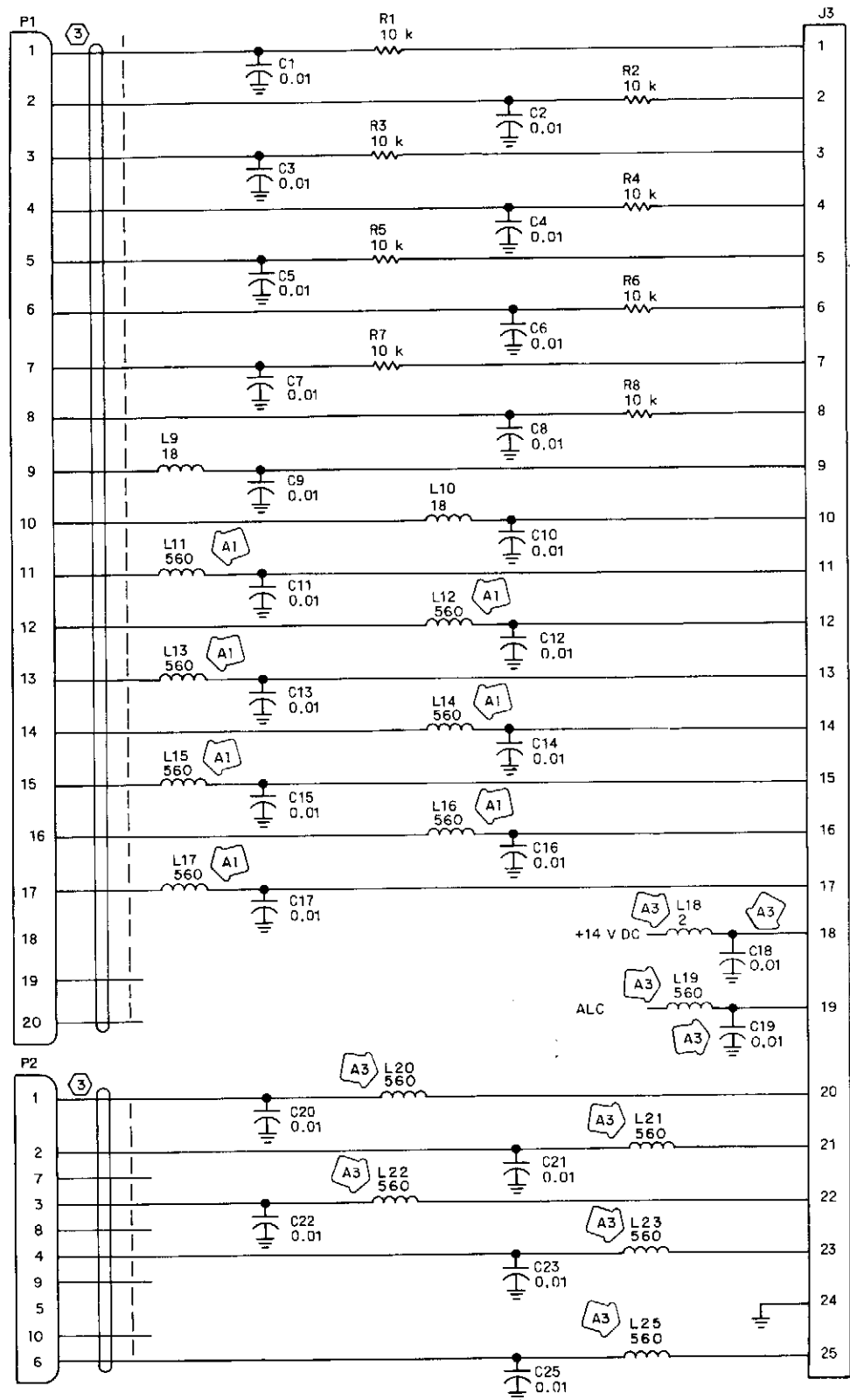
MODIFICATION HISTORY

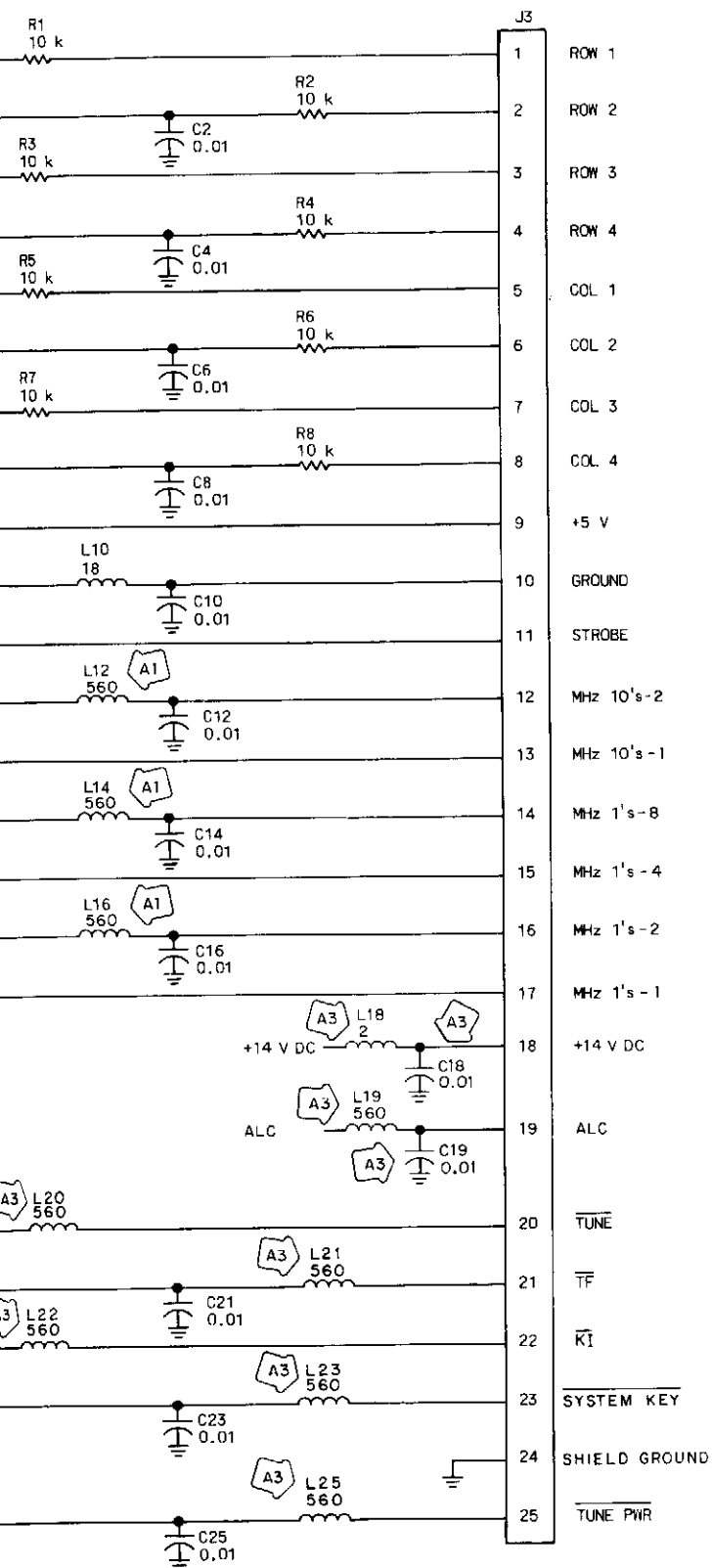
REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
	638-6910-001	
A1	Delete C24-913-3279-110 Added R10-745-0785-000 10K Deleted R11-R17-745-0785-000 10K Added L11-L17-240-2723-050 560UH Added L20-L23-240-2723-050 560UH Added L25-240-2723-050 560UH	REV F
A2	Deleted L20-L23, L25 V	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

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



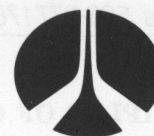


NOTES:

- 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



**Rockwell
International**

instructions

**Audio Low-Pass Filter
(646-5802-001)**

Collins Telecommunications Products Division

523-0771761-001211

1 August 82

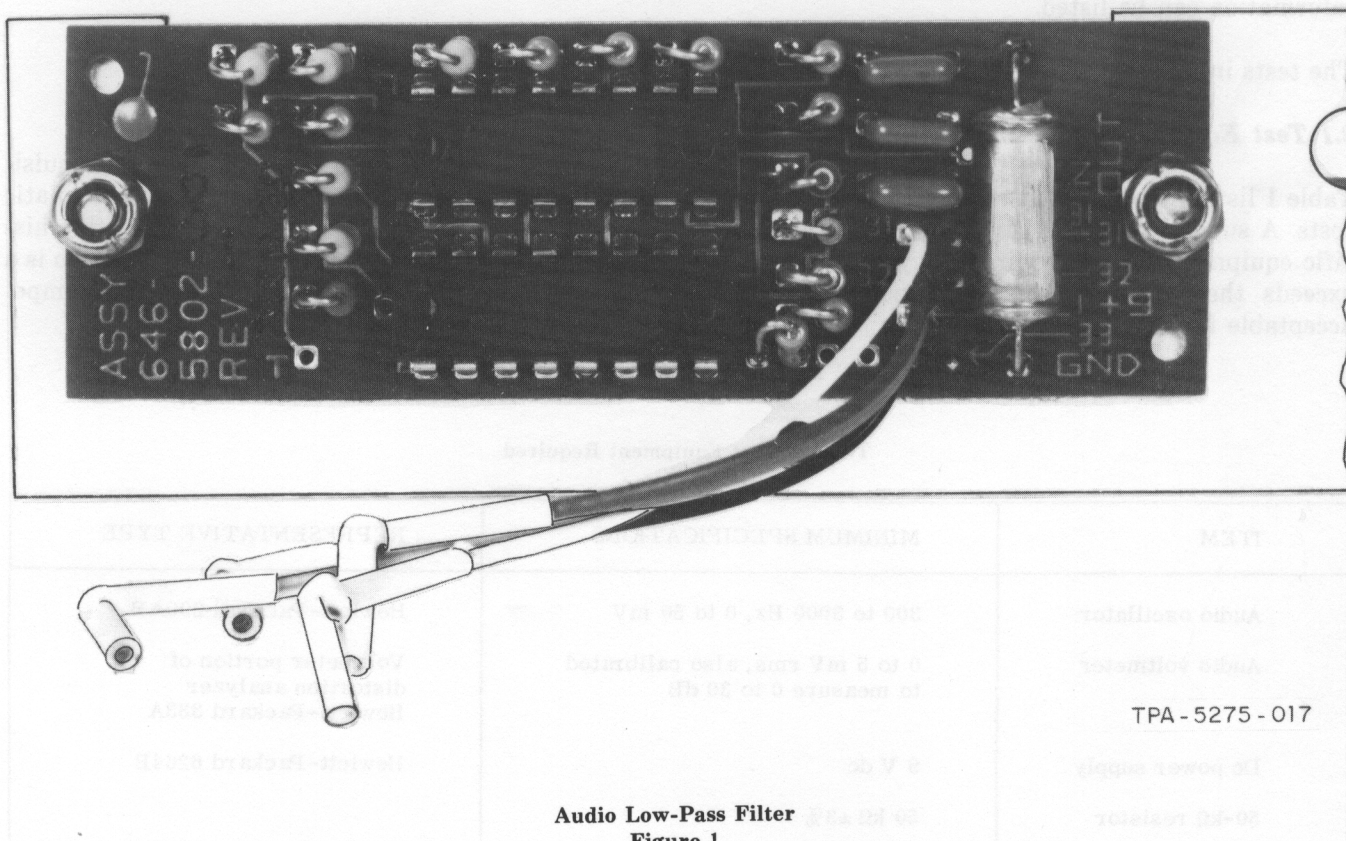
Audio Low-Pass Filter (646-5802-001)

Printed in USA

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**

523-0771761-001211

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-k Ω resistor	50 k Ω $\pm$ 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-k Ω $\pm$ 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. b. Apply power. c. Measure current reading.	12 to 18 mA	Refer to schematic diagram.
3. In-band gain	a. Apply a 1-kHz, 200-mV (open circuit) signal between E31 (audio input) and E33 (ground). b. Measure the output at J31 (audio out).	-1 to +3 dB with reference to E31 (audio in)	Refer to schematic diagram.
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. 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. 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. 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. 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. f. Continue to increase the applied signal frequency up to 20 kHz.	Occurs at frequency of NMT 200 Hz Occurs at a frequency between 3.00 kHz and 3.30 kHz Occurs at a frequency between 3.05 kHz and 3.35 kHz Occurs at a frequency between 3.35 kHz and 3.65 kHz Occurs at a frequency between 3.55 kHz and 3.85 kHz Output signal remains in excess of 30 dB below the reference of para 3.b.	Refer to schematic diagram. Refer to schematic diagram. Refer to schematic diagram. Refer to schematic diagram. 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.

<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
---------------------	--

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	NEPCO/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

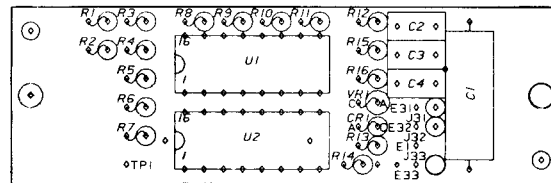
5.3 Equipment Covered

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

<u>CIRCUIT CARD/ SUBASSEMBLY</u>	<u>COLLINS PART NUMBER</u>	<u>LATEST EFFECTIVITY</u>
Audio Low-Pass Filter	646-5802-001	REV A

<u>MFR CODE</u>	<u>MANUFACTURER'S NAME AND ADDRESS</u>
---------------------	--

14433	ITT SEMICONDUCTOR DIV WEST PALM BEACH FL
-------	---



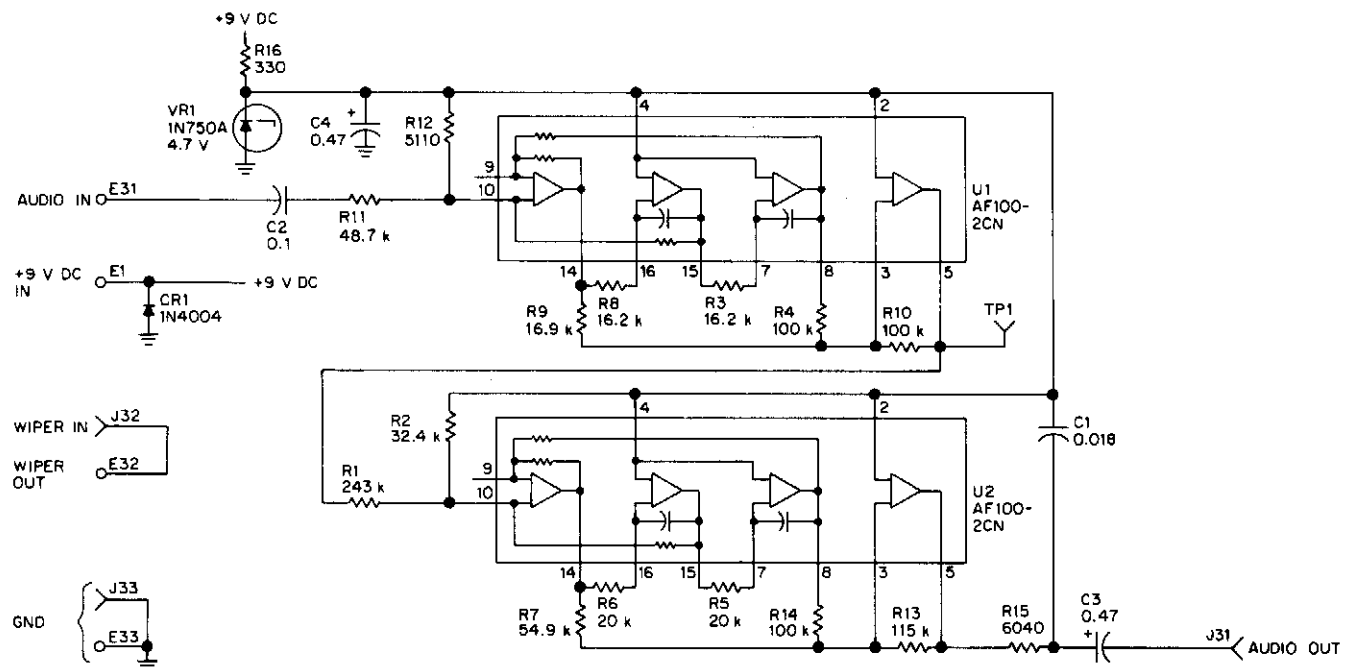
646-5802-001

TPA-5302-019

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
CR1	AUDIO LOW PASS FILTER	646-5802-001			
C1	SEMICOND DEVICE	353-6442-040		14433	1N4004
	CAPACITOR, FIXED POLYSTYRENE DIEL, 18000PF, 1%, 25V	933-1455-070		56699	704C1FG183PF630A
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	CAS01SP100-230-4 30
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 CHPSN, 330 OHMS, 10%, 1/4W	745-0731-000		81349	RCR07G6331KS
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

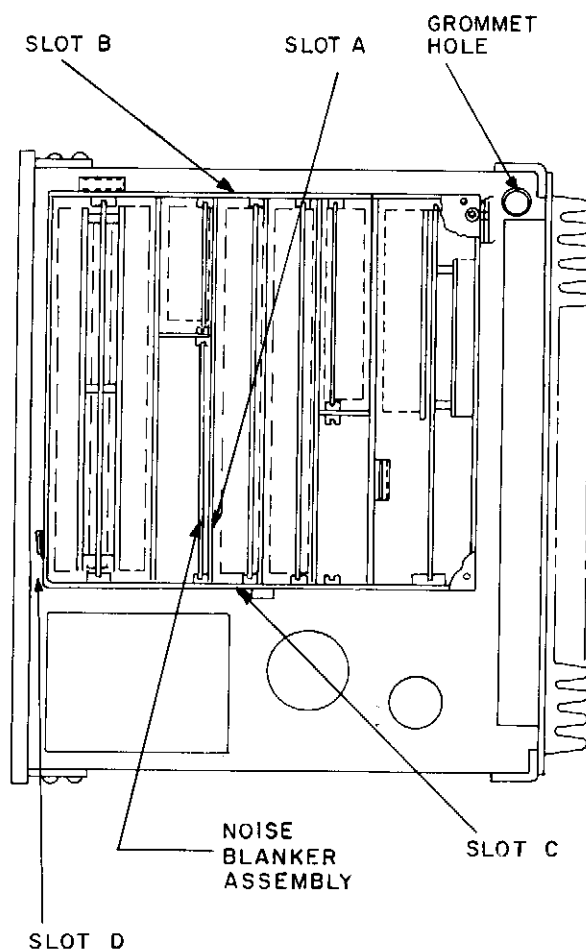
To install the noise blanker, perform the following:

- Remove the KWM-380, HF-380, or 451S-1 dust cover by removing four screws from the bottom of the unit.
- Remove card cage cover to expose plug-in circuit cards.
- 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.

- Route noise blanker coax cables through slots A and B, and through the grommet hole.
- 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.



TPA-2219-019

*Transceiver Card Cage
Figure 1*

- 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.

AC-3801 noise blanker kit

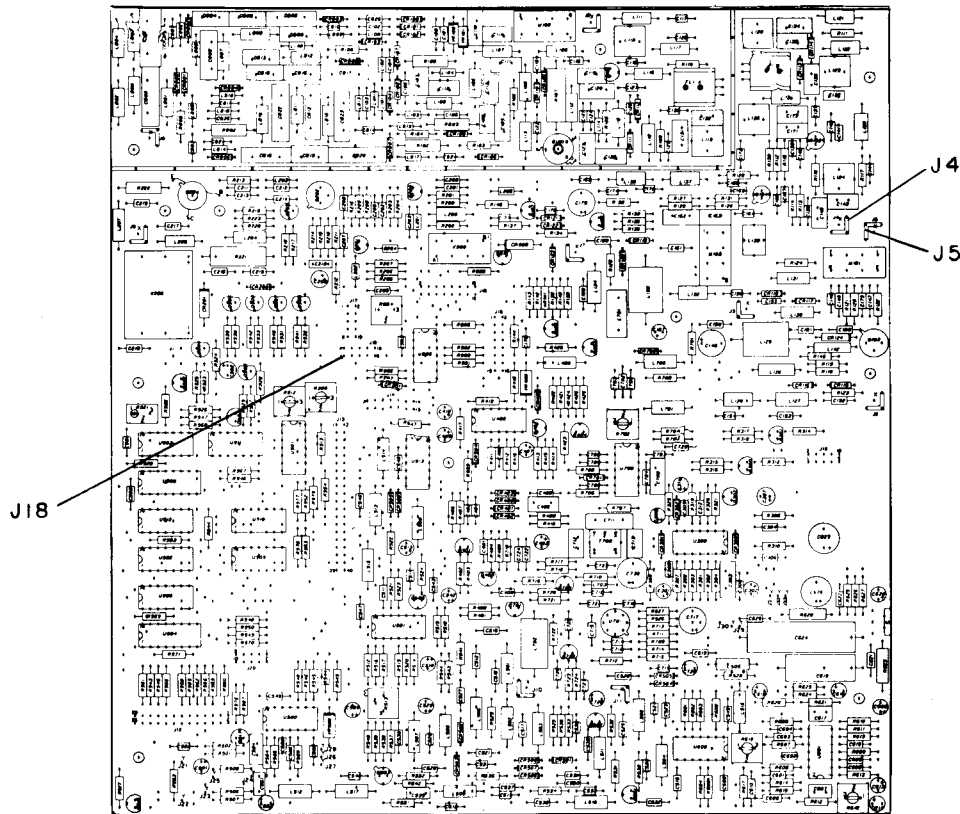
g. Connect noise blanker to receiver-exciter card as follows:

<u>FROM</u> <u>NOISE BLANKER</u>	<u>TO</u> <u>RECEIVER-EXCITER</u>
P1	J4
P2	J5
P18	J18

h. Reinstall card cage and dust covers.

3. PARTS LIST

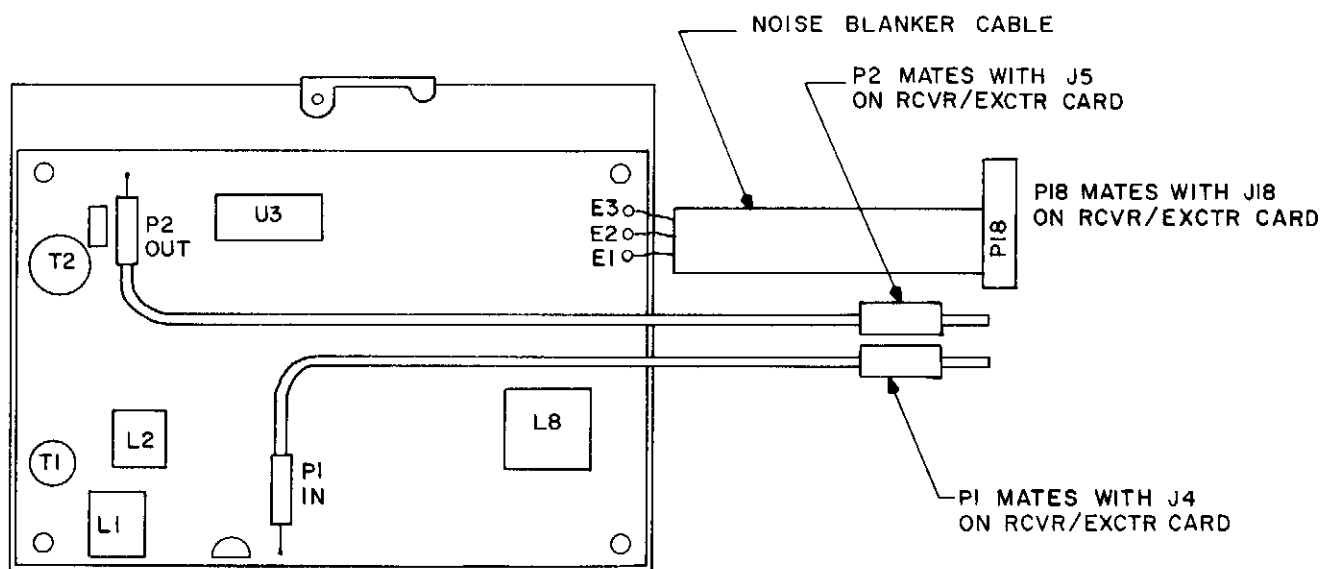
The instruction sheet and one noise blanker card, part number 641-7146-001, are the only parts in the AC-3801 kit.



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



TPA-2211-011

Noise Blanker Circuit Card
Figure 3



Rockwell
International



HF accessories

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.

Collins AC-3802 Speech Processor Kit

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.

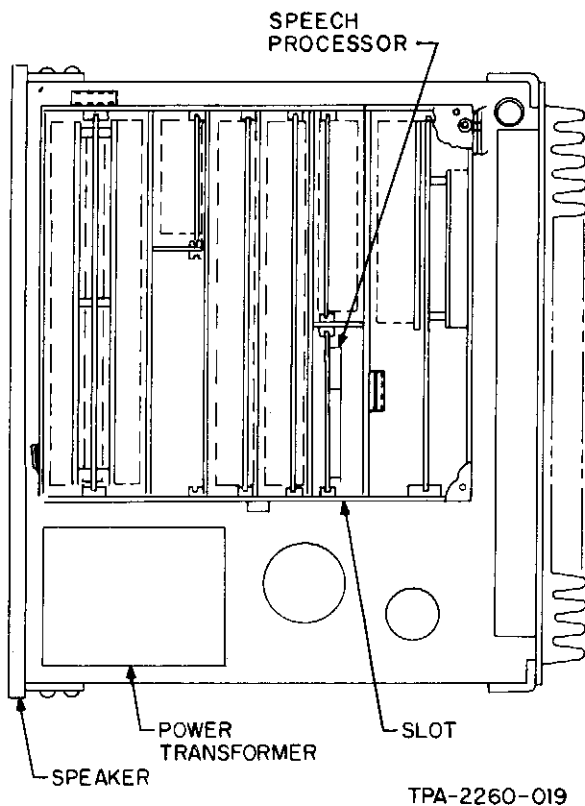
Perform the following for installation of the AC-3802.

- Remove the KWM-380 or HF-380 dust cover by removing four screws from the bottom of the transceiver.
- Remove the card cage cover to expose the plug-in circuit cards.
- 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.

- 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.
- Connect P17 of the ribbon cable assembly into J17 of the receiver-exciter board on the bottom of the chassis.
- 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:

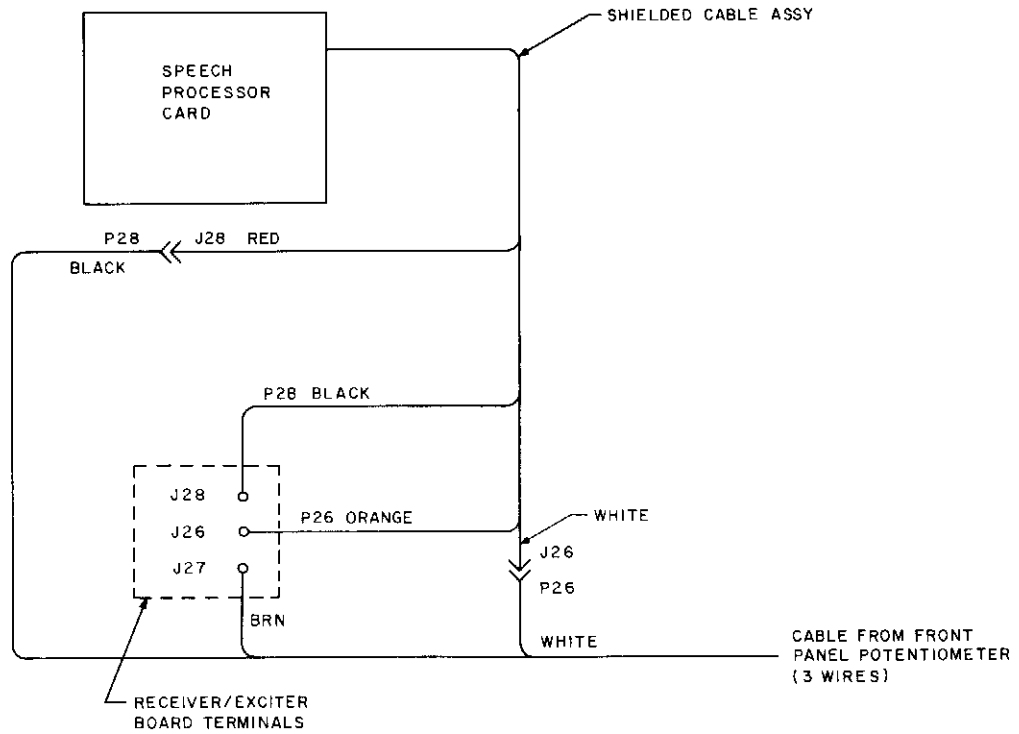
Note

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.

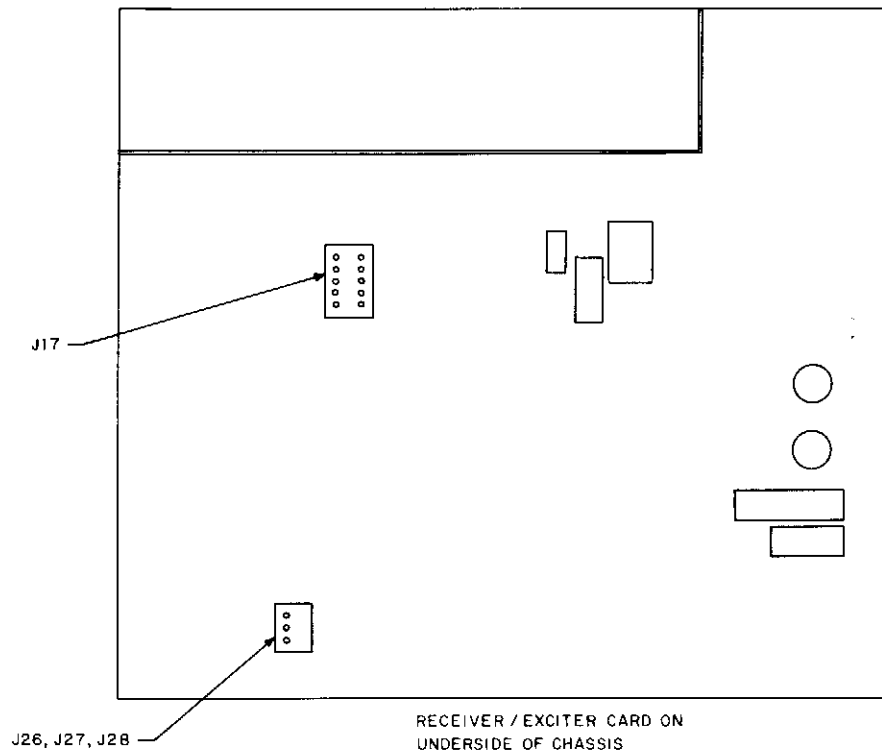
3. PARTS LIST

The instruction sheet and one speech processor assembly, Collins part number 638-6933-001, are the only parts in the AC-3802 kit.



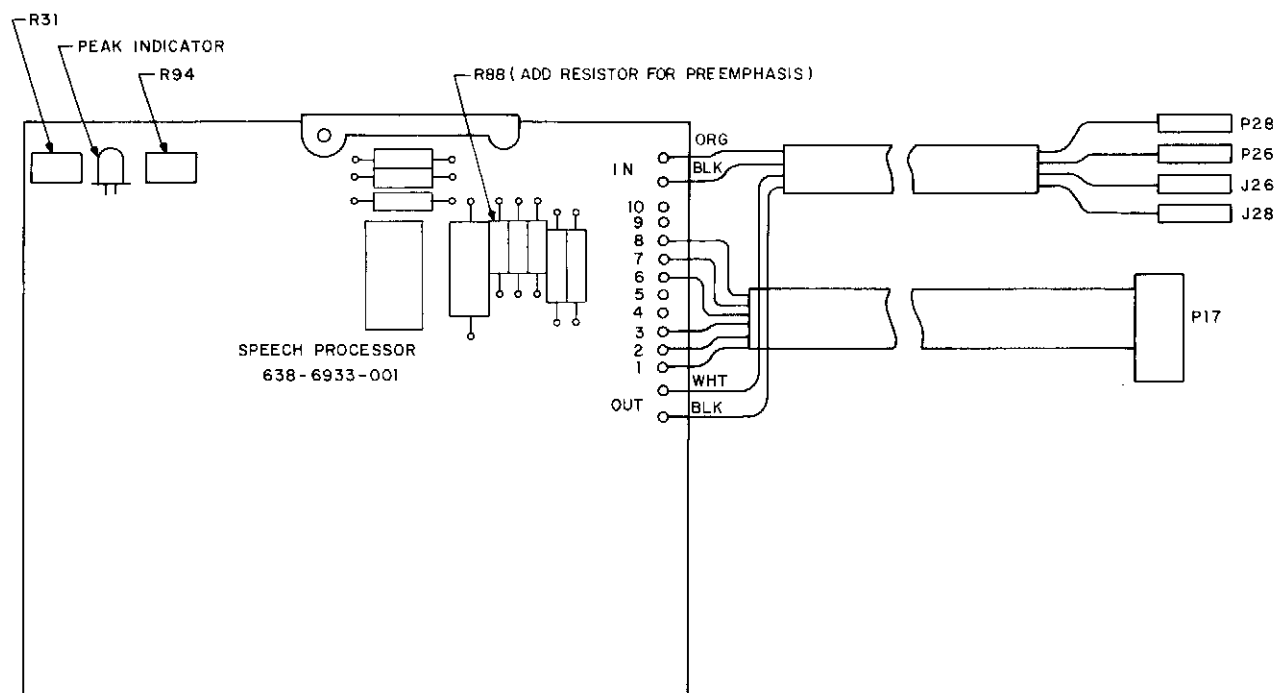
TPA-2259-013

AC-3802 Cable Connections
Figure 2



TPA-2258-013

Receiver-Exciter Card
Figure 3



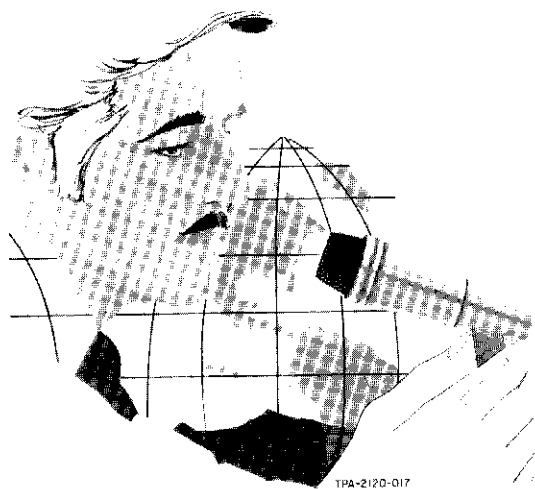
TPA-2257-013

*Speech Processor Card
Figure 4*

Collins Telecommunications Products Division/Rockwell International
Cedar Rapids, Iowa 52498



Rockwell
International



HF accessories

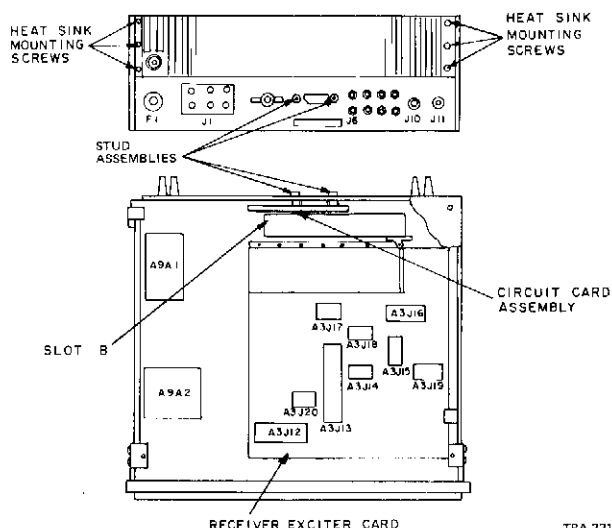
Collins AC-3803 Control Interface Kit

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

- Remove the KWM-380 or HF-380 dust cover by removing four screws from bottom of transceiver.
- Remove card cage cover to expose plug-in circuit cards.
- Refer to figure 1. On rear panel, remove and discard blank cover plate to expose connector hole.



Transceiver Component and Subassembly Locations
Figure 1

- 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.)
- Refer to figures 1, 2, and 3 and install internal connectors as follows:
 - Route P20 directly to J20 on receiver-exciter card on bottom of chassis.
 - Remove the heat-sink mounting screws to provide space and route connector P4 through slot B. Replace the heat-sink mounting screws.
 - 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.
 - Raise the bandpass tuning (BPT) card about 3/8 inches and remove P11.
 - 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).
 - 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.
 - Reattach P11 to the BPT card. Lower the card completely into the card cage.
- Solder unterminated white wire from control interface circuit card to ground lug at J6 (AUD OUT) on rear panel.

AC-3803 control interface kit

- 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.

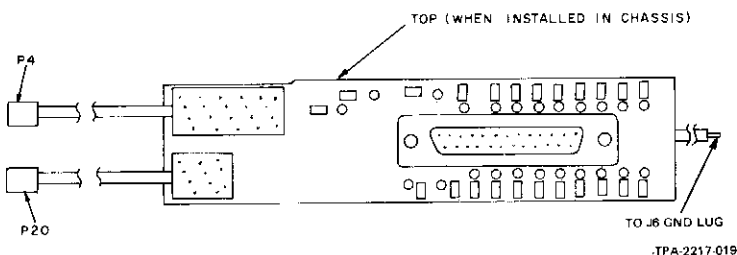
- i. Reinstall card cage and dust covers.

3. CONNECTOR PIN ASSIGNMENTS AND KEYPAD CONNECTION

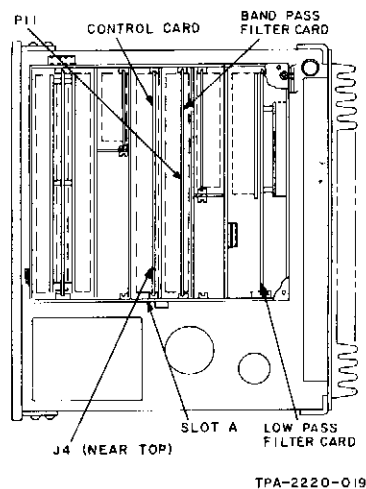
3.1 Interface Connector Pin Assignments

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	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

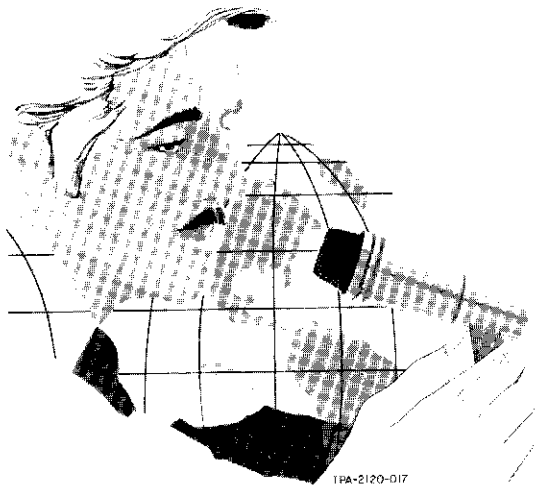


Transceiver Card Cage
Figure 3

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



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Collins AC-3803

Control Interface Kit

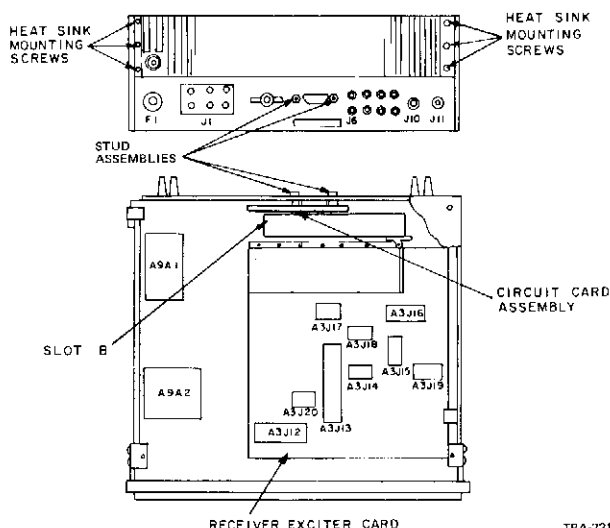
HF accessories

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

- Remove the KWM-380 or HF-380 dust cover by removing four screws from bottom of transceiver.
- Remove card cage cover to expose plug-in circuit cards.
- Refer to figure 1. On rear panel, remove and discard blank cover plate to expose connector hole.



Transceiver Component and Subassembly Locations
Figure 1

- 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.)
- Refer to figures 1, 2, and 3 and install internal connectors as follows:
 - Route P20 directly to J20 on receiver-exciter card on bottom of chassis.
 - Remove the heat-sink mounting screws to provide space and route connector P4 through slot B. Replace the heat-sink mounting screws.
 - 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.
 - Raise the bandpass tuning (BPT) card about 3/8 inches and remove P11.
 - 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).
 - 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.
 - Reattach P11 to the BPT card. Lower the card completely into the card cage.
- Solder unterminated white wire from control interface circuit card to ground lug at J6 (AUD OUT) on rear panel.

AC-3803 control interface kit

- 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.

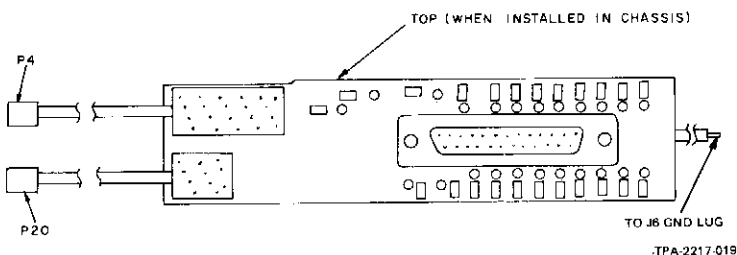
- i. Reinstall card cage and dust covers.

3. CONNECTOR PIN ASSIGNMENTS AND KEYPAD CONNECTION

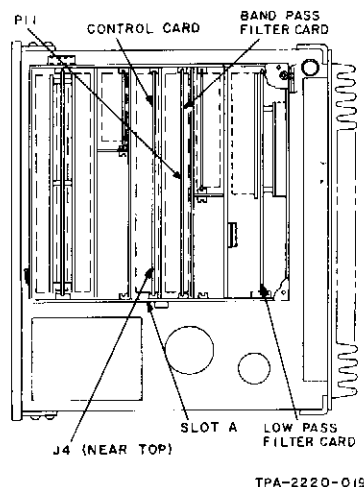
3.1 Interface Connector Pin Assignments

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
1	Row 1	10	Ground	*19	ALC
2	Row 2	11	Strobe	20	TUNE
3	Row 3	12	10 MHz-2	21	TF (tune fault)
4	Row 4	13	10 MHz-1	22	KI (key interlock)
5	Column 1	14	1 MHz-8	*23	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



Rockwell
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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.



TPA-5708-017

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

<u>Action Desired</u>	<u>Key Operation Sequence</u>	<u>Display</u>
Turn equipment on		15.00000
Change to 14,00000 MHz	1 4 . ENT	14.00000
Change to 14.02350 MHz	1 4 . 2 3 5 0	14.2350
with error in keying	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 oper- ating frequency.
	or	
	1 4 . STO 2	
Recall frequency in memory location 2 (see paragraph 3.4)	RCL 0 2	14.00000
	or	
	RCL 2	

AC-3805 and AC-3805A keypads

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-3805A
		AC-3805	
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.

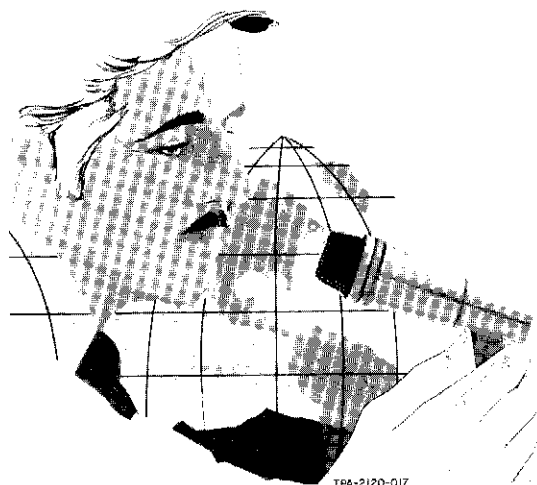
WIRE NO (see NOTE)	CONNECTOR PIN	KEYPAD PIN
1	P1-1	A1-1
2	P1-2	A1-2
3	P1-3	A1-3
4	P1-4	A1-4
5	P1-5	A1-5
6	P1-6	A1-6
7	P1-7	A1-7
8	P1-8	A1-8
9	P1-9	A1-9
10	P1-10 cable shield	

CAUTION

Use care when soldering wires to keypad to avoid temperature damage to keypad assembly.



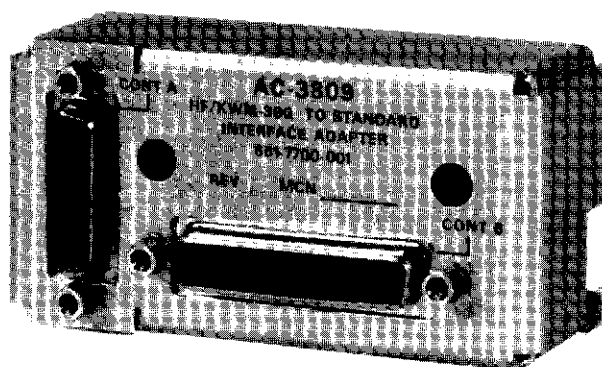
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HF accessories

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

Collins AC-3809 Interface Adapter

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 equipped 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.

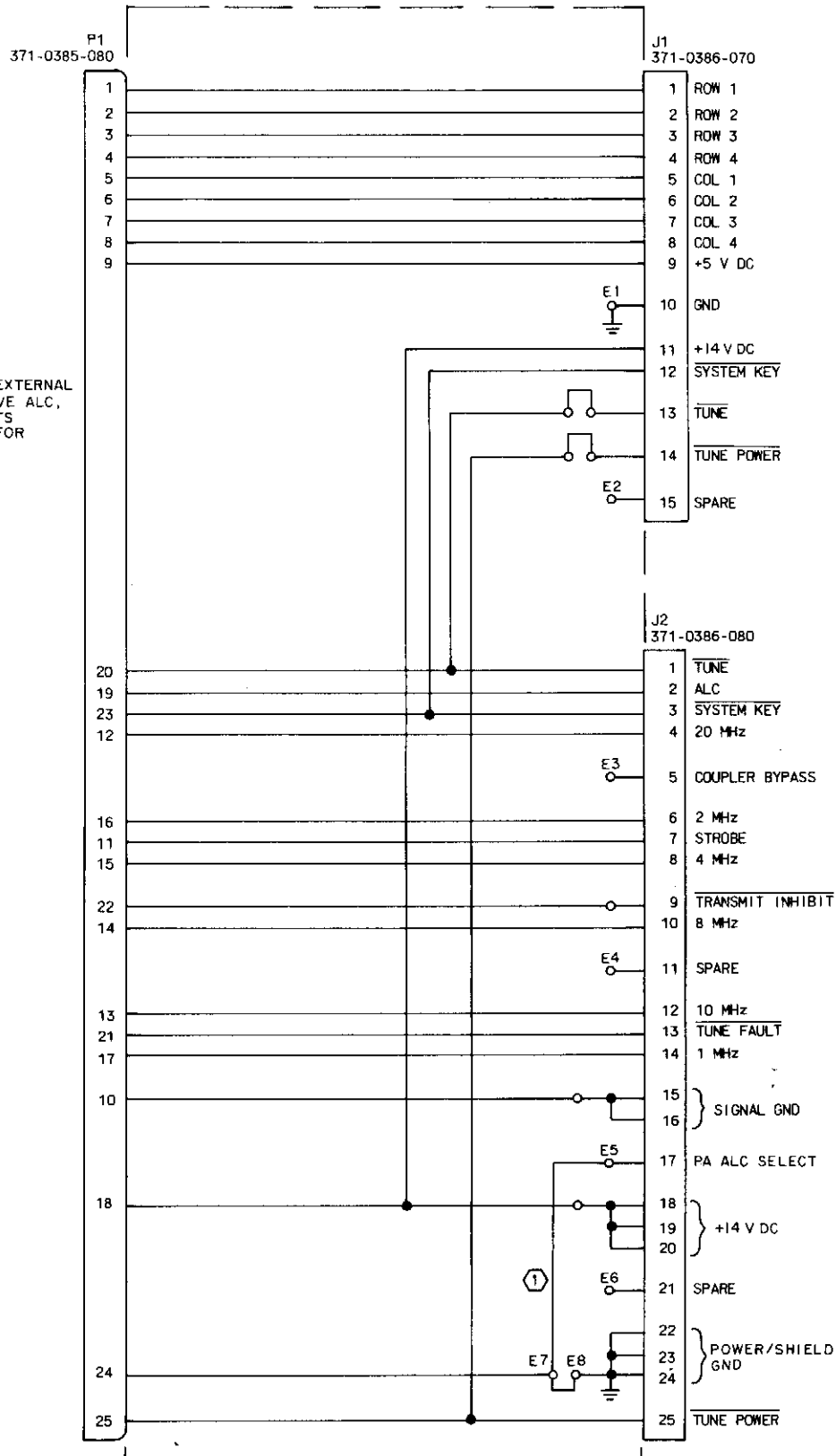
AC-3809 interface adapter

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

NOTE:

- ① JUMPER SETS EXTERNAL PA FOR NEGATIVE ALC, NO JUMPER SETS EXTERNAL PA FOR POSITIVE ALC.

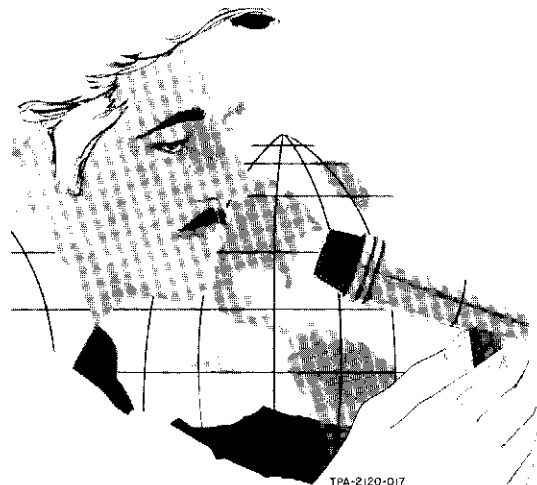


651-5005

Adapter Wiring Interconnections
Figure 2



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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:

- Remove KWM-380 or HF-380 dust cover by removing four screws from bottom of transceiver.
- Remove card cage cover to expose plug-in circuit cards.
- 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.

AC-3810, AC-3811, AC-3812, AC-3813 and AC-3814 filter kits

- d. For the AC-3813 only, remove the existing piggy-back 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.

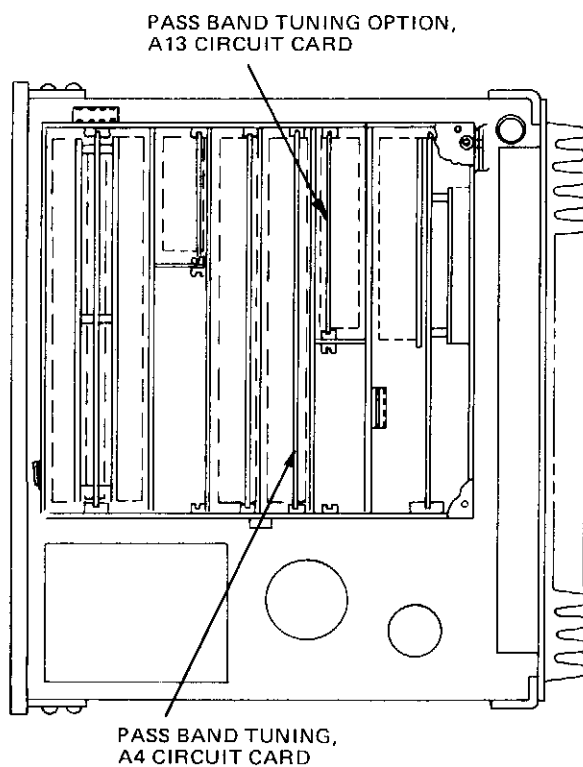
- (4) Connect a wattmeter and 50-ohm load to antenna jack.
- (5) Connect an audio oscillator to line AUD IN jack on chassis rear.
- (6) Locate junction of R1 and C9 on A4 card and connect a frequency counter to this point.
- (7) Set MODE switch to CW, MIC/CARRIER control fully counterclockwise, and push in MOX pushbutton switch.
- (8) Adjust potentiometer R31 on A4 card for a frequency of 6.7100 MHz $\pm$ 10 Hz.
- (9) Set MODE switch to USB and adjust R28 for 6.7120 MHz $\pm$ 100 Hz.
- (10) Set MODE switch to LSB and adjust R34 for 6.7080 MHz $\pm$ 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, AC-3811, AC-3812, AC-3813 and AC-3814 filter kits

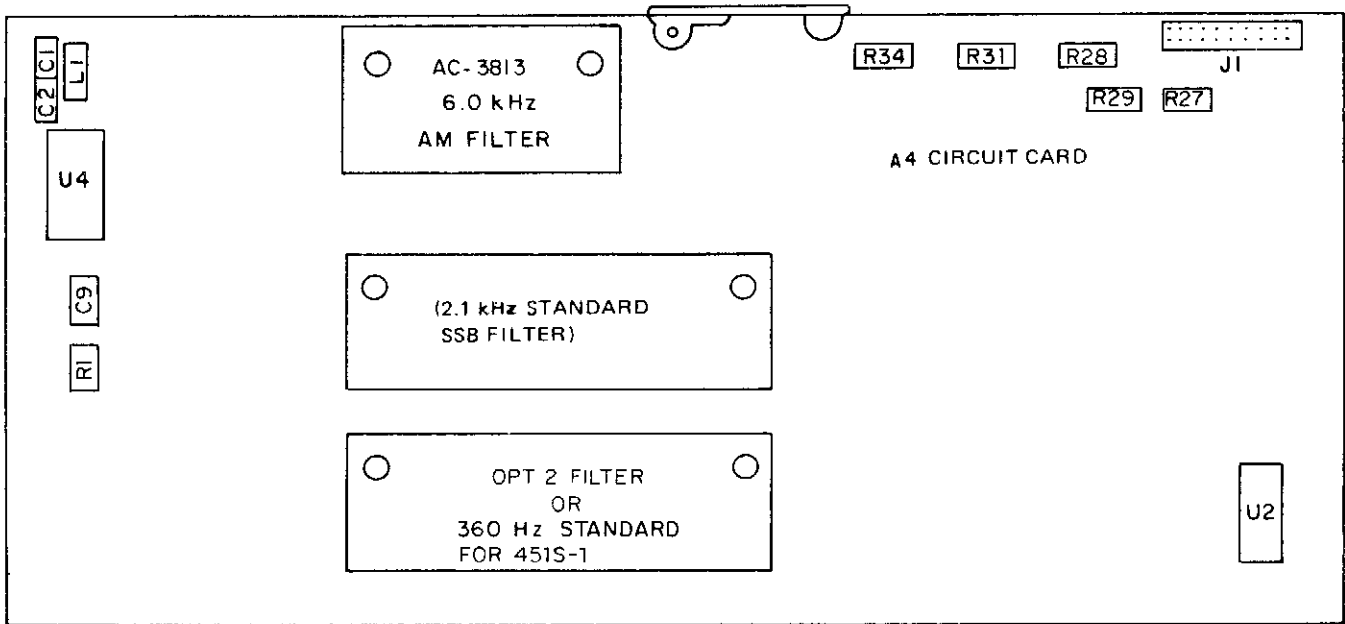
AC-3810 QTY	AC-3811 QTY	AC-3812 QTY	AC-3813 QTY	AC-3814 QTY	DESCRIPTION	COLLINS PART NUMBER
1	1	1	1	1	360-Hz bandpass filter	293-1337-040
					140-Hz bandpass filter	293-1337-050
					1.7-kHz bandpass filter	293-1337-020
					6-kHz bandpass filter	293-1337-030
					3-kHz bandpass filter	293-1337-060
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



TPA-2221-019

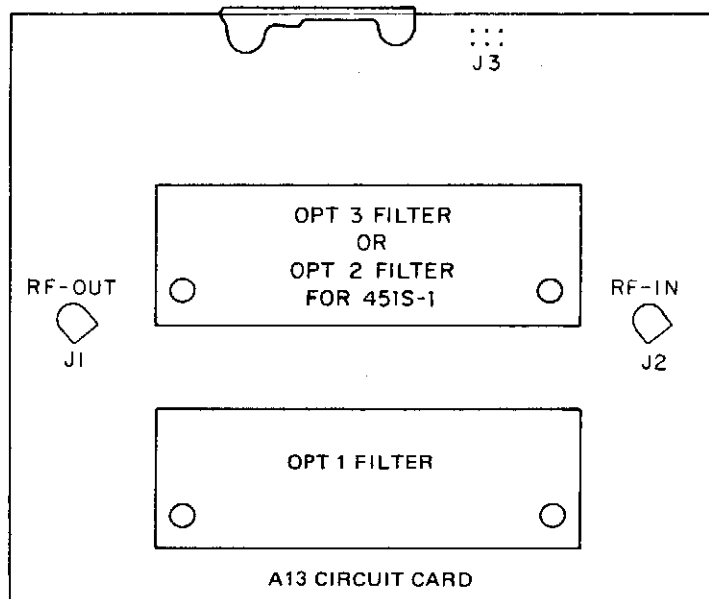
Transceiver Card Cage
Figure 1

AC-3810, AC-3811, AC-3812, AC-3813 and AC-3814 filter kits



TPA-2213-019

*Passband Tuning, Card A4 (CPN 638-6912-001, -002)
Figure 2*



TPA-2214-019

*Passband Tuning Option, Card A13 (CPN 638-6914-001)
Figure 3*

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Cedar Rapids, Iowa 52498



TPA-2120-017



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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.

AC-3821, AC-3822, and AC-3823 transceiver-to-coupler rf cables

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*

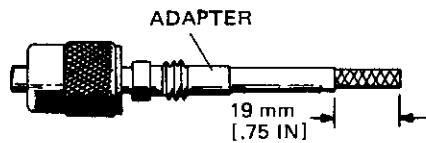
Table 3. AC-3822 Replacement Parts.

DESCRIPTION	PART NUMBER
Connector PL-259 RG-213 coaxial cable	357-9014-000 425-0952-000*

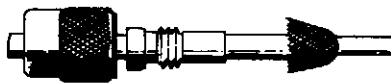
Table 4. AC-3823 Replacement Parts.

DESCRIPTION	PART NUMBER
Connector Andrews L44P Helix coaxial cable	(357-0086-070) 425-0232-030*

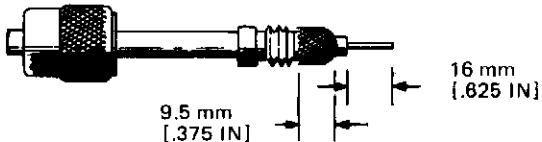
*When ordering cable, specify length required.



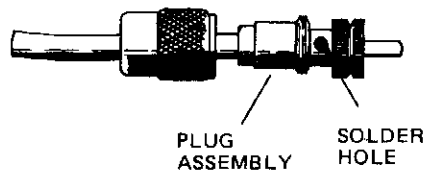
1. CUT END OF CABLE AND REMOVE 19 mm [.75 IN] OF OUTER JACKET. BE CAREFUL TO NOT NICK BRAID. SLIDE COUPLING RING AND ADAPTER ON CABLE.



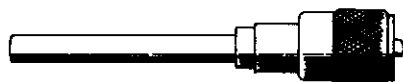
2. FAN BRAID SLIGHTLY AND FOLD BACK OVER CABLE.



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.

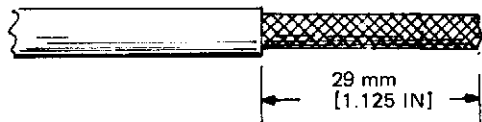


5. SCREW COUPLING RING ONTO PLUG ASSEMBLY.

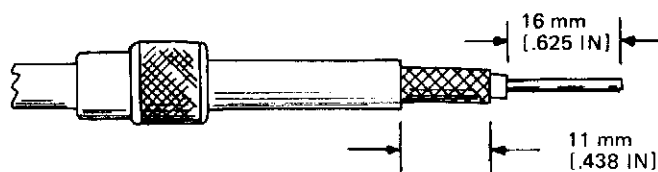
TPA-0210-011

*Connector Attached to RG-58C Cable
Figure 1*

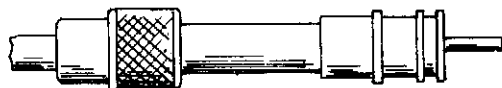
AC-3821, AC-3822, and AC-3823 transceiver-to-coupler rf cables



1. REMOVE 29 mm [1.125 IN] 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.



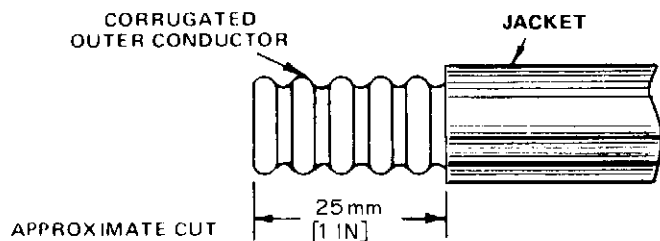
3. SCREW CONNECTOR BODY ONTO CABLE. SOLDER BRAID TO SHELL THROUGH SOLDER HOLES. SOLDER CONDUCTOR TO CENTER CONTACT.



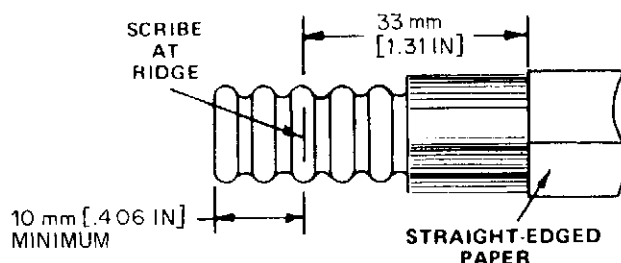
4. SCREW COUPLING RING ONTO PLUG ASSEMBLY.

TPA-1120-011

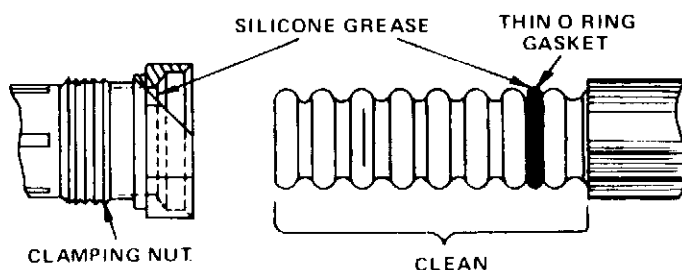
Connector Attached to RG-213 Cable
Figure 2



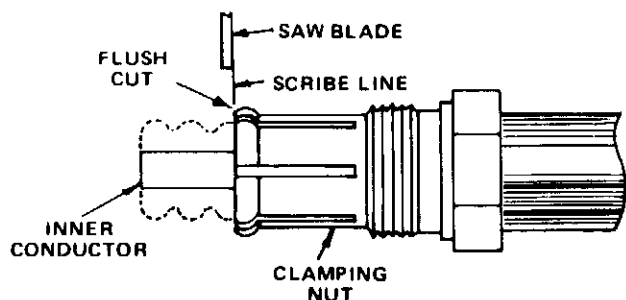
1. PREPARE CABLE. END OF CABLE MUST BE STRAIGHT FOR AT LEAST 254 mm [10 IN]. REMOVE JACKET TO APPROXIMATE DIMENSION SHOWN. USE KNIFE. DEBURR SHARP END OF CUT OUTER CONDUCTOR.



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.

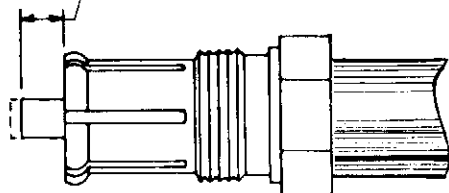


4. ADD CLAMPING NUT AND CUT CABLE. PUSH CLAMPING NUT ON CABLE. USE TWISTING MOTION TO ASSURE SPRING CONTACTS SNAP INTO GROOVE. REFER TO CUTAWAY VIEW IN STEP 6. GRIP CLAMPING NUT WITH ONE HAND AND ALIGN EDGE WITH SCRIBED LINE, THEN CAREFULLY CUT OUTER CONDUCTOR AND FOAM DIELECTRIC MATERIAL FLUSH WITH 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.

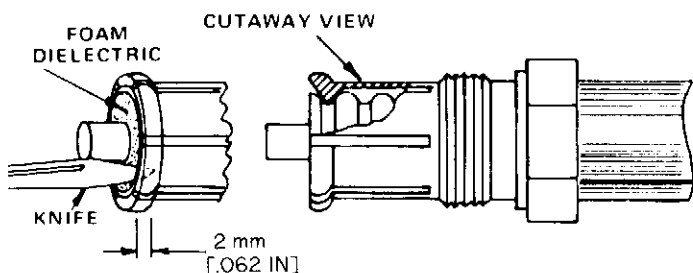
TPA-5872-021

AC-3821, AC-3822, and AC-3823 transceiver-to-coupler rf cables

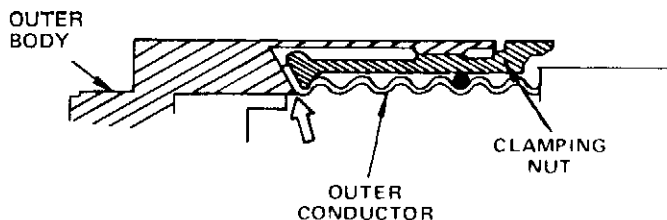
43716, L44EN, L44EW, L44J, L44M, L44N,
L44T, L44W = 5 mm [.218 IN]
L44P, L44U = 8 mm [.312 IN]
L44R = 10 mm [.375 IN]
L44F = 11 mm [.438 IN]



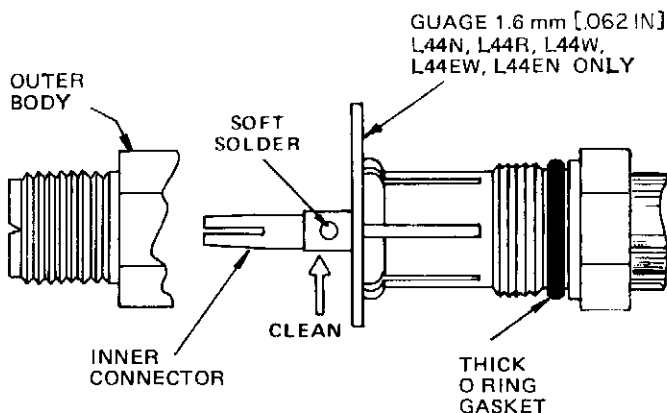
5. TRIM INNER CONDUCTOR. CUT INNER CONDUCTOR TO LENGTH SHOWN. USE FILE TO DEBURR CUT END OF INNER CONDUCTOR.



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 Helix and Low-Loss RF Cable
Figure 3 (Sheet 2)

Collins Telecommunications Products Division/Rockwell International
Cedar Rapids, Iowa 52498



**Rockwell
International**



HF accessories

Collins AC-2801 Rack Mount Kit

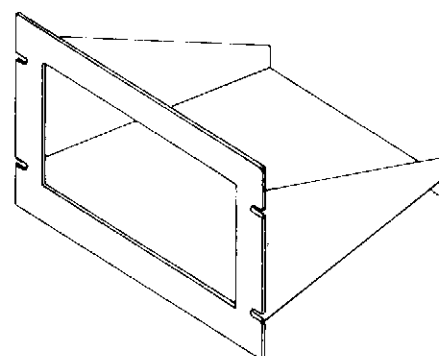
1. DESCRIPTION

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.



TPA-0762-019

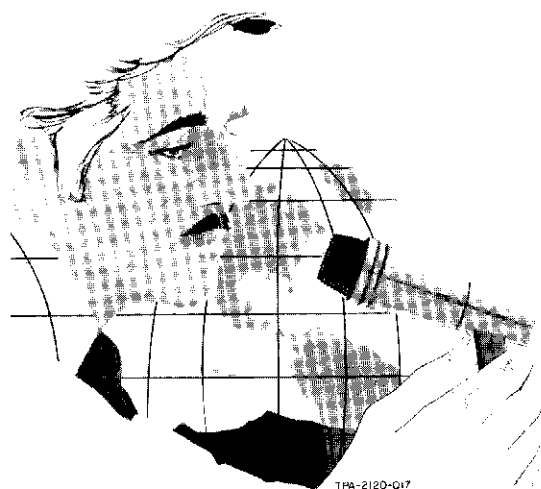
*AC-2801 Rack Mount
Figure 1*

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
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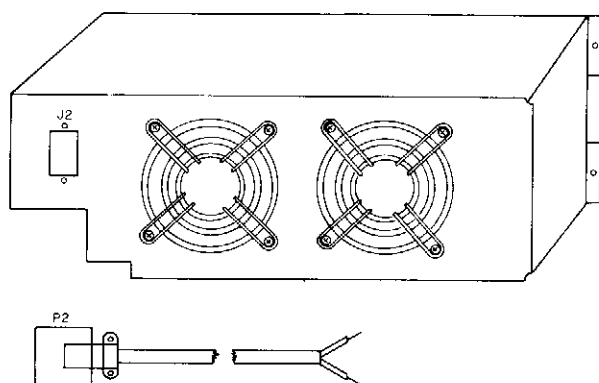


HF accessories

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:

- Remove four screws on the bottom of the transceiver that secure the dust cover to the unit. Slide dust cover off the unit.
- Position transceiver so the screws that mount the heat sink to the chassis bracket are visible.
- 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.
- 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:

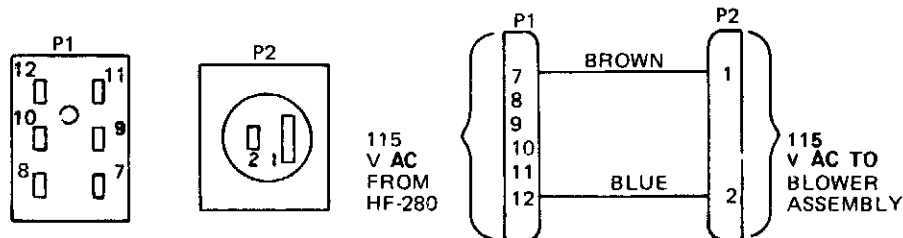
- Disconnect P1 located at the back of the transceiver.
- Remove cover from P1 and connect the brown lead in the blower assembly power cable to P1-7 (refer to figure 2).
- Connect the blue lead in the blower assembly power cable to P1-12.
- Replace the P1 cover and connect the modified P1 to J1 on the transceiver.
- 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.

- Refer to figure 3 and remove the top cover of the low-pass filter.
- 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.
1. For units having a black rubber flex coupling, loosen the four setscrews on the flex coupling. (Refer to figure 3, detail B.)

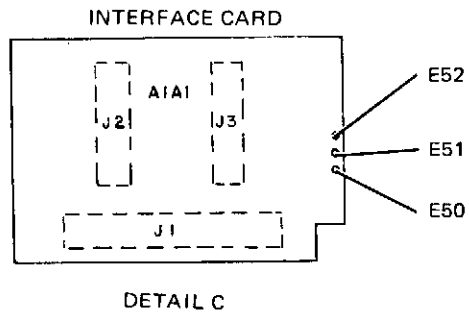
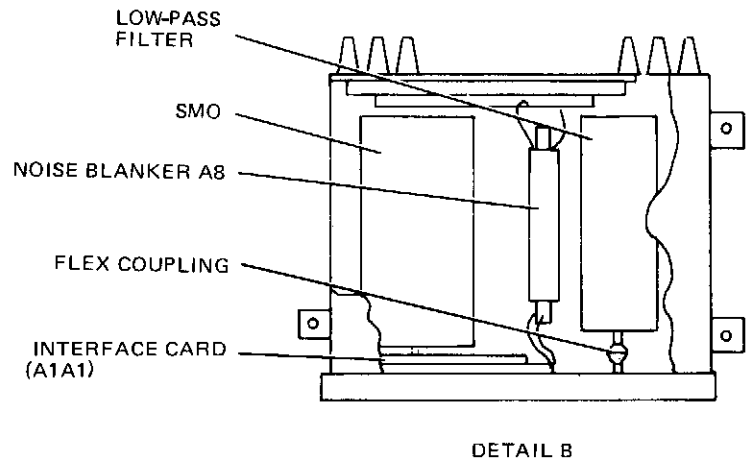
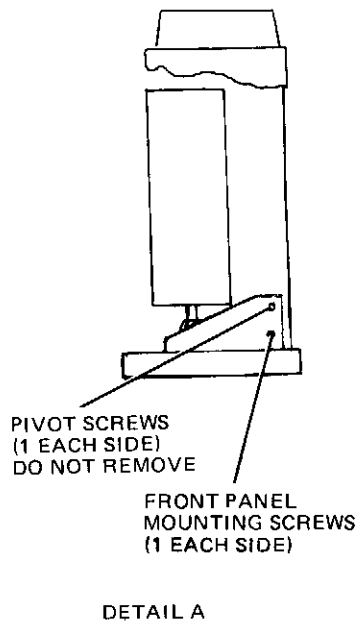
AC-2808 blower kit

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.



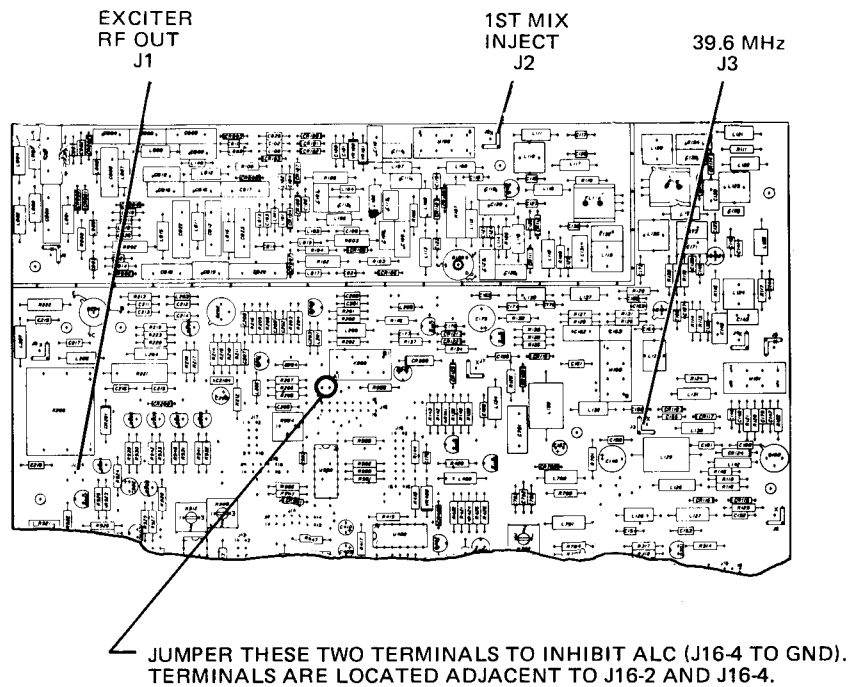
TPA-0771-011

*Blower Assembly Power Cable
Figure 2*



TPA-1290-019

*HF-281/HF-282 Component Locations
Figure 3*



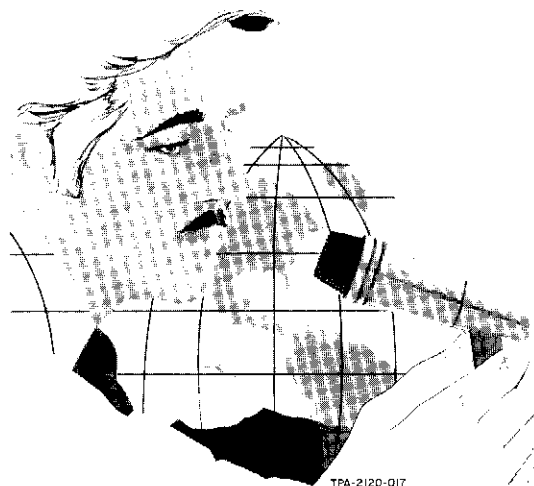
ALTHOUGH SOME COMPONENT LOCATIONS MAY DIFFER DUE TO
CIRCUIT BOARD CHANGES, LOCATION OF ALC INHIBIT TERMINALS
IS AS SHOWN HERE.

HF-380/KWM-380 ALC Inhibit Terminals on Receiver-Exciter
Figure 4

Collins Telecommunications Products Division/Rockwell International
Cedar Rapids, Iowa 52498



Rockwell
International



TPA-2120-017

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.

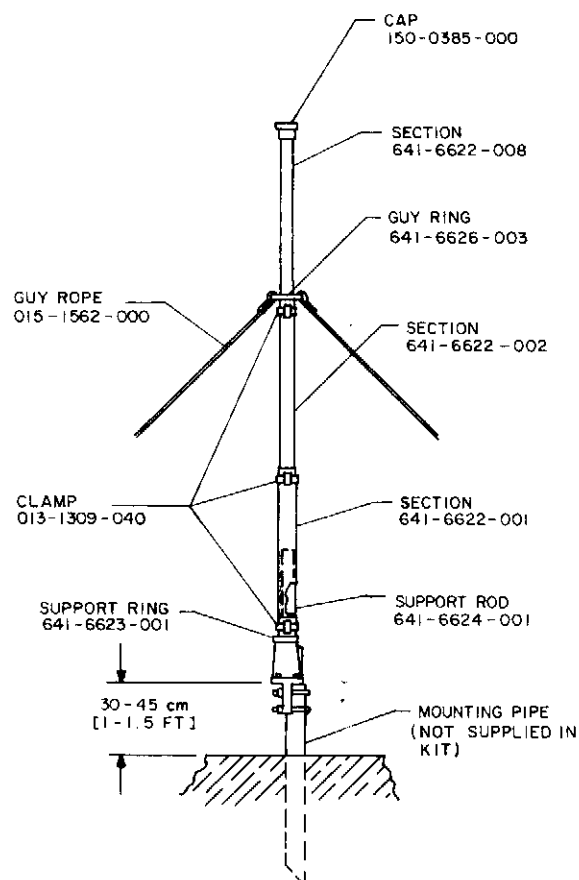
Also required, but not supplied with either kit, are tie points for securing the guy ropes to the mounting surface and a support to which the base insulator assembly will be attached.

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.

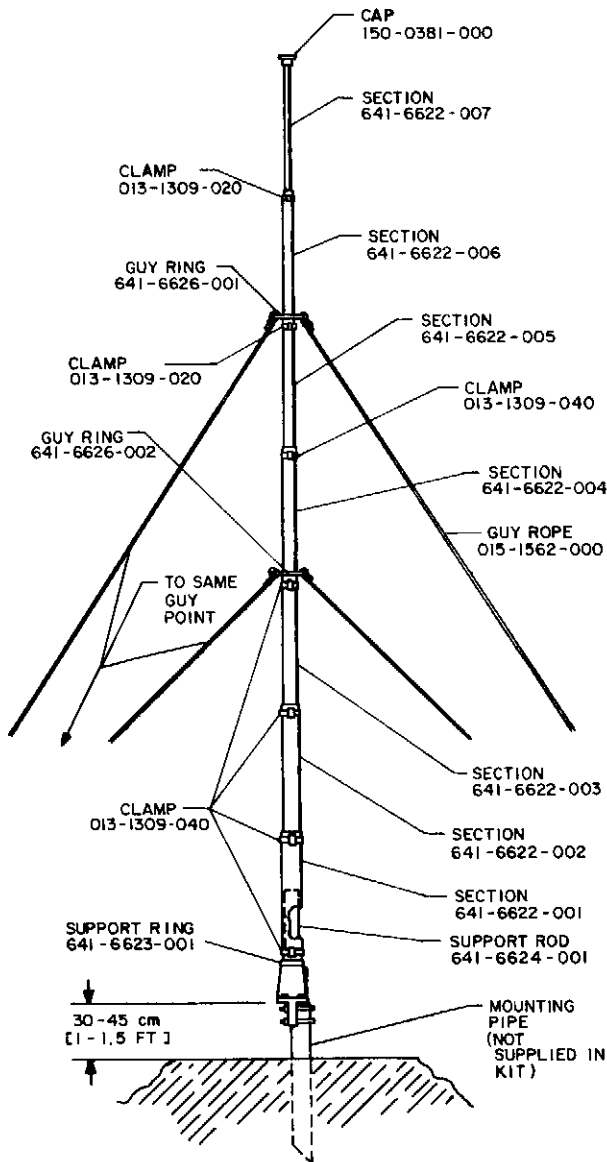
- a. Position insulating portion of base assembly on base assembly casting. Place two short screws through insulator and into tapped holes in casting. Four remaining screws, lockwashers, and nuts secure insulator to casting at edges.



TPA-1331-011

Typical Ground Installation of AC-2810
Figure 1

AC-2810 and AC-2811 vertical antenna kits



TPA-1330-011

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

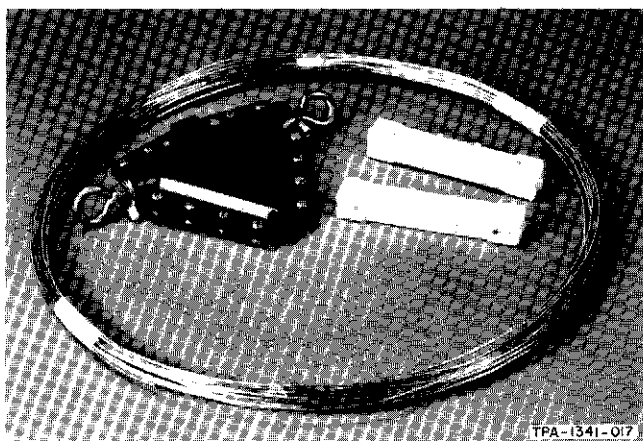


Rockwell
International

HF accessories

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

Collins AC-2812 and AC-2813 Dipole Antenna Kits

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) =

$$\frac{71.3}{\text{freq (in MHz)}} \text{ metres}$$

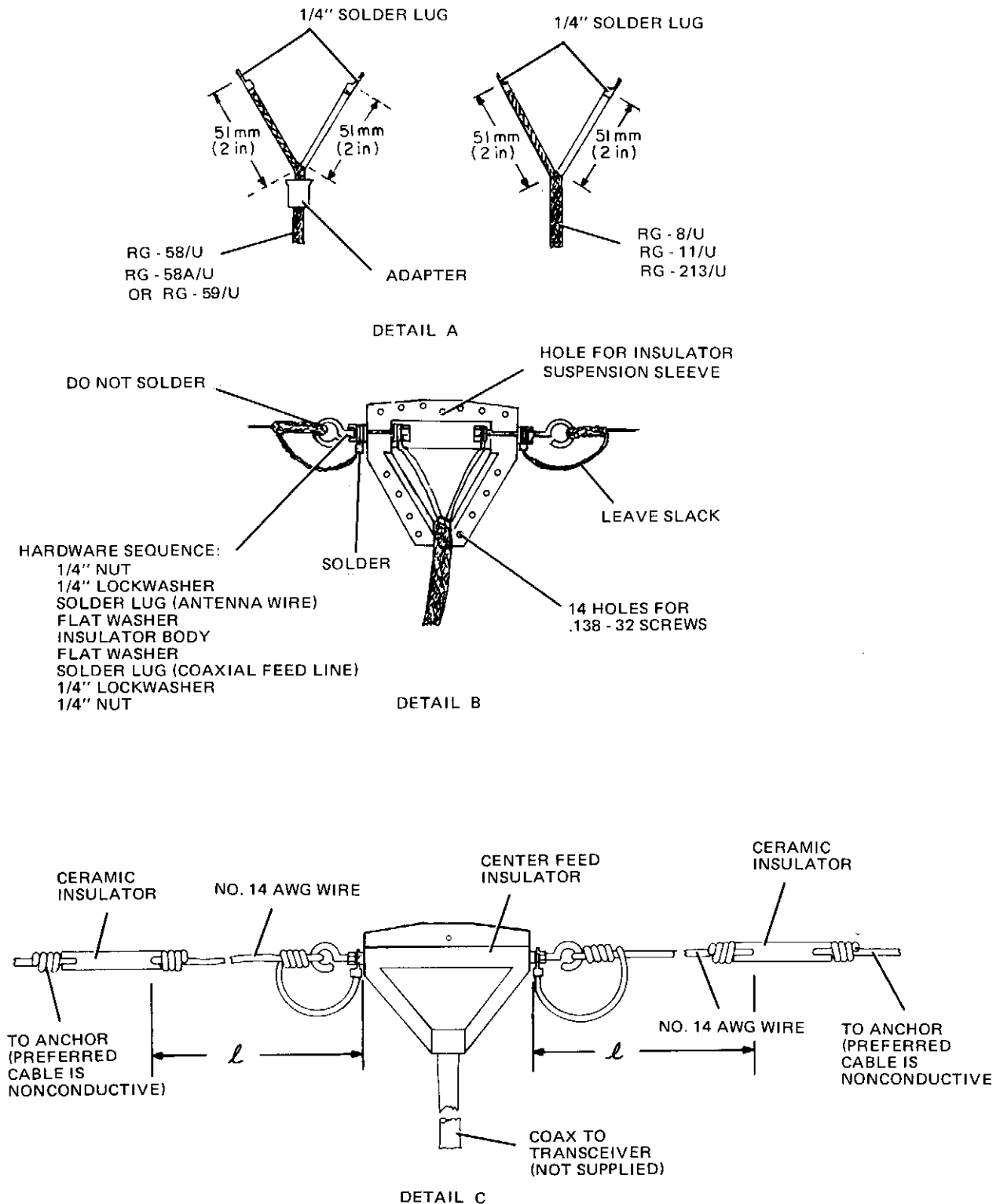
or

$$\frac{234}{\text{freq (in MHz)}} \text{ feet}$$

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.

AC-2812 and AC-2813 dipole antenna kits



TPA-0784-019

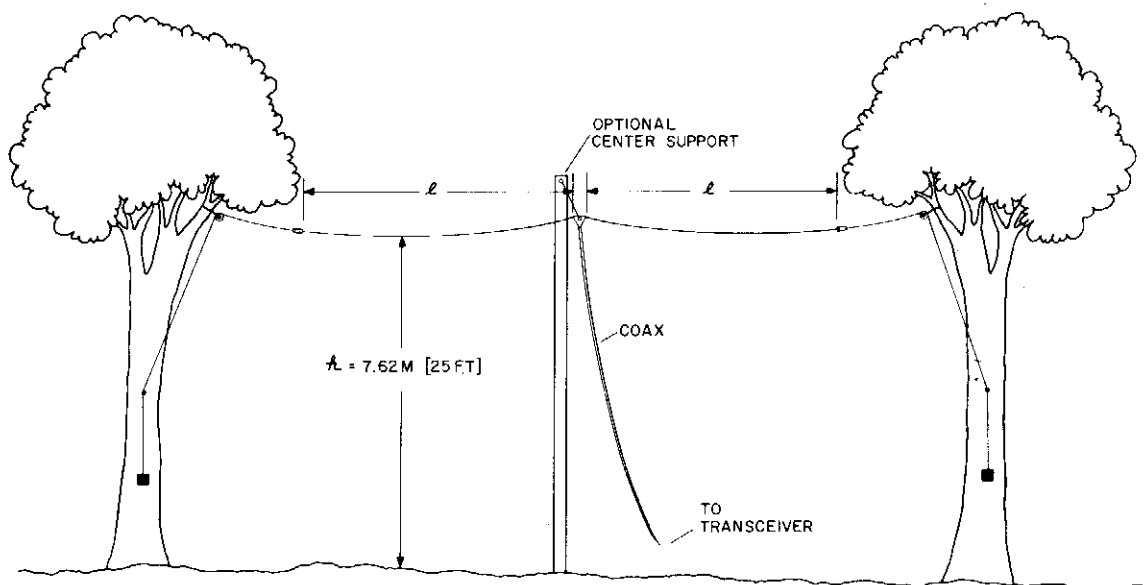
Antenna Assembly Details
Figure 2

- 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*

AC-2812 and AC-2813 dipole antenna kits

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

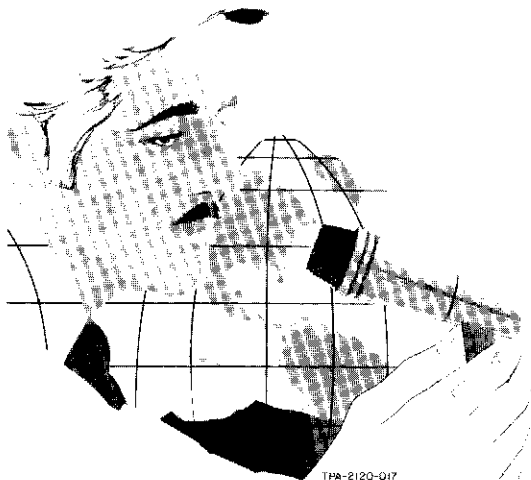
prevents the weight of the coaxial feedline from pulling the dipole to the ground.

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



**Rockwell
International**

Collins AC-2814 and AC-2815 Long- wire Antenna Kits

HF accessories

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.

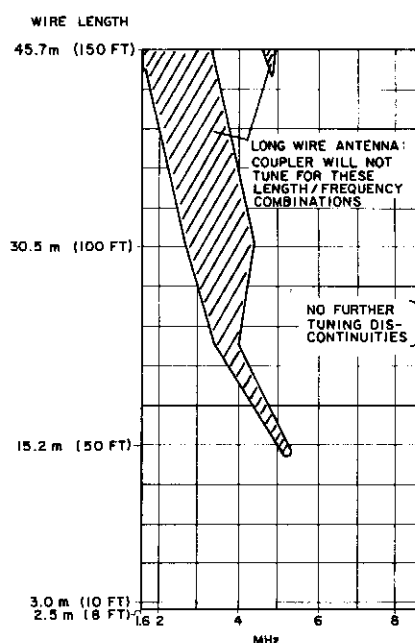
The CU-281, CU-282, or CU-380 Antenna Coupler (for up to 6 or up to 20 different frequencies, respectively) must be used with the long-wire antenna.

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.

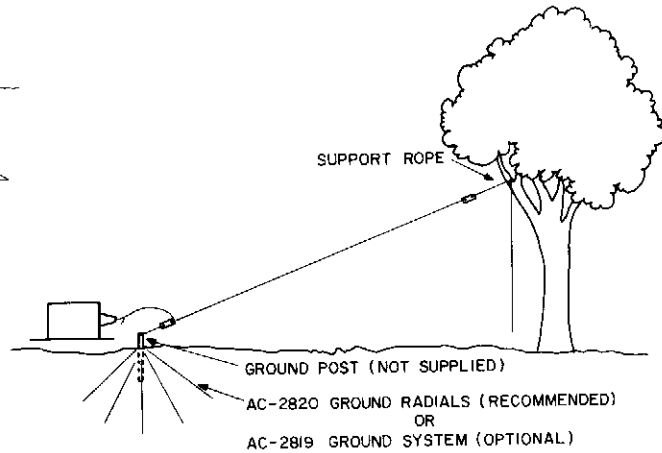
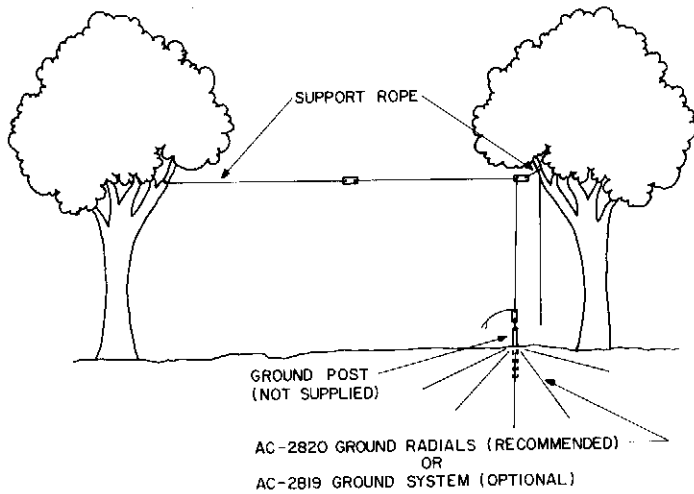


TPA-0259-011

*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).

AC-2814 and AC-2815 long-wire antenna kits



TPA-1105-018

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:

- Using one insulator and the solder lug, construct the base end of the antenna as shown in figure 3, detail A.
- 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.
- 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

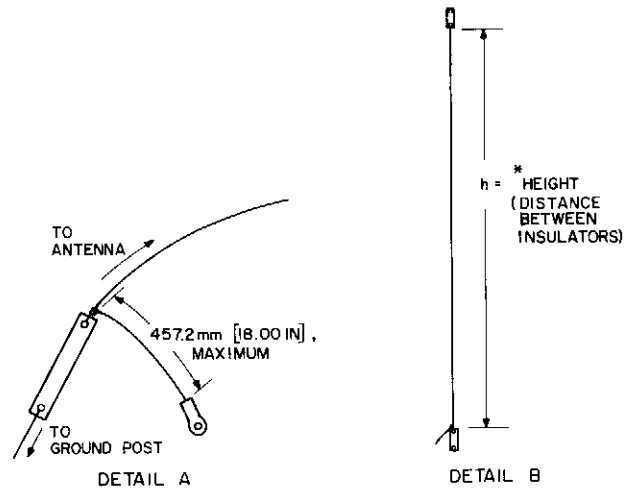
guys, or any other related wires or cables to contact electrical power wires. Death could result!

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.

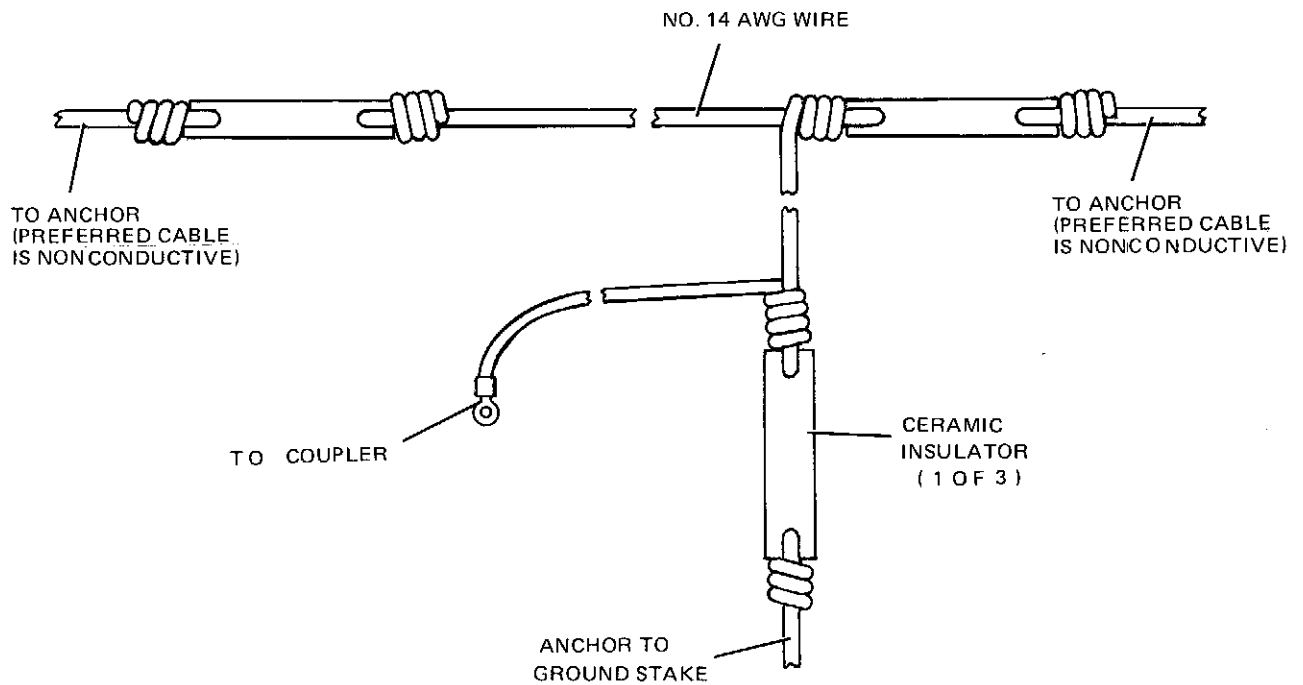
If trees are used as supporting structures, be sure to take into consideration guy length changes due to tree sway in the wind. Provision should be made to keep the antenna wire taut during tree movement. This can be done with weighted support ropes operating through pulleys attached to the trees.



* IF h = ENTIRE LENGTH OF ANTENNA, ONLY TWO INSULATORS WILL BE REQUIRED FOR THE INSTALLATION; OTHERWISE THIRD INSULATOR AT END OF ANTENNA WILL BE REQUIRED.

TPA-1106-019

*Long-wire Antenna Assembly
Figure 3*



TPA-0783-019

*Detailed View of Insulator/Antenna Connections
Figure 4*

AC-2814 and AC-2815 long-wire antenna kits

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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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 M Ω 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

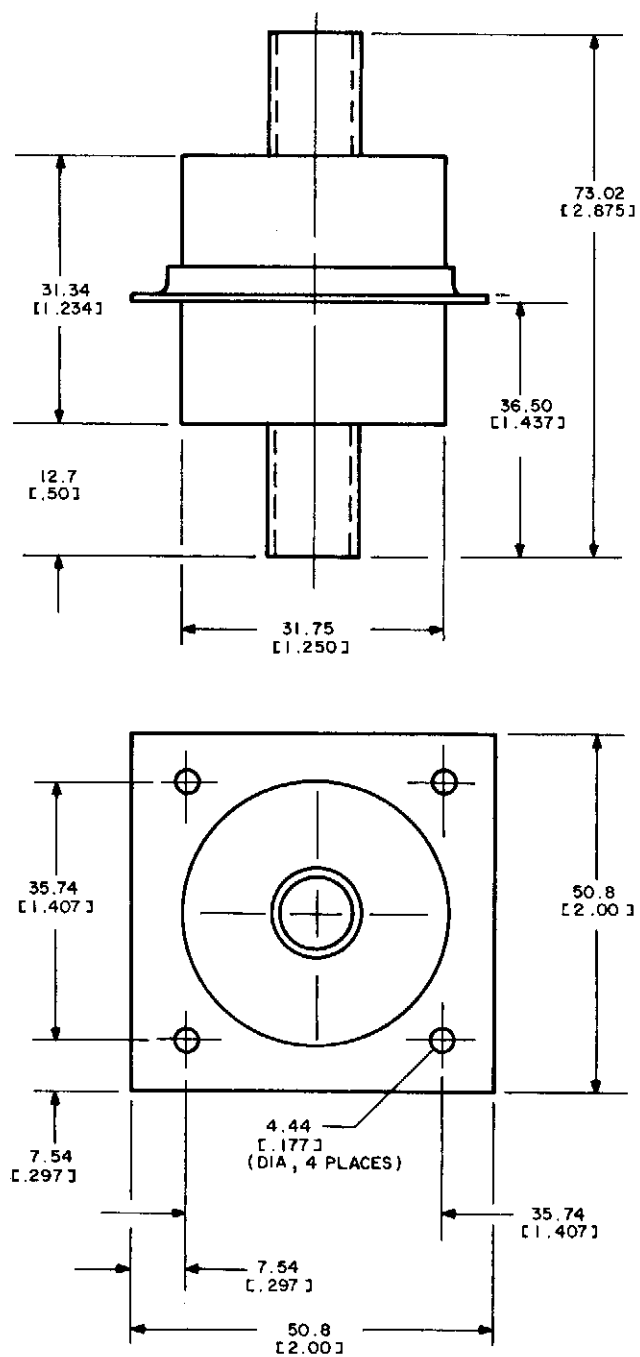
It is recommended that the arrester be mounted through a metal plate approximately 150 x 150 mm (6 x 6 in) by 1.5 mm (0.06 in) thick.

- 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.

AC-2818 lightning arrester



NOTE: DIMENSIONS ARE IN MILLIMETRES [INCHES].

TPA - 1333 - 011

*AC-2818 Lightning Arrester Dimensions
Figure 1*

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Collins AC-2819 Grounding Kit

HF accessories

1. DESCRIPTION

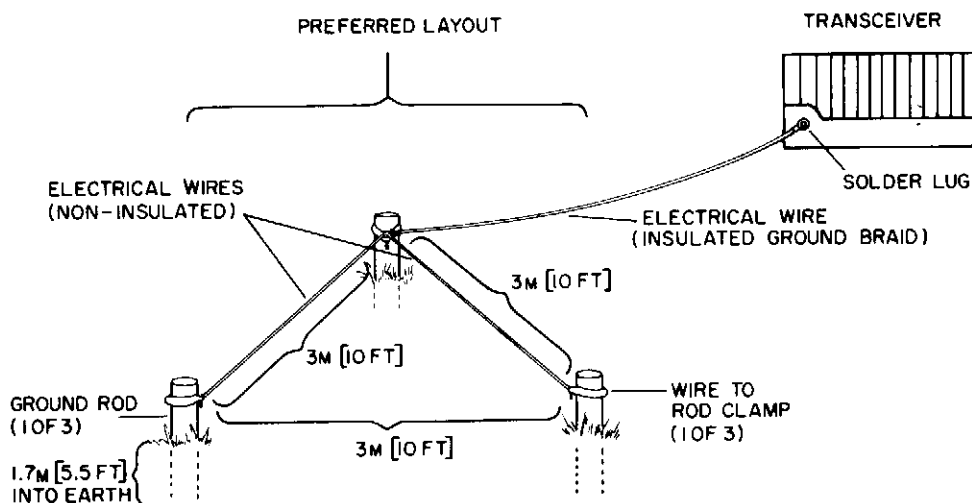
The AC-2819 Grounding Kit, Collins part number 622-3562-001, contains parts for making electrical ground to earth. Included in the kit are three 1.8-metre (6-ft) copper-clad steel ground rods, three wire-to-rod clamps, 12.2 metres (40 ft) of electrical wire, and a solder lug.

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:

- Drive 1.8-metre (6-ft) rods 1.7 metres (5.5 ft) into ground in triangular pattern as illustrated in figure 1.
- Cut uninsulated wire into two 3-metre (10-ft) lengths. Clamp wire ends to ground rods as shown in figure 1.
- Attach one end of insulated wire to common ground rod where uninsulated wires meet.
- Using as short a length as is practical for installation, attach other end of insulated wire to equipment to be grounded.



TPA-0780-019

Typical Grounding Kit Installation
Figure 1

AC-2819 grounding kit

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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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:

$$\begin{aligned} \text{antenna length} &= \frac{81.3}{\text{Freq (in MHz)}} \text{ metres} \\ &\text{or} \\ &= \frac{234}{\text{Freq (in MHz)}} \text{ feet} \end{aligned}$$

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



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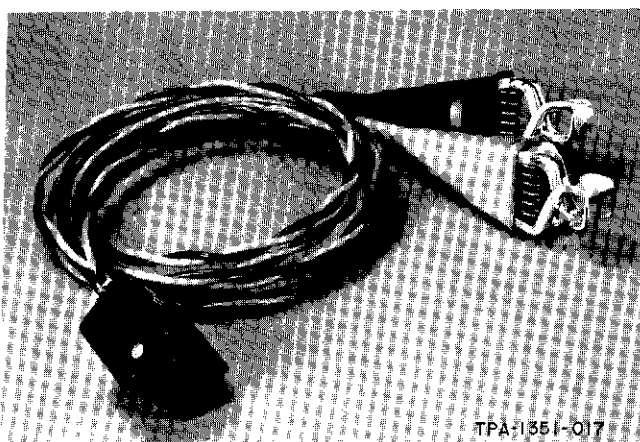
Collins AC-2821 DC Power Cable

HF accessories

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.

- Connect multipin connector of dc power cable to transceiver power input connector.
- 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



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HF accessories

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.

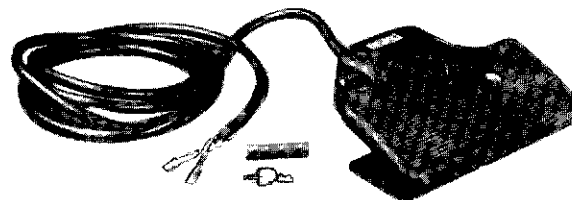
2. INSTALLATION

If the foot switch is to be used with the HF-281 or HF-282 transceivers, proceed as follows:

- Place the foot switch in a convenient position.
- 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:

- Cut the black wire off directly behind the red lug.
- Strip the black wire back 11/16 inch and tin the exposed wire.
- Cut the white wire off 7/8 inch behind the red lug.
- Strip the white wire back 9/32 inch and tin the exposed wire.
- Insert the black wire into the plug probe as far as possible and solder to the tip of the probe.
- 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.



TPA-2577-C17

AC-2828 Foot Switch Kit
Figure 1

- Crimp the two inside crimp lugs of the plug to the exposed portion of the white wire and solder.
- Crimp the two outside crimp lugs to the insulated portion of the white wire.
- 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).
- 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

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Collins AC-2832 Transceiver-to-Coupler Control Cable

HF accessories

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.

- 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.
- Remove six screws from around edges of CU-380 coupler cover and remove cover.
- Loosen bushing locknut and insert control cable through bushing.

Table 1. AC-2832 Cable Length to Part Number.

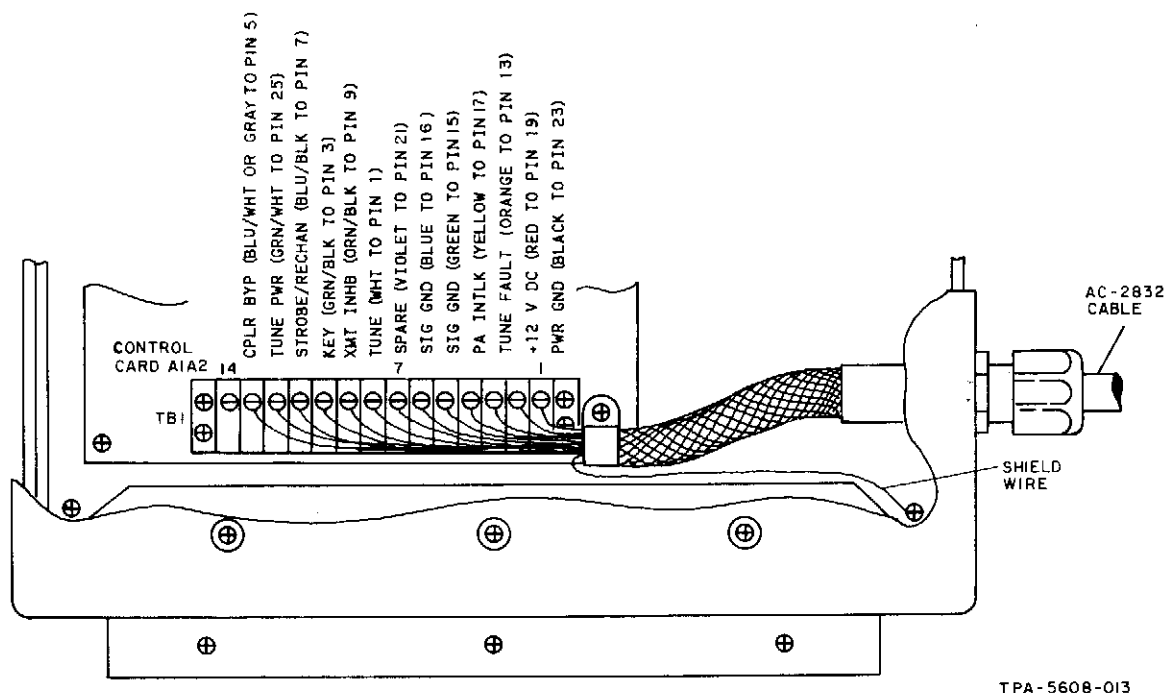
CABLE LENGTH	PART NUMBER
m/ft	651-7638-XXX
1/33	001
3/10	002
10/33	003
20/66	004
30/100	005
40/131	006
50/164	007
60/200	008
70/230	009
80/263	010
90/300	011
100/328	012
110/361	013
120/400	014

- Connect control cable terminals to coupler terminal strip TB1 as listed in table 2 and shown in figure 1.
- Tighten locknut until cable cannot be pulled from bushing.
- 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



TPA-5608-013

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