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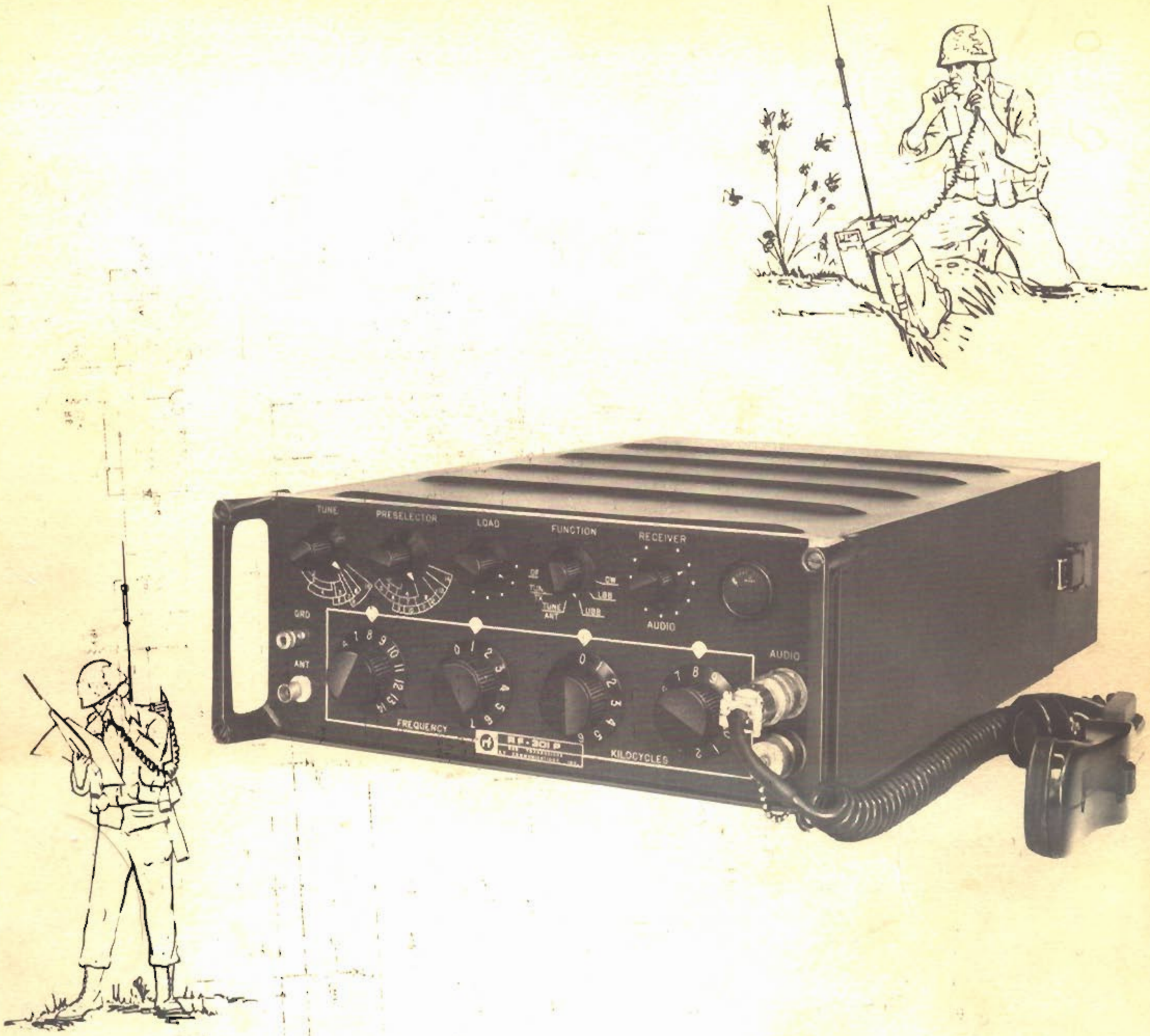

rf

RF-301P

SSB TRANSCEIVER PACKSET

RF COMMUNICATIONS, INC. ■ ROCHESTER, NEW YORK, U.S.A.

WARRANTY

R F Communications, Inc. warrants the equipment purchased hereunder to be free from defect in material and workmanship under normal use and service, when used for the purpose for whieh the same is designed, for a period of one year from the date of delivery, provided that notice of such defect is given to R F Communications within sixty (60) days after the discovery thereof and provided that inspection by R F Communications indicates the parts are defective to R F Communications' reasonable satisfaction. R F Communications' obligations under this warranty are limited to the repair or replacement of defective parts and the return of such repaired or replaced parts to the purchaser F.O.B factory. At R F Communications' option, any defective part shall be returned to R F Communications' factory for inspection, properly packed and all expenses prepaid. No parts shall be returned unless the purchaser first obtains a return authorization number, which will be furnished on request. Electron tubes are warranted in accordance with the manufacturer's standard tube warranty policy, which will be furnished on request. Equipment furnished by R F Communications, but manufactured by another, bears only the warranty given by such other manufacturer, which will be furnished on request. No warranties other than those set forth in this section are given or are to be implied with respect to the equipment furnished hereunder and R F Communications shall in no event be liable for consequential damages, or for loss, damage, or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause.

CORRESPONDENCE AND PARTS ORDERING

Whenever writing about this unit or ordering parts, always refer to the model and serial numbers and the approximate date of purchase. Special parts should be ordered by the R F part number and the schematic designation number. Standard parts can be obtained from your local parts distributor.

RETURN OF EQUIPMENT

No part shall be returned to RF Communications Field Service Department unless the purchaser first obtains a return merchandise authorization number (RM). This number is to be marked on the shipping container.

ACCESSORIES

From time to time, new accessories are added to our product line. Often, these are a result of particular customer needs. Our sales department will be happy to discuss your requirements and suggest possible solutions.

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CHAPTER 1
GENERAL INFORMATION

1.1 SCOPE OF MANUAL.

This manual describes the RF-301P SSB Transceiver and the accessories that make up the RF-301P Packset, figure 1.1. Included are installation and operation procedures, principles of operation, and maintenance and servicing instructions. For brevity the RF-301P SSB Transceiver will be referred to in this manual as the transceiver.

1.2 PURPOSE.

The transceiver, shown on front cover, is a rugged, lightweight two-way radio set designed for tactical communications using voice or telegraphy in manpack or other portable applications. The transceiver operates within the high-frequency (hf) frequency range of 2-15 megacycles per second (Mc/s) on a total of 13,000 channels in increments of 1 kilocycles per second (kc/s) or with continuous tuning between channels. It employs either upper or lower sideband suppressed carrier mode for voice operation and upper sideband with a sidetone signal for cw telegraphy.

Since the transceiver operates at the low frequency end of the hf spectrum, the transmitted signals are propagated by both groundwave and skywave. Groundwave propagation is normally used for communication at distances up to 25 miles. For greater distances, skywave propagation is used and signals reach distant points by proper selection of frequency, antenna, and time of day.

Different antennas and accessories are available with the transceiver to provide various types of operation. For portable applications, in which the operator will spend some amount of time at one location, a doublet antenna can be erected to provide efficient radiation for long distance communications. For applications in which the operator is mobile, a whip antenna is available which will allow the operator to transmit and receive with the transceiver on his back. Both dry cell and rechargeable battery packs may be used with the transceiver.

1.3 DESCRIPTION OF COMPONENTS.

The components that make up an RF-301P Packset are the RF-301P SSB Transceiver with the RF-3000 Handset, either the RF-327 Rechargeable Battery Pack or the RF-328 Dry Cell Battery Pack, the RF-333 Whip Antenna Kit, the RF-330 Manpack Frame, and the RF-331 Nylon Bag. These components are illustrated in figure 1.1. Also required, if operating with the RF-327 Rechargeable Battery Pack, is the RF-329 Battery Charger or a suitable substitute. Accessories available are listed in paragraph 1.5.

The RF-301P SSB Transceiver is housed in a rugged, rainproof aluminum case. All operating controls, indicators, and connectors are mounted on the front panel. The power connector is located on the rear panel to mate with the attachable battery packs. The transceiver utilizes solid state circuitry exclusively in all low power stages with the transmitter driver and final amplifier stages using instant-heat type tubes. Control of the channel frequency is accomplished with a frequency synthesizer which is frequency locked to a temperature compensated crystal frequency standard. At the operator's option, the 1 kc/s frequency knob can be pulled out to provide vernier frequency tuning. A transmitter power supply is used to provide high voltages for the transmitter tubes. The transmitter power supply and the tube heaters have power applied only during transmit, thereby reducing the battery drain during receive.

The RF-327 Rechargeable Battery Pack consists of two, ten cell, nickel-cadmium batteries in a weatherproof container. When fully charged the battery pack will provide a 14 ampere-hour supply at 12 volts. The two ten cell batteries are charged separately and discharged in parallel. A connector is provided on the top panel for mating with the transceiver power connector and with the RF-329 Battery Charger output cable. The battery pack is secured to the transceiver by quick-release fasteners located on the sides of the transceiver.

The RF-328 Dry Cell Battery Pack consists of forty-five 1.5 volt alkaline cells mounted in a weatherproof metal container. The cells are connected into three 15 cell, 4.5 volt, series-parallel batteries. The three 4.5 volt batteries are wired in series providing 13.5 volts for the transceiver. A connector is provided on the top panel for mating with the transceiver power connector. The bottom panel of the battery pack is secured with two quick-release fasteners for access when replacing the cells. The battery pack is secured to the transceiver by the two quick-release fasteners located on the sides of the transceiver.

The RF-333 Whip Antenna Kit is a sectionalized eight foot whip antenna and mounting base that can be disassembled for storage. The whip antenna consists of four main sections; the top section, the center loading coil section, the lower section and the bottom flexible section. When required, the antenna is mounted on the transceiver using the mounting base and attached with two quick-release fasteners. The mounting base also allows the antenna to be rotated to a vertical position when the operator and packset are in a prone, horizontal, position. Coarse and fine tuning of the antenna are made with controls on the loading coil. The bottom flexible section protects the operator and antenna against damage from encounters with obstructions.

The RF-330 Manpack Frame consists of a tubular aluminum frame with heavy padded shoulder straps to support the weight of the packset on the operator's shoulders.

The RF-331 Nylon Bag (which can be supplied separately) is fastened to the manpack frame. One large compartment is provided to house the transceiver with the whip antenna and a battery pack attached. Two other smaller compartments are for storage of the antennas and accessories. All three compartments are provided with flaps and tie-down straps.

1.4 TECHNICAL CHARACTERISTICS.

Nominal electrical and physical characteristics of the transceiver are listed in table 1.1.

1.5 ACCESSORIES AND SPARES.

The following is a list of accessories and spares that are available for use with the RF-301P SSB Transceiver. Those accessories followed by an asterisk are illustrated in figure 1.2.

RF-329	Battery Charger
RF-334	Doublet Antenna Kit*
RF-3001	Headset*
RF-3002	Headset (with boom microphone)*
RF-3004	Cw Hand Key*
RF-3005	Two-Way Audio Adapter*
RF-308P	Running Spares Parts Kit
RF-309P	Depot Spares Parts Kit
RF-311P	Comprehensive Spares Parts Kit
RF-327A	Replacement Cell Pack for RF-327
RF-327B	Replacement Cell Pack for RF-328

TABLE 1.1 - RF-301P SSB TRANSCEIVER, NOMINAL CHARACTERISTICS.

GENERAL	
Frequency Range	2 to 15 Mc/s
Frequency Setting	Digital, 13,000 channels in 1 kc/s steps with provisions for continuous tuning between channels.
Frequency Stability	1 part in 10^6
Modes of Operation	Selectable upper/lower sideband and cw.
Primary Power	12 ±2 vdc supplied by an RF-328 Rechargeable Battery Pack, an RF-329 Dry Cell Battery Pack, or an external dc source.
Power Consumption:	
Receive	4.5 watts.
Transmit	70 watts average.
Size	5 x 13 x 15 inches (13 x 33 x 38 cm).
Weight	23 lb (10.4 Kg.).
Environmental:	
Temperature	-28°C to +65°C.
Humidity	95%
Climatic	Weatherproof
RECEIVE	
Sensitivity	1.0 microvolt for 10 dB (s+n)/n
Selectivity	300 to 3200 cps nominal
Image Rejection	-65 dB
I-f Rejection	-65 dB
Agc	Fast-attack, slow-release, 16 dB change in audio output with signals from 1 uV to 100 mV.

TABLE 1.1 - RF-301P SSB TRANSCEIVER, NOMINAL CHARACTERISTICS (Cont.)

Audio Output	5 mW into 600 ohms maximum.
TRANSMIT	
Audio Input	Carbon or dynamic microphone
Audio Passband	300 to 3200 cps
Output Power	50 W p.e.p. voice 20 W cw
Output Impedance	52 ohms nominal, 35-150 ohm range
Carrier Suppression	-45 dB
Unwanted Sideband Suppression	-50 dB
Harmonic Suppression	-40 dB
Intermodulation Distortion	-26 dB

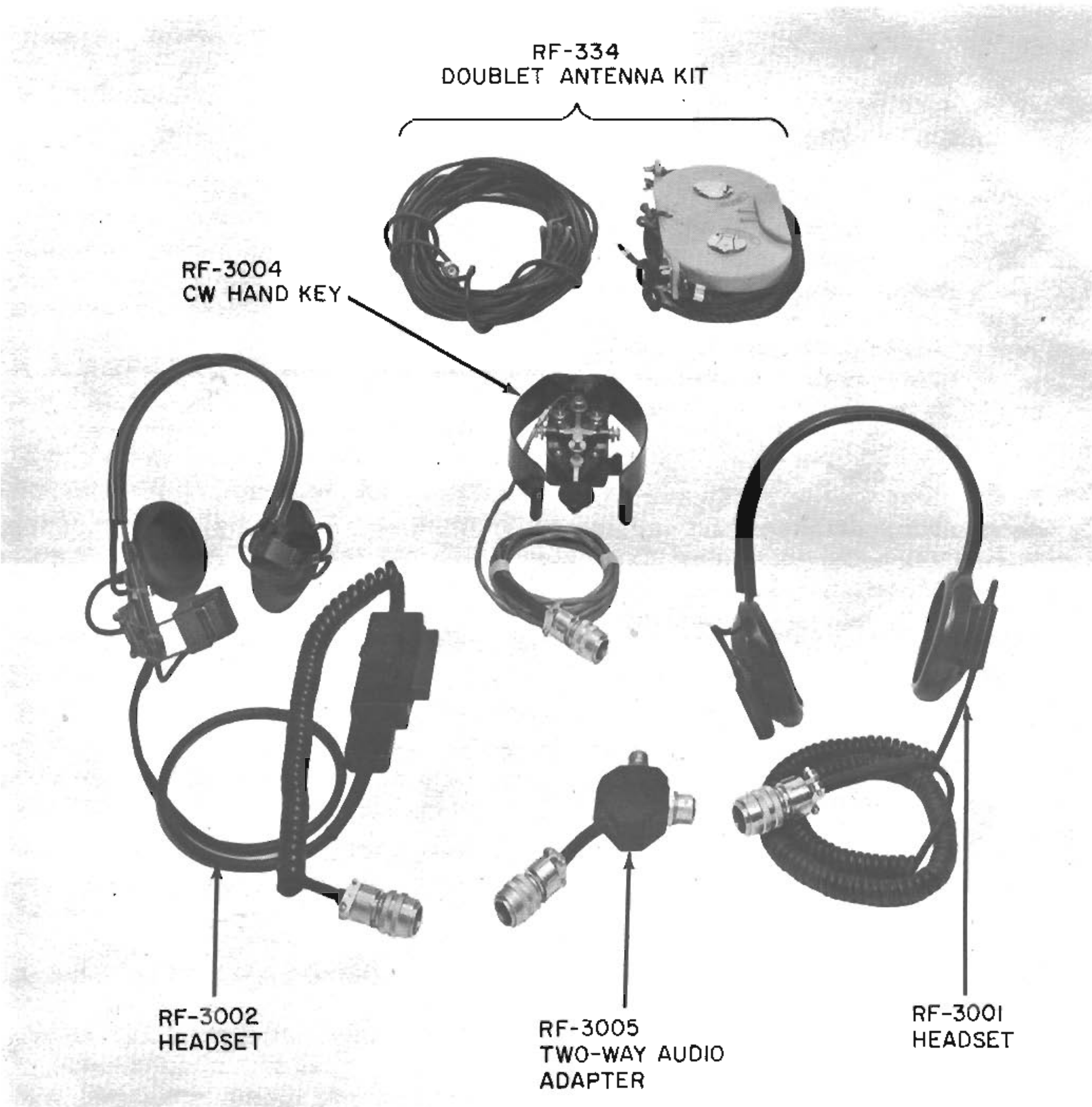


FIGURE 1.2 – RF-301P PACKSET ACCESSORIES

CHAPTER 2
INSTALLATION

2.1 GENERAL.

This section contains procedures for unpacking and assembling the RF-301P Packset. Also included are instructions to correctly charge the rechargeable battery pack and for doublet antenna installations. Instructions are limited to packset type operations.

2.2 UNPACKING AND INSPECTION.

Remove packing material from containers and carefully lift out the transceiver. The antennas, nylon bag and frame, battery packs and any other accessories which were ordered with the transceiver are packaged separately. Check all items when received, using the packing list shipped with the set. Be sure not to discard small items with the packing material.

Each item should be carefully inspected for signs of damage. If any damage is discovered, save packing material and containers and notify the carrier immediately.

If it is known that the set might be reshipped, save the container and packing material for future use.

2.3 BATTERY CHARGING.

The RF-327 Rechargeable Battery Pack must be fully charged before using. The following instructions describe the proper procedure, for charging the battery pack both initially and in regular service.

Note

The RF-328 Dry Cell Battery Pack cannot be recharged.

2.3.1 BATTERY CHARGING WITH A RF-329 BATTERY CHARGER.

The RF-329 Battery Charger is completely described in instruction manual PM-0575. The following procedures are limited to charging the RF-327 Battery Pack. The charger can be set to operate from ac power (117 or 235 vac, 45 to 65 cps, single phase) or dc power (12 ±2 vdc or 24 ±4 vdc). To charge the RF-327 proceed as follows.

Note

The 235 vac and the dc primary power cables are not supplied with the battery charger. They can be ordered separately as accessories.

CAUTION

For dc primary power source observe the polarity of the cable. Black lead to negative - terminal, white lead to positive + terminal.

a. Connect the appropriate power cable, either dc, 117 vac, or 235 vac, to the primary power source. Connect the primary power cable to J1 on the battery charger.

b. Connect the output cable to the connector on the battery pack and to OUTPUT connector J2 on the battery charger.

c. Set battery charger INPUT POWER switch S1 at the proper position for the primary power source and allow the battery charge for the required length of time.

Note

A fully discharged battery pack will require a total charging time of 14 hours. If the battery pack is less than fully discharged, less charging time will be required.

2.3.2 BATTERY CHARGING WITHOUT AN RF-329 BATTERY CHARGER.

If a RF-329 Battery Charger is not available, the battery pack can be charged using a 20 to 28 vdc power source, such as a 24 vdc battery or a 24 vdc vehicle supply. The battery pack is charged as two separate batteries as outlined below.

a. Using a 13 ohm, 10 watt load resistor, connect the positive ⊕ terminal of the dc power source to pin 1 on the battery pack.

b. Using a second 13 ohm, 10 watt load resistor, connect the positive ⊕ terminal of the dc power source to pin 2 on the battery pack.

c. Connect the negative ⊖ terminal of the dc power source to pin 3 on the battery pack.

Note

A fully discharged battery pack will require a total charging time of 14 hours. If the battery pack is less than fully discharged, less charging time will be required.

Note

Make sure that the battery pack is disconnected from the power source when the source is switched off, or the recharged battery pack may discharge itself back into the source.

2.4 INSTALLING DRY CELLS.

The RF-328 Dry Cell Battery Pack uses 45 alkaline dry cells. The bottom cover is removed by releasing the two quick-release fasteners. Dry cells of the following types may be used.

Military	BA3030
Mallory	MN1300
Eveready	E95
Burgess	AL-2
RCA	VS1336
Marathon	122

To replace the dry cells proceed as follows:

a. Place the battery pack on a flat surface with the connector down.

b. Release the two quick-release fasteners on the sides of the battery pack and lift the bottom cover off. Disconnect the connector on the bottom cover and place the cover to one side.

c. Lift the battery pack and pour out the old cells.

d. Replace the A5 new cells into the tubes, three to a tube.

Note

All cells are placed in the tubes in the same direction with the negative end to the springs and the positive center terminal toward the cover.

e. Reconnect the connector on the bottom cover and replace the cover. Engage and lock the quick-release fasteners.

f. Using a multimeter measure the voltage at the battery pack connector. Negative lead to pin 3, positive lead to pin one and measure approximately 13.5 volts.

2.5 ATTACHING BATTERY PACKS.

To attach the battery pack (either type) to the transceiver, place the battery pack, with the connector up, on a flat surface. Make sure that the transceiver FUNCTION switch is set at OFF. Hold the transceiver above the battery pack and align the connector on the rear panel of the transceiver with the connector on the battery pack. Lower the transceiver engaging the transceiver connector with the battery pack connector. Engage and lock the quick-release fasteners on the sides of the transceiver.

2.6 ASSEMBLING MANPACK STATION.

The following instructions outline the procedure for assembling the manpack configuration, using the RF-330 Manpack Frame, the RF-331 Nylon Bag, the RF-333 Whip Antenna Kit, the transceiver, and a battery pack.

Note

When the RF-333 Whip Antenna is not in use, it can be disassembled and stowed in the right hand compartment of the nylon bag.

a. Install the whip antenna base on the transceiver case by hooking the top of the mounting base over the flange at the top of the transceiver's left hand side. Secure the two quick-release fasteners at the bottom of the base plate. Route the coaxial cable from the mounting base through the left handle of the transceiver and connect to ANT connector on the front panel.

Note

The antenna can swivel by loosening the wing nut on the mounting base. For normal portable operation, with the transceiver on the operator's back, the antenna should be positioned vertical, refer to figure 2.1. For operating in a prone position the whip antenna is rotated until perpendicular to the terrain.

b. Open the top (transceiver compartment) flap on the nylon bag and insert the transceiver, with battery pack attached, into the bag, making sure that the antenna base is on the left hand side (side with opening for whip base), as shown in figure 2.1.

c. Secure the RF-331 Nylon Bag to the manpack frame with two straps at the top of the case and one centered at the bottom (not shown).

d. With the top transceiver compartment cover open, secure the top and bottom straps around the outside of the pack, as shown in figure 2.1.

e. To install the whip antenna, first screw the bottom flexible section into the mounting base receptacle, as shown in figure 2.1. Unfold the whip antenna section and assemble. Screw the assembled antenna onto the flexible section on the mounting base.

2.7 SITE SELECTION.

For operation when the operator can choose the operating location, considerable advantages are offered by selecting the site carefully. Following are some general rules for site selection.

a. Radio signals can be absorbed and reflected by nearby obstructions, such as hills, trees, metal buildings, and telephone or power lines.

b. Transmissions can be made over the greatest range when the doublet antenna is at the proper height above ground for the frequency and distance required. For line of sight operation, within about 30 miles, the

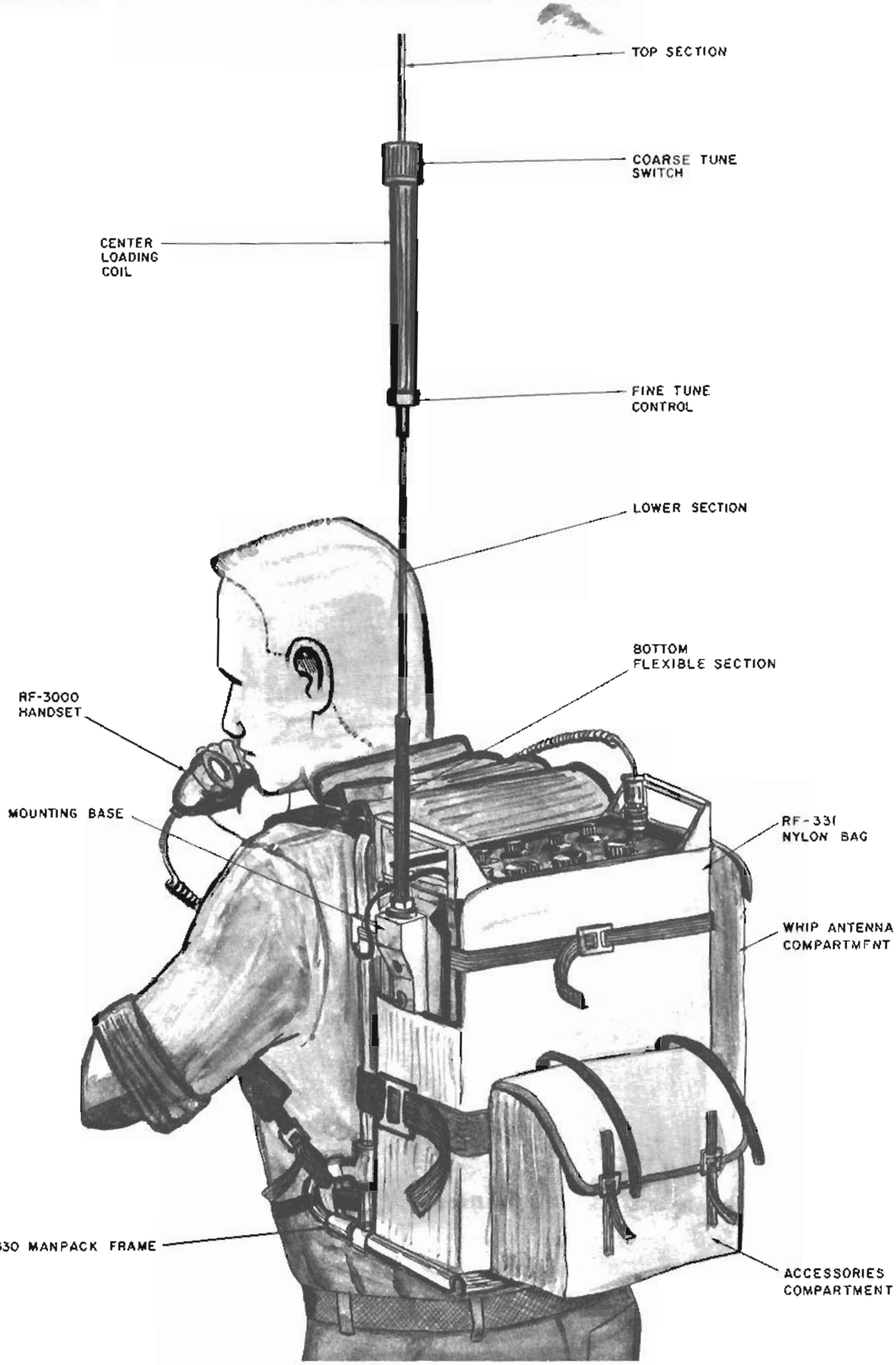


FIGURE 2.1 - TYPICAL MANPACK CONFIGURATION

best operation is usually obtained with the antenna as high as possible. For over 30 miles, operation using ionospheric reflection is usually necessary, and it may be desirable to have the antenna lower than would be used for line of sight operation. Generally, for 100 to 1000 mile operation, the antenna should be about one-quarter wavelength above ground; that is, the length of one leg of doublet antenna. For over 1000 miles, the antenna should be somewhat higher than one-quarter wavelength. A vertical or slanted antenna may provide better range for long range communications. If the whip antenna is used, a good ground connected to the GRD terminal on the front panel of the transceiver will improve performance.

c. Transmissions are best from the top of a hill, over level ground, or over water.

d. Some antennas, including the doublet antenna, are directional in nature. The doublet antenna should be erected perpendicular to the direction of the station to be contacted.

e. Avoid interference fields from nearby power lines, radar sets, field hospitals, other transmitters, neon or flashing lights, motors, and electrical fired engines.

f. It may be helpful to try several different locations in the area.

2.8 RF-334 DOUBLET ANTENNA ERECTION.

The RF-334 Doublet Antenna Kit is a self-contained doublet antenna in a molded plastic reel container. The antenna consists of two flexible metal tape elements (marked in metres), two attached support ropes, and center coaxial connector. Included separately is 50 feet of coaxial cable for connecting the antenna to the transceiver. To erect the antenna, the operator reels out the proper amount of tape, as determined by the operating frequency, and connects the coaxial cable to tbe center connector. The ends of the antenna are then tied to supporting objects with the rope. The doublet antenna is usually preferred for long distance communications.

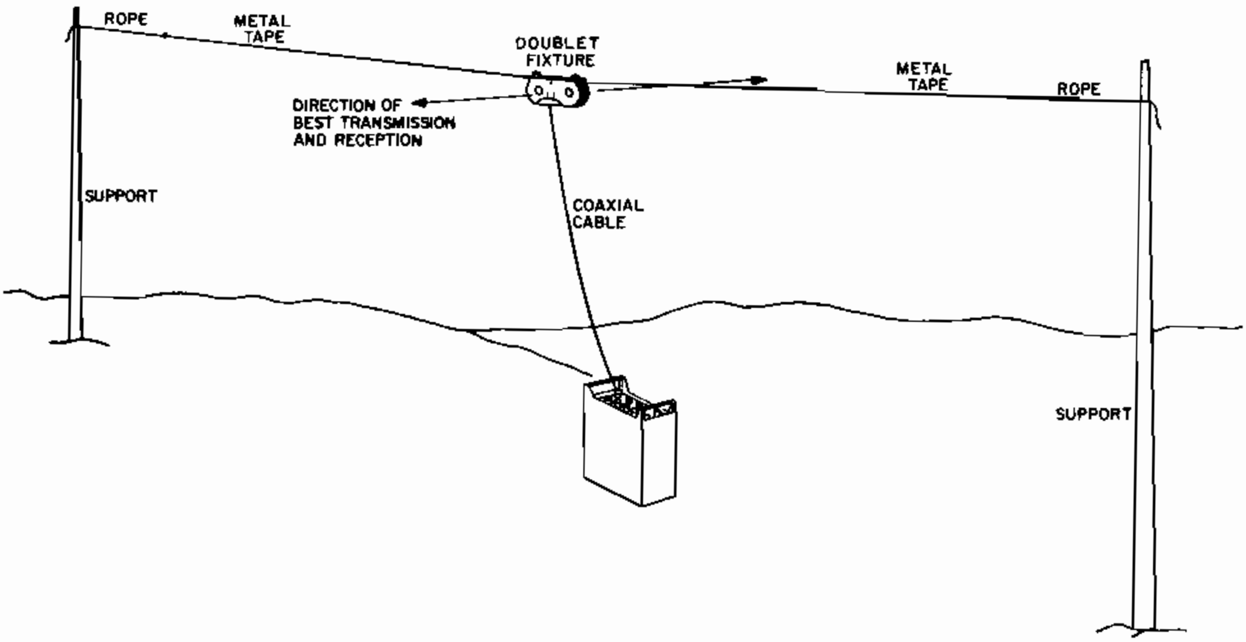
Three types of antennas can be constructed with the RF-334 Doublet Antenna Kit. All three are doublet antennas, that is, they have two legs of equal length and have one leg connected to the inner conductor of the coaxial cable and the other leg connected to the shield. The antenna elements have a combined length of an electrical half wavelength (one-quarter wavelength for each element).

A horizontal doublet can be erected as shown in figure 2.2A by suspending the antenna by its ends between two trees or other tall objects.

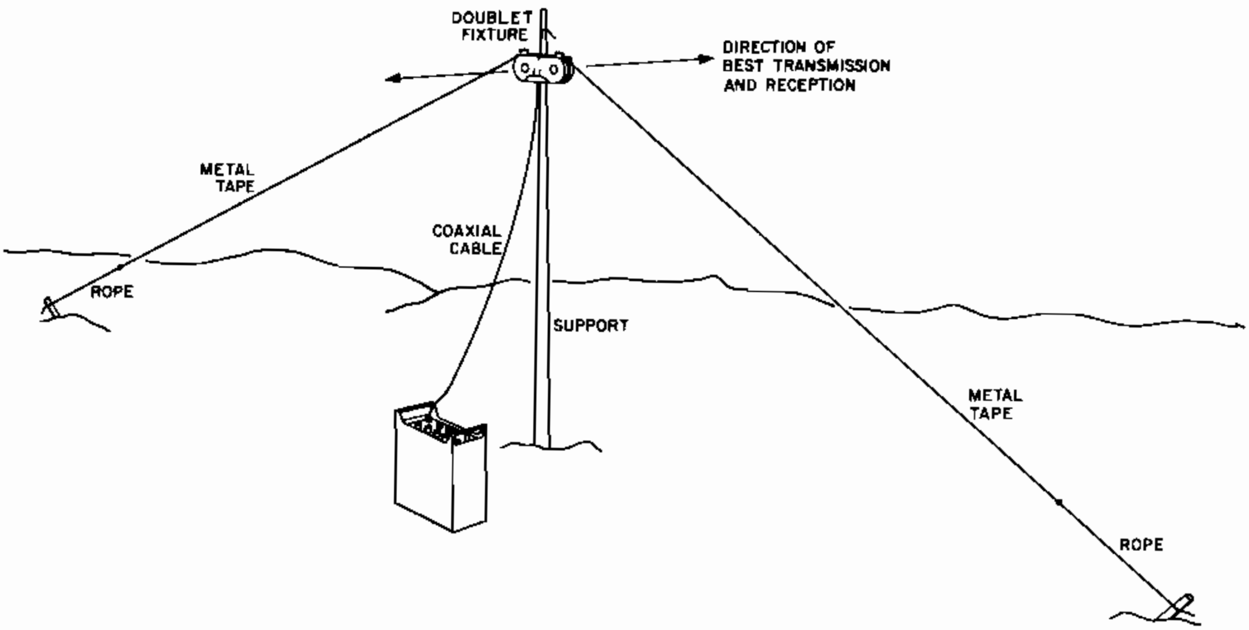
If only one tall support is available, an inverted V antenna can be constructed as shown in figure 2.2B. In this case, the antenna is suspended from the supporting structure with nylon cord or any other insulating cord and the two legs are tied at the ends to stakes in the ground. For best operation, an inverted V should have an angle of about 90° between elements.

Another variation of the doublet is the slanted doublet antenna, not shown. A slanted doublet antenna is a combination of the horizontal and the inverted V; that is, one end is secured to a tall vertical support, the other end is secured to a stake driven into the ground. This antenna may provide better results for some forms of propagation such as long skip or operation with another nearby station using a whip antenna.

All of these antennas are directional in nature, with the antenna providing better response to received signals from directions perpendicular to the antenna and radiating more of the transmitted signal in those directions than in others. The directional effect



A. TWO SUPPORT DOUBLET



B. INVERTED V-DOUBLET

FIGURE 2.2 - TYPICAL DOUBLET ANTENNA INSTALLATIONS

of the doublet antenna is illustrated by arrows in figure 2.2.

With any of these types of antennas, the procedure for installing the antenna is basically the same. The only variations are in the method of suspension and the points at which the ends are tied. Assemble the antenna as follows:

a. Unreel the required lengths of metal tape from the reels. Metre markers are provided on the tape and a table for conversion of metres to frequency is provided on the reel assemhly. The length of each element can also be determined by the use of one of the following formulas or by using table 2.1.

Horizontal and slanted doublet

$$\text{Length of each element in feet} = \frac{234}{\text{frequency (Mc/s)}}$$

$$\text{Length of each element in metres} = \frac{71.3}{\text{frequency (Mc/s)}}$$

Inverted V doublet

$$\text{Length of each element in feet} = \frac{245}{\text{frequency (Mc/s)}}$$

$$\text{Length of each element in metres} = \frac{74.5}{\text{frequency (Mc/s)}}$$

Allow proportionate additional lengths to compensate between markers for other frequencies. The antenna elements must be very close to the correct resonant lengths to provide proper operation. The transmitter can be damaged by operation with improper antenna lengths.

b. Secure the tape to the reel assembly using the wing nuts on the top of the assembly.

c. Unreel the coaxial cable and connect one end to the connector on the reel assembly. Connect the other end into the ANT connector on the front panel of the transceiver.

d. Determine how the antenna is to be supported. Tie ends (and the reel assembly, if necessary) to the supports or stakes using the attached rope. When tying the ends to trees, be sure to leave some slack to allow for movement of the trees in the wind.

e. Position the transceiver, if possible, so that the coaxial cable does not hang near either of the antenna elements. If the coaxial cable is run parallel to one of the elements, some detuning of the antenna may occur. The best routing of the coaxial cable is perpendicular to the antenna.

TABLE 2.1 - DOUBLET ANTENNA, LENGTH VS FREQUENCY

Frequency (Mc/s)	Element Length		Frequency (Mc/s)	Element Length	
	Feet	Metres		Feet	Metres
2.0	117	35.6	6.0	39.0	11.9
2.1	111.4	33.9	6.1	38.4	11.7
2.2	106.3	32.4	6.2	37.7	11.5
2.3	101.7	30.9	6.3	37.2	11.3
2.4	97.5	29.7	6.4	36.5	11.1
2.5	93.6	28.5	6.5	36.0	11.0
2.6	90.0	27.4	6.6	35.5	10.8
2.7	86.7	26.4	6.7	34.9	10.6
2.8	83.6	25.4	6.8	34.4	10.5
2.9	80.7	24.2	6.9	33.9	10.3
3.0	78.0	23.7	7.0	33.4	10.9
3.1	75.5	23.0	7.1	33.0	10.0
3.2	73.1	22.3	7.2	32.5	9.90
3.3	70.9	21.6	7.3	32.1	9.78
3.4	68.8	21.0	7.4	31.6	9.63
3.5	66.9	20.4	7.5	31.2	9.50
3.6	65.0	19.8	7.6	30.8	9.38
3.7	63.2	19.3	7.7	30.4	9.26
3.8	61.5	18.7	7.8	30.0	9.14
3.9	60.0	18.3	7.9	29.6	9.02
4.0	58.5	17.8	8.0	29.2	8.90
4.1	57.1	17.4	8.1	28.9	8.80
4.2	55.7	17.0	8.2	28.6	8.71
4.3	54.4	16.6	8.3	28.1	8.56
4.4	53.2	16.2	8.4	27.9	8.50
4.5	52.0	15.8	8.5	27.5	8.38
4.6	50.9	15.5	8.6	27.2	8.29
4.7	49.8	15.2	8.7	26.9	8.20
4.8	48.7	14.8	8.8	26.6	8.11
4.9	47.8	14.5	8.9	26.3	8.02
5.0	46.0	14.0	9.0	26.0	7.92
5.1	45.9	13.9	9.1	25.7	7.83
5.2	45.0	13.7	9.2	25.5	7.77
5.3	44.1	13.4	9.3	25.1	7.65
5.4	43.3	13.2	9.4	24.9	7.59
5.5	42.6	13.0	9.5	24.7	7.53
5.6	41.8	12.7	9.6	24.3	7.41
5.7	41.0	12.5	9.7	24.2	7.38
5.8	40.4	12.3	9.8	23.8	7.25
5.9	39.6	12.0	9.9	23.7	7.22

TABLE 2.1 - DOUBLET ANTENNA, LENGTH VS FREQUENCY (Cont.)

Frequency (Mc/s)	Element Length		Frequency (Mc/s)	Element Length	
	Feet	Metres		Feet	Metres
10.0	23.4	7.13	12.6	18.6	5.67
10.1	23.1	7.04	12.7	18.4	5.61
10.2	22.9	6.98	12.8	18.3	5.58
10.3	22.7	6.92	12.9	18.2	5.55
10.4	22.5	6.86	13.0	18.0	5.49
10.5	22.3	6.80	13.1	17.8	5.43
10.6	22.1	6.74	13.2	17.7	5.40
10.7	21.8	6.64	13.3	17.6	5.36
10.8	21.7	6.61	13.4	17.5	5.33
10.9	21.5	6.55	13.5	17.3	5.27
11.0	21.2	6.46	13.6	17.2	5.24
11.1	21.1	6.43	13.7	17.1	5.21
11.2	20.9	6.37	13.8	17.0	5.18
11.3	20.7	6.31	13.9	16.8	5.12
11.4	20.5	6.25	14.0	16.7	5.09
11.5	20.4	6.22	14.1	16.6	5.06
11.6	20.2	6.16	14.2	16.5	5.03
11.7	20.0	6.10	14.3	16.4	5.00
11.8	19.8	6.04	14.4	16.2	4.94
11.9	19.6	5.97	14.5	16.1	4.91
12.0	19.5	5.94	14.6	16.0	4.88
12.1	19.4	5.91	14.7	15.9	4.85
12.2	19.2	5.85	14.8	15.8	4.82
12.3	19.0	5.79	14.9	15.7	4.79
12.4	18.9	5.76	15.0	15.6	4.75
12.5	18.7	5.70			

CHAPTER 3
OPERATION

3.1 GENERAL.

This chapter contains a description of the operating devices of the RF-301P SSB Transceiver and provides operating instructions for the transceiver and the RF-333 Whip Antenna. Refer to chapter 2 for erection of the whip and doublet antennas and for charging and installing battery packs.

3.2 OPERATING CONTROLS, INDICATORS, AND CONNECTIONS.

The operating controls, indicators, and connectors for the transceiver are mounted on the front panel. They are shown in figure 3.1 and their functions are described in table 3.1. Note that all controls advance counterclockwise.

3.3 OPERATION.

3.3.1 PREPARATION.

CAUTION

Damage to the transmitting power amplifier circuits will result from transmitting without a properly tuned antenna. Refer to chapter 2 for antenna installation information.

b. Set the FUNCTION switch at CW to check the battery voltage. The meter should indicate in the middle of the green sector if the battery is charged. If the meter indicates at the lower end of the green sector, the battery pack should be recharged; or in the case of a dry cell battery pack, the cells should be replaced. If the meter does not indicate, either the battery is completely dead or the front panel fuse is blown.

c. Connect the handset to AUDIO connector.

Note

If operating with more than one audio terminal device, such as a cw key and headset combination, connect the RF-3005 Two-way Audio Adapter to AUDIO connector. The two audio terminal devices are then connected to the adapter.

3.3.2 RECEIVE MODE.

a. Set FUNCTION switch at USB, LSB, or CW.

b. Set FREQUENCY KILOCYCLES switches at the desired channel frequency.

c. Sct RECEIVER AUDIO control for the desired listening level.

d. Set PRESELECTOR to the low end of the band which the operating frequency is in, and then tune the PRESELECTOR counterclockwise up into the band for maximum signal or noise response.

Note

If the received signal is not clear or the desired operating frequency is not on an even 1 kc/s channel, pull the 1 kc/s FREQUENCY KILLOCYCLES control knob out and tune for maximum clarity or desired cw tone.

3.3.3 TRANSMIT MODE.

a. Set FUNCTION switch at TUNE TX. Perform receive operation steps 3.3.2b through 3.3.2d.

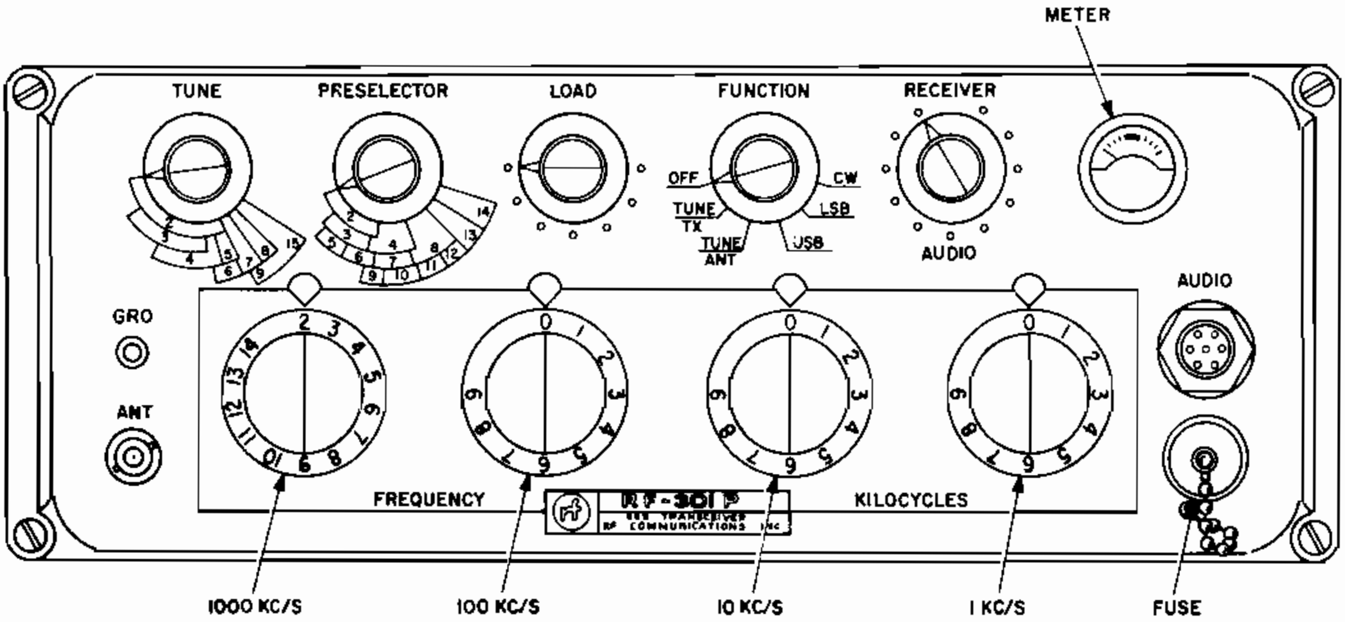


FIGURE 3.1 - RF-301P SSB TRANSCEIVER FRONT PANEL.

TABLE 3.1 - RF-301P SSB TRANSCEIVER, OPERATING CONTROLS, INDICATORS,AND CONNECTORS.

DEVICE NAME	FUNCTION	
TUNE	Adjusts the transmitter output to resonance for maximum output.	
PRESELECTOR	Adjusts the transmitter and receiver rf stages to resonance for maximum response.	
LOAD	Adjusts the output impedance of the transmitter for maximum output.	
FUNCTION Switch	Position	Response
	OFF	Disconnects power from set.
	TUNE TX	Connects transmitter output to an internal dummy load and activates tune oscillator.

TABLE 3.1 - RF-301P SSB TRANSCEIVER, OPERATING CONTROLS, INDICATORS, AND CONNECTORS (Cont.)

DEVICE NAME	FUNCTION
	<u>Position</u> <u>Response</u> TUNE ANT — Connects transmitter output to antenna and activates tune oscillator. USB — Selects upper sideband voice mode. LSB — Selects lower sideband voice mode. CW — Selects upper sideband telegraphy mode.
RECEIVER AUDIO	Sets audio output level.
Meter	On receive, the meter indicates signal strength with FUNCTION switch at TUNE ANT, USB, or LSB and indicates battery voltage with FUNCTION switch at CW. On transmit, the meter indicates rf output current. Indicates battery voltage on cw.
GRD Post	For ground connection to chassis.
ANT Connector	BNC type for connection of coaxial cable to antenna.
FREQUENCY KILOCYCLES Switches	For digital channel selection in 1000, 100, 10, and 1 kc/s steps. The 1 kc/s control knob can be pulled out for vernier tuning between even 1 kc/s channels.
AUDIO Connector	For connection of handset, cw key, headset, or the RF-3005 Two-way Audio Adapter. The RF-3005 Two-way Audio Adapter can be used to connect two devices to the connector.
FUSE	Protects transceiver from primary power overloads. See parts list for value.

b. Preset TUNE control to the approximate operating frequency. Set LOAD control to mid-scale.

c. Depress the microphone push-to-talk switch or cw hand key and alternately adjust TUNE and LOAD for maximum meter indication. Repeak PRESELECTOR for maximum meter indication.

d. Set FUNCTION switch at TUNE ANT.

Note

If operating with the RF-333 Whip Antenna, perform steps e through g below. If operating with the RF-334 Doublet Antenna, proceed directly to step g below.

e. At the whip antenna loading coil, set the coarse tune switch (upper control) to the operating frequency band and the fine tune (lower) control to the full counterclockwise position. (See figure 2.1.)

f. Depress the microphone push-to-talk switch or the cw key, and adjust the fine tune control on the loading coil for a dip indication on the meter. If a dip cannot be obtained within the range of the fine tune control, set the coarse tune switch to another position and try tuning for a dip again with the fine tune control.

g. Depress the microphone push-to-talk switch or cw key, and adjust the LOAD and TUNE controls on the transceiver alternately for maximum meter indication.

h. Set the FUNCTION switch to the desired operating mode. The transceiver is now ready for operation.

Note

When operating in the cw mode, the transceiver will go to transmit when the key is depressed and held for a short time after the key is released. A transmit sidetone signal will be heard in the earphone at a level adjusted by the RECEIVER AUDIO control in all operating modes.

CHAPTER 4
PRINCIPLES OF OPERATION

4.1 FUNCTIONAL DESCRIPTION.

The RF-301P SSB Transceiver is a triple-conversion superheterodyne receiver and transmitter for upper and lower sideband, suppressed carrier voice and continuous wave (cw) telegraphy modes of operation in the 2 to 15 Mc/s frequency range.

Digital frequency selection is accomplished by setting four controls on the front panel of the transceiver. One each of these controls establishes the operating frequency in steps of 1000 kc/s, 100 kc/s, 10 kc/s and 1 kc/s, respectively, from left to right on the panel. The displayed frequency is read on the knobs under the pointers and is variable in 1 kc/s steps. Optionally, the 1 kc/s control knob may be pulled out to unlock the 1 kc/s step control of the last digit and allow the 1 kc/s control to be continuously tuned. The frequency is controlled by a frequency synthesizer, which contains a high stability frequency standard oscillator.

The transmitter provides 50 watts peak envelope power (p. e. p.) output on voice operation and 20 volts watts average power output for cw. The receiver provides a low level audio output sufficient to drive an earphone or an external speaker amplifier.

The transceiver operates from 12 ±2 volt dc power source, such as a rechargeable battery pack or a dry cell battery pack. Receiver and frequency synthesizer circuits and most of the transmitter circuits are transistorized and operate directly from the dc power source. The transmitter driver and power amplifier stages use instant-heat tubes which are on only during transmit. High voltage power for transmit is supplied by the transmit power supply which operates only on transmit.

4.2 MAIN SIGNAL FLOW.

With the exception of the frequency synthesizer, which supplies all of the internal frequencies needed, the RF-301P SSB Transceiver is a straight-forward triple-conversion superheterodyne transceiver. To make the discussion of signal flow easier to follow, the frequency synthesizer will be considered temporarily as a "black box" and will be discussed later after the general signal flow.

4.2.1 RECEIVE SIGNAL FLOW.

Refer to figure 4.1 during the following discussion. The received rf signal is routed from the antenna to the RF Amplifier Assembly through the antenna transfer relay. Two stages of amplification occur in the RF Amplifier Assembly, which together with the tuned circuits in the assembly, provide the required sensitivity and "front-end" selectivity for the receiver. The output of the RF Amplifier Assembly is applied to the Translator Assembly.

The Translator Assembly consists of three mixer stages which up convert and then down convert the signal to the i-f frequency of 455 kc/s. Three stages of frequency conversion are used so that in addition to the two normal frequency conversions which are based on increment tuning, a third conversion can be made in conjunction with an error correcting signal from the frequency synthesizer to compensate for any errors in the incremental crystal oscillator signals used in the other

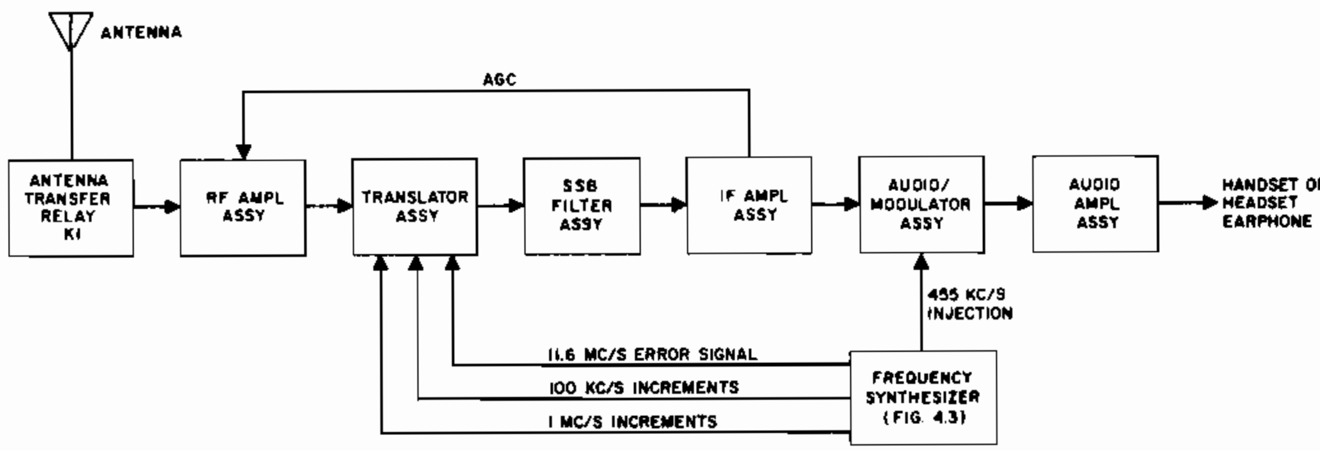


FIGURE 4. 1 – RECEIVE MODE, SIMPLIFIED SIGNAL FLOW DIAGRAM

two stages of mixing. The output of the Translator Assembly is at the 455 kc/s i-f frequency.

The i-f signal output from the Translator Assembly is applied to the I-f Amplifier Assembly through the SSB Filter Assembly which selects either upper or lower sideband. The signal is then amplified by five successive stages in the I-f Amplifier Assembly and applied to the detector circuit in the Audio/Modulator Assembly. An automatic gain control (agc) signal is derived from the i-f signal level in the I-f Amplifier Assembly. The agc signal is applied to three of the i-f amplifier stages and to one of the rf amplifier stages in the RF Amplifier Assembly to compress the variation of audio output signal levels. As the signal level into the RF Amplifier Assembly increases, the agc signal applied to the controlled amplifier stages acts to decrease the gain of the amplifier stages to offset the higher signal level. The end result is that the level of the audio output varies much less than the level of the input rf signal.

The i-f output is applied to a product detector circuit in the Audio/Modulator Assembly with a 455 kc/s signal injected from the frequency synthesizer. The product detector converts the single sideband or cw signal to an audio frequency which is then applied to the Audio Amplifier Assembly through the RECEIVER AUDIO level control. The audio output of the Audio Amplifier Assembly is applied to the earphone in the headset or handset through AUDIO connector on the front panel. The audio output can also be used to drive an external speaker amplifier.

4. 2. 2 TRANSMIT SIGNAL FLOW.

Refer to figure 4. 2 during the following discussion. The transmit signal flow is similar to the receive signal flow, but in the opposite direction. In voice operation, audio from the microphone or handset is applied through the transmit audio gain adjustment, R6, in the Frequency Standard/Tuning Oscillator Assembly to the Audio/Modulator Assembly. It is then amplified and applied to the balanced modulator stage in that assembly.

The balanced modulator, which has a 455 kc/s injection signal applied to it from the frequency synthesizer, converts the audio signal

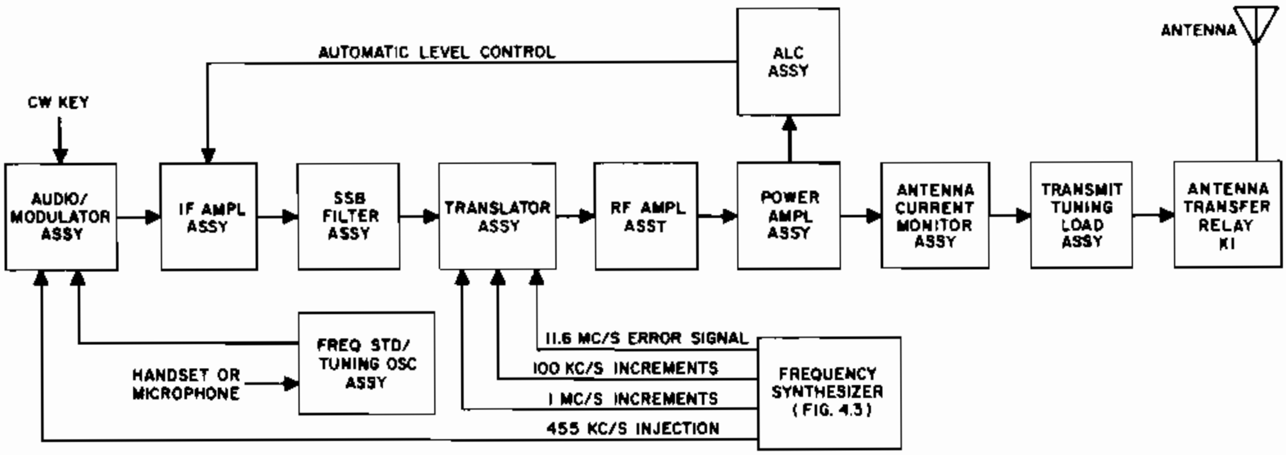


FIGURE 4.2 – TRANSMIT MODE, SIMPLIFIED SIGNAL FLOW DIAGRAM

to a double sideband i-f signal with the carrier frequency suppressed. In cw, the cw hand key applies a make/break signal to the cw circuits of the Audio/Modulator Assembly. When the cw key is depressed, the transceiver is keyed to transmit, and a cw audio oscillator in the assembly applies a single tone signal to the audio amplifier stage. The output of the audio amplifier is applied to the modulator to produce a signal similar to a voice sideband signal, but with a single audio tone.

The double sideband i-f frequency transmit signal from the Audio/Modulator Assembly is then applied to the I-f Amplifier Assembly which has one stage of amplification. The amount of amplification which the stage produces is determined by an automatic level control (alc) signal which is derived from the Power Amplifier Assembly. When the drive level at the grid of the power amplifier tube reaches a point where overdrive might otherwise occur, the ALC Assembly provides a control signal to reduce the gain of the transmit i-f amplifier stage.

The next several stages of signal processing are similar to the receiver signal process, but reversed. The double sideband i-f signal is converted to a single sideband signal in the SSB Filter Assembly, in which only one of two sideband filters passes the i-f signal depending on the setting of the FUNCTION switch. In all positions except LSB, the lower sideband i-f signal is passed and the upper i-f signal is suppressed. Just the opposite occurs when the FUNCTION switch is set to LSB. The lower sideband i-f signal after conversion to the transmit frequency will be the upper sideband and upper sideband i-f signal will be converted to the lower sideband transmit signal. The now single sideband signal from the SSB Filter Assembly is upconverted in two stages in the Translator Assembly and is then down-converted to the transmission frequency in the third mixer stage. The Translator output signal is then amplified in two transistor amplifier stages in the RF Amplifier Assembly and applied to a driver tube stage in the assembly. The output of the driver tube is applied to the power amplifier tube in the Power Amplifier Assembly. As previously described, the ALC Assembly limits the level of the drive signal which can be applied to the power amplifier.

The output of the power amplifier stage passes through the Antenna Current Monitor

Assembly to the Transmit Tuning Load Assembly. The Antenna Current Monitor Assembly detects the relative level of antenna current to operate the front panel meter. The Transmit Tuning Load Assembly contains a relay and a dummy transmitter load. When the FUNCTION switch is in the TUNE TX position, the relay connects the output of the transmitter to the dummy load so that the output tuned circuits of the power amplifier stage can be accurately tuned. When the FUNCTION switch is in any other position, the relay connects the transmitter output to the antenna through the antenna transfer relay. Once the power amplifier stage has been accurately tuned using the dummy load in this way, the whip antenna can then be tuned without affecting the tuning of the power amplifier.

4.3 FREQUENCY SYNTHESIZER OPERATION.

4.3.1 GENERAL.

The frequency synthesizer generates the frequencies used in the superheterodyne frequency conversion process. It employs oscillators in decade switching arrangements, error mixers, frequency dividers, spectrum generators, and a frequency standard as shown in figure 4.3. The frequencies generated by the frequency synthesizer have the effect of providing frequency stability on any of the 13,000 channels equal to the stability of the frequency standard, which is several orders of magnitude better than that of the individual crystal oscillators.

4.3.2 ERROR MIXERS.

As shown in figure 4.3, the MC and 100 KC Crystal Oscillators output, with a certain inherent magnitude of possible frequency error, is fed into the Translator. The same output is fed into the 11.6 MC Error Mixer, which compares the oscillator frequency with the frequency spectrum generated from the frequency standard signal. Since the frequency standard frequency is several orders of magnitude better in accuracy than the frequency of the crystal oscillator, the frequency error of the frequency standard is considered negligible. The error mixer output signal contains the error of the crystal oscillator, but because of the algebraic method in which the error mixer subtracts the crystal oscillator frequency from the spectrum frequency derived from the frequency standard, the relationship between the error of the crystal oscillator frequency and the error in the error mixer frequency is reversed. Thus, if the crystal oscillator has a positive error (high in frequency), the error mixer signal will have a negative error (low in frequency), and vice-versa.

4.3.3 ERROR CANCELLING.

The output of the 11.6 MC Error Mixer Assembly, with its reversed error, is fed into the third mixer stage in the Translator Assembly. The mixer stage mixes this frequency (with the reversed crystal error) with the signal which has an error inherited from the crystal oscillators. The net effect is a cancellation of errors. The crystal oscillator error and the reversed error cancel, and a new frequency is produced with no error other than the frequency standard error.

The error of the MC and 100 KC Oscillators is much greater than that of the 10 KC and 1 KC Oscillators because the crystal frequencies are much higher. The cancellation of the MC and 100 KC Oscillator errors takes place in the Translator as described. The cancellation of errors from the 10 KC and 1 KC Oscillators takes place in a different manner. The 10 KC and 1 KC Oscillator signals are injected into the 11.6 MC Error Mixer Assembly and into the 455 KC Error Mixer Assembly.

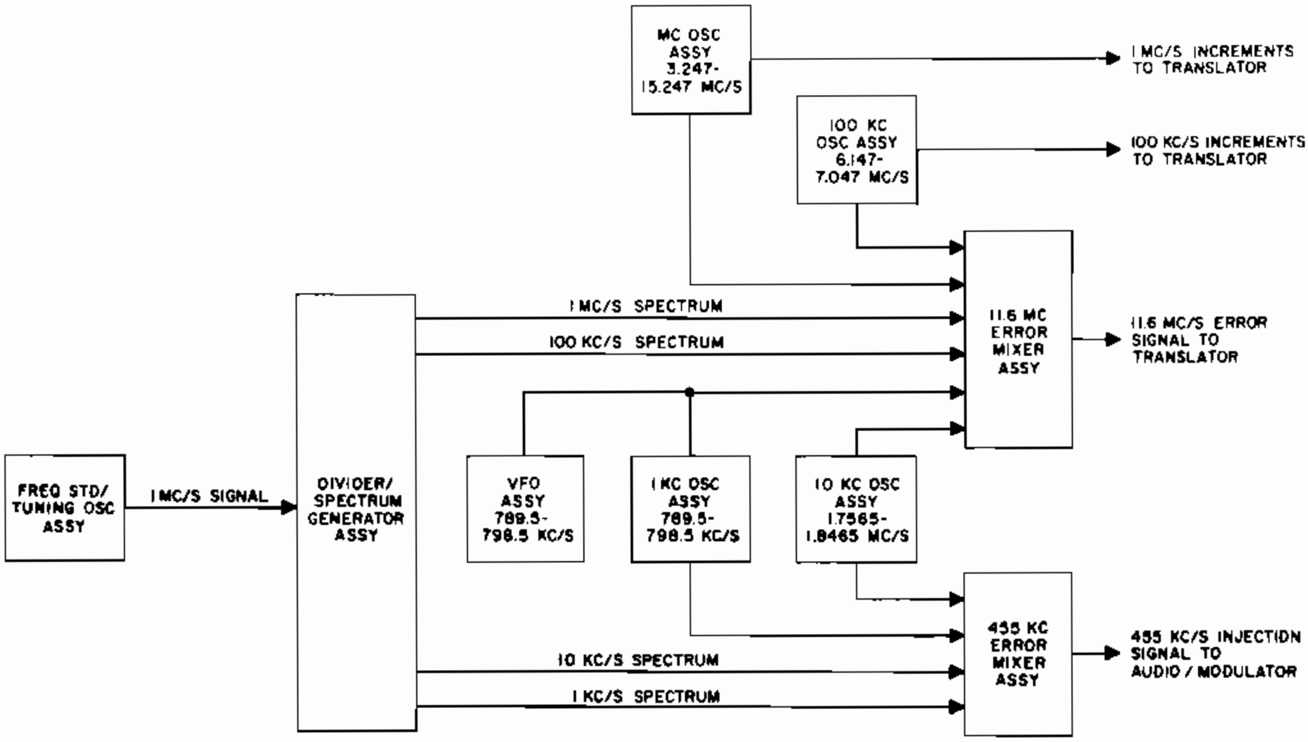


FIGURE 4.3 – FREQUENCY SYNTHESIZER, SIMPLIFIED SIGNAL FLOW DIAGRAM

The 455 KC Error Mixer produces a 455 kc/s signal for injection into the balanced modulator/product detector stage in the Audio/ Modulator Assembly. The error introduced in the Translator is cancelled by the reversed error introduced into the balanced modulator/ product detector.

4.3.4 VERNIER TUNING.

Vernier tuning is possible when the 1 kc/s FREQUENCY KILOCYCLE control knob is pulled out. The VFO Assembly is substituted for the 1 KC Oscillator in this case. When using the vernier feature, however, complete error cancellation does not occur. It is necessary to substitute a fixed crystal oscillator frequency for the 1 kc/s interval spectrum to obtain the 455 kc/s output. This sacrifice in stability is not too significant, however, since most of the error is a result of errors in the MC and 100 KC Oscillators which are still cancelled in the other error loop.

4.4 POWER SUPPLIES.

A simplified signal flow diagram of the power supplies in the transceiver is shown in figure 4.4. The 12 ±2 volt dc input from the battery is partially filtered at the input of the transceiver by ripple and rf filter capacitors. After passing through the fuse, the 12 volt line has a zener diode across the line to blow the fuse if the input voltage is too high or of the wrong polarity. A line from this point (before the main switch) is connected to the antenna transfer relay, which is energized only when the set is keyed to transmit. After the power main passes through the FUNCTION switch, an unfiltered 12 volt line is taken off to the primary key relay. When the switch is on and the key relay is energized by the push-to-talk switch in handset or by the cw hand keyer, 12 volts is connected to the coil of the antenna transfer relay on the secondary keyline. In addition to switching

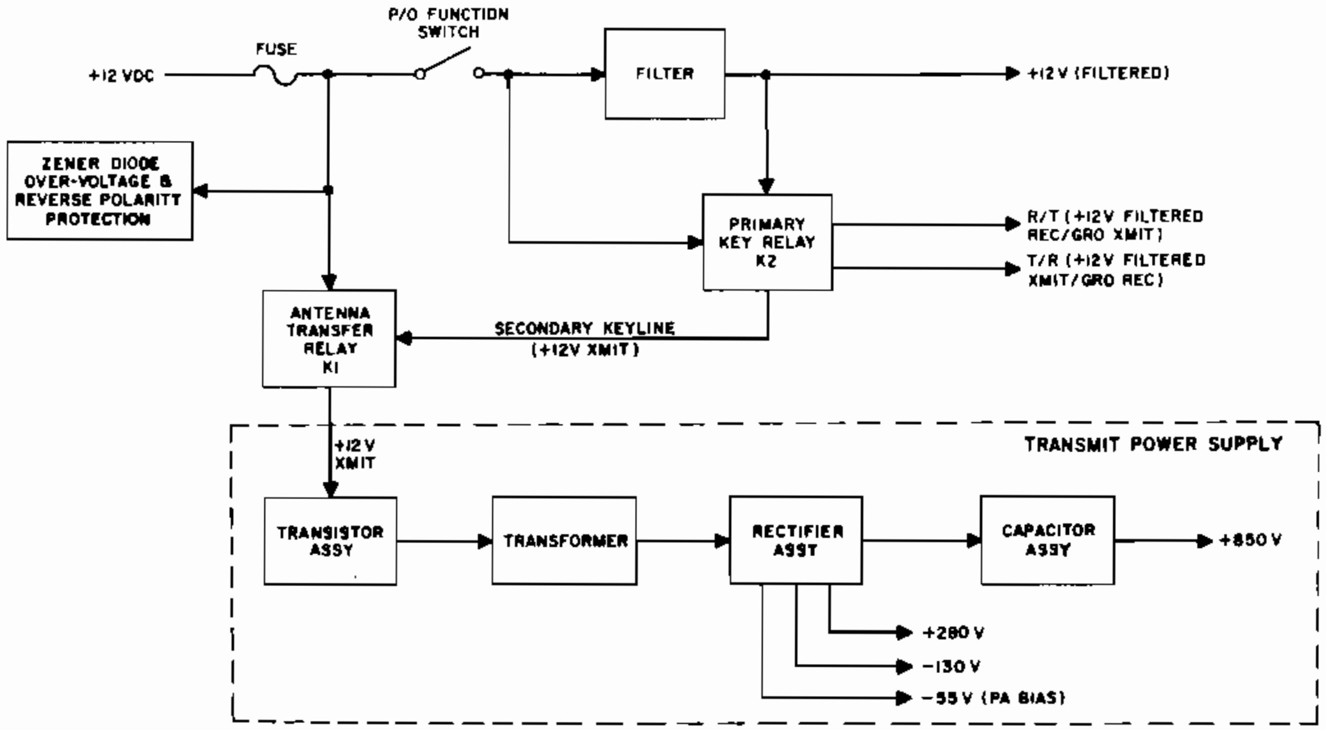


FIGURE 4.4 - POWER SUPPLY, BLOCK DIAGRAM

the antenna line when keyed, the relay also turns on the unfiltered 12 volts to the transmit power supply.

The transistor stages in the transceiver operate from filtered +12 volts dc which is taken from the FUNCTION switch and applied to the circuits through a capacitive and inductive pi section filter. The transistor circuits which must operate on both transmit and receive are fed directly for the filter. The other circuits are fed through the primary key relay, which applies +12 volts dc to either of two lines alternately: a T/R line, which has +12 volts applied on transmit and is grounded on receive, and an R/T line, which has +12 volts applied on receive and is grounded on transmit. In addition to turning circuits on and off at appropriate times, these two lines also control diode gates in the transceiver to perform transmit/receive signal path switching when changing from transmit to receive.

The tube stages are powered from the transmit power supply. The transmit power supply has power applied from the antenna transfer relay only during transmit. Two chopper transistors are used to switch 12 volts to the power transformer alternately on and off in a push-pull manner to provide high voltages. The outputs of the power transformer are rectified and filtered and applied to the tube stages in four levels: +850 volts for the power amplifier plate circuit, +280 volts for the power amplifier screen grid circuit and the driver tube plate and screen, -130 volts for driver tube bias, and adjustable power amplifier bias of about -55 volts.

4.5 TRANSMIT/RECEIVE SIGNAL ASSEMBLY DESCRIPTIONS.

Refer to figure 4.5 during the following discussions.

4.5.1 POWER AMPLIFIER ASSEMBLY.

The Power Amplifier Assembly consists of a class AB_1 linear power amplifier stage, V1. Tube V1 is an instant heat type with heater and B+ voltage applied only during transmit. RF drive for the power amplifier stage is provided from the RF Amplifier Assembly. The output of the power amplifier stage is nominally 50 watts p.e.p on voice. During cw operation the screen voltage is lowered so that the output power is reduced to 20 watts. The output is developed in the pi-network which uses fixed inductance, selected in steps by the left hand (1000 kc/s) FREQUENCY KILOCYCLES switch, and variable capacitance adjusted by the front panel TUNE and LOAD controls. The output network matches loads with impedances of 35 to 150 ohms.

4.5.2 ANTENNA CURRENT MONITOR ASSEMBLY.

The antenna Current Monitor Assembly is used to provide a dc signal for the front panel meter to indicate relative rf output current from the power amplifier stage. Proper tuning of the antenna and the power amplifier stage is indicated by maximum antenna current. A toroidal rf step-up transformer is used to provide an rf output voltage proportional to the antenna current. The primary of the transformer is in series with the output of the power amplifier stage. Diode CR1 and associated circuitry form a detector circuit. Diode CR2 is connected across the output of the detector circuit to limit the peak output voltage of the assembly to a level which will not damage the meter.

4.5.3 TRANSMIT TUNING LOAD ASSEMBLY.

The Transmit Tuning Load Assembly contains a relay operated by the FUNCTION switch and a dummy load consisting of two resistors. When the FUNCTION switch is in any position other than TUNE TX, the relay connects the output of the Antenna Current Monitor Assembly to the antenna through an antenna transfer relay. When the FUNCTION switch in the TUNE TX position, the relay in the Transmit Tuning Load Assembly connects the output of the transmitter into the dummy load resistors so that the power amplifier stage can be tuned with a predetermined load impedance.

4.5.4 RF AMPLIFIER ASSEMBLY.

The RF Amplifier Assembly consists of four rf amplifier stages and an agc amplifier stage. It uses a tracked, permeability tuned coil arrangement which is adjusted by the front panel PRESELECTOR control.

During receive, the rf signal enters the assembly from the antenna transfer relay and is routed to the first rf amplifier stage through t/r relay K1 on the assembly. The first rf amplifier stage, Q1, utilizes a field-effect transistor that provides a low noise figure with good cross modulation characteristics. At the input of the first amplifier stage, diodes CR2 and CR3 are connected back-to-back across the primary winding of the input tuned circuit. The diodes limit the received rf voltage for protection of the field-effect transistor and are connected only in receive. The output of Q1 is further amplified by the second and third rf amplifier stages, Q1 and Q2 on assembly 591-2340. These amplifiers also use field-effect transistors. Agc voltage is applied to the second rf amplifier on receive as a gate bias through agc amplifier stage Q2 on assembly 591-2320. The receive output from the third amplifier stage, which acts as a buffer, is connected through t/r relay K1 to Translator Assembly.

During transmit, the signal path is very similar to the receive path described above.

The first two rf amplifier stages are re-used for transmit, but driver stage V1 is used in place of the receive buffer amplifier stage. The input from the Translator Assembly is connected into the amplifier chain by the input t/r relay and the output of the second amplifier stage is connected to the driver stage by a second t/r relay. Driver tube V1, an instant heat type tube, operates as a class A amplifier.

4.5.5 TRANSLATOR ASSEMBLY.

The Translator consists of three transistor mixer stages: Q1, Q2, and Q3. A crystal filter is used between each stage to select the desired mixer product.

During receive, the received rf signal frequency is added to the MC Oscillator frequency by mixer Q1 and converted to a new i-f frequency of approximatley 17.748 Mc/s. The output of Q1 is coupled by FL1 to the second mixer stage, Q2. In mixer Q2 the 100 KC Oscillator injection frequency is subtracted from the 17.748 Mc/s i-f signal frequency to down-convert the signal to approximately 11.1515 Mc/s. The desired output from Q2 is selected by FL2 and connected to the third mixer stage, Q3. In mixer Q3, the 11.1515 Mc/s i-f frequency signal is subtracted for 11.6 MC Error Mixer frequency and down-converted to 455 kc/s. The output, 455 kc/s, is connected through the SSB Filter Assembly to the I-f Amplifier Assembly.

During transmit, the signal processing is reversed. The 455 kc/s i-f transmit signal is applied to mixer Q3 from the SSB Filter Assembly. In mixer Q3 the signal is subtracted from the 11.6 MC Error Mixer injection frequency to produce a new i-f signal frequency of approximately 11.1515 Mc/s. In mixer Q2, this signal, 11.1515 Mc/s, is added to the 100 KC Oscillator frequency to up-convert to approximately 17.748 Mc/s. In mixer Q3, this signal is down-converted to the channel frequency in the 2-15 Mc/s range by subtraction of the MC Oscillator frequency from the input signal. The resultant channel frequency signal is then applied to the RF Amplifier Assembly.

4.5.6 SSB FILTER ASSEMBLY.

The SSB Filter Assembly consists of an upper-sideband 455 kc/s filter and a lower-sideband 455 kc/s filter. Diode gates select the proper filter for the mode selected by the FUNCTION switch.

During receive, the filter selected passes only signals in the required passband for single sideband reception. During transmit, the filter passes the desired sideband from the Audio/Modulator Assembly and rejects the unwanted sideband.

4.5.7 I-F AMPLIFIER ASSEMBLY.

The I-F Amplifier Assembly consists of eight transformer coupled i-f amplifier stages, a noise limiter, an agc detector, and two agc amplifier stages. Five i-f amplifier stages are in the receive signal path, and one i-f amplifier stage is used for transmit.

During receive, the Translator output is coupled to the first i-f amplifier stage through the SSB Filter Assembly. Five successive i-f amplifier stages are used, three of which are controlled by agc. The output is connected to the Audio/Modulator Assembly, where the audio signal is detected. A portion of the received i-f signal is connected to agc amplifier Q7. This signal is further amplified by Q7 and Q8, and detected by diode CR7 and, converted to a fast-attack, slow-release dc signal at driver Q9. The dc agc signal is then applied to the RF Amplifier Assembly and to the front panel meter through output amplifier Q10. The agc signal is also applied to the first three receive i-f amplifier stages.

During transmit, the 455 kc/s i-f transmit signal from the Audio/Modulator Assembly is amplified by Q6 and applied to the Translator Assembly by the SSB Filter Assembly. An alc voltage from the ALC Assembly is also applied to Q6 to control the gain of the stage. The control is exerted on the stage only when the power amplifier is being overdriven. The effect of alc is to limit the amount of drive which can be applied to the power amplifier.

4.5.8 AUDIO / MODULATOR ASSEMBLY.

The Audio/Modulator Assembly consists of an ssb modulator/detector, an am. detector, a transmit audio amplifier, a cw oscillator, a cw keyline hold circuit, two receive audio amplifiers, and two modulator/detector driver stages. The am. detector is not used in the RF-301P SSB Transceiver.

The ssb modulator/detector consists of a diode ring which performs the functions of a balanced modulator in transmit and a product detector in receive. In receive, the incoming signal is applied through driver stage Q10 to the diode ring. Transistor Q10 matches the high output impedance of the I-f Amplifier Assembly to the low input impedance of the diode ring. The i-f signal is mixed with the 455 kc/s injection from injection amplifier Q9 to detect the received audio signal. In transmit, audio from transmit audio amplifier Q4 is applied to the diode ring with a 455 kc/s injection signal. The two signals produce a double sideband, suppressed carrier signal, the carrier is balanced by the diode ring. Transistor Q9 is the 455 kc/s injection amplifier, and operates as an emitter follower to drive the diode ring. The 455 kc/s injection signal applied to the injection amplifier is provided by the 455 KC Error Mixer Assembly.

Transistor Q3 and diode CR4 form an am. detector. Because the am. mode is not used in the packet transceiver, the stage is turned off all of the time.

Transistors Q7 and Q8 are the receive audio amplifier stages. The audio output signal from Q8 is applied to the Audio Amplifier Assembly for further amplification. Transistor Q4 is the transmit audio amplifier. The input to the transmit audio amplifier is provided by either a microphone or by the tune oscillator stage. The input level to Q4 is set by the transmit audio gain control, R6, on the Frequency Standard/Tuning Oscillator Assembly. The output of Q4 is used to drive the diode ring modulator.

Transistor Q5 is the cw sidetone oscillator, and generates a single audio tone when keyed. Transistor Q6, the cw hold circuit, keys the transmitter when the cw key is depressed and keeps the transmitter keyed after the key is released for a half second.

4.5.9 AUDIO AMPLIFIER ASSEMBLY.

The Audio Amplifier Assembly consists of two audio amplifier stages, Q1, and Q2. The output of the Audio/Modulator Assembly is applied to Q1, amplified and applied to Q2. The output of Q2 is used to drive the handset or headset earphone or an external speaker amplifier.

4.5.10 FREQUENCY STANDARD/TUNE OSCILLATOR ASSEMBLY.

In addition to containing a temperature compensated crystal oscillator assembly, the Frequency Standard/Tune Oscillator Assembly contains the tune oscillator Q1 and transmit audio gain control R6. Transistor Q1, a unijunction transistor, generates several audio frequency tones at once so that the average power of the power amplifier stage will be low during tuning. The oscillator is energized only with FUNCTION switch set at TUNE TX or TUNE ANT. Transmit audio gain control R6 sets the tune oscillator output signal level during tune and the external microphone audio input signal level during normal voice operation.

4.5.11 ALC ASSEMBLY.

Rectification of positive pulses of heavily modulated rf drive signals applied to the power amplifier stage grid develops negative voltage pulses at the base of alc amplifier stage Q1. This occurs only when the power amplifier stage is driven beyond the threshold of grid current. These pulses are amplified sufficiently in Q1 to trigger amplifier stage Q2 into conduction. The dc signal at the output of Q2 has a fast-attack, slow-release characteristic due to time constants of the output circuit. The alc voltage thus developed is applied to the transmit i-f amplifier stage in the I-f Amplifier Assembly to reduce the gain of the stage. When an initial surge of overdrive occurs at the power amplifier stage, the alc signal is developed, and because of the fast-attack slow-release characteristics, the alc signal is applied to the i-f amplifier stage in proportion to the magnitude of the initial overdrive and maintains lower gain in the i-f amplifier stage until the drive peaks are subsequently reduced. If, following this action. the audio level applied to the modulator is reduced below the point at which pa tube grid current is drawn, the alc signal will decay to the point at which it has no effect. If, however, the audio level is not reduced, alc will continue to be applied to the i-f amplifier. If the audio level is increased further, a higher alc voltage will be applied to the i-f stage.

4.5.12 METERING CIRCUITS.

The front panel meter is connected to four circuits at various times through primary key relay K2, pa idle current test switch S7, and FUNCTION switch S5. When spring return pa idle current test switch S7 (inside chassis) is in its normal position, the meter is fed through the FUNCTION switch. When the FUNCTION switch is in the CW position, the meter will indicate battery voltage through the +12V power supply circuits. With the FUNCTION switch in any other position, the meter is fed through the primary key relay. In receive, the agc voltage is applied to the meter for signal strenght indication; and in transmit, the meter operates from the Antenna Current Monitor Assembly for rf output current indication. When S7 is depressed the meter is connected to the plate supply for the power amplifier stage, so that relative plate current can be monitored for checking the pa tube idle current and for setting the pa tube bias.

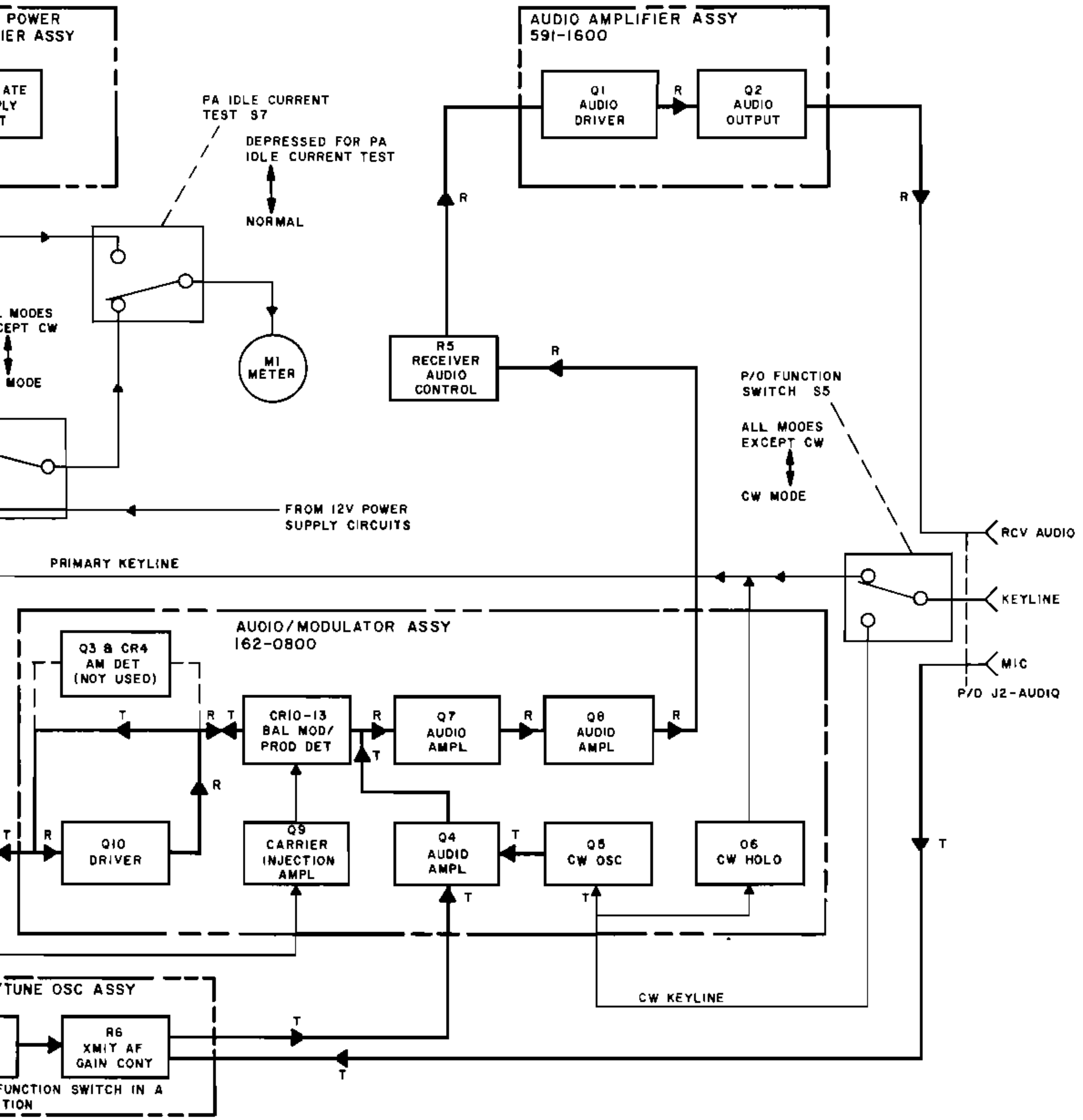
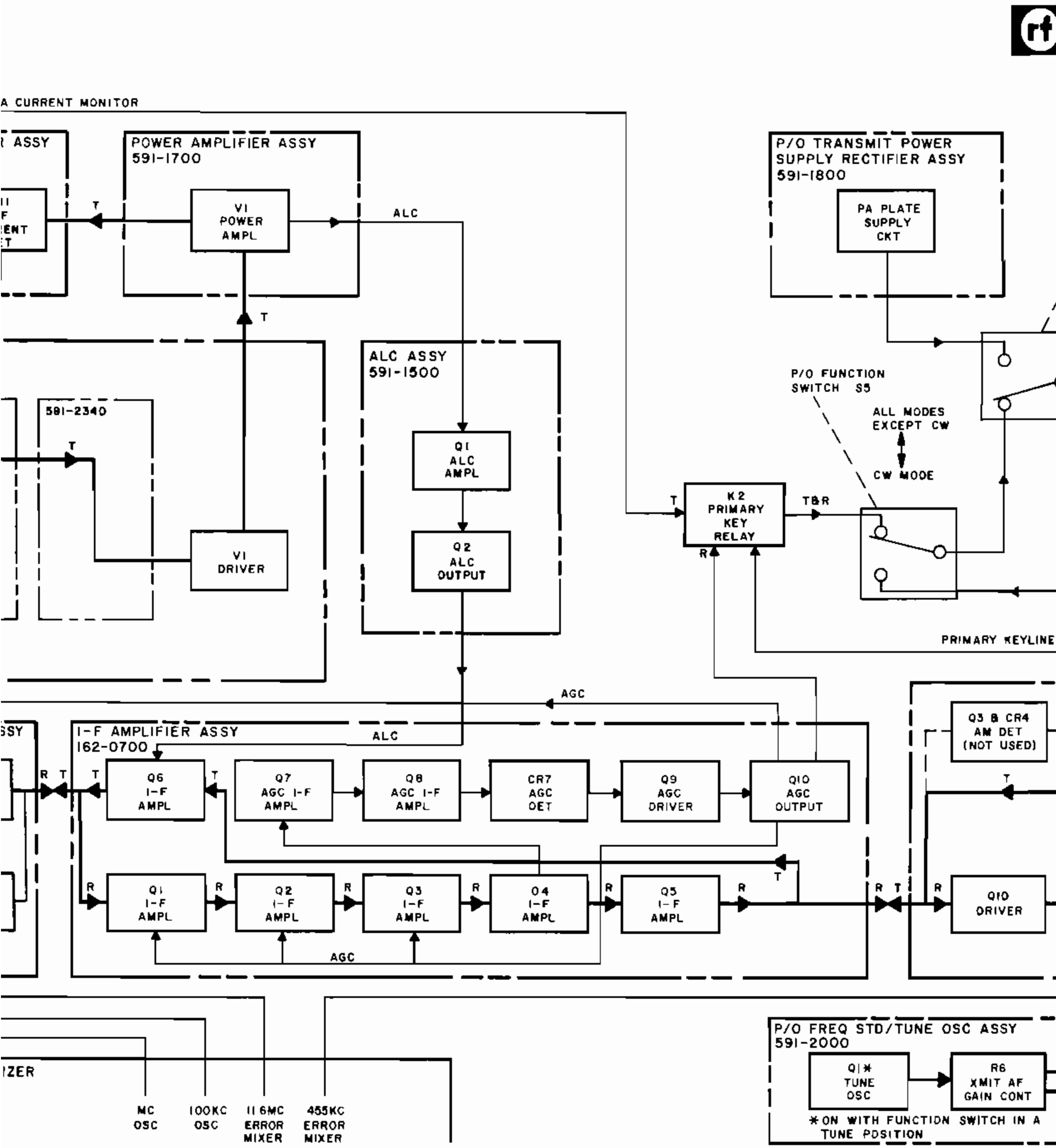
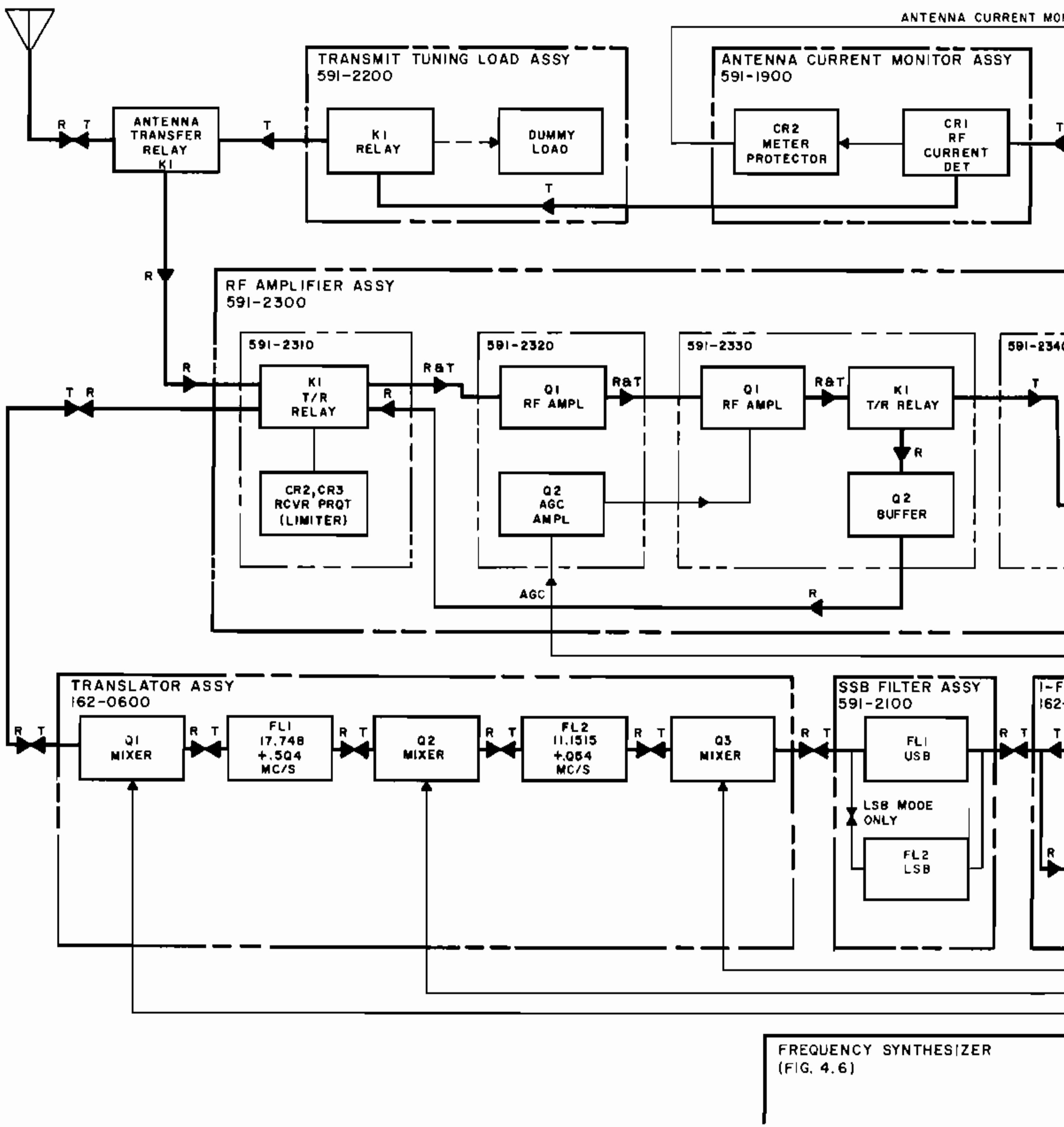


FIGURE 4.5 – BLOCK DIAGRAM, TRANSMIT/RECEIVE SIGNAL FLOW



A CURRENT MONITOR
POWER AMPLIFIER ASSY 591-1700
V1 POWER AMPL
V1 DRIVER
591-2340
ALC
ALC ASSY 591-1500
Q1 ALC AMPL
Q2 ALC OUTPUT
P/O TRANSMIT POWER SUPPLY RECTIFIER ASSY 591-1800
PA PLATE SUPPLY CKT
P/O FUNCTION SWITCH S5
ALL MODES EXCEPT CW
CW MODE
K2 PRIMARY KEY RELAY
T&R
PRIMARY KEYLINE
AGC
I-F AMPLIFIER ASSY 162-0700
Q6 I-F AMPL
Q7 AGC I-F AMPL
Q8 AGC I-F AMPL
CR7 AGC DET
Q9 AGC DRIVER
Q10 AGC OUTPUT
Q1 I-F AMPL
Q2 I-F AMPL
Q3 I-F AMPL
Q4 I-F AMPL
Q5 I-F AMPL
Q3 & CR4 AM DET (NOT USED)
Q10 DRIVER
IZER
MC OSC
100KC OSC
11.6MC ERROR MIXER
455KC ERROR MIXER
P/O FREQ STD/TUNE OSC ASSY 591-2000
Q1* TUNE OSC
R6 XMIT AF GAIN CONT
*ON WITH FUNCTION SWITCH IN A TUNE POSITION



ANTENNA CURRENT MO
TRANSMIT TUNING LOAD ASSY
591-2200
ANTENNA CURRENT MONITOR ASSY
591-1900
ANTENNA TRANSFER RELAY K1
K1 RELAY
DUMMY LOAD
CR2 METER PROTECTOR
CR1 RF CURRENT DET
RF AMPLIFIER ASSY
591-2300
591-2310
591-2320
591-2330
591-234
K1 T/R RELAY
CR2,CR3 RCVR PRQT (LIMITER)
Q1 RF AMPL
Q2 AGC AMPL
Q1 RF AMPL
K1 T/R RELAY
Q2 BUFFER
AGC
R&T
TRANSLATOR ASSY
162-0600
Q1 MIXER
FL1 17.748 +.504 MC/S
Q2 MIXER
FL2 11.1515 +.064 MC/S
Q3 MIXER
SSB FILTER ASSY
591-2100
FL1 USB
LSB MODE ONLY
FL2 LSB
I-F
162-
FREQUENCY SYNTHESIZER
(FIG. 4.6)

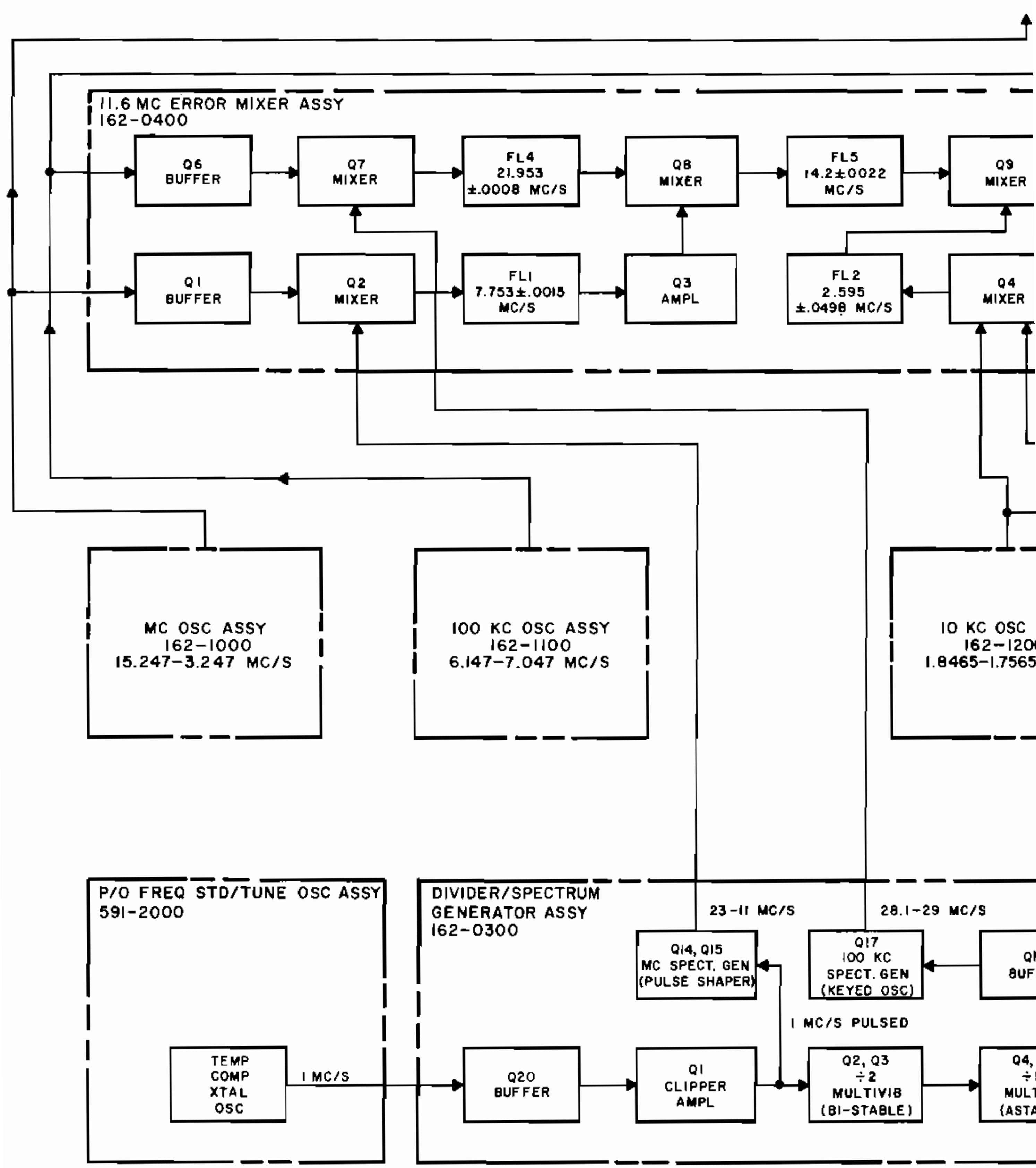
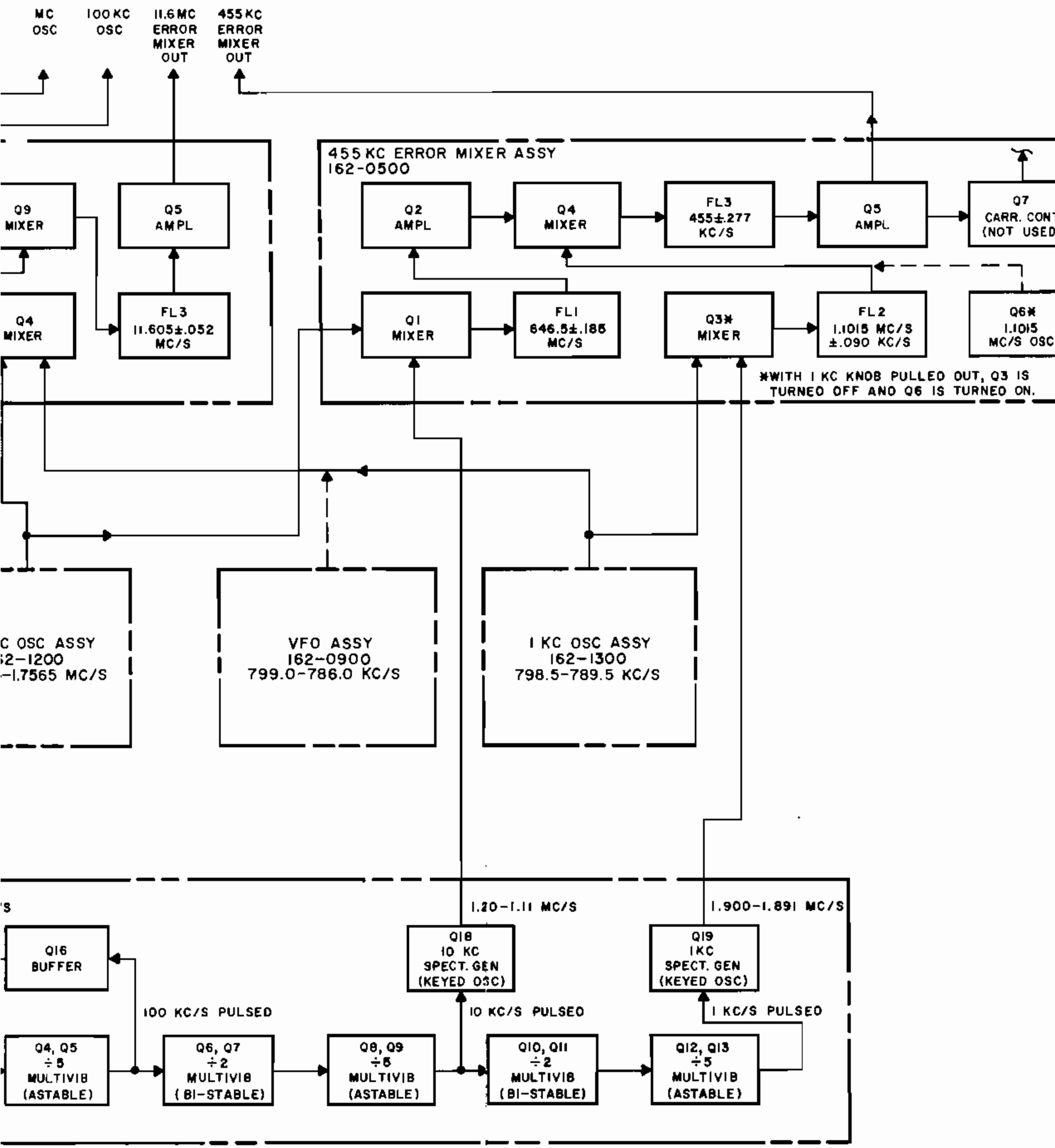
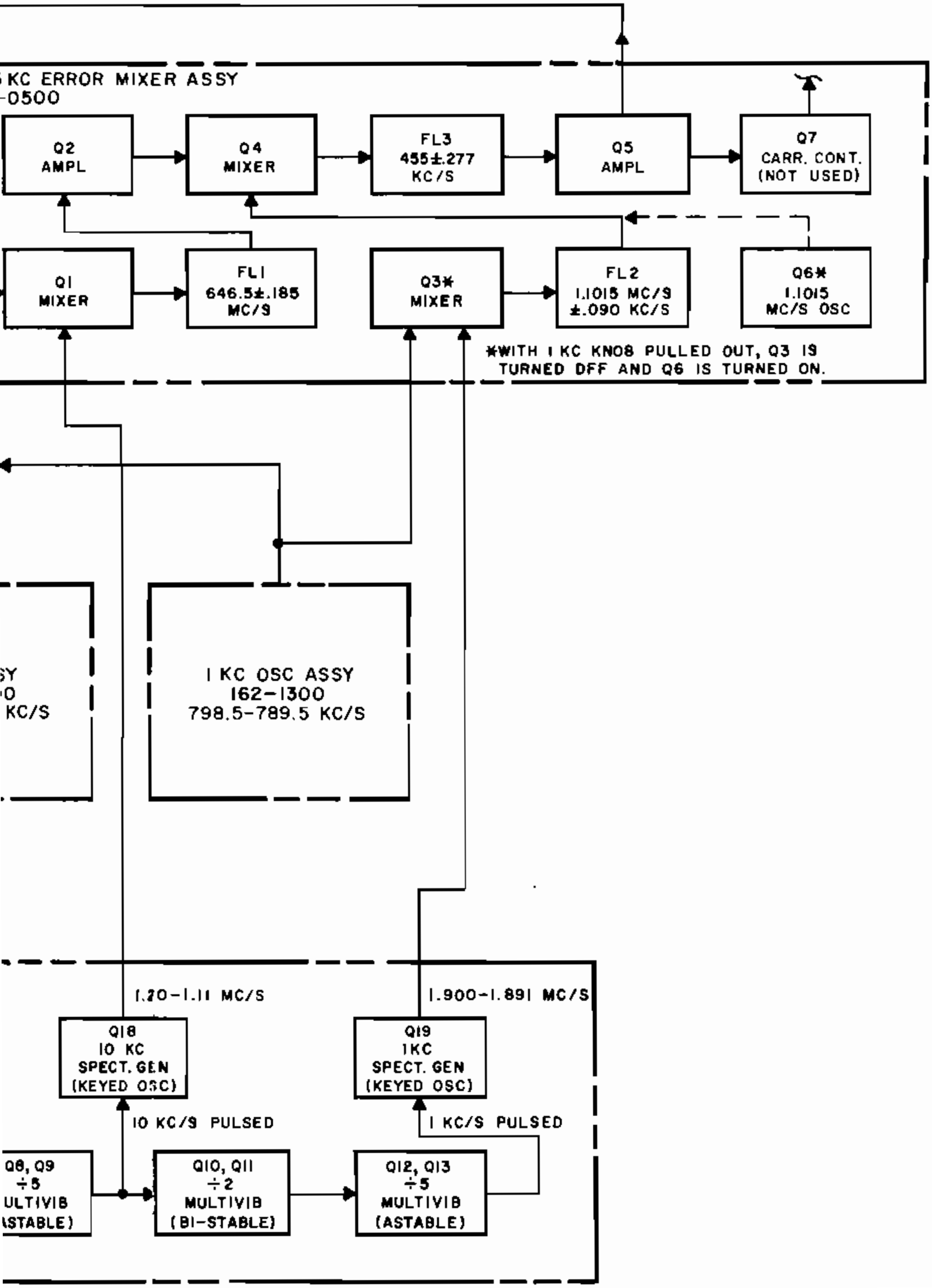


FIGURE 4.6 – BLOCK DIAGRAM, FREQUENCY SYNTHESIZER SIGNAL FLOW



MC OSC
100 KC OSC
11.6 MC ERROR MIXER OUT
455 KC ERROR MIXER OUT
455 KC ERROR MIXER ASSY
162-0500
Q9 MIXER
Q5 AMPL
Q4 MIXER
FL3 11.605±.052 MC/S
Q2 AMPL
Q4 MIXER
FL3 455±.277 KC/S
Q5 AMPL
Q7 CARR. CONT (NOT USED
Q1 MIXER
FL1 646.5±.185 MC/S
Q3* MIXER
FL2 1.1015 MC/S ±.090 KC/S
Q6* 1.1015 MC/S OSC
*WITH 1 KC KNOB PULLED OUT, Q3 IS TURNED OFF AND Q6 IS TURNED ON.
C OSC ASSY
62-1200
-1.7565 MC/S
VFO ASSY
162-0900
799.0-786.0 KC/S
1 KC OSC ASSY
162-1300
798.5-789.5 KC/S
1.20-1.11 MC/S
1.900-1.891 MC/S
Q16 BUFFER
Q18 10 KC SPECT. GEN (KEYED OSC)
Q19 1KC SPECT. GEN (KEYED OSC)
100 KC/S PULSED
10 KC/S PULSED
1 KC/S PULSED
Q4, Q5 ÷5 MULTIVIB (ASTABLE)
Q6, Q7 ÷2 MULTIVIB (BI-STABLE)
Q8, Q9 ÷5 MULTIVIB (ASTABLE)
Q10, Q11 ÷2 MULTIVIB (BI-STABLE)
Q12, Q13 ÷5 MULTIVIB (ASTABLE)



KC ERROR MIXER ASSY
-0500
Q2 AMPL
Q4 MIXER
FL3 455±.277 KC/S
Q5 AMPL
Q7 CARR. CONT. (NOT USED)
QI MIXER
FLI 646.5±.185 MC/S
Q3* MIXER
FL2 1.1015 MC/S ±.090 KC/S
Q6* 1.1015 MC/S OSC
*WITH I KC KNOB PULLED OUT, Q3 IS TURNED OFF AND Q6 IS TURNED ON.
SY
O
KC/S
I KC OSC ASSY
162-1300
798.5-789.5 KC/S
1.20-1.11 MC/S
1.900-1.891 MC/S
Q18 10 KC SPECT. GEN (KEYED OSC)
Q19 1KC SPECT. GEN (KEYED OSC)
10 KC/S PULSED
I KC/S PULSED
Q8, Q9 ÷5 ULTIVIB ASTABLE)
Q10, Q11 ÷2 MULTIVIB (BI-STABLE)
Q12, Q13 ÷5 MULTIVIB (ASTABLE)

4.6 FREQUENCY SYNTHESIZER ASSEMBLY DESCRIPTION.

Refer to the frequency synthesizer block diagram in figure 4.6 during the following discussions.

4.6.1 CRYSTAL OSCILLATOR ASSEMBLIES.

The MC, 100 KC, 10 KC, and 1 KC Oscillator Assemblies each consist of oscillator and buffer stages and a bank of crystals switched into the circuit by the respective FREQUENCY KILOCYCLES switch. In the MC and 100 KC Oscillator Assemblies, Q1 operates as an oscillator, and the crystals oscillate in the parallel mode. Transistor Q2 in these assemblies is used as a buffer amplifier. In the 10 KC and 1 KC Oscillator Assemblies, both Q1 and Q2 are used to form the oscillator circuit. The crystals in these two assemblies oscillate in the series mode.

4.6.2 VFO ASSEMBLY.

The VFO Assembly consists of a three transistor variable frequency oscillator (vfo) circuit and a one stage amplifier. The vfo is tuned by a variable capacitor, and a preset coil and padder capacitor. The tuning capacitor is mechanically coupled to the 1 kc/s FREQUENCY KILOCYCLES control. When the 1 kc/s FREQUENCY KILOCYCLES control knob is pulled out, the VFO Assembly is activated and the 1 KC Oscillator Assembly is disabled.

4.6.3 DIVIDER/SPECTRUM GENERATOR ASSEMBLY.

The Divider/Spectrum Generator Assembly consists of twenty transistors used as amplifiers, multivibrators, pulse shapers, and keyed oscillators.

Transistor Q20 acts as a buffer for the 1 Mc/s frequency standard input signal. The output of Q20 is applied to Q1, which amplifies and clips the 1 Mc/s signal to provide a pulse output. Transistors Q14 and Q15 are pulse shapers. Harmonics are generated; and with the filtering in the output, desired harmonics are produced at 1 Mc/s intervals in the 11 to 23 Mc/s range for use in the 11.6 MC Error Mixer Assembly.

The frequency dividers consist of multivibrators Q2 through Q13. They consecutively divide the frequency by 2 and 5 thereby providing output frequencies of 100 kc/s, 10 kc/s, and 1 kc/s. Transistor Q16 is the buffer for the 100 kc/s output from Q5.

The 100, 10, and 1 kc/s spectrum generators are keyed oscillators which produce frequencies at intervals of 100, 10, and 1 kc/s, respectively. They function as oscillators at their natural frequencies of resonance, but since they are keyed by the frequency divider outputs, they produce a spectrum of frequencies centered about the oscillator frequency of resonance rather than just a single frequency. For example, Q17 would normally oscillate near 28.6 Mc/s; but, since it is keyed by the 100 kc/s output pulses from Q16, it produces at least the 10 desired frequencies at 100 kc/s intervals between 28.1 and 29.0 Mc/s. Other undesired frequencies near the desired ones, are produced, but their amplitudes are considerably lower and they will not result in products which would pass through filters in the Error Mixer Assemblies.

4.6.4 11.6 MC ERROR MIXER ASSEMBLY.

The 11.6 MC Error Mixer Assembly consists of buffers, mixers, amplifiers, and filters. The MC Oscillator frequency is applied to mixer Q2 through buffer Q1. Transistor Q2 subtracts the MC Oscillator frequency, with error from the appropriate MC spectrum frequency, resulting in a product of approximately 7.753 Mc/s with reversed error.

(Refer to paragraphs 4.3.2 and 4.3.3 for a discussion of error cancelling. Refer to table 4.1 for particular oscillator and spectrum frequencies.) The product from mixer Q2 is passed through FL1 and amplified by Q3. All other frequencies generated are attenuated to a negligible level.

The 100 KC Oscillator frequency is applied to mixer Q7 through buffer Q6. In Q7, the 100 KC Oscillator frequency with error is subtracted from the appropriate 100 kc/s spectrum frequency to produce a frequency of approximately 21.953 Mc/s with a reversed error. This product is passed through FL4 to mixer Q8. In Q8, the 7.753 Mc/s frequency and reversed MC Oscillator error from Q3 is subtracted from the 21.953 Mc/s frequency and reversed error to produce a new frequency of approximately 14.2 Mc/s with the reversed 100 KC Oscillator error and the twice reversed (normal) MC Oscillator error.

Transistor Q4 adds the 10 KC and 1 KC Oscillator frequencies and their errors to produce a new frequency of approximatley 2.595 Mc/s containing the two errors. Filter FL2 passes this product to Q9. In Q9, the 2.595 Mc/s (plus error) frequency is subtracted from the 14.2 Mc/s frequency with the error of the MC Oscillator and the reversed error of the 100 KC Oscillator to produce a new frequency of approximately 11.6 Mc/s with the error of the MC Oscillator and the reversed errors of the 100, 10, and 1 KC Oscillators. Filter FL3 passes this product to Q5, which amplifies it and applies it to the Translator Assembly.

In order to simplify the mixing and error reversal process, consider it algebraically. Let the appropriate MC, 100 KC, 10 KC, and 1 KC Oscillator frequencies be represented by F_4, F_3, F_2, and F_1, respectively. Let the MC, 100 KC, 10 KC, and 1 KC Oscillator frequency errors be represented by E_4, E_3, E_2, and E_1, respectively. Let the 1 Mc/s, 100 kc/s, 10 kc/s, and 1 kc/s interval spectrum frequencies be represented by S_4, S_3, S_2, and S_1, respectively.

The product of Q2 will then be $S_4-F_4-E_4$. The product of Q7 will be $S_3-F_3-E_3$. Subtracting $S_4-F_4-E_4$ from $S_3-F_3-E_3$ in Q8, we get $S_3-S_4-F_3+F_4-E_3+E_4$ as the product. Note that the error represented by E_4 has been reversed twice by double subtraction.

The product of Q4 will be $F_2+E_2+F_1+E_1$. Subtracting this product from $S_3-S_4-F_3+F_4-E_3+E_4$ in Q9, we arrive at a final mixer product of $S_3-S_4-F_3+F_4-E_3+E_4-F_2-E_2-F_1-E_1$.

Referring to table 4.1, substituting the corresponding frequencies listed for S (spectrum) and F (oscillator), the resultant frequency will be approximatley 11.6 Mc/s $+E_4-E_3-E_2-E_1$. The resulting errors cancel in the Translator Assembly and in the balanced modulator/product detector stage in the Audio/Modulator Assembly.

4.6.5 455 KC ERROR MIXER ASSEMBLY.

The 455 KC Error Mixer Assembly consists of mixers, amplifier, filters, and an oscillator. In Q1, the appropriate 10 kc/s interval spectrum frequency is subtracted from the 10 KC Oscillator frequency to produce a new frequency of approximately 646.5 kc/s, containing the 10 KC Oscillator error. This product is passed through FL1 and is amplified by Q2.

TABLE 4.1 – CRYSTAL OSCILLATOR AND SPECTRUM FREQUENCIES

CRYSTAL OSCILLATOR FREQUENCIES (Mc/s)				
DIGIT	MC OSC	100 KC OSC	10 KC OSC	1 KC OSC
0	-	6.147	1.8465	0.7985
1	-	6.247	1.8365	0.7975
2	15.247	6.347	1.8265	0.7965
3	14.247	6.447	1.8165	0.7955
4	13.247	6.547	1.8065	0.7945
5	12.247	6.647	1.7965	0.7935
6	11.247	6.747	1.7865	0.7925
7	10.247	6.847	1.7765	0.7915
8	9.247	6.947	1.7665	0.7905
9	8.247	7.047	1.7565	0.7895
10	7.247	-	-	-
11	6.247	-	-	-
12	5.247	-	-	-
13	4.247	-	-	-
14	3.247	-	-	-

SPECTRUM FREQUENCIES (Mc/s)				
CORRESPONDS TO DIGIT	MC SPECT	100 KC SPECT	10 KC SPECT	1 KC SPECT
0	-	28.1	1.20	1.900
1	-	28.2	1.19	1.899
2	23.0	28.3	1.18	1.898
3	22.0	28.4	1.17	1.897
4	21.0	28.5	1.16	1.896
5	20.0	28.6	1.15	1.895
6	19.0	28.7	1.14	1.894
7	18.0	28.8	1.13	1.893
8	17.0	28.9	1.12	1.892
9	16.0	29.0	1.11	1.891
10	15.0	-	-	-
11	14.0	-	-	-
12	13.0	-	-	-
13	12.0	-	-	-
14	11.0	-	-	-

In Q3, the 1 KC Oscillator frequency and error is subtracted from the appropriate 1 kc/s interval spectrum frequency to produce an output frequency of approximately 1101.5 kc/s containing the reversed error from the 1 KC Oscillator.

Transistor Q4 subtracts the 646.5 kc/s frequency and the 10 KC Oscillator error from the 1101.5 kc/s frequency and the reversed 1 KC Oscillator error, resulting in a new frequency of approximately 455 kc/s containing the reversed errors of the 10 KC and 1 KC Oscillators. The output is amplified by Q5 and applied to the balanced modulator/product detector in the Audio/Modulator Assembly.

When the VFO is used, it is no longer possible to derive the 1101.5 kc/s frequency for Q4 from the 1 KC Oscillator and 1 kc/s interval spectrum in Q3. So 1101.5 kc/s oscillator, Q6 is employed to generate this frequency; and mixer Q3 is disabled. To accomplish this change, operating voltage is applied to Q6, and Q3 is biased to cutoff.

Transistor Q7 is a carrier control amplifier, which is not used in the RF-301P Transceiver.

CHAPTER 5
MAINTENANCE

5.1 GENERAL.

This chapter contains procedures for routine maintenance and overall performance tests. The length of intervals between times at which periodic preventive maintenance should be performed depends on the amount of usage and the environmental conditions and is, therefore, left to the discretion of the user. It should be obvious, however, that regular preventive maintenance increases the reliability and service life of the equipment.

It is helpful to record performance measurements and other information discovered during routine maintenance. The notes can be referred to at subsequent maintenance or servicing times.

If malfunctions or degraded performance are evident, and their corrections are not within the scope of this chapter, the problems should be referred to a technician qualified to perform advanced servicing covered in chapter 6.

5.2 TEST EQUIPMENT.

Following is a list of test equipment which should be available for general maintenance purposes. The models listed are recommended; however, equivalent models may be substituted.

a. Tube Tester

b. General Purpose vtvm Hewlett-Packard Model 410B

c. Ac vtvm - Ballantine Model 314A

d. Rf Signal Generator - Hewlett-Packard Model 606A

e. Rf dummy load, 50 ohm, 100 watt

f. General coverage communications receiver or an RF-301 ( ) Series Transceiver

5.3 PREVENTIVE MAINTENANCE.

Normally, the transceiver components do not require any additional lubrication; however, lubrication might be necessary if the factory lubrication is removed for some reason or if a specific problem develops.

Periodically, depending upon usage, the transceiver should be removed from the case and inspected for loose or damaged components. This should be done if the transceiver is physically abused while in service. Tighten any loose components; and if any major damage is noted, refer the problem to a qualified technician. Refer to paragraph 5.5 for chassis removal.

Periodically or when judged necessary, the transceiver should be subjected to the performance tests listed in paragraph 5.6. This should be done especially when the operator notices a degradation in performance, such as reduced receiver sensitivity or transmitter output. If necessary, the tests can be modified for special symptoms or intermittent problems.

Because many of the adjustments in the transceiver require special procedures and equipment, random peaking of adjustments is not recommended. If performance tests reveal a specific problem, it should be given proper attention. Do not try to optimize performance by making random checks or adjustments.

5.4 FUSE REPLACEMENT.

The front panel fuse is the only fuse in the transceiver. Should the set be completely inoperative, it should be checked. To open the fuseholder, first unscrew the metal cap. Then, turn the inside fuseholder knob a quarter turn counterclockwise and remove the fuse. Before replacing the fuse, determine the cause of failure. If there is a probable internal fault in the set, remedial action should be taken before replacing the fuse. Refer to parts list for fuse type and rating.

Note

A zener diode is used in the transceiver to automatically blow the fuse if high line voltage or reversed polarity is applied to the set.

5.5 CHASSIS REMOVAL.

To remove the chassis from the case, set the unit on the bench with the front panel upward. Unscrew and remove the four screws in the corners of the handles. Lift the transceiver chassis up and out of the case. Set the case aside.

To reinstall the chassis in the case, set the case upright on the bench. Make sure that the gasket is installed properly in the U-channel in the panel. The gasket is formed in a "U" shape, and the open part of the "U" should be inside the channel.

Note

When properly sealed, the transceiver is weatherproof. However, a somewhat better seal can be made if a liberal amount of Dow-Corning #111 Silicone Grease is applied to the gasket and U-channel before reinstalling the transceiver chassis. Be careful that dirt does not accumulate on the gasket.

Set the transceiver chassis down in to the case, making sure that the channel is aligned with the edge of the case. Then install and tighten the four screws in the corners of the handles.

5.6 PERFORMANCE TEST.

5.6.1 GENERAL.

To determine the condition of the transceiver, conduct the over-all performance test in the following paragraphs. Comparing information obtained in these procedures with data recorded from previous tests may indicate that a problem exists. These tests will also indicate if the transceiver is in good condition so that it may be put back in service with confidence. Any problems discovered should be repaired or referred to a qualified service technician for repair or adjustment.

5.6.2 RECEIVER SENSITIVITY AND AUTOMATIC GAIN CONTROL.

a. Disconnect the microphone from the AUDIO connector.

b. If available, connect an RF-3005 Two-Way Audio Adapter to AUDIO connector. Connect a headset to the adapter. Connect an ac vtvm to the adapter with the ground lead at pin 4 and the ac probe at pin 3. If the adapter is not available connect a 600 ohm resistor to AUDIO connector across pins 3 and 4. Connect a ac vtvm across the resistor with the ground lead at pin 4, ac probe to pin 3.

c. Connect an rf signal generator to ANT connector.

CAUTION

Be careful not to transmit with the rf signal generator connected.

d. Set the transceiver to receive usb or lsb on any frequency, as described in chapter 3.

e. Adjust the rf signal generator frequency to the operating frequency of the transceiver, set the attenuator on the rf signal generator for 1 uV output.

f. Note the audio voltage on the meter, peak the rf signal generator frequency adjustment for maximum output indication. Record the meter reading.

g. Detune the rf signal generator to another part of the band, and note the vtvm reading. The ratio of the reading recorded for step f to the reading above should be at least 3.2/1 (10 dB).

h. Tune the rf signal generator back to the operating frequency of the transceiver, and set the attenuator for 0.1 volt output. Adjust RECEIVE AUDIO control for maximum ac vtvm reading without noticeable distortion in the headset if connected to the adapter. If the adapter is not being used, disconnect the 600 ohm resistor and ac vtvm and connect a headset or handset. Check for distortion and adjust the RECEIVER AUDIO control if required. After checking reconnect the 600 ohm resistor and ac vtvm as outlined in step a above. Record the ac vtvm reading.

i. Turn the rf signal generator output down to 1 uV. Observe the meter reading. The ratio of the reading taken in step h to the reading above should be less than 7/1 (16 dB).

5.6.3 CHECKING FREQUENCY SWITCHES.

While the transceiver is set to receive, connect an antenna to ANT connector and check each of the FREQUENCY KILOCYCLES switch positions to be sure that some signal or noise is heard on each position. If the receiver output is noticeably reduced with a switch in one position, it may indicate that a crystal is defective or that the associated crystal oscillator is marginal in operation and dropping out of oscillation in the one position.

5.6.4 TRANSMITTER OUTPUT AND MODULATION.

a. Connect a 100 watt, 50 ohm dummy load and a Hewlett-Packard 410B vtvm (ac probe) to ANT connector.

b. Connect the microphone or cw key to AUDIO connector.

c. Set the FUNCTION switch at TUNE ANT.

d. Key the transceiver, and tune for a maximum output indication. The vtvm should indicate approximately 50 $\pm$ 5 volts.

Note

If full output power cannot be obtained, it may be necessary to change the driver or power amplifier tube in the transmitter.

e. Listen to the transmitted voice signal on either usb or lsb using a separate single sideband receiver. Check that the transmitted voice signal is of good quality and without distortion.

5.7 TRANSMIT POWER SUPPLY VOLTAGE MEASUREMENTS.

Table 5.1 lists the approximate dc voltages that can be measured on the Transmit Power Supply Rectifier Assembly. Figure 5.1 shows the location of the test points. Chassis ground is used as a reference and any deviation more than 15% from the expected reading should be investigated. The measurements should be made with a vtvm, transceiver keyed, no modulation and in the usb mode.

TABLE 5.1 - TRANSMITTER POWER SUPPLY VOLTAGE MEASUREMENT

TEST POINT	VTVM SET FOR	EXPECTED READING
A	+1000 V	+850 V
B	+300	+280 V
C	-300	-130 V
D	-100	-50 V

5.8 TUBE REPLACEMENT.

5.8.1 GENERAL.

If full transmit power cannot be obtained, the driver and power amplifier (p.a.) tubes should be tested in a tube tester. If found weak or defective, the tubes should be replaced.

5.8.2 DRIVER TUBE REMOVAL AND REPLACEMENT.

To remove the driver tube (figure 5.1), carefully pull the outer shield off the side of the tube. A small pair of pliers or the hook on the end of an inspection probe should be used to pull on the embossed tab on the outer shield. With the outer shield off, bend the two halves of the inner shield away from the tube, and remove the tube from the socket.

To replace the driver tube, seat it in the socket, fold the inner shield around the tube, and snap the outer shield down over the inner shield.

5.8.3 P. A. TUBE REMOVAL AND REPLACEMENT.

WARNING

High voltage is applied to the plate cap of the p.a. tube when the set is keyed to transmit. Make sure that power is off before handling the tube.

To remove the p.a. tube (figure 5.1), carefully lift off the plate connection from the top of the tube. Remove the two screws and attaching hardware securing the heat sink to the chassis. Remove the heat sink. Then, gently rock the tube out of the socket.

To replace the p.a. tube, seat it in the socket, and reinstall the heat sink and the plate connection. Be careful to orient the plate lead so that it will not short to surrounding objects while in service. Readjust the p.a. bias as described in paragraph 5.9.

5.9 P.A. BIAS ADJUSTMENT.

Whenever the p.a. tube is replaced, the control grid bias should be readjusted for the proper idling plate current. The bias is set with the p.a. bias control on the Power Supply Rectifier Assembly (figure 5.1). Be sure to nse a fully charged battery pack or other source of proper supply voltage for the test.

WARNING

High voltage is applied to the plate cap of the p.a. tube when the set is keyed to transmit. Make sure that power is off before handling the tube.

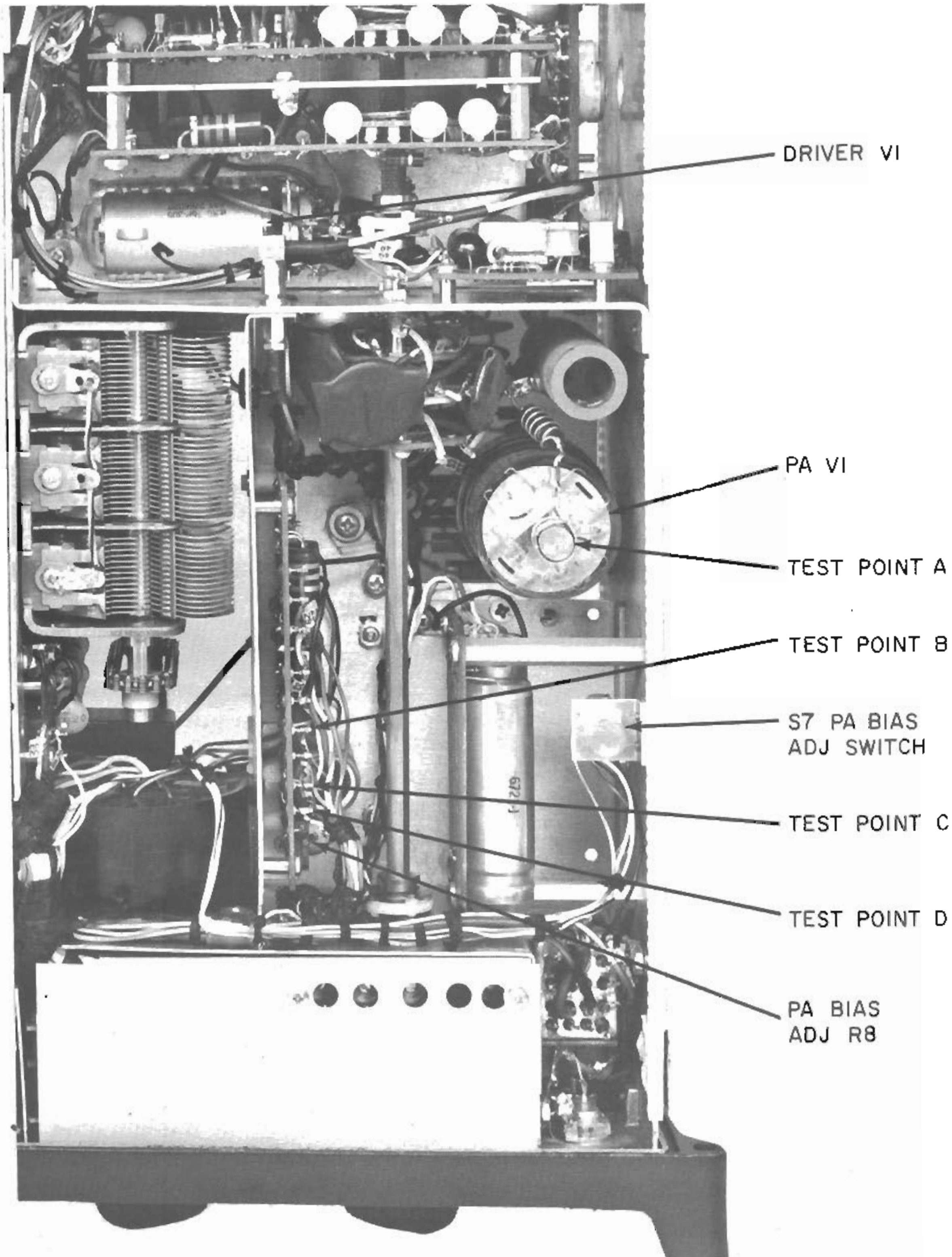


FIGURE 5.1 - DC VOLTAGE TEST POINTS AND PA ADJUSTMENT LOCATION

WARNING

High voltages are present on the power supply assemblies around this control. Since the adjustment must be made while the transceiver is keyed to transmit, keep hands away from any circuitry.

Perform the following steps to set the p.a. bias:

a. Connect a 50 ohm 100 watt rf dummy load to ANT connector.

b. Set FUNCTION switch at usb or lsb.

c. Connect the cw key (preferred) or a microphone to AUDIO connector to key the transmitter.

Note

During the adjustment, there must be no modulation. Therefore, if using a microphone to key the transceiver, make sure that no audio is applied. While the pa idle current test switch is depressed, the meter can be overloaded with modulation.

d. While depressing the push-button pa idle current test switch S7 figure 5-1, key the transceiver, and adjust the p.a. bias control for a front panel meter indication in the middle of the green section.

e. Unkey the transceiver, release the switch, and set FUNCTION switch at OFF.

CHAPTER 6
SERVICING

6.1 GENERAL.

The servicing chapter of this manual is intended for use by persons qualified to perform advanced troubleshooting and repair for this type of equipment. It covers procedures for isolating the trouble to a functional section of the transceiver and locating and correcting faults within the functional section. The functional sections are, for the most part. built in separate assemblies, so that once a particular fault is narrowed down, only one assembly will be involved in the repair. This helps to simplify the troubleshooting procedure.

It is assumed that, prior to servicing the transceiver, the technician has a thorough knowledge of general troubleshooting techniques and the principles of operation for this set as discussed in chapter 4.

Refer to paragraph 5.5 for instructions on removal of the chassis from the case.

6.2 ASSEMBLY IDENTIFICATION.

Figures 6.1 and 6.2 show the location of the assemblies and tubes. These items are referenced by key numbers to table 6.1, which lists all electrical assemblies and tubes.

Each assembly listed in table 6.1 is referenced to the figure number of the illustrations for that assembly in chapter 8. Illustrations in chapter 8 consist of the schematic diagram of the assembly, a composite printed circuit board diagram showing components and printed wiring, and a list of significant dc test voltages.

6.3 TEST EQUIPMENT AND SPECIAL TOOLS.

Following is a list of test equipment and special tools required for servicing the transceiver. Models specified are recommended, however, equivalent models may be substituted.

a. Dc Power Supply, 12 ± 2 volts, 10 amp, regulated.

b. General Purpose Vtvm with Rf Probe — Hewlett-Packard model 410B.

c. Low Level Rf Vtvm – Boonton Electronics model 91CA.

d. Ac Vtvm – Ballantine model 314A.

e. Heterodyne Voltmeter – Bruel and Kjaer model 2005.

f. Rf Signal Generator – Hewlett-Packard model 606A.

g. Electronic Frequency Counter - Hewlett-Packard model 5242L.

h. High Frequency Oscilloscope – Tektronix model 515.

i. Rf Dummy Load – 50 ohms, 100 watts.

j. Alignment Tool – JFD #5284.

k. Alignment Tool – 1/4 to 3/8 inch plastic flat blade type.

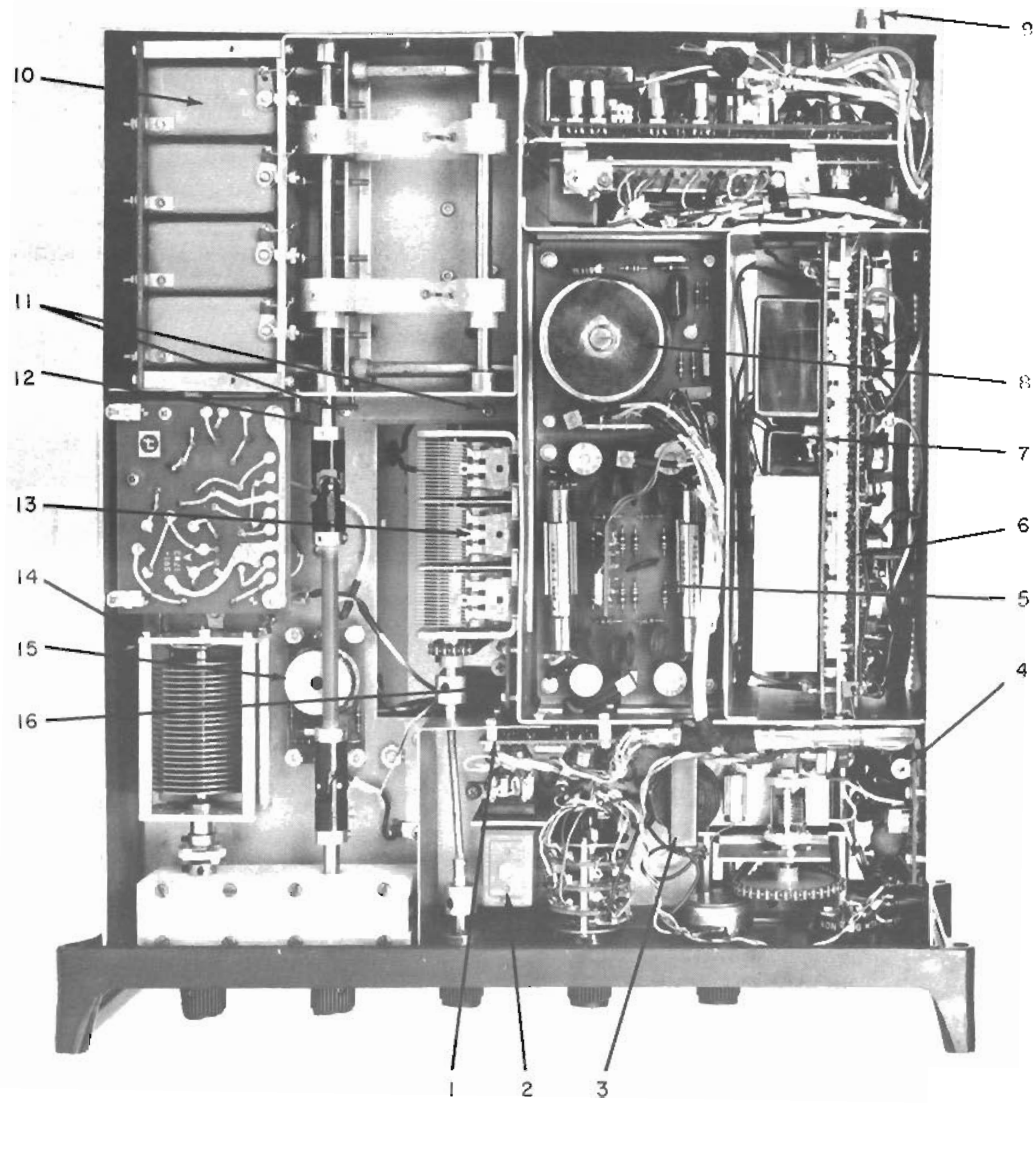


FIGURE 6.1 - ASSEMBLY IDENTIFICATION, TOP OF TRANSCEIVER CHASSIS

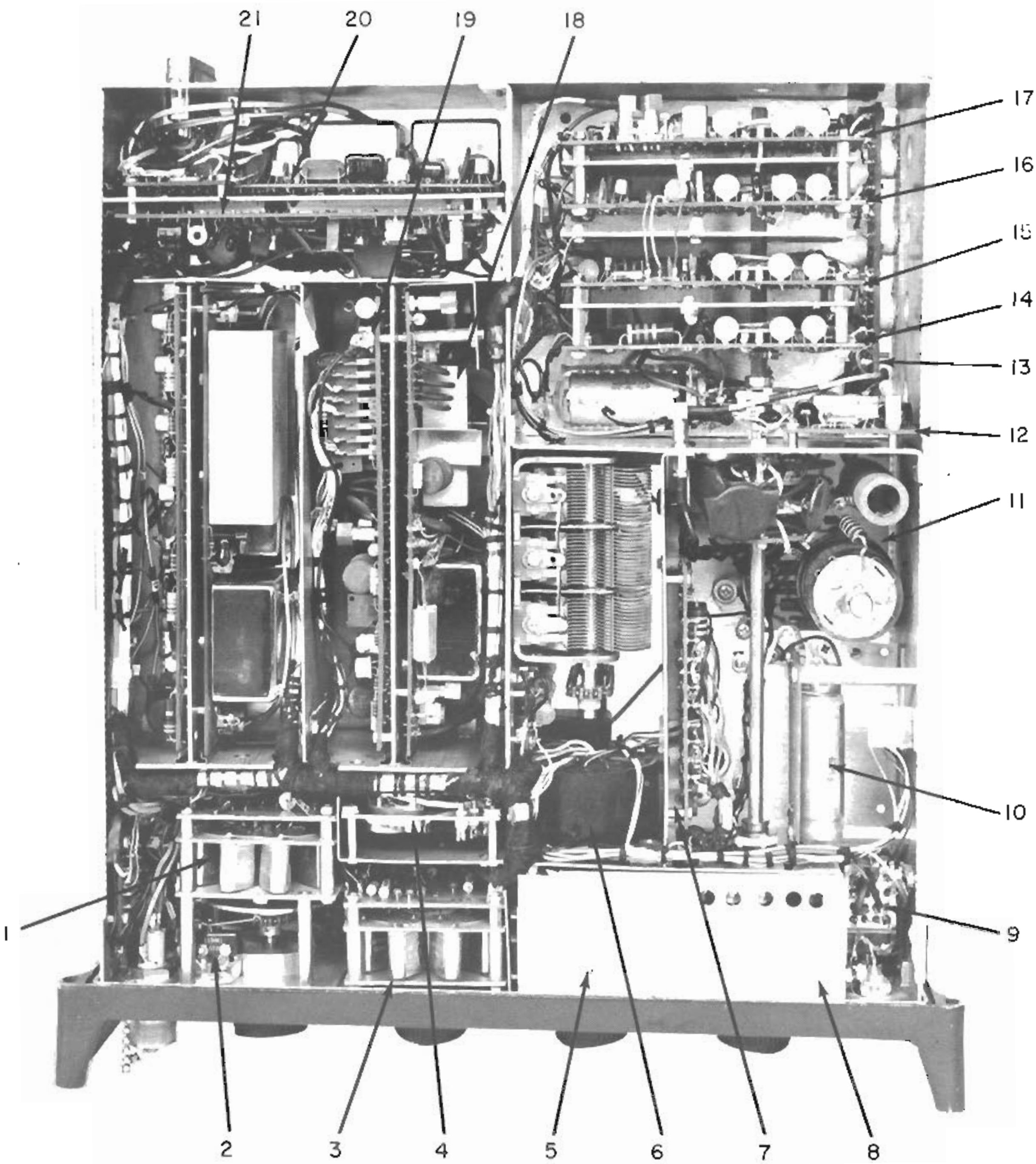


FIGURE 6.2 - ASSEMBLY IDENTIFICATION, BOTTOM OF TRANSCEIVER CHASSIS

TABLE 6.1 - IDENTIFICATION OF ASSEMBLIES AND COMPONENTS

REF. NO.	NAME	CHAPTER 8 FIG. NO.
	Figure 6.1	
1	Audio Amplifier Assembly	8.14
2	T/R Relay K2	8.1
3	Choke L2	8.1
4	VFO Assembly	8.8
5	SSB Filter Assembly	8.21
6	Divider/Spectrum Generator Assembly	8.2
7	11.6 MC Error Mixer Assembly	8.3
8	Frequency Standard/Tuning Oscillator Assembly	8.20
9	Connector J3	8.1
10	RF Amplifier 591-2350 Assembly	8.23
11	RF Amplifier Mounting Screws	—
12	Preselector Shaft	—
13	"Load" Capacitors · C2 and C4	8.1
14	"Tune" Capacitor C8	8.1
15	Antenna Current Monitor Assembly	8.19
16	Transmit Tuning Load Assembly	8.22
17		
18		
19		
20		
	Figure 6.2	
1	1 KC Oscillator Assembly	8.12
2	Switch S6	8.1
3	10 KC Oscillator Assembly	8.11
4	Transmit Power Supply Transistor Assembly	8.18
5	100 KC Oscillator Assembly (Hidden)	8.10
6	Transformer T1	8.1
7	Transmit Power Supply Rectifier Assembly	8.16
8	MC Oscillator Assembly (Hidden)	8.9
9	R/T Relay K1	8.1
10	Transmit Power Supply Capacitor Assembly	8.17
11	Transmit Power Amplifier Assembly	8.15
12	ALC Assembly	8.13
13	RF Amplifier 591-2350 Assembly	8.23
14	RF Amplifier 591-2340 Assembly	8.23
15	RF Amplifier 591-2330 Assembly	8.23
16	RF Amplifier 591-2320 Assembly	8.23
17	RF Amplifier 591-2310 Assembly	8.23
18	Translator Assembly	8.5
19	IF Amplifier Assembly	8.6
20	455 KC Error Mixer Assembly	8.4
21	Audio/Modulator Assembly	8.7

l. Fabricated keying text fixture - refer to figure 6.3;

Note

The fabricated keying test fixture is required for keying the transceiver when it is desired to transmit without having any audio applied to the modulator. A cw key can be used, although it is not as convenient.

m. Subminiature male and female coaxial connectors with pigtail leads for test connections - order replacement cables with RF part numbers C162-0315 and C162-0311.

6.4 PC BOARD REPAIR TECHNIQUES.

Special handling of printed circuit (pc) boards and semiconductors is necessary to avoid damaging these parts. Use only a low heat soldering iron when removing or installing soldered in parts. When removing a part from a printed circuit board, first unbend the crimped leads; then use only the amount of heat necessary to melt the solder and remove the part immediately while the solder is molten. Clear excess solder from mounting holes, making sure that the holes are open on the printed side of the board before inserting the new component. When removing a transformer or other part having a multiple number of leads, straighten all leads first and then heat leads one at a time, working around the part until the part can be gently rocked out of its holes. A desoldering iron or a regular soldering iron used in conjunction with a solder remover or a piece of cable braid will greatly simplify removal of solder from multiple lead components. A wood tooth pick can be used to clear holes once the part is removed.

When installing or removing a soldered-in semiconductor, grasp the lead, to which heat is being applied, between the solder joint and the semiconductor with long-nose

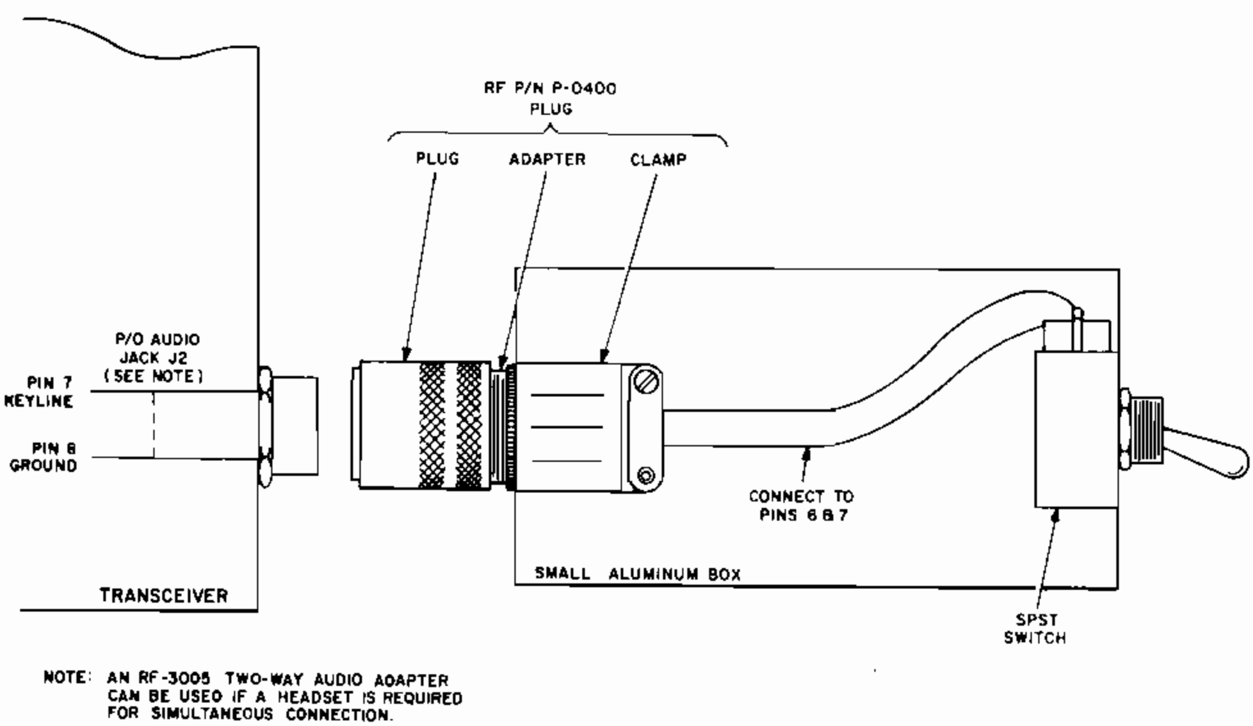


FIGURE 6.3 - FABRICATED KEYING TEST FIXTURE

pliers. This will dissipate some of the heat that would otherwise conduct into the semiconductor device from the soldering iron. Make certain that all wires soldered to semiconductor terminals have first been properly tinned so that the connection can be made quickly. Excessive heat may permanently damage semiconductors, especially germanium types.

If the copper foil wiring is damaged, a piece of small buss wire can be used to bridge the gap. It is seldom necessary to replace a pc board because of such damage.

Capacitors, resistors, and other two lead components can be replaced without removing the old leads, using the following procedure. This method is not as good as removing old leads and soldering the new part into the board, but it may be used to advantage when time or access to the wiring side of the board is a factor.

a. Cut the component in half with diagonal cutters.

b. Crush the remains of the component, and break the pieces away from the leads. This will leave the maximum lead length remaining.

c. Bend the leads close to the board to form a terminal loop.

d. Connect the leads of the new component to the terminals formed by the old leads, and solder the connections. Be careful to dress the leads so they don't contact other nearby leads.

6.5 TROUBLESHOOTING TECHNIQUES.

The first step in troubleshooting a defective transceiver is to isolate the fault to a particular section or assembly. The second step is to localize the fault or defective part responsible for the trouble. Some faults, such as burned-out resistors, arcing, and shorted circuits may be found through visual inspection; however, the majority of problems will have to be located by logical troubleshooting procedures, including checking stage output levels and dc voltages.

Dc voltages significant for troubleshooting are listed with the schematic diagrams. Significant ac signal levels are included in this chapter along with necessary details for test set up and are arranged in logical sequence to facilitate effective troubleshooting. Both dc and ac levels may deviate to some extent from the nominal values given, especially if the power source has a voltage deviation from the nominal input voltage of the transceiver, 12 volts. Some voltages are affected by control settings, and all voltages may vary by as much as the tolerances of the components in the circuit. These deviations are to be expected and are of no major consequence. The important thing to remember when troubleshooting is that problems are usually the result of a missing signal or greatly increased or reduced signal level. They may also be caused by a change in the frequency of the signal, eg., the outputs of the astable multivibrators in the Divider/Spectrum Generator Assembly may shift to another frequency due to extremely low operating voltage or a bad component. Severe signal distortion may be a result of a change in dc operating conditions of a stage. In such cases make sure that dc voltages are checked. All voltages are referenced to chassis ground.

Included with the schematic diagrams in chapter 8 are composite printed circuit board diagrams, showing the components on the board with the printed wiring superimposed. Inter assembly connection points are also identified in these diagrams.

Paragraph 6.6 provides a generalized troubleshooting procedure to help in locating the faulty functional section for some of the simpler problems. Paragraph 6.7 provides general information for locating the fault within the faulty assembly. The remaining paragraphs of this chapter each contain troubleshooting, repair, alignment, removal, and replacement procedures for a particular assembly.

Following are some general rules to observe in troubleshooting. Due to the wide use of transistors and printed circuit boards, it is suggested that these rules be closely observed to prevent damage and to aid in troubleshooting.

a. In solid state circuits, the resistances and impedances are of much lower values than in tube type circuits. A discrepancy of a few ohms can affect performance. Also, transistors can be damaged by high current or high voltage ohmmeter circuits. Therefore, use only the low resistance ranges of the ohmmeter, and use a meter with a sensitivity rating of 20,000 ohms per volt or greater to make accurate measurements and to avoid damaging transistors.

b. Transistors are best checked in the circuit, using ac and dc voltage indications for troubleshooting. Ac signal levels are given in the remaining paragraphs of this chapter together with test set ups. Dc voltages are listed in chapter 8 with the schematic diagrams. Be sure to check the emitter resistor voltage drop to determine if the transistor is operating at the proper dc current conditions. Also, check the transistor base bias. A change in transistor bias may be a problem if a resistor has been overheated or has shorted or opened.

c. A transistor can be checked out of the circuit with a sensitive ohmmeter as follows:

Connect one lead of the ohmmeter to the base and the other first to the emitter and then the collector. The resistance should be high for both checks with the meter polarity one way; and when the tests are repeated with reversed polarity, the resistance should be low to both leads. When a connection is made to the emitter and collector leads, the emitter to collector resistance should likewise be high in one polarity and low with the opposite polarity.

CAUTION

If a transistor is found to be defective, make certain that the circuit is in good order before installing a replacement transistor. If the cause of the transistor's failure was a short circuit or a similar problem, the new transistor will likely succumb to the same problem.

d. Care must be exercised, when checking transistor circuitry, not to short the leads to the case or surrounding circuits. Even momentary current overloads will destroy a transistor. It is usually convenient to use the lead of a component connected to the transistor element as a test point. This is preferred to trying to contact the transistor lead itself.

e. The transceiver was accurately aligned at the factory. Many of the adjustments are critical, and are adjusted for results other than maximum output. Therefore, random adjustments of controls "to optimize performance" will probably only lead to a degradation or complete failure. Alignment should only be done when necessary, and then only according to the test procedures provided.

f. Be careful not to key the transceiver while an rf signal generator is connected to the ANT connector. For insurance, use a headset for receive tests rather than a handset, so that the set cannot be inadvertently keyed.

6.6 LOCATING THE FAULTY FUNCTIONAL SECTION.

6.6.1 SYMPTOM RECOGNITION.

Carful consideration of the symptoms evident during a failure is the most important step in troubleshooting. Random checking of circuits, with no orderly pattern does not help in troubleshooting complex equipment. An attempt to elaborate on the symptoms quite often is a key to the areas to check first.

Failure on transmit but not receive or vice-versa eliminates assemblies common to both transmit and receive, i.e., Translator, Error Mixers, Divider/Spectrum Generator, Crystal Oscillators, and common parts of the Rf Amplifier, but not their associated switching or power circuits. If one of these common mode assemblies operates in one mode but not the other, the fault probably lies in the T/R or R/T lines or in the relay or diode gate switching circuits which route the signal.

Simultaneous failure to transmit and receive indicates defects in the circuits common to both transmit and receive modes.

Various frequencies and modes should be checked, and the operating controls and meter should be checked to determine which functions and frequencies may be affected.

A few of the problems which may be encountered can be identified directly from operating symptoms. These are listed in table 6.2. If one of these problems occurs, proceed directly to the test procedure in the paragraph for that particular assembly to verify and pinpoint the fault.

Tables 6.3 through 6.8 provide test procedures in logical order for localizing faults to a particular circuit area. These tables should be used when symptoms described in their titles are evident. Generally, begin with the first tables where broad catagories are known, and then work toward the more localized procedures as directed in the tables when further clues are discovered. Following the tables properly will eliminate many needless steps. Refer to figures 4.5, 4.6, and 8.1 during the test procedures.

If signal voltage measurements taken are considerably lower than they should be, the problem most likely involves a stage with low gain, or if a mixer stage, the injection signal may be low in level.

CAUTION

The miniature coaxial connectors are easily damaged by abuse and they can be a possible trouble point. When a test indicates that a signal is not present at an input or output cable, check the connector to determine if it is making a good connection before suspecting the assembly to be at fault. When making test connections to connectors, do not jam pieces of wire or test prods into the connector pins. Use test cables with mating connectors plugged into the connectors to make connections to test equipment.

WARNING

Keep away from high voltage circuitry in the power amplifier and power supply areas when the transceiver is keyed. Voltages up to 900 volts are exposed.

TABLE 6.2 - FAULT LOCATION CHART, DIRECTLY IDENTIFIABLE CONDITIONS.

FAULT	PROBABLE TROUBLE AREA
Completely Dead	Fuse (Check polarity and voltage of primary power source) or battery pack.
No lsb; usb ok	Lsb Filter on SSB Filter Assy
No usb, cw, or tune; lsb ok	Usb Filter on SSB Filter Assy
No tune signal	Tuning oscillator on Freq. Std./Tuning Osc. As'sy
No cw transmit or cw sidetone	Cw oscillator on Audio/Modulator Assy
Failure on certain frequencies	Associated crystal oscillator
No vernier tuning	VFO Assy or 1.1015 Mc/s osc. on 455 KC Error Mixer Assy
Receiver overloaded, no meter deflection on strong signals	Agc circuits not operating
Transmitter output distorted	Alc circuits not operating
Transmitter output broken up	Alc circuits oscillating
Transmitter has no output to antenna but meter indicates	Transmit Tuning Load Assy
Transmitter output ok, no meter reading	Antenna Current monitor Assy

TABLE 6.3 - TROUBLESHOOTING CHART, TRANSMITTER FAILURES ONLY.

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
1	Disconnect P50 at SSB Filter Assy. Connect low level rf vtvm to J50.	FUNCTION switch-TUNE TX. Key set momentarily.	If 15-30 mV is obtained, fault is probably between Translator and antenna; reconnect P50 and refer to table 6.4. If results are negative, check i-f and audio circuits in tbe following step.

TABLE 6.3 - TROUBLESHOOTING CHART, TRANSMITTER FAILURES ONLY (Cont.)

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
2	Disconnect P51 at SSB Filter Assy. Connect low level rf vtvm to P51.	Same as step 1.	If approximately 135 mV is obtained, check SSB Filter Assy. If results are negative check IF Amplifier Assembly and Audio/ Modulator Assembly transmit circuits.

TABLE 6.4 - TROUBLESHOOTING CHART, TRANSMITTER HF CIRCUITS.

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
1	Connect dummy load and ac probe of gen. purp. vtvm to ANT connector. Leave dummy load connected for the following steps.	Set frequency to 2.555 Mc/s, set FUNCTION switch to TUNE ANT. Tune PRESELECTOR for receive. Key set, and adjust TUNE and LOAD controls.	Full output should be approximately 50 $\pm$ 5 volts. If low, check pa stage voltages power source, and pa bias setting (chapter 5). Continue with the following steps to find first assembly with proper level. If output is very high, check for oscillations or lack of alc.
2	Connect ac probe of gen. purp. vtvm to E1901 on Antenna Current Monitor Assy.	Same as step 1.	Output indication should be the same as step 1. If proper output is obtained but not at step 1, check Transmit Tuning Load Assy, Antenna transfer relays, and interconnecting cables.
3	Connect ac probe of gen. purp. vtvm to E1902 on Antenna Current Monitor Assy.	Same as step 1.	Output should be the same as steps 1 and 2. If output indication occurs but much greater than step 2, check Antenna Current Monitor Assy signal path through transformer.

TABLE 6.4 - TROUBLESHOOTING CHART, TRANSMITTER HF CIRCUITS (Cont.)

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
4	Remove protective board from bottom of Power Amplifier Assy. Connect ac probe of gen. purp. vtvm to underside of E1702 (pa grid).	FUNCTION switch-TUNE TX. Key set, and repeak PRESELECTOR.	Pa grid drive voltage should be about 42 volts for full output. If results are positive, trouble is probably in pa stage. If level is low, check to be sure PRESELECTOR peaks near the center of the 2 Mc/s band marking.
5	Connect dummy load and ac probe of gen. purp. vtvm to ANT connector. Unplug P11 from Translator Assy. Connect rf signal generator through a .01 uF capacitor to P11.	FUNCTION switch-USB. Set rf signal generator for 175 mv indicated output at 2.55 Mc/s. Key set, and adjust PRESELECTOR, TUNE and LOAD controls for maximum output.	The output indication should be about 35 volts. If output is not obtained, trouble is probably in Rf Amplifier Assy. If output is obtained, check Translator Assy, beginning with injections signal (table 6.7, steps 1-3). Disconnect rf signal generator and reconnect P11.

TABLE 6.5 - TROUBLESHOOTING CHART, RECEIVE OR TRANSMIT AND RECEIVE FAILURES.

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
1	Disconnect P50 on SSB Filter Assy. Connect rf signal generator to J50.	FUNCTION switch-USB. Disconnect any keying device for safety. Listen with headset connected to AUDIO jack. Adjust frequency of rf signal generator for loudest beat note (about 454 kc/s).	Observe a weak tone signal rf signal generator with output set for 3 uV. Meter on set should deflect to half scale with about 4.0 mV output. If the weak signal is present but meter will not deflect, check agc circuits in I-f Amplifier Assy. If no signal, check i-f and audio sections (table 6.6). If both results are positive, continue with hf circuit checks as follows. Disconnect rf signal generator and reconnect P50.
2	Disconnect P55 on Rf Amplifier Assy. Connect rf signal generator to P55.	Same as step 1 with transceiver and rf signal generator set to 2.555 Mc/s.	Observe a weak tone with generator output set for 1 uV. Meter should deflect to half scale with a generator output of about

TABLE 6.5 - TROUBLESHOOTING CHART, RECEIVE OR TRANSMIT AND RECEIVE FAILURES (Cont.)

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
			200 u V. If results are negative, check Translator; begin with injections (table 6.7, steps 1-3). Disconnect rf signal generator and reconnect P55.
3	Disconnect P54 on Rf Amplifier Assy. Connect rf signal generator to J54.	Same as step 2. Peak PRESELECTOR control for maximum signal.	Observe a tone with generator output set for 0.5 uV. Meter should deflect to half scale with gen. output of about 10 uV. If results are negative, check Rf Amplifier Assy. If results are marginal, check alignment of Rf Amplifier Assy. Disconnect generator and reconnect P54.
4	Connect rf signal generator to ANT connector.	Same as step 2.	Indications should be the same as step 3. If results of step 3 were positive and results are now negative or sensitivity is reduced, check antenna transfer relay and cables.

NOTE: If transceiver meter deflects more than one scale division without input signal, check for oscillations. Start at Rf Amplifier Assy and disconnect inter-assembly cables in succession to find assembly which is oscillating. Oscillations are usually indicated by multi beat notes as generator is tuned through frequency. If no oscillation is evident, check agc circuits for high idle voltage.

TABLE 6.6 - TROUBLESHOOTING CHART, RECEIVE I-f and AUDIO FAILURES AND TRANSMIT I-f FAILURES

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
1	Disconnect P51 on SSB Filter Assy. Connect rf signal generator to P51.	FUNCTION switch - USB. Listen with headset connected to AUDIO jack. Adjust generator frequency for loudest beat note (about 454 kc/s.	Observe a tone signal with 0.5 uV generator output. Meter should deflect to half scale with a 600 uV generator output. If results are positive but were negative in table 6.5, step 1, check ssb filters in SSB Filter

TABLE 6.6 - TROUBLESHOOTING CHART, RECEIVE I-f and AUDIO FAILURES AND TRANSMIT I-f FAILURES (Cont.)

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
			Assy. If meter does not deflect properly but weak signal was heard, check agc circuits in I-f Amplifier. Disconnect rf signal generator and reconnect P51.
2	Disconnect P25 on Audio/ Modulator Assy. Connect rf signal generator to J25.	Same as step I.	Observe a tone signal with a 10 uV generator output. Meter will not deflect. If results are positive, check I-f Amplifier Assy and associated cables.
3	Same as above plus connect ac probe of gen. purp. vtvm to ccw lug of RECEIVER AUDIO control.	Same as step 1.	Vtvm should indicate about one-half volt audio at control with a 30 mV generator output. If results are positive, check Audio Amplifier Assy. If negative, check Audio/Modulator Assy; begin with 455 KC Error Mixer signal (table 6.7, step 4). Disconnect rf signal generator and reconnect P25.

TABLE 6.7 - TROUBLESHOOTING CHART, FREQUENCY SYNTHESIZER OUTPUT CHECKS.

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
1	Disconnect P7 at Translator. Connect low level rf vtvm to P7.	FUNCTION switch-USB. Rotate FREQUENCY KILOCYCLES 100 kc/s control through positions 0-9.	100 KC Oscillator output-level should be 150-250 mV for all positions. If not, check 100 KC Oscillator Assy.
2	Disconnect P8 at Translator. Connect low level rf vtvm to P8.	Same as step 1. Rotate FREQUENCY KILOCYCLES 100 kc/s control through position 2-14.	MC Oscillator output-level should be 250-650 mV for all positions. If not, check MC Oscillator Assy.

TABLE 6.7 - TROUBLESHOOTING CHART, FREQUENCY SYNTHESIZER OUTPUT CHECKS (Cont.)

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
3	Disconnect P9 at Translator. Connect low level rf vtvm to P9.	Same as step 1.	11.6 MC Error Mixer output-level should be 125-200 mV. If not, procced to table 6.8, steps 1-6.
4	Disconnect P24 at Audio/Modulator Assy. Connect low level rf vtvm to P24.	Same as step 1.	455 KC Error Mixer output-level should be 200-300 mV. If not, proceed to table 6.8, steps 7-10.

TABLE 6.8 - TROUBLESHOOTING CHART, FREQUENCY SYNTHESIZER INTER-ASSEMBLY SIGNALS.

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
1	Disconnect P34 on 11.6 MC Error Mixer. Connect low level rf vtvm to P34.	FUNCTION switch-USB. Rotate 1000 kc/s FREQUENCY KILOCYCLES control through positions 2-14.	MC Oscillator output-level should be 20-50 mV for all positions. If not, check MC Oscillator Assy. Reconnect P34.
2	Disconnect P33 on 11.6 MC Error Mixer. Connect low level rf vtvm to P33.	Same as step 1. Rotate 100 kc/s FREQUENCY KILOCYCLES control through positions 0-9.	100 KC Oscillator output-level should be 30-45 mV for all positions. If not, check 100 KC Oscillator Assy. Reconnect P33.
3	Disconnect P42 on 11.6 MC Error Mixer. Connect low level rf vtvm to P42.	Same as step 1. Rotate 10 kc/s FREQUENCY KILOCYCLES control through positions 0-9.	10 KC Oscillator-level should be 5.7 mV for all positions. If not, check 10 KC Oscillator Assy. Reconnect P42.
4	Disconnect P35 at 11.6 MC Error Mixer. Connect low level rf vtvm to P35.	Same as step 1. Rotate 1 kc/s FREQUENCY KILOCYCLE control through position 0-9.	1 KC Oscillator output-level should be 190-220 mV. If not, check 1 KC Oscillator Assy. Reconnect P35.
5	Disconnect P36 at 11.6 MC Error Mixer. Connect low level rf vtvm to P36.	Same as step 1.	MC spectrum - level should be 840 mV. If not, check Divider/Spectrum Generator Assy and check Freq. Std. output (should

TABLE 6.8 - TROUBLESHOOTING CHART, FREQUENCY SYNTHESIZER INTER-ASSEMBLY SIGNALS (Cont.)

STEP	TEST CONNECTIONS	CONDITIONS	DIAGNOSIS
			be about 75 mV). Reconnect P36.
6	Connect low level rf vtvm to E165 on 11.6 MC Error Mixer Assy.	Same as step 1.	100 kc spectrum - level should be 50-80 mV. If not, check Divider/Spectrum Generator Assy and Freq. Std. output.
7	Disconnect P12 at 455 KC Error Mixer. Connect low level rf vtvm to P12.	Same as step 1.	1 KC Oscillator output - level should be about 50 mV. If not, check 1 KC Oscillator Assy. Reconnect P12.
8	Disconnect P13 at 455 KC Error Mixer. Connect low level rf vtvm to P13.	Same as step 1.	10 KC Oscillator output-level should be about 150 mV. If not, check 10 KC Oscillator Assy. Reconnect P13.
9	Disconnect P14 at 455 KC Error Mixer. Connect low level rf vtvm to P14.	Same as step 1.	10 kc spectrum - level should be 30-50 mV. If not, check Divider Spectrum Generator Assy and Freq. Std. output. Reconnect P14.
10	Disconnect P15 at 455 KC Error Mixer. Connect low level rf vtvm to P15.	Same as step 1.	1 kc spectrum-level should be 5.5-7.5 mV. If not, check Divider/Spectrum Generator and Freq. Std. output. Reconnect P15.

Note: If steps 1-6 checked normal, troubleshoot 11.6 MC Error Mixer Assembly. If steps 7-10 checked normal, troubleshoot 455 KC Error Mixer Assy.

6.7 SERVICING THE FAULTY ASSEMBLY.

The remaining major paragraphs of this section contain detailed test and alignment procedures for individual assemblies and removal-replacement procedures where necessary.

6.7.1 TEST PROCEDURES.

Once the problem has been isolated to a particular assembly, a stage-by-stage check of input and output signal levels in logical order will be used for determining the faulty stage. Test procedures given are intended to guide in doing this in the most thorough and direct method. Test set-up conditions and expected results are given along with any special requirements or cautions for the particular test.

These procedures will involve checking for presence or absence of proper signals, since it is assumed that the stages, if faulty, are either not operating or are operating at reduced performance. Normal signal levels are given for each stage. It must be remembered, however, that signal levels may vary widely with such conditions as supply voltage variations, parts tolerances, control settings, and so on. So the best method of determining whether or not a stage is operating properly is by comparing signal levels relative to others in the assembly. Complete lack of signal is an obvious sign of trouble; however, some problems may require the comparison of the input signal with the output signal and with the corresponding test information given in the procednres to determine if the stage is faulty or if the input is also at the wrong level.

The test procedures will also involve checking for injections to mixers; since, as in the tests for the transceiver as a whole, a missing mixer injection or one at the wrong level can be responsible for the malfunction of the mixer rather than the problem being in the mixer itself. In checking mixer stages, care is required to make sure that the level measured is the desired signal and not the injection. Normally, a mixer injection will be at a much higher level than the input signal level, and the mixer injection signal will appear at the input and output signal elements of the stage at a level higher than that of the desired signal. Therefore, it is desirable to use a heterodyne (selective frequency) voltmeter for making mixer stage level checks. As an alternate method to measure the level of an input signal to a mixer with a regular rf vtvm, the injection lead can be disconnected so that only the input signal is present at the meter. To measure the output of a mixer, it is necessary to leave the injection connected; but measure the level at the input to the next stage, after the mixer output filter which atteuuates the injection signal to a level below that of the signal to be measured. Tests in the procedures will be made based on the assumption that a heterodyne voltmeter is not available. If one is available, time can be saved by not using the indirect methods of checking mixers.

It is assumed that proper operating voltages are applied to the assembly being tested. If, however, it is found that none of the stages are operating, the dc voltages should be checked. These are given with the schematic diagram in chapter 8. Also, the dc voltages of a stage found to be not operating or operating with reduced performance should be checked.

During the test procedures and alignment procedures, refer to the appropriate schematic and pc board assembly diagrams in chapter 8 and to the appropriate overall block diagram, figure 4.5 or 4.6. Test points referred to in the text are identified in the pc board assembly diagrams in chapter 8.

In most cases, the pc boards are mounted on metal shields which slide out of the chassis for testing. It will be found convenient most times to partially remove the assembly from its normal position in the chassis, leaving it partially engaged in the mounting clips for support. When sliding assemblies in and out of the chassis, be careful not to damage the connected leads. In some cases, the assembly is accessible from both the top and bottom of the chassis. Avoid applying pressure to components. The use of test cables for making test connections to miniature coaxial connectors is recommended to avoid damaging the center contacts with test probes.

Portions of the crystal oscillator and vfo assemblies are inconvenient to test with the front panel in place. For that reason, it may be necessary to remove the front panel at times. A procedure for doing this is provided in paragraph 6.7.4.

6.7.2 ALIGNMENT.

The alignment procedures describe the electrical alignment of the assemblies. The set up conditions are described in the procedures. Mechanical alignment, when necessary, is described in the removal and installation procedures.

In most cases, electrical adjustments will already be close to being correct, and only touch up is required. In other cases, where a stage has been repaired, only a few of the adjustments may be needed. Random adjustments are not advisable because of the special set ups involved for many of the adjustments in the transceiver. Careful thought should be given to determining which adjustments are actually necessary. These should then be done carefully according to the procedures. Most of the procedures given describe all of the adjustments in a particular assembly or section. If some of the adjustments described are not necessary, omit them.

In many cases, adjustment controls are sealed with wax. In cases where it is necessary to reset such controls, carefully break the seal loose and readjust the control. Then reset the wax by melting it with the tip of a soldering pencil. If it is necessary to melt the wax to break the seal originally because the wax buildup is thick, let the component cool before making the adjustment so that the electrical properties of the control are not altered during the adjustment measurement.

6.7.3 ASSEMBLY REMOVAL AND INSTALLATION.

In most cases, assembly removal is straightforward and quite obvious. Leads should be tagged and disconnected, and the assembly should be unscrewed from the mounting. Be sure to note which way the assembly is oriented when mounted.

In cases requiring elaborate removal or installation procedures or mechanical alignment, procedures are given with the text for the assemblies.

Reference to some location on the chassis (such as top, upper, lower, left, etc.) are made with respect to the transceiver being set in its normal bench operating position — flat down with the front panel forward and upright. Screws designated to secure assemblies and components are normally used with other related hardware, such as split lockwashers and flat washers. These requirements are obvious from visual inspection and they are not called out in the text.

6.7.4 FRONT PANEL REMOVAL.

Following are procedures for removing the front panel for access to the crystal oscillator and VFO assemblies. The front panel is designed to be pulled two inches away from the main chassis without disconnecting any leads.

a. Set the TUNE control to the bottom of the 2 Mc/s band, and loosen two setscrews at the capacitor end of the shaft coupling.

b. Turn the PRESELECTOR to the clockwise stop, and loosen two setscrews at the front of the second coupling.

c. Turn the LOAD control to the clockwise stop, and loosen one setscrew at the front coupling of the flexible shaft.

d. Set the 1000 kc/s FREQUENCY KILOCYCLES control at 11, and loosen one setscrew at the rear of the coupling directly behind the MC Oscillator Assembly. Set the 1000 kc/s control to 14, and mark the shaft flush with the rear of the coupling to indicate later the depth to which the shaft should be inserted in the coupling. Loosen the remaining setscrew.

e. Draw a diagram indicating the exact position of the rotor blade of the front wafer in the pa compartment.

f. Unsolder the solder lug mounted under the ANT connector from the solder lug mounted to the MC Oscillator shield.

g. Set the transceiver right side up flat on a bench.

h. Remove two screws from each side of the chassis just behind the front panel.

i. The panel can be pulled out about two inches without disconnecting any leads. It is recommended that the panel be pulled out only as far as necessary; so that the shields will help support the panel.

6.7.5 FRONT PANEL REPLACEMENT.

Following are procedures for replacement of the front panel.

a. Check to make sure that no leads are broken. Dress the leads as necessary to avoid interference when pushing the panel back in place. Make sure that the front panel controls are still set as left when couplings were loosened.

b. Push the panel in part way, making sure the leads clear, couplings line up with shafts, and shields will clear the oscillators.

c. Push the panel in the rest of the way. Align the panel with the chassis, and install the two screws at one side of the chassis. Then, seat the other side of the panel, and install the two screws on that side.

d. Check all control settings and associated shafts for positions. Check the front switch wafer in the pa compartment for alignment according to the sketch made before removal. Make sure that the pa switch shaft is inserted in the coupling the same depth as before removal.

e. Tighten setscrews on all couplings previously loosened.

f. Resolder the lugs at the ANT connector.

6.8 DIVIDER/SPECTRUM GENERATOR ASSEMBLY.

Refer to figure 8.2 for component and test point locations, schematic diagram, and dc voltage information.

6.8.1 DIVIDER/SPECTRUM GENERATOR TEST PROCEDURE.

a. Activate the transceiver, and set FUNCTION switch at USB.

b. Determine which area is faulty by checking spectrum outputs with a heterodyne vtvm according to information in table 6.9. Refer to block diagram figure 4.6 to determine the probable faulty stages from information thus discovered. Note that most stages depend upon proper operation of preceding stages. If the faulty spectrum(s) is already known from the overall transceiver troubleshooting procedure, the heterodyne vtvm tests may either be used to confirm previous findings or may be omitted.

c. Once the faulty area is determined, proceed by checking individual stages with an oscilloscope according to the following steps. Only the steps up to the faulty stage need to be performed.

Note

Make sure that the oscilloscope probe is calibrated properly before making tests.

d. Compare the waveform and amplitude of the 1 Mc/s Frequency Standard input at the ungrounded side of R70 (input at J43) with that in figure 6.4.

TABLE 6.9 - SPECTRUM GENERATOR TESTS.

TEST POINT TERMINAL	SPECTRUM	FREQUENCIES TO CHECK	LEVEL
E84	Mc/s	11.0 to 23.0 Mc/s at 1 Mc/s intervals	8 mV ± 2 mV
E87	100 kc/s	28.1 to 29.0 Mc/s at 100 kc/s intervals	5 mV ± 2 mV
E89	10 kc/s	1.11 to 1.20 Mc/s at 10 kc/s intervals	6 mV ± 2 mV
E91	1 kc/s	1.8 Mc/s	7 mV ± 2 mV

e. Compare the waveform and amplitude at the junction of R72 and the base of Q1 (output of Q20) with that in figure 6.5.

f. Compare the waveform and amplitude at the ungrounded side of R2 (collector of Q14) with that in figure 6.7.

g. Compare the waveform and amplitude at the side of R47 connected to the base of Q15 (collector of Q14) with that in figure 6.7.

h. Compare the waveform at E84 (Mc/s spectrum output) with that in figure 6.8.

i. Compare the waveform and amplitude at the junction of R7 and R10 (collector of Q3) with that in figure 6.9.

j. Compare the waveform and amplitude the junction of R13 and R14 (base of Q16) with that in figure 6.10.

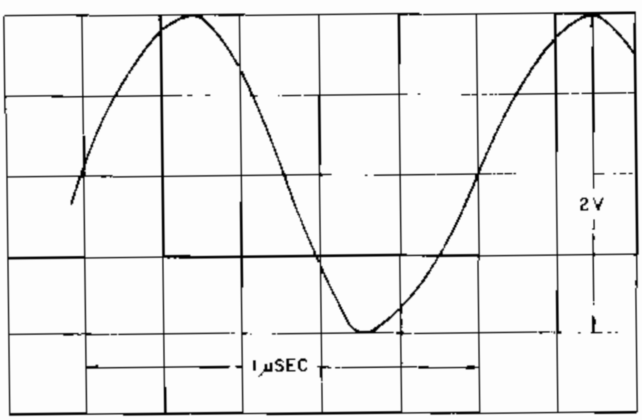


FIGURE 6.4 - FREQUENCY STANDARD OUTPUT WAVEFORM AT J3

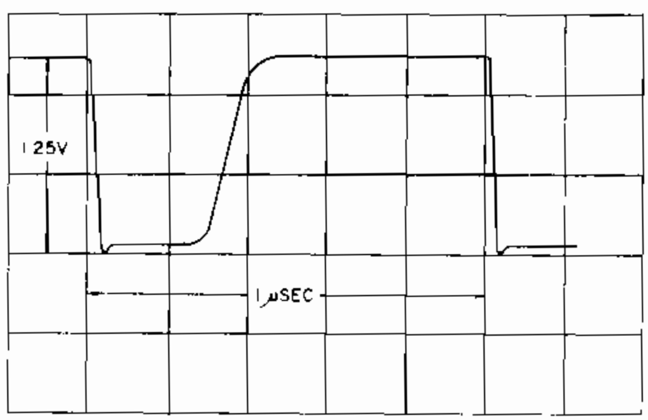


FIGURE 6.5 - WAVEFORM AT BASE Q1

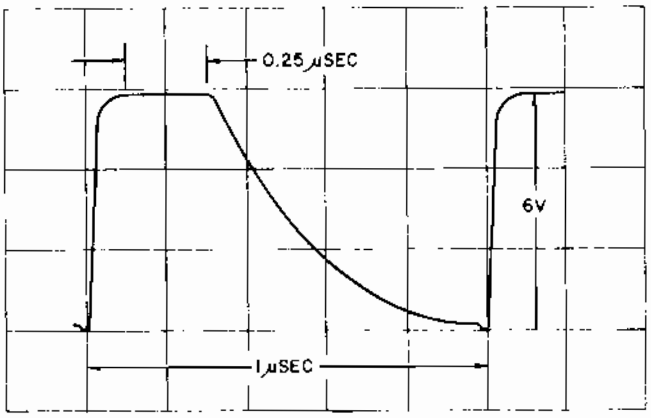


FIGURE 6. 6 - WAVEFORM AT COLLECTOR OF Q1

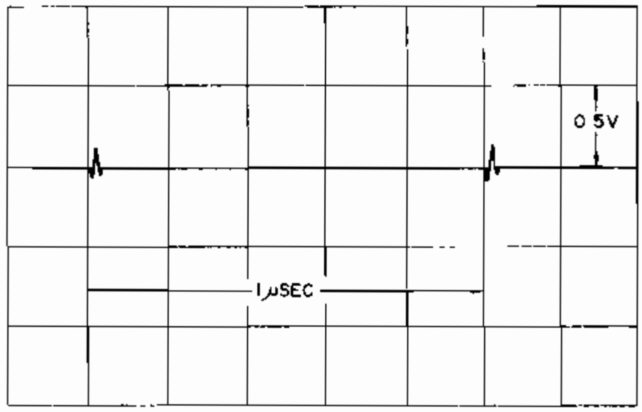


FIGURE 6. 8 - WAVEFORM AT E84, MC SPECTRUM OUTPUT

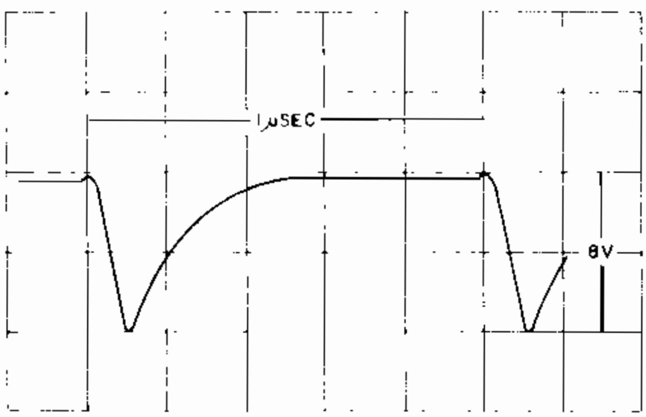


FIGURE 6. 7 - WAVEFORM AT COLLECTOR OF Q14

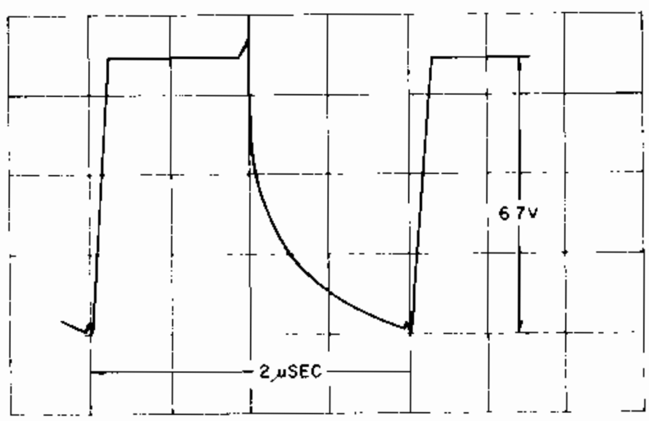


FIGURE 6. 9 - WAVEFORM AT COLLECTOR OF Q3

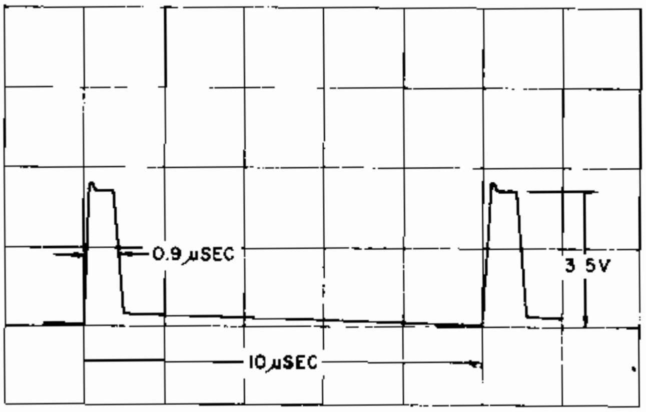


FIGURE 6.10 - WAVEFORM AT BASE OF Q16

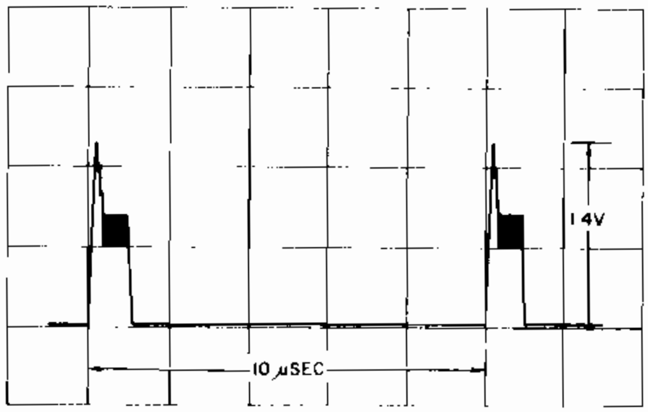


FIGURE 6.11 - WAVEFORM AT EMITTER OF Q17

k. Compare the waveform and amplitude at the side of R51 connected to the base of Q17 with that in figure 6.11.

l. Compare the waveform at E87 (100 kc/s spectrum output) with that in figure 6.12.

m. Compare the waveform and amplitude and the junction of R21 and R23 (collector of Q7) with that in figure 6.13.

n. Compare the waveform and amplitude at the junction of R26 and R28 (collector of Q9) with that in figure 6.14.

o. Compare the waveform and amplitude at the side of R54 connected to the emitter of Q18 with that in figure 6.15.

p. Temporarily disconnect P14 at the 455 KC Error Mixer Assembly. Compare the waveform at E89 (10 kc/s spectrum output) with that in figure 6.16.

q. Compare the waveform and amplitude at the junction of R32 and R35 (collector of Q11) with that in figure 6.17.

r. Compare the waveform and amplitude at the side of R43 connected to the collector of Q13 with that in figure 6.18.

s. Compare the waveform and amplitude at the side of R57 connected to the emitter of Q19 with that in figure 6.19.

t. Compare the waveform at the transformer side of R61 (1 kc/s spectrum output) with than in figure 6.20.

6.8.2 DIVIDER/SPECTRUM GENERATOR ALIGNMENT PROCEDURE.

a. Set up transceiver to receive on 2.444 Mc/s in usb mode.

b. Connect oscilloscope to the ungrounded side of R2 (collector of Q1) and adjust R66 for a pulse width of 0.25 usec at the flat top of the waveform as shown in figure 6.6.

c. Connect the oscilloscope to the junction of R13 and R14 (base of Q16). Set R11 to the

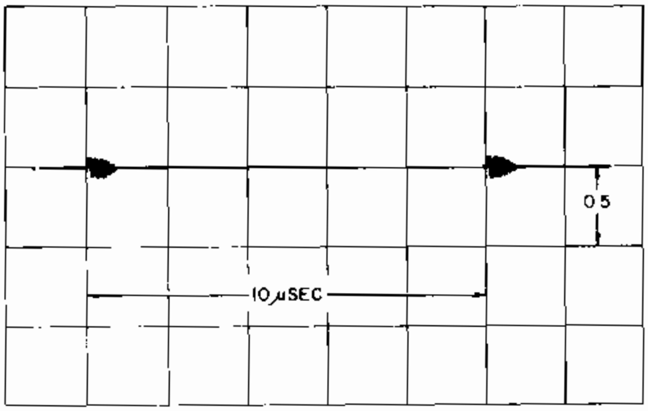


FIGURE 6.12 - WAVEFORM AT
E87, 100 KC SPECTRUM OUTPUT

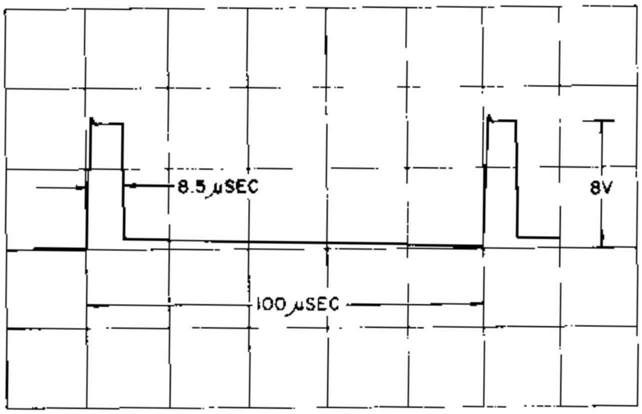


FIGURE 6.14 - WAVEFORM AT
COLLECTOR OF Q9

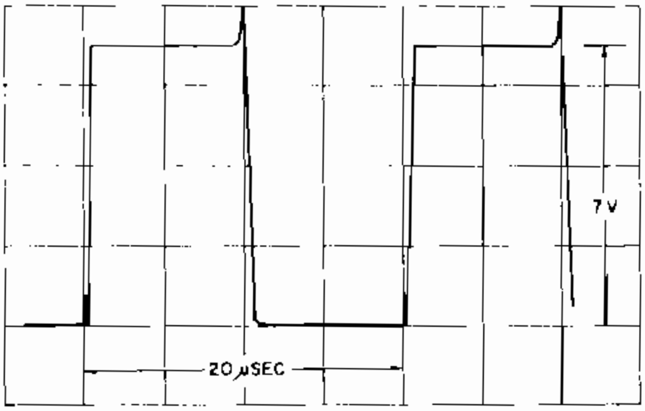


FIGURE 6.13 - WAVEFORM AT
COLLECTOR OF Q7

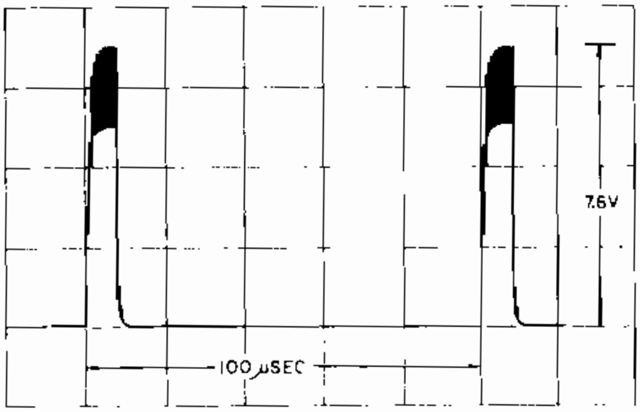


FIGURE 6.15 - WAVEFORM AT
EMITTER OF Q18

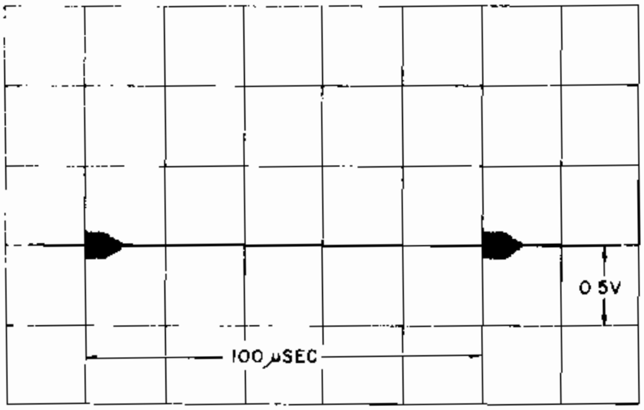


FIGURE 6.16 - WAVEFORM AT
E89, 10 KC SPECTRUM OUTPUT

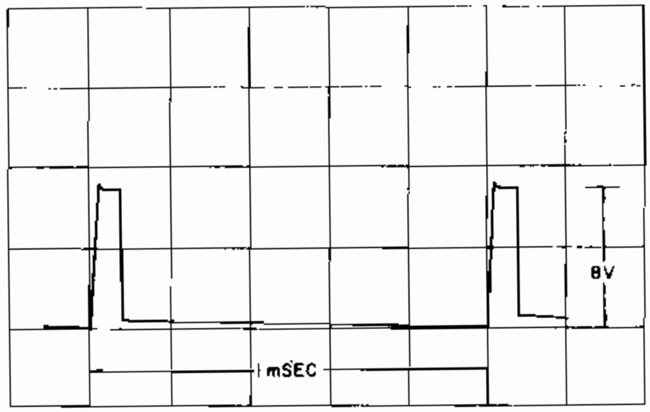


FIGURE 6.18 - WAVEFORM AT
COLLECTOR OF Q13

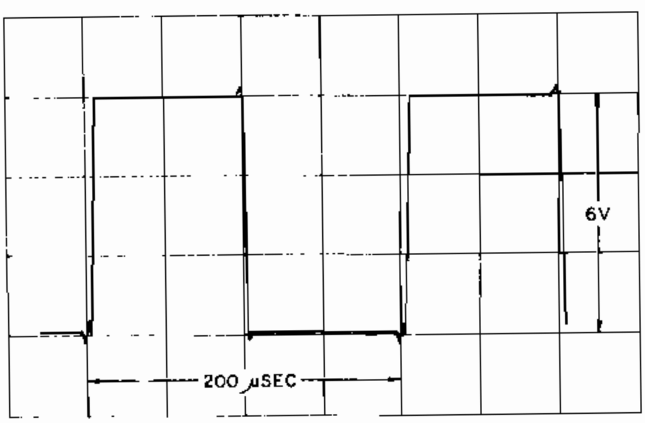


FIGURE 6.17 - WAVEFORM AT
COLLECTOR OF Q11

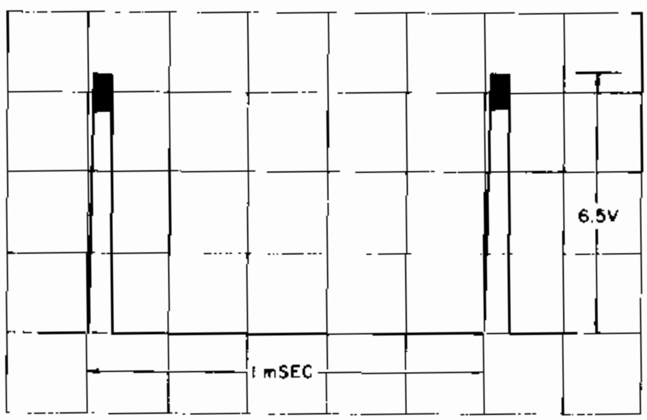


FIGURE 6.19 - WAVEFORM AT
EMITTER OF Q19

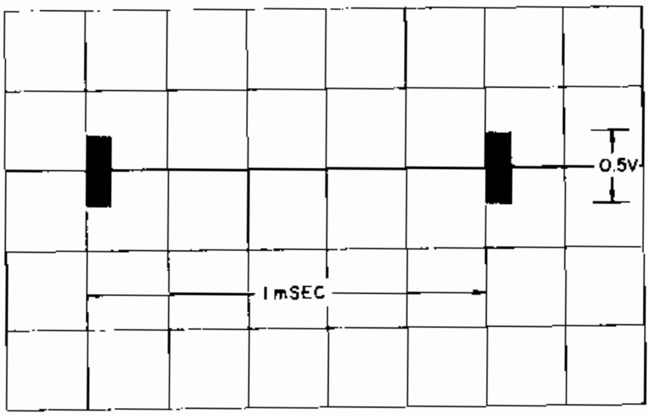


FIGURE 6.20 - WAVEFORM AT TRANSFORMER SIDE OF R61, 1 KC SPECTRUM OUTPUT

center of the range which results in a waveform with time between pulses equal to that shown in figure 6.10. For example, if the time between pulses is correct over a range of 3-1/2 turns of R11, set R11 exactly 1-3/4 turns from the setting at which the time between pulses jumps to the next longer or shorter value.

d. Connect the oscilloscope to the junction of R26 and R28 (collector of Q9). Set R24 to the center of the range which results in a waveform with time between pulses equal to that shown in figure 6.14.

e. Connect the oscilloscope to the side of R43 connected to the collector of Q13. Set R38 to the center of the range which results in a waveform with time between pulses equal to that shown in figure 6.20.

f. Connect a heterodyne vtvm to R34 at the output of FL4 on the 11.6 MC Error Mixer Assembly. Tune the vtvm to the signal at 21.9 Mc/s.

g. Place the 100 kc/s FREQUENCY KILOCYCLES control at 4 and adjust T2 on the Divider/Spectrum Generator Assembly for the strongest peak on the vtvm. Rotate the 100 kc/s FREQUENCY KILOCYCLES control from 0 to 9, and check the vtvm for a change of less than 6 dB on any frequency from the reading of the 4 position. If the change is more than 6 dB, a very slight adjustment of T2 should decrease the amount of variation. The peak level should be about 5 mV when correctly tuned.

h. Connect the heterodyne vtvm to R5 at the base of Q2 on the 455 KC Error Mixer Assembly. Set the 10 kc/s FREQUENCY KILOCYCLES control at 4 and tune the vtvm to the signal at 646.5 kc/s.

i. Tune T3 on the Divider/Spectrum Generator Assembly for the strongest peak on the vtvm. Rotate the 10 kc/s FREQUENCY KILOCYCLES control from 0 to 9, and check the level at each frequency. If the levels are not within 6 dB, a slight adjustment of T3 should decrease the amount of variation. The level, when correctly tuned should be about 30 mV.

j. Connect the heterodyne vtvm to R15 at the base of Q4 on the 455 KC Error Mixer Assembly, and with the 1 kc/s FREQUENCY KILOCYCLES control at 4, tune the vtvm to the signal at 1.1015 Mc/s.

k. Tune T4 on the Divider/Spectrum Generator Assembly for the strongest peak on the vtvm. Rotate the 1 kc/s FREQUENCY KILOCYCLES control from 0 to 9, and check the level at each frequency. If the levels are not within 6 dB, a slight readjustment of T4 should decrease the amount of variation. When correctly tuned, the level should be about 3 mV.

Note

The alignment procedure can be performed using a low level rf vtvm in place of the heterodyne vtvm by substituting the following steps for their counterparts in the above procedure.

l. Connect a low level rf vtvm to R34 at the output of FL4 on the 11.6 MC Error Mixer Assembly. Disconnect P34 and P36.

m. Reconnect P34 and P36. Disconnect P12 and P15 at the 455 KC Error Mixer Assembly, and connect the low level rf vtvm to R5 at the base of Q2 on that assembly.

n. Reconnect P12 and P15. Disconnect P13 and P14. Connect the low level rf vtvm to R15 at the base of Q4 on the 455 KC Error Mixer Assembly.

o. Reconnect P13 and P14.

6.9 11.6 MC ERROR MIXER ASSEMBLY.

Refer to figure 8.3 for dc test voltages, test point and component locations, and schematic diagram.

6.9.1 11.6 MC ERROR MIXER TEST PROCEDURE.

It is assumed at this point that the oscillator and spectrum inputs were previously checked in the overall transceiver test procedure and that the trouble is in this assembly.

Note

Use a low level rf vtvm to make the following tests.

a. Set the transceiver for usb reception on 2.555 Mc/s.

b. Q1, Q2, and Q3 – Check the signal level at the junction of CR1 and CR2. If 200 mV is present, Q1, Q2, and Q3 are operating; proceed to step c. If the proper signal is not present, Q1, Q2, or Q3 stage is probably defective; proceed to step f.

CAUTION

Q8 and Q9 are easily damaged by shorting or current transients.

c. Q6, Q7, and Q8 – Temporarily unplug P35 and P42. Check the signal level at the end of R41 connected to the base of Q9. If 90-160 mV is present, Q6, Q7, and Q8 are operating; reinstall plugs, and proceed to step d. If the proper signal is not present. Q6, Q7, or Q8 stage is probably defective; reinstall plugs, and proceed to step g.

d. Q4 – Temporarily unplug P34 and ground the collector of Q8 by shorting R40. Check the signal level at the junction of R43 and the emitter of Q9. If 2-5 mV is present, Q4 is operating; reinstall P34, remove the ground, and proceed to step e. If the proper signal is not present, Q4 stage is probably defective.

e. Q9 and Q5 – Check the signal level at the end of R39 connected to the base of Q5. If 30-60 mV is present, the fault is properly in Q5 stage. If proper signal is not present, Q9 or FL3 is probably defective.

Once the trouble is narrowed down to a particular stage or stages, check ac and dc voltages in the suspected stages. Ac voltages are given in table 6.10, and dc voltages are given in figure 8.3.

6.9.2 11.6 MC ERROR MIXER ALIGNMENT PROCEDURE.

a. Set the transceiver for usb reception at 2.555 Mc/s.

TABLE 6.10 - 11.6 MC ERROR MIXER ASSEMBLY
SIGNIFICANT AC TEST VOLTAGES

STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	-	43 mV	380 mV	J36 disconnected
Q2	22 mV	73 mV	-	J36 disconnected
Q2	210 mV	80 mV	2.6 V	-
Q3	3.5 mV	20 mV	750 mV	-
Q4	50 mV	7.3 mV	510 mV	-
Q4	60 mV	34 mV	-	J42 disconnected
Q4	5.4 mV	7.4 mV	-	J35 disconnected
Q5	2.5 mV	48 mV	930 mV	-
Q6	6 mV	37 mV	320 mV	-
Q7	28 mV	9 mV	-	P33 disconnected
Q7	38 mV	88 mV	1.3 V	-
Q8	7.5 mV	19 mV	100 mV	P34 and P36 disconnected
Q8	110 mV	15 mV	590 mV	P33 disconnected
Q8	110 mV	20 mV	700 mV	-
Q9	48 mV	140 mV	220 mV	P35 and P42 disconnected
Q9	6.3 mV	3.3 mV	5.0 mV	P34 disconnected. Collector of Q8 grounded.
Q9	45 mV	140 mV	320 mV	-

b. Connect a low level rf vtvm to the junction of CR1, CR2, and T1. Adjust C5, C8, and T1, respectively, for maximum meter indication (about 300 mV).

c. Connect the low level rf vtvm to the junction of R12 and R13, and retune C5 and C8 for peak indication.

d. Connect the low level rf vtvm to the end of R36 connected to the base of Q8. Temporarily unplug P36. Adjust C31 and C33 for maximum meter indication. Reinstall P36.

e. Connect the low level rf vtvm to the junction of CR3, CR4, and T2. Adjust C20, C22, and T2, respectively, for maximum meter indication.

f. Connect the low level rf vtvm to the end of R39 connected to the base of Q5. Adjust C20, C22, C34, C36, and C16 for maximum meter indication.

g. Repeat step d.

6.10 455 KC ERROR MIXER ASSEMBLY.

Refer to figure 8.4 for dc test voltages, test point and component locations, and schematic diagram.

6.10.1 455 KC ERROR MIXER TEST PROCEDURE.

It is assumed at this point that the oscillator and spectrum inputs were checked in the overall transceiver test procedure and that the trouble is in this assembly.

Note

Use a low level rf vtvm to make the following tests.

a. Set the transceiver for usb reception at 2.555 Mc/s.

b. Check the signal level at the end of R5 connected to the base of Q2. The level should be about 40 mV. If the proper signal level is not present, the problem is probably in Q1 or FL1.

c. Temporarily disconnect P12. Check the signal level at the end of R15 connected to the base of Q4. The level should be at least 70 mV. If not, the problem is probably in the Q2 stage. Reconnect P12.

d. Temporarily disconnect P13. Check the signal level at the same point as in step c. The level should be about 3 mV. If not, the problem is probably in the Q3 stage or in FL2. Reconnect P13.

e. Check the signal level at the same point as in steps c and d with the 1 kc/s FREQUENCY KILOCYCLES control pulled out. This disables Q3 and activates 1.1015 Mc/s oscillator stage Q6. The level should be about 3 mV. Return the control to the normal position.

f. Check the signal level at the end of R21 connected to the base of Q5. The signal level should be at least 30 mV. If not, the problem is probably in the Q4 stage or in FL3.

g. Temporarily unplug P17. Check the signal level at J17. The signal level should be 140-280 mV. If not, the problem is probably in the Q5 stage.

Once the problem is narrowed down to a particular stage, check the individual parts of the stage and the dc voltages for the stage given in figure 8.4.

Note

Transistor Q7 is not used in the RF-301P SSB Transceiver and should not have dc voltages applied.

6.10.2 455 KC ERROR MIXER ALIGNMENT PROCEDURE.

a. Set the transceiver for usb reception at 2.555 Mc/s.

b. Connect a low level rf vtvm to the anode of CR7. Adjust T2, C25, C26, C11, T1, and C3, respectively, for maximum meter indication (about 300 mV).

c. Connect the low level rf vtvm to the end of R21 connected to the base of Q5. Adjust C11, T1, C3, C25, and C26, respectively, for maximum meter indication.

d. With the meter still connected as in step c, pull the 1 kc/s FREQUENCY KILOCYCLES control out. Turn the tuning slug in T4 clockwise until the meter indicates that stage Q6 has stopped oscillating. Then turn the slug clockwise one quarter turn past the position at which the oscillation begins.

6.11 TRANSLATOR ASSEMBLY.

Refer to figure 8.5 for dc test voltages, test point and component locations, and schematic diagram.

6.11.1 TRANSLATOR TEST PROCEDURE.

a. Set the transceiver for usb reception at 2.444 Mc/s.

b. Connect a low level rf vtvm to the end of R3 connected to the emitter of Q1. The MC Oscillator injection at this point should be about 50 mV. If not, refer to the oscillator test procedure.

c. Connect the low level rf vtvm to the end of R10 connected to the emitter of Q2. The 100 KC Oscillator injection at this point should be at least 70 mV. If not, refer to the oscillator test procedure.

d. Connect the low level rf vtvm to the end of R15 connected to the emitter of Q3. The 11.6 MC Error Mixer injection at this point should be at least 100 mV. If not, refer to the 455 KC Error Mixer test procedure.

e. Connect an rf signal generator to the ANT connector, and set it for 10 mV output at 2.444 Mc/s.

f. Temporarily disconnect the 100 KC Oscillator injection at P7. Connect the low level rf vtvm to the end of R8 connected to the base of Q2. The signal level at this point should be about 45 mV. If not, and the signal was present at the input (J11) during the overall transceiver troubleshooting procedure, the problem is most likely in stage Q1, filter FL1, or the diode switching circuits.

g. Reconnect P7, disconnect the injection input at P9, and connect the low level rf vtvm to the end of R13 connected to the base of Q3. The level at this point should be about 100 mV. If not, the problem probably lies in stage Q2, filter FL2, or the diode switching circuits.

h. Reconnect P9, disconnect the injection input at P10, and connect the low level rf vtvm to J10. The level at this point should be about 700 mV. If not, the problem is probably in stage Q3 or in its diode switching circuits.

If all of the stages check out to be good. and the Translator operates on receive but not on transmit, the problem probably lies in the switching circuitry or the associated R/T or T/R line.

The T/R line should be at +12 volts on transmit and grounded on receive. The R/T line should be at +12 volts on receive and grounded on transmit. These control lines forward or reverse bias diodes to steer the signal along its receive or transmit signal path.

Diodes CR1, CR3, CR5, CR7, CR10, CR12, CR15, and CR16 should be forward biased on receive. Diodes CR2, CR4, CR6, CR8, CR9, CR11, CR13, and CR14 should be forward biased on transmit. A dc vtvm can be used to determine if a diode is forward biased. When forward biased, the anode should be at least 0.2 volt more positive than the cathode.

6.11.2 TRANSLATOR ALIGNMENT PROCEDURE.

a. Tune the transceiver for usb reception at 2.444 Mc/s.

b. Connect an rf signal generator to ANT connector.

c. Connect an ac vtvm across the audio output, pin 3 (signal) and pin 4 (ground) of the AUDIO connector.

d. Set the signal generator to the receive frequency, and adjust the output level for a low signal strength indication on the transceiver front panel meter.

e. Adjust C2, C13, C19, and C22 for maximum indication on the vtvm.

f. Remove the signal generator and connect a 50 ohm, 100 watt rf dummy load to the ANT connector.

g. Set the transceiver to TUNE ANT. Key the transceiver, and adjust T1, C27, C20, and C10 for maximum indication on the transceiver front panel meter.

h. Repeat steps b through g until the results are acceptable.

6.12 IF AMPLIFIER ASSEMBLY.

Refer to figure 8.6 for dc test voltages, test point and component locations, and schematic diagram.

6.12.1 IF AMPLIFIER TEST PROCEDURE.

6.12.1.1 Receive I-f Stages.

a. Connect an rf signal generator to E167. Connect a heterodyne vtvm to E167. Set transceiver for USB reception, set signal generator and heterodyne vtvm to 455 kc/s, and set signal generator output for an 18 uV reading on the heterodyne vtvm.

b. Connect heterodyne vtvm to the end of R5 connected to the base of Q2, and check for a reading of about 50 uV.

c. Connect heterodyne vtvm to the end of R9 connected to the base of Q3, and check for a reading of about 200-600 mV.

d. Connect heterodyne vtvm to the end of R13 connected to the base of Q4, and check for a reading of about 300-800 uV.

e. Connect heterodyne vtvm to the end of R26 connected to the base of Q5, and check for a reading of about 120 uV.

f. Connect heterodyne vtvm to the junction of L1 and the collector of Q5, and check for a reading of about 14 mV.

If any of these readings are low, it indicates a faulty i-f amplifier stage at the point preceding the test point.

g. Connect heterodyne vtvm to E167. Increase the signal generator output to obtain 58 mV reading on the vtvm.

h. Connect heterodyne vtvm to the junction of L1 and the collector of Q5. If the agc circuits are operating properly, the i-f output at this point should now measure about 100 mV.

6.12.1.2 Agc Circuits. If it has been determined under steps 6.12.1.1 g and h that the agc circuits do not control the gain of the receive i-f amplifier stages properly, proceed with these tests.

a. Connect an rf signal generator to E167. Set it for 1 mV output at 455 kc/s, as indicated on heterodyne vtvm connected to the junction of R40, R41, and C21 (Q9 circuit).

b. Connect heterodyne vtvm to the end of CR6 connected to the base of Q8, and check for a reading of about 15 mV.

c. Connect the dc lead of a general purpose vtvm to the end of R29 connected to the base of Q9, and check for a reading of about +1.4 volts.

d. Connect the dc lead of a general purpose vtvm to the end of R47 connected to the emitter of Q9 and the base of Q10, and check for a reading of about +3.5 volts.

e. Connect the dc lead of a general purpose vtvm to the junction of L3 and C37, and check for a reading of about +3 volts.

e. Set the alc potentiometer, R35 on the I-f Amplifier Assembly to the point at which the output observed at E167 just begins to decrease.

f. Remove test connections, and reconnect the coaxial lead at E167 and the alc lead at E1504 on the Alc Assembly.

6.13 AUDIO/MODULATOR ASSEMBLY.

Refer to figure 8.7 for dc test voltages, test point and component locations, and schematic diagram.

6.13 AUDIO/MODULATOR ASSEMBLY.

Several possible faulty sections in the assembly can be identified just by checking symptoms while attempting to operate the transceiver.

If the transceiver will not receive, but you can hear sidetone in the earphone on transmit, the problem probably lies in the balanced modulator/product detector stage CR10-CR13 in amplifier stages Q9 and Q10. If the transceiver will not prodnce an audio output in receive or transmit, but the transmitter output is normal, the problem is probably in the receive audio amplifier stages Q7 and Q8 or in the RECEIVER AUDIO control. If sidetone cannot be heard on cw transmit and there is no transmitter output, the problem may lie in cw oscillator stage Q5. If the transceiver will not transmit but receiver operation is normal, the problem may lie in transmit audio amplifier stage Q4 or in the transmit audio gain control circuitry on the Frequency Standard/Tuning Oscillator Assembly.

Note

Transistor Q3 and diode CR4 are for AM received signal detection and are not used in the RF-301P SSB Transceiver.

Note

The balanced modulator/product detector stage depends upon the 455 kc/s injection from the 455 KC Error Mixer Assembly through J24 and Q9. If the proper injection is not present at J24, the balanced modulator/product detector stage will not operate. Other necessary inputs to the assembly are the R/T and T/R lines. The R/T line should be at +12 volts in receive and grounded in transmit, and the T/R line should be at +12 volts in transmit and grounded in receive.

Once the fault is narrowed down to a suspected stage or stages, the inputs and outputs can be checked according to the following information.

a. Q9 Injection Amplifier – Check for about 230 mV of 455 kc/s with a low level rf vtvm at the base and emitter.

b. Q10 Amplifier – Check for about 0.15 volts at the emitter and base and about 0.36 volts at the collector with 100 uV signal applied to ANT connector on USB receive mode.

c. Q4 Transmit Audio Amplifier – Check for about 2-1/4 times voltage at collector as at emitter and base with set keyed in TUNE TX. Level should be about 20 mV at emitter and base about 45 mV at collector. Levels are only approximate and depend on transmit audio gain control setting.

d. Q5 Cw Oscillator – Check for about 2.2 volts of audio at the collector with the set keyed in cw mode.

e. Q6 Cw Hold Stage – Check for +12 volts at emitter and base with the set unkeyed and less than +1 volts at emitter and base with set keyed in cw mode.

f. Q7 and Q8 Receive & Sidetone Audio Amplifiers – Check for the following approximate levels at indicated points with a 100 uV signal applied to the ANT connector on usb receive mode: Q7 emitter, 22 mV; Q7 base, 39 mV; Q7 collector and Q8 emitter and base, 1.5 volts.

6.13.2 AUDIO / MODULATOR ALIGNMENT PROCEDURE.

CAUTION

Do not force the tuning slugs of the transformers at the full clockwise setting or withdraw the slug more than 3 turns from the full clockwise point.

Note

T6 and L4 require no adjustment.

a. T7 Adjustment – Temporarily disconnect P25. Connect a low level rf vtvm to J25. Set transceiver to TUNE TX, key the set, and adjust T7 for maximum meter indication. There will only be a small peak and it may occur at the end of slug travel.

b. Modulator Balancing – Connect a 50 ohm, 100 watt rf dummy load and the ac probe of a general purpose vtvm to the ANT connector. Set the transceiver to USB and make sure that no audio is applied. Key the set, and alternately adjust R56 and C58 for minimum meter indication. Some interaction may occur, so it may be necessary to continue alternately adjusting the two controls until no further decrease is noted.

c. T8 Adjustment – Set the transceiver to receive on usb. Connect an rf signal generator to the ANT connector, and adjust it for a low level signal at the receive frequency. Connect the probe of an ac vtvm to pin 3 of the AUDIO connector and the ground lead to pin 4. Adjust T8 for maximum meter indication. This adjustment will result in a very small peak which may occur at the end of slug travel.

6.14 VFO ASSEMBLY.

Refer to figure 8.8 for dc test voltages, test point and component locations, and schematic diagram.

6.14.1 VFO TEST PROCEDURE.

a. Set transceiver to receive usb on 2.555 Mc/s.

b. At the 11.6 MC Error Mixer Assembly, temporarily unplug P42, and connect a low level rf vtvm to the end of R19 connected to the emitter of Q4. Pull the 1 kc/s FREQUENCY KILOCYCLES control out and check for an indication of about 50 mV. If the voltage indication is correct, proceed to step c; if missing, proceed to step d.

c. Connect a frequency counter through the amplifier in an ac vtvm to the end of R19 connected to the emitter of Q4 (11.6 MC Error Mixer Assembly). Check the vfo frequency at dial settings of 0 (798.5 kc/s) and 9 (789.5 kc/s). If incorrect, refer to alignment procedure.

Note

If the VFO operates properly, but the transceiver does not operate with the 1 kc/s FREQUENCY KILOCYCLES control pulled out, the problem may lie in the 1.1015 Mc/s oscillator stage, Q6, on the 455 KC Error Mixer Assembly. This oscillator must be operating properly when the vfo is used.

d. Check the dc voltages in the VFO Assembly according to information in figure 8.8.

e. Connect the low level rf vtvm to the junction of R5 and R6 on the VFO Assembly. The level at this point should be about 30 mV. If there is a lack of proper signal level, adjust R7 fully in each direction. Normally R7 is set for 35 mV at the collector of Q3. If oscillation does not occur and all dc measurements check out, proceed to step f.

f. Unsolder and remove the lead at the end of C5 not connected to the base of Q1. Use C5 to connect a signal generator, set for 40 mV output at 785 kc/s, to the base of Q1. This will break the feedback path and allow the vfo stages to be checked as amplifiers. Check for the following approximate signal levels to locate the faulty stage: Q1 emitter and base, 40 mV; Q2 emitter, 1 mV; Q2 base, 40 mV; Q2 collector, 1.5 volts; Q3 emitter, 50 mV; Q3 base, 105 mV; Q3 collector, 40 mV; Q4 emitter, 18 mV; Q4 base, 62 mV; Q4 collector, 4 volts.

g. Make any necessary repairs, and perform steps e and c, respectively, after reconnecting C5.

6.14.2 VFO ALIGNMENT PROCEDURE.

a. If the vfo tuning capacitor, C13, is mechanically out of adjustment, loosen the set-screws on the capacitor drive sprocket; and after setting the capacitor to half mesh with the 1 kc/s FREQUENCY KILOCYCLES control set to 0, tighten the set-screws.

b. Connect the low level rf vtvm to the collector of Q4. Push the 1 kc/s FREQUENCY KILOCYCLES control knob in, and set it at 4. Adjust T1 for peak meter reading, using the signal from the 1 KC Oscillator Assembly to tune by.

c. Connect the low level rf vtvm to the end of R11 connected to the collector of Q3. With the 1 kc/s FREQUENCY KILOCYCLES control pulled out and set to 4, set R7 for a 35 mV meter indication.

d. Temporarily disconnect P42 at the 11.6 MC Error Mixer Assembly. Connect an ac vtvm, which has a built-in amplifier, to the end of R19 (11.6 MC Error Mixer Assembly) connected to the emitter of Q4. Connect a frequency counter to the output of the amplifier on the ac vtvm.

e. With the 1 kc/s FREQUENCY KILOCYCLES control pulled out, set it exactly to 0.

Note

A good method of insuring accuracy in setting the control is to rotate it to the desired position while it is pushed in, so that the switch detent can be used, and then pull the knob directly out without rotating it.

f. Adjust C1 for a counter reading of exactly 798.5 kc/s.

g. Set the control to the 9 position.

h. Adjust the fine tuning indicator, L2, for a counter reading of 789.5 kc/s.

Note

The coarse tuning inductor, L1, is a factory adjustment. It should not be tampered with unless sufficient tuning range cannot be obtained with L2.

i. Repeat steps e through h until the vfo tracks at the correct frequencies without retuning.

j. Replace P42, and disconnect the test equipment.

6.15 CRYSTAL OSCILLATORS.

Refer to figures 8.9 through 8.12 for dc test voltages, test point and component locations, and schematic diagrams. Refer to paragraph 6.7.4 for information on front panel removal for access to the oscillators.

6.15.1 CRYSTAL OSCILLATOR TEST PROCEDURES.

Crystal oscillator failures will generally fall into one of three general categories. The first is loss of output on one or more frequencies but not on all frequencies of a particular assembly. This would probably be due to switch contacts, defective crystals, or low gain transistors. The second and third types of failure usually result in no output, and are due to a failure of either the oscillator circuit (Q1 in the MC and 100 KC Oscillators or Q1 and Q2 in the 10 KC and 1 KC Oscillators) or a failure of the buffer circuit (Q2 in the MC in 100 KC Oscillators).

If the oscillator circuit fails, there will be no signal to trace, so the only practical resort is to check dc voltages first to see if a transistor or its biasing circuit components are at fault. If a buffer circuit has failed in the MC or 100 KC Oscillators, you can determine that the oscillator circuit is good by checking the output of that stage with a low level rf vtvm. The output at the collector of Q1 in the MC Oscillator should be about 1 volt. The output at the collector of Q1 in the 100 KC Oscillator should be about 2.4 volt.

Expected output voltages at the two outputs of each of the oscillator assemblies are given in table 6.11. Note that the voltage range is wide, and the output will vary with different crystals.

6.15.2 CRYSTAL OSCILLATOR ALIGNMENT PROCEDURES.

Alignment procedures for the MC and 100 KC Oscillator Assemblies are given in paragraphs 6.15.2.1 and 6.15.2.2. No alignment is necessary for the 10 KC and 1 KC Oscillator Assemblies.

TABLE 6.11 – CRYSTAL OSCILLATOR ASSEMBLIES, EXPECTED OUTPUT LEVELS.

Assembly	Test Point	Expected Output Voltage Range
MC Oscillator	E9	25 – 75 mV
	E11	65 – 135 mV
100 KC Oscillator	E23	80 – 92 mV
	E18	32 – 37 mV
10 KC Oscillator	E30	71 – 82 mV
	E35	5.8 – 7.1 mV
1 KC Oscillator	E42	120 – 135 mV
	E47	52 – 70 mV

6.15.2.1 MC Oscillator Alignment Procedure.

a. Set the transceiver to TUNE ANT, but do not key set.

b. Connect a frequency counter through a .01 uF capacitor to the emitter of Q1 on the Translator Assembly.

c. Adjust C5 on the MC Oscillator Assembly for approximate frequency readings, according to the chart in the schematic diagram, in 1000 kc/s FREQUENCY KILOCYCLES control positions 2 through 7, 10, 12, and 14. The setting of C5 will be a compromise to make all of the frequencies as close as possible, so the process should be repeated, if necessary.

d. With the 1000 kc/s FREQUENCY KILOCYCLES control set to 13, adjust C4 for the proper frequency according to the chart.

e. With the control set to 11, adjust C3 for the proper frequency.

f. With the control set to 9, adjust C2 for the proper frequency.

g. With the control set to 8, adjust C1 for the proper frequency.

h. Remove the frequency counter. Connect a 50 ohm, 100 watt rf dummy load to the ANT connector. Set the transceiver to 13.005 Mc/s and tune the transmitter controls. Then set the mode switch at USB.

i. Connect a heterodyne vtvm, set for 12.741 MC/s, to E158 on RF Amplifier pc board 591-2340. The heterodyne vtvm will indicate the strength of a spurious signal at 12.741 Mc/s when the set is keyed. No modulation is required, since the normal 13.005 Mc/s signal is undesired for this test.

j. With the transceiver keyed, carefully adjust C4 for a null indication on the vtvm at the spurious frequency. Do not turn C4 to a position which gives no indication, since this may stop the oscillation of the crystal. When adjusted properly, a crystal in the RF Amplifier Assembly traps the spurious signal. C4 is adjusted such that the frequency of the spurious signal falls at the trap crystal frequency, and a null occurs. The same process will also be used for nulling three other spurious frequencies.

k. Tune the transceiver for operation on 11.915 Mc/s. Set the mode switch to USB as before and set the heterodyne vtvm for 12.494 Mc/s. Adjust C3 to null this spurious signal.

l. Tune the transceiver for operation on 9.005 Mc/s. Set FUNCTION switch at USB, set the heterodyne vtvm to 8.247 Mc/s, and adjust C2 to null this spurious signal as before.

m. Tune the transceiver for operation on 8.915 Mc/s. Set FUNCTION switch at USB, set the heterodyne vtvm to 9.247 Mc/s, and adjust C1 to null this spurious signal as before.

n. Remove the test equipment.

6.15.2.2 100 KC Oscillator Alignment Procedure.

a. Set the transceiver to receive on usb.

b. Connect a frequency counter through a .01 uF capacitor to E23 on the 100 KC Oscillator Assembly.

c. Adjust C3 to bring the oscillator frequencies on all positions to within 200 cps of the frequencies shown in the schematic diagram for the corresponding dial positions. If all but one crystal oscillates on the correct frequency, the crystal may be faulty.

6.16 ALC ASSEMBLY.

Refer to figure 8.13 for dc test voltages, test point and component locations, and schematic diagram. No alignment is necessary for this assembly. A test procedure follows.

a. Connect a 50 ohm, 100 watt rf dummy load to the ANT connector.

b. Disconnect P11 from the Translator Assembly, and connect an rf signal generator through a .01 uF capacitor to P11. Set the FUNCTION switch at usb.

c. Set the signal generator to 2.5 Mc/s, and set its output level to 100 mV. Key the transceiver, and tune the TUNE and LOAD controls for transmission at 2.5 Mc/s.

CAUTION

During the following steps, do not drive the power amplifier stage to full power for long periods at a time.

d. Connect the dc probe of a general purpose vtvm to pin D of the ALC Assembly plug. Key the transceiver, and check for a reading of approximately +3 volts.

c. With the transceiver keyed, slowly increase the generator output to the point at which the front panel meter no longer rises. The dc voltage at the ALC Assembly should increase from +3 volts to over +5 volts. This is the normal range of the alc control voltage. If the voltage was not close to +3 v, a fault is in the Q2 circuit in the ALC Assembly. If the voltage was close to +3 v but did not increase, a fault is in the Q1 circuit on the ALC Assembly or in the input circuit to the control grid of the power amplifier stage.

6.17 FREQUENCY STANDARD/ TUNING OSCILLATOR ASSEMBLY.

Refer to figure 8.20 for test points, component locations and for schematic diagram.

6.17.1 FREQUENCY STANDARD/TUNING OSCILLATOR ASSEMBLY. TEST PROCEDURE

a. Disconnect P52 from the assembly and connect a coaxial cable terminated with a 1,000 ohm load resistor to J52.

b. Connect the electronic counter across the 1,000 ohm resistor.

c. Energize the test equipment and the transceiver, set FUNCTION switch to USB. Allow 5 minutes for warm-up.

d. Measure the frequency. The electronic counter should indicate 1,000,000 ±0.5 cycles. Disconnect the test equipment and reconnect P52 to J52.

e. Connect the electronic counter to pin E of J53. Set FUNCTION switch at TUNE TX.

f. Measure the frequency. The electronic counter should indicate 300 ±50 cycles.

6.17.2 FREQUENCY STANDARD/TUNING OSCILLATOR ASSEMBLY ALIGNMENT PROCEDURES.

a. Repeat steps 6.17.1a through 6.17.1c.

b. Remove the screw from the frequency standard cover for access to the adjustment screw.

c. Rotate the exposed adjustment screw until the electronic counter indicates 1,000,000 ±0.5 cycles.

d. Disconnect the test equipment, replace the screw, and reconnect P52 to J52.

6.18 SSB FILTER ASSEMBLY ALIGNMENT PROCEDURE.

Refer to figure 8.21 for test points, component locations, and for the schematic diagram.

a. Tag and disconnect P51. Connect a coaxial cable terminated with a 1,000 ohm resistor to J51 on the assembly.

b. Tag and disconnect P50. Connect a coaxial cable terminated with a 1,000 ohm resistor to J50 on the assembly. Solder one lead of a 4,700 ohm resistor to the tie point of the 1,000 ohm resistor and the coaxial cable center conductor connected to J50.

c. Using a T connector, connect the rf output of the rf signal generator to the remaining lead of the 4,700 ohm resistor and to the electronic counter.

d. Set rf signal generator output for cw, 3 volts, at 453.20 kc/s. Check frequency using the electronic counter.

e. Connect the rf probe of the low level rf vtvm across the 1,000 ohm resistor connected to J51.

f. Set FUNCTION switch at USB and adjust C5 and C8 for a maximum indication on the vtvm.

g. Reset rf signal generator for 456.8 kc/s, set FUNCTION switch at LSB. Check frequency with the electronic counter.

h. Adjust C13 and C16 for a maximum indication.

i. Disconnect test equipment and reconnect P51 to J51 and P50 to J50.

6.19 RF AMPLIFIER ASSEMBLY.

The following paragraphs provide the necessary test and alignment procedures and installation instructions to service the RF Amplifier Assembly. Refer to figure 8.23 for test point and component locations and for the schematic diagram.

6.19.1 TEST PROCEDURES

The test procedures are divided into three general tests; the rf agc test, the receive rf gain test, and the transmit rf gain test.

To check the rf agc proceed as follows:

a. Tag and disconnect P20 on the IF Amplifier Assembly. Using a short jumper cable, connect pin D of J56 on the RF Amplifier to ground.

b. Set transceiver FUNCTION switch to USB, do not key transceiver.

c. At the 591-2320 board, terminal E126, measure +1.5 volts using a vtvm. If voltage is absent look for trouble in the 591-2320 and 591-2330 boards. Set FUNCTION switch at OFF. Remove the test equipment and jumper. Reconnect P20 to the IF Amplifier Assembly.

To check the receive rf gain proceed as follows:

a. Tag and disconnect P54 and P55 from the 591-2310 board on the RF Amplifier.

b. Using coaxial cables connect a low level vtvm to J55 and a rf signal generator to J54.

c. Set rf signal generator for a 2.5 Mc/s cw signal at 1.0 mV.

d. Set transceiver FUNCTION switch at USB, set FREQUENCY KILOCYCLES controls to 2.5 Mc/s.

e. Adjust PRESELECTOR control for a maximum indication of the vtvm. The vtvm should indicate a minimum of 54 mV.

f. Repeat step e above using frequencies of 4.0 Mc/s, 7.0 Mc/s, and 12.0 Mc/s for the rf signal generator and for the FREQUENCY KILOCYCLES control. Observe that the peak indication is obtained when the PRESELECTOR is indicating the approximate frequency and that the output indication is above 54 mV for all frequencies. Set FUNCTION switch at OFF and disconnect the test equipment. Reconnect P54 to J54 and P55 to J55.

To check for transmit rf gain proceed as follows:

a. Remove the shield and tag and disconnect P8 on the Translator Assembly. Connect an rf signal generator to J8.

b. Set the rf signal generator for a 2.5 Mc/s am. signal at 8 mV at 80%.

c. Connect an ac probe of a vtvm to E1702 on the Transmit Power Amplifier Assembly. Connect a 50 ohm, 100 watt dummy load to ANT connector.

d. Set transceiver FREQUENCY KILOCYCLES control for 2.5 Mc/s and the FUNCTION switch at USB.

e. Key transceiver and peak output on vtvm with PRESELECTOR control. The vtvm should indicate a minimum of 40 volts.

f. Repeat steps d and e above using frequencies of 4.0 Mc/s, 7.0 Mc/s, and 12.0 Mc/s for the rf signal generator and for the FREQUENCY KILOCYCLES controls. Observe that the peak indication is obtained when the PRESELECTOR control is indicating the approximate frequency and that the output indication is above 40 volts for all frequencies.

g. Set FUNCTION switch at OFF. Disconnect the test equipment and reconnect P8 to J8 on the Translator Assembly.

6.19.2 ALIGNMENT

To align the RF Amplifier proceed as follows:

a. Refer to paragraph 6.19.3 and remove the assembly from the chassis.

b. Solder a 30 pF capacitor across terminals E113 and E112 on the 591-2310 board.

c. Solder a 30 pF capacitor across terminals E147 and E124 on the 591-2350 board.

d. Connect the rf probe of a vtvm to E147 on the 591-2350 board, conneet ground lead to E124. Set vtvm for 100 volt ac range.

e. Connect output of an rf signal generator to E184 on the 591-2350 board, ground to E185.

f. Set rf signal generator to 5.5 Mc/s. Select internal 1000 cps modulation at 80%. Set rf output at 0.03 volts.

g. Connect the following voltages to J56 on the assembly.

1. -130 volts at 10 mA to pin A.

2. +12 volts at 100 mA to pin B.

3. +12 volts at 75 mA to pin C.

4. Ground pin D and pin E.

5. +6 volts at 650 mA to pin F.

6. +275 volts at 50 mA to pin G.

Note

Connect the ground leads of the various power supplies to pin E.

h. Set preselector shaft to fully clockwise limit. Adjust each slug for maximum insertion in the coil.

i. Refer to figure 6.21 and adjust all trimmer capacitor on the 591-2310 through 591-2350 boards to mid range.

FIGURE 6.21 - VARIABLE CAPACITORS SHOWN AT MAXIMUM CAPACITANCE SETTINGS

j. Energize the test equipment and power supplies. Adjust the preselector shaft for a maximum indication on the vtvm. Adjust each slug for a peak output on the vtvm.

k. Disconnect the power supplies from J56. Leaving the rf signal generator and vtvm leads connected reinstall the assembly into the chassis, refer to paragraph 6.19.4. Connect P56 to J56, do not reconnect the coaxial cables to the RF Amplifier.

l. Reconnect the rf signal generator and vtvm. Set transceiver FUNCTION switch at USB. Set rf signal generator at 2.9 Mc/s, set FREQUENCY KILOCYCLES controls to 2.0 Mc/s.

m. Key the transceiver and peak the output using the PRESELECTOR control. Adjust C1, C2, C3, and C4 on the 591-2350 board for a maximum indication. Unkey trans-ceiver.

n. Set rf signal generator at 4.8 Mc/s. Set FREQUENCY KILOCYCLES controls at 4.0 Mc/s. Key transceiver and peak the output using the PRESELECTOR control. Adjust C7 on 591-2310 board, C13 on 151-2320 board, C13 on 591-2330 board, and C11 on 591-2340 board for a maximum indication.

o. Set rf signal generator at 8.5 Mc/s. Set FREQUENCY KILOCYCLES controls at 8.0 Mc/s. Key transceiver and peak the output using the PRESELECTOR control. Adjust C1 on the 591-2310 board, C6 on the 591-2320 board, C5 on the 591-2330 board, and C2 on the 591-2340 board for a maximum indication. Unkey the transceiver.

p. Set rf signal generator at 14.9 Mc/s. Set FREQUENCY KILOCYCLES controls at 14.0 Mc/s. Key the transceiver and peak the output using the PRESELECTOR control. Adjust C3 on the 591-2310 board, C8 on the 591-2320 board, C7 on the 591-2330 board, and C4 on the 591-2340 board for a maximum indication.

q. Set FUNCTION switch at OFF. Refer to paragraph 6.19.3, and remove the assembly from the chassis. Disconnect the test equipment and unsolder the capacitors installed in steps b and c above. Refer to paragraph 6.19.4 and reinstall the assembly into the chassis. Perform the test procedures outlined in paragraph 6.19.1.

Note

If the agc voltage is not correct at E126 adjust R10 on the 591-2320 board for the correct value, +1.5 volts.

6.19.3 REMOVAL.

To remove the RF Amplifier from the transceiver proceed as follows:

a. Set FREQUENCY KILOCYCLES 1000 kc/s controls at 11. Loosen the setscrew on the shaft coupler on the RF Amplifier Assembly. Set the control at 14 and loosen the other setscrew.

b. Slide the shaft in the RF Amplifier toward the rear of the transceiver.

c. Rotate the PRESELECTOR control for access to the coupler setscrews. Loosen the setscrews and disconnect the shaft from the RF Amplifier Assembly.

d. Tag and disconnect coaxial cables P54 and P55 on the assembly, and P58 on the partition between the RF Amplifier and the Transmit Power Amplifier.

e. Unplug P56 from the assembly.

f. Loosen and remove the three screws on the rear panel securing the assembly to the chassis.

g. Refer to figure 6.1, loosen and remove the two screws adjacent to the preselector shaft and load capacitor.

h. Slide the assembly from the chassis.

6.19.4 INSTALLATION.

To install the RF Amplifier Assembly proceed as follows.

a. Rotate the Mc/s switch shaft to the 14 Mc/s position.

Note

The 14 Mc/s shaft position can be identified by either of two ways. (1) The rotating switch contact on the last wafer, located on the 591-2310 board, will be adjacent to the wiper contact when set at 14 Mc/s. (2) Or the round key hole in the rotating section of the switch, adjacent to one of the shafts flat sides, will be toward the trimmer capacitors on the top of the board when set at 14 Mc/s.

b. Slide the assembly into the chassis and secure with the screws removed in steps 6.19.3 f and 6.19.3 g.

c. Set the FREQUENCY KILOCYCLES 1000 kc/s control at 14. Slide the switch shaft in the RF Amplifier into the flexable coupler. Secure the setscrew. Rotate the 1000 kc/s control to 11 and secure the remaining setscrew.

d. Set the PRESELECTOR control to the line on the high frequency end of the 14 Mc/s band.

e. Adjust the preselector shaft on the RF Amplifier so that the slugs are at the limit of travel, minimum inductance.

f. Reconnect the preselector shaft and secure the set screws. Rotate the PRESELECTOR to the full clockwise limit. Observe that the slugs are at maximum insertion and that the PRESELECTOR control is below the low frequency end of the 2Mc/s band.

g. Reconnect the cables removed in step 6.19.3 d and 6.19.3 e.

CHAPTER 7
PARTS LISTS

RF-301P SSB TRANSCEIVER

REF DESIG	DESCRIPTION	RF P/N
	MAIN FRAME ASSEMBLY	
C2	Capacitor, variable 15-465 pF	C-6225
C3	Capacitor, dipped-mica 680 pF, 500 VDCW, 5%	C-0148
C4	Same as C2	C-6225
C5	Capacitor, ceramic .01 uF, 1600 VDCW	C-0010
C6, C7	Capacitor, ceramic 36 pF, 1000 VDCW, 5%	C-0637
C8	Capacitor, variable 17.5-327 pF	C-6227
C9/C12	Capacitor, electrolytic 150 uF, 15 VDCW	C-5849
C13	Capacitor, variable 1.8-15 pF	C-4064
C15	Capacitor, ceramic .01 uF, 150 VDCW	C-0065
C21	Capacitor, ceramic .1 uF, 25 VDCW	C-2210
C22/C24	Same as C15	C-0065
C25	Capacitor, electrolytic 15 uF, 20 VDCW	C-5832
CR1/CR3	Diode, silicon type 1N4001	CR-0043
CR4	Diode, zener type 1N3315	CR-0684
F1	Fuse, slo-blo 10 amp, 32 V	F-0037
J1	Connector, RF, type BNC	J-0001
J2	Connector, 7 pin	J-0400
J3	Connector, 6 pin	P-0540
J18	Connector, 6 pin	591-0859
J23	Connector, 23 pin	J-0340
J40	Connector, 5 pin	591-0860
J48	Socket, relay	J-0801
J58	Connector, coax	J-0033
K1, K2	Relay, 4PDT, 12V	K-0041
L1	Choke, RF, 1.5 MH	L-0031
L2	Inductor	L-0602
M1	Ammeter, sealed, self-luminous	M-0015
P7/P15	Connector, coax, minature	P-0032
P17	Same as P7	P-0032
P20	Connector, 7 pin	591-0858
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
P22	Same as P7	P-0032
P24, P25	Same as P7	P-0032
P33/P36	Same as P7	P-0032
P42, P43	Same as P7	P-0032
P49	Connector, 3 pin	591-0870
P50/P52	Same as P7	P-0032
P53	Connector, 6 pin	591-0861
P54/P55	Same as P7	P-0032
P56	Connector, 7 pin	591-2362
R1	Resistor, composition 33 ohms, 1/4 W, 5%	R1213
R2	Resistor, composition 4.7K, 1/4W, 10%	R-0032
R3	Resistor, composition 24K, 1/4W, 5%	R-1282
R5	Resistor, variable 1K, 2W	R-3172
S4	Switch, rotary	591-1711
S5	Switch, rotary	591-0096
S6	Switch, sensitive	S-0080
S7	Switch, push	S-0280
T1	Transformer, DC to DC converter	T-0178
XF1	Fuseholder	X-1016
	DIVIDER AND SPECTRUM GENERATOR ASSEMBLY	162-0300
C2	Capacitor, dipped-mica, 75 pF, 500 VDCW, 5%	C-0123
C3	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C4, C5	Same as C2	C-0123
C6	Capacitor, tantalum, 15 uF, 20 VDCW, 20%	C-5832
C7	Capacitor, dipped-mica, 5 pF, 500 VDCW, 5%	C-0103
C8	Capacitor, dipped-mica, 20 pF, 500 VDCW, 5%	C-0108
C9	Capacitor, polystyrene, .0022 uF, 100 VDCW	C-2700
C10	Same as C2	C-0123
C11	Same as C3	C-2210
C12, C13	Same as C2	C-0123
C14	Same as C6	C-5832
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
C15	Same as C7	C-0103
C16	Same as C8	C-0108
C17	Capacitor, polystyrene, .022 uF, 100 VDCW	C-2701
C18	Same as C2	C-0123
C19	Same as C3	C-2210
C20, C21	Same as C2	C-0123
C22	Same as C6	C-5832
C23	Capacitor, dipped-mica, 10 pF, 500 VDCW, 5%	C-0104
C24	Same as C8	C-0108
C25	Capacitor, polystyrene, .33 uF, 100 VDCW	C-2702
C26	Capacitor, dipped-mica, 68 pF, 500 VDCW, 5%	C-0122
C27, C28	Capacitor, ceramic, .05 uF, 30 VDCW	C-0060
C29	Capacitor, dipped-mica, 56 pF, 500 VDCW, 5%	C-0120
C30	Capacitor, dipped-mica, 300 pF, 500 VDCW, 5%	C-0139
C31	Capacitor, film, .22 uF, 100 VDCW, 20%	C-2350
C32	Same as C27	C-0060
C33	Capacitor, dipped-mica, 820 pF, 300 VDCW, 2%	C-2503
C34	Capacitor, ceramic, 68 pF, N-220, 150 VDCW	C-2301
C35	Same as C27	C-0060
C36	Capacitor, ceramic, 330 pF, 2%, N-080, 150 VDCW	C-2804
C37	Capacitor, dipped-mica, 100 pF, 500 VDCW, 5%	C-0126
C38	Capacitor, ceramic, 120 pF, N-080	C-2802
C39	Same as C3	C-2210
C41	Same as C33	C-2503
C42	Same as C3	C-2210
C43	Capacitor, dipped-mica, 220 pF, 500 VDCW, 5%	C-0134
C44	Capacitor, dipped-mica, 82 pF, 500 VDCW, 5%	C-0124
C45	Same as C3	C-2210
C46	Same as C3	C-2210
C47	Same as C33	C-2503
CR1	Diode, zener, type UZ709	CR-0048
CR2	Diode, silicon, type 1N816	CR-0050
CR3/CR11	Diode, germanium, type 1N270	CR-0047
CR12/CR15	Same as CR2	CR-0050
CR16	Same as CR3	CR-0047
J43	Connector, receptacle, coax	J-0031
L1/L4	Inductor, 1 MH	L-0050
L5	Inductor, .47 uH	L-0028
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
L6	Inductor, .22 uH	L-0029
L7	Inductor, .15 uH	L-0074
Q1/Q3	Transistor, type 2N3638A	Q-0319
Q4	Transistor, type 2N706	Q-0107
Q5/Q7	Transistor, type 2N1301	Q-0109
Q8	Same as Q4	Q-0107
Q9/Q11	Same as Q5	Q-0109
Q12	Same as Q4	Q-0107
Q13	Same as Q5	Q-0109
Q14	Same as Q4	Q-0107
Q15	Same as Q5	Q-0109
Q16/Q19	Transistor, type 2N2084	Q-0105
Q20	Same as Q4	Q-0107
R1	Resistor, composition, 33 ohms, 1W, 5%	R-1613
R2	Resistor, composition, 4.7K, 1/2W, 10%	R-0132
R3	Resistor, composition, 10K, 1/2W, 10%	R-0136
R4	Resistor, composition, 6.8K, 1/2W, 10%	R-0134
R5	Resistor, composition, 1.8K, 1/2W, 10%	R-0127
R6, R7	Same as R3	R-0136
R8	Resistor, composition, 330 ohms, 1/2W, 10%	R-0118
R9	Same as R4	R-0134
R10	Same as R5	R-0127
R11	Potentiometer, 10K, 1/2W, 10%	R-3104
R12	Same as R3	R-0136
R13	Resistor, composition, 180 ohms, 1/2W, 10%	R-0115
R14	Resistor, composition, 220 ohms, 1/2W, 10%	R-0116
R15	Same as R3	R-0136
R16	Resistor, composition, 1.2K, 1/2W, 10%	R-0125
R17	Same as R3	R-0136
R18	Same as R4	R-0134
R19	Same as R5	R-0127
R20, R21	Same as R3	R-0136
R22	Same as R4	R-0134
R23	Same as R5	R-0127
R24	Same as R11	R-3104
R25	Same as R3	R-0136
R26	Resistor, composition, 560 ohms, 1/2W, 10%	R-0121
R27	Same as R14	R-0116
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
R28	Same as R3	R-0136
R29	Same as R5	R-0127
R30	Same as R3	R-0136
R31	Same as R4	R-0134
R32	Same as R3	R-0136
R33	Same as R5	R-0127
R34	Same as R3	R-0136
R35	Same as R5	R-0127
R36	Same as R14	R-0116
R37	Same as R4	R-0134
R38	Same as R11	R-3104
R39	Resistor, composition, 2.7K, 1/2W, 10%	R-0129
R40	Same as R3	R-0136
R41	Resistor, composition, 1K, 1/2W, 10%	R-0124
R42	Same as R26	R-0121
R43	Same as R3	R-0136
R44	Resistor, composition, 56 ohms, 1/2W, 10%	R-0109
R45	Resistor, composition, 82 ohms, 1/2W, 10%	R-0111
R46	Same as R2	R-0132
R47	Resistor, composition, 5.6K, 1/2W, 10%	R-0133
R48	Resistor, composition, 3.3K, 1/2W, 10%	R-0130
R49	Resistor, composition, 8.2K, 1/2W, 10%	R-0135
R50	Same as R5	R-0127
R51	Same as R3	R-0136
R53	Same as R48	R-0130
R54	Resistor, composition, 680 ohms, 1/2W, 10%	R-0122
R55, R56	Resistor, composition, 15K, 1/2W, 10%	R-0138
R57	Same as R16	R-0125
R58	Same as R48	R-0130
R59, R60	Resistor, composition, 22 ohms, 1/2W, 10%	R-0104
R61	Resistor, composition, 39 ohms, 1/2W, 10%	R-0107
R62	Resistor, composition, 4.7 ohms, 1/2W, 10%	R-0177
R63, R64	Resistor, composition, 100 ohms, 1/2W, 10%	R-0112
R66	Potentiometer, 500 ohms, 1W, 10%	R-3361
R67	Resistor, composition, 5.6 ohms, 1/2W, 5%	R-0881
R68	Same as R47	R-0133
R69	Same as R47	R-0133
R70	Resistor, composition, 1.5K, 1/2W, 10%	R-0126
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
R71	Resistor, composition, 2.2K, 1/2W, 10%	R-0128
R72	Same as R41	R-0124
T2	Transformer	162-0156
T3, T4	Transformer	162-0157
	11.6 MC ERROR MIXER ASSEMBLY	162-0400
C1, C2	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C3	Capacitor, ceramic, .005, 100 VDCW	C-2220
C4	Capacitor, dipped-mica, 200 pF, 500 VDCW, 5%	C-0133
C5	Capacitor, variable, 7-25 pF	C-2304
C6	Same as C1	C-2210
C7	Capacitor, dipped-mica, 130 pF, 500 VDCW, 5%	C-0129
C8	Same as C5	C-2304
C9	Capacitor, dipped-mica, 100 pF, 500 VDCW, 5%	C-2479
C10/C15	Same as C1	C-2210
C16	Same as C5	C-2304
C17	Capacitor, tantalum, 15 uF, 20 VDCW	C-5832
C18, C19	Same as C1	C-2210
C20	Capacitor, variable, 2.5-11 pF	C-2303
C21	Same as C1	C-2210
C22	Same as C5	C-2304
C23	Same as C7	C-0127
C24	Same as C1	C-2210
C25	Capacitor, dipped-mica, 39 pF, 500 VDCW, 2%	C-2468
C26/C30	Same as C1	C-2210
C31	Same as C5	C-2304
C32	Same as C7	C-0129
C33	Same as C5	C-2304
C34	Same as C20	C-2303
C35	Same as C7	C-0129
C36	Same as C5	C-2304
C37/C45	Same as C1	C-2210
C46, C47	Capacitor, dipped-mica, 20 pF, 500 VDCW, 5%	C-0108
CR1/CR4	Diode, germanium, 1N270	CR-0047
FL1	Filter, 7.7 MC/S	FL-0102
FL2	Filter, 2.5 MC/S	FL-0100
FL3	Filter, 11.6 MC/S	FL-0105
FL4	Filter, 21.0 MC/S	FL-0101
FL5	Filter, 14.2 MC/S	FL-0107
J33/J36	Connector, receptacle, coax	J-0031
J42	Same as J33	J-0031
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
J46	Coax cable assembly	162-0315
L1/L7	Inductor, 240 uH	L-0052
L8	Inductor, .15 uH	L-0074
P9	Coax cable assembly	162-0314
Q1/Q7	Transistor, type 2N2084	Q-0105
Q8, Q9	Transistor, type 2N2996	Q-0103
R1	Resistor, composition, 10K, 1/4W, 10%	R-0036
R2	Resistor, composition, 15K, 1/4W, 10%	R-0038
R3	Resistor, composition, 1.2K, 1/4W, 10%	R-0025
R4	Resistor, composition, 100 ohms, 1/4W, 10%	R-0012
R5	Resistor, composition, 33 ohms, 1/4W, 10%	R-0006
R6	Resistor, composition, 3.3K, 1/4W, 10%	R-0030
R7	Same as R2	R-0038
R8	Same as R3	R-0025
R9	Resistor, composition, 15 ohms, 1/4W, 10%	R-0002
R10	Same as R1	R-0036
R11	Resistor, composition, 1K, 1/4W, 10%	R-0024
R12	Same as R6	R-0030
R13	Same as R2	R-0038
R14, R15	Resistor, composition, 2.2K, 1/4W, 10%	R-0028
R16	Same as R6	R-0030
R17	Same as R2	R-0038
R18	Same as R3	R-0025
R19	Resistor, composition, 47 ohms, 1/4W, 10%	R-0008
R20	Same as R1	R-0036
R21	Same as R3	R-0025
R22	Same as R6	R-0030
R23	Same as R2	R-0038
R24	Same as R3	R-0025
R25	Same as R1	R-0036
R26	Same as R2	R-0038
R27	Same as R3	R-0025
R28	Same as R4	R-0012
R29	Same as R5	R-0006
R30	Same as R6	R-0030
R31	Same as R2	R-0038
R32	Same as R3	R-0025
R33	Resistor, composition, 22K, 1/4W, 10%	R-0040
R34	Resistor, composition, 220 ohms, 1/4W, 10%	R-0016
R35	Same as R6	R-0030
R36	Same as R2	R-0038
R37	Same as R6	R-0030
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
R38	Same as R2	R-0038
R39	Resistor, composition, 1.5K, 1/4W, 10%	R-0026
R40	Same as R1	R-0036
R41	Same as R11	R-0024
R42	Same as R2	R-0038
R43	Same as R4	R-0012
T1, T2	Transformer	162-0159
	455 KC ERROR MIXER ASSEMBLY	162-0500
C1	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C2	Capacitor, .0047 uF, 100 VDCW	C-2108
C3	Capacitor, variable, 7-25 pF	C-2304
C4	Same as C1	C-2210
C5	Capacitor, dipped-mica, 120 pF, 500 VDCW, 5%	C-0128
C7	Capacitor, dipped-mica, 620 pF, 300 VDCW, 5%	C-2500
C8, C9	Same as C1	C-2210
C10	Capacitor, mylar, .015 uF, 100 VDCW	C-2114
C11	Same as C3	C-2304
C12, C13	Same as C1	C-2210
C14	Same as C5	C-0128
C15	Capacitor, dipped-mica, 27 pF, 500 VDCW, 5%	C-0111
C16	Same as C1	C-2210
C17, C18	Capacitor, dipped-mica, 180 pF, 500 VDCW, 5%	C-0132
C19, C20	Same as C1	C-2210
C21	Capacitor, dipped-mica, 820 pF, 300 VDCW, 2%	C-2503
C22	Capacitor, dipped-mica, 270 pF, 500 VDCW, 5%	C-0137
C23, C24	Same as C1	C-2210
C25, C26	Same as C3	C-2304
C27, C28	Same as C1	C-2210
C29	Capacitor, dipped-mica, 100 pF, 5%, 500 VDCW	C-0126
C30	Capacitor, dipped-mica, 1200 pF, 500 VDCW, 5%	C-3401
C31	Capacitor, dipped-mica, 240 pF, 500 VDCW, 5%	C-2488
C33	Same as C21	C-2503
C34	Same as C1	C-2210
C35	Capacitor, tantalum, 15 uF, 20 VDCW	C-5832
C36, C37	Same as C1	C-2210
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
CR1/CR3	Diode, germanium, type 1N270	CR-0047
CR4/CR7	Diode, silicon, type 1N3064	CR-0070
CR8	Same as CR1	CR-0047
CR9	Diode, zener, type UZ709	CR-0048
FL1	Filter, 646.5 KC/S	FL-0104
FL2	Filter, 1.1015 MC/S	FL-0103
FL3	Filter, 455 KC/S	FL-0109
J12/J17	Connector, receptacle, coax	J-0031
L2	Inductor, 1 MH	L-0050
Q1/Q3	Transistor, type 2N2084	Q-0105
Q4, Q5	Transistor, type 2N3638	Q-0306
Q6	Same as Q1	Q-0105
Q7	Transistor, type 2N1224	Q-0108
R1	Resistor, composition, 3.3K, 1/4W, 10%	R-0030
R2	Resistor, composition, 10K, 1/4W, 10%	R-0036
R3	Resistor, composition, 1.5K, 1/4W, 10%	R-0026
R4	Same as R2	R-0036
R5	Resistor, composition, 680 ohms, 1/4W, 10%	R-0022
R6	Same as R1	R-0030
R7	Same as R2	R-0036
R8	Same as R3	R-0026
R9	Resistor, composition, 5.6K, 1/4W, 10%	R-0033
R10	Same as R1	R-0030
R11	Same as R2	R-0036
R12	Same as R3	R-0026
R14	Same as R2	R-0036
R15	Resistor, composition, 820 ohms, 1/4W, 10%	R-0023
R16	Same as R1	R-0030
R17	Same as R2	R-0036
R18	Same as R3	R-0026
R19	Resistor, composition, 6.8K, 1/4W, 10%	R-0034
R20	Same as R1	R-0030
R21	Same as R5	R-0022
R22	Same as R2	R-0036
R23	Same as R3	R-0026
R24	Resistor, composition, 8.2K, 1/4W, 10%	R-0035
R25, R26	Same as R19	R-0034
R27	Same as R1	R-0030
R28	Same as R19	R-0034
R29	Resistor, composition, 470 ohms, 1/4W, 10%	R-0020
R30	Resistor, composition, 22K, 1/4W, 10%	R-0040
R31	Same as R5	R-0022
R32	Same as R1	R-0030
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
R33	Resistor, composition, 15K, 1/4W, 5%	R-1277
R34	Resistor, composition, 2.4K, 1/4W, 5%	R-1258
R36	Same as R1	R-0030
R37	Resistor, composition, 15K, 1/4W, 10%	R-0038
R38	Same as R3	R-0026
R39	Resistor, composition, 1.6K, 1/4W, 5%	R-1254
R40	Resistor, composition, 56 ohms, 1W, 10%	R-0209
T1	Transformer	162-0158
T2, T3	Transformer	162-0162
T4	Same as T1	162-0158
Y1	Crystal, 1.1015 MC/S	Y-0610
	TRANSLATOR ASSEMBLY	162-0600
C1	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C2	Capacitor, variable, 7-25 pF	C-2304
C3	Same as C1	C-2210
C4	Capacitor, tantalum, 15 uF, 20 VDCW	C-5832
C5/C9	Same as C1	C-2210
C10	Capacitor, variable, 2.5-11 pF	C-2303
C11, C12	Same as C1	C-2210
C13	Same as C10	C-2303
C14/C16	Same as C1	C-2210
C17	Same as C4	C-5832
C18	Same as C1	C-2210
C19	Same as C2	C-2304
C20	Same as C10	C-2303
C21	Same as C1	C-2210
C22	Same as C10	C-2303
C23, C24	Same as C1	C-2210
C25	Same as C4	C-5832
C26	Same as C1	C-2210
C27	Same as C2	C-2304
C28	Capacitor, dipped-mica, 820 pF, 300 VDCW, 2%	C-2503
C29, C30	Same as C1	C-2210
CR1/CR16	Diode, germanium, type 1N270	CR-0047
FL1	Filter, 17.748 MC/S	FL-0108
FL2	Filter, 11.1515 MC/S	FL-0106
J7/J11	Connector, receptacle,	J-0031
L1	Inductor, 240 uH	L-0052
L2	Inductor, 390 uH	L-0075
L3/L6	Same as L1	L-0052
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
Q1/Q3	Transistor, type 2N2996	Q-0103
R1	Resistor, composition, 2.7K, 1/4W, 10%	R-0029
R2	Resistor, composition, 2.2K, 1/4W, 10%	R-0028
R3	Resistor, composition, 47 ohms, 1/4W, 10%	R-0008
R4	Same as R2	R-0028
R5	Resistor, composition, 390 ohms, 1/4W, 10%	R-0019
R6	Same as R2	R-0028
R7	Same as R5	R-0019
R8	Same as R1	R-0029
R9	Same as R2	R-0028
R10	Same as R3	R-0008
R11	Resistor, composition, 1.5K, 1/4W, 10%	R-0026
R12	Resistor, composition, 1.8K, 1/4W, 10%	R-0027
R13	Same as R1	R-0029
R14	Same as R2	R-0028
R15	Same as R3	R-0008
R16, R17	Resistor, composition, 1.2K, 1/4W, 10%	R-0025
R18	Resistor, composition, 15K, 1/4W, 10%	R-0038
R19	Resistor, composition, 10K, 1/4W, 10%	R-0036
R20	Same as R5	R-0019
T1	Transformer	162-0162
Y1	Crystal, 18.441 MC/S	Y-0641
	IF AMPLIFIER ASSEMBLY	162-0700
C1	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C2	Capacitor, tantalum, 15 uF, 20 VDCW	C-5832
C3	Same as C1	C-2210
C4	Capacitor, dipped-mica, 820 pF, 300 VDCW, 2%	C-2503
C5/C7	Same as C1	C-2210
C8	Same as C4	C-2503
C9/C11	Same as C1	C-2210
C12	Same as C4	C-2503
C13/C14	Same as C1	C-2210
C15	Same as C4	C-2503
C16/C22	Same as C1	C-2210
C23	Same as C4	C-2503
C24/C26	Same as C1	C-2210
C27	Same as C4	C-2503
C28	Same as C1	C-2210
C29	Same as C2	C-5832
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
C30, C31	Same as C1	C-2210
C32	Same as C4	C-2503
C33	Same as C2	C-5832
C34	Capacitor, tantalum, 220 uF, 10 VDCW	C-5850
C35	Same as C2	C-5832
C38/C38	Same as C1	C-2210
C39	Same as C2	C-5832
C40, C41	Same as C1	C-2210
CR1/CR7	Diode, germanium, type 1N270	CR-0047
J22	Connector, receptacle, coax	J-0031
K1	Relay, SPDT, 12 VDC	K-0045
L1/L3	Inductor, 1 MH	L-0050
L4, L5	Induetor, 240 uH	L-0052
Q1/Q3	Transistor, type 2N1224	Q-0108
Q4, Q5	Transistor, type 2N2084	Q-0105
Q6	Same as Q1	Q-0108
Q7, Q8	Same as Q4	Q-0105
Q9	Transistor, type 2N3642	Q-0320
Q10	Transistor, type 2N1479	Q-0106
R1	Resistor, composition, 10K, 1/4W, 5%	R-1273
R2	Resistor, composition, 8.2K, 1/4W, 5%	R-1271
R3	Resistor, composition, 6.8K, 1/4W, 5%	R-1269
R4	Resistor, composition, 820 ohms, 1/4W, 10%	R-0023
R5	Resistor, composition, 470 ohms, 1/4W, 10%	R-0020
R6	Same as R1	R-1273
R7	Resistor, composition, 15K, 1/4W, 5%	R-1277
R8	Same as R4	R-0023
R9	Resistor, composition, 220 ohms, 1/4W, 10%	R-0016
R10, R11	Same as R1	R-1273
R12, R13	Same as R4	R-0023
R14	Resistor, composition, 130 ohms, 1/4W, 5%	R-1228
R15	Resistor, composition, 470 ohms, 1/4W, 5%	R-1241
R16	Resistor, composition, selected in test, 1/4W, 10%	
R17	Resistor, composition, 3.3K, 1/4W, 10%	R-0030
R18	Resistor, composition, 2.7K, 1/4W, 10%	R-0029
R19	Resistor, composition, 1.2K, 1/4W, 10%	R-0025
R20	Resistor, composition, 390 ohms, 1/4W, 5%	R-1239
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
R21	Resistor, composition, 10 MEG, 1/4W, 10%	R-0072
R22	Same as R2	R-1271
R23	Resistor, composition, 1.5K, 1/4W, 10%	R-0023
R24	Resistor, composition, 10 ohms, 1/4W, 10%	R-0000
R25	Same as R17	R-0030
R26	Same as R18	R-0029
R27	Same as R19	R-0025
R28	Resistor, composition, 4.7K, 1/4W, 10%	R-0032
R29	Resistor, composition, 6.8K, 1/4W, 10%	R-0034
R30	Resistor, composition, 270 ohms, 1/4W, 5%	R-1235
R31, R32	Resistor, composition, 820 ohms, 1/4W, 5%	R-1247
R33	Same as R1	R-1273
R34	Resistor, composition, 4.7K, 1/4W, 5%	R-1265
R35	Potentiometer, 10K, 1W,	R-3104
R36, R37	Same as R17	R-0030
R38	Resistor, composition, 68 ohms, 1/4W, 5%	R-1221
R39	Potentiometer, 500 ohms, 1W	R-3100
R40	Same as R17	R-0030
R41	Resistor, composition, 15K, 1/4W, 10%	R-0038
R42	Same as R23	R-0026
R43	Resistor, composition, 1K, 1/4W, 10%	R-0024
R44	Resistor, composition, 10K, 1/4W, 10%	R-0036
R45	Same as R43	R-0024
R46	Resistor, composition, 150 ohms, 1/4W, 10%	R-0014
R47	Same as R44	R-0036
R48	Same as R46	R-0014
R49	Same as R9	R-0016
R50	Resistor, composition, 47K, 1/4W, 10%	R-0044
R51	Resistor, composition, 390 ohms, 1/4W, 10%	R-0019
T1/T7	Coil Assembly	162-0162
	AUDIO/MODULATOR ASSEMBLY	162-0800
C19, C20	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C21	Capacitor, dipped-mica, 880 pF, 300 VDCW, 2%	C-2501
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
C22	Same as C19	C-2210
C23	Capacitor, tantalum, 15 uF, 20 VDCW	C-5832
C24	Capacitor, tantalum, 33 uF, 20 VDCW	C-5839
C25, C26	Same as C23	C-5832
C27/C29	Capacitor, mylar, 4700 pF, 100 VDCW, 10%	C-2108
C30	Same as C23	C-5832
C31	Same as C24	C-5839
C32/C35	Same as C23	C-5832
C36	Capacitor, ceramic, .02 uF, 30 VDCW	C-0059
C37	Same as C23	C-5832
C39	Capacitor, tantalum, 68 uF, 15 VDCW	C-5844
C41	Capacitor, dipped-mica, 820 pF, 300 VDCW, 2%	C-2503
C42	Same as C19	C-2210
C44	Capacitor, .01 uF, 500 VDCW	C-0003
C45	Capacitor, ceramic, .01 uF, 150 VDCW	C-0065
C50	Same as C19	C-2210
C51	Capacitor, .22 uF, 50 VDCW	C-2601
C52	Same as C19	C-2210
C53	Capacitor, ceramic, 0.47 uF, 10 VDCW	C-0058
C56	Same as C44	C-0003
C57	Capacitor, .01 uF, 75 VDCW	C-4300
C58	Capacitor, variable, 1-38 pF	C-2563
C59	Capacitor, 75 pF, 2%	C-2476
C60	Capacitor, 120 pF, 2%	C-2481
C61/C64	Same as C41	C-2503
C65	Same as C51	C-2601
C66	Same as C19	C-2210
C67	Same as C41	C-2503
C68	Same as C19	C-2210
C69	Same as C45	C-0065
CR2/CR5	Diode, germanium, type 1N270	CR-0047
CR6	Diode, silicon, type 1N3064	CR-0070
CR7, CR8	Same as CR2	CR-0047
CR9	Diode, zener, type UZ709	CR-0048
CR10/CR14	Same as CR6	CR-0070
J24, J25	Connector, receptable	J-0031
L2	Choke, RF, 1 MH	L-0050
L4	Inductor, transformer	162-0165
P23	Connector, right-angle, multi-pin	P-0340
Q3	Transistor, type 2N2084	Q-0105
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
Q4	Transistor, type 2N652	Q-0020
Q5	Transistor, type 2N3638A	Q-0319
Q6/Q8	Same as Q4	Q-0020
Q9, Q10	Transistor, type 2N3638	Q-0306
R1	Resistor, composition, 1K, 1/4W, 10%	R-0024
R17	Resistor, composition, 3.3K, 1/4W, 10%	R-0030
R18, R19	Resistor, composition, 1.5K, 1/4W, 10%	R-0026
R20	Resistor, composition, 6.8K, 1/4W, 10%	R-0034
R21	Resistor, composition, 2.2K, 1/4W, 10%	R-0028
R22	Same as R17	R-0030
R23	Resistor, composition, 820 ohms, 1/4W, 10%	R-0023
R24	Same as R18	R-0026
R25	Resistor, composition, 15K, 1/4W, 10%	R-0038
R26	Resistor, composition, 560 ohms, 1/4W, 10%	R-0021
R27	Resistor, composition, 33 ohms, 1/4W, 10%	R-0006
R28, R29	Same as R25	R-0038
R30	Thermister, 1K at 25°C	R-3167
R31	Same as R25	R-0038
R32	Resistor, composition, 56K, 1/4W, 10%	R-0045
R33	Resistor, composition, 2.7K, 1/4W, 10%	R-0029
R34	Same as R20	R-0034
R35	Resistor, composition, 1.8K, 1/4W, 10%	R-0027
R36	Resistor, composition, 5.6K, 1/4W, 10%	R-0033
R37	Same as R17	R-0030
R38	Resistor, composition, 8.2K, 1/4W, 10%	R-0035
R39	Same as R21	R-0028
R40	Same as R27	R-0006
R41	Same as R26	R-0021
R42	Resistor, composition, 3.3K, 1/4W, 5%	R-1261
R43	Same as R26	R-0021
R44	Same as R35	R-0027
R45	Resistor, composition, 22K, 1/4W, 10%	R-0040
R46	Same as R27	R-0006
R47	Resistor, composition, 33 ohms, 1W, 5%	R-1613
R48	Same as R17	R-0030
R50	Same as R33	R-0029
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
R51	Resistor, composition, 3.9K, 1/4W, 10%	R-0031
R52	Resistor, composition, 15 ohms, 1/4W, 10%	R-0002
R53	Resistor, composition, 100 ohms, 1W, 10%	R-0212
R54, R55	Resistor, 100 ohms, 1%	R-3741
R56	Resistor, variable, 500 ohms, 1W, 10%	R-3106
R57, R58	Resister, 681 ohms, 1%	R-3743
R59/R62	Same as R54	R-3741
R63, R64	Resistor, 221 ohms, 1%	R-3742
R65, R66	Resistor, 5620 ohms, 1%	R-3744
R67	Same as R21	R-0028
R68	Resistor, composition, 270 ohms, 1/4W, 10%	R-0017
R69	Resistor, composition, 1.2K, 1/4W, 10%	R-0025
R70	Same as R17	R-0030
R71	Same as R33	R-0029
R72	Resistor, composition, 10K, 1/4W, 10%	R-0036
T3, T5	Transformer	162-0811
T6/T8	Transformer	162-0162
	VFO ASSEMBLY	162-0901
C1	Capacitor, variable, .8-18 pF	C-2561
C2	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C3	Capacitor, porcelain, 190 pF, 300 VDCW, 2%	C-2308
C4	Capacitor, dipped-mica, 8200 pF, 500 VDCW, 5%	C-0176
C5	Same as C2	C-2210
C6	Capacitor, tantalum, 15 uF, 20 VDCW	C-5832
C7	Same as C2	C-2210
C8	Capacitor, mylar, .0047 uF, 100 VDCW	C-2108
C9	Same as C2	C-2210
C10	Same as C8	C-2108
C11	Capacitor, dipped-mica, 430 pF, 500 VDCW, 5%	C-2495
C12	Capacitor, ceramic, 100 pF, N-330	C-4050
C13	Capacitor, variable, 2.2-21.5 pF	C-4067
CR1	Diode, zener, type 1N4737A	CR-0073
L1	Coil	L-0510
L2	Coil Assembly	162-0163
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
Q1/Q4	Transistor, type 2N2084	Q-0105
R1, R2	Resistor, composition, 1K, 1/4W, 10%	R-0024
R3	Resistor, composition, 3.3K, 1/4W, 10%	R-0030
R4	Resistor, composition, 2.7K, 1/4W, 10%	R-0029
R5	Resistor, composition, 2.2K, 1/4W, 10%	R-0028
R6	Resistor, composition, 100 ohms, 1/4W, 10%	R-0012
R7	Potentiometer, 500 ohms, 1W, 10%	R-3100
R8	Same as R3	R-0030
R9	Resistor, composition, 15K, 1/4W, 10%	R-0038
R10	Same as R1	R-0024
R11	Same as R6	R-0012
R12	Resistor, composition, 220 ohms, 1/4W, 10%	R-0016
R13	Same as R3	R-0030
R14	Same as R9	R-0038
R15	Same as R1	R-0024
R16	Resistor, composition, 39 ohms, 1/4W, 10%	R-0007
R17	Resistor, composition, 68 ohms, 1/4W, 10%	R-0010
R16	Resistor, composition, 1.8K, 1/4W, 10%	R-0031
T1	Coil Assembly	162-0158
	MEGACYCLE OSCILLATOR ASSEMBLY	162-1000
C1/C4	Capacitor, variable, 7-25 pF	C-2301
C5	Capacitor, variable, 2.5-11 pF	C-2300
C6	Capacitor, ceramic, temp compensating, 27 pF, 5%, 500 VDCW, N750	C-1375
C7	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C8	Capacitor, dipped-mica, 270 pF, 5%, 500 VDCW	C-0137
C9	Capacitor, paper, .22 uF, 20%, 50 VDCW	C-2601
C10	Capacitor, dipped-mica 68 pF, 5%, 500 VDCW	C-0122
C11, C12	Same as C7	C-2210
C13	Same as C8	C-0137
C14	Capacitor, ceramic, .01 uF, 400 VDCW	C-0065
C15, C16	Same as C7	C-2210
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
C17, C18	Capacitor, ceramic, .001 uF, 500 VDCW	C-0001
L1	Inductor, 27 uH	L-0087
L2	Inductor, 240 uH	L-0052
Q1	Transistor, type 2N4916	Q-0360
Q2/Q4	Transistor, type 2N3904	Q-0361
R1, R2	Resistor, composition, 15K, 1/4W, 10%	R-0038
R3	Resistor, composition, 2.2K, 1/4W, 10%	R-0028
R4	Resistor, composition, 680 ohms, 1/4W, 10%	R-0022
R5	Resistor, composition, 470 ohms, 1/4W, 10%	R-0020
R6, R7	Resistor, composition, 12K, 1/4W, 10%	R-0037
R8	Resistor, composition, 1K, 1/4W, 10%	R-0024
R9, R10	Resistor, composition, 47 ohms, 1/4W, 10%	R-0008
R11	Resistor, composition, 68 ohms, 1/4W, 10%	R-0010
R12	Resistor, composition, 82 ohms, 1/4W, 10%	R-0011
R13, R14	Resistor, composition, 390 ohms, 1/4W, 10%	R-0019
R15	Resistor, composition, 220 ohms, 1/4W, 10%	R-0016
S1	Switch	A162-1003
Y1	Crystal, 3.247 MCS	Y-0450
Y2	Crystal, 4.247 MCS	Y-0451
Y3	Crystal, 5.247 MCS	Y-0452
Y4	Crystal, 6.247 MCS	Y-0455
Y5	Crystal, 7.247 MCS	Y-0464
Y6	Crystal, 8.247 MCS	Y-0465
Y7	Crystal, 9.247 MCS	Y-0466
Y8	Crystal, 10.247 MCS	Y-0467
Y9	Crystal, 11.247 MCS	Y-0468
Y10	Crystal, 12.247 MCS	Y-0469
Y11	Crystal, 13.247 MCS	Y-0470
Y12	Crystal, 14.247 MCS	Y-0471
Y13	Crystal, 15.247 MCS	Y-0472
	100 KC OSCILLATOR ASSEMBLY	162-1100
C1	Capacitor, dipped-mica, 270 pF, 500 VDCW, 5%	C-0137
C2	Capacitor, dipped-mica, 82 pF, 500 VDCW, 5%	C-0124
C3	Capacitor, variable, 7-25 pF	C-2304
C4	Capacitor, dipped-mica, 33 pF, 500 VDCW, 5%	C-0113
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
C5, C6	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C7	Same as C4	C-0113
C8	Same as C5	C-2210
C9	Capacitor, dipped-mica, 820 pF, 300 VDCW, 2%	C-2503
C10	Capacitor, dipped-mica, 1000 pF, 300 VDCW, 2%	C-2505
L1	Inductor, 240 uH	L-0052
L2	Inductor, 1 uH	L-0054
Q1	Transistor, type 2N2084	Q-0105
Q2	Transistor, type 2N706	Q-0107
R1	Resistor, composition, 15K, 1/2W, 10%	R-0138
R2	Resistor, composition, 2.2K, 1/2W, 10%	R-0128
R3	Resistor, composition, 12K, 1/2W, 10%	R-0137
R4	Resistor, composition, 10 ohms, 1/2W, 10%	R-0100
R5	Resistor, composition, 390 ohms, 1/2W, 10%	R-0119
R6	Same as R3	R-0137
R7, R8	Resistor, composition, 470 ohms, 1/2W, 10%	R-0120
R9	Same as R1	R-0138
R10	Resistor, composition, 270 ohms, 1/2W, 10%	R-0117
R11	Resistor, composition, 220 ohms, 1/2W, 10%	R-0116
S1	Switch	162-1103
Y1	Crystal, 6.147 MCS	Y-0453
Y2	Crystal, 6.247 MCS	Y-0454
Y3	Crystal, 6.347 MCS	Y-0456
Y4	Crystal, 6.447 MCS	Y-0457
Y5	Crystal, 6.547 MCS	Y-0458
Y6	Crystal, 6.647 MCS	Y-0459
Y7	Crystal, 6.747 MCS	Y-0460
Y8	Crystal, 6.847 MCS	Y-0461
Y9	Crystal, 6.947 MCS	Y-0462
Y10	Crystal, 7.047 MCS	Y-0463
	10 KC OSCILLATOR ASSEMBLY	162-1200
C1	Capacitor, mylar, .0015 uF, 100 VDCW	C-2102
C2	Capacitor, mylar, .01 uF, 100 VDCW	C-2112
C5, C6	Same as C1	C-2102
C7, C8	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
L1, L2	Inductor, 4.7 uH	L-0056
L3	Inductor, 240 uH	L-0052
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
Q1	Transistor, type 2N2084	Q-0105
Q2	Transistor, type 2N706	Q-0107
R1	Resistor, composition, 2.7K, 1/2W, 5%	R-1459
R2	Resistor, composition, 680 ohms, 1/2W, 5%	R-1445
R3	Resistor, composition, 39 ohms, 1/2W, 10%	R-0107
R4	Resistor, composition, 22K, 1/2W, 5%	R-1481
R5	Resistor, composition, 2.2K, 1/2W, 5%	R-1457
R6	Resistor, composition, 5.6K, 1/2W, 10%	R-0133
R7	Resistor, composition, 390 ohms, 1/2W, 10%	R-0119
R8	Resistor, composition, 820 ohms, 1/2W, 10%	R-0123
R9	Resistor, composition, 10 ohms, 1/2W, 10%	R-0100
S1	Switch	162-1203
Y1	Crystal, 1.7565 MCS	Y-0600
Y2	Crystal, 1.7665 MCS	Y-0601
Y3	Crystal, 1.7765 MCS	Y-0602
Y4	Crystal, 1.7865 MCS	Y-0603
Y5	Crystal, 1.7965 MCS	Y-0804
Y6	Crystal, 1.8065 MCS	Y-0605
Y7	Crystal, 1.8165 MCS	Y-0606
Y8	Crystal, 1.8265 MCS	Y-0607
Y9	Crystal, 1.8365 MCS	Y-0608
Y10	Crystal, 1.8465 MCS	Y-0609
	1 KC OSCILLATOR ASSEMBLY	591-1310
C1	Capacitor, mylar, .1 uF, 100 VDCW	C-2124
C2	Capacitor, paper, .22 uF, 50 VDCW	C-2601
C3	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C5	Capacitor, mylar, .002 uF, 100 VDCW	C-2116
C6	Same as C2	C-2601
C7	Capacitor, dipped-mica, 390 pF, 500 VDCW, 5%	C-0141
L1	Inductor, 4.7 uH	L-0056
L2	Inductor, 240 uH	L-0052
L3	Choke, RF, 100 uH, 5%	L-0051
Q1	Transistor, 2N2084	Q-0105
Q2	Transistor, 2N706	Q-0107
R1	Resistor, composition, 10K, 1/2W, 5%	R-1473
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
R2	Resistor, composition, 3.3K, 1/2W, 5%	R-1461
R3	Resistor, composition, 560 ohms, 1/2W, 10%	R-0121
R4	Resistor, composition, 8.2K, 1/2W, 5%	R-1471
R5	Resistor, composition, 2.2K, 1/2W, 5%	R-1457
R6	Resistor, composition, 270 ohms, 1/2W, 10%	R-0117
R7	Resistor, composition, 100 ohms, 1/2W, 10%	R-0112
R6	Same as R6	R-0117
S1	Switch	162-1308
Y1	Crystal, 789.5 KCS	Y-0621
Y2	Crystal, 790.5 KCS	Y-0622
Y3	Crystal, 791.5 KCS	Y-0623
Y4	Crystal, 792.5 KCS	Y-0624
Y5	Crystal, 793.5 KCS	Y-0625
Y6	Crystal, 794.5 KCS	Y-0626
Y7	Crystal, 795.5 KCS	Y-0627
Y8	Crystal, 796.5 KCS	Y-0628
Y9	Crystal, 797.5 KCS	Y-0629
Y10	Crystal, 798.5 KCS	Y-0630
	ALC CIRCUIT ASSEMBLY	591-1500
C1	Capacitor, ceramic, .001 uF, 10%, 150 VDCW	C-0001
C2	Capacitor, dipped mylar, 22 uF, 200 VDCW, 10%	C-0820
C4	Capacitor, tantalum, 33 uF, 20 VDCW	C-5839
C5, C6	Capacitor, tantalum, 15 uF, 20 VDCW	C-5832
C7	Capacitor, tantalum, 220 uF, 10 VDCW	C-5850
CR1	Diode, silicon, type 1N4001	CR-0043
Q1	Transistor, type (a) 2N1623, or (b) 2N3638	(a)Q-0101 (b)Q-0306
Q2	Transistor, type 2N1479	Q-0106
R1	Resistor, composition, 33K, 1/4W, 10%	R-0042
R2	Resistor, composition, 10K, 1/4W, 10%	R-0036
R3	Resistor, composition, 150K, 1/4W, 10%	R-0050
R4	Resistor, composition, 2.7K, 1/4W, 10%	R-0029
R5	Resistor, composition, 5.6K, 1/4W, 10%	R-0033
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
R6	Resistor, composition, 2.2K, 1/4W, 10%	R-0028
R7	Resistor, composition, 100 ohms, 1/4W, 10%	R-0012
R8	Resistor, composition, 330 ohms, 1/4W, 10%	R-0018
T1	Transformer	T-0173
	AUDIO AMPLIFIER	591-1600
C1, C2	Capacitor, electrolytic 15 uF, 20 VDCW	C-5832
C4/C6	Same as C1	C-5832
Q1, Q2	Transistor, type 2N652	Q-0020
R1	Resistor, composition, 1.2K, 1/4W, 10%	R-0025
R2	Resistor, composition, 8.2K, 1/4W, 10%	R-0035
R3	Resistor, composition, 100 ohms, 1/4W, 10%	R-0012
R4	Resistor, composition, 120 ohms, 1/4W, 10%	R-0013
R5	Resistor, composition, 560 ohms, 1/4W, 10%	R-0021
R6	Resistor, composition, 15K, 1/4W, 10%	R-0038
R7	Same as R2	R-0035
R8	Same as R3	R-0012
R9	Same as R5	R-0021
	TRANSMIT POWER AMPLIFIER	591-1700
C1/C3	Capacitor, ceramic, .01 uF, 1.6K VDCW	C-0010
C4, C5	Capacitor, ceramic, .01 uF, 500 VDCW	C-0003
C6/C10	Capacitor, ceramic, .01 uF, 25 VDCW	C-2210
C11, C12	Same as C4	C-0003
FL1	Filter, anti-parasitic	L-0223
L1	Choke, RF, 220 uH	L-0034
L2	Inductor	591-1706
L3, L4	Choke, RF, 6.8 uH	L-0037
L5	Choke, RF, 1 MH	L-0050
R1	Resistor, composition, 100 ohms, 1/2W, 10%	R-0112
R2	Resistor, composition, 27K, 1/2W, 10%	R-0141
V1	Tube, electron, type 4604	V-0110
XV1	Socket, tube	X-0805
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
	TRANSMIT PS, RECTIFIER ASSEMBLY	591-1800
C1	Capacitor, electrolytic 10 uF, 350 VDCW	C-6216
C2	Capacitor, electrolytic 10 uF, 150 VDCW	C-1131
CR1/CR13	Diode, silicon, type 1N2071	CR-0001
R1	Resistor, composition, 100 ohms, 2W, 10%	R-0312
R2/R4	Resistor, composition, 68K, 2W, 10%	R-0346
R5	Resistor, composition, 220 ohms, 2W, 10%	R-0316
R6	Resistor, composition, 100K, 2W, 10%	R-0348
R7	Resistor, composition, 10K, 1/2W, 10%	R-0136
R8	Resistor, variable 50K, 1W, 5%	R-7025
R9	Same as R7	R-0136
R10	Resistor, composition, 180 ohms, 1/2W, 10%	R-0115
R11	Resistor, composition, 1.5 ohms, 1/2W, 5%	R-0867
	TRANSMIT PS, CAPACITOR ASSEMBLY	591-1820
C1/C3	Capacitor, electrolytic 15 uF, 350 VDCW	C-6217
	TRANSMIT PS, TRANSISTOR ASSEMBLY	591-1840
C1	Capacitor, electrolytic 15 uF, 20 VDCW	C-5832
Q1, Q2	Transistor, type SDT9743	Q-0372
R1	Resistor, wirewound 10 ohms, 5W, 5%	R-3225
R2	Resistor, wirewound 120 ohms, 3W, 5%	R-3228
R3	Same as R1	R-3225
XQ1, XQ2	Socket, transistor	X-0807
	ANTENNA CURRENT MONITOR	591-1950
C1	Capacitor, ceramic, .01 uF, 150 VDCW	C-0065
C2	Capacitor, electrolytic 15 uF, 20 VDCW	C-5832
C3	Same as C1	C-0065
CR1	Diode, silicon, type 1N3064	CR-0070
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
Q1	Transistor, type 2N3642	Q-0320
R1	Resistor, composition, 15K, 1W, 5%	R-1677
R2	Resistor, composition, 750 ohms, 1/2W, 5%	R-1446
R3	Resistor, composition, 8.2K, 1/4W, 10%	R-0035
R4, R5	Resistor, composition, 2.2K, 1/4W, 10%	R-0028
	FREQ. STD/TUNING OSC.	591-2050
C1	Capacitor, electrolytic 15 uF, 20 VDCW	C-5832
C2	Capacitor, mylar .22 uF, 100 VDCW	C-2350
C3	Same as C1	C-5832
C4	Capacitor, ceramic .1 uF, 25 VDCW	C-2210
FS1	Crystal oscillator	591-2060
J52	Connector, coax	J-0031
J53	Connector, 8 pin	MP-1418
L1	Choke, RF, 1 MH	L-0050
Q1	Transistor, type 2N2646	Q-0120
R1	Resistor, composition, 1K, 1/4W, 10%	R-0024
R2	Resistor, composition, 15K, 1/4W, 10%	R-0038
R3	Resistor, composition, 100 ohms, 1/4W, 10%	R-0012
R4	Resistor, composition, 1.5K, 1/4W, 10%	R-0026
R5	Resistor, composition, 180 ohms, 1/4W, 10%	R-0015
R6	Resistor, variable 1K, 1W, 10%	R-3101
R7	Resistor, composition, 470 ohms, 1/4W, 10%	R-0020
	SSB FILTER ASSEMBLY	591-2100
C1/C4	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C5	Capacitor, variable, 8-50 pF	C-6224
C6, C7	Capacitor, dipped-mica, 100 pF, 500 VDCW, 5%	C-0126
C8	Same as C5	C-6224
C9/C12	Same as C1	C-2210
C13	Same as C5	C-6224
C14, C15	Same as C6	C-0126
C16	Same as C5	C-6224
C17	Same as C1	C-2210
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
CR1/CR4	Diode, germanium type 1N270	CR-0047
FL1	Filter, mechanical 455 KCS, lower-sideband	FL-0001
FL2	Filter, mechanical 455 KCS, upper-sideband	FL-0004
J49	Connector, 3 pin	MP-1427
J50, J51	Connector, coax	J-0031
R1/R8	Resistor, composition 4.7K, 1/4W, 10%	R-0032
	TRANSMIT TUNING LOAD ASSEMBLY	591-2200
C1	Capacitor, ceramic .01 uF, 150 VDCW	C-0065
CR1	Diode, silicon type 1N4001	CR-0043
K1	Relay, DPDT, 12V	K-0065
R1, R2	Resistor, film 50 ohms, 7W, 5%	R-0955
	RF AMPLIFIER	591-2300
	Amplifier Main Frame	
C1, C2	Capacitor, ceramic .1 uF, 25 VDCW	C-2210
C3	Capacitor, ceramic .01 uF, 500 VDCW	C-0003
J56	Connector, 7 pin	591-2363
P58	Cable assembly, coax	162-0313
V1	Tube, electron, type 7905	V-0021
XV1	Socket, tube	X-1015
	Amplifier Subassembly	591-2310
C1	Capacitor, variable 9-35 pF	C-2302
C2	Capacitor, dipped-mica, 82 pF, 500 VDCW, 2%	C-2477
C3	Same as C1	C-2302
C4	Capacitor, dipped-mica 43 pF, 500 VDCW, 2%	C-2469
C5	Capacitor, dipped-mica, 5 pF, 500 VDCW, 1/2 pF tol.	C-0103
C6	Capacitor, dipped-mica, 470 pF, 500 VDCW, 2%	C-2496
C7	Same as C1	C-2302
C8	Capacitor, dipped-mica, 1100 pF, 500 VDCW, 2%	C-3400
C9	Capacitor, dipped-mica, 51 pF, 500 VDCW, 2%	C-2492
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
CR1	Diode, silicon type 1N4001	CR-0043
CR2, CR3	Diode, silicon type 1N3064	CR-0070
J54, J55	Connector, coax	J-0031
K1	Relay, DPDT, 12V	K-0065
S1A	Switch, wafer	162-0283
Y1	Crystal, 9.247 MHZ	162-0193
Y2	Crystal, 8.247 MHZ	162-0196
	Amplifier Subassembly	591-2320
C1/C4	Capacitor, ceramic, .01 uF, 150 VDCW	C-0065
C5	Capacitor, dipped-mica 5 pF, 500 VDCW, 1/2 pF tol.	C-0103
C6	Capacitor, variable 9-35 pF	C-2302
C7	Capacitor, dipped-mica, 82 pF, 300 VDCW, 2%	C-2477
C8	Same as C6	C-2302
C10	Same as C1	C-0065
C11	Capacitor, electrolytic 15 uF, 20 VDCW	C-5832
C12	Capacitor, dipped-mica, 470 pF, 500 VDCW, 2%	C-2496
C13	Same as C6	C-2302
C14	Capacitor, dipped-mica, 91 pF, 500 VDCW, 2%	C-2478
C15	Capacitor, dipped-mica 1100 pF, 500 VDCW, 2%	C-3400
C16	Capacitor, dipped-mica, 27 pF, 500 VDCW, 5%	C-0111
C17	Capacitor, dipped-mica 15 pF, 500 VDCW, 5%	C-0106
C18	Capacitor, dipped-mica, 10 pF, 500 VDCW, 5%	C-0104
C19	Same as C5	C-0103
Q1	Transistor, type 2N4416	Q-0365
Q2	Transistor, type 2N328B	Q-0366
R1	Resistor, composition, 47K, 1/4W, 10%	R-0044
R2	Resistor, composition, 470 ohms, 1/4W, 10%	R-0020
R3	Resistor, composition, 1.8K, 1/4W, 10%	R-0027
R4	Same as R2	R-0020
R7, R8	Resistor, composition, 10K, 1/4W, 5%	R-1273
R9	Resistor, composition, 560 ohms, 1/4W, 10%	R-0021
R10	Resistor, variable 1K, 1W, 10%	R-3108
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
R11	Resistor, composition, 390 ohms, 1/4W, 10%	R-0019
R12	Resistor, composition, 1.2K, 1/4W, 10%	R-0025
R13	Resistor, composition, 100 ohms, 1/4W, 10%	R-0012
S1B	Switch, wafer	162-0283
Y1	Crystal, 12.494 MHZ	162-0194
Y2	Crystal, 12.741 MHZ	162-0195
	Amplifier Subassembly	591-2330
C1	Capacitor, electrolytic 15 uF, 20 VDCW	C-5832
C2, C3	Capacitor, ceramic, .01 uF, 150 VDCW	C-0065
C4	Capacitor, dipped-mica 5 pF, 500 VDCW, 1/2 pF tol.	C-0103
C5	Capacitor, variable 9-35 pF	C-2302
C6	Capacitor, dipped-mica 82 pF, 500 VDCW, 2%	C-2477
C7	Same as C5	C-2302
C8, C9	Same as C2	C-0065
C10	Capacitor, dipped-mica, 18 pF, 500 VDCW, 2%	C-2460
C11, C12	Same as C2	C-0065
C13	Same as C5	C-2302
C14	Capacitor, dipped-mica, 470 pF, 500 VDCW, 2%	C-2496
C15	Capacitor, dipped-mica 75 pF, 500 VDCW, 2%	C-2476
C16	Capacitor, dipped-mica, 1100 pF, 500 VDCW, 2%	C-3400
C17, C18	Same as C2	C-0065
CR1	Diode, silicon type 1N4001	CR-0043
K1	Relay, DPDT, 12V	K-0065
Q1, Q2	Transistor, type 2N4416	Q-0365
R1	Resistor, composition, 47K, 1/4W, 10%	R-0044
R2	Resistor, composition, 1.2K, 1/4W, 5%	R-1251
R3, R4	Resistor, composition, 100 ohms, 1/4W, 10%	R-0012
R7	Resistor, composition, 330 ohms, 1/4W, 5%	R-1237
R8	Same as R1	R-0044
R9	Resistor, composition, 470 ohms, 1/4W, 10%	R-0020
R10	Resistor, composition, 220 ohms, 1/4W, 10%	R-0016
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
R11	Resistor, composition, 1.2K, 1/4W, 10%	R-0025
S1C	Switch, wafer	162-0283
	Amplifier Subassembly	591-2340
C1	Capacitor, dipped-mica 5 pF, 500 VDCW, 1/2pF tol.	C-0103
C2	Capacitor, variable 9-35 pF	C-2302
C3	Capacitor, dipped-mica 82 pF, 500 VDCW, 2%	C-2477
C4	Same as C2	C-2302
C5, C6	Capacitor, ceramic, .01 uF, 500 VDCW	C-0003
C7, C8	Capacitor, ceramic, .1 uF, 25 VDCW	C-2210
C9	Same as C5	C-0003
C11	Same as C2	C-2302
C12	Capacitor, dipped-mica, 470 pF, 500 VDCW, 2%	C-2496
C13	Capacitor, dipped-mica, 51 pF, 500 VDCW, 2%	C-2472
C14	Capacitor, dipped-mica 1100 pF, 500 VDCW, 2%	C-3400
L1	Choke, RF, 6.6 uH	L-0037
R3	Resistor, composition, 3.9K, 1/2W, 10%	R-0131
R4	Resistor, composition, 47K, 1/2W, 10%	R-0144
R5	Resistor, composition, 33K, 1/2W, 10%	R-0142
R6	Resistor, composition, 10K, 1/2W, 10%	R-0136
R7	Resistor, composition, 470 ohms, 2W, 10%	R-0320
S1D	Switch, wafer	162-0283
	Amplifier Subassembly	591-2350
C1/C4	Capacitor, variable 11-110 pF	162-0271
C5	Capacitor, ceramic .01 uF, 150 VDCW	C-0065
C6, C7	Capacitor, ceramic .01 uF, 500 VDCW	C-0003
L1	Inductor	162-0276
L2, L3	Inductor	162-0278
L4	Same as L1	162-0276
R1/R3	Resistor, composition 6.8K, 1/4W, 5%	R-1469
R4	Resistor, composition 6.8K, 1/2W, 5%	R-1269
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
	BATTERY PACK	
RF-327A	Rechargeable Battery set for RF-327	591-2403
RF-328A	Dry Cell Battery Case	591-2505
	ENTER CHANGE DATA	

REF DESIG	DESCRIPTION	RF P/N
RF-328B	Replacement Alkaline cells for RF-328	591-2550
J1	Connector, 6 pin	J-0829
	ENTER CHANGE DATA	

CHAPTER 8
CIRCUIT DIAGRAMS

-NOTES-

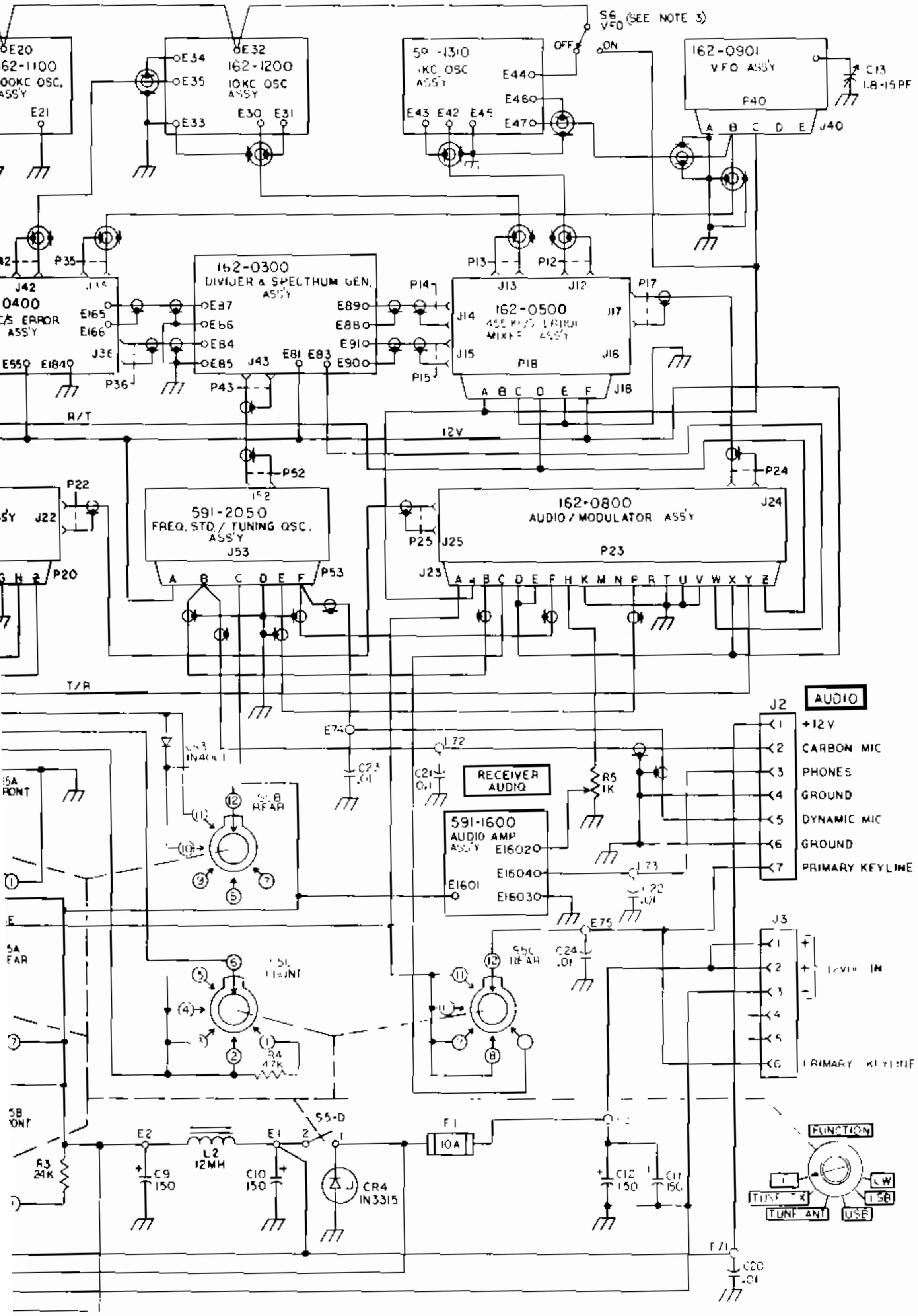
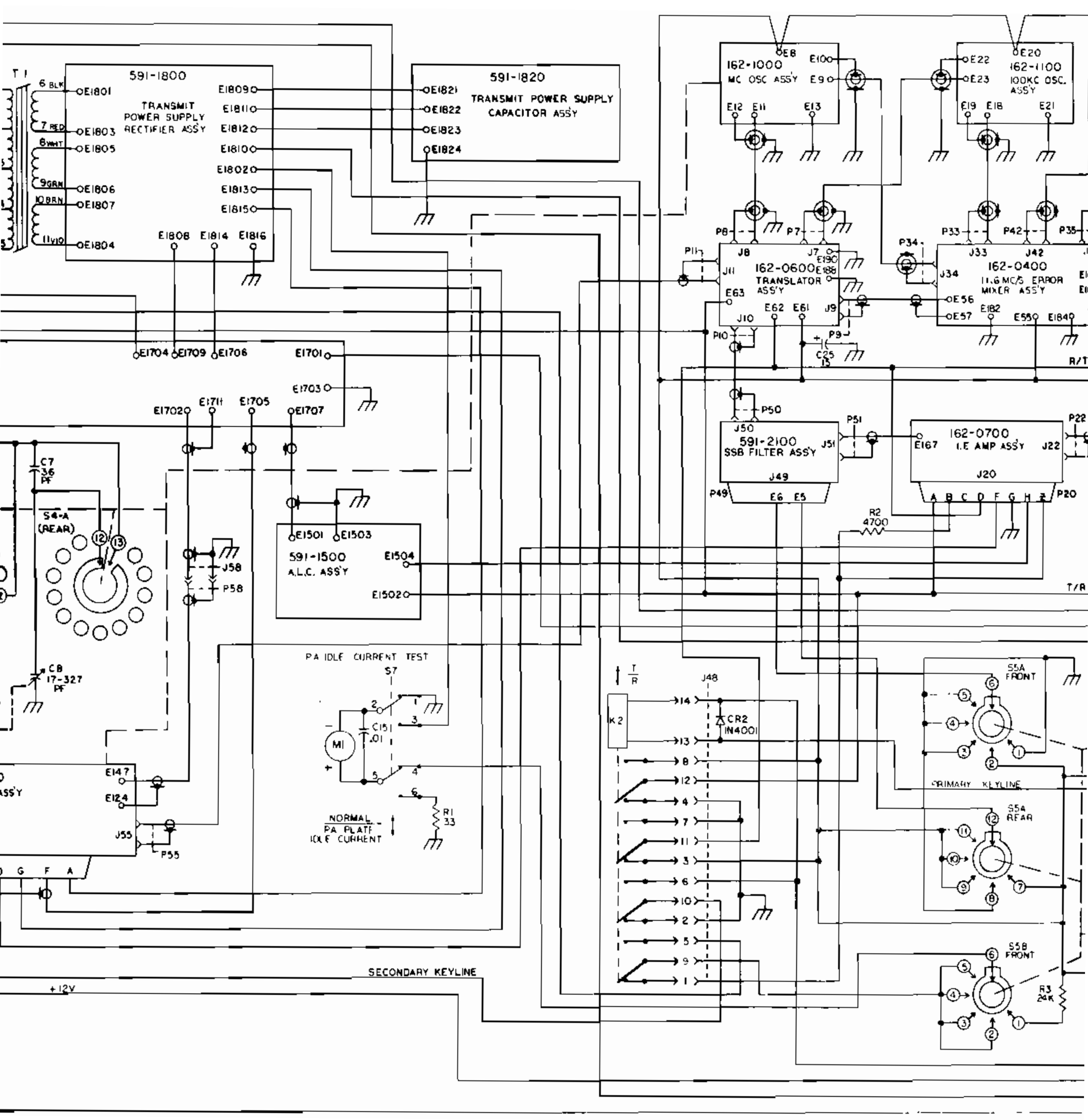
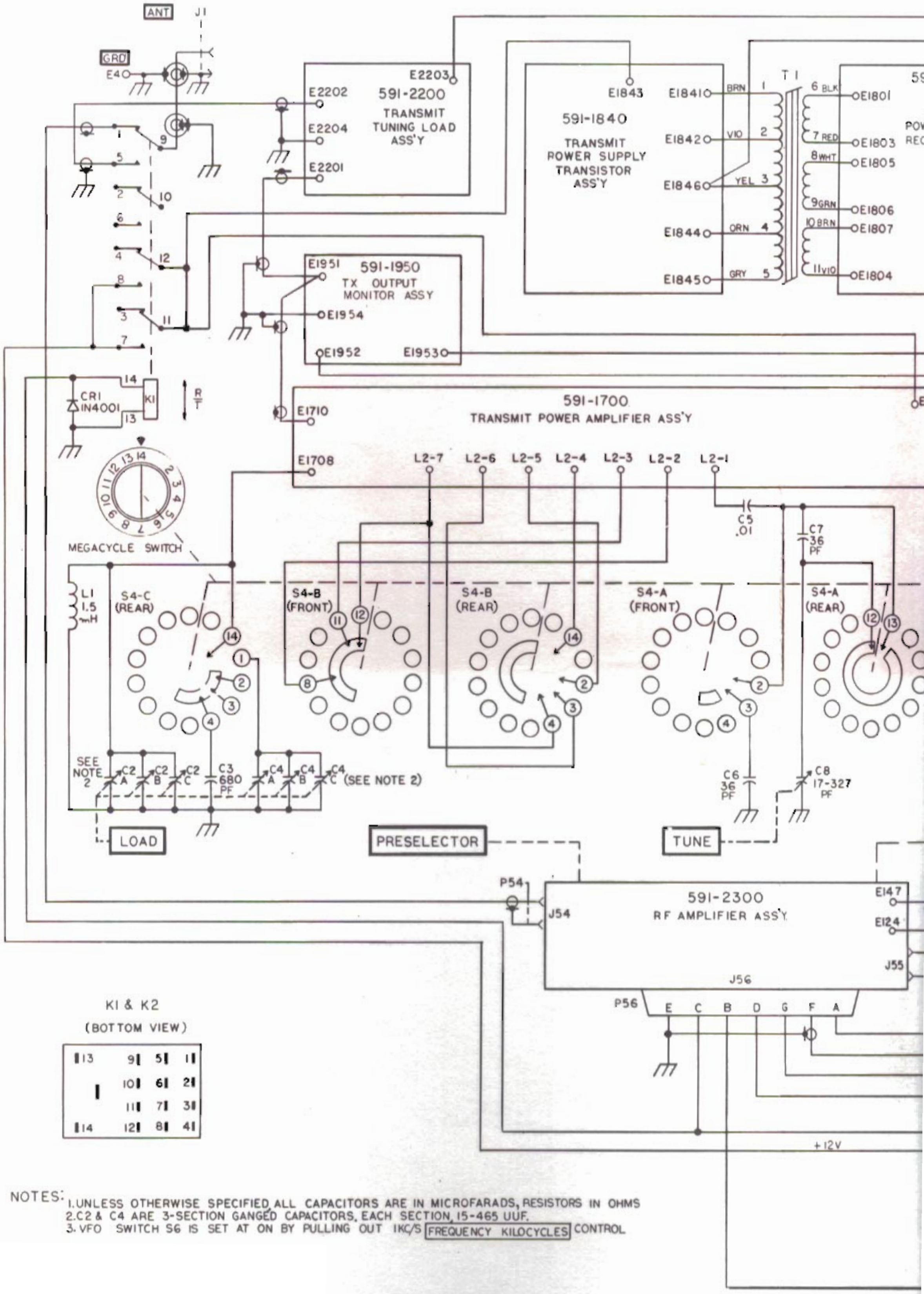


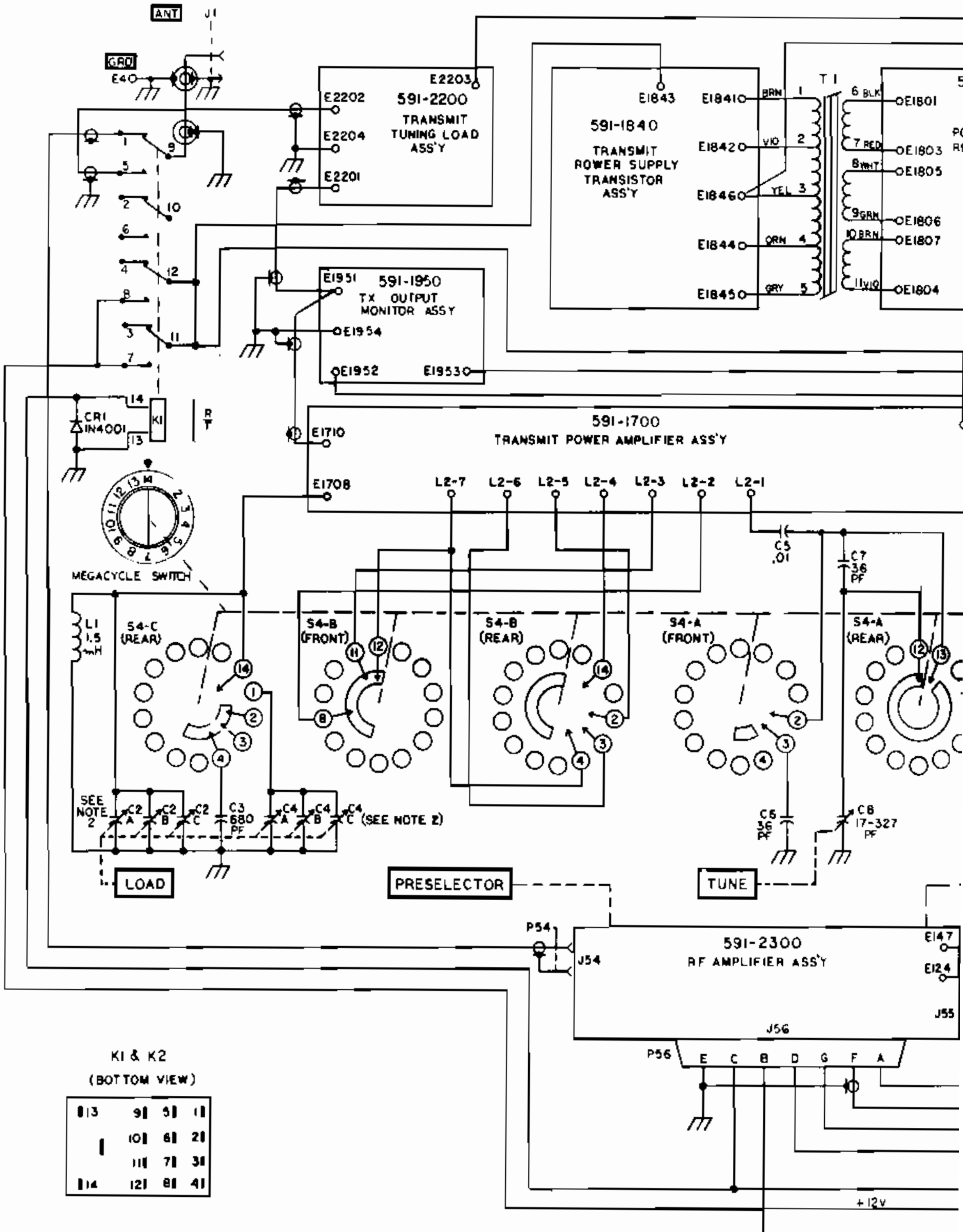
FIGURE 8.1 - MAIN FRAME, RF-301P SSB TRANSCEIVER



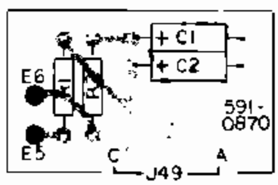
591-1800
TRANSMIT POWER SUPPLY RECTIFIER ASS'Y
591-1820
TRANSMIT POWER SUPPLY CAPACITOR ASS'Y
162-1000
MC OSC ASS'Y
162-1100
100KC OSC. ASS'Y
162-0600
TRANSLATOR ASS'Y
162-0400
11.6 MC/S ERROR MIXER ASS'Y
591-2100
SSB FILTER ASS'Y
162-0700
I.F. AMP ASS'Y
591-1500
A.L.C. ASS'Y
S4-A (REAR)
C7 36 PF
C8 17-327 PF
PA IDLE CURRENT TEST
S7
C151 .01
M1
R1 33
NORMAL
PA PLATE IDLE CURRENT
K2
J48
CR2 1N4001
T/R
R/T
R2 4700
S5A FRONT
S5A REAR
S5B FRONT
R3 24K
PRIMARY KEYLINE
SECONDARY KEYLINE
+12V



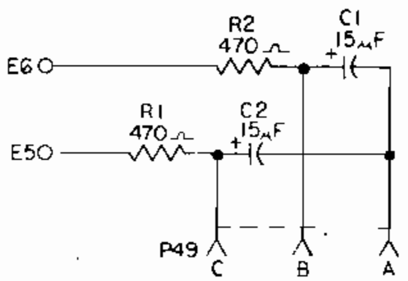
NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE IN MICROFARADS, RESISTORS IN OHMS
2. C2 & C4 ARE 3-SECTION GANGED CAPACITORS, EACH SECTION 15-465 UUF.
3. VFO SWITCH S6 IS SET AT ON BY PULLING OUT 1KC/S FREQUENCY KILOCYCLES CONTROL



NOTES: 1. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE IN MICROFARADS, RESISTORS IN OHMS
2. C2 & C4 ARE 3-SECTION GANGED CAPACITORS, EACH SECTION 15-465 UUF.
3. VFO SWITCH S6 IS SET AT ON BY PULLING OUT 1KC/S FREQUENCY KILOCYCLES CONTROL



+ C1
+ C2
E6
E5
591-
0870
C
A
J49



R2
470 Ω
C1
15 μF
E6
R1
470 Ω
C2
15 μF
E5
P49
C
B
A

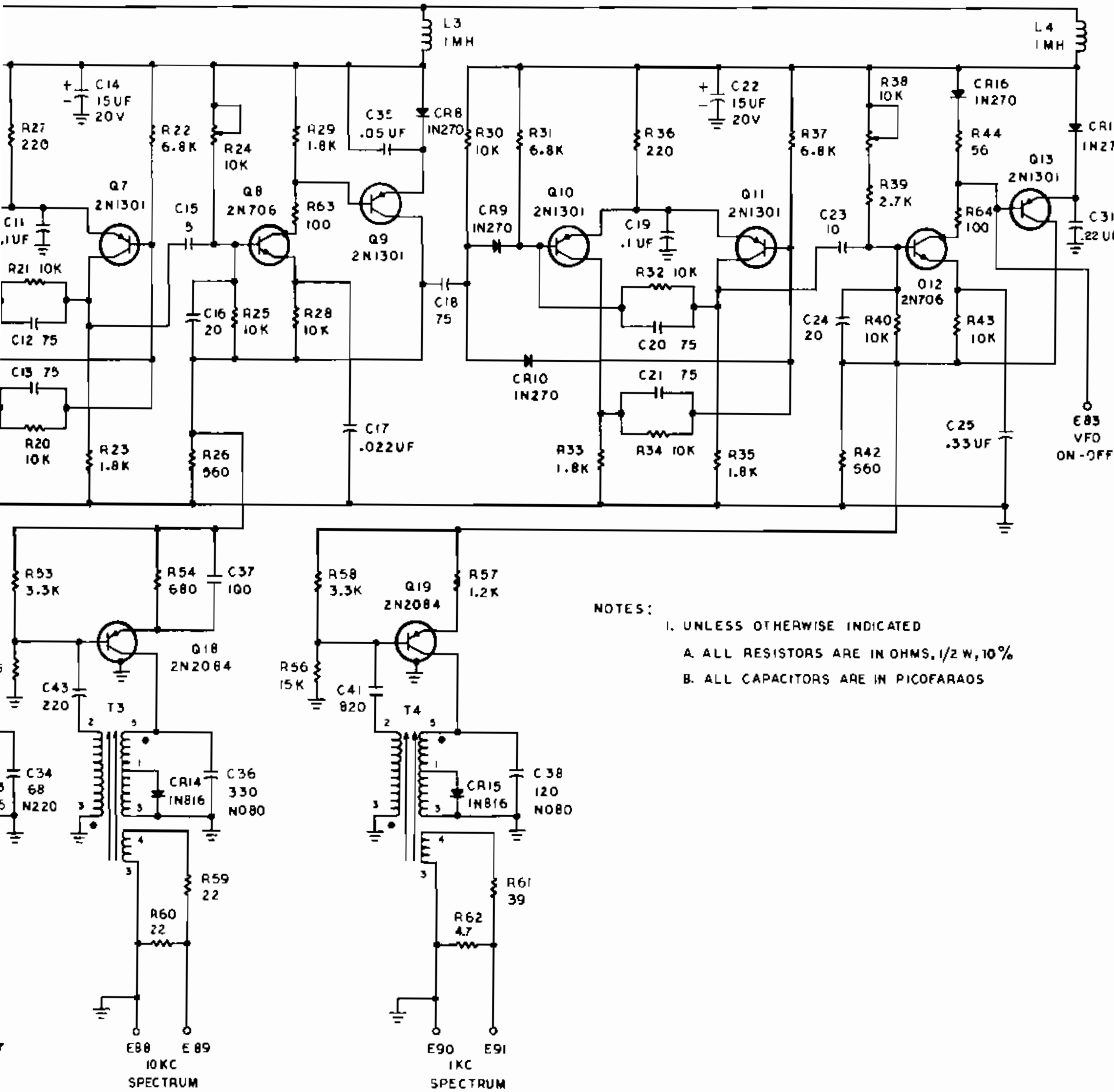
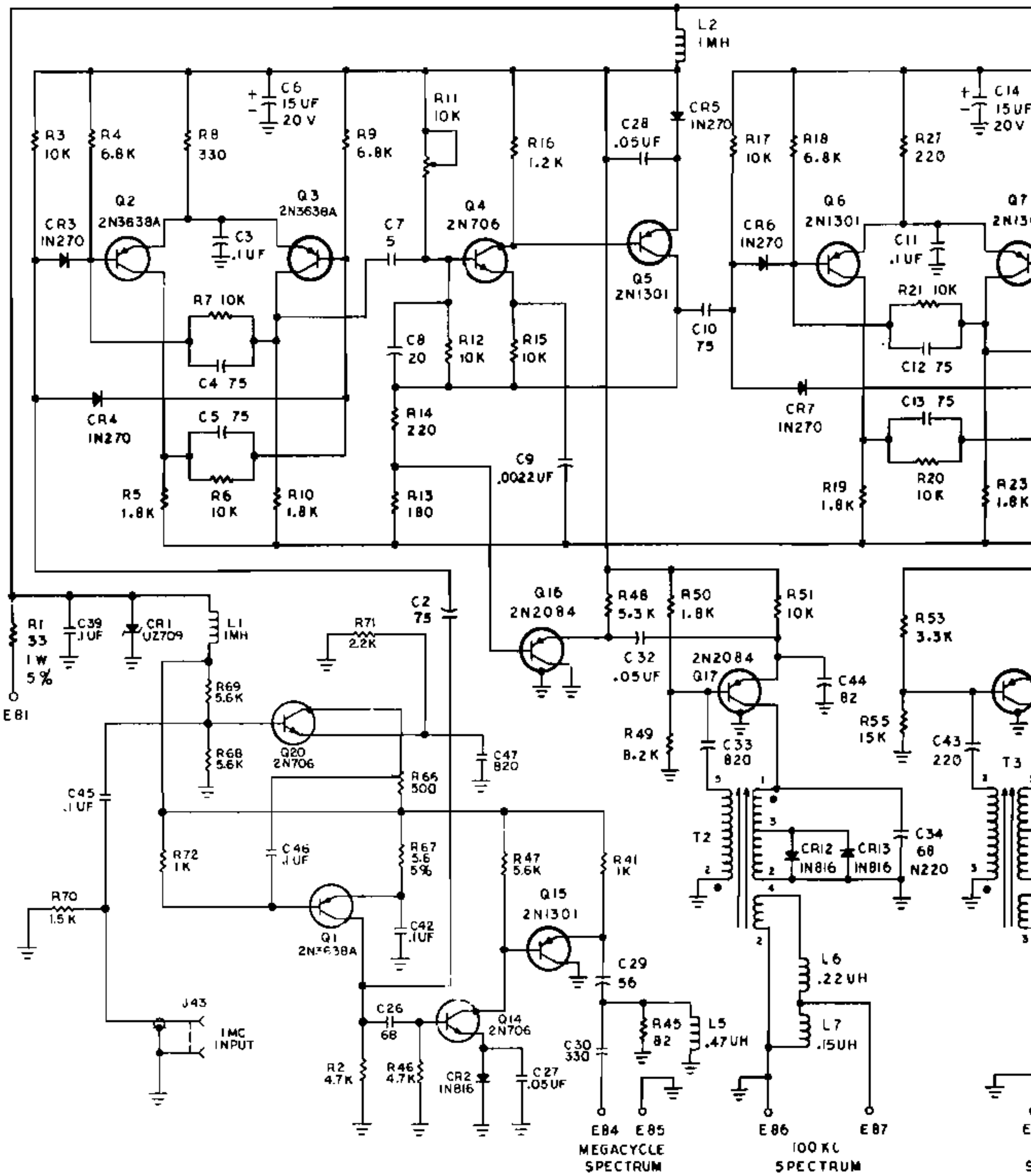
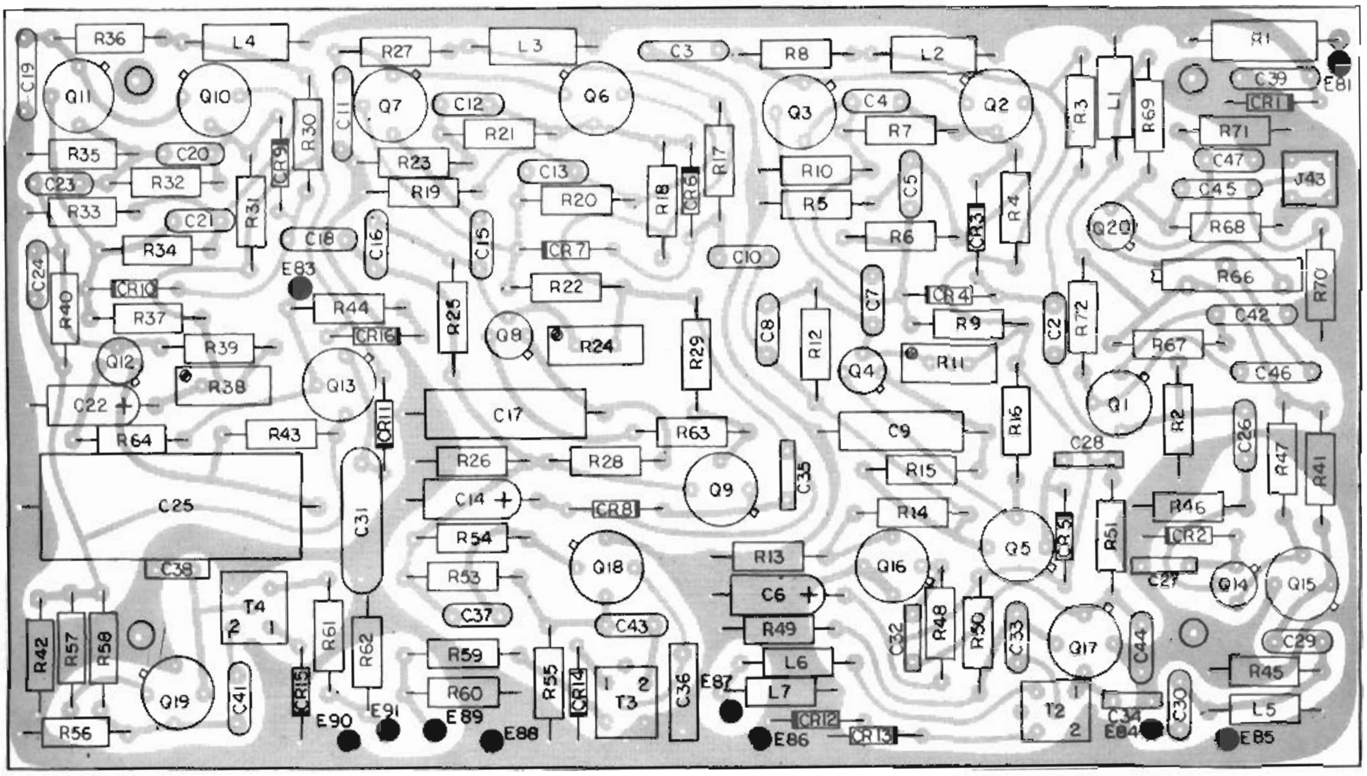


FIGURE 8.2 - DIVIDER/SPECTRUM GENERATOR ASSEMBLY

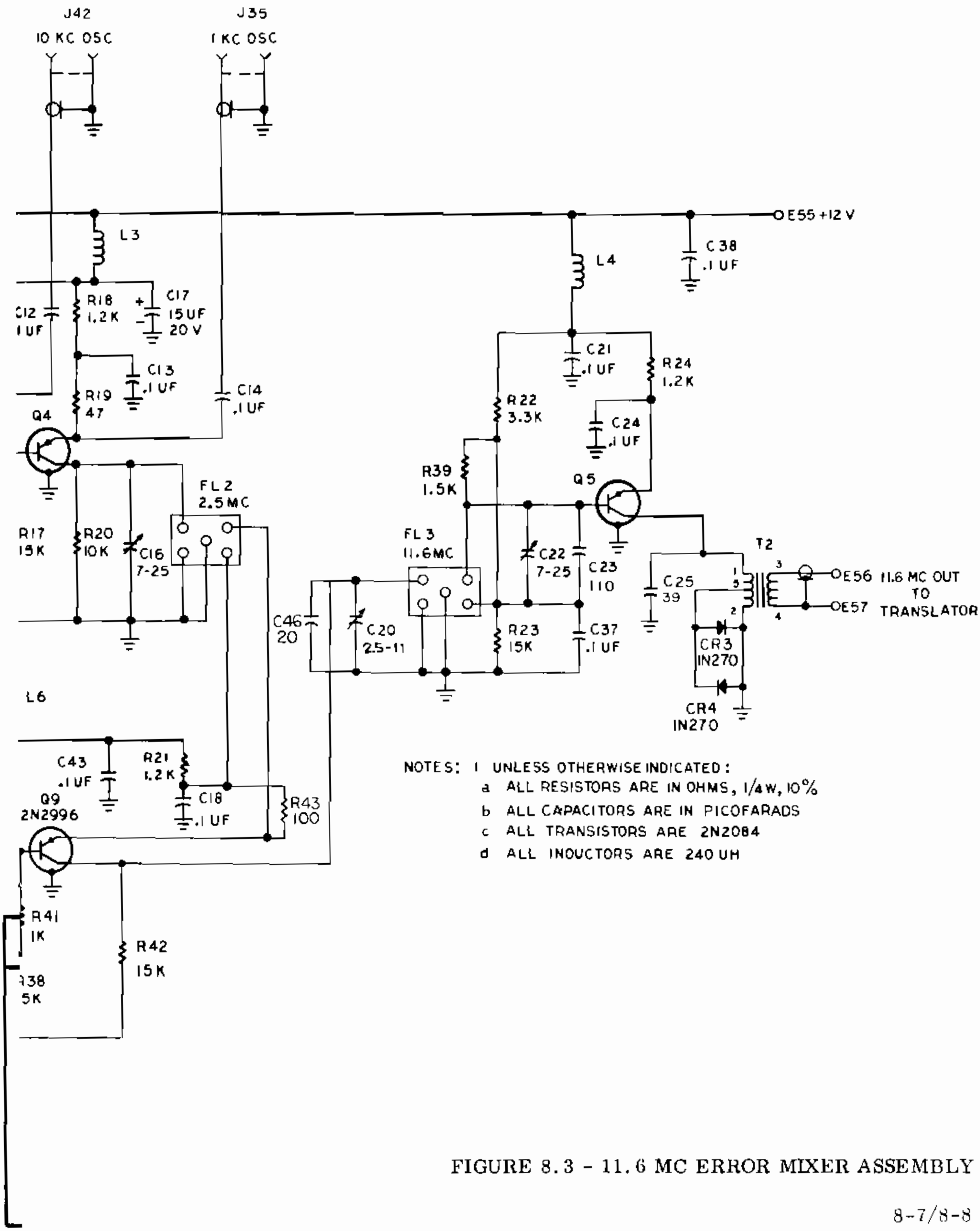

R16
C39
E81
R4
Q15
L5


L2
1MH
CR5
1N270
C6
15 UF
20 V
R11
10K
R3
10K
R4
6.8K
R8
330
R9
6.8K
R16
1.2K
C28
.05UF
Q2
2N3638A
Q3
2N3638A
Q4
2N706
Q5
2N1301
CR3
1N270
C3
.1UF
C7
5
R7 10K
C4 75
C8
20
R12
10K
R15
10K
C10
75
CR4
1N270
C5 75
R14
220
C9
.0022UF
R5
1.8K
R6
10K
R10
1.8K
R13
180
R17
10K
R18
6.8K
R27
220
C14
15UF
20V
Q6
2N1301
CR6
1N270
C11
.1UF
R21 10K
C12 75
CR7
1N270
C13 75
R20
10K
R19
1.8K
R23
1.8K
Q16
2N2084
R48
5.3K
R50
1.8K
R51
10K
R53
3.3K
C32
.05UF
2N2084
Q17
C44
82
R49
8.2K
C33
820
R55
15K
C43
220
T3
T2
CR12
1N816
CR13
1N816
C34
68
N220
L6
.22UH
L7
.15UH
R1
33
1W
5%
E81
C39
.1UF
CR1
UZ709
L1
1MH
C2
75
R71
2.2K
R69
5.6K
Q20
2N706
C47
820
R68
5.6K
R66
500
C45
.1UF
R72
1K
C46
.1UF
R67
5.6
5%
R47
5.6K
R41
1K
Q15
2N1301
R70
1.5K
Q1
2N3638A
C42
.1UF
C29
56
J43
1MC
INPUT
C26
68
Q14
2N706
R45
82
L5
.47UH
C30
330
R2
4.7K
R46
4.7K
CR2
1N816
C27
.05UF
E84
E85
MEGACYCLE
SPECTRUM
E86
E87
100 KC
SPECTRUM



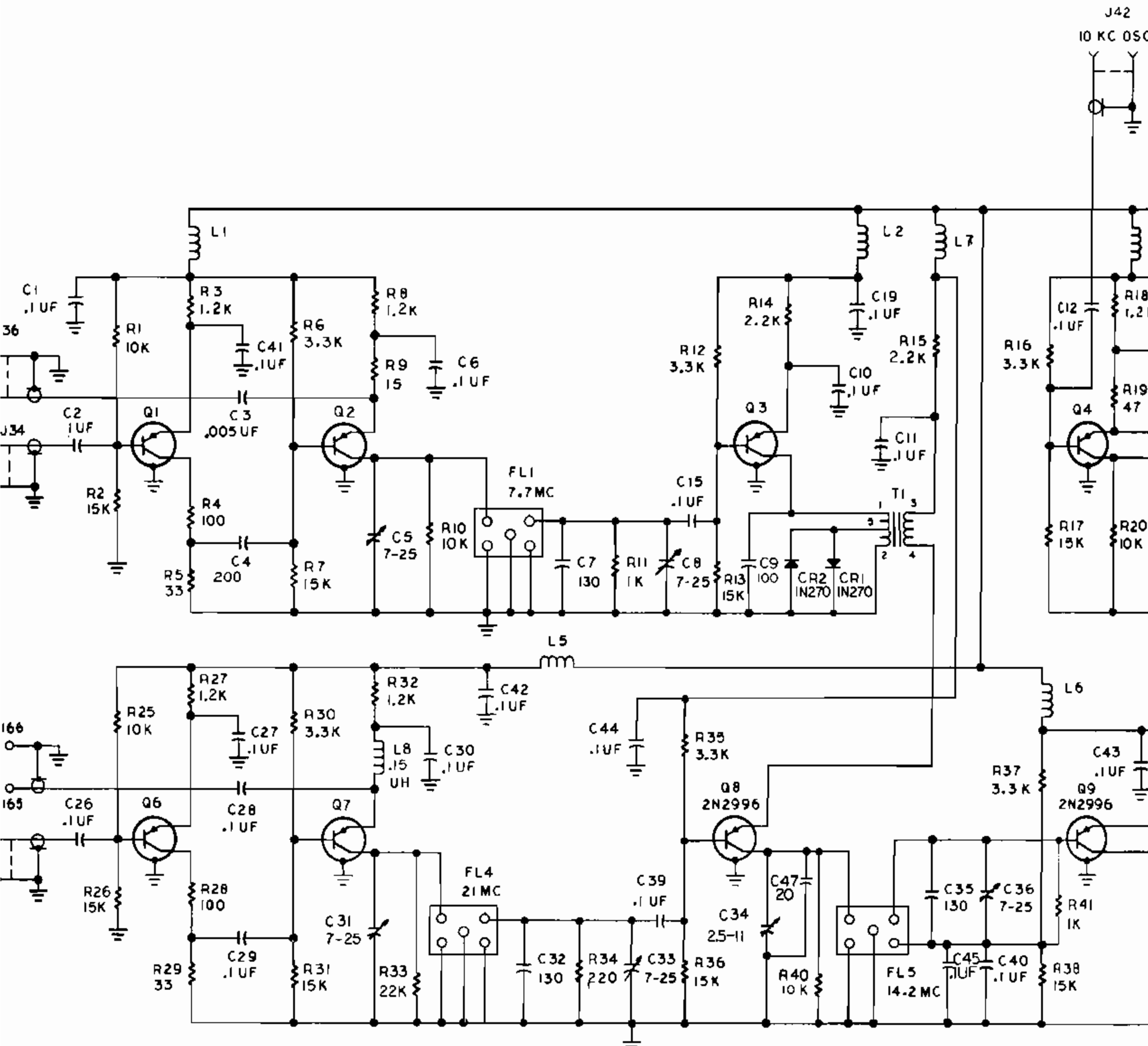
POSITIVE DC VOLTAGES TO GROUND

STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	9.2V	9.2V	6.1V	
Q2	8 V	8.6V	4.6V	
Q3	8 V	8.6V	4.6V	
Q4	6.5V	6.0V	9 V	
Q5	8.8V	9.0V	1.2V	
Q6	8.2V	8.4V	4.6V	
Q7	8.2V	8.4V	4.6V	
Q8	6.6V	6 V	9 V	
Q9	9 V	9.1V	1.4V	
Q10	8.1V	8.3V	4.6V	
Q11	8.2V	8.3V	4.6V	
Q12	6.4V	5.6V	9 V	
Q13	9.2V	9.1V	.94V	
Q14	.6V	-.7V	7.9V	
Q15	8.1V	7.8V	0 V	
Q16	.6V	.52V	0 V	
Q17	6.2V	7.2V	0 V	
Q18	1.25V	1.15V	0 V	
Q19	.86V	.76V	0 V	
Q20	4.1V	4.3V	7.9V	

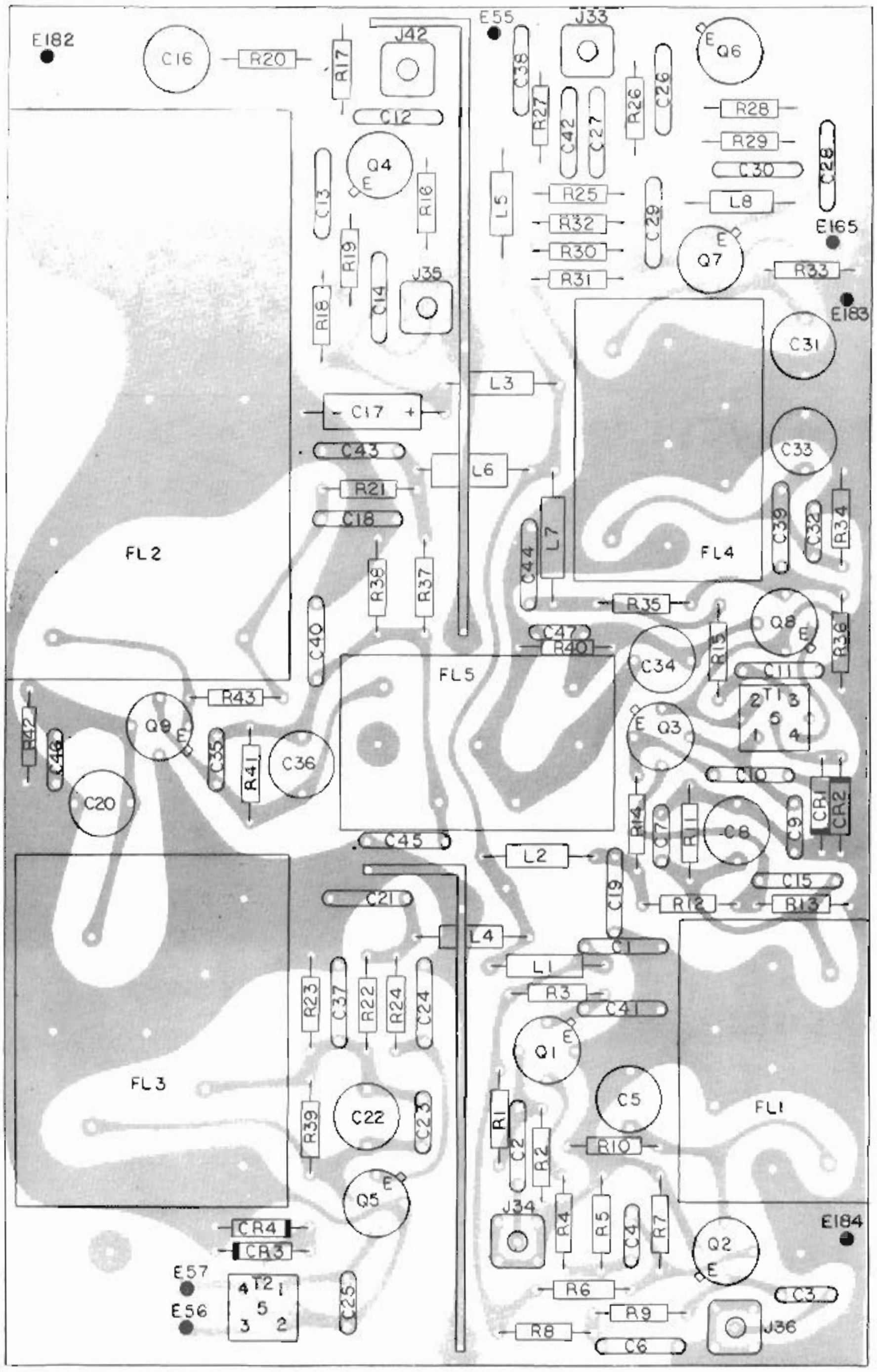


NOTES: 1 UNLESS OTHERWISE INDICATED:
- a ALL RESISTORS ARE IN OHMS, 1/4W, 10%
- b ALL CAPACITORS ARE IN PICOFARADS
- c ALL TRANSISTORS ARE 2N2084
- d ALL INDUCTORS ARE 240 UH

FIGURE 8.3 - 11.6 MC ERROR MIXER ASSEMBLY

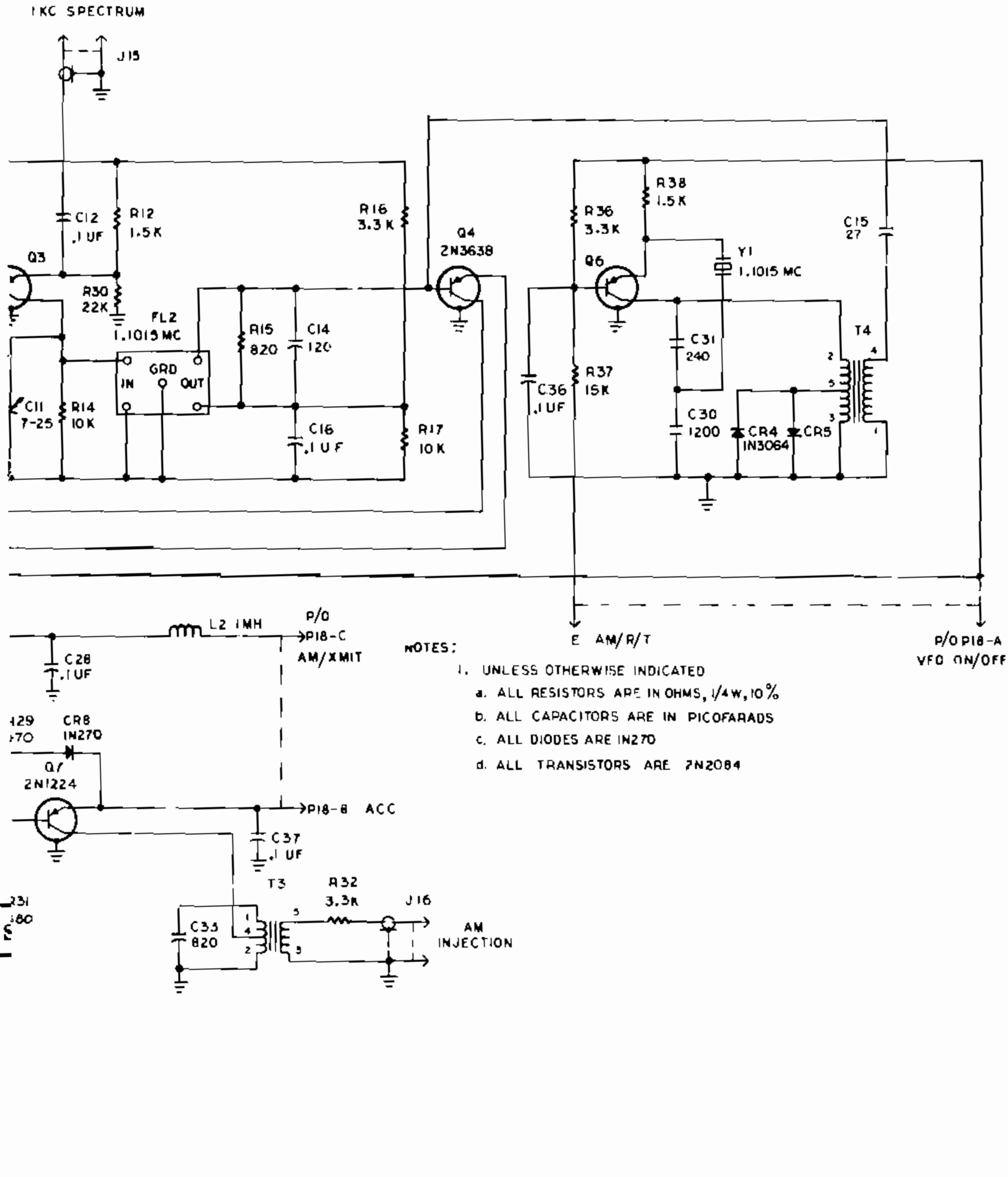


J42
10 KC OSC
L1
L2
L7
C1 .1 UF
R1 10K
R3 1.2K
C41 .1UF
R6 3.3K
R8 1.2K
R9 15
C6 .1 UF
R14 2.2K
C19 .1 UF
R12 3.3K
C10 .1 UF
R15 2.2K
C12 .1 UF
R16 3.3K
Q1
Q2
Q3
Q4
C2 .1 UF
C3 .005 UF
J34
R2 15K
R4 100
C4 200
R5 33
R7 15K
C5 7-25
R10 10K
FL1 7.7MC
C7 130
R11 1K
C8 7-25
C15 .1 UF
R13 15K
C9 100
CR2 IN270
CR1 IN270
C11 .1 UF
T1
R17 15K
L5
C42 .1UF
R25 10K
R27 1.2K
C27 .1UF
R30 3.3K
R32 1.2K
L8 .15 UH
C30 .1UF
C44 .1UF
R35 3.3K
L6
C43 .1UF
R37 3.3 K
166
165
C26 .1UF
Q6
C28 .1 UF
Q7
Q8 2N2996
Q9 2N2996
R26 15K
R28 100
C29 .1 UF
R29 33
R31 15K
C31 7-25
R33 22K
FL4 21MC
C32 130
R34 220
C39 .1 UF
C33 7-25
R36 15K
C34 2.5-11
C47 20
R40 10 K
FL5 14.2 MC
C35 130
C36 7-25
C45 .1UF
C40 .1 UF
R41 1K
R38 15K



POSITIVE DC VOLTAGES TO GROUND

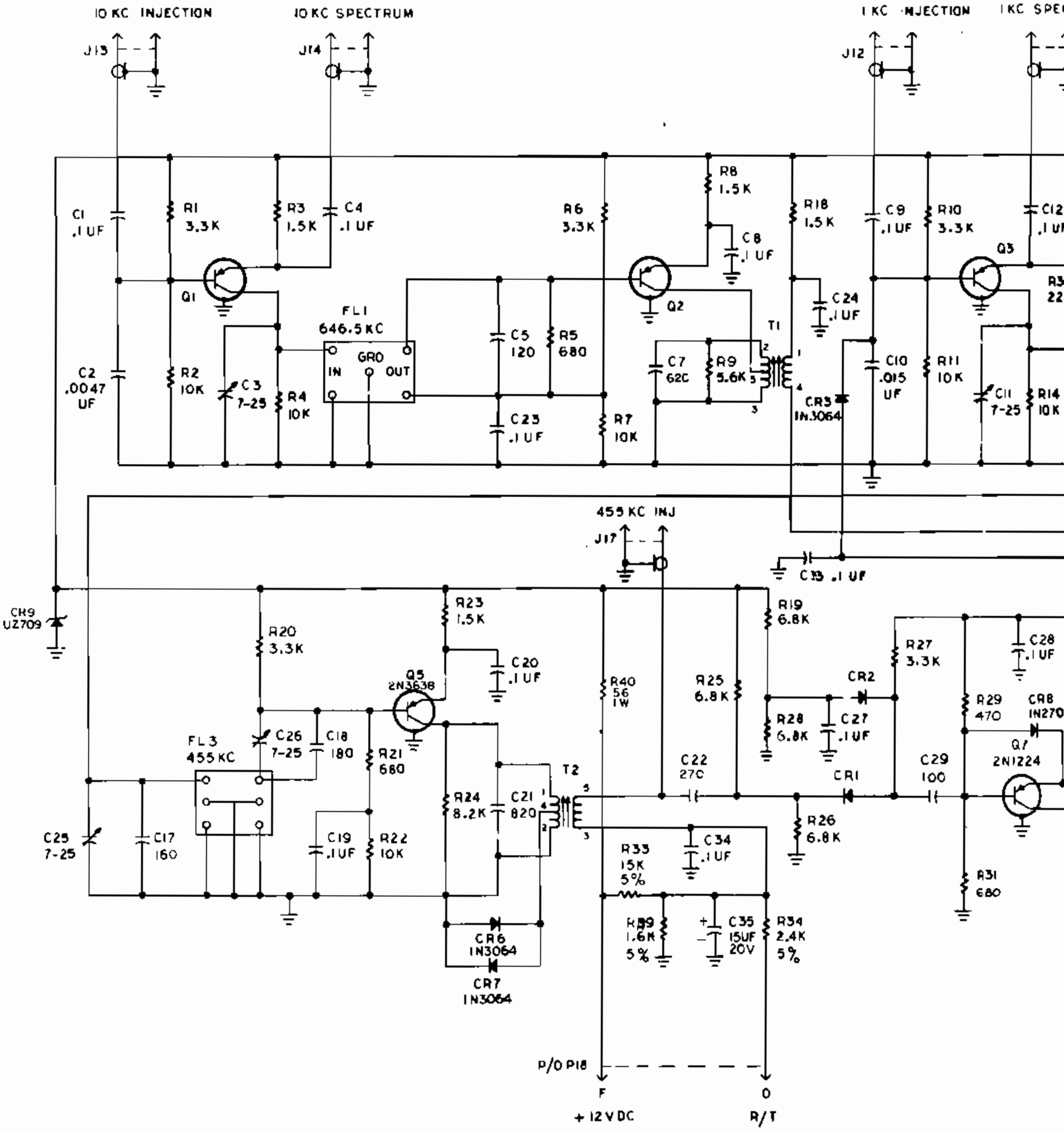
STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	7.4V	7.2V	0.5V	
Q2	10 V	9.8V	0 V	
Q3	10 V	9.9V	0 V	
Q4	9.8V	9.6V	0 V	
Q5	10 V	9.8V	0 V	
Q6	7.2V	7.0V	0.5V	
Q7	9.8V	9.6V	0 V	
Q8	10 V	9.9V	0 V	
Q9	11 V	10.5V	0 V	



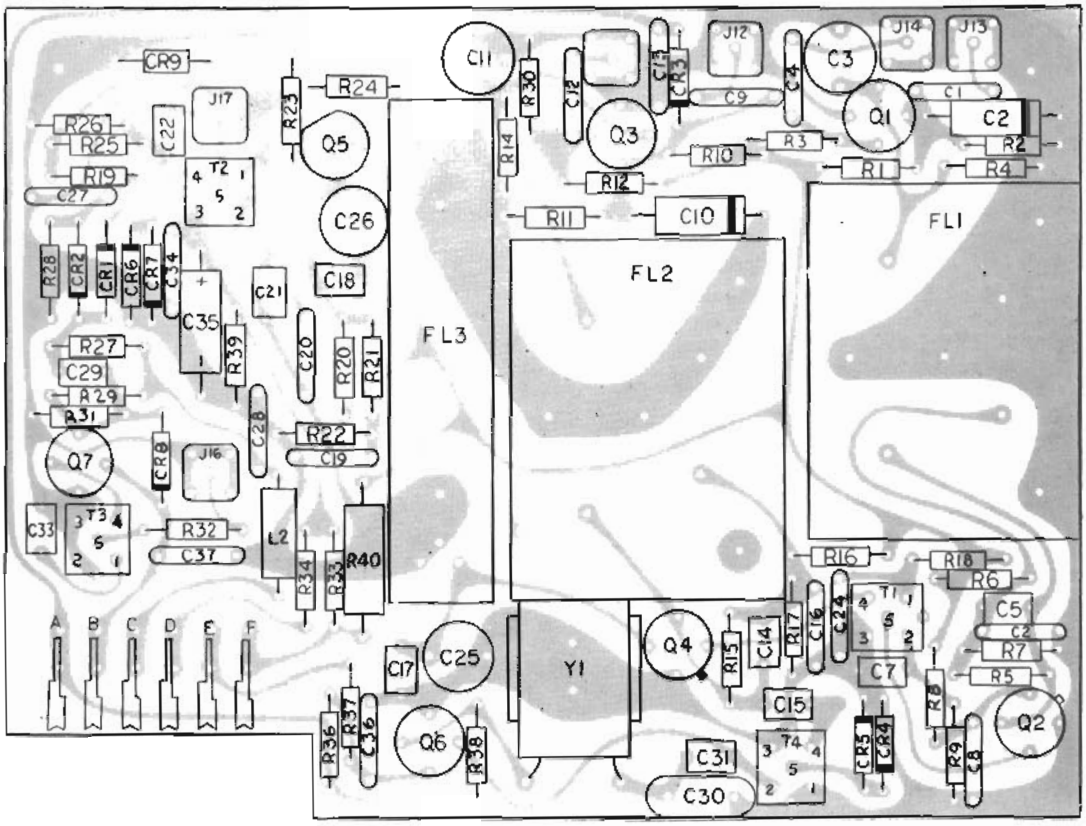
NOTES:

1. UNLESS OTHERWISE INDICATED
   a. ALL RESISTORS ARE IN OHMS, 1/4W, 10%
   b. ALL CAPACITORS ARE IN PICOFARADS
   c. ALL DIODES ARE IN270
   d. ALL TRANSISTORS ARE 2N2084

FIGURE 8.4 - 455 KC ERROR MIXER ASSEMBLY

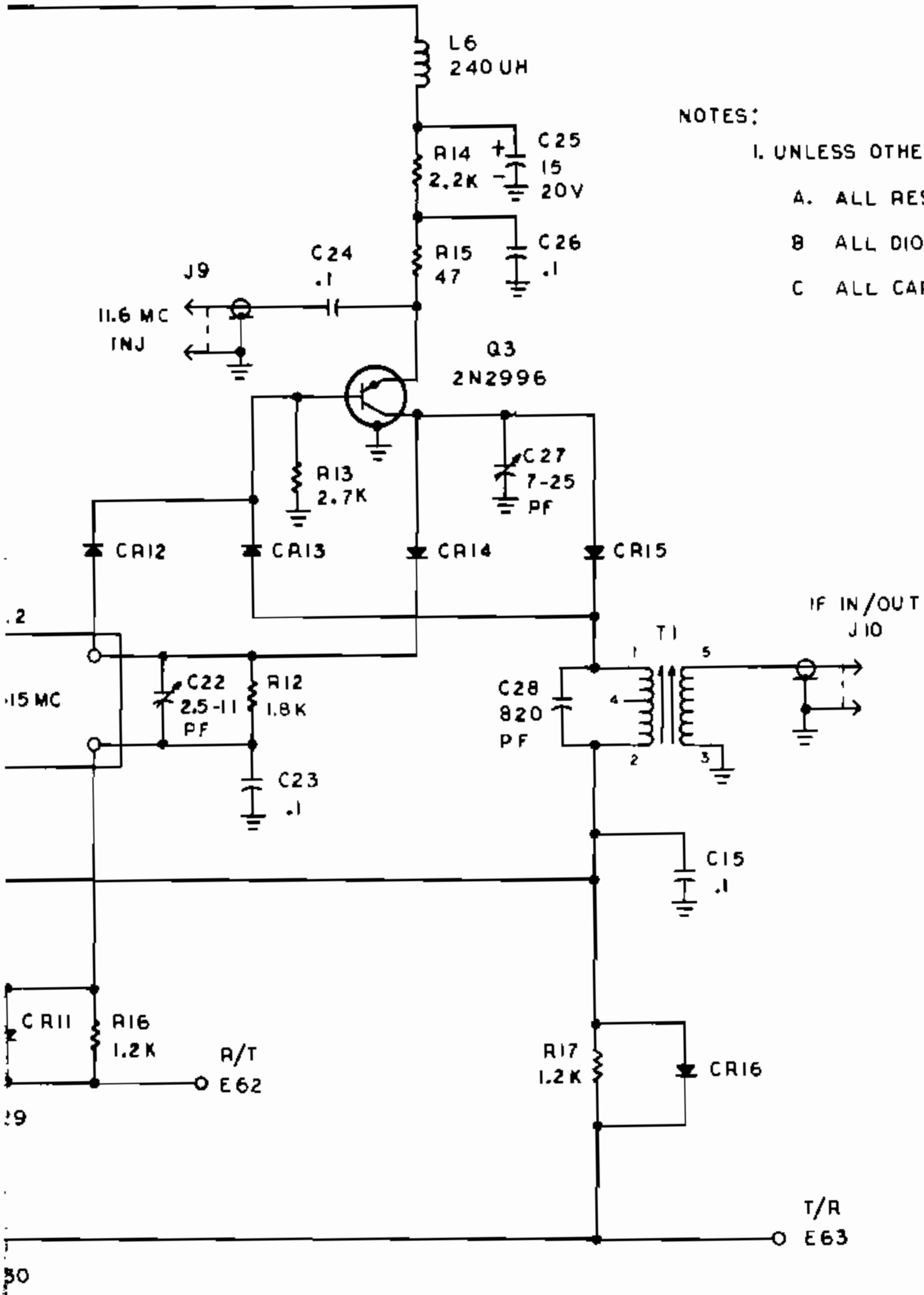


10 KC INJECTION
10 KC SPECTRUM
1 KC INJECTION
J13
J14
J12
C1 .1 UF
R1 3.3K
R3 1.5K
C4 .1 UF
Q1
C2 .0047 UF
R2 10K
C3 7-25
R4 10K
FL1 646.5KC
IN
GRD
OUT
C5 120
R5 680
C23 .1 UF
R6 3.3K
R7 10K
R8 1.5K
C8 .1 UF
Q2
C7 620
R9 5.6K
T1
R18 1.5K
C24 .1 UF
CR3 1N3064
C9 .1 UF
C10 .015 UF
R10 3.3K
R11 10K
Q3
C11 7-25
R14 10K
455 KC INJ
J17
C33 .1 UF
CR9 UZ709
R20 3.3K
R23 1.5K
C20 .1 UF
Q5 2N3638
FL3 455KC
C26 7-25
C18 180
R21 680
C25 7-25
C17 160
C19 .1 UF
R22 10K
R24 8.2K
C21 820
T2
CR6 1N3064
CR7 1N3064
R40 56 1W
C22 270
R25 6.8K
R19 6.8K
R28 6.8K
C27 .1 UF
CR2
R27 3.3K
C28 .1 UF
CR1
R26 6.8K
C34 .1 UF
R33 15K 5%
R39 1.6K 5%
C35 15UF 20V
R34 2.4K 5%
R29 470
CR8 1N270
Q7 2N1224
C29 100
R31 680
P/O P18
F
+12VDC
0
R/T



POSITIVE DC VOLTAGES TO GROUND

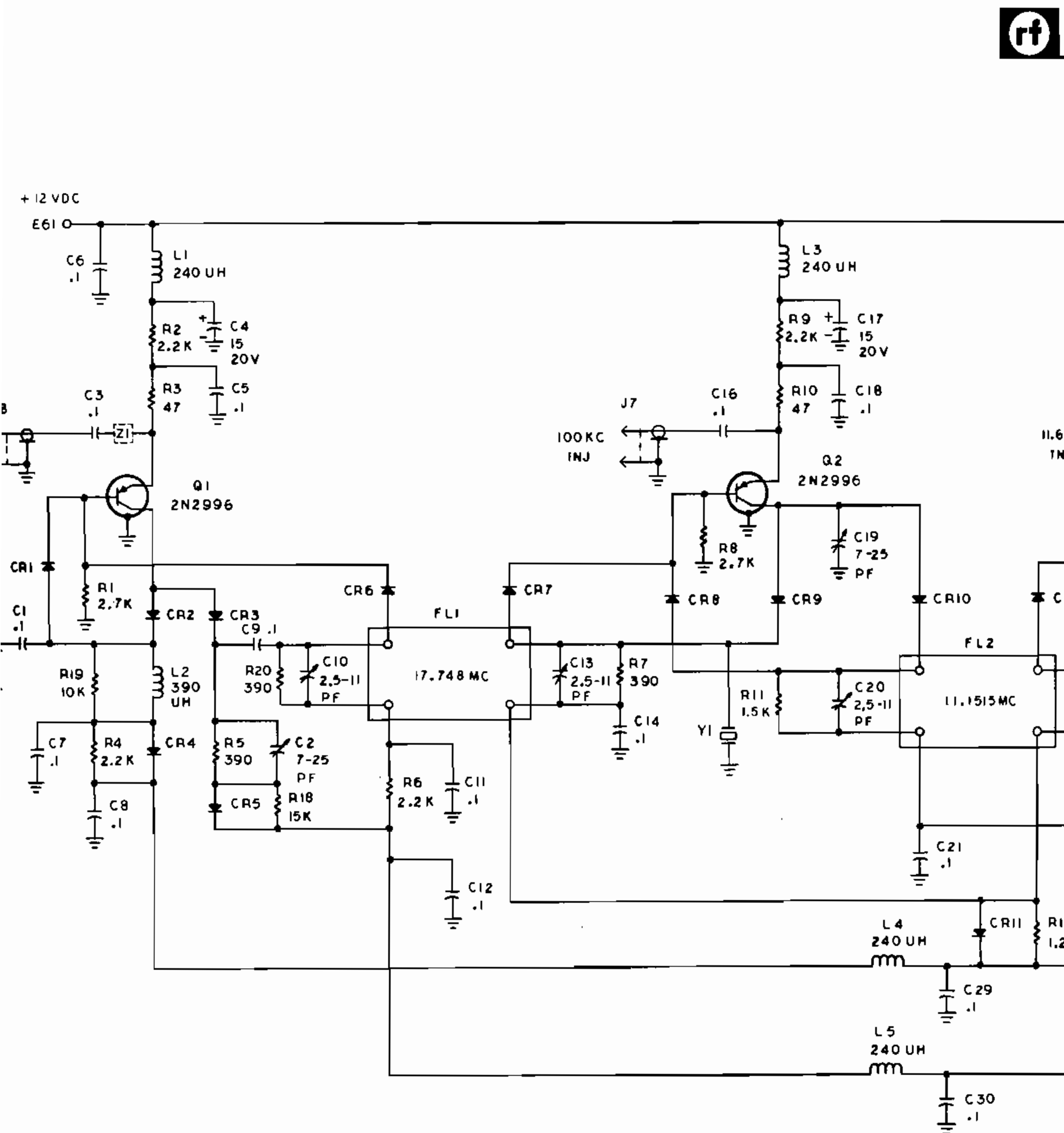
STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	6.8V	6.6V	0V	
Q2	7.2V	7.0V	0V	
Q3	7.2V	7.0V	0V	
Q4	7.4V	6.8V	0V	
Q5	7.6V	7.1V	0V	
Q6	10.2V	10 V	0V	with VFO on
Q7	0 V	0 V	0V	not used in RF-301P

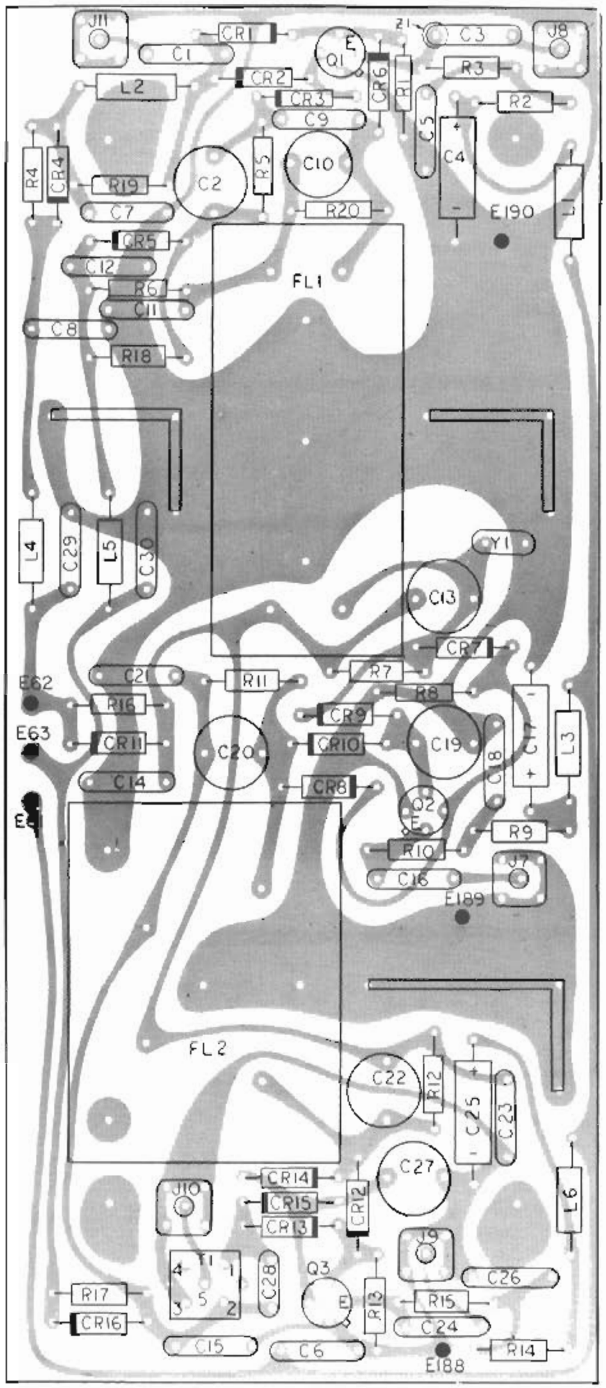


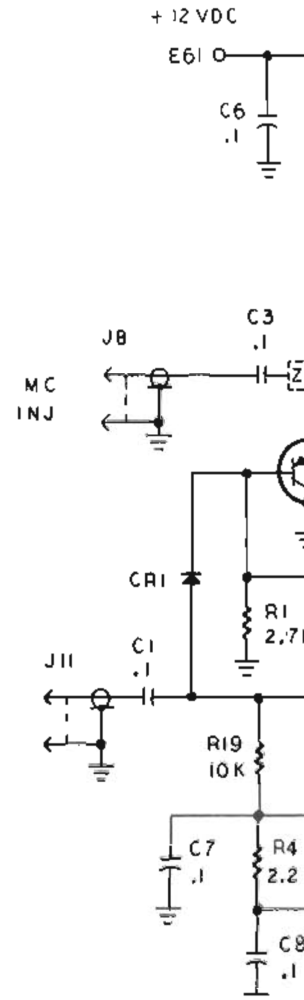
NOTES:

1. UNLESS OTHERWISE INDICATED
   - A. ALL RESISTORS ARE IN OHMS, 1/4 W, 10%
   - B ALL DIODES ARE IN270
   - C ALL CAPACITORS ARE IN MICROFARADS

FIGURE 8.5 - TRANSLATOR ASSEMBLY

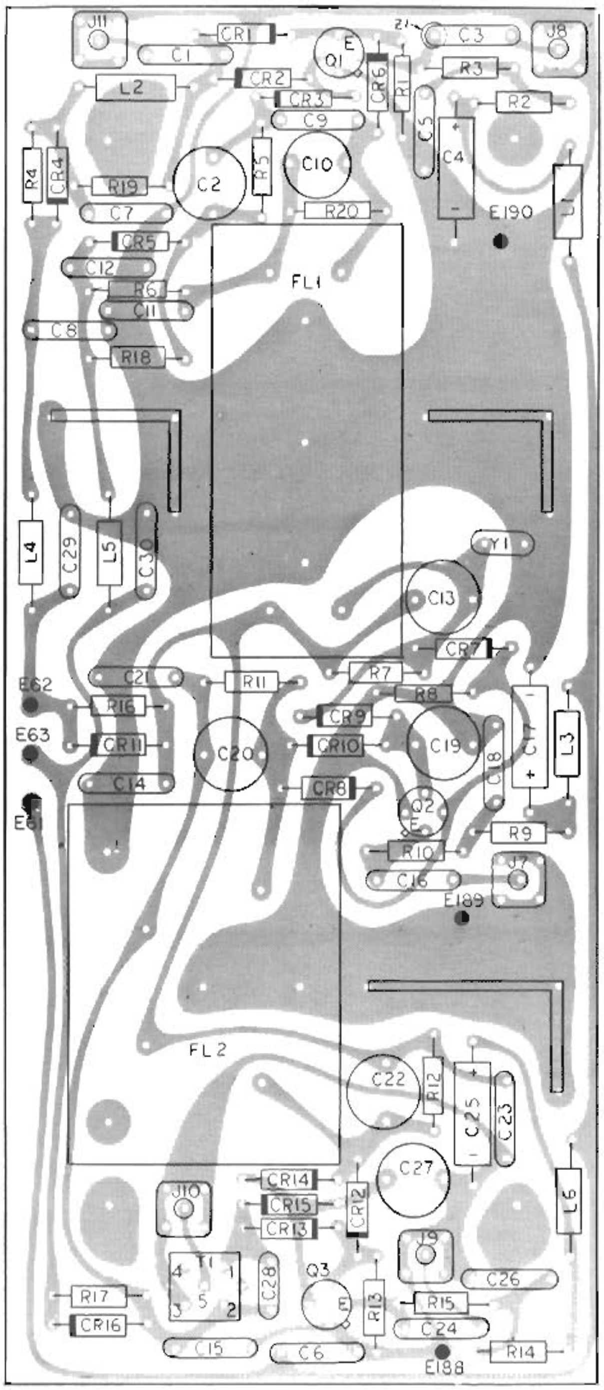

+12 VDC
E61
C6 .1
L1 240 UH
R2 2.2K
C4 15 20V
R3 47
C5 .1
C3 .1
Z1
Q1 2N2996
CR1
R1 2.7K
CR2
CR3
C9 .1
CR6
FL1
17.748 MC
CR7
C1 .1
R19 10K
L2 390 UH
R20 390
C10 2.5-11 PF
C13 2.5-11 PF
R7 390
C14 .1
C7 .1
R4 2.2K
CR4
R5 390
C2 7-25 PF
CR5
R18 15K
R6 2.2K
C11 .1
C8 .1
C12 .1
J7
100KC INJ
C16 .1
L3 240 UH
R9 2.2K
C17 15 20V
R10 47
C18 .1
Q2 2N2996
R8 2.7K
C19 7-25 PF
CR8
CR9
CR10
FL2
11.1515MC
R11 1.5K
C20 2.5-11 PF
Y1
C21 .1
L4 240 UH
CR11
C29 .1
L5 240 UH
C30 .1





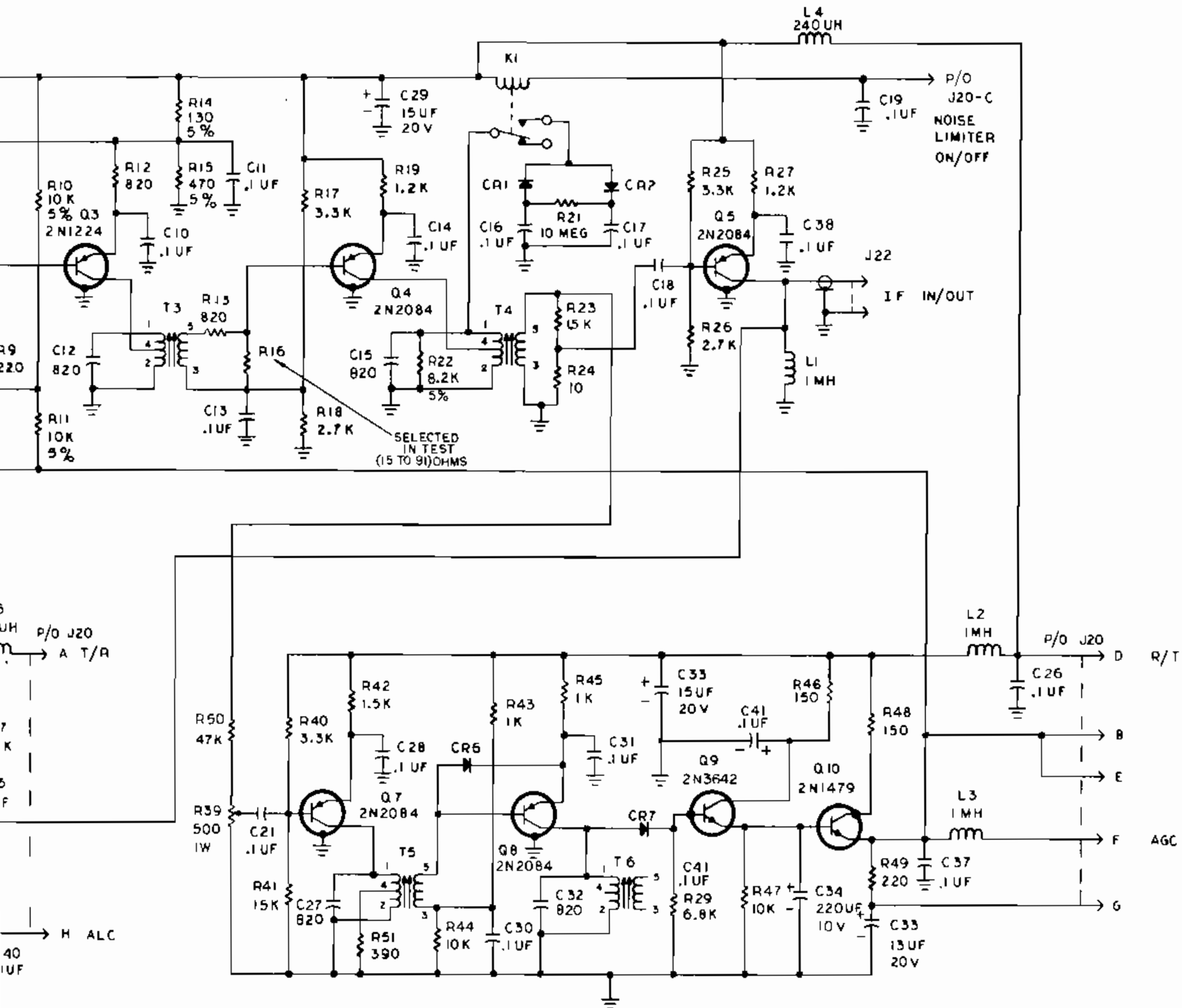
POSITIVE DC VOLTAGES TO GROUND

STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	6.8V	6.6V	1.6V	
Q2	6.4V	6.2V	0.8V	
Q3	6.2V	6.0V	0.65V	



POSITIVE DC VOLTAGES TO GROUND

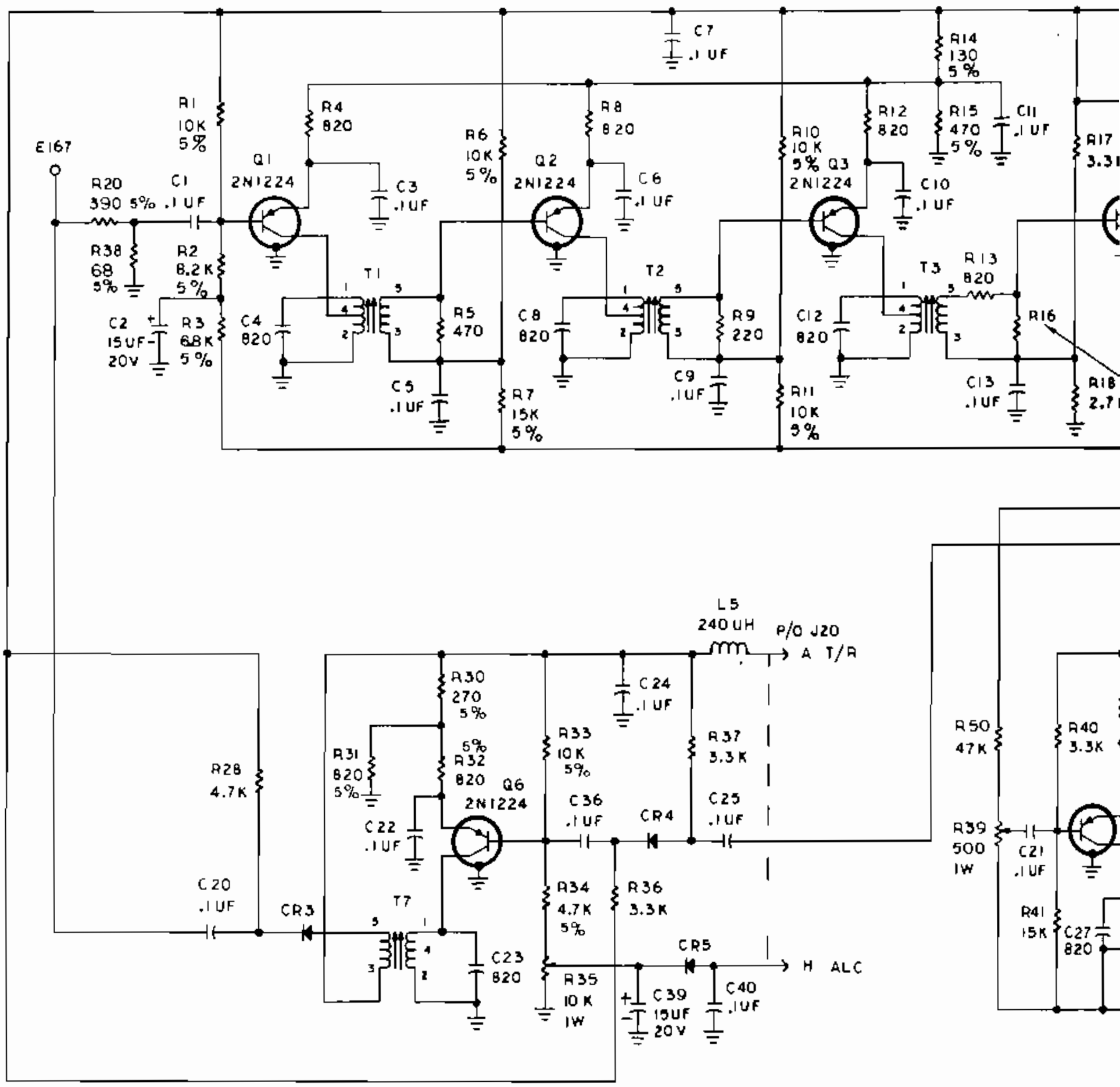
STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	6.8V	6.6V	1.6V	
Q2	6.4V	6.2V	0.8V	
Q3	6.2V	6.0V	0.65V	



NOTES:

1. UNLESS OTHERWISE INDICATED
   a. RESISTORS ARE IN OHMS, 1/4W, 10%
   b. CAPACITORS ARE IN PICOFARADS
   c. DIODES ARE IN270

FIGURE 8.6 - IF AMPLIFIER ASSEMBLY



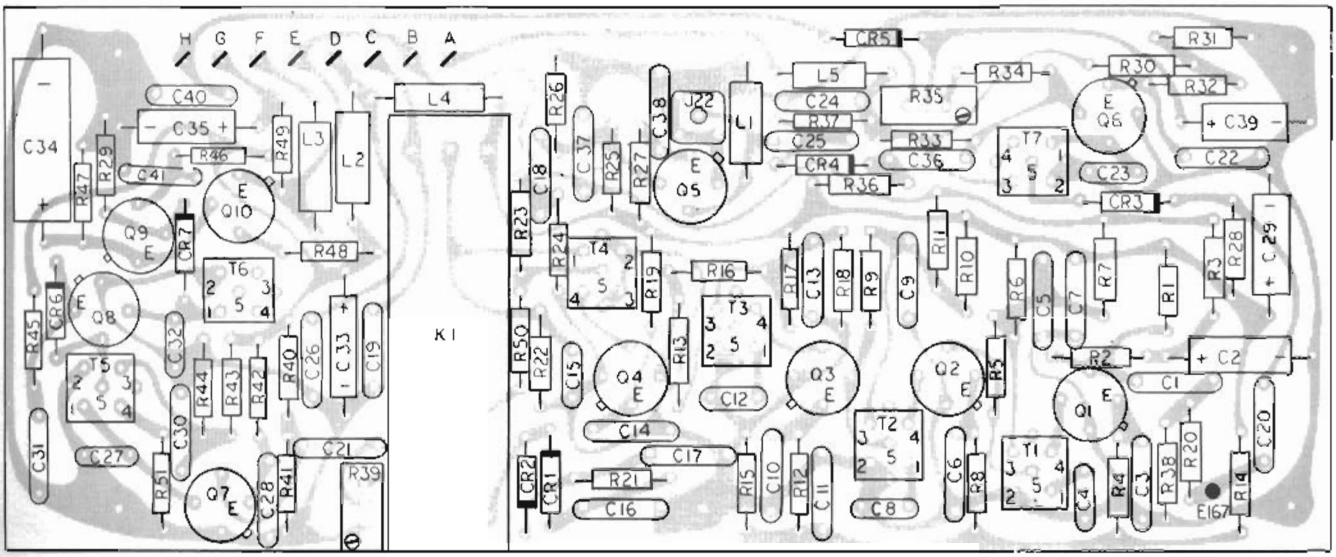
NOTES:

1. UNL

a. F

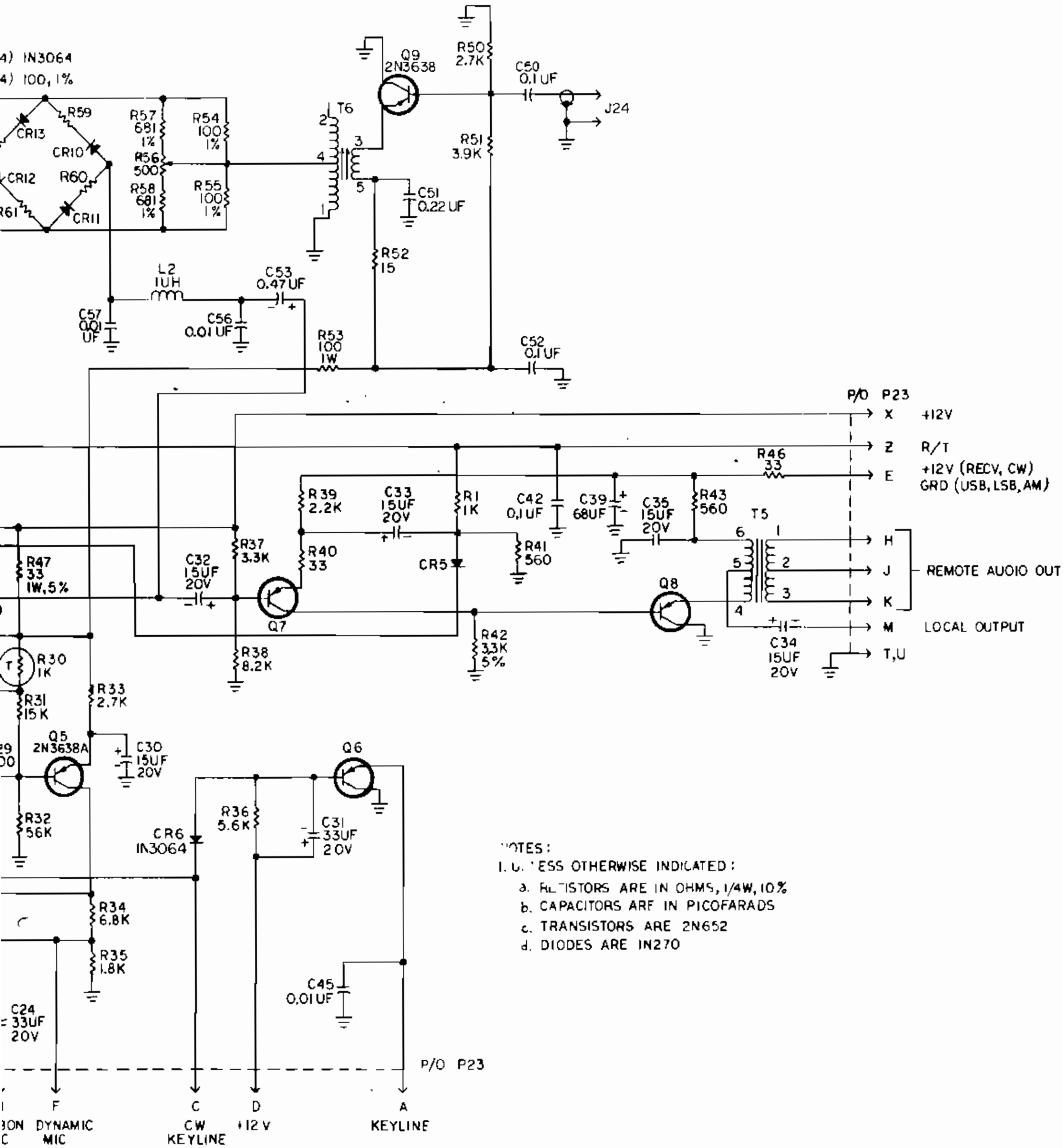
b. C

c. L



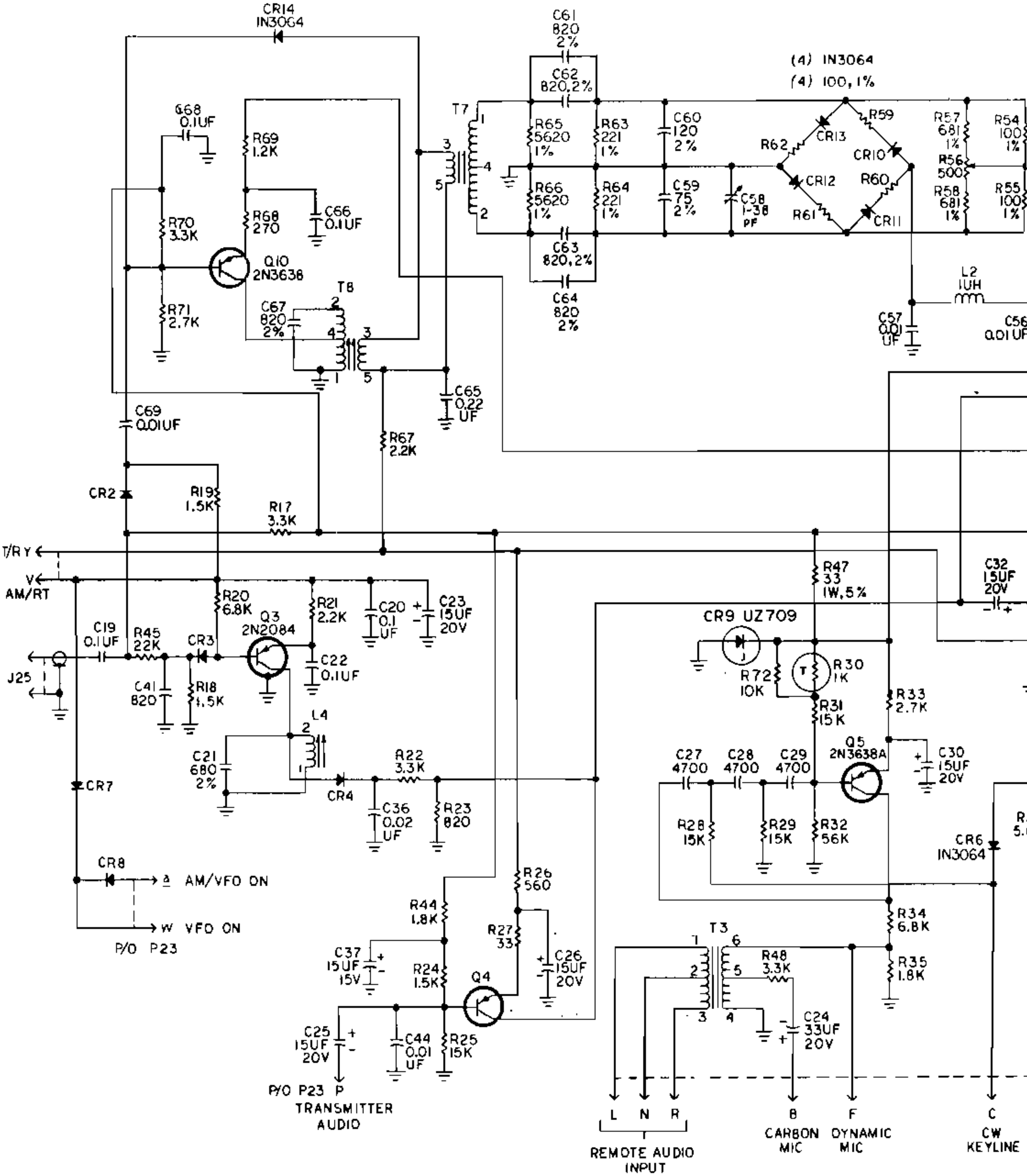
POSITIVE DC VOLTAGES TO GROUND

STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	8 V	7.8V	0 V	Receive
Q2	7.8V	7.6V	0 V	Receive
Q3	6.8V	6.4V	0 V	Receive
Q4	5.4V	5.0V	0 V	Receive
Q5	5.6V	5.2V	.06V	Receive
Q6	8.4V	8.2V	0 V	Transmit
Q7	9.8V	9.6V	0 V	Receive
Q8	10.5V	10 V	0 V	Receive
Q9	0 V	0 V	12 V	Receive
Q10	.3V	0 V	12 V	Receive

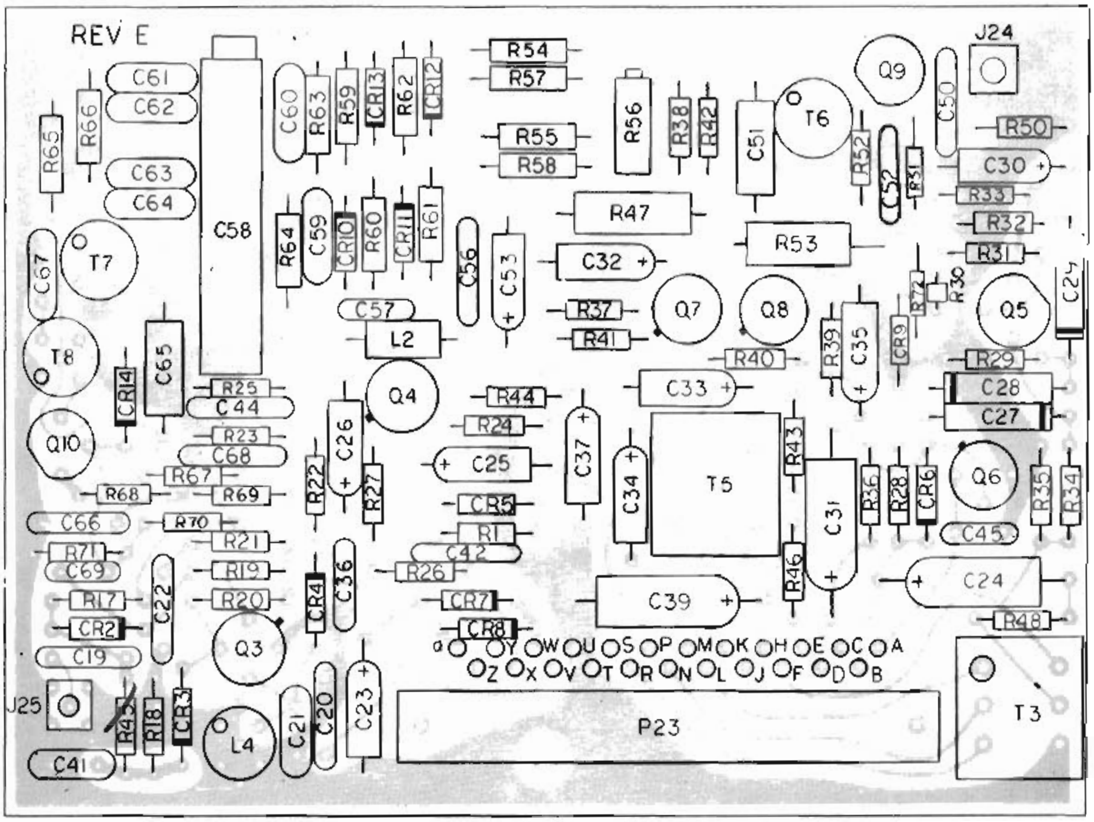


NOTES:
1. UNLESS OTHERWISE INDICATED:
   a. RESISTORS ARE IN OHMS, 1/4W, 10%
   b. CAPACITORS ARE IN PICOFARADS
   c. TRANSISTORS ARE 2N652
   d. DIODES ARE IN270

FIGURE 8.7 - AUDIO/MODULATOR ASSEMBLY



CR14
IN3064
C61
820
2%
C62
820,2%
(4) IN3064
(4) 100,1%
C68
0.1UF
R69
1.2K
T7
R65
5620
1%
R63
221
1%
C60
120
2%
R62
CR13
R59
CR10
R57
681
1%
R54
100
1%
R56
500
R58
681
1%
R55
100
1%
R66
5620
1%
R64
221
1%
C59
75
2%
C58
1-38
PF
CR12
R60
R61
CR11
R68
270
C66
0.1UF
R70
3.3K
Q10
2N3638
C63
820,2%
C64
820
2%
L2
1UH
C57
0.01
UF
C56
0.01UF
T8
R71
2.7K
C67
820
2%
C65
0.22
UF
C69
0.01UF
R67
2.2K
CR2
R19
1.5K
R17
3.3K
T/RY
V
AM/RT
R47
33
1W,5%
C32
15UF
20V
R20
6.8K
R21
2.2K
C20
0.1
UF
C23
15UF
20V
C19
0.1UF
R45
22K
CR3
Q3
2N2084
C22
0.1UF
CR9 UZ709
R30
1K
R72
10K
J25
C41
820
R18
1.5K
R31
15K
R33
2.7K
L4
C21
680
2%
R22
3.3K
Q5
2N3638A
C30
15UF
20V
C27
4700
C28
4700
C29
4700
CR7
CR4
C36
0.02
UF
R23
820
R28
15K
R29
15K
R32
56K
CR6
IN3064
CR8
AM/VFO ON
W VFO ON
P/O P23
R26
560
R44
1.8K
C37
15UF
15V
R27
33
C26
15UF
20V
R24
1.5K
Q4
T3
R48
3.3K
R34
6.8K
R35
1.8K
C25
15UF
20V
C44
0.01
UF
R25
15K
C24
33UF
20V
P/O P23 P
TRANSMITTER
AUDIO
L N R
REMOTE AUDIO
INPUT
B
CARBON
MIC
F
DYNAMIC
MIC
C
CW
KEYLINE



POSITIVE DC VOLTAGES TO GROUND

STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q3	3 V	2.8V	0V	Receive
	0 V	0 V	0V	Transmit
Q4	0 V	10 V	0V	Receive
	10 V	10 V	3V	Transmit
Q5	8 V	7.4V	3V	Receive
Q6	13 V	13 V	0V	Receive
	0.9V	0.6V	0V	Transmit CW
Q7	9.3V	9.1V	4V	Receive
Q8	3.5V	3.2V	0V	Receive
Q9	36 V	2.9V	0V	Receive
Q10	6 V	5.3V	0V	Receive
	0.9V	7 V	0V	Transmit

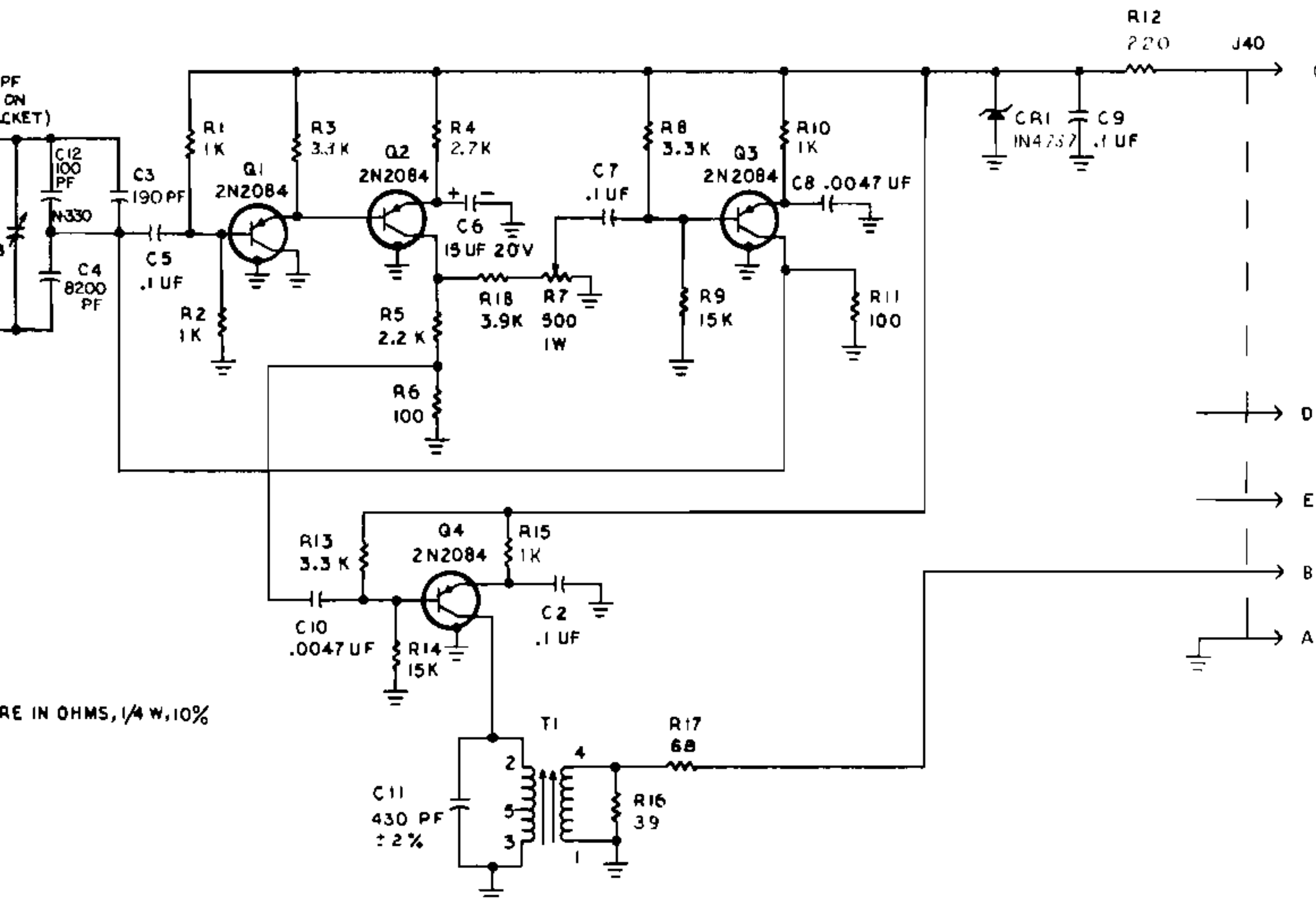
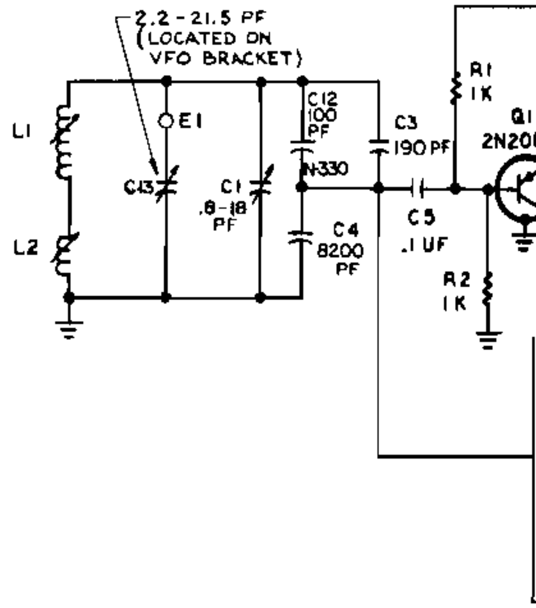
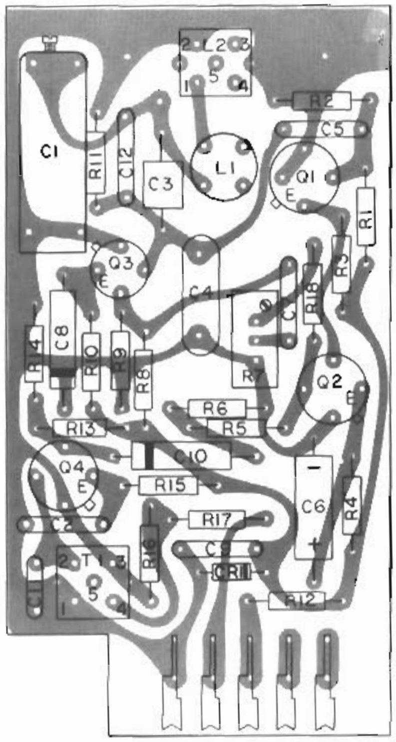


FIGURE 8.8 - VFO ASSEMBLY



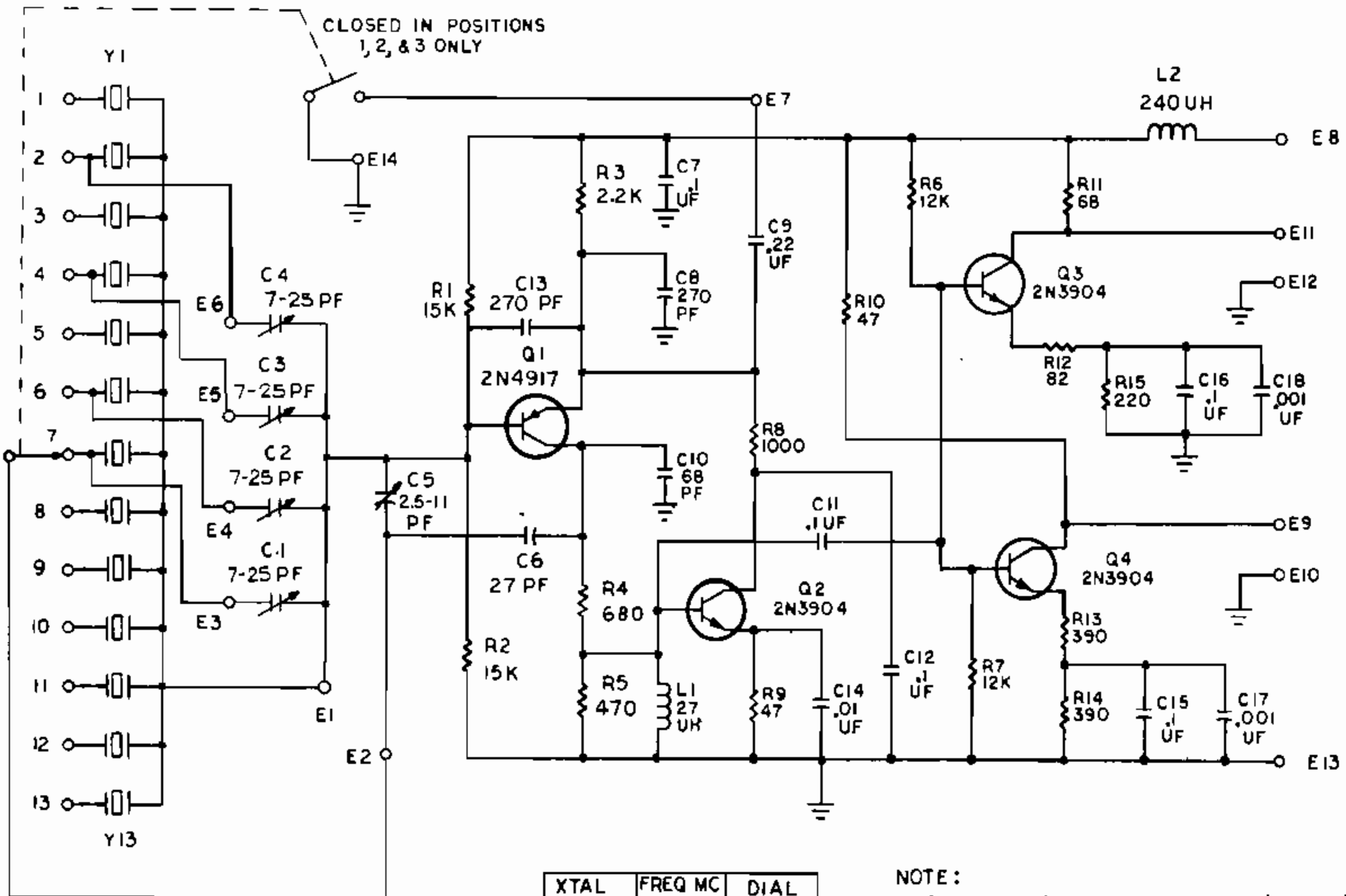
NOTES:

1. RES ARE IN OHMS, 1/4 W, 10%



POSITIVE DC VOLTAGES TO GROUND

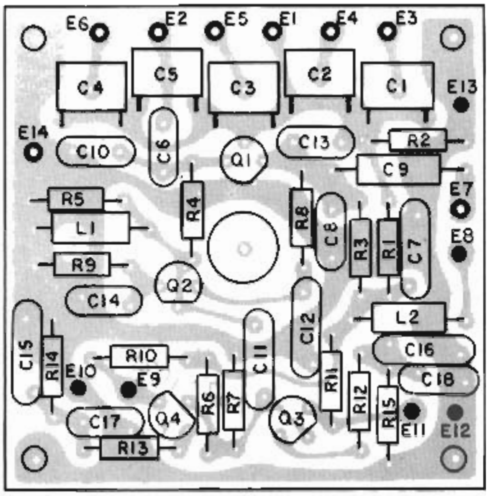
STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	4.6V	4.4V	0V	
Q2	5 V	4.6V	1.6V	
Q3	7.4V	7.2V	.1V	
Q4	7.3V	7 V	0V	



XTAL	FREQ MC	DIAL
Y1	3.247	14
Y2	4.247	13
Y3	5.247	12
Y4	6.247	11
Y5	7.247	10
Y6	8.247	9
Y7	9.247	8
Y8	10.247	7
Y9	11.247	6
Y10	12.247	5
Y11	13.247	4
Y12	14.247	3
Y13	15.247	2

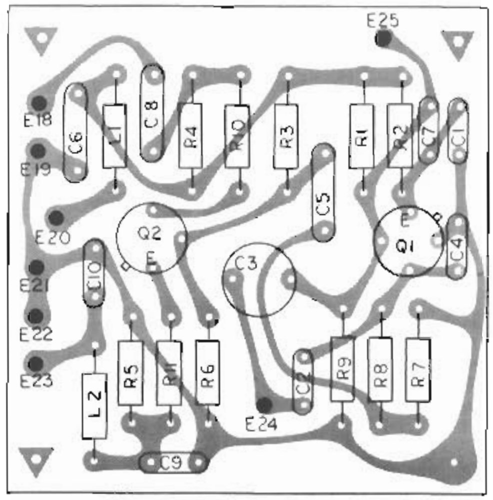
NOTE:
1-ALL RESISTORS ARE IN OHMS, 1/4W, 10%

FIGURE 8.9 - MC OSCILLATOR ASSEMBLY



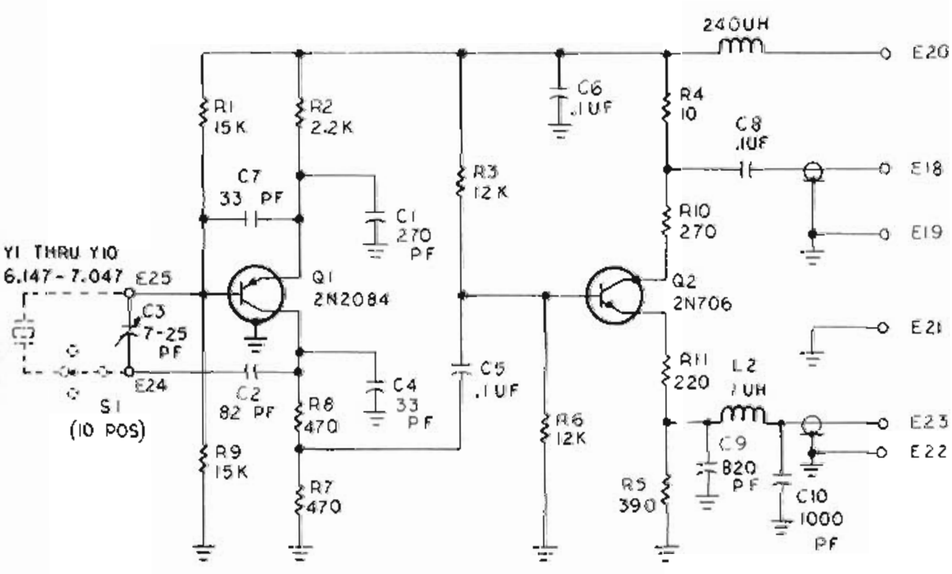
POSITIVE DC VOLTAGES TO GROUND

STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	6.3V	5.9V	0.75V	
Q2	0.06V	0 V	4.9 V	
Q3	4.6V	5.2V	10.5 V	
Q4	4.6V	5.2V	11.0 V	



POSITIVE DC VOLTAGES TO GROUND

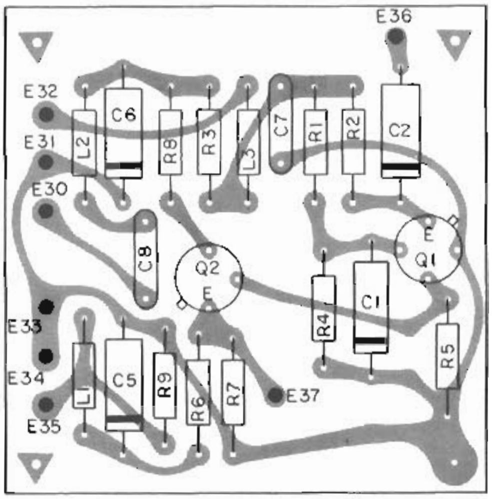
STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	5.8V	6.1V	2.4V	
Q2	4.4V	5.2V	10 V	



NOTES:
1. ALL RESISTORS ARE IN OHMS, 1/2W, 10%

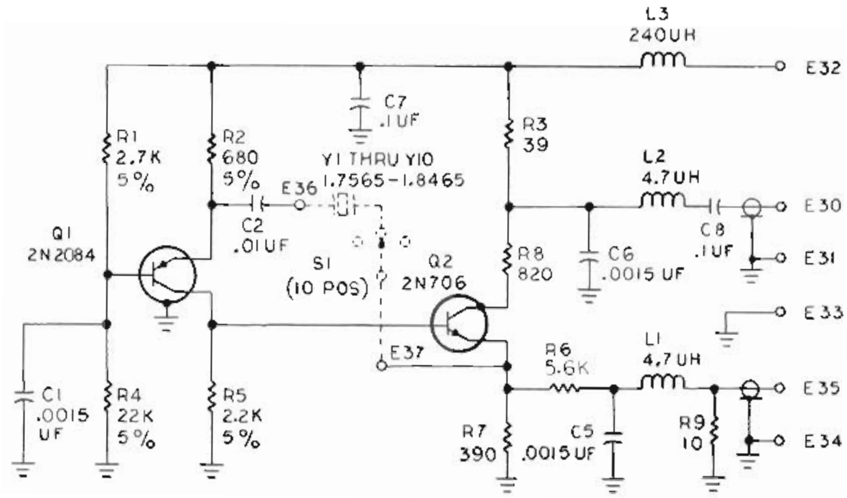
XTAL	FREQ MC	DIAL
Y1	6.147	0
Y2	6.247	1
Y3	6.347	2
Y4	6.447	3
Y5	6.547	4
Y6	6.647	5
Y7	6.747	6
Y8	6.847	7
Y9	6.947	8
Y10	7.047	9

FIGURE 8.10 - 100 KC OSCILLATOR ASSEMBLY



POSITIVE DC VOLTAGES TO GROUND

STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	10V	10.2V	2.4V	
Q2	2.6V	2.4V	7.6V	

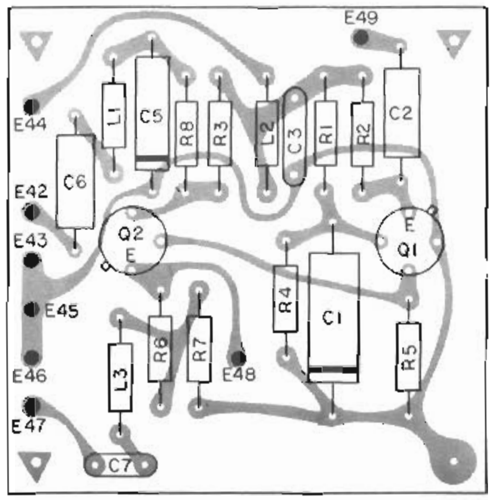


XTAL	FREQ MC	DIAL
Y1	1.7565	9
Y2	1.7665	8
Y3	1.7765	7
Y4	1.7865	6
Y5	1.7965	5
Y6	1.8065	4
Y7	1.8165	3
Y8	1.8265	2
Y9	1.8365	1
Y10	1.8465	0

NOTES:

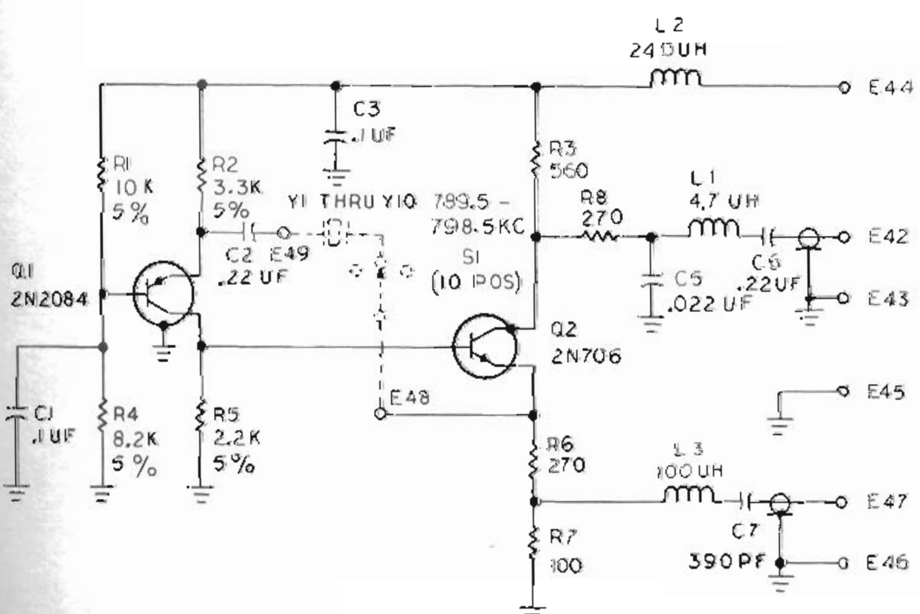
1. ALL RESISTORS ARE IN OHMS, 1/2W, 10%

FIGURE 8.11 - 10 KC OSCILLATOR ASSEMBLY



POSITIVE DC VOLTAGES TO GROUND

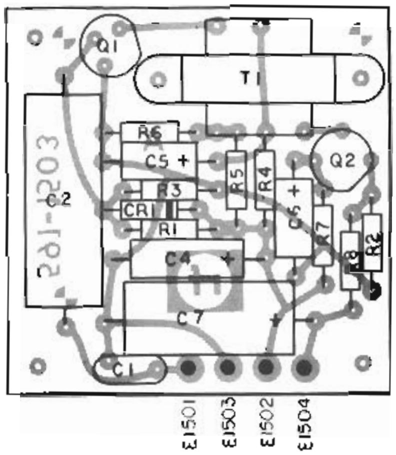
STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	5.5V	5.7V	3.7V	
Q2	3.6V	3.7V	7.2V	



XTAL	FREQ KC	DIAL
Y1	789.5	9
Y2	790.5	8
Y3	791.5	7
Y4	792.5	6
Y5	793.5	5
Y6	794.5	4
Y7	795.5	3
Y8	796.5	2
Y9	797.5	1
Y10	798.5	0

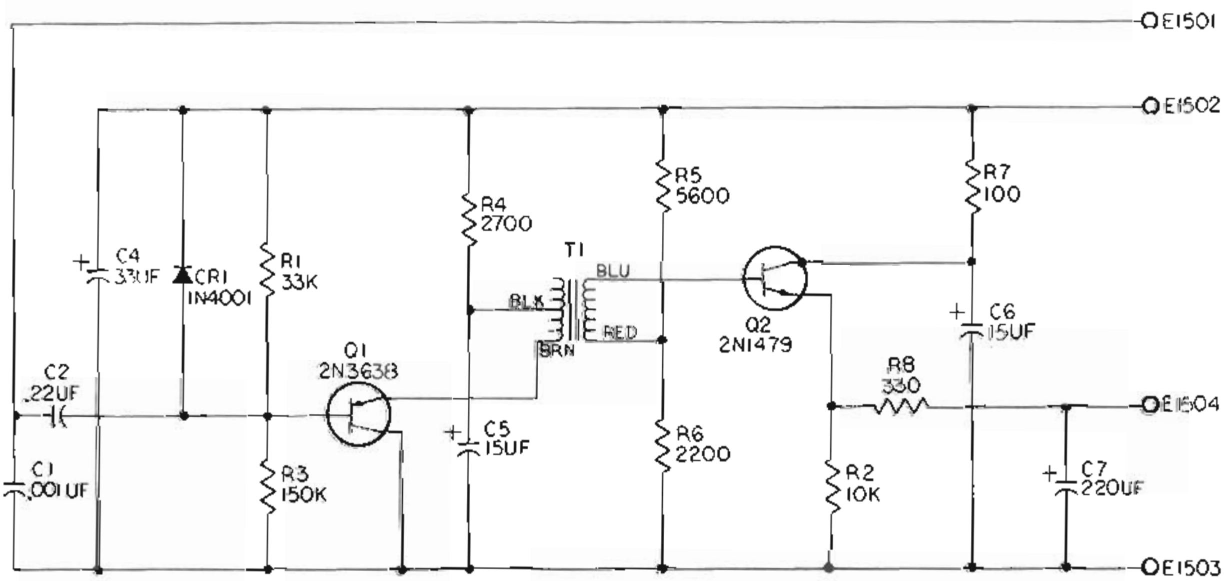
NOTES:
1. ALL RESISTORS ARE IN OHMS, 1/2W, 10%

FIGURE 8.12 - 1 KC OSCILLATOR ASSEMBLY



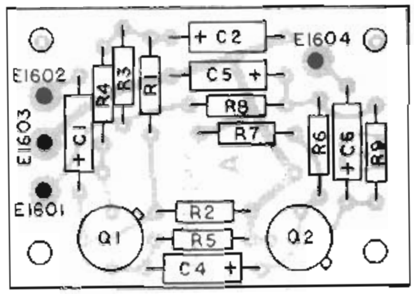
POSITIVE DC VOLTAGES TO GROUND

STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	10.5V	10 V	0V	(Taken in USB
Q2	4.4V	3.3V	11V	Transmit Mode)



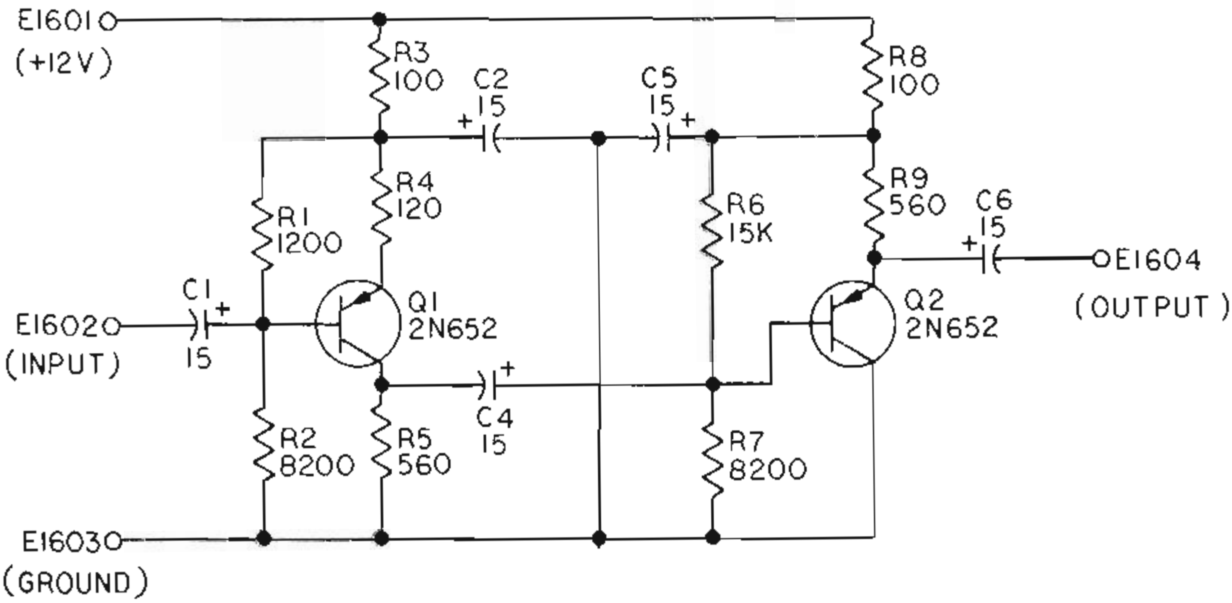
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCES IN OHMS

FIGURE 8.13 - ALC ASSEMBLY



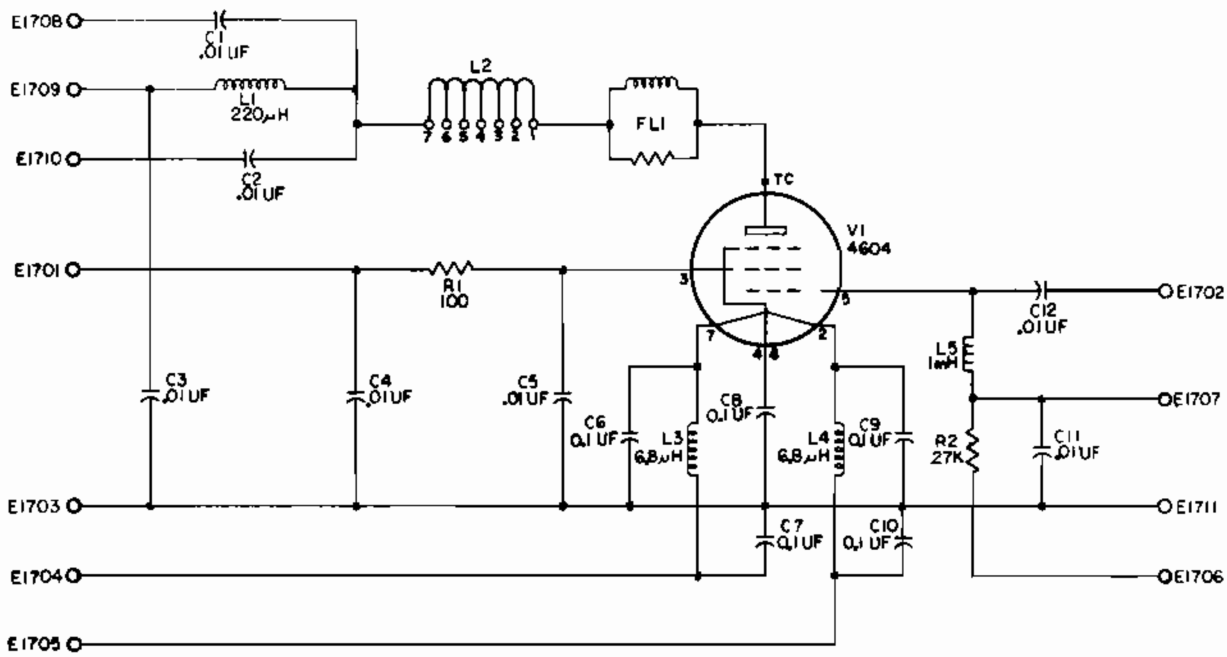
POSITIVE DC VOLTAGES TO GROUND

STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	+9.6V	+9.4V	+6.2V	
Q2	+4.6V	+4.4V	0	



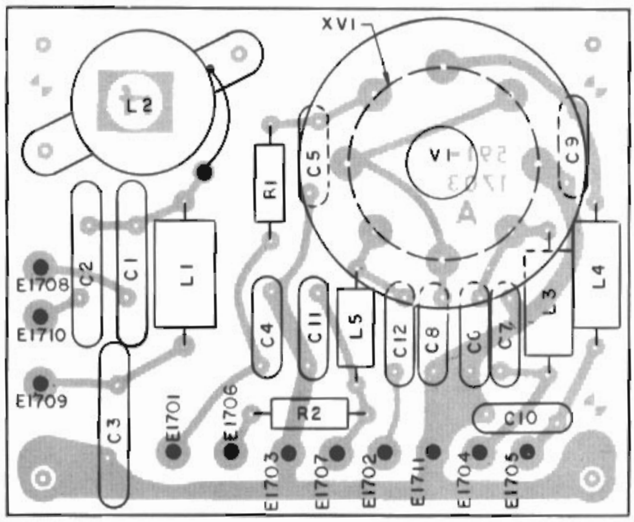
NOTE: ALL RESISTANCES IN OHMS, CAPACITANCES IN UF

FIGURE 8.14 - AUDIO AMPLIFIER ASSEMBLY



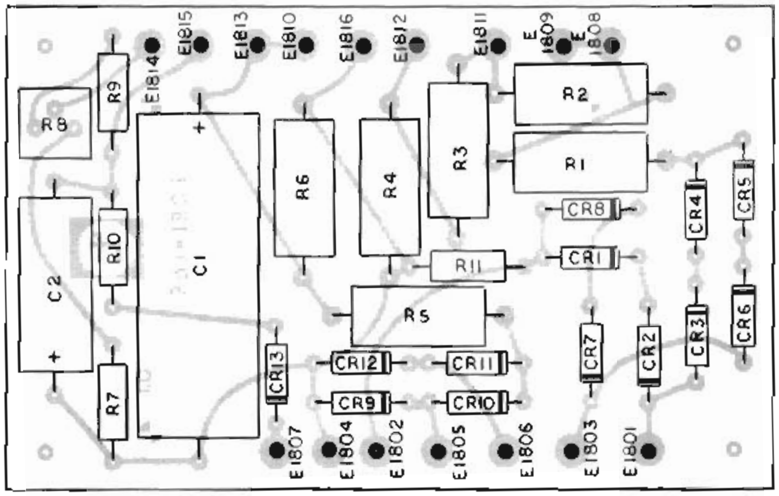
NOTES
1. ALL RESISTANCES IN OHMS

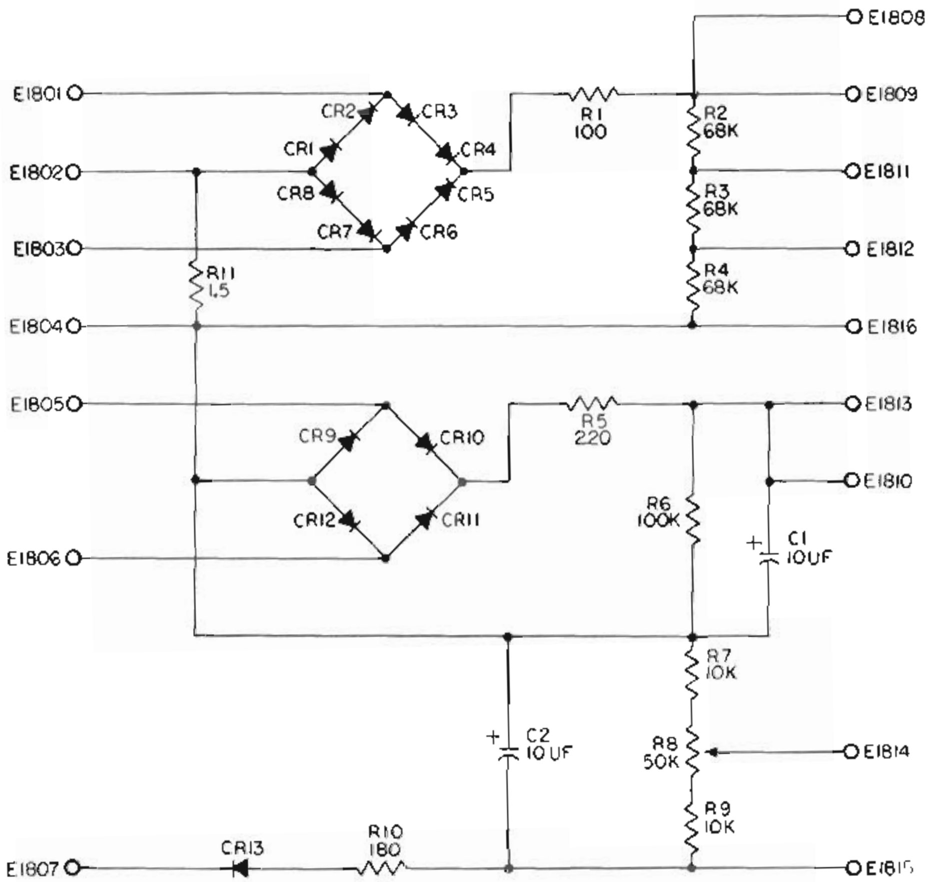
FIGURE 8.15 - TRANSMIT POWER AMPLIFIER ASSEMBLY



VI DC VOLTAGES TO GROUND

PIN	VOLTAGE	NOTES
1	+ 9.0V	
2	+ 6.2V	
3	+28.0V	
4	+ 9.0V	(All Taken
5	-50 V	in Transmit
6	+ 9 V	USB Mode,
7	+12 V	No Modulation)
8	0 V	
CAP	+850 V	





NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCES IN OHMS
2. ALL DIODES IN2071

FIGURE 8.16 - TRANSMIT POWER SUPPLY RECTIFIER ASSEMBLY

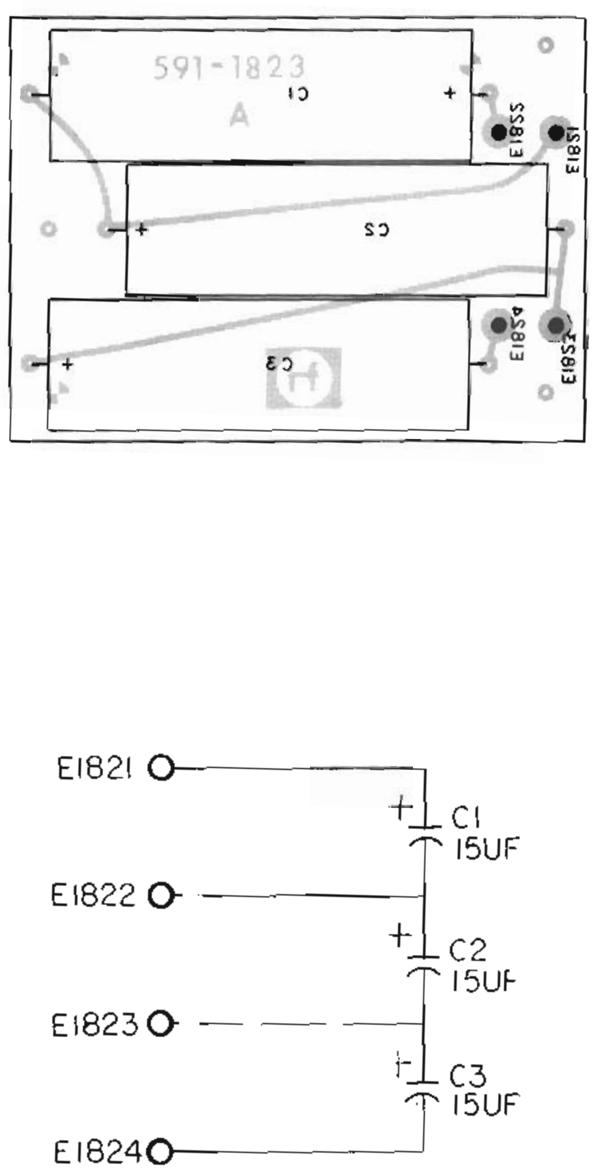
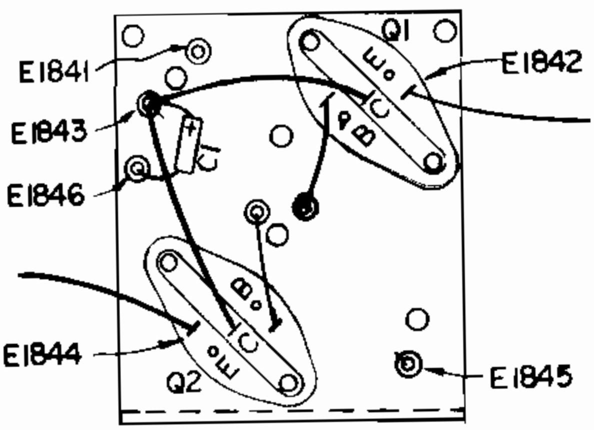
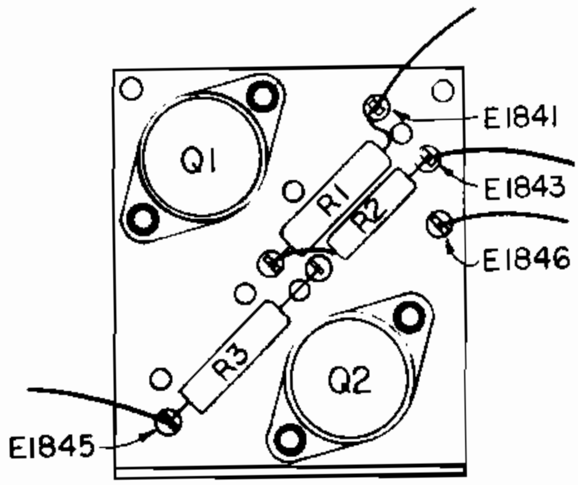


FIGURE 8.17 - TRANSMIT POWER SUPPLY CAPACITOR ASSEMBLY





POSITIVE DC VOLTAGES TO GROUND

STAGE	EMITTER	BASE	COLLECTOR	NOTES
Q1	+100MV	-2.1V	+12V	Transmit
Q2	+50MV	-3.3V	+12V	Transmit

NOTE:
1. ALL RESISTANCES IN OHMS

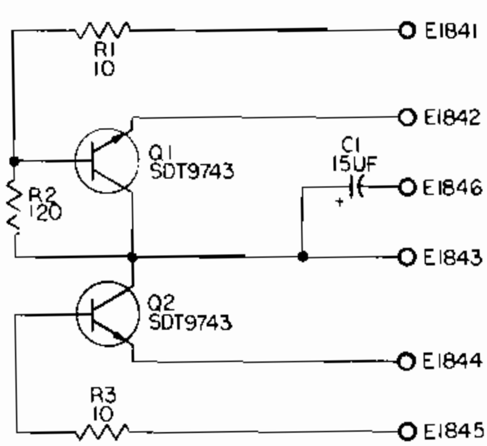
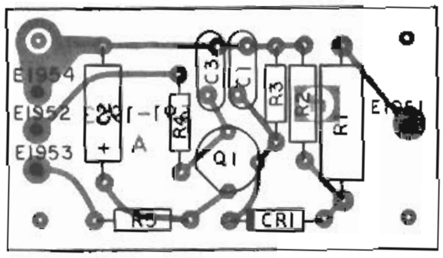
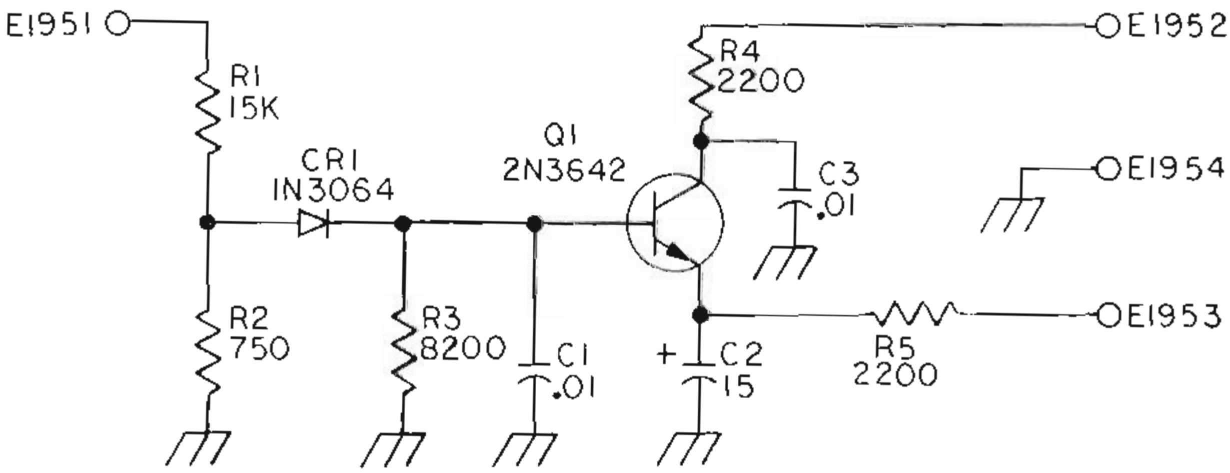


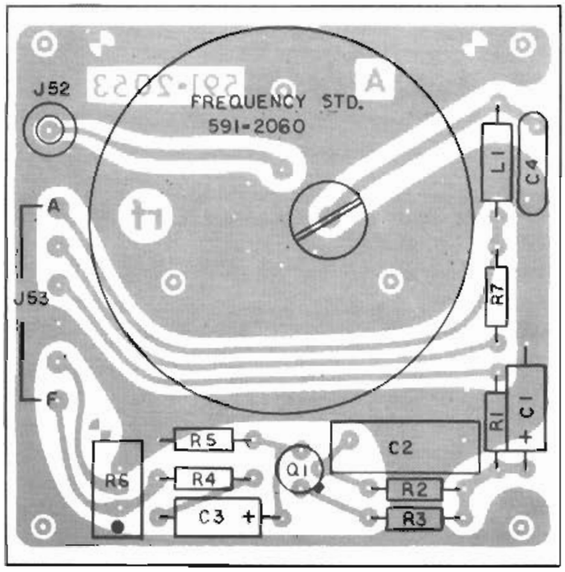
FIGURE 8.18 - TRANSMIT POWER SUPPLY TRANSISTOR ASSEMBLY

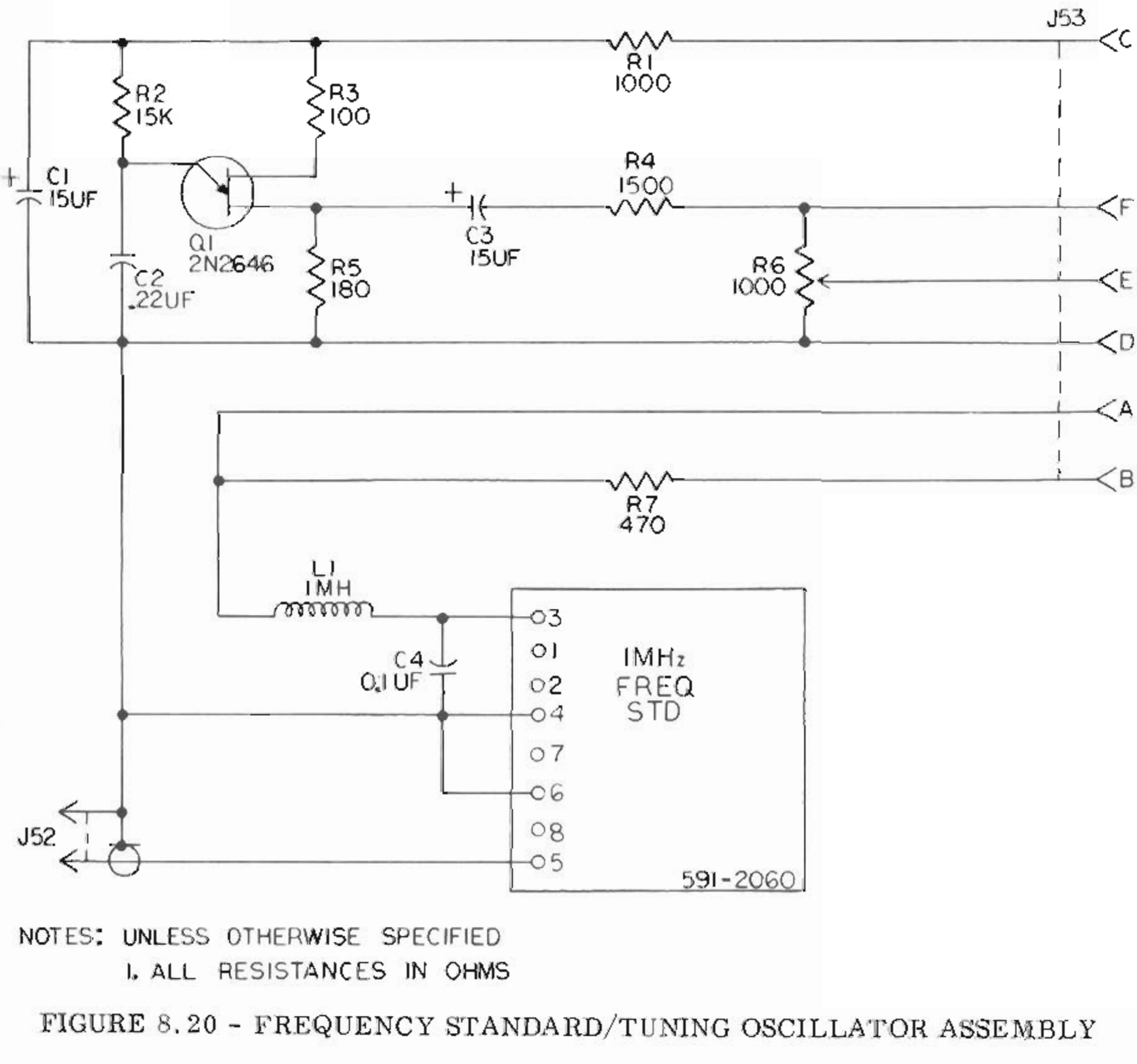




NOTE
ALL RESISTORS IN OHMS
ALL CAPACITORS IN MICROFARADS

FIGURE 8.19 · ANTENNA CURRENT MONITOR ASSEMBLY

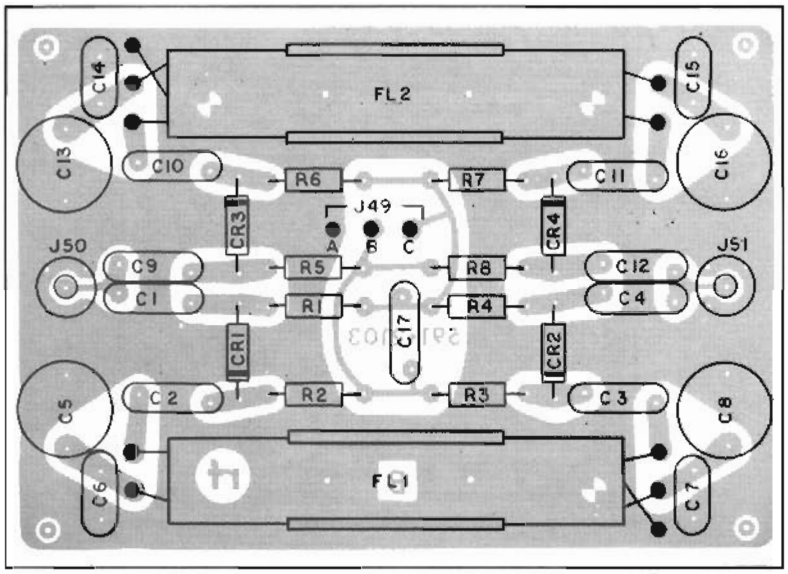


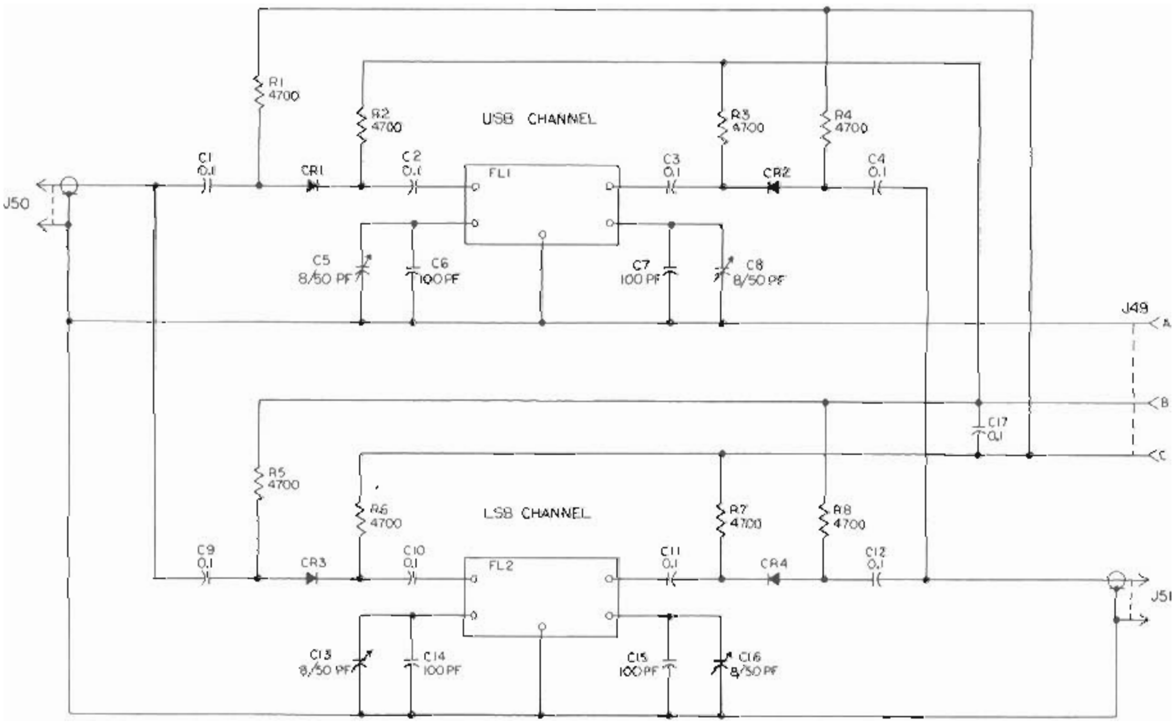


NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCES IN OHMS

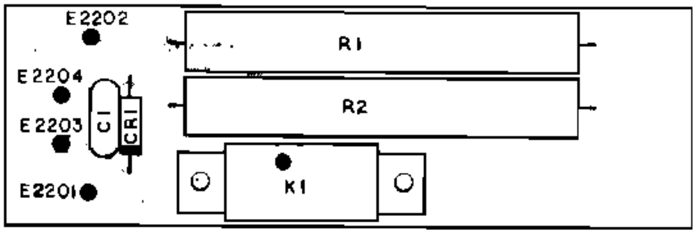
FIGURE 8.20 - FREQUENCY STANDARD/TUNING OSCILLATOR ASSEMBLY





NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCES IN OHMS
2. ALL DIODES IN270
3. ALL CAPACITANCES IN UF

FIGURE 8.21 - SSB FILTER ASSEMBLY



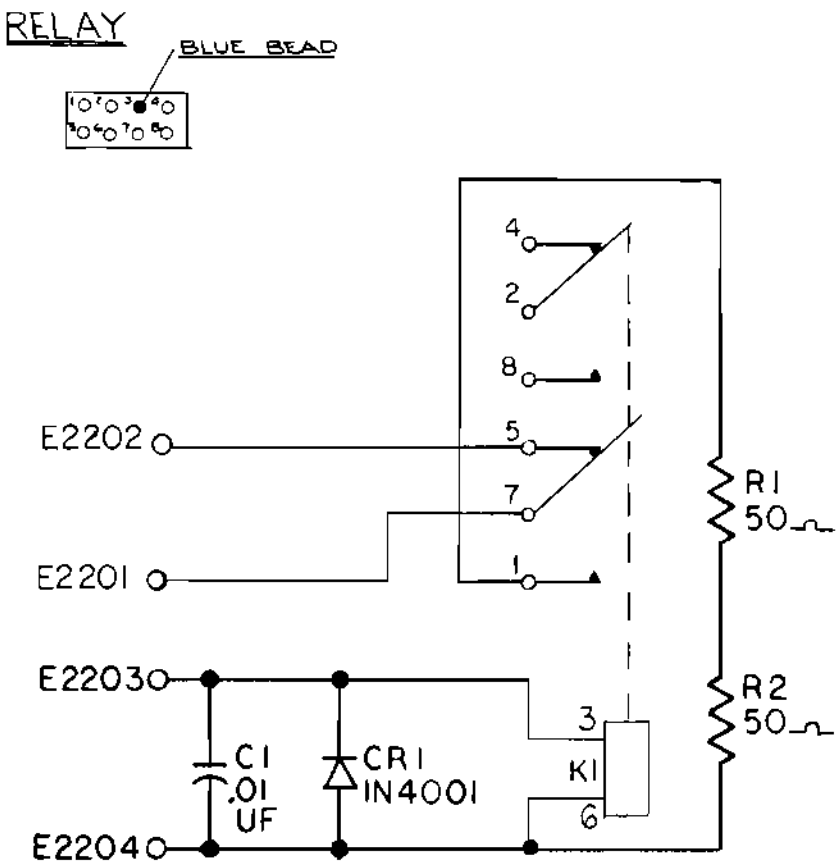
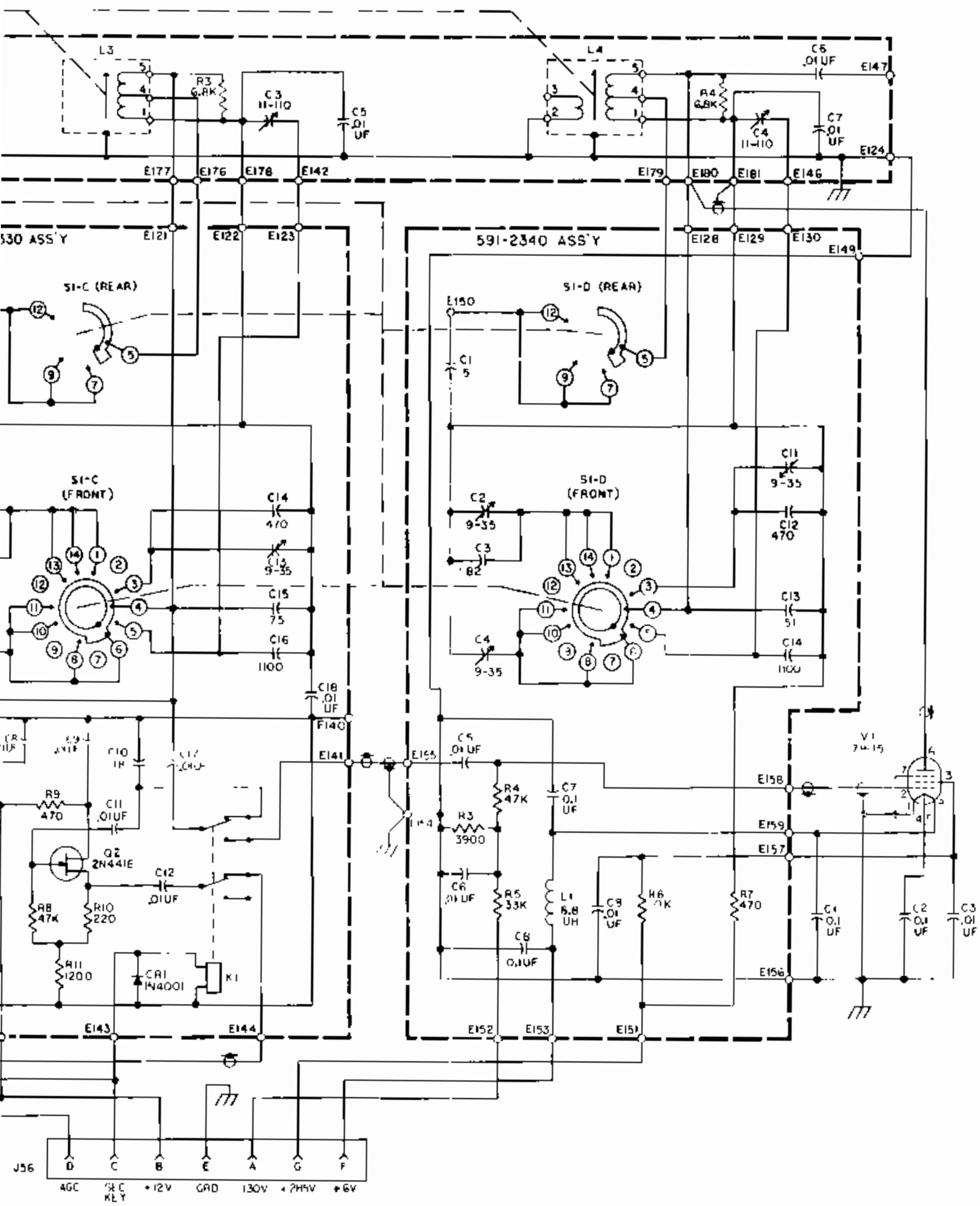
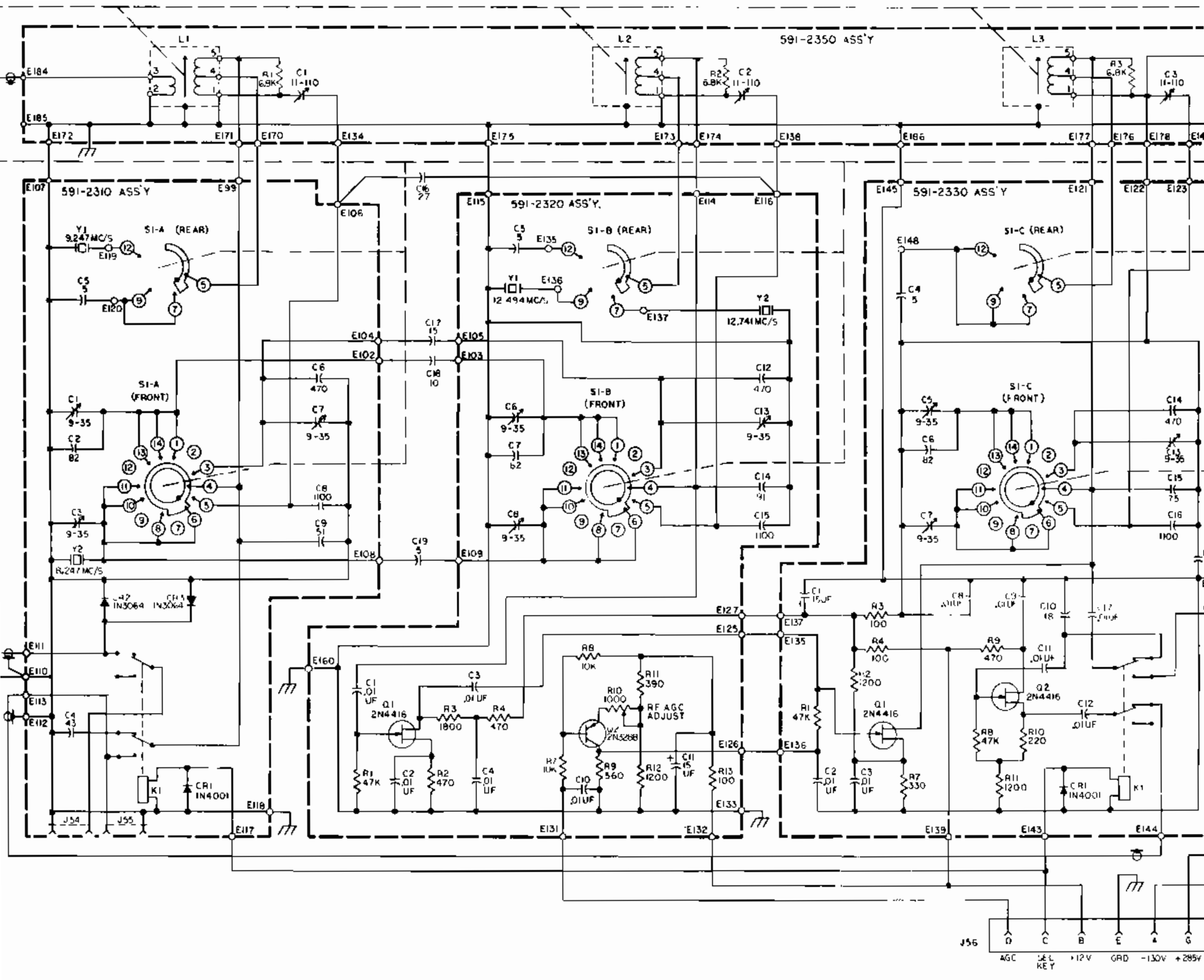


FIGURE 8.22 - TRANSMIT TUNING LOAD ASSEMBLY

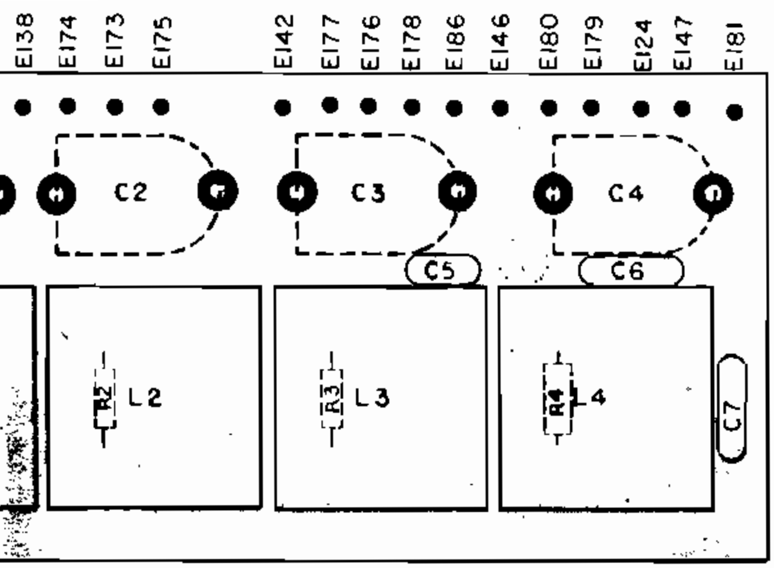


NOTES
1. UNLESS OTHERWISE SPECIFIED
ALL CAPACITORS ARE IN PICOFARADS
ALL RESISTORS ARE IN OHMS
2. ON EACH SECTION OF S1, THE FRONT AND REAR ROTOR BLADES ARE ELECTRICALLY COMMON
3. S1 IS SHOWN IN THE 14 MC/S POSITION

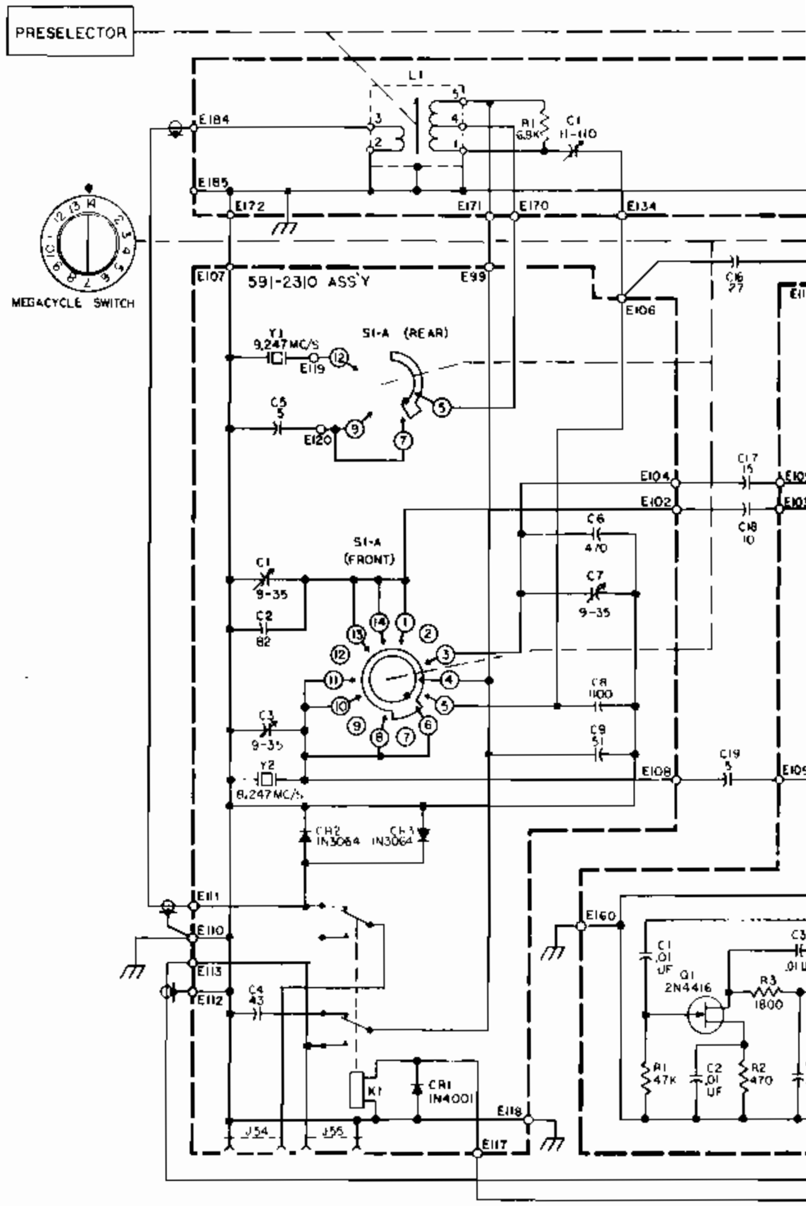
FIGURE 8.23 - RF AMPLIFIER ASSEMBLY



591-2350 ASS'Y
591-2310 ASS'Y
591-2320 ASS'Y.
591-2330 ASS'Y
S1-A (REAR)
S1-B (REAR)
S1-C (REAR)
S1-A (FRONT)
S1-B (FRONT)
S1-C (FRONT)
9.247 MC/S
12.494 MC/S
12.741 MC/S
8.247 MC/S
2N4416
2N3288
RF AGC ADJUST
1N3064
1N4001
J56
AGC
SEL KEY
+12V
GRD
-130V
+285V



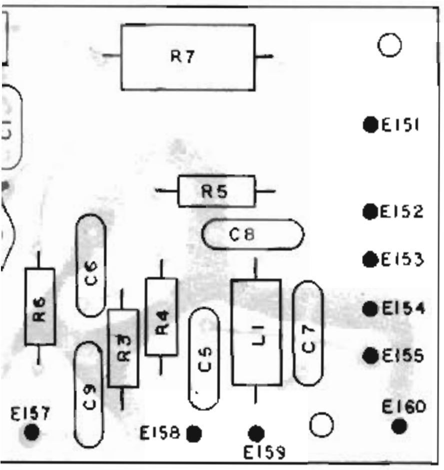
591-2350 ASSEMBLY



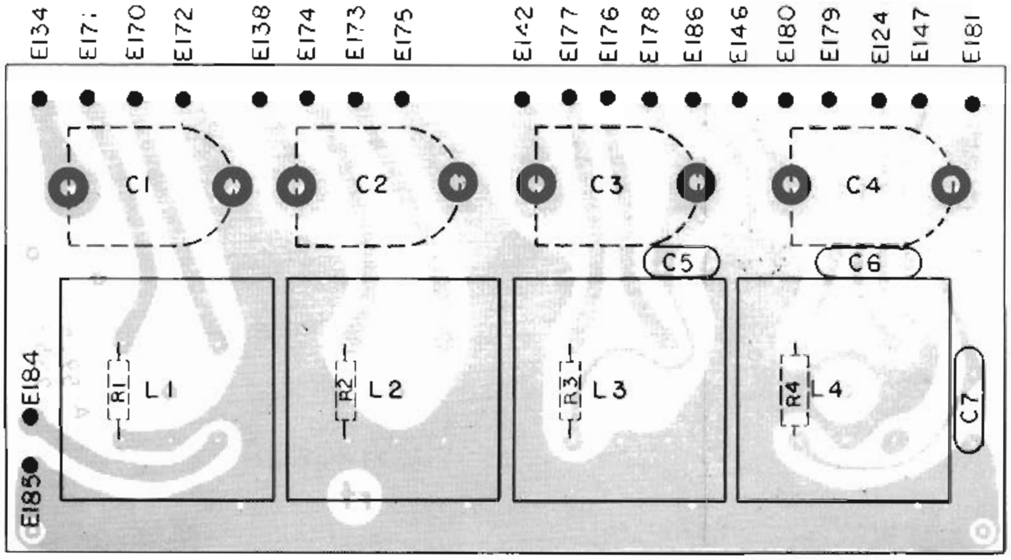
D

E	NOTES
	Receive Receive, No Signal Receive
TOR	

	NOTES
	(All taken in Transmit, USB Mode, No Modulation)



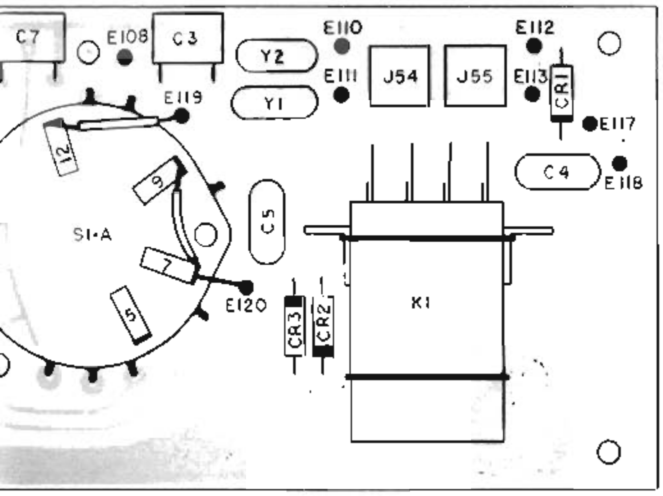
ASSEMBLY



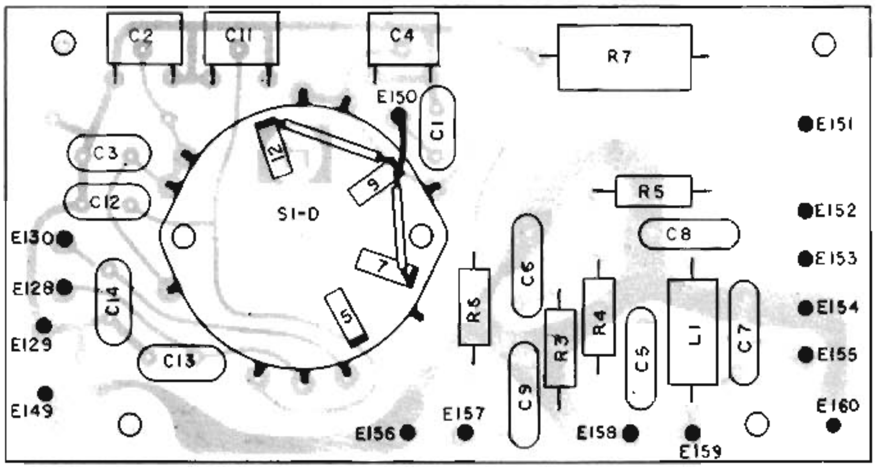
591-2350 ASSEMBLY

DC VOLTAGES TO GROUND

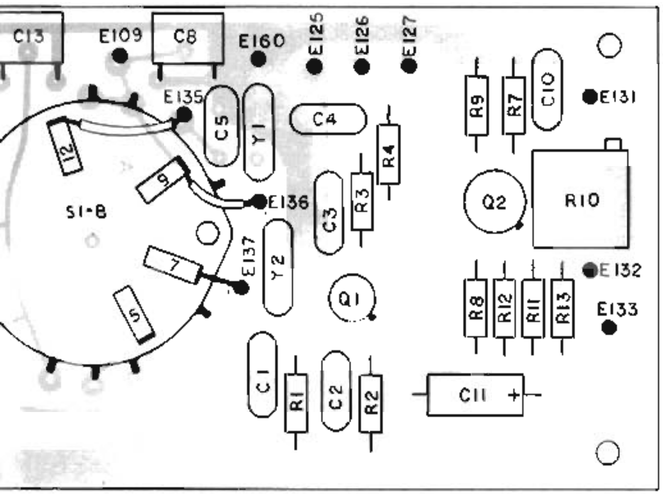
TAGE	DRAIN	GATE	SOURCE	NOTES
91-2320)	+ 5.0V	+0 V	+1.5V	Receive
91-2330)	+10.0V	+1.5V	+3.0V	Receive, No Signal
91-2330)	+10.0V	+5.4V	+6.2V	Receive
	EMITTER	BASE	COLLECTOR	
91-2320)	+ 6.9V	+6.3V	+1.5V	
1 PIN	VOLTAGE			NOTES
1	0 V			(All taken in Transmit, USB Mode, No Modulation)
2	-12 V			
3	+26.0V			
4	+ 3.0V			
5	+ 3.0V			
6	+265 V			
7	0 V			
8				
9	+ 6.0V			



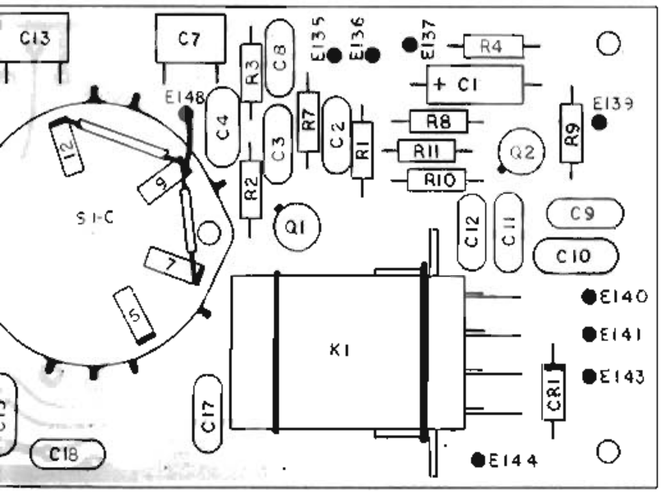
591-2310 ASSEMBLY



591-2340 ASSEMBLY



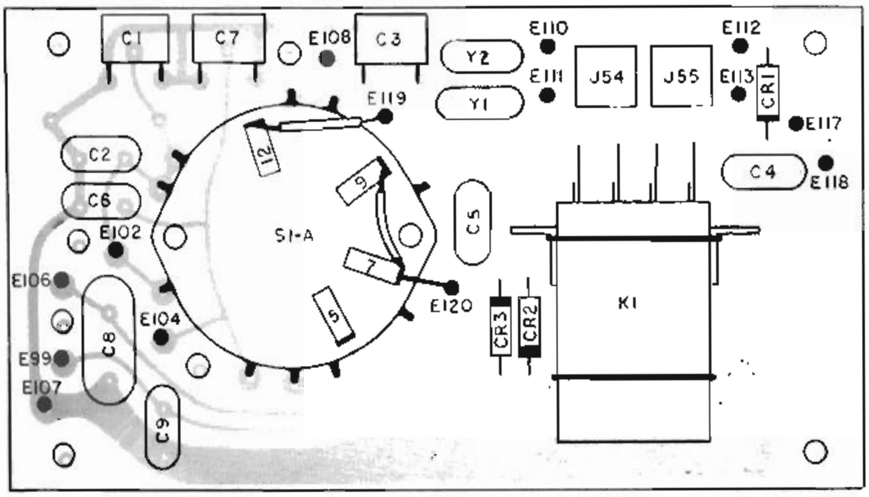
591-2320 ASSEMBLY



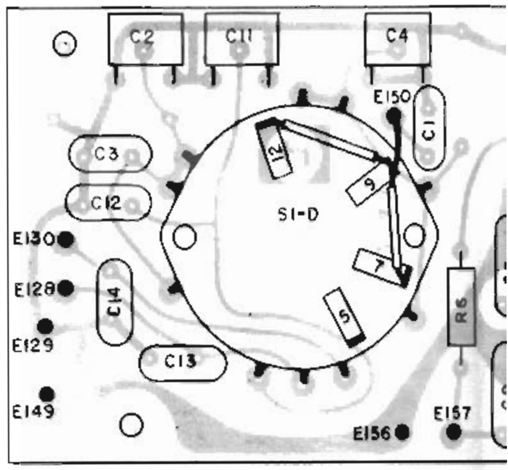
591-2330 ASSEMBLY

DC VOLTA

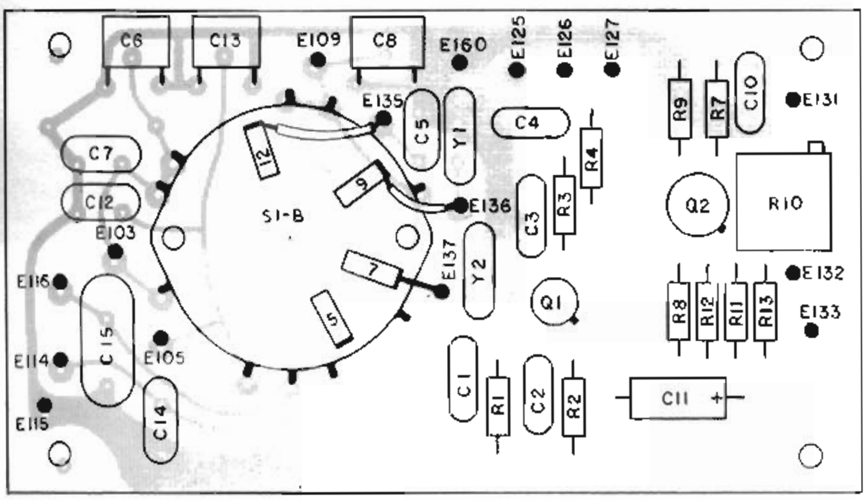
STAGE	DRAIN	GATI
Q1(591-2320)	+ 5.0V	+0
Q1(591-2330)	+10.0V	+1.5
Q2(591-2330)	+10.0V	+5.4
	EMITTER	BASI
Q2(591-2320)	+ 6.9V	+6.3
V1 PIN	VOLTAGE	
1	0 V	
2	-12 V	
3	+26.0V	
4	+ 3.0V	
5	+ 3.0V	
6	+265 V	
7	0 V	
8		
9	6.0V	



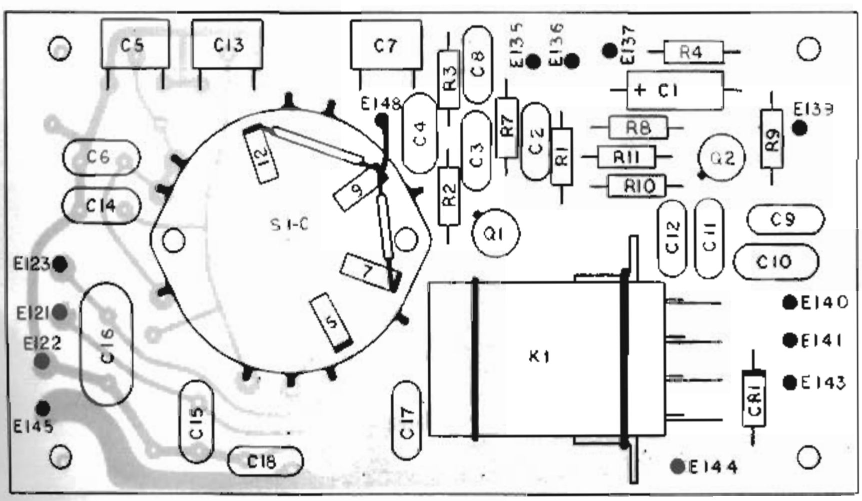
591-2310 ASSEMBLY



591-2340 ASSEM



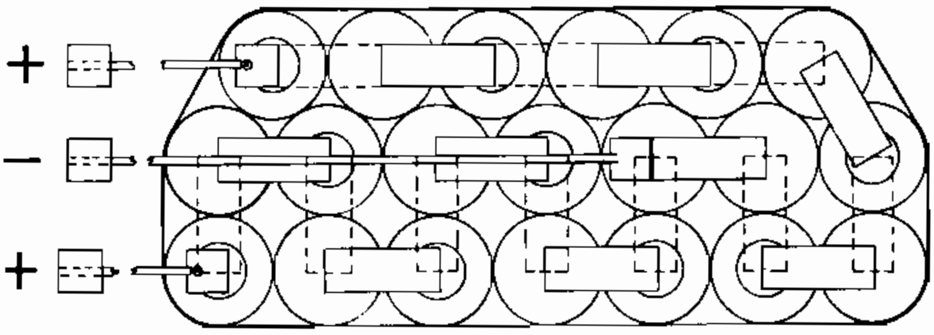
591-2320 ASSEMBLY



591-2330 ASSEMBLY

STAGE
Q1(591-232
Q1(591-233
Q2(591-233
Q2(591-232

V1 PIN
1
2
3
4
5
6
7
8
9



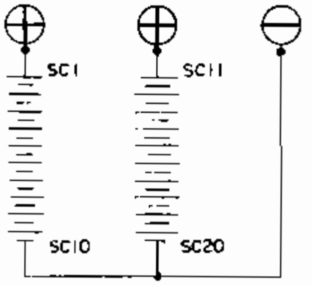


FIGURE 8.24 - RF-327 RECHARGEABLE BATTERY PACK

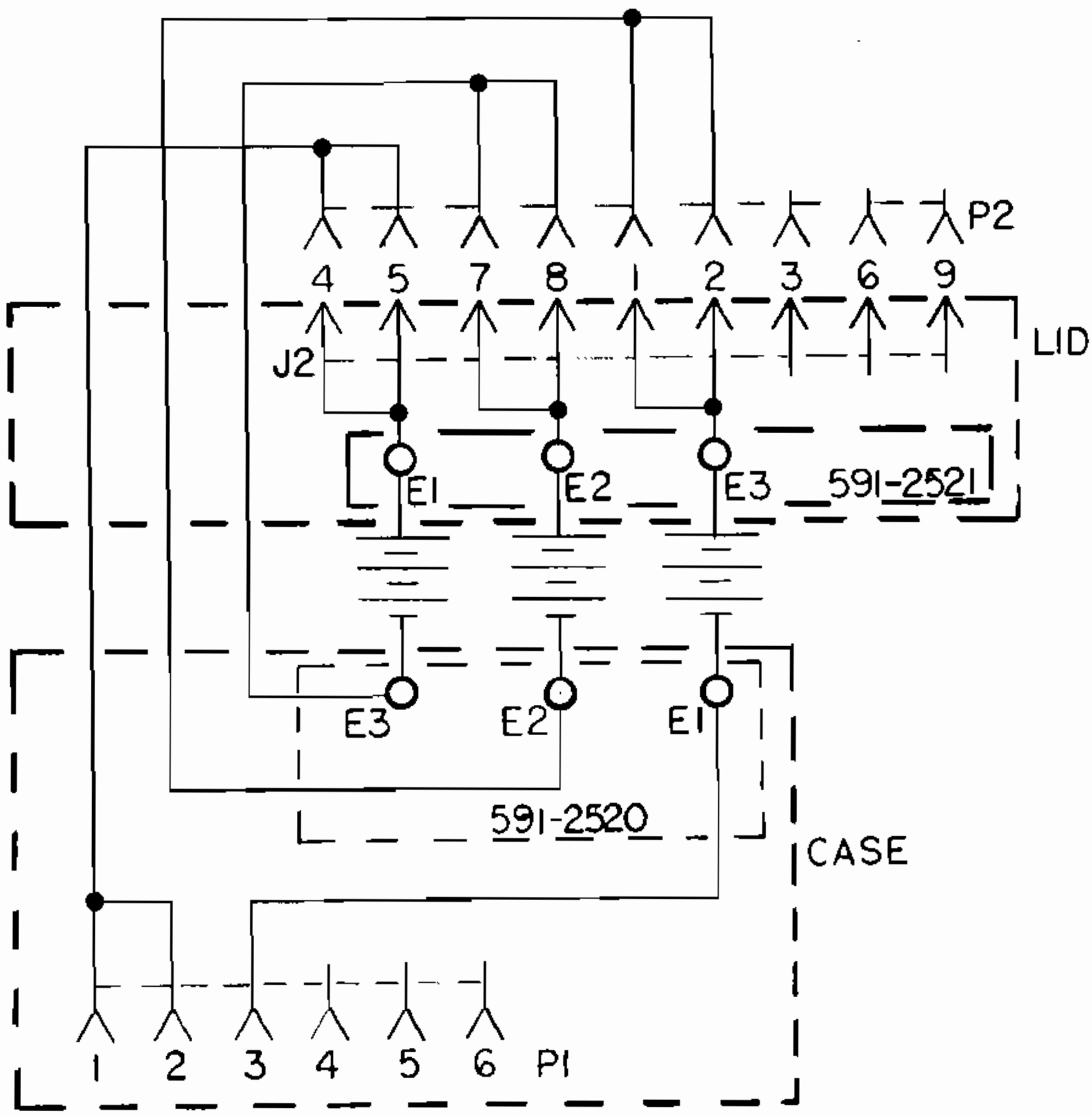


FIGURE 8.25 - RF-328 DRY CELL BATTERY PACK

R F COMMUNICATIONS, INC.

1680 UNIVERSITY AVENUE ■ ROCHESTER, NEW YORK 14610, U.S.A.