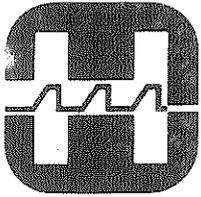


G-502



HARRIS

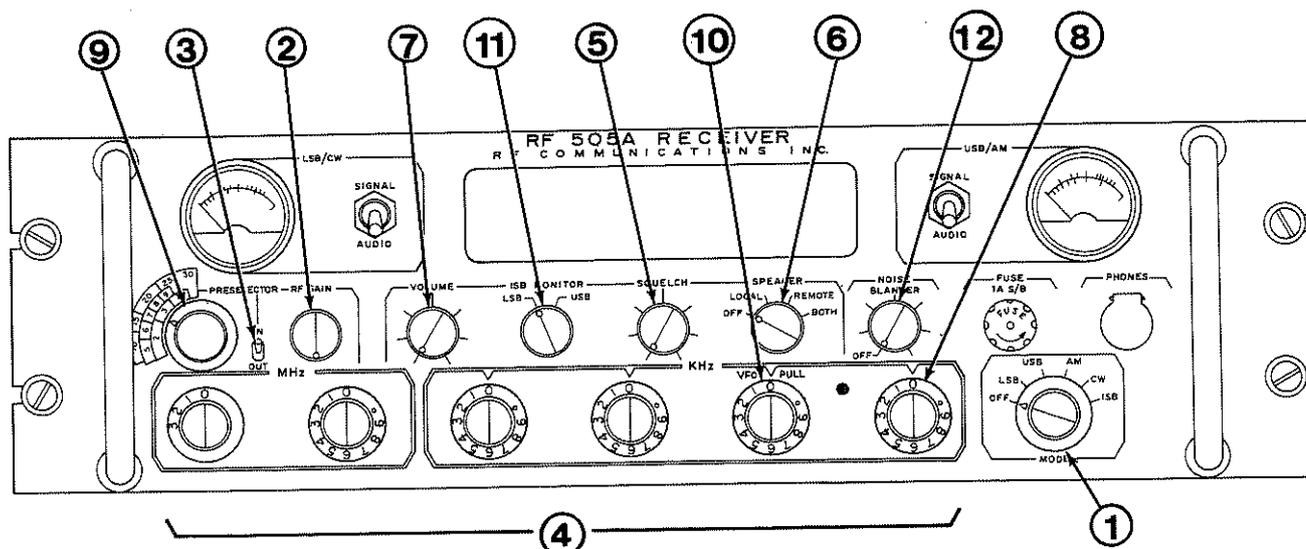
COMMUNICATIONS AND
INFORMATION HANDLING



RF-505A RECEIVER

PM-0711C

RF-505A RECEIVER OPERATING INSTRUCTIONS



I USB/LSB/AM/ISB MODES

NOTE: The numbers ① through ⑫ below correspond to the numbered controls on the illustration.

- Set MODE switch ① at desired mode, RF GAIN control ② fully clockwise, and PRESELECTOR switch ③ at OUT.
- Set FREQUENCY MHz switches ④ to operating frequency.
- Set SQUELCH control ⑤ fully clockwise, SPEAKER switch ⑥ to LOCAL, and adjust VOLUME control ⑦ for desired listening level. Fine tune for clarity with the 100 Hz FREQUENCY MHz switch ⑧.

NOTE: If signal is still garbled, pull out on 1 kHz FREQUENCY MHz switch ⑩ and rotate switch for best signal (VFO operation).

- Set PRESELECTOR switch ③ at IN and tune PRESELECTOR control ⑨ for maximum received signal strength.
- If strong interference is present, adjust RF GAIN control ② counterclockwise to minimize.
- Adjust SQUELCH control ⑤ counterclockwise until desired signal is "squelched" off. Re-adjust clockwise stopping just as the desired signal is again present.

NOTE: Re-adjust SQUELCH control ⑤ each time RF GAIN control ② is adjusted.

NOTE: For ISB operation set ISB MONITOR switch ⑪ at LSB and USB positions to check for a signal on each channel.

II CW MODE

- Perform steps a through d above with MODE switch ① set at USB.

NOTE: The RF-505A must be set at the specified frequency for CW signals. Fine tune for the desired tone using 1 kHz ⑩ or 100 Hz ⑧ FREQUENCY MHz switches.

- Rotate either the 100 Hz ⑧ or 1 kHz FREQUENCY MHz ⑩ switches for a 1 kHz beat tone.
- Set MODE switch ① at CW.

NOTE: The CW filter bandpass is centered in the upper sideband. If unit does not have optional CW filter, there will be no output in the CW position, but, CW signals can be received on either USB, LSB, or ISB modes.

III NOISE BLANKER

If optional RF-506 Noise Blanker is installed, rotate Noise Blanker Control ⑫ clockwise to increase blanking action on random noise spikes.



TABLE OF CONTENTS

CHAPTER	PAGE	CHAPTER	PAGE		
1	GENERAL DESCRIPTION . . .	1-1	6	MAIN FRAME AND PRE-SELECTOR MODULE	6-1
1.1	Scope of Instruction Manual	1-1	6.1	General	6-1
1.2	Description	1-1	6.2	Frequency MHz Switches Check	6-1
1.3	Purpose and Uses	1-1	6.3	Steering Voltage Checks	6-3
1.4	Technical Specifications	1-1	6.4	Preselector and RF Gain Control Test	6-3
1.5	Accessories and Spares	1-3	6.5	VFO Tracking Alignment	6-5
2	INSTALLATION	2-1	6.6	VHF Filter Assembly Alignment	6-6
2.1	General	2-1	6.7	Circuit Diagrams and Parts Lists	6-7
2.2	Unpacking and Inspection	2-1	7	RECEIVER MODULE	7-1
2.3	Site Selection	2-1	7.1	General	7-1
2.4	Antennas and Transmission Lines	2-1	7.2	Detailed Theory of Operation	7-1
2.5	Installation	2-2	7.3	Performance Checks	7-4
2.6	Connections	2-4	7.4	Fault Analysis	7-5
3	OPERATION	3-1	7.5	Alignment Procedures	7-11
3.1	General	3-1	7.6	Circuit Diagrams and Parts Lists	7-15
3.2	Operating Controls, Indicators, and Connectors	3-1	8	SYNTHESIZER MODULE	8-1
3.3	Operating Instructions	3-4	8.1	General	8-1
4	THEORY OF OPERATION	4-1	8.2	Detailed Theory of Operation	8-1
4.1	General	4-1	8.3	Performance Checks	8-7
4.2	Description	4-1	8.4	Fault Analysis	8-8
4.3	RF-505A Receiver Block Diagram Theory	4-1	8.5	Alignment Procedures	8-16
4.4	Receiver Module	4-3	8.6	Circuit Diagrams and Parts Lists	8-21
4.5	Synthesizer Module	4-7	9	POWER SUPPLY MODULES	9-1
5	MAINTENANCE	5-1	9-1	Introduction	9-1
5.1	General	5-1	9.2	1402 AC Power Supply Module	9-1
5.2	Preventative Maintenance	5-1	9.2.1	General	9-1
5.3	Performance Test	5-1	9.2.2	Theory of Operation	9-1
5.4	Fault Analysis Table	5-5	9.2.3	Tests Procedures	9-3
5.5	Modules Removal	5-7	9.2.4	Fault Analysis	9-4
5.6	Module Replacement	5-7			
5.7	Printed Circuit Assemblies	5-8			



TABLE OF CONTENTS (Cont.)

CHAPTER	PAGE	CHAPTER	PAGE
9.2.5	Circuit Diagram and Parts List	9.4.1	Test Equipment
			9-12
9.3	1500 Power Supply Module	9.4.2	Preliminary
			9-12
9.3.1	General	9.4.3	Procedures
			9-13
9.3.2	Theory of Operation	9.5	Fault Analysis
			9-14
9.3.2.1	General	9.6	Circuit Diagram and Parts List
			9-17
9.3.2.2	Input Rectifier		
9.3.2.4	5KHz Multivibrator	10	FREQUENCY STANDARD MODULE
			10-1
9.3.2.5	Trigger Networks	10.1	General
			10-1
9.3.2.6	Monostable Multivibrator	10.2	Theory of Operation
			10-1
9.3.2.7	NAND Gates A1-B and A1-C	10.3	Test and Alignment
			10-1
9.3.2.8	Transistor Switches Q7 through Q12	10.4	Fault Analysis
			10-3
9.3.2.9	Rectifiers CR8/CR9	10.5	Circuit Diagram and Parts List
			10-5
9.3.2.10	Output Rectifier and Post Regulators		
9.4	Test and Alignment Procedures	APPENDIX	A-1
		ACCESSORIES	B-1

LIST OF ILLUSTRATIONS

FIGURE	PAGE	FIGURE	PAGE
1.1	Top and End View of RF-505A Receiver	6.4	VHF Filter Assembly Circuit Diagram
	1-3		6-15
2.1	Typical Doublet Antenna Installation	7.1	Front End Assembly Test Set-up
	2-3		7-11
2.2	RF-505A Rack Installation	7.2	Receiver Module Circuit Diagram
	2-4		7-17
2.3	Typical Antenna and Terminal Unit Connections	7.3	Front End Assembly Circuit Diagram
	2-6		7-19
3.1	RF-505A Front Panel	7.4	Filter Assembly Circuit Diagram
	3-1		7-21
4.1	RF-505A Receiver Block Diagram	7.5	Detector/AGC Assembly Circuit Diagram
	4-2		7-23
4.2	RF-505A Receiver Module Block Diagram	7.6	Speaker Driver and Squelch Gate Assembly Circuit Diagram
	4-5		7-25
4.3	RF-505A Synthesizer Module Block Diagram	8.1	Synthesizer Module Circuit Diagram
	4-6		8-23
5.1	RF-505A Top View (Cover Removed)	8.2	HF VCO Assembly Circuit Diagram
	5-8		8-25
5.2	RF-505A Shown With an Assembly Extended for Testing	8.3	HF Divider Assembly Circuit Diagram
	5-9		8-27
6.1	RF-505A Receiver Main Frame Circuit Diagram	8.4	VHF VCO Assembly Circuit Diagram
	6-9		8-29
6.2	Preselector Module Circuit Diagram	8.5	VHF Divider Assembly Circuit Diagram
	6-11		8-31
6.3	IF. Gain Control Assembly Circuit Diagram		
	6-13		



LIST OF ILLUSTRATIONS (Cont.)

FIGURE		PAGE	FIGURE		PAGE
8.6	Spectrum Generator Assembly Circuit Diagram	8-33	9.5	Power Supply Waveforms	9-12
8.7	Second L.O. Generator Assem- bly Circuit Diagram	8-35	9.6	Fabricated Test Circuit	9-14
8.8	Translator Assembly Circuit Diagram	8-37	9.7	Component Locations, Top View	9-15
8.9	14 MHz Up-Mixer and VFO As- sembly Circuit Diagram	8-39	9.8	Component Locations, Side View	9-15
9.1	AC Power Supply Module Block Diagram	9-2	9.9	Power Supply Module Circuit Diagram	9-19
9.2	Major Assemblies Locations	9-5	10.1	Frequency Standard Module 724-1600	10-1
9.3	AC Power Supply Module Circuit Diagram	9-7	10.2	Terminal E4 Waveform	10-3
9.4	Power Supply Block Diagram	9-10	10.3	Frequency Standard Module Circuit Diagram	10-7

APPENDIX

1	Circuit Diagrams for IC-0010 and IC-0011	A-2	5	Circuit Diagrams for IC-0020 and IC-0023	A-4
2	Circuit Diagrams for IC-0013 and IC-0014	A-2	6	Circuit Diagrams for IC-0024, IC-0025, and IC-0030	A-5
3	Circuit Diagrams for IC-0016 and IC-0017	A-3	7	Circuit Diagrams for IC-0035 and IC-0036	A-6
4	Circuit Diagrams for IC-0018 and IC-0019	A-3	8	Circuit Diagrams for IC-0037 and IC-0051	A-7
			9	Circuit Diagram for IC-0052	A-8

ACCESSORIES

1	RF-506 Noise Blanker Assembly Component Locations and Circuit Diagram	B3	3	RF-520 Muting Conversion Module Component Locations and Circuit Diagrams	E-3
1	RF-520 Muting Conversion Module Installation	E-1	1	RF-522 Mounted on a RF-505 Receiver	F-2
2	Typical Keyline Installation	E-2			



CHAPTER 1

GENERAL DESCRIPTION

1.1 SCOPE OF INSTRUCTION MANUAL

This instruction manual contains the information necessary to install, operate, and maintain the model RF-505A Receiver.

1.2 DESCRIPTION

The RF-505A Receiver, shown on the front cover, is a high quality, general purpose receiver. Full specified performance is provided over the medium and high frequency range of 1.6 to 30.0 megahertz (MHz) with modes of operation including upper sideband (usb), lower sideband (lsb), amplitude modulation (am.), continuous wave (cw), and independent sideband (isb). Fully synthesized, the RF-505A Receiver can be digitally set to within 50 Hz of any frequency up to 29.9999 MHz. Continuous tuning is available between each 10 kHz step. Exclusive use of solid state circuitry allows for instantaneous operation, maximum reliability and minimum power consumption. Modular construction utilizing printed circuit boards provides for ease of troubleshooting and maximum serviceability. The RF-505A Receiver consists of five major modules; the Receiver Module, the Synthesizer Module, the Power Supply Module, the Frequency Standard Module, Preselector Module; and the VHF Filter Assembly.

1.3 PURPOSE AND USES

The RF-505A Receiver is designed for continuous operation as a general purpose mf/hf single sideband receiver. It is completely self contained for use in fixed, semi-portable, or mobile installations as a separate unit or as part of a communications system. With suitable adapters the RF-505A Receiver can be rack mounted in a standard 19 inch enclosure, stack mounted with other units, or enclosed in a metal case for desk top installations. Operation is provided from ac primary power sources of

100 to 260 volts, 48 to 1000 Hz, 1 phase, and dc primary power sources of 10 to 40 volts. Total power consumption is 60 watts at maximum audio level.

As a high accuracy receiver and frequency standard source, the RF-505A Receiver has many valuable uses in the laboratory. For communications systems, the RF-505A can easily fill those applications where one or more monitor receivers are required to operate on a single common frequency standard. The frequency standard in this type of application can be either an RF-505A (± 1 part in 10^6 with the supplied TCXO standard or ± 1 part in 10^8 with the optional high stability oven standard) or a master clock.

Perceptible audio signals can be detected from transmitted single sideband (usb, lsb, or isb) signals, am. or compatible am. signals, and cw signals on any one of 284,000 channels. The channels are spaced in even 100 Hz steps within the operational frequency range of 1.6 MHz and 30.0 MHz. Continuous tuning is provided as a standard feature between each 10 kHz step. Detected audio signals are applied to a front panel speaker, to terminals for two 600 ohm balanced remote output lines, and to a remote speaker terminal. Depending on system application, TTY, digital data, or facsimile equipment can be connected to either or both of the 600 ohm remote audio lines.

1.4 TECHNICAL SPECIFICATIONS

Nominal electrical and physical specifications of the RF-505A are listed in table 1.1.

NOTE

Specifications are subject to change without notice.



Table 1.1 — RF-505A Receiver Technical Specifications *

GENERAL

Frequency Range

Up to 29.9999 MHz in synthesized 100 Hz steps. VFO continuous tuning with 10 kHz range also provided.

Frequency Stability

± 1 part in 10^6 - Standard (5 MHz TCXO)
 ± 1 part in 10^8 - Optional (with RF-508 High Stability, 5 MHz Oven)

Modes of Operation

USB, LSB, AM, CW, ISB (A1, A3A, A3B, A3G, A3H): RATT, FAX, DATA - With external modems.

Type of Circuit

Double conversion, Superheterodyne.

RF CHARACTERISTICS

Sensitivity: 2.0000 to 29.9999 MHz

SSB/ISB: .25 uV maximum for 10 dB S+N/N in a 3 kHz bandwidth.
AM: 1.5 uV maximum, 30% modulated for 10 dB S+N/N in a 10 kHz bandwidth.
CW: .12 uV maximum for a 10 dB S+N/N in a 500 Hz bandwidth.
Note: Below 2 MHz sensitivity is gradually reduced. For example, typical SSB sensitivity at 100 kHz is 2 uV for 10 dB S+N/N.

RF Input Attenuator

0 to 20 dB, continuous.

Dynamic Range

125 dB, independent of RF gain control setting.

IF and Image Rejection

70 dB

Internal Spurious Response

Almost negligible, 99.5% below .3 uV equivalent signal at the antenna terminals.

In-Band Intermodulation

At least 45 dB below the level of two 20,000 uV emf signals in the receiver passband.

Cross Modulation

An unwanted signal of 60,000 uV, 30 kHz removed and modulated at 30% will produce cross modulation greater than 20 dB down from a desired signal of 100 uV rms, exclusive of preselection or RF gain control action. This cross modulation specification will typically remain greater than 20 dB down for all desired signals from 1 to 1,000 uV.

Blocking (Desensitization)

An undesired signal of 20,000 uV emf, 30 kHz removed shall produce less than 6 dB degradation of receiver sensitivity to the desired signal.

Input Impedance

50 ohms resistive, nominal. Less than 3:1 VSWR

IF CHARACTERISTICS

IF Frequencies

FIRST - 156 MHz. SECOND - 500 kHz.

Selectivity

SSB: Desired Sideband - 300 to 3300 Hz at 6 dB; at 5000 Hz, at least 50 dB down.
Carrier - At least 25 dB down.
Entire Opposite Sideband - At least 50 dB down.

AM: Nominally 6 dB at 10 kHz. At least 60 dB at 20 kHz.
CW: (with optional CW filter) 6 dB at 500 Hz. At least 60 dB at 2 kHz.

Automatic Gain Control (AGC)

Threshold: Nominally 10 uV (internally adjustable).
Range: Less than 12 dB change in output for an input signal variation of 100 dB (5 uV to 500 mV) at the input.
Attack Time: 5 milliseconds nominal.
Release Time: 1 second nominal.

AF CHARACTERISTICS

AF Response

Determined by the IF Filter in use.

AF Output

MONITOR
a) 3 watts at 5% distortion into internal speaker (3.2 ohms).
b) Speaker/Headphone monitor selection of either LSB/CW or USB/AM from the front panel.
c) Connections for remote 3.2 ohm speaker (such as the RF-511).
CHANNEL OUTPUTS
a) Two 600 ohm balanced outputs (one for each channel). Each is adjustable to 0 dBm at 5% maximum audio distortion with 10 uV input in the receiver passband.
b) Individual front panel meters are provided to monitor the audio output level or signal strength of each channel.

ENVIRONMENT

Temperature

STORAGE: -55 to +75 degrees C. OPERATING: -28 to +65 degrees C.

Humidity

95 percent

Vibration

Per MIL-STD-167, Type 1

Shock

Per MIL-STD-202C, Method 205C

INSTALLATION REQUIREMENTS

Wide Range Power Supply - 724-1500

AC or DC, selectable by rear panel switch.
AC: 100 to 260 volts, single phase, 48 to 1,000 Hz.
DC: 10 to 40 volts, positive or negative ground.
CONSUMPTION: 60 watts at 3 watts audio output.

AC Power Supply 724-1400

115/230 volts +20% -10% 48 to 65 Hz

Size

a) BASIC UNIT: 5 1/4 H x 19 W x 13 7/8 D in. (13.3 H x 48.3 W x 35.2 D cm)
b) WITH DESK TOP CASE (RF-512): 6 H x 19 3/8 W x 15 D in. (15.2 H x 49.2 W x 38.1 D cm)
c) WITH STACK MOUNT (RF-513): 5 1/4 H x 19 1/2 W x 13.7 D in. (13.3 H x 49.3 W x 35.2 D cm)

Weight

a) BASIC UNIT: 29.25 pounds (13.25 kg)
b) WITH DESK TOP CASE (RF-512): 33.9 pounds (15.36 kg)
c) WITH STACK MOUNT (RF-513): 36 pounds (16.3 kg)

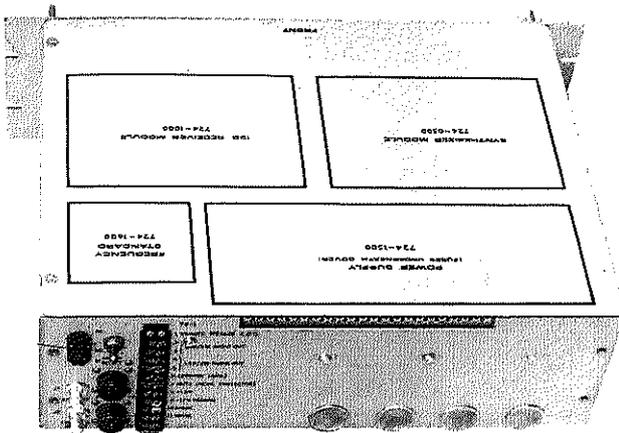


Figure 1.1 — Top and End View of RF-505A Receiver

1.5 ACCESSORIES AND SPARES

The following is a list of accessories and spares that are available for use with the RF-505A Receiver. Additional accessories and compatible equipment is listed in RF Communications catalogs or can be obtained from RF Communications Sales Department.

Table 1.2 — RF-505A Receiver Accessories and Spare Parts

MODEL NO.	DESCRIPTION	RF PART NO.
RF-506	Noise Blanker	724-1300
RF-508	High Stability Oven	
RF-509	CW Filter (500 Cycle)	724-1186
RF-511	Remote Monitor Speaker	724-0200
RF-512	Desk Top Case Kit	724-0044
RF-513	Stack Mounting Brackets with Slides	724-0030
RF-514	Rack Slides (Pair)	724-0035
RF-515	Running Spare Parts Kit	724-0022
RF-516	Depot Spare Parts Kit	724-0023
RF-517	Frequency Standard Multiplier	
RF-518	Earphones	724-0075
RF-519	Comprehensive Spare Parts Kit	724-0024
RF-520	Muting Conversion Module	724-0240
RF-521	Suitcase Carrying Case	724-0068
RF-523	Wide Shift RATT Filter	
RF-524	Narrow Shift RATT Filter	
RF-525	A & B Wideband Filters	
—	*Ancillary Kit	724-0025
	AC Power Cord Assembly	724-0029
	DC Power Connector Extender	724-0040
	Test Adapter for 724-0700 Assembly	724-0060
	Coaxial Test Cable	724-0032
	Tuning Tool	724-0026
	Fuse 1A, 3AG	F-0027
	Fuse 2A, 3AG	F-0012
	Fuse 5.0A, 3AG	F-0015

*Supplied with the unit



CHAPTER 2

INSTALLATION

2.1 GENERAL

Chapter two includes information necessary for unpacking and inspection, site selection, connecting antenna and transmission lines, installation, and making external connections.

2.2 UNPACKING AND INSPECTION

No special procedures are required for unpacking. Special care, however, should be exercised to prevent injury to personnel or damage to the equipment. Remove all packing materials and carefully lift the unit from the shipping container. Check contents against the packing list and inspect carefully for physical damage. If any damage is found, save packing material to substantiate claim with transportation agency.

2.3 SITE SELECTION

When selecting an installation site, adequate consideration should be given to the following:

- a. Best operating conditions (temperature, room, noise level, etc.).
- b. Availability of an adequate ground.
- c. Accessibility of an antenna system (antennas are discussed in paragraph 2.4).
- d. Possibility of interaction from other electronic or power sources.
- e. Availability of adequate primary power.

2.4 ANTENNAS AND TRANSMISSION LINES

2.4.1 GENERAL CONSIDERATIONS

The RF-505A Receiver is designed to operate with any 50 ohm resistive antenna system. The antenna system may be a non-resonant whip or a long wire tuned by an antenna coupler; a resonant dipole antenna cut for a specific operating frequency; or a broadband antenna, such as a log periodic or discone.

For fixed base station operation, either a non-resonant whip or long wire antenna tuned by an antenna coupler is recommended. The long wire antenna is more effective for base station to base station operation, particularly at the lower frequencies. This type of antenna system permits efficient use of all assigned frequencies within the 1.6 to 30.0 MHz frequency range of the RF-505A Receiver.

The half-wave doublet antenna is an efficient, easily constructed, resonant antenna. However, the doublet is efficient for only a narrow band of frequencies within 2-1/2% of the center resonant frequency. Separate doublet antennas must therefore be constructed for each small band of frequencies in use.

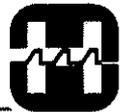
Broadband antennas, such as the log periodic or discone, provide an efficient impedance match over their specified operating frequency range. Although this type of antenna eliminates the need of antenna couplers from the system, they are more expensive and more complex in construction.

2.4.2 INSTALLATION

To provide maximum receiver sensitivity, the antenna input impedance presented at J1 should be 50 ohms. The use of coaxial cables, such as type RG-58/U or RG-8/U (with suitable adapters) terminated with a BNC connector, prevent feed-line noise pick-up and provide the proper impedance match. When operating with a long wire antenna of random length, an antenna coupler should be used to provide the desired 50 ohm impedance.

For installations where the antenna can be installed in several locations, considerable advantages are offered by selecting the site carefully. Following are some general rules for antenna site selection.

- a. Radio signals can be absorbed and reflected by nearby obstructions, such as hills, trees, buildings, and power lines. Avoid these if possible, especially if they are in a direct line with the desired transmitted signal.



b. Some antennas, especially the doublet, are directional. Directional antennas should be oriented for maximum signal gain.

c. Reception is best from the top of a hill, over level ground, or over water.

d. A good earth ground connection will improve performance.

2.4.3 DOUBLET ANTENNAS

Doublet antenna kits, such as the RF-334, are available from RF Communications. Three basic types of antennas can be constructed with these kits; the horizontal doublet, the inverted V, and the slant wire (figure 2.1).

All three types are doublet antennas, that is, they each have two legs of equal length with one leg connected to the center conductor of the coaxial cable and the other leg connected to the coax shield. The antenna elements have a combined length of an electrical half wavelength (one-quarter wavelength for each element). The inverted V and slant wire doublets are very useful if the antenna site prohibits the two supports required for the horizontal doublet or if the supports cannot be located so that the doublet is perpendicular to the direction of the desired transmitted signal.

As all of these antennas are directional, the antenna provides better response to received signals from directions perpendicular to the antenna.

Figure 2.1 shows the three types of doublet antennas in typical installations. The length of each element can be determined by the use of one of the following formulas.

Horizontal and Slanted Doublet

Length of Each Element in Feet =

$$\frac{234}{\text{Frequency (MHz)}}$$

Length of Each Element in Meters =

$$\frac{71.3}{\text{Frequency (MHz)}}$$

Inverted V Doublet

Length of Each Element in Feet =

$$\frac{245}{\text{Frequency (MHz)}}$$

Length of Each Element in Meters =

$$\frac{74.5}{\text{Frequency (MHz)}}$$

2.5 INSTALLATION

The RF-505A Receiver can be installed in one of three different configurations: (1) rack mounted, (2) stack mounted, or (3) desk top mounted. Refer to figure 2.2.

2.5.1 RACK INSTALLATION

To install the RF-505A Receiver in a rack configuration proceed as follows using RF P/N 724-0035.

a. Mount the 1/8 inch spacers (724-0116) and chassis sections of the slide to each side of the RF-505A unit using four No. 8-32 pan head screws with lockwashers on each section.

b. Mount the cabinet sections of the slide to the equipment rack jamb plate using four 1/4 inch screws on each section.

c. Extend the outer slide member on the cabinet section until the rear locks engage.

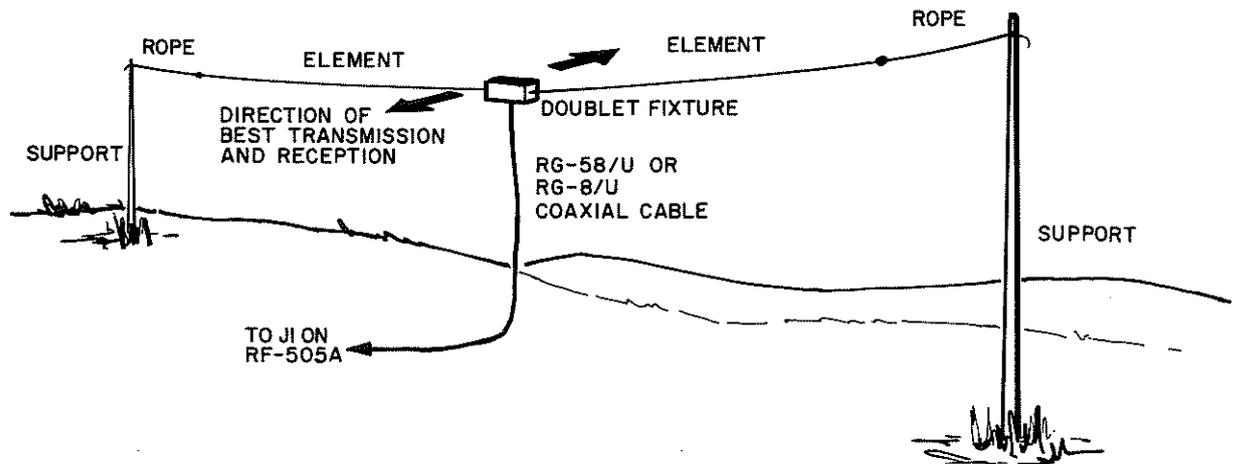
d. Slide the chassis sections into the outer slide members. Push in on the chassis section safety locks and slide the two members together.

e. Release the rear lock and slide the unit into the equipment rack. Secure with front panel mounting hardware.

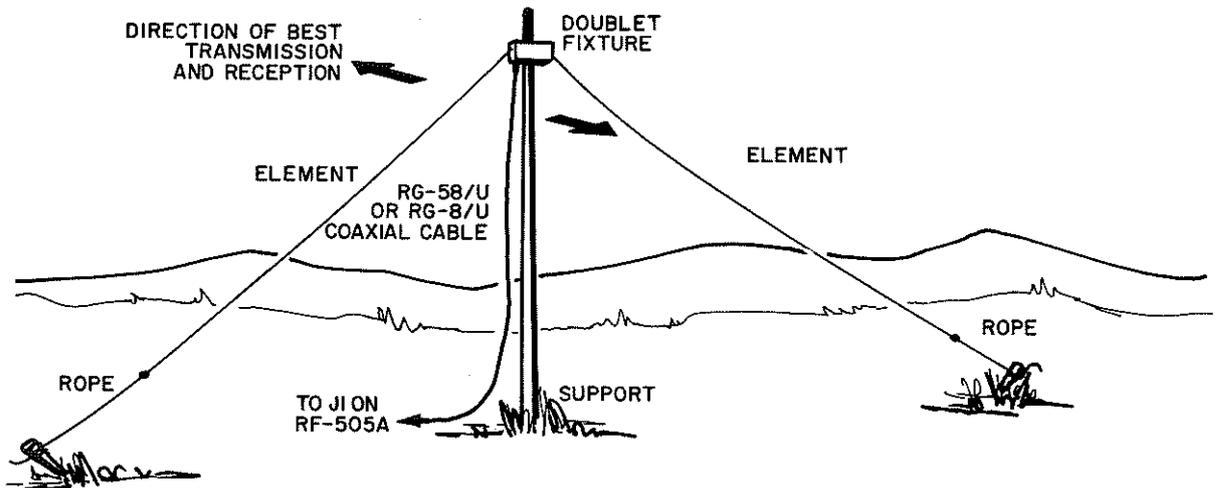
2.5.2 STACK INSTALLATION

To install the RF-505A Receiver in a stack installation use adapter brackets 724-0027 (left side) and 724-0028 (right side), spacers (724-0016), and slide unit, 724-0035. Stack installation procedures are the same as those for the rack installation with the following exceptions.

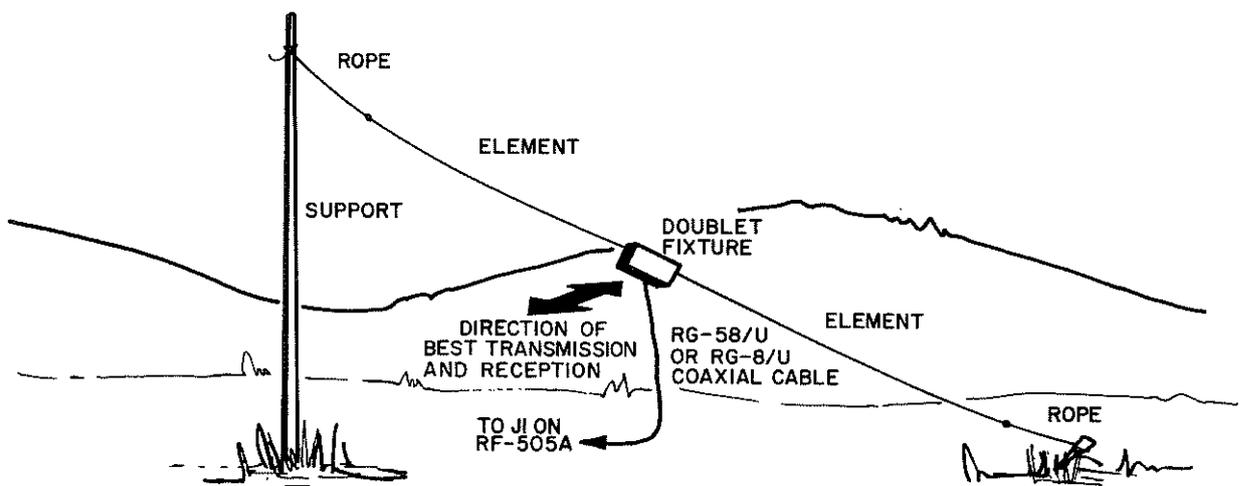
a. The cabinet sections of the slides are mounted on the two stack adapter brackets using eight No. 8-32 pan head screws, lockwashers, and nuts.



A. HORIZONTAL DOUBLET



B. INVERTED V-DOUBLET



C. SLANT WIRE DOUBLET

Figure 2.1 – Typical Doublet Antenna Installation

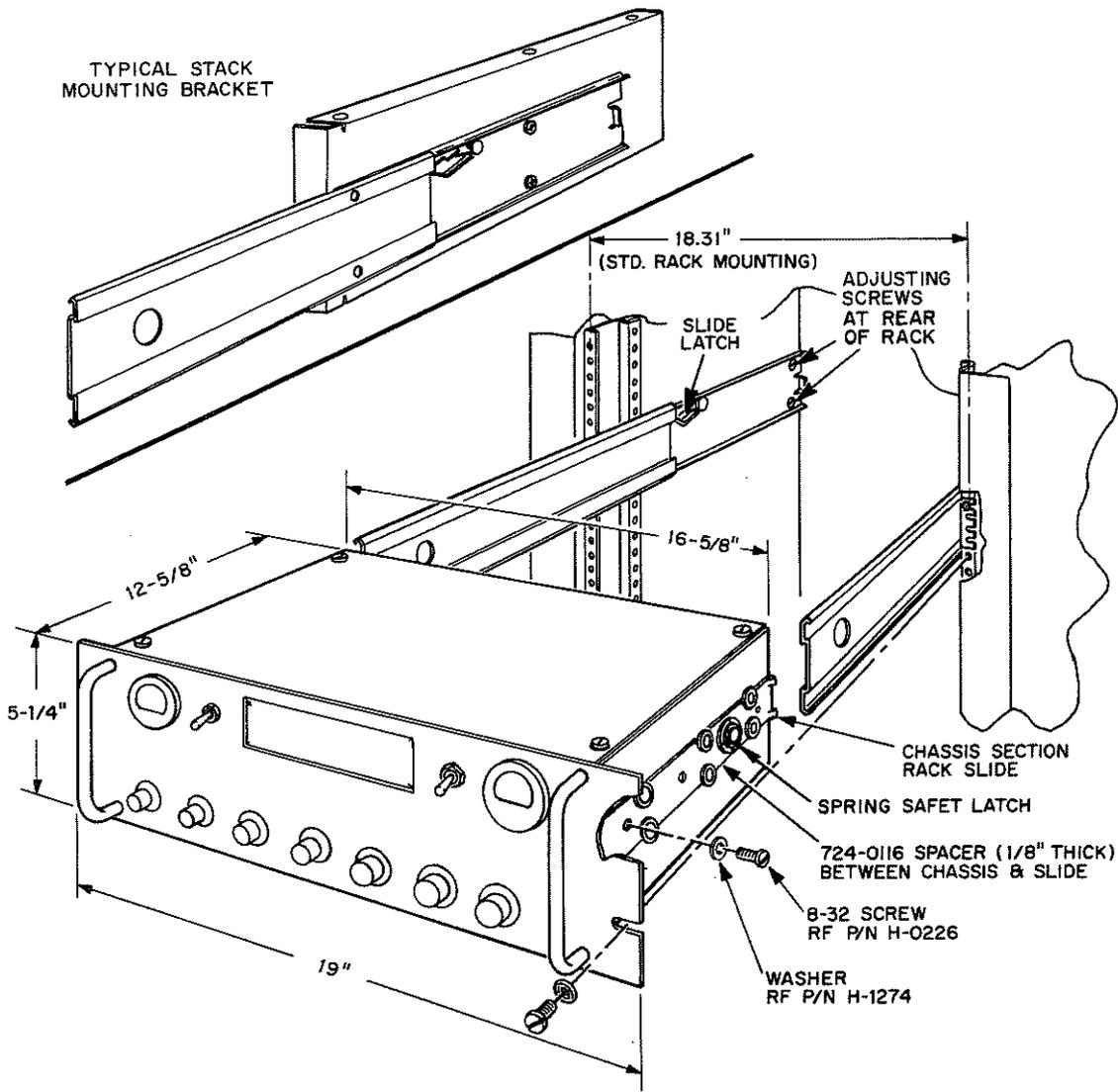
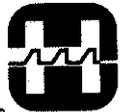


Figure 2.2 – RF-505A Rack Installation

NOTE

The nuts and lockwashers are located on the outside of the stack adapters.

b. The outer slide members must be extended for access to the two front mounting screws.

2.5.3 DESK TOP INSTALLATION

To install the RF-505A Receiver in the desk top configuration proceed as follows:

- a. Slide the RF-505A Receiver into the desk case.
- b. Secure the front panel with four No. 10-32 screws with cup washers.

c. Secure the rear panel of the unit to the desk case using four No. 10-32 pan head screws.

2.6 CONNECTIONS

Normal connections required by the RF-505A Receiver are: (1) primary power, either ac or dc; (2) earth ground; and (3) an antenna. However, differences in systems and configurations may require inter-unit connections such as transmit muting, frequency standard input or output, remote speaker, or remote terminal devices. Table 2.1 lists the function of each connector on the RF-505A Receiver. Also included are the mating connector types and cables.



2.6.1 PRIMARY POWER CONNECTIONS

The RF-505A Receiver can be operated from either ac power (100 to 260 volts, 48 to 1000 Hz, 1 phase) or dc power (10 to 40 volts). Connect the power cable corresponding to the primary power to J3 for ac or J4 for dc. Set Power Switch S1 to the corresponding position.

NOTE

Observe the polarity of the dc power source when connecting the leads of the dc power cable.

2.6.2 SYSTEM CONNECTIONS

NOTE

If the RF-505A Receiver is to be used for FSK reception, set agc threshold to 5 microvolts. Refer to paragraph 7.5.3 steps 22, 23, 28 and 29 and substitute 5 uVrms for 10 uVrms in steps 22 and 28.

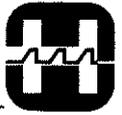
Figure 2.3 shows the RF-505A Receiver connected in a typical communications system. All inter-unit connections are made at TB-1 and J2. Connector J2 provides a frequency standard output signal when S1 on the Frequency Standard Module is at INT OUT. This provides a method of locking all other units of the system to the standard in the RF-505A. Operation with an external frequency standard, connected to J2, is provided by setting S1 on the Frequency Standard Module at EXT IN. This locks the RF-505A Receiver to a master clock or to a second RF-505A unit.

NOTE

Only up to three additional RF-505A Receivers can be operated from the internal standard without the use of an additional distribution amplifier.

Table 2.1 — Rear Panel Connections

CONNECTOR NO.	FUNCTION	MATING CONNECTOR TYPE	CABLE TYPE																						
J1	Antenna Lead Input	BNC (Male)	Coaxial (RG-58/U or RG-8/U)																						
J2	Frequency Standard Input/Output	BNC (Male)	Coaxial (RG-58/U)																						
J3	Ac Primary Power	RF P/N 724-0039	Multiconductor RF P/N W-0000																						
J4	Dc Primary Power	RF P/N 724-0040	Multiconductor																						
TB1	Accessories Connections:																								
	<table border="0"> <thead> <tr> <th>Terminal</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Remote Audio Output 3.2 Ohm</td> </tr> <tr> <td>2</td> <td rowspan="2">Balanced 600 Ohms usb/am, Audio Output (Adjustable)</td> </tr> <tr> <td>3</td> </tr> <tr> <td>4</td> <td rowspan="2">Balanced 600 Ohms lsb/cw Audio Output (Adjustable)</td> </tr> <tr> <td>5</td> </tr> <tr> <td>6</td> <td>Common Ground</td> </tr> <tr> <td>7</td> <td>Mute</td> </tr> <tr> <td>8</td> <td>+12 vdc output for keyline interlock</td> </tr> <tr> <td>9</td> <td>+12 vdc return from keyline interlock</td> </tr> <tr> <td>10</td> <td>Spare</td> </tr> <tr> <td>11</td> <td>Spare</td> </tr> </tbody> </table>	Terminal	Function	1	Remote Audio Output 3.2 Ohm	2	Balanced 600 Ohms usb/am, Audio Output (Adjustable)	3	4	Balanced 600 Ohms lsb/cw Audio Output (Adjustable)	5	6	Common Ground	7	Mute	8	+12 vdc output for keyline interlock	9	+12 vdc return from keyline interlock	10	Spare	11	Spare	Terminal Lugs	Multiconductor
Terminal	Function																								
1	Remote Audio Output 3.2 Ohm																								
2	Balanced 600 Ohms usb/am, Audio Output (Adjustable)																								
3																									
4	Balanced 600 Ohms lsb/cw Audio Output (Adjustable)																								
5																									
6	Common Ground																								
7	Mute																								
8	+12 vdc output for keyline interlock																								
9	+12 vdc return from keyline interlock																								
10	Spare																								
11	Spare																								



- NOTES:
- TERMINALS 8 & 9 OF TB-1 JUMPERED WHEN KEYLINE INTERLOCK IS NOT USED.
 - JUMPER TB-1 TERMINALS 2 TO 4 AND 3 TO 5 WHEN OPERATING WITH A SINGLE TERMINAL UNIT.
NOTE - DO NOT SET [MODE] SWITCH AT [LSB] WITH THIS CONFIGURATION.

3. TB-1 TERMINALS:

TERMINAL	FUNCTION
1	REMOTE SPEAKER
2	USB/AM AUDIO OUT
3	LSB/CW AUDIO OUT
4	COMMON GROUND
5	MUTE
6	+12V OUT KEYLINE INTERLOCK
7	+12V IN KEYLINE INTERLOCK
8	SPARE
9	SPARE
10	SPARE
11	SPARE

4. DENOTES TWISTED PAIR

5. ANTENNA COUPLER IS NOT NEEDED WHEN OPERATING WITH A DOUBLET OR BROADBAND ANTENNA.

6. TERMINATE UNUSED OUTPUTS (USB, LSB) WITH A 560 OHM RESISTOR.

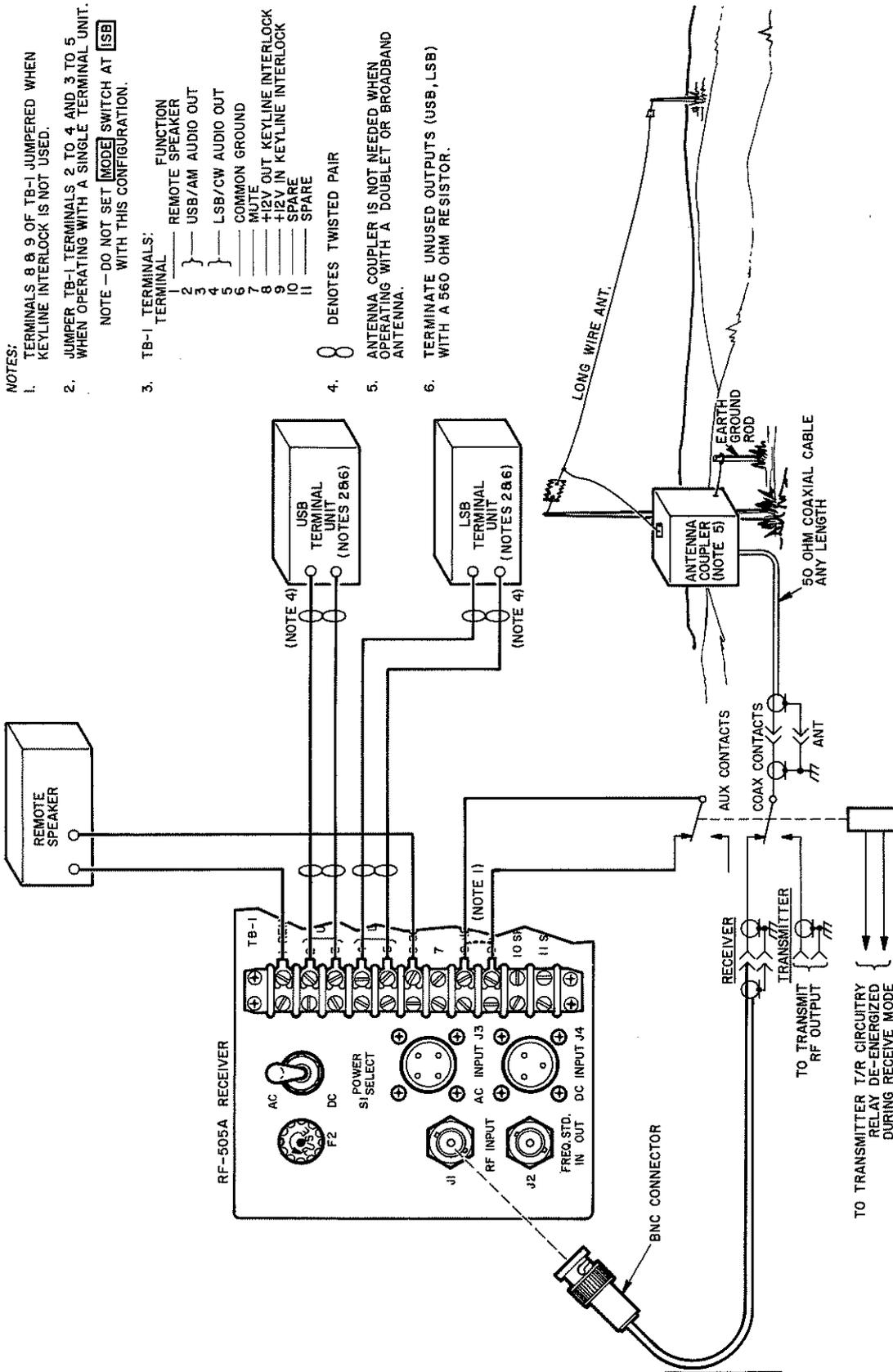


Figure 2-3 – Typical Antenna and Terminal Unit Connections



CHAPTER 3 OPERATION

3.1 GENERAL

This chapter includes information and instructions required for proper operation of the RF-505A Receiver. A description of all operating controls, indicators, and connectors is presented first followed by the operation procedures.

3.2 OPERATING CONTROLS, INDICATORS, AND CONNECTORS

Table 3.1 lists the operating controls, indicators, and connectors. They are illustrated in figure 3.1.

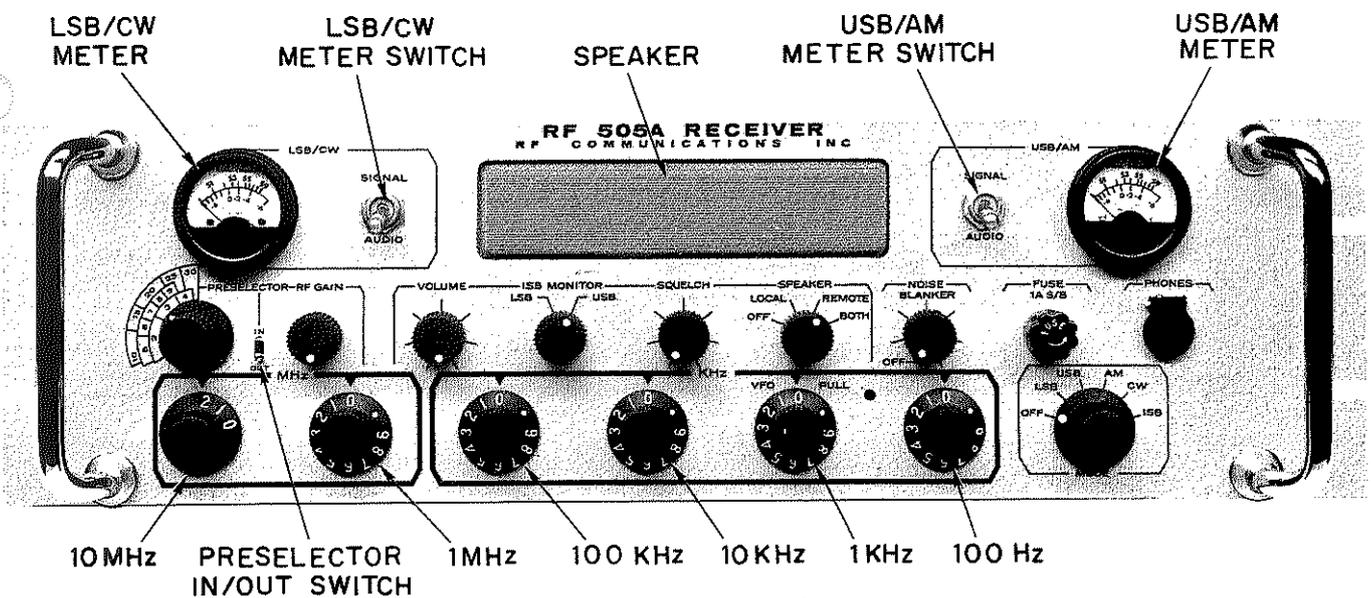


Figure 3.1 — RF-505A Front Panel



Table 3.1 – Operating Controls, Indicators, and Connectors

CONTROL, INDICATOR OR CONNECTOR	FUNCTION	CONTROL, INDICATOR OR CONNECTOR	FUNCTION									
FREQUENCY MHz Switches	<p>a. Selects operating frequency in MHz with six switches; 10 MHz switch, 1 MHz switch, 100 kHz switch, 10 kHz switch, 1 kHz switch, and 100 Hz switch.</p> <p>b. The 1 kHz switch is pulled out for continuous tuning between each 10 kHz channel.</p>	MODE Switch (Cont.)	<p>b. Selects continuous wave receive mode. With optional cw filter installed band width is reduced to 500 Hz for maximum selectivity.</p>									
PRESELECTOR Control	Adjusts tuning of unit to operating frequency when selected.		NOTE									
PRESELECTOR In/Out Switch	Selects preselector circuitry into signal path when set at IN. Preselector is bypassed when set at OUT.		<p><i>If optional cw filter is not installed the receiver will be inoperative in this mode. However, cw signals may be received in either the lsb, usb or isb positions.</i></p>									
MODE Switch	<table border="0"> <tr> <td style="text-align: center;">Switch Position</td> <td style="text-align: center;">Equipment Response</td> </tr> <tr> <td style="text-align: center;">OFF</td> <td>Disconnect primary power.</td> </tr> </table> <p style="text-align: center;">NOTE</p> <p><i>If the high stability oven standard is installed, the 28 Vdc oven heater power will be applied to the frequency standard in all positions of MODE switch except OFF.</i></p>	Switch Position		Equipment Response	OFF	Disconnect primary power.						
	Switch Position	Equipment Response										
OFF	Disconnect primary power.											
	<table border="0"> <tr> <td style="text-align: center;">LSB</td> <td> <p>a. Applies primary power.</p> <p>b. Selects lower sideband receive mode.</p> </td> </tr> </table>	LSB		<p>a. Applies primary power.</p> <p>b. Selects lower sideband receive mode.</p>	<p>ISB</p> <p>a. Applies primary power.</p> <p>b. Selects independent sideband receive mode for dual reception of both the upper and lower sidebands.</p>							
LSB	<p>a. Applies primary power.</p> <p>b. Selects lower sideband receive mode.</p>											
	<table border="0"> <tr> <td style="text-align: center;">USB</td> <td> <p>a. Applies primary power.</p> <p>b. Selects upper sideband receive mode.</p> </td> </tr> </table>	USB	<p>a. Applies primary power.</p> <p>b. Selects upper sideband receive mode.</p>	<p>RF GAIN Control</p> <p>Adjust attenuation of received signal levels and controls agc voltage in Receiver Module. Counterclockwise rotation decreases input signal level and reduces if. gain.</p>								
USB	<p>a. Applies primary power.</p> <p>b. Selects upper sideband receive mode.</p>											
	<table border="0"> <tr> <td style="text-align: center;">AM</td> <td> <p>a. Applies primary power.</p> <p>b. Selects amplitude modulation receive mode for conventional am. signals or compatible am. signals.</p> </td> </tr> </table>	AM	<p>a. Applies primary power.</p> <p>b. Selects amplitude modulation receive mode for conventional am. signals or compatible am. signals.</p>	<p>NOISE BLANKER Control (Optional)</p> <p>Provides reduced sensitivity to random noise spikes. Clockwise rotation increases blanking action. OFF position de-activates noise blanker circuitry.</p>								
AM	<p>a. Applies primary power.</p> <p>b. Selects amplitude modulation receive mode for conventional am. signals or compatible am. signals.</p>											
	<table border="0"> <tr> <td style="text-align: center;">CW</td> <td>a. Applies primary power.</td> </tr> </table>	CW	a. Applies primary power.	<p>SPEAKER Switch</p> <table border="0"> <tr> <td style="text-align: center;">Switch Position</td> <td style="text-align: center;">Equipment Response</td> </tr> <tr> <td style="text-align: center;">OFF</td> <td>Audio signals removed from front panel and remote speaker output terminal at TB1.</td> </tr> <tr> <td style="text-align: center;">LOCAL</td> <td>Audio signals applied to internal speaker only.</td> </tr> <tr> <td style="text-align: center;">REMOTE</td> <td>Audio signals applied to remote speaker output terminal at TB1 only.</td> </tr> </table>	Switch Position	Equipment Response	OFF	Audio signals removed from front panel and remote speaker output terminal at TB1.	LOCAL	Audio signals applied to internal speaker only.	REMOTE	Audio signals applied to remote speaker output terminal at TB1 only.
CW	a. Applies primary power.											
Switch Position	Equipment Response											
OFF	Audio signals removed from front panel and remote speaker output terminal at TB1.											
LOCAL	Audio signals applied to internal speaker only.											
REMOTE	Audio signals applied to remote speaker output terminal at TB1 only.											



Table 3.1 – Operating Controls, Indicators, and Connectors (Cont.)

CONTROL, INDICATOR OR CONNECTOR	FUNCTION		CONTROL, INDICATOR OR CONNECTOR	FUNCTION	
SPEAKER Switch (Cont.)	Switch Position	Equipment Response	LSB/CW Switch	Switch Position	Equipment Response
	BOTH	Audio signals applied to both speaker and remote speaker output terminal at TB1.		SIGNAL STRENGTH	LSB/CW meter indicates the level of the lsb or cw received signal in "S" units.
SQUELCH Control	Adjusts squelch threshold level. Clockwise rotation decreases the level required by the received signal to break squelch silence. If the control is advanced fully clockwise, the receiver is unsquelched.			AUDIO LEVEL	LSB/CW meter indicates level of detected audio in dBm into a 600 ohm load.
ISB MONITOR Switch	When ISB mode is selected by MODE switch the ISB MONITOR switch provides the following functions:		LSB/CW Meter	Indicates level of either the lsb or cw signal in signal ("S") strength or dBm into a 600 ohm line.	
	Switch Position	Equipment Response	Speaker	Provides monitoring of detected audio signal selected by the SPEAKER switch (positions LOCAL and BOTH).	
	LSB	Audio signals detected from the lower sideband are applied to SPEAKER switch.	USB/AM Switch	Switch Position	Equipment Response
	USB	Audio signals detected from the upper sideband are applied to SPEAKER switch.		SIGNAL STRENGTH	USB/AM meter indicates the level of either the usb or am, received signal in "S" units.
VOLUME Control	Adjusts level of received audio signal at front panel speaker, PHONES jack, and the remote speaker terminal at TB1. During isb mode it adjusts audio output level of channel selected by ISB MONITOR switch.			AUDIO LEVEL	USB/AM meter indicates the level of either the usb or am, detected audio in dBm into a 600 ohm load.
FUSE	Ac primary power fuse F1.		USB/AM Meter	Indicates level of either the usb or am, signal in signal strength ("S") units or dBm into a 600 ohm load.	
PHONES Jack	For connecting headphones to monitor received audio signals.				



3.3 OPERATING INSTRUCTIONS

3.3.1 USB, LSB, AM., AND ISB MODES

a. Set the following switches and controls at the positions listed.

<u>Switch or Control</u>	<u>Position</u>
MODE Switch	At desired mode.
LSB/CW and USB/AM. switches	At SIGNAL STRENGTH
FREQUENCY MHz switches	To operating frequency.
NOISE BLANKER control (Optional)	Fully counterclockwise.
SQUELCH control	Fully clockwise.
SPEAKER switch	At LOCAL.
RF GAIN control	Fully clockwise
PRESELECTOR select switch	At IN.

b. Adjust VOLUME control for desired listening level.

c. Tune PRESELECTOR control to peak the signal on the receiver S meter corresponding to the selected mode.

d. If optional noise blanker is installed, adjust NOISE BLANKER control clockwise to reduce pulse noise interference.

e. If strong interference is present, adjust RF GAIN control counterclockwise to minimize.

NOTE

The RF GAIN control is normally left fully clockwise for maximum sensitivity, but can be adjusted counterclockwise for extremely strong signals or to reduce background noise. By adjusting RF GAIN control so that the S-meter fluctuates only about 1/2 S-units during a period of reception, background noise normally heard between speech syllables is reduced considerably.

f. For isb mode, set ISB MONITOR switch first at LSB and then at USB to check for signals on each channel.

g. If received signal is garbled, pull out on 1 kHz FREQUENCY MHz switch and adjust for best signal.

h. Adjust SQUELCH control counterclockwise until desired signal is squelched OFF. Readjust clockwise stopping just as the desired signal is again present.

NOTE

Re-adjust SQUELCH control setting as outlined in step h each time the RF GAIN control is adjusted.

i. For remote audio monitoring, set SPEAKER switch at either REMOTE or BOTH.

3.3.2 CW Mode

NOTE

If unit does not have optional cw filter installed, cw signals can be received on either the usb, lsb, or isb modes.

a. Set the following switches and controls at the positions listed.

<u>Switch or Control</u>	<u>Position</u>
MODE switch	At USB
LSB/CW and USB/AM. switches	At SIGNAL STRENGTH
NOISE BLANKER control (Optional)	Fully counterclockwise.
SQUELCH control	Fully clockwise.
SPEAKER switch	At LOCAL.
RF GAIN control	Fully clockwise.
PRESELECTOR select switch.	At IN.

b. Set FREQUENCY MHz switch at exact channel frequency then rotate either the 100 Hz or 1 kHz switch for a 1 kHz beat tone.

c. Set MODE switch at CW.

d. Adjust VOLUME control for desired listening level.

NOTE

The cw filter band pass is centered in the usb sideband.



NOTE

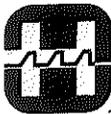
Some transmitted cw signals are offset from the channel frequency. Therefore the FREQUENCY MHz switches must be set at 1000 Hz below the channel frequency.

e. Tune PRESELECTOR control to peak the signal on the receiver S meter corresponding to the CW mode.

f. If optional noise blanket is installed, adjust NOISE BLANKER control clockwise to reduce pulse noise interference.

3.3.3 FSK OPERATION

It may be desirable to set the agc threshold at 5.0 microvolts for FSK operation. Refer to Receiver Module Alignment Procedures, paragraph 7.5 3, steps 22, 23, 28, and 29 and adjust for 5.0 microvolts. The receiver may then be operated in the same manner as in paragraph 3.3.1.



CHAPTER 4

THEORY OF OPERATION

4.1 GENERAL

This discussion of the theory of operation of the RF-505A is separated into four parts. A brief description is presented first followed by a block diagram discussion of the RF-505A Receiver. Block diagram discussions of the Receiver and Synthesizer Modules cover the theory to the level of the individual assemblies. For more detailed theory of the Power Supply Module, Frequency Standard Module, and of the various assemblies in the Receiver and Synthesizer Modules refer to the appropriate chapters in this manual.

4.2 DESCRIPTION

The RF-505A Receiver is a double conversion superheterodyne receiver for operation in the medium and high frequency range of 1.6 to 30.0 MHz. Modes of operation are; lsb, usb, am., cw, and isb. The isb mode is for simultaneous reception and monitoring of both sideband signals on a single channel frequency. Frequency stability is ± 1 part in 10^6 over the operating frequency range. Front panel FREQUENCY MHz switches allow the operator to digitally select the operating frequency to within 50 Hz. Continuous tuning (vfo) between each 10 KHz step is provided by pulling out on the 1 kHz control. Basically the RF-505A Receiver consists of a main frame chassis with Receiver Module (724-1000), Synthesizer Module (724-0500), Power Supply Module (724-1500), or (724-1400) Power Supply for AC only, Frequency Standard Module (724-1600), or (724-1601) high stability Frequency Standard Module (optional), Preselector Assembly (724-1750), and VHF Filter Assembly (724-0300).

4.3 RF-505A RECEIVER BLOCK DIAGRAM THEORY

NOTE

Refer to Figure 4.1 during the following discussion.

Rf signals, received by the antenna, are applied to RF INPUT connector J1. The received rf signals are then coupled to the Rf Gain Control Assembly (724-0162) in the Preselector. Controlled by the

position of RF GAIN control, the Rf Gain Control Assembly attenuates the input levels of the received rf signal while maintaining a constant 50 ohm input impedance to the receiver module. This allows the operator to attenuate high level, on-frequency signals to prevent overdriving without reducing the full 125 dB dynamic range of the receiver. In addition, the RF GAIN control provides manual control of the receiver if. gain.

From the output of the Rf Gain Control Assembly the rf signal is applied to the PRESELECTOR In/Out switch. When set at OUT the output of the Rf Gain Control Assembly is applied directly to the Receiver Module. The IN position couples the received rf signal through the Preselector circuitry to the input of the Receiver Module. The function of the Preselector is to provide more than 10 dB gain and to improve crossmodulation and desensitization performance of the receiver by rejecting off-frequency signals.

In the Receiver Module the received rf signal is progressively mixed with three injection signals supplied by the Synthesizer Module. The first injection signal, local oscillator number 1, is variable between 156.0000 MHz and 185.9999 MHz. It is controlled by the FREQUENCY MHz switches to provide a 156.0 MHz difference frequency (first if. signal) when mixed with the received signal. The 156.0 MHz signal is filtered, amplified and mixed with the second injection signal, local oscillator number 2 (156.5 MHz). The difference, 500 kHz, is selected as the second if. signal. The second if. signal is amplified, coupled through selectable sideband filters, and applied to a usb product detector, to a lsb product detector and to an am. envelope detector. In each product detector the second if. ssb signal (nominal 500 kHz) is mixed with a 500 kHz injection signal. The 500 kHz injection signal is the 1 MHz output from the Synthesizer Module (local oscillator number 3) divided by two in the Receiver Module. The mixing results in the audio intelligence being extracted from the if. sideband signal. During am. operation the audio signal is detected by the am. envelope detector circuitry. The audio signal from the appropriate detector is amplified and

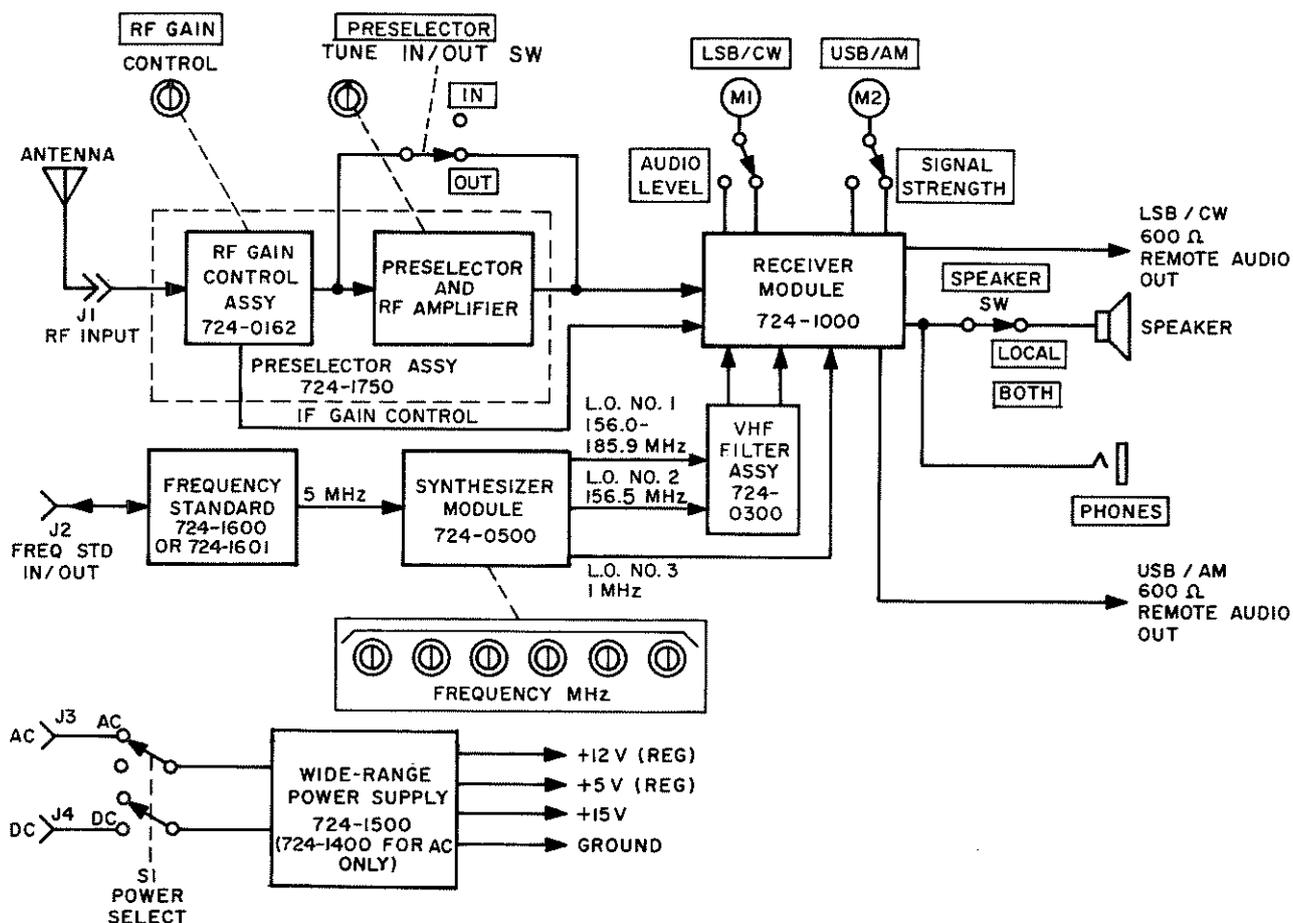


Figure 4.1 - RF-505 Receiver Block Diagram

applied to a squelch gate diode and to a remote audio amplifier.

The squelch gate diode blocks all received signals that are below a predetermined level, adjusted by the SQUELCH control, from the speaker amplifier. From the output of the speaker amplifier the signal is applied to the front panel PHONES jack and through the BOTH and SPEAKER contacts of the SPEAKER switch to the front panel speaker.

The output of the remote audio amplifier is coupled to rear panel remote audio output terminals and to the audio level meter circuitry. The audio level meter circuitry provides a dc voltage proportional to the audio level. This voltage is coupled through the AUDIO LEVEL contacts of USB/AM and LSB/CW Meter switches to the respective front panel meters.

Frequency Standard Module 724-1600 (or 724-1601 high stability module) supplies the 5 MHz

frequency standard signal to the Synthesizer Module. The reference signal is selected on the module from either a temperature compensated crystal oscillator (TCXO), from a high stability oven standard, installed on the module, or from an external 5 MHz source connected to the rear panel of the unit. The accuracy and stability rating of the TCXO is ± 1 part in 10^6 . The optional high stability standard is available by special order with an accuracy and stability of ± 1 part in 10^8 .

Power Supply Module 724-1500 provides all operating voltages from primary power sources of either ac (100 to 260 volts, 48 to 1000 Hz, single phase) or dc (10 to 40 volts). Output voltages are +12 vdc regulated, +5 vdc regulated, and +15 vdc. The Power Supply Module uses a proportional control configuration to automatically provide a constant output with input voltage variations.



VHF Filter Assembly 724-0300 provides improved spurious signal rejection of the first and second local oscillator signals from the Synthesizer Module. This assembly consists of a 156.5 MHz band-pass filter for local oscillator number two signal and a 156.0 to 186.0 MHz band-pass filter combined with a 156.0 MHz notch filter for local oscillator number one. The 156.5 MHz filter attenuates all signals above and below 156.5 MHz. The 156.0 to 186.0 MHz filter attenuates all signals above 186.0 MHz and below 156.0 MHz. When the RF-505 is operated above 10 MHz the 156.0 MHz notch filter is activated to attenuate all 156.0 MHz signals.

4.4 RECEIVER MODULE

Receiver Module 724-1000 contains the circuitry for converting the received rf signals to perceptible audio signals. To accomplish this the Receiver Module consists of the following six printed circuit assemblies and an interconnecting mother board.

- a. Front End Assembly 724-1100.
- b. Usb/Am. Filter Assembly 724-1150.
- c. Lsb/Cw Filter Assembly 724-1175.
- d. Two each Detector/Agc Assemblies 724-1200.
- e. Speaker Driver and Squelch Gate Assembly (Discrete) 724-1275.

Referring to figure 4.2, the input rf signal from the Preselector Assembly is applied to Front End Assembly 724-1100 for mixing with the first and second local oscillator injection signals. The input rf signal is first coupled through a low pass filter, which attenuates all received rf signals above 35 MHz, to the input of an up-converter and mixer. The first local oscillator injection signal, from the Synthesizer Module, is also applied to the up-converter and mixer and is always 156.0 MHz higher in frequency than the frequency of the desired received rf signal. The difference between these two signals is selected by a filter, amplified, and applied to a second mixer as the 156.0 MHz first if. signal. In the second mixer, the second local oscillator injection signal (156.5 MHz) from the Synthesizer Module is mixed with the first if. signal. Again the difference is selected (500 kHz) as the second if. signal. The second if. signal is then amplified and applied to the input terminal of Usb/Am. Filter Assembly 724-1150 and to the input terminal of Lsb/Cw Filter Assembly 724-1175.

When selected by the MODE switch, each filter assembly, filters out the unwanted signals and couples the desired sideband if. signal to the corresponding Detector/Agc Assembly. During isb operation (MODE switch at ISB) both the usb and lsb filters on their respective assemblies are selected. This allows the audio signals on both sidebands of a carrier frequency to be detected as two separate audio channels.

The single sideband if. signal at the input of each Detector/Agc Assembly is coupled to a product detector (for ssb and cw signals) and to an am./agc amplifier. The output of the am./agc amplifier is then applied to the am. envelope detector and to the agc detector. The product detector and am. envelope detector are utilized to recover the transmitted audio signal from the second if. signal. Depending on the operating mode of the unit, the output of the appropriate audio detector is selected and amplified by a preamplifier mode switch. From the preamplifier mode switch the audio is then applied to the MODE switch and to the input of the line amplifier.

The MODE switch selects the audio output and agc signal output from the Detector/Agc Assembly corresponding to the operating mode as inputs to the Speaker Driver and Squelch Gate Assembly. The squelch circuitry compares the agc signal level, indicating received signal level, with a predetermined level controlled by the position of the SQUELCH control. When the received signal agc level is proportional to the SQUELCH control level the squelch gate diode is forward biased coupling the audio signal to the audio power amplifier. The audio output from the audio power amplifier is applied to the SPEAKER switch and to the front panel PHONES jack. SPEAKER switch applies the audio signal to the front panel speaker, LOCAL and BOTH positions, and to the rear panel remote speaker terminal, REMOTE and BOTH positions.

The received audio signal from the preamplifier mode switch in the Detector/Agc Assembly is also amplified by the line amplifier to provide a balanced 600 ohm remote audio output. A portion of the line amplifier output is applied to an audio level meter amplifier where it is amplified and then rectified by the audio level rectified circuitry. The output of the rectifier is a dc voltage proportional to the level of the audio signal. This dc voltage is



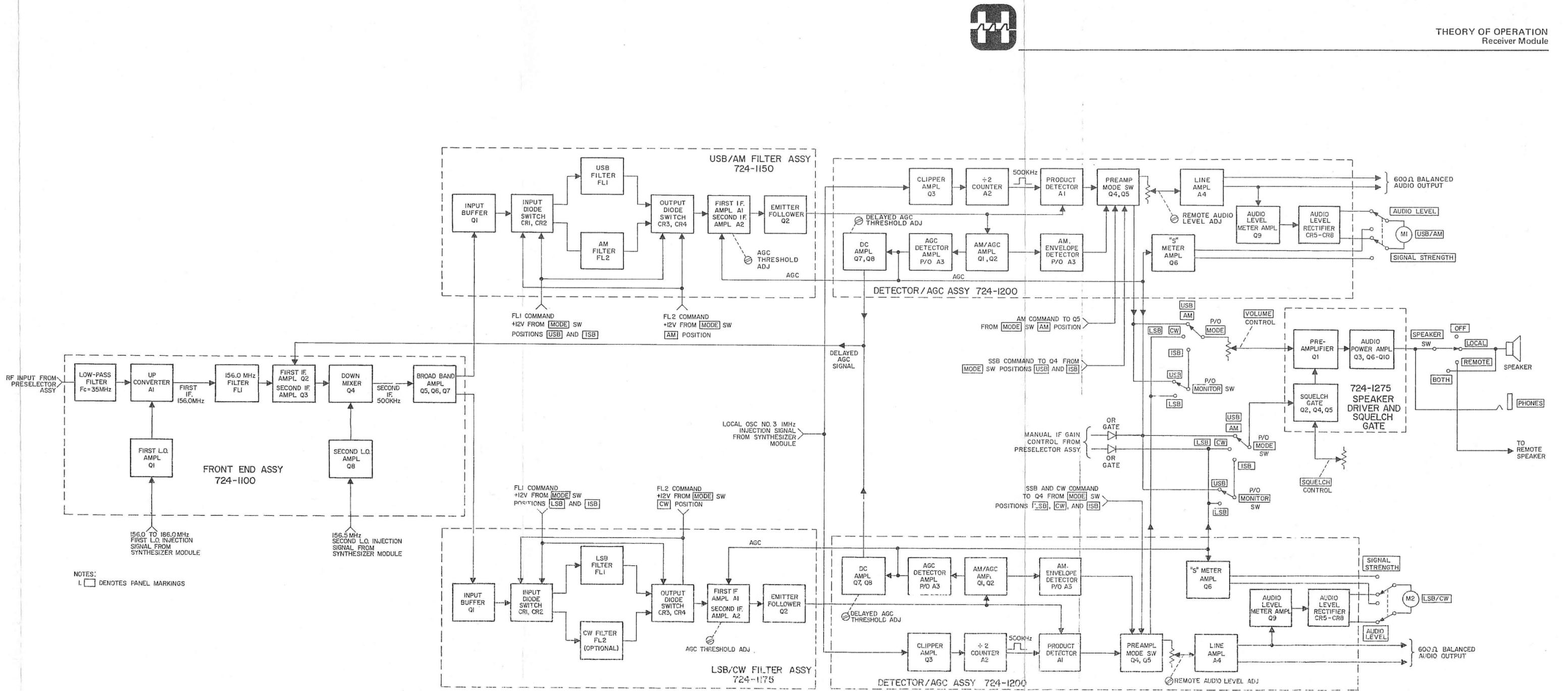
coupled to the front panel meters, to indicate received audio level, through the AUDIO LEVEL contacts of the Meter switches.

From the agc detector the agc signal is also routed to the if. amplifier in the corresponding filter assemblies, to the dc amplifier, to the MODE switch, and to the "S" meter amplifier.

The agc signal at the if. amplifier is used to adjust the gain of each channel, individually. The dc amplifier provides a delayed agc signal, through an OR gate configuration with the other channel, to adjust the overall gain of the receiver at the Front End Assembly. "S" meter amplifier provides a dc voltage

through the SIGNAL STRENGTH contacts of each Meter switch to the front panel meter. This dc voltage indicates the level of the received rf signal.

The front panel RF GAIN control operates in conjunction with the agc voltage to control the if. gain of each receiver channel. This is accomplished by placing agc voltage, controlled by the position of the RF GAIN control, through two OR gates on each agc line in the receiver module. The operator can then reduce the if. gain when receiving very strong signals. The use of diode OR gates permits the automatic gain control to function as normal for any large fluctuating signal above the adjusted level.



NOTES:
I. □ DENOTES PANEL MARKINGS

Figure 4.2 — RF-505A Receiver Module Block Diagram

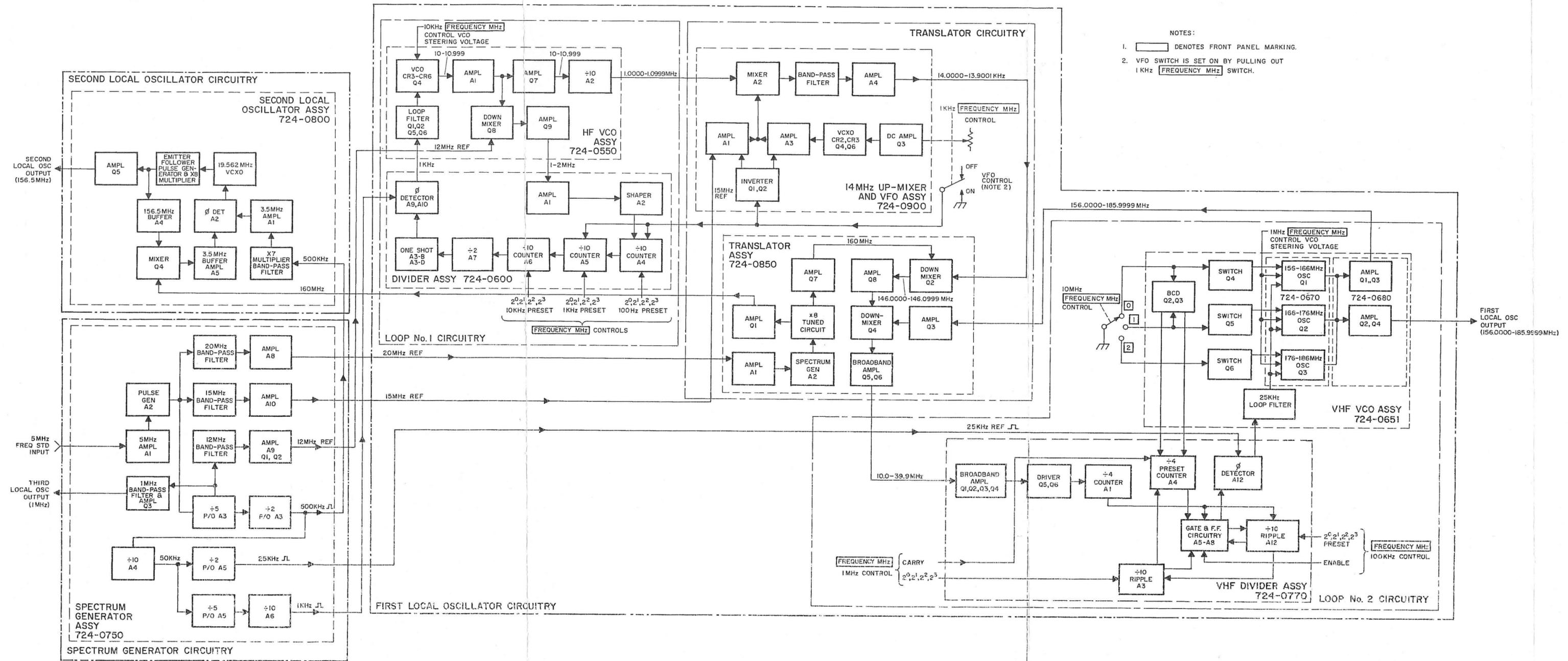


Figure 4.3 - RF-505A Synthesizer Module Block Diagram



4.5 SYNTHESIZER MODULE

4.5.1 GENERAL

Synthesizer Module 724-0500 provides the three injection signals for frequency conversion required by the unit. These signals are synthesized from voltage controlled oscillators that are phase locked to a 5.000000 MHz standard signal or generated by dividing the 5 MHz standard signal, by decade counters, down to the required frequency. The output signals are 1.0 MHz, 156.5 MHz, and a variable frequency between 156.0000 and 185.9999 MHz, depending on the operating frequency of the unit. The 5 MHz input standard signal is supplied to the Synthesizer Module by a frequency standard source either located within the unit (Frequency Standard Module) or externally (Master Clock or a second unit such as another RF-505 Receiver).

The Synthesizer Module consists of eight printed circuit board assemblies with an interconnecting mother board. These assemblies are mounted in a modular aluminum chassis. The assemblies are:

- a. Spectrum Generator Assembly 724-0750.
- b. Second Local Oscillator Assembly 724-0800.
- c. HF Voltage Controlled Oscillator Assembly (HF VCO) 724-0550.
- d. HF Divider Assembly 724-0600.
- e. 14 MHz Upmixer and Variable Frequency Oscillator Assembly (14 MHz Upmixer and VFO) 724-0900.
- f. Translator Assembly 724-0850.
- g. VHF Voltage Controlled Oscillator Assembly (VHF VCO) 724-0651.
- h. VHF Divider Assembly 724-0770.

4.5.2 BLOCK DIAGRAM THEORY

NOTE

Refer to figure 4.3 during the following discussion.

Basically the Synthesizer Module consists of three major circuits, each one providing a specific output

signal or signals. They are the spectrum generator (Spectrum Generator Assembly 724-0750), the second local oscillator (Second Local Oscillator Assembly 724-0800), and the first local oscillator circuitry.

An external frequency standard signal of 5 MHz is applied to the Spectrum Generator Assembly where it is amplified and applied to a pulse generator and digital counters. The pulse generator produces a narrow pulse output signal that contains desired harmonics. Bandpass filters are utilized to select the desired 20 and 15 MHz signals. Digital counters progressively divide the 5 MHz signal to 1 MHz, 500 kHz, 25 kHz, and 1 kHz. The 1 MHz signal is applied, after filtering and amplifying, as an output injection signal, and to a band-pass filter where the twelfth harmonic is extracted as an output signal. The 500 kHz, 25 kHz, and 1 kHz signals are supplied as output signals to the second local oscillator circuitry. The second local oscillator circuitry provides the fixed 156.5 MHz injection signal to the Receiver Module. This signal is generated by a voltage controlled crystal oscillator (VCXO) connected in a phase lock loop configuration. Two input signals, a 160 MHz signal from the translator Assembly and a 500 kHz signal from the Spectrum Generator Assembly, are used in the phase lock loop as reference standards.

The first local oscillator is further divided into three sub-circuits; loop number 1, translator, and loop number 2. Loop number 1 contains the HF VCO and the HF Divider assemblies. The 14 MHz Upmixer and VFO assembly and Translator Assembly make up the translator circuitry section of the first local oscillator. Loop number 2 consists of the VHF VCO assembly, VHF Divider Assembly, and the down-mixer portion of the Translator Assembly. Loop number 1 provides the 100 Hz, 1 kHz, and 10 kHz digits of the first local oscillator injection signal. The translator section converts the output of loop number 1, 1.0000 to 1.0999 MHz, up to 146.0000 to 146.0999 MHz through two stages of mixing. VFO tuning of the unit is also provided at this stage. The 100 kHz, 1 MHz, and 10 MHz portion of the first local oscillator injection signal is supplied by loop number 2. Together they provide an output signal that will vary from 156.0000 MHz to 185.9999 MHz in 100 Hz steps. The exact frequency depends on the position of the front panel FREQUENCY MHz control switches.



To further illustrate the operation of the first local oscillator circuitry consider an operating frequency of 12.3456 MHz as set by the front panel FREQUENCY MHz switches. The output of the VHF VCO Assembly, local oscillator number 1, should be 168.3456 MHz since the first local oscillator is always 156.0000 MHz higher in frequency than the operating frequency.

In the VHF VCO Assembly one of three voltage controlled oscillators (vco) is selected by the 10 MHz FREQUENCY MHz control. Vco number one for operating frequencies up to 9.9999 MHz, vco number two for operating frequencies between 10.0000 and 19.9999 MHz, and vco number three for frequencies between 20.0000 and 29.9999 MHz. A coarse tuning voltage to the selected oscillator is provided by a resistive voltage divider chain on the 1 MHz Switch. Fine tuning of the vco provides the 1 MHz, 100 kHz, 10 kHz, 1 kHz and 100 Hz information and is accomplished by comparing the output of the selected vco, driven to 168.3456 MHz, with a 146.0456 MHz signal in the Translator Assembly. The 146.0456 signal contains the 10 kHz, 1 kHz, and 100 Hz digit information. Therefore the difference between these two signals will reflect this information as an error if the vhf vco is off frequency. This signal, 22.30000 MHz, is applied to the VHF Divider Assembly where it is divided down by preset counters. The counters, preset by the 1 MHz and 100 kHz controls, provides a division that will result in an output (at full count) of 25 kHz if the vhf vco is exactly on frequency. Any frequency other than the expected 25 kHz signal reflects the 1 MHz, 100 kHz, digital information plus the 10 kHz, 1 kHz, and 100 Hz information carried over by the input signal to the dividers. This signal is then applied to a phase detector where it is compared with a 25 kHz reference signal. If the input signal is not 25 kHz the phase detector will lock, either high or low and provide a steering voltage to the 25 kHz loop filter in the VHF VCO Assembly. The steering voltage will shift the frequency of the vhf vco in the proper direction until the output is on frequency. At that time the phase detector will unlock and provide a 25 kHz output signal. The 25 kHz signal is filtered into a dc voltage that stabilizes the vhf vco on frequency.

The 146.0456 MHz signal in the Translator Assembly with which the output of the vhf vco is mixed, is derived in the following way.

At the HF VCO Assembly a preset voltage, controlled by a resistor voltage divider network on the 10 kHz control set at position 4, coarse tunes the hf vco to approximately 10.456 MHz. Fine tuning of the hf vco for the exact 10 kHz, 1 kHz, and 100 Hz digit is accomplished in the same fashion as in the vhf vco. To control the output of the hf vco to the exact required frequency (fine tuning), the output signal of the hf vco is mixed with a 12 MHz reference signal. The difference, 1.544 MHz, is then divided by preset counters controlled by the 10 kHz, 1 kHz, and 100 Hz controls. These counters are preset to provide an output of 1 kHz if the hf vco is exactly on frequency. If the hf vco is off frequency the output of the counters will reflect the error. The output signal of the divider is then compared to a fixed reference 1 kHz signal in a phase detector. When the hf vco is on frequency the output of the phase detector is 1 kHz. If the hf vco is off frequency then the phase detector will lock, depending on the direction of the error, either high or low. This lock signal, a dc voltage, will steer the hf vco in the proper direction until it is on frequency. At that time the phase detector output will unlock and provide a 1 kHz signal and the hf vco will stabilize on frequency.

The output of the hf vco is divided by ten in the HF VCO Assembly to provide an output of 1.0456 MHz. This signal is applied to the 14 MHz Upmixer and VFO Assembly. In this assembly the 1.0456 MHz signal is mixed with a reference signal of 15 MHz to provide an output of 13.9544 MHz.

During VFO operation, the fixed 15 MHz signal is replaced with a variable 14.9900 to 15.0000 MHz signal. This variable frequency signal is controlled by rotating the 1 kHz FREQUENCY MHz control.

The 13.9544 MHz signal is then applied to the Translator Assembly and mixed with a 160 MHz referenced signal. The difference, 146.0456 MHz, is selected as the signal for mixing with the output of the VHF VCO Assembly output signal, local oscillator number 1.



5.4 FAULT ANALYSIS TABLE

A fault analysis table is presented below as an aid in sectionalizing or localizing source of trouble in the RF-505A.

Table 5.1 – Fault Analysis

SYMPTOM	POSSIBLE TROUBLE	CHECKS AND CORRECTIVE MEASURES
Receiver inoperative, meters not illuminated.	<ul style="list-style-type: none"> a. Primary power fuse F1 open for ac operation or F2 open for dc operation. b. Power Supply Module fuse F1 open. c. POWER SELECT switch S1 at improper position. d. Primary power source improper. e. Power cord defective or not connected. f. Power Supply Module defective. 	<ul style="list-style-type: none"> a. Replace fuse. b. Replace defective fuse. c. Set S1 to position corresponding to primary power source. d. Make voltage measurement to verify. Notify responsible personnel. e. Make continuity check of power cable. Repair or replace cable. f. Refer to chapter 9. Repair or replace Power Supply Module.
No audio or background noise at speaker or PHONES jack. Meters indicate both rf and audio signals present. Audio signals present at TB1 terminals, 2 and 3, 4 and 5. No audio at TB1 terminal 1.	<ul style="list-style-type: none"> a. Fuse F1 on Speaker Driver Assembly open. b. Speaker Driver Assembly defective. c. SPEAKER switch set at OFF or defective. d. SQUELCH control set fully counterclockwise or defective. 	<ul style="list-style-type: none"> a. Replace fuse. b. Refer to chapter 7. Repair or replace defective assembly. c. Set SPEAKER switch at BOTH. Make continuity checks and replace faulty component or repair wiring. d. Adjust SQUELCH control. Make continuity check and replace faulty component.
No audio or background noise at speaker in all modes. Meters do not indicate rf signal but illuminate when selected.	<ul style="list-style-type: none"> a. Mute jumper or receiver keyline open at TB1 terminals 8 and 9. b. Frequency Standard Module defective or Mode switch S1F1 set at improper position. c. Synthesizer Module defective. d. Frequency Standard and Synthesizer Module interconnecting coaxial cables open. e. Front End Assembly in Receiver Module defective. 	<ul style="list-style-type: none"> a. Make continuity check. Repair open cable or replace jumper. b. Check for proper position of Mode switch. Refer to chapter 11 and repair or replace Frequency Standard Module. c. Refer to chapter 8, repair or replace defective module. d. Make continuity check. Repair or replace defective cables. e. Refer to chapter 7. Repair or replace defective assembly.
Am. mode normal, all other modes inoperative.	<ul style="list-style-type: none"> a. Third local oscillator injection signal absent at receiver module. b. Synthesizer Module defective. 	<ul style="list-style-type: none"> a. Make continuity check of coaxial cable. Repair or replace. b. Refer to chapter 8, repair or replace Synthesizer Module.



Table 5.1 – Fault Analysis (Cont.)

SYMPTOM	POSSIBLE TROUBLE	CHECKS AND CORRECTIVE MEASURES
<p>Usb and/or am, modes inoperative, lsb and cw modes normal.</p>	<p>a. Usb/Am. Filter Assembly defective.</p> <p>b. Usb/Am. Detector/Agc Assembly defective.</p> <p>c. MODE switch or associated wiring defective.</p>	<p>a. Refer to chapter 7, repair or replace defective assembly.</p> <p>b. Refer to chapter 7, repair or replace defective assembly.</p> <p>c. Make continuity checks. Repair or replace defective component.</p>
<p>Lsb and/or cw modes inoperative, usb and am, modes normal.</p>	<p>a. Lsb/Cw Filter Assembly defective.</p> <p>b. Lsb/Cw Detector/Agc Assembly defective.</p> <p>c. MODE switch or associated wiring defective.</p>	<p>a. Refer to chapter 7, repair or replace defective assembly.</p> <p>b. Refer to chapter 7, repair or replace defective assembly.</p> <p>c. Refer to chapter 6, make continuity checks. Repair or replace defective components.</p>
<p>Usb or am, audio signals absent at TB1 terminals 2 and 3. Speaker normal.</p>	<p>Usb/Am. Detector/Agc Assembly defective.</p>	<p>Refer to chapter 7, repair or replace defective assembly.</p>
<p>Lsb or cw audio signals absent at TB1, terminals 4 and 5. Speaker normal.</p>	<p>Lsb/Cw Detector/Agc Assembly defective.</p>	<p>Refer to chapter 7, repair or replace defective assembly.</p>
<p>Received signals are weak in all modes.</p>	<p>a. RF GAIN control improperly adjusted or defective.</p> <p>b. Agc action improper.</p> <p>c. Front End Assembly defective.</p> <p>d. Synthesizer Module injection signals improper.</p>	<p>a. Adjust control for maximum signal strength. Make continuity check and replace defective component.</p> <p>b. Refer to chapter 7, and make agc checks and adjustments.</p> <p>c. Refer to chapter 7, repair or replace defective assembly.</p> <p>d. Refer to chapter 8, repair or replace defective module.</p>
<p>Large received signals are distorted in all modes.</p>	<p>a. RF GAIN control improperly adjusted.</p> <p>b. Front End Assembly defective.</p> <p>c. Improper agc adjustment in either Detector/Agc Assembly.</p>	<p>a. Rotate RF GAIN control counterclockwise for best signal response.</p> <p>b. Refer to chapter 7, make agc check and repair or replace defective assembly.</p> <p>c. Refer to chapter 7, make agc checks and adjustments.</p>
<p>Large received signals are distorted in lsb and cw modes only.</p>	<p>Improper agc action in either Lsb/Cw Filter Assembly or Lsb/Cw Detector/Agc Assembly.</p>	<p>Refer to chapter 7, make agc check. Repair or replace defective assembly.</p>
<p>Large received signals are distorted in usb and am, modes only.</p>	<p>Improper agc action in either Usb/Am, Filter Assembly or Usb/Am, Detector/Agc Assembly.</p>	<p>Refer to chapter 7, make agc checks. Repair or replace defective assembly.</p>



5.5 MODULES REMOVAL

To remove the modules from the main chassis proceed as follows:

5.5.1 RECEIVER AND SYNTHESIZER MODULES

- a. Loosen the four captive screws located at each corner of the module.
- b. Slide module toward rear of unit to disconnect multi-pin connector.
- c. Lift up on module for access to coaxial cable connectors and disconnect.
- d. Lift module up and out of unit.

5.5.2 POWER SUPPLY MODULE

NOTE

In most cases it is unnecessary to completely remove the power supply for servicing as all components are accessible with the module mounted in the unit.

- a. Remove top cover from module.
- b. At printed circuit board remove screws securing it to module. Rotate the printed circuit board upward for access to the two mounting screws.
- c. Loosen the two mounting screws under the printed circuit board and the two captive screws at the end of the module adjacent to connector J1501.
- d. Disconnect connector J1501.
- e. Remove the three screws at the back panel, and lift the module up and out of the unit.

5.5.3 FREQUENCY STANDARD MODULE

- a. Tag and unsolder the three wires at C1, C2, and C3.
- b. Disconnect the coaxial cable connectors from J1601 and J1602.
- c. Loosen the four mounting screws and lift the module up and out of the unit.

5.5.4 PRESELECTOR MODULE

NOTE

Refer to paragraph 5.5.1 and remove the Synthesizer Module before proceeding with the following procedures.

- a. At the rear of the Preselector Module disconnect coaxial connectors P1651 and P1652 and the main harness connector P1653.
- b. Remove the two screws and lockwashers securing the 724-0232 Synthesizer Post Regulator Assembly to the Preselector Module. Rotate the assembly away from the module for access to the shield mounting screw.
- c. Remove the two screws and lockwashers securing the Preselector Module shield. Remove the shield.
- d. At the front panel of the RF-505A rotate the PRESELECTOR Tune control for access to the two lock screws securing the shaft of C1 to the planetary drive coupler. Loosen the screws.
- e. At the front panel of the RF-505A remove the knobs from the PRESELECTOR Tune control and Select switch and from the FREQUENCY MHz 10 MHz and 1 MHz switches. Remove the hex nuts from each of the above controls.
- f. Slide the Preselector Module back until the shafts clear the mounting holes then lift the module up and out of the unit.

5.5.5 VHF FILTER ASSEMBLY

- a. Refer to paragraph 5.5.1 and remove the Receiver Module.
- b. At the VHF Filter Assembly tag and unsolder the wires connected to E1, E2, and E3. Disconnect P-0301, P-0302, P-0303 and P-0304.
- c. Remove hardware securing VHF Filter to chassis and remove the assembly.

5.6 MODULE REPLACEMENT

Reverse the removal procedures for the installation of the modules in the RF-505A.

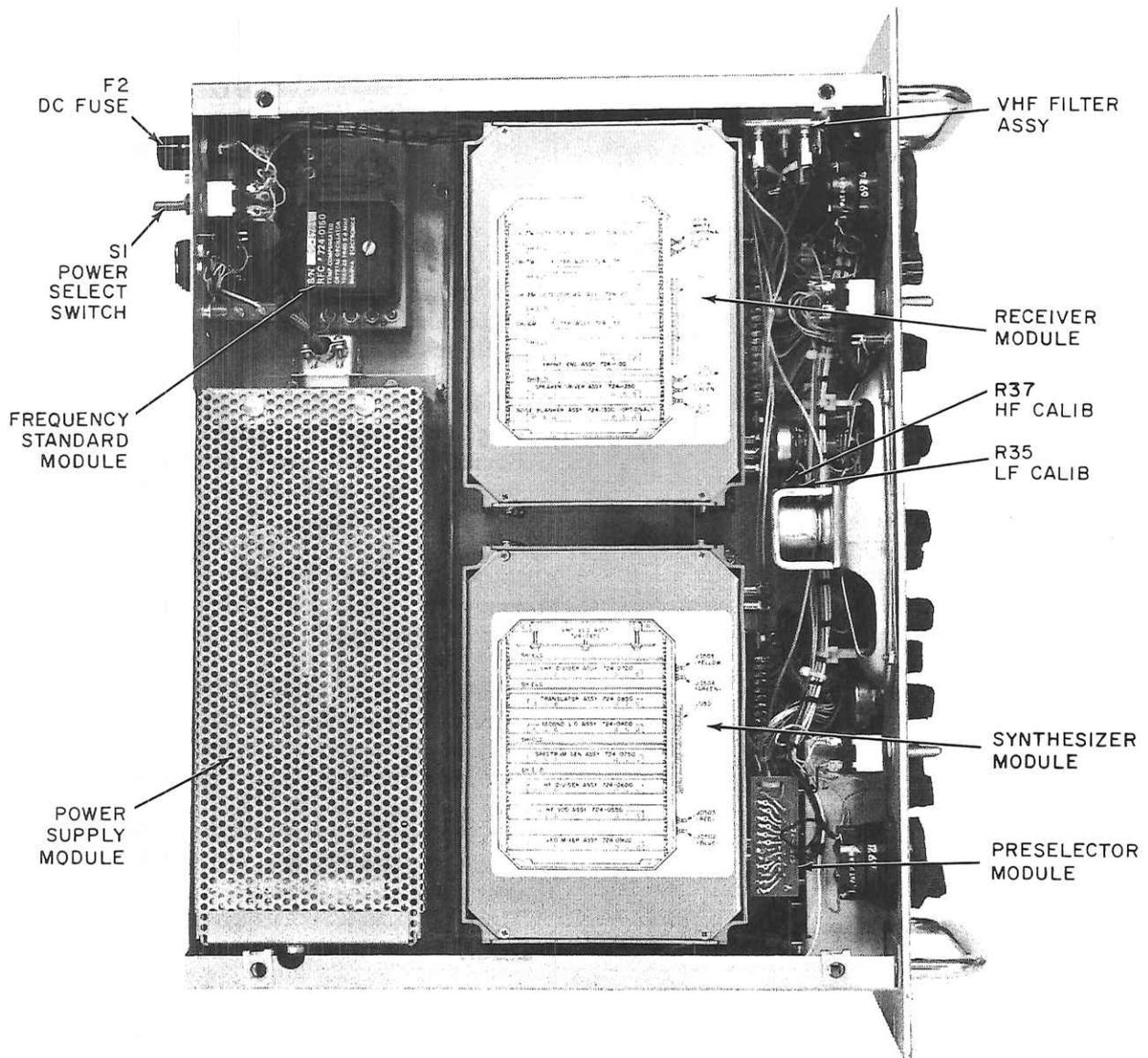


Figure 5.1 – RF-505A Top View (Cover Removed)

NOTE

After installing the Preselector Module perform step a through d below.

- a. If the shaft of C1 does not align with the planetary coupler loosen the three mounting screws securing C1 to the Preselector chassis. Align the shafts and then retighten the three screws.
- b. Tighten the lock screws on the planetary coupler.
- c. At the front panel rotate PRESELECTOR Tune control to the counterclockwise stop of capacitor C1.

- d. Loosen the lock screws on the PRESELECTOR Tune indicator (skirt) and align the pointer with the 2 on the front panel. Retighten the set screw.

5.7 PRINTED CIRCUIT ASSEMBLIES

5.7.1 REMOVAL

To remove the printed circuit assemblies from the Receiver and Synthesizer Modules proceed as follows:

- a. Lift upward on the inside ends of the two printed circuit assembly extractor arms simultaneously.
- b. Slide the assembly out of the module guides.



5.7.2 EXTENDING ASSEMBLIES

- a. Lift up on the two plastic latch tabs to unlock the assembly.
- b. Rotate the tabs toward the outside of the modules to disengage the assembly from the module connector.
- c. Release the two tabs and slide the assembly up until it is out of the module.

5.7.2 EXTENDER

To use the assembly extender (RF P/N 724-0060) proceed as follows:

- a. Remove the assembly from the module using the procedures of paragraph 5.7.1.

NOTE

The extender is keyed to prevent connecting it into the module in the wrong direction.

- b. Slide the extender into the assembly connector on the module.

CAUTION

The component side of the assembly must be located on the same side as the extender connector to prevent reversal of the interconnecting circuitry.

- c. Connect the assembly to the extender, refer to figure 5.2.

5.7.3 ASSEMBLY INSTALLATION

To install the assembly into the module proceed as follows:

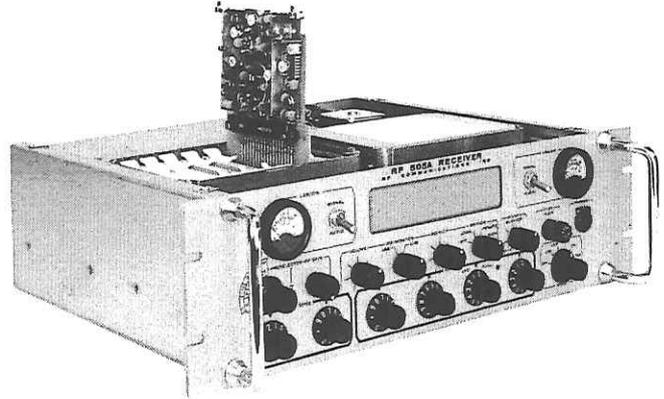


Figure 5.2 – RF-505A Shown With An Assembly Extended for Testing

NOTE

Each assembly connector is keyed to prevent accidental connection to a wrong module connector, refer to the figure on the module top cover.

- a. Slide the assembly into the module.
- b. Push down on the assembly until the two connectors are engaged completely. Two clicks will be heard indicating the assembly has locked into place.



CHAPTER 6

MAIN FRAME AND PRESELECTOR MODULE

6.1 GENERAL

Chapter six provides the necessary information for checking the Main Frame circuitry and Preselector Module (724-1750) of the RF-505A Receiver.

The Main Frame consists of the front panel controls, switches, and indicators; the rear panel connectors; and the interconnecting harness.

The Preselector Module contains the 10 MHz and 1 MHz FREQUENCY MHz switches, the rf wide-band amplifier (724-1690), the IF GAIN CONTROL ASSEMBLY (724-0260) and the rf gain control. The IF GAIN CONTROL ASSEMBLY contains the Synthesizer Regulator which provides a constant voltage for the VHF and HF steering voltages and the VFO control.

Included in this chapter are the FREQUENCY MHz switches binary decimal code (BCD) and steering voltage checks, Preselector test, and rf gain control test. Main Frame, Preselector Module, and Synthesizer Regulator Assembly circuit diagrams and parts list are also included.

Table 6.1 – 10 MHz Switch S3

SWITCH POSITION	P0501 PIN NO.'S		
	11	R	P
0	0	1	1
1	1	0	1
2	1	1	0

0 = GROUND
1 = OPEN CIRCUIT

6.2 FREQUENCY MHz SWITCHES CHECK

To check for the correct BCD input to the Synthesizer Module proceed as follows:

- a. Set MODE switch at OFF and remove the Synthesizer Module from the unit, refer to Chapter 5, paragraph 5.5.1.
- b. Using an ohmmeter check for the proper information (open or ground) on the pins of Synthesizer Module main frame connector P0501 for each position of switch S3 through S8.

NOTE

The following tables, 6.1 through 6.6, list the switch positions with the corresponding BCD information.

Table 6.2 – 1 MHz Switch S4

SWITCH POSITION	P0501 PIN NO.'S (FUNCTION)				
	U (2 ⁰)	S (2 ¹)	V (2 ²)	T (2 ³)	13 (Carry)
0	0	0	0	0	1
1	1	0	0	1	0
2	0	0	0	1	0
3	1	1	1	0	0
4	0	1	1	0	0
5	1	0	1	0	0
6	0	0	1	0	0
7	1	1	0	0	0
8	0	1	0	0	0
9	1	0	0	0	0

0 = GROUND
1 = OPEN CIRCUIT



Table 6.3 – 100 kHz Switch S5

DIAL POSITION	P0501 PIN NO.'S (FUNCTION)				
	15 (2 ⁰)	17 (2 ¹)	16 (2 ²)	18 (2 ³)	14 (Enable)
0	0	0	0	0	0
1	1	0	0	1	1
2	0	0	0	1	1
3	1	1	1	0	1
4	0	1	1	0	1
5	1	0	1	0	1
6	0	0	1	0	1
7	1	1	0	0	1
8	0	1	0	0	1
9	1	0	0	0	1

0 = GROUND
1 = OPEN CIRCUIT

Table 6.5 – 1 kHz Switch S7

DIAL POSITION	P0501 PIN NO.'S (FUNCTION)			
	K (2 ⁰)	C (2 ¹)	5 (2 ²)	7 (2 ³)
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1

0 = GROUND
1 = OPEN CIRCUIT

Table 6.4 – 10 kHz Switch S6

DIAL POSITION	P0501 PIN NO.'S (FUNCTION)			
	A (2 ⁰)	8 (2 ¹)	9 (2 ²)	B (2 ³)
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1

0 = GROUND
1 = OPEN CIRCUIT

Table 6.6 – 100 Hz Switch S8

DIAL POSITION	P0501 PIN NO.'S (FUNCTION)			
	J (2 ⁰)	E (2 ¹)	H (2 ²)	D (2 ³)
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1

0 = GROUND
1 = OPEN CIRCUIT



6.3 STEERING VOLTAGE CHECKS

To check for the proper steering voltage at the Synthesizer Module proceed as follows:

a. Set MODE switch at OFF and remove the Synthesizer Module, refer to Chapter 5, paragraph 5.5.1.

b. Using a dc vtvm connect the ground lead to the RF-505A chassis and the positive lead to the pin listed below in tables 6.7 or 6.8.

c. Set MODE switch at LSB and check each position of the switch for the proper voltage. (Other switches do not affect readings.)

Table 6.7 – HF VCO Steering Voltage

10 kHz FREQUENCY MHz SWITCH S6 POSITION	J0501 PIN 2 VOLTAGE ($\pm 7\%$)
0	3.40
1	3.88
2	4.48
3	5.18
4	5.88
5	6.79
6	8.00
7	9.40
8	10.90
9	12.00

Table 6.8 – VHF VCO Steering Voltage

1 MHz FREQUENCY MHz SWITCH S4 POSITION	J0501 PIN 6 VOLTAGE ($\pm 7\%$)
0	0.89
1	1.12
2	1.43
3	1.78
4	2.37
5	3.00
6	4.03
7	5.10
8	7.00
9	9.35

6.4 PRESELECTOR AND RF GAIN CONTROL TEST

To test for proper operation of the Preselector Module perform the following test procedures.

6.4.1 TEST EQUIPMENT

NOTE

The following test equipment or equivalent is required to perform the following procedures.

a. Rf signal generator – HP, Model 606.

b. RF vtvm – Boonton, Model 91C with 50 ohm BNC termination.

c. Coax test cable – RF P/N 724-0032.

d. Adapter, BNC to miniature – Sealectro No. 51-074-6800.

6.4.2 PRELIMINARY

a. At the rf signal generator set frequency at 2 MHz, cw output at zero microvolts.

b. Refer to chapter 5, paragraph 5.5.1, and remove the Synthesizer Module from the RF-505A.

c. Connect the coax test cable (paragraph 6.4.1c) to the 50 Ω termination on the rf vtvm. Connect the coax adapter (paragraph 6.4.1d) to the rf signal generator.

d. Connect the coax adapter to the coax test cable.

e. At the rf vtvm set range switch at 1 Vrms. Adjust rf signal generator output level until the rf vtvm indicates 0 dB. Do not readjust rf signal generator.

f. Disconnect the coax adapter and coax test cable and connect them to the two coax connectors J1651 and J1652, on the rear panel of the Preselector Module.



6.4.3 PROCEDURES

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.	As outlined in paragraph 6.4.2 for steps 2 through 20.	Perform procedures of paragraph 6.4.2	
2.		Set MODE switch at OFF, 10 MHz and 1 MHz FREQUENCY MHz switches at 0. Set RF GAIN control fully clockwise and Preselector Select switch at OUT. Record the rf vtm indication.	Between 0 and 0.5 dB.
3.		Adjust rf signal generator output for 0 dB on rf vtm.	Adjusted for 0 dB (full scale).
4.		Set RF GAIN control fully counterclockwise and record rf vtm indication.	Greater than 35 dB decrease.
5.		Set RF GAIN control fully clockwise. Reduce rf signal generator to less than 20 mV. Set rf vtm to 0.1 V scale and adjust rf signal generator output until rf vtm reads 10 dB. Set mode switch to LSB and set Preselector switch at IN. Set 1 MHz FREQUENCY MHz switch at 2. Adjust Preselector Tune control for a peak indication on the rf vtm.	Greater than 10 dB increase from reference of step 3.
6.		At rf signal generator decrease output level for 0 dB indication on rf vtm, 0.1 V scale.	Adjusted for 0 dB.
7.		Set 1 MHz FREQUENCY MHz switch first at 3 and then at 4 while observing rf vtm. Leave switch at position 4.	Less than 0.25 dB change.
8.		At rf signal generator set frequency first at 1.5 MHz and then at 2.5 MHz while observing rf vtm.	More than 15 dB decrease at both frequencies from reference of step 6.
9.		At rf signal generator set frequency at 35 MHz and observe rf vtm.	More than 10 dB decrease from reference of step 6.
10.		Set rf vtm to 0.1 V range. Set Preselector Select switch at OUT, rf signal generator at 5 MHz and adjust output level for 10 dB on rf vtm.	Adjusted to 10 dB.
11.		Set Preselector Select switch at IN and adjust Preselector Tune control for a peak indication on the rf vtm.	Greater than 10 dB increase from reference of step 10.
12.		At rf signal generator set frequency first at 2.5 MHz and then at 7.5 MHz while observing the rf vtm.	More than a 15 dB decrease at both settings from level of step 11.
13.		Set 1 MHz FREQUENCY MHz switch at position 5 and repeat step 10 and 11 with rf signal generator set at 5 MHz.	Same as steps 10 and 11.
14.		Cycle 1 MHz FREQUENCY MHz switch at positions 6, 7, 8, and 9 while observing rf vtm.	No more than a 0.25 dB decrease from reference of step 13.
15.		Set 1 MHz FREQUENCY MHz switch at position 9 and repeat steps 10 and 11 with rf signal generator set at 10 MHz.	Same as steps 10 and 11
16.		Repeat step 12 with rf signal generator first set at 3 MHz and then at 7 MHz.	At least 15 dB below reference of step 15.
17.		Repeat steps 10 and 11 with rf signal generator set at 30 MHz and 10 MHz FREQUENCY MHz switch at 1.	Same as steps 10 and 11.
18.		Set 10 MHz FREQUENCY MHz switch at position 2 and observe rf vtm indication.	Between 0 and 1.5 dB decrease from reference of step 17.
19.		With Preselector Select switch at IN and Preselector Tune control in any position, set both 10 MHz and 1 MHz FREQUENCY MHz switches at position 0. Set rf signal generator at 1 MHz and rf vtm at .1 V range. Adjust rf signal generator for a 0 dB indication on the rf vtm.	Adjusted to 0 dB.
20.		At rf signal generator set frequency at 4 MHz and observe rf vtm indication.	At least 20 dB decrease from reference of step 19.



6.5 VFO TRACKING ALIGNMENT

To test for proper tracking of the 1 kHz FREQUENCY MHz switch during vfo operation proceed as follows:

6.5.1 TEST EQUIPMENT

NOTE

The following test equipment or equivalent is required to perform the following procedures.

- a. Rf signal generator – HP, Model 606.
- b. Coax cable, RG-58/U terminated with male BNC connectors.

6.5.2 PRELIMINARY

- a. Using the coaxial cable, connect the rf signal generator to RF-505A rear panel connector J1.

- b. Connect the ac power cable to connector J3 and to a 117 vac, 60 Hz, 1 phase power source. Set rear panel POWER SELECT switch to AC.

- c. At RF-505A front panel, set the following switches and controls to the positions listed.

<u>Switch or Control</u>	<u>Position</u>
FREQUENCY MHz switches	01.6000 MHz
SQUELCH control	Fully clockwise
MODE switch	LSB
SPEAKER switch	LOCAL
PRESELECTOR switch	OUT
VOLUME control	Midrange
RF GAIN control	Fully clockwise

- d. At rf signal generator, set controls for a cw output signal of 1.6 MHz at 100 microvolts. Fine tune the frequency for an audio signal (beat tone) at the RF-505A speaker.

6.5.3 PROCEDURES

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Refer to paragraph 6.5.2 and perform steps a through d. Set MODE switch at LSB, ISB MONITOR switch at USB, and 1 kHz switch at 5. Fine tune rf signal generator for zero beat.	
2.	Front panel speaker for steps 2 through 6.	At RF-505A set 1 kHz FREQUENCY MHz switch at 2.	
3.		Pull out on 1 kHz FREQUENCY MHz switch to energize vfo. Do not rotate switch.	Adjust R35 (refer to figure 5.1) for the same beat tone as obtained in step 2.
4.		Push in on the 1 kHz FREQUENCY MHz switch and rotate it to position 8. Set ISB MONITOR to LSB.	
5.		Pull out on the 1 kHz FREQUENCY MHz switch to re-energize the vfo. Do not rotate the switch.	Adjust R37 (refer to figure 5.1) for the same beat tone as obtained in step 4.
6.		Repeat steps 2 through 5 until adjustment interaction is minimized and the results are acceptable.	



6.6 VHF FILTER ASSEMBLY ALIGNMENT

To align the VHF Filter Assembly proceed as follows:

6.6.1 TEST EQUIPMENT

NOTE

The following test equipment or equivalent is required to perform the following procedures.

a. RF Vtvm-Boonton, Model 91H with 50 ohm termination.

b. Lead with alligator clips.

6.6.2 PRELIMINARY

a. Refer to paragraph 5.5.5 and remove the VHF Filter Assembly, except that it is not necessary to unsolder the wires connected to E1, E2 and E3.

b. Reconnect P-0301 to J-0301 on the assembly.

c. At the RF-505A front panel set controls for usb operation at 6.0000 MHz.

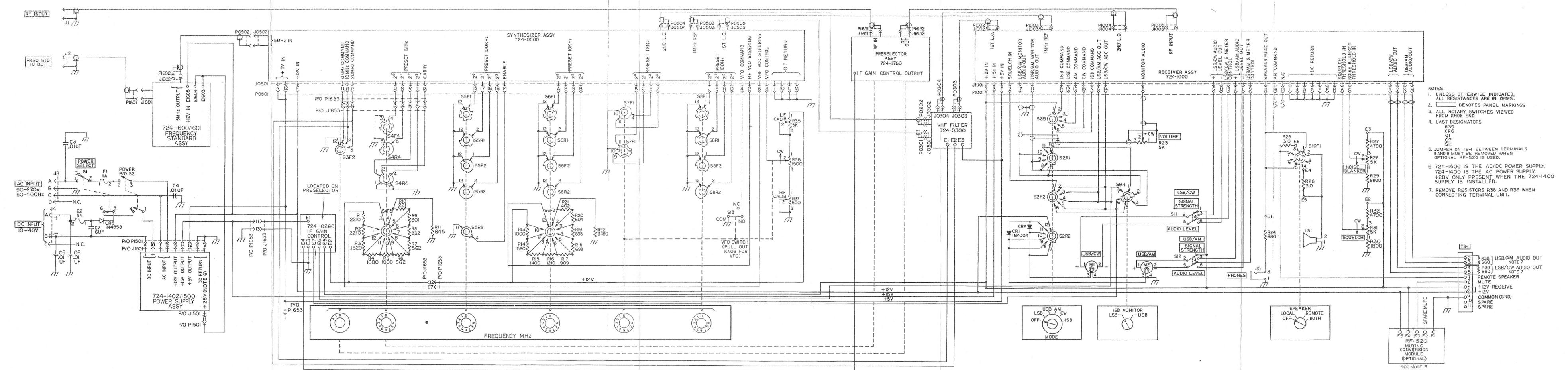
6.6.3 PROCEDURES

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Refer to paragraph 6.6.2 and perform steps a through c.	
2.	Connect rf vtvm with 50 ohm termination to J-0303.	Adjust C2.	Peak indication on rf vtvm.
3.		Remove test equipment from J-0303. Refer to paragraph 5.6 and install VHF Filter Assembly in the receiver.	
4.	Connect rf vtvm with 50 ohm termination to J-0303. Connect clip lead from chassis ground to junction of CR2, CR3, and R1 on VHF Filter Assembly.	At RF-505A set FREQUENCY MHZ controls at 00.0000 MHz in usb mode. Adjust C5.	Null indication on rf vtvm.
5.	Connect rf vtvm with 50 ohm termination to J-0304.	Unground CR2, CR3, and R1. Connect P-0302 to J-0302. Adjust C9 and C11.	Peak indication on rf vtvm.
		NOTE	
		<i>There is a marked interaction between the adjustments of C9 and C11. Both adjustments must be repeated until no further increase in output is indicated.</i>	
6.	Disconnect test equipment.	Reconnect P-0303 to J-0303 and P-0304 to J-0304.	



724-0110

RF-505 MAIN FRAME
Circuit Diagram
PARTS LIST



- NOTES:
- UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS.
 - DENOTES PANEL MARKINGS FROM KNOB END
 - ALL ROTARY SWITCHES VIEWED FROM KNOB END
 - LAST DESIGNATORS:
 - R39
 - CR5
 - Q1
 - C7
 - S11
 - JUMPER ON TB1 BETWEEN TERMINALS 8 AND 9 MUST BE REMOVED WHEN OPTIONAL RF-520 IS USED.
 - 724-1500 IS THE AC/DC POWER SUPPLY. 724-1400 IS THE AC POWER SUPPLY. +28V ONLY PRESENT WHEN THE 724-1400 SUPPLY IS INSTALLED.
 - REMOVE RESISTORS R38 AND R39 WHEN CONNECTING TERMINAL UNIT.

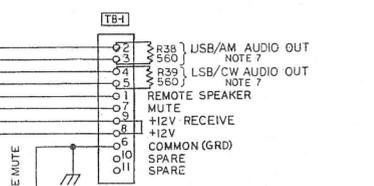
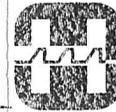


Figure 6.1 - RF-505A Receiver Main Frame Circuit Diagram
REV. V



MAIN FRAME - 724-0110

REF DESIG	DESCRIPTION	RF PART NUMBER
C3	Capacitor, Ceramic, 0.02 UF, 1K Vdcw	C-0008
C4	Capacitor, Ceramic, 0.01 UF, 1K Vdcw	C-0008
C5	Capacitor, Ceramic, 0.01 UF, 1K Vdcw	C-0008
C6	Capacitor, Ceramic, 0.01 UF, 1K Vdcw	C-0008
C7	Capacitor, Electrolytic, 6 UF, ±20%, 190 Vdcw	C-1196
CR1	Diode, Silicon, Type 1N4004	CR-0725
CR2	Diode, Silicon, Type 1N4004	CR-0725
CR6	Diode, Silicon, Type 1N4998	CR-0666
F1	Fuse, Slo-Blo, 1A	F-0027
F2	Fuse, 3AG Quick Acting; 5A	F-0015
J1	Connector, Coaxial BNC	724-0144
J2	Connector, Coaxial BNC	724-0144
J3	Connector, AC Power	724-0146
J4	Connector, DC Power	724-0147
J5	Jack, Phone	J-0102
LS1	Speaker	LS0014
M1	Meter	724-0170
M2	Meter	724-0170
P0501	Connector, P.C. Board	724-0142
P0502	Connector, Coaxial, Female	P-0032
P0503	Connector, Coaxial, Female	P-0032
P0504	Connector, Coaxial, Female	P-0032
P0505	Connector, Coaxial, Female	P-0032
P1001	Connector, P.C. Board	724-0142
P1002	Connector, Coaxial, Female	P-0032
P1003	Connector, Coaxial, Female	P-0032
P1004	Connector, Coaxial, Female	P-0032
P1005	Connector, Coaxial, Female	P-0032
P1501	Connector, Power, 14 Pin	P-0051
P1601	Connector, Coaxial, Female	P-0032
P1602	Connector, Coaxial, Female	P-0032
P1651	Connector, Coaxial, Female	P-0032
P1652	Connector Board Assembly	724-1740
P1653	Connector, Coaxial, Male	P-0014
*R1	Resistor, Metal Film; 2210 ohms ± 1%; 1/8W	R-7279
*R2	Resistor, Metal Film; 2210 ohms ± 1%; 1/8W	R-7279
*R3	Resistor, Metal Film; 1820 ohms ± 1%; 1/8W	R-7292
*R4	Resistor, Metal Film; 1000 ohms ± 1%; 1/8W	R-7270
*R5	Resistor, Metal Film; 1000 ohms ± 1%; 1/8W	R-7270
*R6	Resistor, Metal Film; 562 ohms ± 1%; 1/8W	R-7293
*R7	Resistor, Metal Film; 562 ohms ± 1%; 1/8W	R-7293
*R8	Resistor, Metal Film; 332 ohms ± 1%; 1/8W	R-7295
*R9	Resistor, Metal Film; 301 ohms ± 1%; 1/8W	R-7271
*R10	Resistor, Metal Film; 221 ohms ± 1%; 1/8W	R-7294
*R11	Resistor, Metal Film; 845 ohms ± 1%; 1/8W	R-7284
R13	Resistor, Metal Film; 1000 ohms ± 1%; 1/8W	R-7270
R14	Resistor, Metal Film; 1580 ohms ± 1%; 1/8W	R-7291
R15	Resistor, Metal Film; 1400 ohms ± 1%; 1/8W	R-7281
R16	Resistor, Metal Film; 1210 ohms ± 1%; 1/8W	R-7290

* Located on Preselector Module

MAIN FRAME - 724-0110 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
R17	Resistor, Metal Film; 909 ohms ± 1%; 1/8W	R-7282
R18	Resistor, Metal Film; 698 ohms ± 1%; 1/8W	R-7274
R19	Resistor, Metal Film; 698 ohms ± 1%; 1/8W	R-7274
R20	Resistor, Metal Film; 604 ohms ± 1%; 1/8W	R-7272
R21	Resistor, Metal Film; 402 ohms ± 1%; 1/8W	R-7273
R22	Resistor, Metal Film; 3480 ohms ± 1%; 1/8W	R-7289
R23	Resistor, Variable; 5K ± 20%; 1W	R-7192
R24	Resistor, Carbon; 680 ohms ± 5%; 1/4W	R-1245
R25	Resistor, Wirewound; 3 ohms ± 5%; 5W	R-0603
R26	Resistor, Wirewound; 3 ohms ± 5%; 5W	R-0603
R27	Resistor, Carbon; 4700 ohms ± 5%; 1/4W	R-1265
R28	Resistor, Variable; 5K ± 20%; 2W	R-7193
R29	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R30	Resistor, Carbon; 1800 ohms ± 5%; 1/4W	R-1255
R31	Resistor, Variable; 5K ± 20%; 2W	R-7193
R32	Resistor, Carbon; 4700 ohms ± 5%; 1/4W	R-1265
R35	Resistor, Variable; 5K ± 10%; 1/2W	R-4045
R36	Resistor, Variable; 1500 ohms ± 10%; 2W	R-0978
R37	Resistor, Variable; 500 ohms ± 10%; 5W	R-0979
S1	Switch, Toggle, DPDT	S-0201
S2	Switch, Rotary	724-0135
*S3	Switch, Rotary	724-1788
*S4	Switch, Rotary	724-1789
S5	Switch, Rotary	724-0157
S6	Switch, Rotary	724-0165
S7	Switch, Rotary	724-0155
S8	Switch, Rotary	724-1560
S9	Switch, Rotary	724-0017
S10	Switch, Rotary	724-0018
S11	Switch, Toggle, DPDT	S-0201
S12	Switch, Toggle, DPDT	S-0201
S13	Switch, Micro	724-0175
TB1	Terminal Block	TB-0160
	Synthesizer Module Assembly	724-0500
	Receiver Module Assembly	724-1000
	Power Supply Module Assembly	724-1500
	Frequency Standard Module Assembly	724-1600
	Preselector Module Assembly	724-1160/ 1760
	IF. Gain Control Assembly	724-0260
	10 kHz Switch Assembly (S6)	724-0165
	1 kHz Switch and VFO Assembly (S7)	724-0155
	Fuseholder	X-0006
	Phone Jack Cover	MP-4335
	Handle	H-4287
	Speaker Grill	724-0180
	Knob, 10 MHz	724-0193
	Knob, 1 MHz	724-0194
	Knob, 100 kHz	724-0294
	Knob, 10 kHz	724-0194
	Knob, 1 kHz	724-0194
	Knob, 100 Hz	724-0194
	Knob, MODE	MP-0000
	Knob, Noise Blanker	MP-0200
	Knob, SPEAKER	MP-0200
	Knob, SQUELCH	MP-0200
	Knob, ISB MONITOR	MP-0200
	Knob, RF GAIN	MP-0200
	Knob, PRESELECTOR	MP-0200

* Located on Preselector Module

MAIN FRAME - 724-0110 (Cont.)

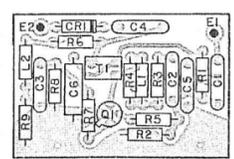
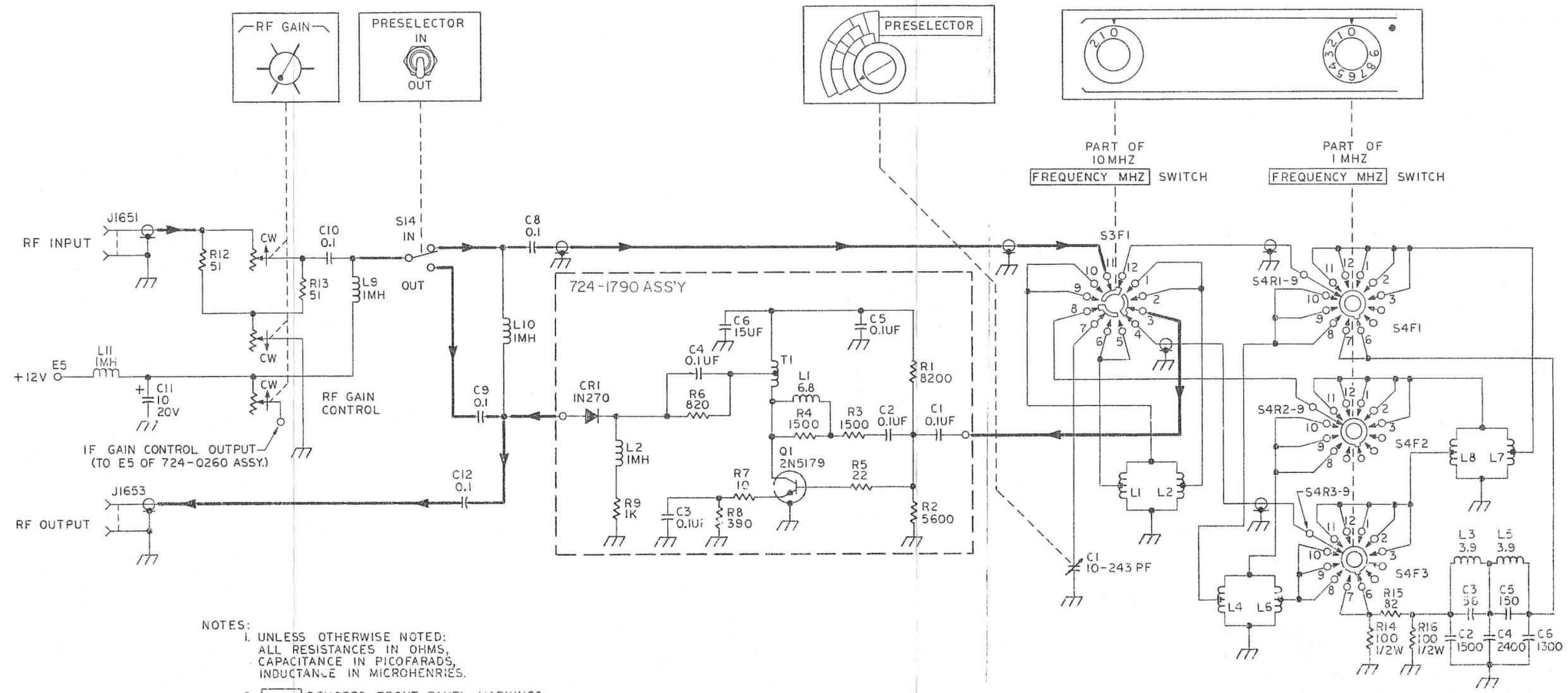
REF DESIG	DESCRIPTION	RF PART NUMBER
	Skirt, PRESELECTOR	MP-1081
	Ratio Drive, PRESELECTOR	162-0132



724-1760/70

PRESELECTOR MODULE
Circuit Diagram

PARTS LIST →



724-1790 ASSY
BROADBAND AMPLIFIER

- NOTES:
1. UNLESS OTHERWISE NOTED:
ALL RESISTANCES IN OHMS,
CAPACITANCE IN PICOFARADS,
INDUCTANCE IN MICROHENRIES.
 2. DENOTES FRONT PANEL MARKINGS.

Figure 6.2 -- Preselector Module Circuit Diagram
REV. C

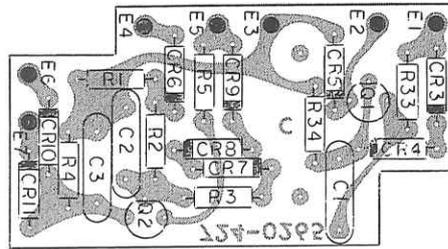


PRESELECTOR — 7241760/70

REF DESIG	DESCRIPTION	RF PART NUMBER
C1	Capacitor, Air Variable, 10-243 PF	724-1781
C2	Capacitor, Mica, 1500 PF $\pm 5\%$; 500 Vdcw	C-0156
C3	Capacitor, Mica, 56 PF $\pm 5\%$; 500 Vdcw	C-0120
C4	Capacitor, Mica, 2400 PF $\pm 5\%$; 500 Vdcw	C-0161
C5	Capacitor, Mica, 150 PF $\pm 5\%$; 500 Vdcw	C-0130
C6	Capacitor, Mica, 1300 PF $\pm 5\%$; 500 Vdcw	C-0155
C8	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%, 25 Vdcw	C-5066
C9	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%, 25 Vdcw	C-5066
C10	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%, 25 Vdcw	C-5066
C11	Capacitor, Tantalum, 10 UF $\pm 10\%$, 20 Vdcw	C-5929
C12	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%, 25 Vdcw	C-5066
J1651	Connector, Coaxial, Female	J-0034
J1653	Connector, Coaxial, Male	J-0030
L1	Coil, Toroid, 10-30 MHz	724-1662
L2	Coil, Toroid, 10-30 MHz	724-1662
L3	Coil, Rf, Molded, 3.9 UH	L-0623
L4	Coil, Rf, Molded, 3.9 UH	L-0623
L5	Coil, Toroid, 2-5 MHz	724-1663
L6	Coil, Toroid, 2-5 MHz	724-1663
L7	Coil, Toroid, 5-10 MHz	724-1664
L8	Coil, Toroid, 5-10 MHz	724-1664
L9	Choke, Rf, 1 MHz	L-0050
L10	Choke, Rf, 1 MHz	L-0050
L11	Choke, Rf, 1.0 MHz	L-0050
R12	Resistor, Metal Film; 51 ohms $\pm 1\%$; 1W	R-7245
R13	Resistor, Metal Film; 51 ohms $\pm 1\%$; 1W	R-7245
R14	Resistor, Carbon; 100 ohms $\pm 5\%$, 1/2W	R-1415
R15	Resistor, Carbon; 82 ohms $\pm 5\%$, 1/4W	R-1223
R16	Resistor, Carbon; 100 ohms $\pm 5\%$, 1/2W	R-1425
S3	Switch, Rotary	724-1788
S4	Switch, Rotary	724-1789
S14	Switch, Toggle, DPDT	S-0243
	Rf Gain Control Assembly	724-1782
	If Gain Control Assembly	724-0260

BROADBAND AMPLIFIER — 724-1790

REF DESIG	DESCRIPTION	RF PART NUMBER
C1	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%, 25 Vdcw	C-5066
C2	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%, 25 Vdcw	C-5066
C3	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%, 25 Vdcw	C-5066
C4	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%, 25 Vdcw	C-5066
C5	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%, 25 Vdcw	C-5066
C6	Capacitor, Ceramic, Monolythic, 15 UF $\pm 10\%$, 20 Vdcw	C-5932
CR1	Diode, Type 1N270	CR-0047
L1	Choke, 6.8 UH	L-0626
L2	Choke, 1000 UH	L-0652
Q1	Transistor, Type 2N5179 (RCA)	Q-0390
R1	Resistor, Carbon; 8,200 ohms $\pm 5\%$, 1/4W	R-1271
R2	Resistor, Carbon; 5,600 ohms $\pm 5\%$, 1/4W	R-1267
R3	Resistor, Carbon; 1,500 ohms $\pm 5\%$, 1/4W	R-1253
R4	Resistor, Carbon; 1,500 ohms $\pm 5\%$, 1/4W	R-1253
R5	Resistor, Carbon; 22 ohms $\pm 5\%$, 1/4W	R-1209
R6	Resistor, Carbon; 820 ohms $\pm 5\%$, 1/4W	R-1247
R7	Resistor, Carbon; 10 ohms $\pm 5\%$, 1/4W	R-1201
R8	Resistor, Carbon; 390 ohms $\pm 5\%$, 1/4W	R-1239
R9	Resistor, Carbon; 1000 ohms $\pm 5\%$, 1/4W	R-1249
T1	Balun Transformer	724-1762



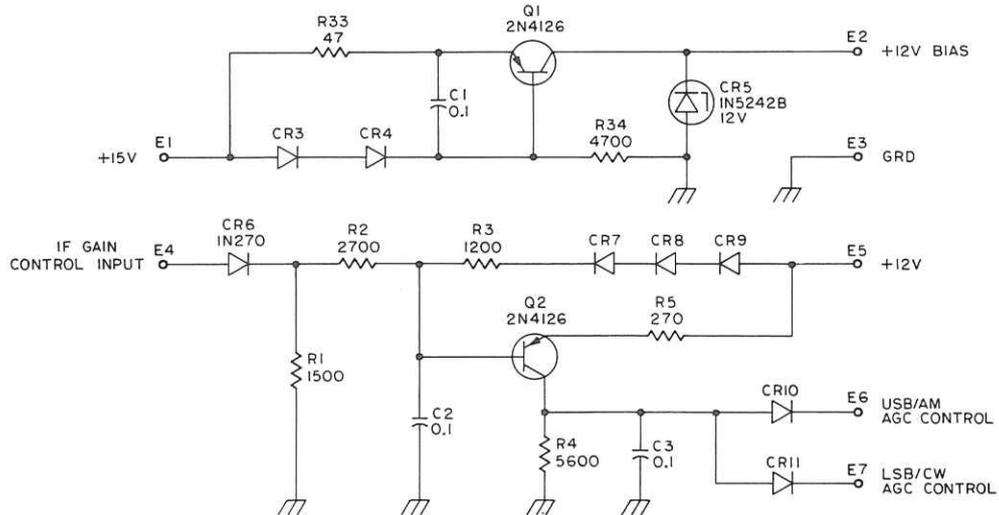
DC VOLTAGES*

Stage	E	B	C
Q1	11.5V	13.5V	11.0V
Q2 (Note 1)	12.0V	11.7V	.0V
Q2 (Note 2)	9.4V	8.8V	9.4V

*Referenced to ground

Notes

1. RF Gain control fully clockwise.
2. RF Gain control fully counterclockwise.
3. For wiring connections refer to connector J1653/P1653 and direct connections shown on main frame circuit diagram, figure 6.1.



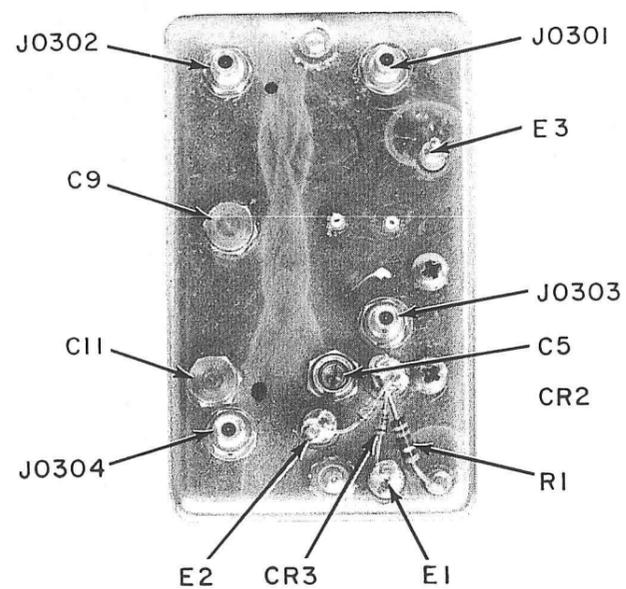
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
ALL DIODES ARE IN4454
ALL RESISTANCES ARE IN OHMS
ALL CAPACITANCES ARE IN MICROFARADS

Figure 6.3 – IF. Gain Control Assembly Circuit Diagram
REV. A

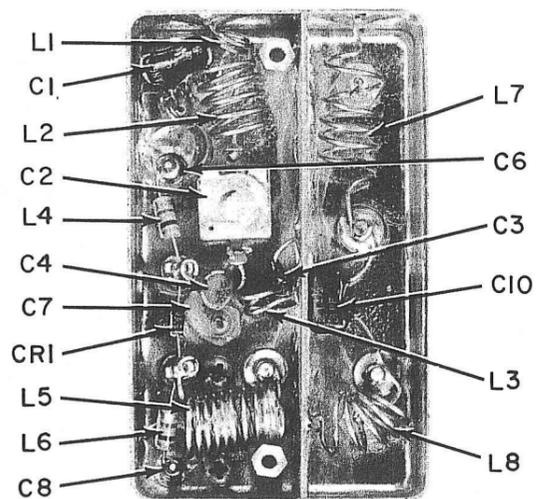


IF. GAIN CONTROL ASSEMBLY – 724-0260

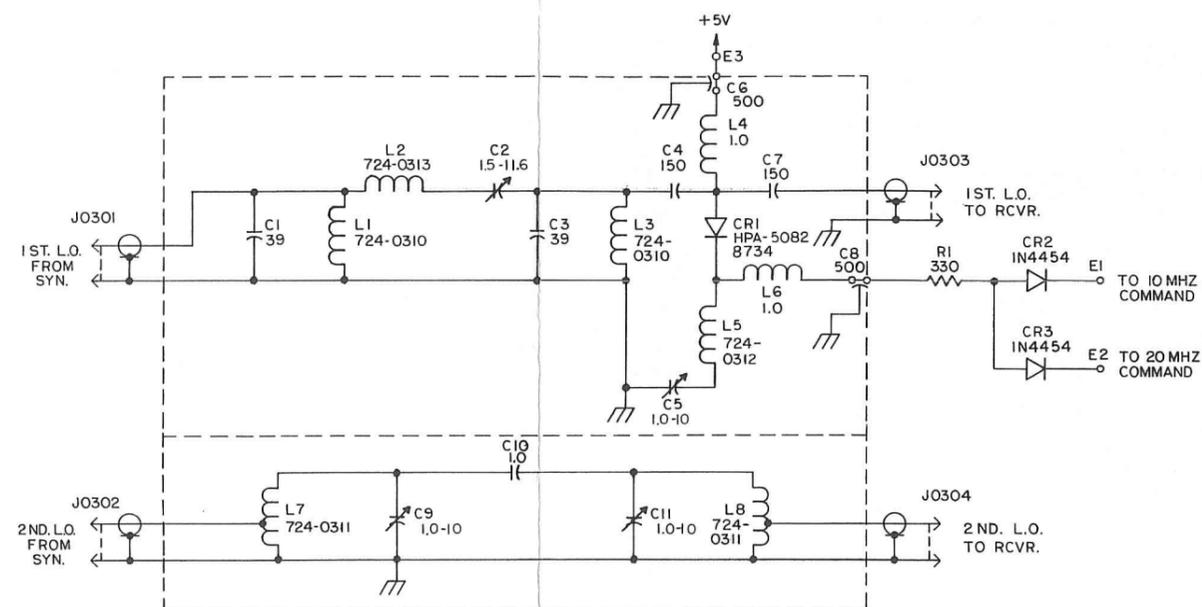
REF DESIG	DESCRIPTION	RF PART NUMBER
C1	Capacitor, Ceramic, Monolythic, 0.1 UF +80% –20%, 25 Vdcw	C-5066
C2	Capacitor, Ceramic, Monolythic, 0.1 UF +80% –20%, 25 Vdcw	C-5066
C3	Capacitor, Ceramic, Monolythic, 0.1 UF +80% –20%, 25 Vdcw	C-5066
CR3	Diode, Silicon, Type 1N4454	CR-0705
CR4	Diode, Silicon, Type 1N4454	CR-0705
CR5	Diode, Zener (12V) Type 1N5242B	CR-0261
CR6	Diode, Silicon, Type 1N270	CR-0047
CR7	Diode, Silicon, Type 1N4454	CR-0705
CR8	Diode, Silicon, Type 1N4454	CR-0705
CR9	Diode, Silicon, Type 1N4454	CR-0705
CR10	Diode, Silicon, Type 1N4454	CR-0705
CR11	Diode, Silicon, Type 1N4454	CR-0705
Q1	Transistor, Silicon, General Purpose, PNP, Type 2N4126	Q-0386
Q2	Transistor, Silicon, General Purpose, PNP, Type 2N4126	Q-0386
R1	Resistor, Carbon; 1500 ohms $\pm 5\%$; 1/4W	R-1253
R2	Resistor, Carbon; 2700 ohms $\pm 5\%$; 1/4W	R-1259
R3	Resistor, Carbon; 1200 ohms $\pm 5\%$; 1/4W	R-1251
R4	Resistor, Carbon; 5600 ohms $\pm 5\%$; 1/4W	R-1267
R5	Resistor, Carbon; 270 ohms $\pm 5\%$; 1/4W	R-1235
R33	Resistor, Carbon; 47 ohms $\pm 5\%$; 1/4W	R-1217
R34	Resistor, Carbon; 4700 ohms $\pm 5\%$; 1/4W	R-1265



VHF FILTER ASSEMBLY
COMPONENT LOCATIONS



VHF FILTER ASSEMBLY
COMPONENT LOCATIONS



- NOTES:
1. ALL CAPACITANCES ARE IN PICO FARADS, ALL INDUCTANCES ARE IN MICROHENRIES, RESISTANCES ARE IN OHMS.
 2. LAST DESIGNATORS:
C8
CR3
L8
R1

Figure 6.4 – VHF Filter Assembly Circuit Diagram
REV. D



VHF FILTER ASSEMBLY - 724-0300

REF DESIG	DESCRIPTION	RF PART NUMBER
C1	Capacitor, Mica, 39 PF \pm 5%; 1000 Vdcw	C-4751
C2	Capacitor, Air, Variable 1.5 - 11.6 PF	C-1355
C3	Capacitor, Mica, 39 PF \pm 5%; 1000 Vdcw	C-4751
C4	Capacitor, Ceramic, Disk, 150 PF \pm 20%; 1000 Vdcw	C-4794
C5	Capacitor, Variable, 1 - 10 PF	C-2175
C6	Capacitor, Feed thru, 500 PF \pm 20%	C-6630
C7	Capacitor, Ceramic, Disk, 150 PF \pm 20%; 1000 Vdcw	C-4794
C8	Capacitor, Feed thru, 500 PF \pm 20%	C-6630
C9	Capacitor, Variable, 1 - 10 PF	C-2175
C10	Capacitor, Mica, 1.0 PF \pm 5%; 500 Vdcw	C-0100
C11	Capacitor, Variable, 1 - 10 PF	C-2175
CR1	Diode, Pin, Type H.P. No. 5082-8734	724-1113
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Silicon, Type 1N4454	CR-0705
J-0301	Connector, Coaxial, Male	J-0030
J-0302	Connector, Coaxial, Male	J-0030
J-0303	Connector, Coaxial, Male	J-0030
J-0304	Connector, Coaxial, Male	J-0030
L1	Coil, Rf	724-0310
L2	Coil, Rf	724-0313
L3	Coil, Rf	724-0310
L4	Coil, Rf, 1.0 UH	L-0616
L5	Coil, Rf	724-0312
L6	Coil, Rf	L-0616
L7	Coil, Rf	724-0311
L8	Coil, Rf	724-0311
R1	Resistor, Carbon; 330 ohms \pm 5%; 1/4W	R-1237



CHAPTER 7

RECEIVER MODULE

7.1 GENERAL

This chapter contains the detailed theory of operation of each assembly in the Receiver Module. Also included are the necessary alignment and troubleshooting procedures to maintain the module and assemblies to specified performance. Circuit diagrams and parts list of the Receiver Module and assemblies are included.

7.2 DETAILED THEORY OF OPERATION

7.2.1 GENERAL

The theory of operation of each of the assemblies in the Receiver Module is presented in the following paragraphs. Refer to chapter 4 for the overall theory of the unit and of the Receiver Module.

7.2.2 FRONT END ASSEMBLY (724-1100)

Front End Assembly 724-1100 is designed to convert the desired received signal progressively to 156.0 MHz (first if.) and to 500 kHz (second if.). Injection signals for mixing are supplied by the synthesizer module. One injection signal is at 156.5 MHz, while the other is always 156.0 MHz higher than the desired operating frequency. Front End Assembly 724-1100 consists of an input low pass filter, an up-converter, a 156.0 MHz bandpass filter, two if. amplifiers and an agc diode, a down mixer, a broadband output amplifier, and two injection amplifiers.

The input received signal, from the antenna, is applied to pin A of J1101, where it is coupled through a low pass filter to the signal port of up-converter A1. The low pass filter, consisting of capacitors C3, C4, C7 and C8, and inductors L1, and L2, attenuates all received signals that are above 35 MHz. This prevents desensitization of the receiver by large high frequency signals that are out of the desired band. It also serves to attenuate the receiver's image response to the specified level, and prevent undesired radiation of the receiver's injection signals.

The output of the first local oscillator amplifier, Q1, is coupled to the local oscillator port of up-converter A1. The frequency of the first local oscillator signal is controlled by the positions of the FREQUENCY MHz switches, and is always 156.0 MHz higher than the desired operating frequency. Transistor Q1 amplifies the first local oscillator input signal to the level required to drive the up-converter, A1. The collector of Q1 is broadly tuned by T1 to cover the range of approximately 156 MHz to 186.0 MHz, which is the operating range of the first local oscillator injection signal.

Up-converter A1 is a balanced diode ring which mixes the incoming signal from the antenna with the first local oscillator injection, and produces sum and difference frequencies. Bandpass filter FL1 selects the difference frequency, which is 156.0 MHz, as the first if. frequency. This if. signal is amplified by Q2, a junction field effect transistor, and applied across agc diode CR2. Diode CR2 is a PIN type diode, whose rf resistance is controlled by the delayed agc voltage applied to pin P by the Detector/AGC assembly and causes the rf resistance of CR2 to decrease as the delayed voltage decreases toward zero. This decreases the load resistance on Q2, and causes the gain of that stage to decrease. This decrease continues until the output of the front end assembly is reduced to the correct level, at which point the delayed level applied to pin P stabilizes and the gain of the front end assembly remains constant until the received signal level changes.

The if. signal appearing across CR2 is simultaneously applied to Q3, which is a junction field effect transistor, where it is further amplified and then applied to one of the control gates of the down mixer, Q4. Transistor Q4 is a dual insulated gate field effect transistor, which mixes the first if. frequency (156.0 MHz) with the second local oscillator injection signal (156.5 MHz). The difference frequency, 500 kHz nominal, is selected by a low pass filter network at the input to broadband amplifier Q5. The low pass filter, consisting of capacitors C31, and C33, and inductors L14, and L15 attenuates the



undesired sum mixing product and both the first if. and second local oscillator frequencies.

Broadband amplifier Q5 provides the final amplification at the second if. frequency (500 kHz) on the front end assembly. The gain of Q5 is adjusted by variable resistor R26 to provide an overall gain of 23 dB in the front end assembly. The receive output signal is coupled through two matching resistors to the receive output terminals.

Second local oscillator amplifier Q8 is identical in operation to Q1, and supplies an injection signal at 156.5 MHz to the second control gate of down mixer Q4.

7.2.3 FILTER ASSEMBLIES (724-1150 and 724-1175)

Usb/Am. Filter Assembly 724-1150 selects the upper sideband or am. if. signal whereas the Lsb/Cw Filter Assembly 724-1175 selects the lower sideband or cw if. signal. Selection of the proper sideband if. signal or am. if. signal is accomplished by filters, either mechanical or ceramic, which are inserted into the signal flow by diode switches. Each assembly consists of four diode switches (two input/output pairs), two filters (the cw filter on the 724-1175 assembly is optional), two integrated circuit if. amplifier stages, an emitter follower output stage, and an input buffer amplifier stage. With the exception of different filters, the two assemblies are identical in circuitry and operation. In the following theory of operation discussion the stages and filters of each assembly are explained separately.

The nominal 500 kHz second if. received signal is amplified by input buffer amplifier Q1 and applied to the two input diode switches, CR1 and CR2. Depending on the mode selected by the operator, one of the diode switches will be forward biased to couple the received signal to the filter corresponding to the operating mode. The filtered if. output signal from the selected filter is coupled through the output diode switch, either CR3 or CR4, to the input of first if. amplifier A1. If. amplifier A1 and A2 are integrated circuit amplifiers with their gain controlled by the agc signal from the Detector/Agc Assembly. From the output of second if. amplifier A2 the received signal is applied to emitter follower Q2. Emitter follower Q2, provides impedance matching for the output signal to the input of the Detector/Agc Assembly.

a. Input Buffer Amplifier Q1

Input buffer amplifier Q1 provides the initial amplification of the nominal 500 kHz if. signal from Front End Assembly 724-1100. The input signal is coupled to the base of Q1 by capacitor C1, and is amplified, and applied to diode switches CR1, CR2 by capacitor C4. The collector circuitry of Q1 is tuned to 500 kHz by T1 and C7 for increased selectivity of the received signal.

b. Diode Switches CR1/CR3, CR2/CR4

Diode switches CR1/CR3 and CR2/CR4 insert the proper filter into the received if. signal path and couple the filter if. output signal to first if. amplifier A1. Filter FL1 (usb filter on 724-1150 assemblies or lsb filter on 724-1175 assemblies) is inserted into the if. signal path by diodes CR1 and CR3. The diodes are forward biased by a positive dc voltage at pin M, filter number one command. Filter FL2 (am. filter on 724-1150) assemblies or cw filter (optional) on 724-1175 assemblies) is inserted into the if. signal path by diodes CR2 and CR4. These diodes are forward biased by a positive dc voltage at pin N, filter number two command.

c. Usb Filter (FL1) 724-1150 Assemblies

Usb filter on the 724-1150 assembly selects the higher frequency usb if. signal from the received signal. A mechanical filter, usb filter FL1 provides a passband of 500.3 kHz to 503.5 kHz with an adjacent sideband rejection of greater than 50 dB. The filter is selected by the USB or ISB positions of MODE switch and is inserted into the signal path by diode CR1 and capacitor C31. The output is coupled to first if. amplifier A1 by capacitors C33, C13 and diode CR3.

d. Lsb Filter (FL1) 724-1175 Assemblies

Lsb filter on the 724-1175 assembly selects the lower frequency lsb if. signal from the received signal. A mechanical filter lsb filter FL1 provides a passband of 496.5 kHz to 499.7 kHz with an adjacent sideband rejection of greater than 50 dB. The filter is selected by the LSB or ISB positions of the MODE switch and is inserted into the signal path by diode CR1 and capacitor C31. The output is coupled to first if. amplifier A1 by capacitors C33, C13, and diode CR3.



e. Am. Filter (FL2) 724-1150 Assemblies

Am. filter on the 724-1150 assembly provides filtering of the received signal to select the received am. if. signal, upper sideband plus carrier. A ceramic filter, am. filter FL2 provides a nominal 10 kc bandwidth at 6 dB centered at 500 kHz. The filter is selected by the AM position of MODE switch and is inserted into the signal path by diode CR2, capacitor C32, and resistor R30. The output is coupled to first if. amplifier A1 by resistor R31, capacitors C34, C13, and diode CR4.

f. Cw Filter (FL2) (Optional) 724-1175 Assemblies

Cw filter on the 724-1175 assemblies provides a narrow bandwidth of 500 Hz for cw signals centered at 501.000 kHz. Adjacent channel sideband rejection is greater than 60 dB. The filter is selected only by the CW position of the MODE switch. It is inserted into the if. signal path by diode CR2 and capacitor C32. The output is coupled to first if. amplifier A1 by capacitor C34, C13, and diode CR4.

g. First If. Amplifier A1

If. amplifier A1, an integrated circuit amplifier, provides the initial amplification of the filtered if. signal. The input circuitry is tuned to 500 kHz by T2 and C14 to provide additional selectivity of the received signal.

Gain control for A1 is provided by the agc voltage applied to pin L of J1151 from the Detector/Agc Assembly. The output level from A1, applied to A2, is adjusted by the position of agc threshold control R17 for the overall gain of the assembly. The output if. signal at R17 is coupled by C19 to T3.

h. Second If. Amplifier A2

Second if. amplifier A2 provides the final amplification of the filtered if. signal. The input signal is applied to A2 by transformer T3, tuned to 500 kHz for selectivity of the received signal. The agc signal at pin L is also applied to A2 for gain control. Transformer T4, resistor R20, and capacitor C26 provide a tuned output circuit centered at 500 kHz.

i. Emitter Follower Q2

Emitter follower Q2 provides the impedance match for the output signal at pin A. Capacitor C27 couples the input signal to Q2 from transformer T4. The output if. signal is coupled by C28 and R24 to pin A.

7.2.4 DETECTOR/AGC ASSEMBLY (724-1200)

Detector/Agc Assembly 724-1200 contains the circuitry for detecting the audio intelligence from the 500 kHz if. signal. The assembly also provides the agc voltage, derived from the received signal level, to Front End Assembly 724-1100 and to the associated channel Filter Assembly 724-1150 or 724-1175.

The nominal 500 kHz received second if. signal from the Filter Assembly is applied at pin A of J1201 and coupled to product detector A1 and to am./agc amplifier Q1.

For ssb operation a 500 kHz reference signal is applied to product detector A1. This signal is derived from a 1 MHz reference signal (Synthesizer Module local oscillator number three output) applied to pin D of J1201. The 1 MHz reference signal is shaped by Q3 and applied as a clipped sine wave to divide by two flip-flop A2. Diodes CR1 and CR2 provide additional shaping of the input waveform. In product detector A1 the two signals are mixed with the resultant audio signal recovered at pin 6 by a low pass filter consisting of C13, C17, and R19. The audio signal is then applied to preamplifier/mode switch Q4. Transistor Q4 is switched on (forward biased) by the ssb command signal at pin J of J1201. The audio output from Q4 is applied to line amplifier A4 and to monitor output, pin K of J1201.

The second if. signal at Q1 is amplified by Q1 and Q2 and applied to am./agc detector and agc amplifier A3 at pins 6 and 3.

The signal at pin 6 is applied to the agc detector and agc amplifier circuitry in A3 with the resulting agc signal extracted at pin 9 of A3. From pin 9 the agc signal is applied to pin 13 of J1201 (agc output to the associated Filter Assembly) and to R36 (delayed agc threshold adjust).

Variable resistor R36 is adjusted to provide a delayed agc voltage output at pin 14 of J1201, only for received signals that are too large to be effec-



tively controlled by the agc signal at pin 13. The delayed agc signal is applied to the if. amplifier in the Front End Assembly to reduce the overall gain of the unit.

The agc signal is also applied to "S" meter amplifier Q6. Transistor Q6 provides an output signal at pin 12 of J1201, that reflects the signal strength of the received rf signal. This signal is selected by the SIGNAL STRENGTH position of the associated meter switch to provide a visual indication on the meter. Received am. signals at pin 6 of A3 are detected with the audio signal recovered by the low pass filter at pin 7 of A3. The higher frequency rf signal is shunted to ground by C20. The am. audio signal is then applied to preamplifier/mode switch Q5. Transistor Q5 is forward biased by the am. command mode at pin 10 of J1201, to provide the initial amplification of the detected am. audio signal. From Q5 the audio signal is coupled to line amplifier A4 and to monitor output, pin K of J1201.

The audio output of line amplifier A4, a balanced 600 ohm audio signal, is applied to pins V and T of J1201 and to the base of audio level meter amplifier Q9. Variable resistor R38 provides output control of the line amplifier. The audio output of Q9 is rectified by diode bridge CR5-CR8 and applied as a dc output voltage to pins S and U of J1201. The amplitude of the dc voltage reflects the audio level of the received signal.

7.2.5 SPEAKER DRIVER AND SQUELCH GATE ASSEMBLY (724-1275)

Speaker Driver and Squelch Gate Assembly 724-1275 provides the final stage of audio amplification and squelch control for the front panel speaker, PHONES jack, and the rear panel remote speaker output terminal. The assembly consists of an audio pre-amplifier (Q1), squelch gate and comparator (Q2, Q4, Q5), and audio amplifier (Q3, Q6-Q10). The audio output signal after amplification is applied to the front panel PHONES jack and to the SPEAKER switch. The SPEAKER switch applies the audio signal to either the front panel speaker or rear panel remote speaker output terminal or to both.

Audio signals from the MODE switch are applied to the base of pre-amplifier Q1. The base bias of Q1 is controlled by the squelch gate circuitry to block the audio input signals from the audio amplifier section. Blocking occurs when the audio input level is below a predetermined value and is accomplished by comparing the detected agc voltage, in-

dicating the relative level of the RF signal, with an adjustable dc voltage controlled by the position of the front panel SQUELCH control.

The operation of the squelch gate circuitry is as follows: Transistors Q4 and Q5 form a differential comparator. Base bias for Q5 is supplied by the SQUELCH control and base bias for Q4 is supplied by the agc signal. Whenever the base of Q4 becomes more positive than the base of Q5, transistor Q4 will conduct more than Q5. When Q4 conducts, transistor Q2 is biased on there by biasing Q1 to unblock the audio signal. When the base of Q5 is more positive than Q4, transistors Q4 and Q2 are biased off to reverse bias Q1 and block the audio signal. As long as the agc voltage (Q4) is more positive than the squelch control voltage the audio is unquieted.

Resistors R8 and R9 provide a pre-bias to the base of Q4 to insure that the ratio will be unquieted when the SQUELCH control is set at its maximum clockwise position.

Transistors Q3 and Q6 form complimentary current amplifier which drive transistors Q7 and Q8. Transistors Q7, Q8, Q9 and Q10 form a complimentary feedback pair with a unity voltage gain. Output is taken from transistors Q9 and Q10 through coupling capacitor C9. Feedback is provided by resistor R20, from the collectors of Q9 and Q6 to the emitter of Q3. This feedback cancels any distortion present in the amplifier and sets the overall voltage gain. Capacitors C9, C8 and inductor L1 determine the frequency response of the amplifier and of the feedback loop in such a manner as to prevent self oscillation in the loop.

7.3 PERFORMANCE CHECKS

Performance checks for the receiver module are presented in chapter 5 of this manual, paragraphs 5.3.4 through 5.3.8. If the unit fails one or more of the receiver module checks refer to the troubleshooting table in chapter 5 and to the Receiver Module troubleshooting procedures in this chapter.

NOTE

For those checks that are only slightly out of tolerance perform the alignment procedures presented in this chapter. If the step is still out of tolerance proceed with the troubleshooting procedures of this chapter.



7.4 FAULT ANALYSIS

The Receiver Module fault analysis table is presented in the following sub paragraphs. This table is designed to isolate a faulty assembly first and then a faulty stage. If the defective assembly has already been isolated, by substitution, then the technician can proceed directly to the appropriate paragraph and proceed from there to isolate the faulty stage. Once a defective stage has been found refer to the appropriate circuit diagram and make voltage checks to locate the faulty component. Suspected faulty assemblies can be verified by substitution with a known good assembly.

NOTE

After a defective assembly or component has been replaced proceed to the alignment procedures located in this chapter.

7.4.1 TEST EQUIPMENT

NOTE

Voltage measurements are made referenced to chassis ground unless otherwise indicated.

NOTE

The following test equipment or equivalent is required to perform the following procedures.

- a. Rf Signal Generator – HP, Model 606
- b. Rf Vtvm – Boonton, Model 91C
- c. Oscilloscope – Tektronix, Model 453
- d. Dc voltmeter – HP, Model 410C
- e. Extender – RF Communications, RF P/N 724-0060
- f. Coaxial cable terminated with male BNC connectors.
- g. Coaxial adapter BNC to miniature – Sealectro No. 51-074-6800

7.4.2 PRELIMINARY

- a. At rear panel connect rf signal generator to RF INPUT connector J1.
- b. Set rf signal generator at 1.6 MHz, cw output at zero mVrms.
- c. At RF-505A set FREQUENCY MHz switches at 1.60000 MHz, set MODE switch at OFF. Set SPEAKER switch at LOCAL, RF GAIN control fully clockwise, and SQUELCH control fully counterclockwise. Set PRESELECTOR switch at OUT. Set LSB/CW and USB/AM meter switches to SIGNAL STRENGTH.
- d. At RF-505A remove top and Receiver Module covers.

7.4.3 FRONT END ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 7.4.2. Remove both Filter Assemblies and both Detector/Agc Assemblies from the Receiver Module. Using assembly extender (RF P/N 724-0060) extend the Front End Assembly for access. At the Receiver Module disconnect P1002 (yellow) and P1004 (green). <div style="border: 1px dashed black; padding: 5px; margin: 10px 0; text-align: center;"> CAUTION </div> <i>It may be necessary to free receiver module from base plate to disconnect the coaxial connectors without damaging them or the 1 kHz switch assembly.</i>	
2.	Rf vtvm with high impedance probe at junction of L2, C8 and A1 on Front End Assembly.	At rf signal generator set rf output level at 80 mVrms and measure rf signal on Front End Assembly.	165 ± 20 mVrms
3.	Rf vtvm at P1002 (yellow).	Terminate rf vtvm probe with 50 ohms. Set Mode switch at LSB and measure first local oscillator injection signal from Synthesizer Module. If signal is absent or incorrect refer to Synthesizer Module troubleshooting procedures. Reconnect P1002 to Receiver Module.	150 ± 50 mVrms



7.4.3 FRONT END ASSEMBLY (CONT.)

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
4.	Rf vtvm at P1004 (green).	Terminate rf vtvm probe with 50 ohms. Set MODE switch at LSB and measure second local oscillator injection signal from Synthesizer Module. If signal is absent or incorrect refer to Synthesizer Module troubleshooting procedures. Reconnect P1004 to Receiver Module.	150 ± 50 mVrms
5.	Rf vtvm at junction of FL1 and C12	Set rf signal generator output at 80 mVrms and fine tune for a peak indication on the rf vtvm. Rotate FREQUENCY MHz switches and observe a decrease in the indication on the rf vtvm. Return switches to their original positions.	25 ± 10 mVrms
6.	Rf vtvm at junction of C25 and L10.	At rf signal generator set output at 15 mVrms. Measure the voltage on the rf vtvm.	200 ± 100 mVrms
7.	Rf vtvm at collector of Q5.	At rf signal generator set output at 15 mVrms and fine tune frequency for a peak indication on the rf vtvm. Rotate FREQUENCY MHz switches and observe a decrease in the indication on the rf vtvm. Return switches to their original positions.	More than 13 mVrms.
8.	Rf vtvm at junction of R26 and C43.	At rf signal generator set output at 1.5 mVrms. Measure voltage on the rf vtvm.	100 ± 25 mVrms. The level is adjustable by R26.
9.	Same as step 8.	Using a 10,000 ohm resistor, connect pin P of J1101 to ground. Measure voltage on the rf vtvm.	45 ± 23 mVrms.

7.4.4 LSB/CW FILTER ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 7.4.2. Remove both Detector/Agc Assemblies from the Receiver Module. NOTE <i>The Front End Assembly must be installed and operating within specifications for the following procedures.</i>	
2.	Rf vtvm at pin V of J1175.	Extend Lsb/Cw Filter Assembly 724-1175 using the RF P/N 724-0060 extender. Set MODE switch at LSB. At rf signal generator adjust output level and frequency adjust controls for a peak indication on the rf vtvm of 100 mVrms.	100 mVrms.
3.	Rf vtvm at junction C4, CR1 and CR2.	Measure voltage.	300 ± 100 mVrms.
4.	Rf vtvm at junction of CR1 and C31.	Measure voltage. Observe zero indication with MODE switch at USB, AM, and CW. NOTE <i>Do not perform steps 5 and 6 if the optional cw filter is not installed on the 724-1175 Assembly.</i>	300 ± 100 mVrms.
5.	Rf vtvm at junction of CR2 and C32.	Measure voltage with MODE switch at CW. Observe zero indication with MODE switch at LSB, USB, AM, and ISB.	300 ± 100 mVrms.
6.	Rf vtvm at cathode of CR3.	Set MODE switch at CW. At rf signal generator fine tune frequency for a peak indication on the rf vtvm.	115 +100 -30 mVrms.
7.	Rf vtvm at cathode of CR3.	Set MODE switch at LSB. At rf signal generator fine tune frequency for a peak indication on the rf vtvm.	115 +100 -30 mVrms.
8.	Rf vtvm at pin 6 of A1.	Measure voltage.	275 +220 -75 mVrms.
9.	Rf vtvm at pin 6 of A2.	Measure voltage.	1 V ± 100 mVrms. The level is adjustable by R17.
10.	Rf vtvm at pin A of J1151.	Measure voltage.	1.7 V ± 250 mVrms. The level is adjustable by R17.



7.4.5 USB/AM FILTER ASSEMBLY

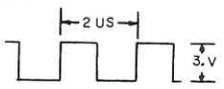
STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		<p>Perform the preliminary procedures outlined in paragraph 7.4.2.</p> <p>Remove both Detector/Agc Assemblies from the Receiver Module.</p> <p style="text-align: center;">NOTE</p> <p style="text-align: center;"><i>The Front End Assembly must be installed and operating within specifications for the following procedures.</i></p> <p>Extend Usb/Am Filter Assembly 724-1150 using the RF P/N 724-0060 extender.</p>	
2.	Rf vtvm at pin V of J1150	Set MODE switch at USB. At rf signal generator adjust output level and frequency adjust for a peak indication of 100 mVrms.	100 mVrms.
3.	Rf vtvm at junction of C4, CR1 and CR2.	Measure voltage.	300 ± 100 mVrms.
4.	Rf vtvm at junction of CR1 and C31.	Measure voltage. Observe zero indication with MODE switch at LSB, AM, and CW.	300 ± 100 mVrms and zero.
5.	Rf vtvm at junction of CR2 and C32.	Measure voltage with MODE switch at AM. Observe zero indication with MODE switch at USB, LSB, CW and ISB.	300 ± 100 mVrms and zero.
6.	Rf vtvm at cathode of CR3.	Set MODE switch at USB. At rf signal generator fine tune frequency for a peak indication on the rf vtvm.	115 +100 -30 mVrms.
7.	Rf vtvm at cathode of CR3.	Set MODE switch at AM. At rf signal generator set output for 30% modulation at 1000 Hz and fine tune frequency for a peak indication on the rf vtvm.	150 + 100 -50 mVrms.
8.	Rf vtvm at pin 6 of A1.	Measure voltage.	275 +220 -75 mVrms.
9.	Rf vtvm at pin 6 of A2.	Measure voltage.	1.0 V ± 100 mVrms. The level is adjustable by R17.
10.	Rf vtvm at pin A of J1151.	Measure voltage.	1.70 V ± 0.25 mVrms. The level is adjustable by R17.
		<p style="text-align: center;">NOTE</p> <p style="text-align: center;"><i>The Performance Standard values listed above for steps 8, 9, and 10 are typical for assemblies aligned with factory test fixtures. The position of R17, which is adjusted to control the overall gain of the Receiver Module, will affect these readings. If R17 is re-adjusted for the value of step 8 then the alignment procedures must be re-checked, paragraph 7.5.</i></p>	

7.4.6 LSB/CW DETECTOR/AGC ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		<p>Perform the preliminary procedures outlined in paragraph 7.4.2.</p> <p>Remove both Detector/Agc Assemblies from the Receiver Module.</p>	

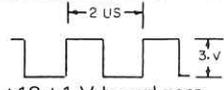


7.4.6 LSB/CW DETECTOR/AGC ASSEMBLY (CONT)

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1. (cont.)		NOTE	
		<p><i>The Front End Assembly and both Filter Assemblies must be installed and operating within specifications for the following procedures.</i></p> <p>Connect the extender into P1201 on the Receiver Module mother board, lsb position. Do not connect the Lsb/Cw Detector/Agc Assembly to the extender at this time.</p>	
2.	Rf vtvm at pin A of extender 724-0060.	Set MODE switch at LSB and adjust rf signal generator for a peak output of 100 mVrms.	100 mVrms.
3.		Set MODE switch at OFF and connect the Lsb/Cw Detector/Agc Assembly to the extender. Set MODE switch at LSB.	
4.	Oscilloscope probe at cathode of CR2.	Measure indicated signal.	4.5 volts peak-to-peak 1 μ sec period, clipped sine wave
5.	Oscilloscope probe at pin 8 of A2.	Measure indicated square wave.	
6.	Dc voltmeter probe at pin J of J1201.	Measure positive dc voltage with MODE switch at LSB, CW and ISB. Observe zero indication with MODE switch at USB, and AM.	
7.	Oscilloscope probe at junction of R19 and C18.	Set MODE switch at LSB and fine tune rf signal generator frequency control for a peak indication of the displayed waveform.	Sine wave, 400 ± 50 mV peak-to-peak. Period variable with rf signal generator frequency control.
8.	Oscilloscope probe at pin 3 of A3.	Same as step 7.	Same as step 7 with a 7 ± 1 volt peak-to-peak sine wave, 500 kHz.
9.	Oscilloscope probe at pin 6 of A3.	Same as step 7.	Same as step 7 with a 5 ± 1 volt peak-to-peak sine wave, 500 kHz.
		NOTE	
		<p><i>The value listed below for step 10 is typical. Actual measurements depend on position of R38 and will vary depending on system application.</i></p>	
10.	Oscilloscope probe at collector of Q9.	At rf signal generator set output level at 1μ Vrms. Set LSB/CW Meter switch at AUDIO LEVEL.	Sine wave 3 ± 0.5 volts peak-to-peak. Period variable with rf signal generator frequency. Observe LSB/CW meter indication of +5 dBm.
11.	Oscilloscope probe at pin K of J1201.	Set LSB/CW meter switch at SIGNAL STRENGTH. At rf signal generator set output level at 1.5μ Vrms. Fine tune frequency control for a peak indication.	Sine wave 600 ± 100 mV peak-to-peak. Period variable with rf signal generator frequency.
12.	Same as step 11.	Increase output level to 5μ Vrms, then to 50μ Vrms.	Sine wave 850 ± 100 mV P-P for entire range.
13.	Dc voltmeter at TP2.	Disconnect rf signal generator and measure voltage.	Less than 0.5 Vdc.
14.	Dc voltmeter at TP1.	Same as step 12.	$+10 \pm 1$ Vdc.
15.	Dc voltmeter at TP2.	Set rf signal generator output to 1μ Vrms. Reconnect rf signal generator. Set MODE switch at LSB. Increase output level at rf signal generator until dc voltmeter indication starts to increase. Repeat dc voltmeter indication using the frequency control. Adjust output level at rf signal generator to 5μ Vrms and note reading, then increase to 1 mVrms.	$+4 \text{ V} \pm 1 \text{ V}$ at 5μ Vrms input $+6 \text{ V} \pm 1 \text{ V}$ at 1 mVrms input.
16.	Dc voltmeter at TP1.	Reduce rf signal generator output to zero and measure voltage. Increase rf signal generator output to 100 mVrms and record indication on dc voltmeter.	10 ± 1.5 Vdc and 8 ± 1.5 Vdc.



7.4.7 USB/AM DETECTOR/AGC ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 7.4.2. Remove both Detector/Agc Assemblies from the Receiver Module. NOTE <i>The Front End Assembly and both Filter Assemblies must be installed and operating within specifications for the following procedures.</i> Connect the extender into P1202 on the Receiver Module mother board, usb position. Do not connect the Usb/Am. Detector/Agc Assembly to the extender at this time.	
2.	Rf vtvm at pin A of extender 724-0060	Set MODE switch at USB and adjust rf signal generator for a peak output of 100 mVrms.	100 mVrms.
3.		Set MODE switch at OFF and connect the Detector/Agc Assembly to the extender. Set MODE switch at USB.	
4.	Oscilloscope probe at cathode of CR2.	Measure indicated signal.	4.5 volts peak-to-peak 1 μ sec period, clipped sine wave.
5.	Oscilloscope probe at pin 8 of A2.	Measure indicated square wave.	
6.	Dc voltmeter probe at pin J of J1201, ground lead at chassis.	Measure positive dc voltage with MODE switch at USB and ISB. Observe zero indication with MODE switch at LSB, CW, and AM.	+12 \pm 1 Vdc and zero.
7.	Dc voltmeter probe at pin 10 of P1201, ground lead at chassis.	Measure positive dc voltage with MODE switch at AM. Observe zero indication with MODE switch at LSB, USB, CW, and ISB.	+12 \pm 1 Vdc and zero.
8.	Oscilloscope probe at junction of R19 and C18.	Set MODE switch at USB and fine tune rf signal generator frequency control for a peak indication of the displayed wave form.	Sine wave, 400 mV peak-to-peak, \pm 50 mV. Period variable with rf signal generator frequency control.
9.	Oscilloscope probe at pin 3 of A3.	Same as step 8.	Sine wave, 7 \pm 1 volts peak-to-peak, 500 kHz.
10.	Oscilloscope probe at pin 6 of A3.	Same as step 8.	Same as step 9 with a 5 \pm 1 volt peak-to-peak sine wave, 500 kHz.
11.	Oscilloscope probe at junction of C21 and base of Q5.	Set MODE switch at AM. Set rf signal generator for 30% modulation at 1000 Hz. Fine tune frequency control for a peak indication.	Sine wave 150 \pm 25 mV peak-to-peak at 1000 Hz.
12.	Oscilloscope probe at collector of Q9.	NOTE <i>The value listed below for step 12 is typical. Actual measurements depend on position of R38 and will vary depending on system applications.</i> Set MODE switch at USB. At rf signal generator set output for cw at 1 μ Vrms output. Fine tune frequency control for a peak indication. Set USB/AM. Meter switch at AUDIO LEVEL.	Sine wave 3 \pm 0.5 volts peak-to-peak. Period variable with rf signal generator frequency control. Observe front panel USB/AM. meter indicates +5 dBm.



7.4.7 USB/AM DETECTOR/AGC ASSEMBLY (CONT.)

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
13.	Oscilloscope probe at pin K of J1201.	Set USB/AM meter switch at SIGNAL STRENGTH. Set MODE switch at USB. Set rf signal generator to cw at 1.5 μ Vrms output. Fine tune frequency control for a peak indication.	Sine wave, 600 \pm 100 mV peak-to-peak. Period variable with rf signal generator frequency control.
14.	Same as step 13.	Increase output level to 5 μ Vrms, then to 50 μ Vrms. MODE switch at AM. Set rf signal generator to 65% modulation at 1000 Hz and 1 mVrms.output.	Sine wave 850 \pm 100 mV P-P for entire range. Sine wave, 400 mVrms peak-to-peak at 1000 Hz.
15.	Dc voltmeter at TP2.	Disconnect rf signal generator and measure voltage.	Less than 0.5 Vdc.
16.	DC voltmeter at TP1.	Same as step 15.	+ 10 Vdc.
17.	Dc voltmeter at TP2.	Set rf signal generator output to 1 μ V. Reconnect rf signal generator. Set MODE switch at USB. Increase output level at rf signal generator until dc voltmeter indication starts to increase. Repeak voltmeter indication using the frequency control. Adjust output at rf signal generator to 5 μ Vrms and note reading, then increase to 1 mVrms.	+ 4 \pm 1 Vdc at 5 μ Vrms input + 6 \pm 1 Vdc at 1 mVrms input.
18.	Dc voltmeter at TP1.	Reduce rf signal generator output to zero and measure voltage. Increase rf signal generator output to 100 mVrms and measure voltage on voltmeter.	10 \pm 1.5 Vdc and 8 \pm 1.5 Vdc.

7.4.8 SPEAKER DRIVER AND SQUELCH GATE ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 7.4.2. NOTE <i>All Receiver Module assemblies must be installed and operating within specifications for the following procedures.</i>	
2.		Remove the Speaker Driver and Squelch Gate Assembly from the module and reinstall it using the 724-0060 extender. Note that the PC connector is reversed with respect to adjacent connector of the FRONT END ASSY.	
	Dc voltmeter at pin D of J1251	Set MODE switch at LSB and rotate rf gain control fully clockwise. Adjust frequency control for a peak indication on the front panel LSB/CW meter. Set SPEAKER switch at OFF. Rotate SQUELCH control from the full counterclockwise stop fully clockwise and observe voltage on voltmeter.	From 2.0 to 8.0 \pm 1 Vdc.
	Dc voltmeter at pin H of J1251	At rf signal generator vary output from zero to 30 mVrms and observe voltage on voltmeter.	From 0 to 6 \pm 1 Vdc.
	Oscilloscope probe at TP1.	Measure displayed sine wave with VOLUME control fully clockwise. Rf signal generator at 30 mVrms.	800 \pm 100 Vrms peak-to-peak.
	Oscilloscope probe at TP2.	Measure displayed sine wave. Adjust rf signal generator output until wave form just starts to clip.	Sine wave 12 \pm 2 volts peak-to-peak.



7.5 ALIGNMENT PROCEDURES

All testing on the Receiver Module is done with the module installed in the RF-505. However, printed circuit card assemblies are removed and installed during test.

CAUTION

At front panel, set MODE switch at OFF whenever removing or installing assemblies.

7.5.1 TEST EQUIPMENT

NOTE

The following test equipment or equivalent is required to perform the following procedures.

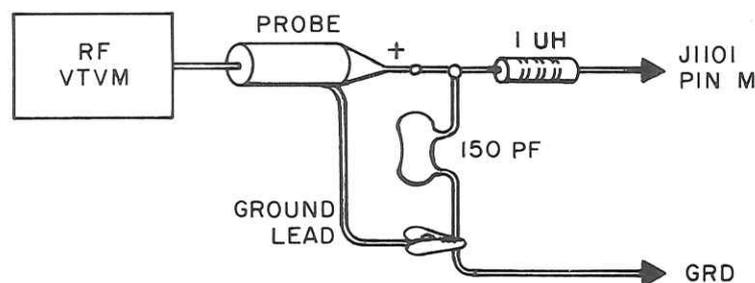
- Oscilloscope – Tektronix, Model 531
- Ac vtvm – Hewlett-Packard, Model 300 E
- Dc vom – Simpson, Model 260
- Rf signal generator (hf) – Hewlett-Packard, Model 606B

- Rf signal generator (vhf) – Hewlett-Packard, Model 608
- Rf Vtvm – Boonton, Model 91H
- 50 ohm probe termination for rf vtvm – Boonton, Model 91-8B
- Frequency counter – Hewlett-Packard, Model 5245L
- Headphones –
- Card extender – RFC, P/N 724-0060
- Adjusting tool – JFD, No. 5284
- BNC “T” adapter, UG/U No. 274A
- BNC to miniature coax connector cable
- BNC to clips cable

7.5.2 PRELIMINARY

- Remove cover from Receiver Module.
- With card extender, extend Front End Assembly 724-1100.
- At front panel, set MODE switch at USB.

DECOUPLING NETWORK



NOTE:
MAKE ALL LEADS AS SHORT AS POSSIBLE
(LESS THAN 1/2 INCH)

Figure 7.1 – Front End Assembly Test Set-Up



7.5.3 PROCEDURES

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.	Connect rf vtvm to pin M of J1101 on Front End Assembly through the decoupling network shown in figure 7.1. Connect (hf) rf signal generator to J1, RF INPUT on rear panel of RF-505A.	<p>At the Receiver Module remove both Detector/AGC Assemblies 724-1200. Set MODE switch at LSB and FREQUENCY MHz switches at 14.0000 MHz, RF GAIN control fully clockwise. PRESELECT select switch at OUT. At (hf) rf signal generator set output to cw, 14.0 MHz at -40 dBm. Fine tune (hf) rf signal generator frequency for a peak indication on the rf vtvm. Set R26 to the full clockwise position.</p> <p style="text-align: center;">CAUTION</p> <p><i>Do not set (hf) rf signal generator output level above +10 dBm while connected to J1. If a peak indication cannot be obtained with the rf vtvm at the 30 mVrms range switch range, switch to next lower scale. Perform the following steps and return the rf vtvm to the 30 mVrms range as soon as possible without exceeding the +10 dBm input limit.</i></p>	
2.	Same as step 1.	At Front End Assembly tune C23, C16, and C13 in order listed for maximum reading on rf vtvm while reducing (hf) rf signal generator output level so that rf vtvm reading does not exceed 30 mVrms.	
3.	Same as step 1.	Repeat step 7 until no further improvement can be obtained in rf vtvm reading.	
4.	Same as step 1.	Adjust (hf) rf signal generator output level until rf vtvm indicates 32 mVrms.	(Hf) rf signal generator output level should be less than -43 dBm.
5.	Same as step 1.	Set (hf) rf signal generator output level at -40 dBm. Adjust R26 for an indication of 32 mVrms on the rf vtvm.	
6.	Remove decoupling network and rf vtvm.		
7.	At J1151 connect (hf) rf signal generator probe to pin V of 724-1150 assembly, ground probe to pin U. Connect frequency counter to uncalibrated output on rf signal generator. Connect oscilloscope and rf vtvm probes to pin A, ground probes to pin U of J1151.	Set FREQUENCY MHz switches to 500 kHz, MODE switch to AM. Remove both Detector/Agc Assemblies and the 724-1100 Front End Assembly. Extend 724-1150 Usb/Am. Filter Assembly. Set rf signal generator to 500 kHz with enough output to read 25 mVrms on the rf vtvm. Tune T1 through T4 while reducing rf signal generator output so that rf vtvm reading never exceeds 30 mVrms.	Peak indication.
8.	Same as step 7.	At front panel, set MODE switch for USB operation. Set rf signal generator for 501 kHz, 200 μ Vrms cw output.	Output should be at least 15 mVrms, adjustable by R17.
9.	Same as step 7.	At front panel, set MODE switch at AM. Set rf signal generator at 500 kHz, 80% 1 kHz modulation, 2.5 mVrms input.	No distortion on oscilloscope display.



7.5.3 PROCEDURES (CONT)

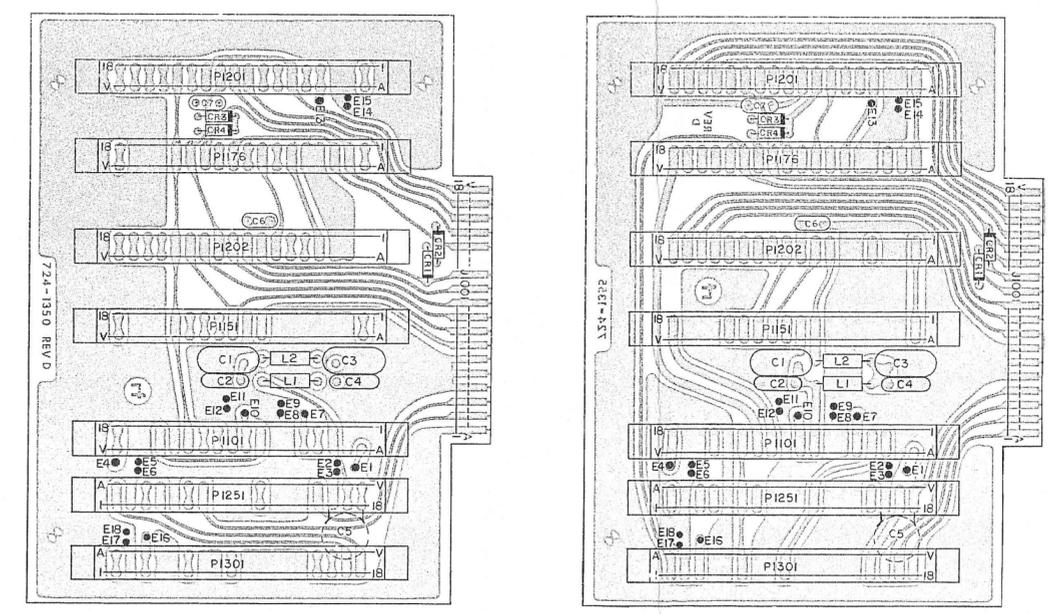
STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
10.	Connect test equipment to 724-1175 assembly as in step 7.	Set FREQUENCY MHz switches to 500 kHz. MODE switch to LSB. Replace 724-1150 assembly and extend Lsb/Cw Filter Assembly. Set rf signal generator to 499 kHz with enough output to read 25 mVrms on the rf vtvm. Tune T1 through T4 while reducing rf signal generator output so that rf vtvm reading never exceeds 30 mVrms.	Peak indication.
11.	Same as step 10.	At front panel set MODE switch for CW operation, if applicable. Adjust rf generator frequency for strongest beat tone, with an output of 200 μ Vrms CW output.	Output should be at least 15 mVrms, adjustable by R17.
12.	Same as step 10.	At front panel set MODE switch at CW. Sweep rf signal generator through passband.	Center frequency should be 501.0 kHz.
13.	At J1201 connect (hf) rf signal generator probe to pin A, ground probe to pin B. Connect oscilloscope probe to pin K, ground probe to pin B. Connect dc vom probe to TP2, ground probe to TP4.	At front panel set MODE switch at AM. Remove Usb/Am. Filter Assembly 724-1150. Extend Usb/Am. Detector/Agc Assembly. Set rf signal generator to 500 kHz, 30% 1 kHz modulation. Adjust rf generator output until oscilloscope indicates 0.1 V peak-to-peak. Tune T1 for maximum outputs on vom and scope.	Input level should be less than 3 mVrms.
14.	Disconnect oscilloscope probes. Connect oscilloscope and ac vtvm probes across pins V and T of J1201.	Set rf signal generator output at 501 kHz, and at: 5 mVrms for AM, modulated 30% with 1 kHz tone 2 mVrms for SSB, Cw output	Oscilloscope should display clean sine wave at 0.7 ± 0.3 volts peak-to-peak with 600 ohm load, adjusted with Remote Audio Level Adj. (R38).
15.	Same as steps 13 and 14.	Exchange LSB/CW Detector/AGC Assembly for Usb/Am. Detector/Agc Assembly and repeat two preceding steps,	Same as steps 13 and 14.
16.	Disconnect all test equipment.	Reinstall both Detector/Agc Assemblies. Be sure all other assemblies are installed.	
17.	Connect (hf) rf signal generator to J1, RF INPUT, on back panel.	Extend Usb/Am. Filter Assembly, 724-1150. At front panel, set MODE switch at USB, FREQUENCY MHz switches at 4.0000 MHz, VOLUME control fully counter-clockwise, RF GAIN fully clockwise, USB/AM meter switch at AUDIO LEVEL. Set rf signal generator at 4.0 MHz cw at an output level of 20 μ Vrms. Adjust frequency for maximum indication on USB/AM meter.	Peak indication on USB/AM. meter.
18.	Same as step 17.	Set rf signal generator to 10 μ V output. At front panel set USB/AM meter switch at SIGNAL STRENGTH. Adjust agc threshold control, R17, on Filter Assembly until USB/AM meter just begins to read up-scale.	Up-scale indication.
19.	Same as step 17. Connect ac vtvm probe to pin K, ground probe to pin B.	Replace Filter Assembly. Extend USB/AM Detector/AGC Assembly. With MODE switch still at USB, reduce rf signal generator output level to 0. Note dB level on ac vtvm. Increase rf signal generator output level with ac vtvm reading increases by 10 dB. Vary frequency slightly to achieve maximum vtvm reading.	(Hf) rf signal generator output level should be less than 1 uVrms.
20.	Same as step 17.	At front panel set MODE switch at AM. Set rf signal generator at 30% 1 kHz modulation at 0 uVrms. Note dB level on ac vtvm. Increase rf signal generator output level until ac vtvm reading increases by 10 dB.	(Hf) rf signal generator output level should be less than 4 uVrms.
21.	Disconnect ac vtvm from pins K and B and connect to USB/AM AUDIO OUT terminals on TB1 on back panel. Also connect a 600 ohm resistor to TB1 terminals 2 and 3. Connect oscilloscope probe to TP3 on Usb/Am. Detector/Agc Assembly, ground probe to TP4, (hf) rf signal generator same as previous step 17.	Set oscilloscope sweep to 1 ms per cm. Set rf signal generator to 80% modulation at 1 kHz at 100 mVrms. output level. Adjust delayed agc threshold control, R36, until flattening of modulation peaks just disappears. Advance volume control and check for a pure-sounding, (i.e. fundamental-frequency only), audio output.	Modulation envelope should be approximately 0.6 V peak-to-peak.



7.5.3 PROCEDURES (CONT.)

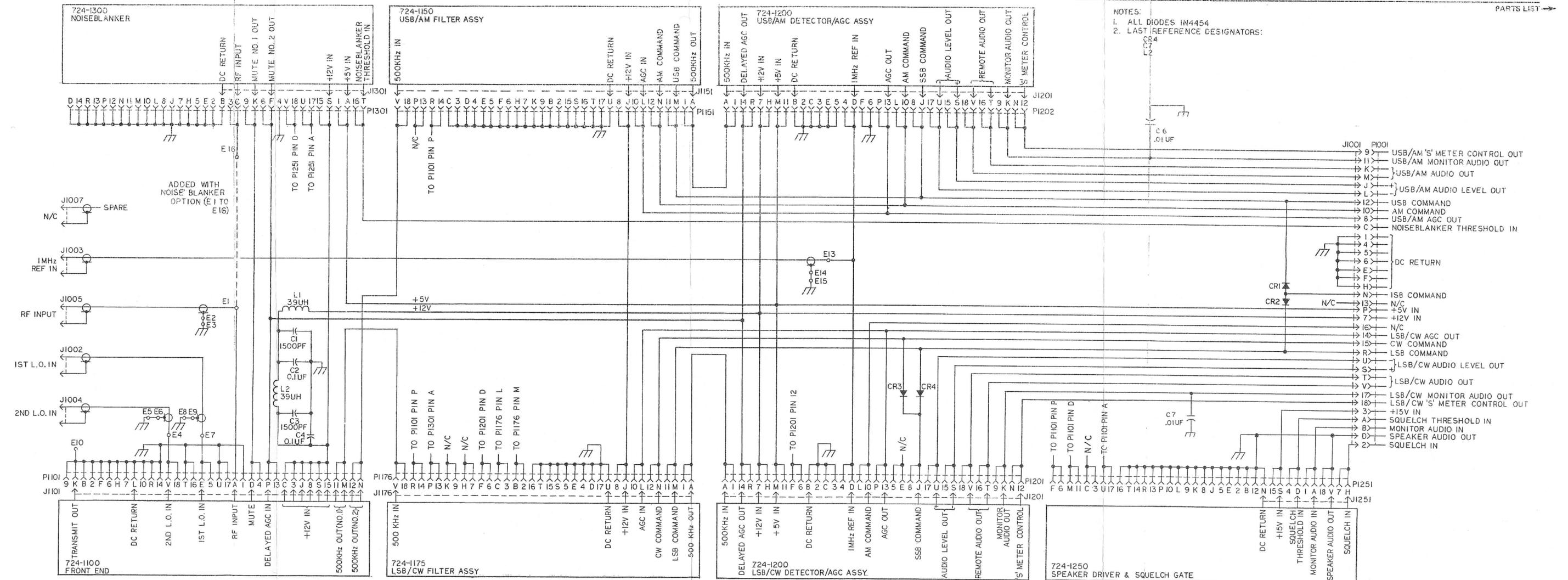
STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
22.	Same as step 21.	At front panel, set USB/AM meter switch at AUDIO LEVEL. Adjust remote audio level control, R38, until ac vtm reads 800 mVrms (0 dBm). (Little adjustment of R38 should be necessary since the value was roughly set in step 19.)	800 mVrms on ac vtm.
23.	Same as step 21.	Set rf signal generator at an output level of 2.5 μ Vrms. Replace Detector/Agc Assembly. Extend Lsb/Cw Filter Assembly. At front panel, set MODE switch at LSB, LSB/CW meter switch at AUDIO LEVEL. Adjust frequency for maximum indication on LSB/CW meter.	Peak indication on LSB/CW meter.
24.	Same as step 21.	At front panel, set LSB/CW meter switch at SIGNAL STRENGTH. Set rf signal generator at output of 10 μ Vrms. Adjust agc threshold control, R17, until LSB/CW meter just begins to read up-scale.	LSB/CW meter indication just starts to increase.
25.	Same as step 21. Connect ac vtm probe to pin K, ground probe to pin B of J1201.	Replace Filter Assembly. Extend Lsb/Cw Detector/Agc Assembly. Reduce rf signal generator output level to 0. Note dB level on ac vtm. Increase rf signal generator output level until ac vtm reading increases by 10 dB. Vary frequency slightly to achieve maximum vtm reading.	(Hf) rf signal generator output level should be less than 1 μ Vrms.
26.	Disconnect ac vtm from pins K and B and connect to LSB/CW AUDIO OUT terminals on TB1 on back panel. Also connect a 600 ohm resistor to TB1 terminals 4 & 5. Connect oscilloscope probe to TB3 on Lsb/Cw Detector/Agc Assembly, ground probe to TP4, (Hf) rf signal generator same as previous step 17.	Set rf signal generator to 80% 400 Hz modulation at 100 mVrms output level. Adjust delayed agc threshold control, R36, until flattening of modulation peaks just disappears. Advance volume control and check for audio output.	Modulation envelopes should be approximately 0.4 V peak-to-peak.
27.	Same as step 26.	At front panel set LSB/CW meter switch at AUDIO LEVEL. Adjust remote audio level control, R38, until ac vtm reads 800 mVrms (0 dBm). (Little adjustment of R38 should be necessary since this value was roughly set in step 20.)	800 mVrms on ac vtm.
<p>NOTE</p> <p><i>The test in step 28 is only to be performed if the receiver is equipped with the optional cw filter.</i></p>			
28.	Disconnect all test equipment except (hf) rf signal generator.	At front panel set LSB/CW meter switch to SIGNAL STRENGTH, and set MODE switch to CW. Set rf signal generator for cw operation at 50 μ Vrms output. Advance volume control and adjust rf signal generator frequency to check for presence of narrow cw filter response.	Narrow response.
29.	Same as step 28.	At front panel, set MODE switch at USB. Adjust rf signal generator frequency to produce audible beat note in speaker. Adjust SQUELCH control until note just mutes. Increase rf signal generator output level to 100 mVrms.	Receiver should unsquelch.

NOTES:
1. ALL DIODES IN4454
2. LAST REFERENCE DESIGNATORS:



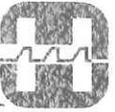
B. Component Locations with Adjacent Side Foil

A. Component Locations with Opposite Side Foil



7-17

Figure 7.2 - Receiver Module Circuit Diagram
REV. J



RECEIVER MODULE -- 724-1000

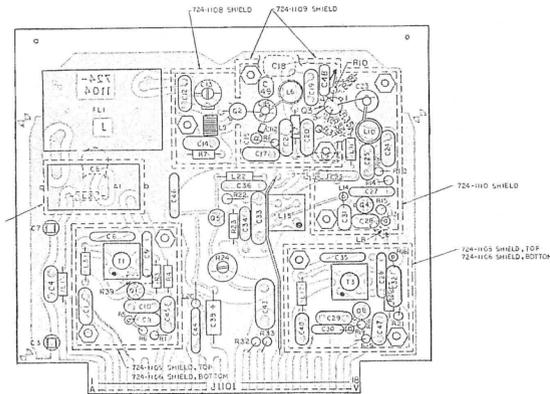
REF DESIG	DESCRIPTION	RF PART NUMBER
C1	Capacitor, Mica, 1500 PF \pm 5%; 500 Vdcw	C-0156
C2	Capacitor, Ceramic Disk, 0.1 UF \pm 20%; 30 Vdcw	C-2210
C3	Capacitor, Mica, 1500 PF \pm 5%; 500 Vdcw	C-0156
C4	Capacitor, Ceramic Disk, 0.1 UF \pm 20%; 30 Vdcw	C-2210
C6	Capacitor, Ceramic, 0.01 UF +60% --40%; 150 Vdcw	C-0065
C7	Capacitor, Ceramic, 0.01 UF +60% --40%; 150 Vdcw	C-0065
CR1	Diode, Silicon, Type 1N4454	CR-0705
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Silicon, Type 1N4454	CR-0705
CR4	Diode, Silicon, Type 1N4454	CR-0705
L1	Coil, Rf, Molded, 39 UH	L-0635
L2	Coil, Rf, Molded, 39 UH	L-0635
J1002	Connector, Coaxial, Male	724-1357
J1003	Connector, Coaxial, Male	724-1358
J1004	Connector, Coaxial, Male	724-1359
J1005	Connector, Coaxial, Male	724-1359
P1101	Connector, P.C. Board	J-0374
P1151	Connector, P.C. Board	J-0374
P1176	Connector, P.C. Board	J-0374
P1201	Connector, P.C. Board	J-0347
P1202	Connector, P.C. Board	J-0347
P1251	Connector, P.C. Board	J-0347
P1301	Connector, P.C. Board	J-0347
	Enclosure, Side	724-0048
	Enclosure, Side	724-0049
	Enclosure, End	724-0047
	Cover	724-0051
	Shield	724-0055
	Front End Assembly	724-1100
	USB/AM Filter Assembly	724-1150
	LSB/CW Filter Assembly	724-1175
	Detector/AGC Assembly	724-1200
	Speaker Driver and Squelch Gate Assembly	724-1275
	Receiver Mother Board Assembly	724-1350



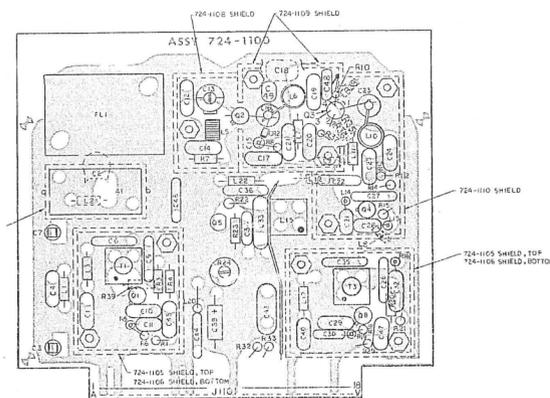
DC VOLTAGES*

Stage	E	B	C	
Q1	4.80	5.60	12.0	
Q5	1.60	2.40	7.80	
Q8	5.10	5.90	12.0	
Q2	0	2.30	8.90	
Q3	0	1.90	8.90	
Q4	Drain 1	Gate 2	Gate 3	Source 4
	8.50	2.50	0.96	1.10

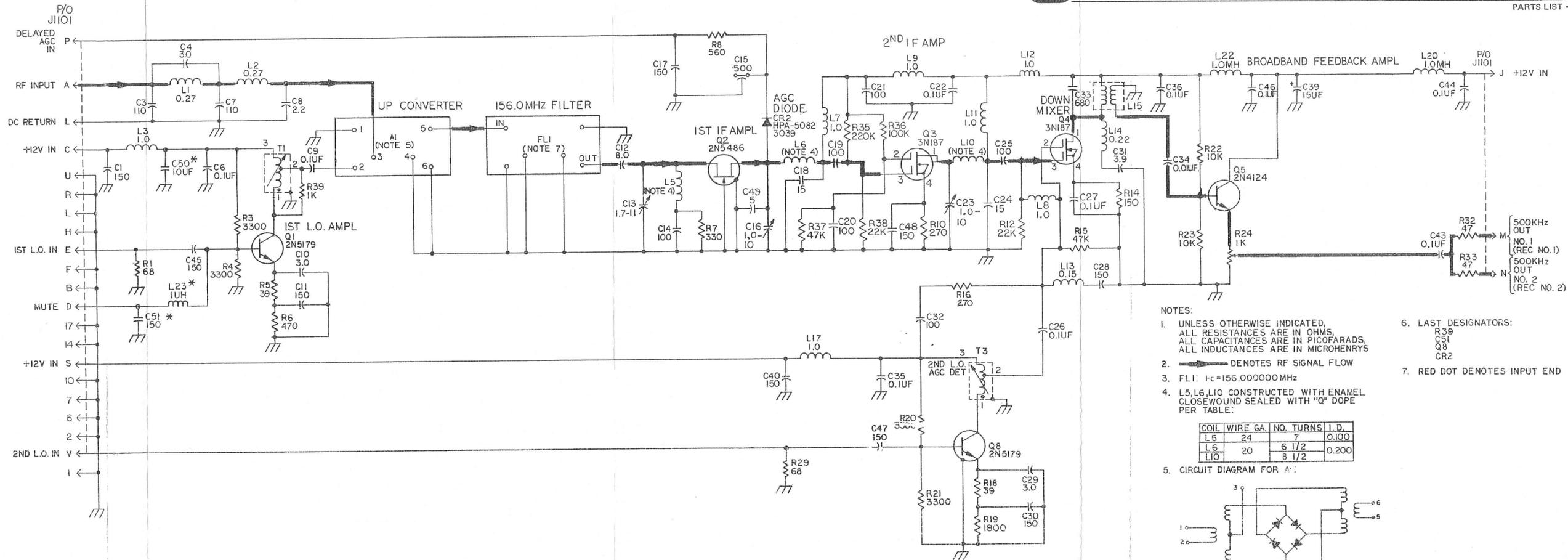
*Referenced to ground.



A. Component Locations with Opposite Side Foil



B. Component Locations with Adjacent Side Foil

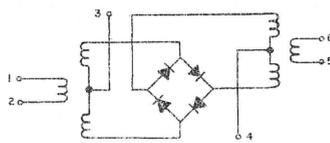


NOTES:

- UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, ALL CAPACITANCES ARE IN PICOFARADS, ALL INDUCTANCES ARE IN MICROHENRYS
- DENOTES RF SIGNAL FLOW
- FL1: $f_c = 156.000000$ MHz
- L5, L6, L10 CONSTRUCTED WITH ENAMEL CLOSEWOUND SEALED WITH "Q" DOPE PER TABLE
- CIRCUIT DIAGRAM FOR A:
- LAST DESIGNATORS:
R39
C51
Q8
CR2
- RED DOT DENOTES INPUT END

COIL	WIRE GA.	NO. TURNS	I. D.
L5	24	7	0.100
L6	20	6 1/2	0.200
L10		8 1/2	

5. CIRCUIT DIAGRAM FOR A:



FIRST LETTER OF MANUFACTURER'S NAME DENOTES INPUT END

* C50, C51 AND L23 ARE USED ONLY WITH NOISE BLANKER OPTION.

724-1100

FRONT END ASSEMBLY
Circuit Diagram
PARTS LIST

Figure 7.3 — Front End Assembly Circuit Diagram
REV. N



FRONT END ASSEMBLY - 724-1100

REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Mixer Assembly	724-1111
C1	Capacitor, Ceramic, 150 PF ± 20%; 1000 Vdcw	C-4794
C3	Capacitor, Ceramic, 110 PF ± 5%	C-1192
C4	Capacitor, Ceramic, 3 PF ± 5%; 1000 Vdcw	C-4733
C6	Capacitor, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C7	Capacitor, Ceramic, 110 PF ± 5%	C-1192
C8	Capacitor, Ceramic, 2.2 PF ± 5%; 1000 Vdcw	C-4731
C9	Capacitor, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C10	Capacitor, Mica, 3 PF ± 5%; 500 Vdcw	C-0102
C11	Capacitor, Ceramic, 150 PF ± 20%; 1000 Vdcw	C-4794
C12	Capacitor, Ceramic, Tubular, 8 PF	C-2156
C13	Capacitor, Air Variable, 1.7 - 11 PF; 250 Vdcw	C-1190
C14	Capacitor, Disk, 100 PF ± 10%; 500 Vdcw	C-3501
C15	Capacitor, Feed-thru, 500 PF	C-6630
C16	Capacitor, Feed-thru, Variable, 1.0 - 10.0 PF; 250 Vdcw	C-2175
C17	Capacitor, Ceramic, 150 PF ± 20%; 1000 Vdcw	C-4794
C18	Capacitor, Mica, 15 PF ± 5%; 1000 Vdcw	C-0106
C19	Capacitor, Disk, 100 PF ± 10%; 500 Vdcw	C-3501
C20	Capacitor, Disk, 100 PF ± 10%; 500 Vdcw	C-3501
C21	Capacitor, Disk, 100 PF ± 10%; 500 Vdcw	C-3501
C22	Capacitor, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C23	Capacitor, Feed-thru, Variable, 1.0 - 10.0 PF; 25 Vdcw	C-2175
C24	Capacitor, Disk, 15 PF ± 5%; 1000 Vdcw	C-2253
C25	Capacitor, Disk, 100 PF ± 10%; 500 Vdcw	C-3501
C26	Capacitor, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C27	Capacitor, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C28	Capacitor, Ceramic, 150 PF ± 20%; 1000 Vdcw	C-4794
C29	Capacitor, Mica, 3 PF ± 5%; 500 Vdcw	C-0102
C30	Capacitor, Ceramic, 150 PF ± 20%; 1000 Vdcw	C-4794
C31	Capacitor, Ceramic, 3.9 PF ± 5%; 1000 Vdcw	C-4735
C32	Capacitor, Disk, 100 PF ± 10%; 500 Vdcw	C-3501
C33	Capacitor, Ceramic, 680 PF ± 5%; 500 Vdcw	C-0148
C34	Capacitor, Ceramic, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C35	Capacitor, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C36	Capacitor, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C39	Capacitor, Tantalum, Electrolyte, 15 UF ± 20%; 20 Vdcw	C-5832
C40	Capacitor, Ceramic, 150 PF ± 20%; 1000 Vdcw	C-4794
C43	Capacitor, Disk, 0.1 UF +80% -20%; 30 Vdcw	C-2210
C44	Capacitor, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C45	Capacitor, Ceramic, 150 PF ± 20%; 1000 Vdcw	C-4794

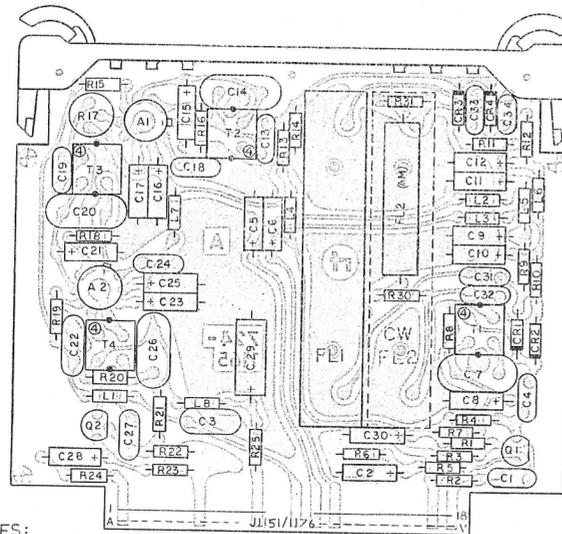
FRONT END ASSEMBLY - 724-1100 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
C46	Capacitor, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C47	Capacitor, Ceramic, 150 PF ± 20%; 1000 Vdcw	C-4794
C48	Capacitor, Ceramic, 150 PF ± 20%; 1000 Vdcw	C-4794
C49	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
*C50	Capacitor, Tantalum 10 UF, ± 20%; 20 Vdcw	C-6327
*C51	Capacitor, Ceramic, 150 PF ± 20%; 1000 Vdcw	C-4794
CR2	PIN Diode, HPA 5082-3039	724-1113
FL1	Filter, Crystal, 156.0 MHz	724-1155
L1	Coil, Rf, 0.27 UH	L-0609
L2	Coil, Rf, 0.27 UH	L-0609
L3	Coil, Rf, 1.0 UH	L-0616
L5	Coil, 7 turns of 24 ga. wire	724-1115
L6	Coil, 6-1/2 turns of 20 ga. wire	724-1116
L7	Coil, Rf, 1.0 UH	L-0616
L8	Coil, Rf, 1.0 UH	L-0616
L9	Coil, Rf, 1.0 UH	L-0616
L10	Coil, 8-1/2 turns of 20 ga. wire	724-1117
L11	Coil, Rf, 1.0 UH	L-0616
L12	Coil, Rf, 1.0 UH	L-0606
L13	Coil, Rf, 0.15 UH	L-0606
L14	Coil, Rf, 0.22 UH	L-0608
L15	Transformer	724-1210
L17	Coil, Rf, 1.0 UH	L-0616
L20	Coil, Rf, 1000 UH	L-0652
L22	Coil, Rf, 1000 UH	L-0652
*L23	Coil, Rf, 1.0 UH	L-0616
Q1	Transistor, Silicon, UHF, NPN, Type 2N5179	Q-0390
Q2	Transistor, FET, Type 2N5486	Q-0376
Q3	Transistor, MOSFET, Dual Gate, VHF Amplifier/Mixer, Type 3N187	Q-0325
Q4	Transistor, MOSFET, Dual Gate, VHF Amplifier/Mixer, Type 3N187	Q-0325
Q5	Transistor, Silicon, Rf/If Amplifier, NPN, Type 2N4124	Q-0385
Q8	Transistor, Silicon, UHF, NPN, Type 2N5179	Q-0390
R1	Resistor, Metal Film; 68 ohms ± 5%; 1/4W	R-7251
R3	Resistor, Metal Film; 3300 ohms ± 5%; 1/4W	R-7258
R4	Resistor, Metal Film; 3300 ohms ± 5%; 1/4W	R-7258
R5	Resistor, Metal Film; 39 ohms ± 5%; 1/4W	R-7250
R6	Resistor, Carbon; 470 ohms ± 5%; 1/4W	R-1241
R7	Resistor, Carbon; 330 ohms ± 5%; 1/4W	R-1237
R8	Resistor, Carbon; 560 ohms ± 5%; 1/4W	R-1243
R10	Resistor, Carbon; 270 ohms ± 5%; 1/4W	R-1235
R12	Resistor, Metal Film; 22K ± 5%; 1/4W	R-7259
R14	Resistor, Carbon; 150 ohms ± 5%; 1/4W	R-1229
R15	Resistor, Metal Film; 47K ± 5%; 1/4W	R-7260
R16	Resistor, Carbon; 270 ohms ± 5%; 1/4W	R-1235
R18	Resistor, Metal Film; 39 ohms ± 5%; 1/4W	R-7250
R19	Resistor, Carbon; 1800 ohms ± 5%; 1/4W	R-1255
R20	Resistor, Metal Film; 3300 ohms ± 5%; 1/4W	R-7258
R21	Resistor, Metal Film; 3300 ohms ± 5%; 1/4W	R-7258
R22	Resistor, Carbon; 10K ± 5%; 1/4W	R-1273
R23	Resistor, Metal Film; 10K ± 5%; 1/4W	R-1273

*Used only with RF-506 Noise Blanking Option

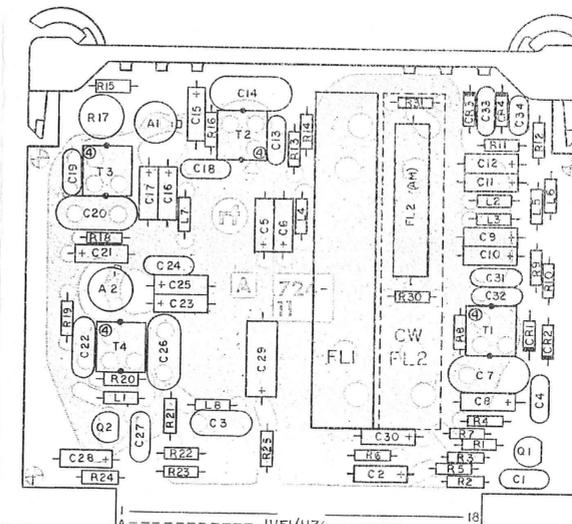
FRONT END ASSEMBLY - 724-1100 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
R24	Resistor, Variable, 1K	R-7210
R29	Resistor, Carbon; 68 ohms ± 5%; 1/4W	R-7251
R32	Resistor, Carbon; 47 ohms ± 5%; 1/4W	R-1217
R33	Resistor, Carbon; 47 ohms ± 5%; 1/4W	R-1217
R35	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R36	Resistor, Carbon; 100K ± 5%; 1/4W	R-1297
R37	Resistor, Metal Film; 47K ± 5%; 1/4W	R-7260
R38	Resistor, Metal Film; 22K ± 5%; 1/4W	R-7259
R39	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
T1	Transformer, Rf	724-1122
T3	Transformer, Rf	724-1123
-	Ejector, P.C. Board	MP-4341



- NOTES:
1. AM FILTER, R30/R31 USED ONLY ON 724-1150 ASSY.
 2. CW FILTER USED ONLY ON 724-1175 ASSY.

A. Component Locations with Opposite Side Foil



- NOTES:
1. AM FILTER, R30/R31 USED ONLY ON 724-1150 ASSY.
 2. CW FILTER USED ONLY ON 724-1175 ASSY.

B. Component Locations with Adjacent Side Foil

DC VOLTAGES*

Stage	E	B	C	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10
Q1	0.83	1.50	4.70							
Q2	2.10	2.80	7.30							
	Pin 1	Pin 2	Pin 3							
A1	1.50	0.75	0.75	1.50	4.00	6.00	0.00	Pin 8	Pin 9	Pin 10
A2	1.50	0.75	0.75	1.50	4.00	7.00	0.00	4.00	6.70	4.00

*Referenced to ground.

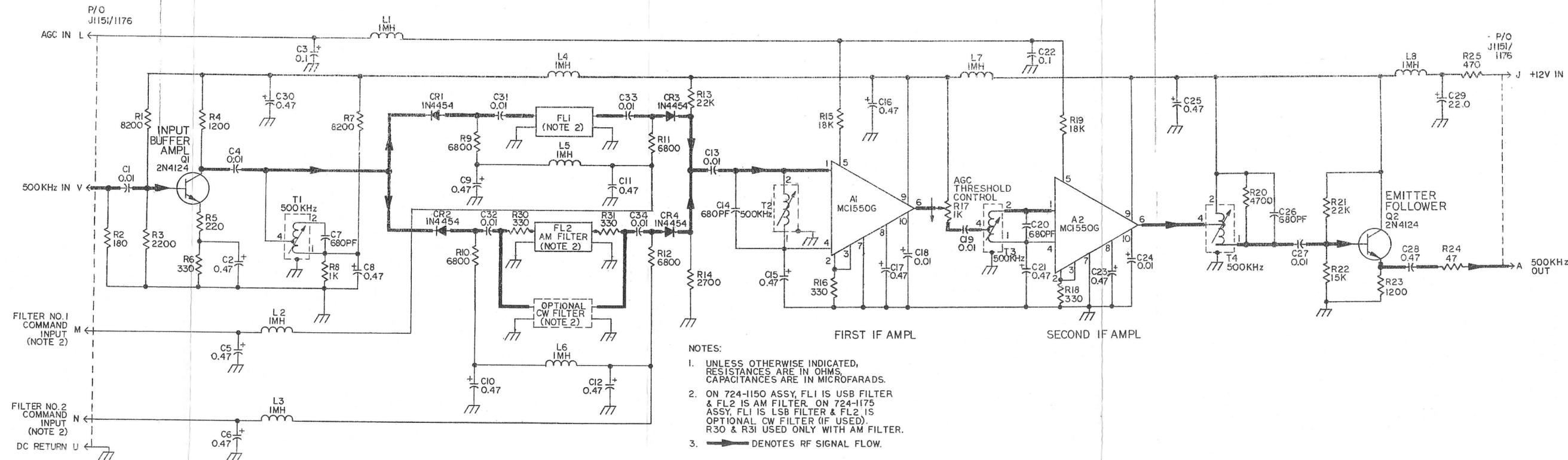


Figure 7.4 — Filter Assembly Circuit Diagram REV. E



CHAPTER 8

SYNTHESIZER MODULE

8.1 GENERAL

This chapter contains the detailed theory of operation of each assembly in the Synthesizer Module. Also included are the necessary alignment and troubleshooting procedures to maintain the module and assemblies to specified performance. Circuit diagrams and parts list of the Synthesizer Module and assemblies are included.

8.2 DETAILED THEORY OF OPERATION

The theory of operation of each of the assemblies in the Synthesizer Module is presented in the following paragraphs. Refer to chapter 4 for the general overall theory of the Synthesizer Module.

8.2.1 SPECTRUM GENERATOR ASSEMBLY (724-0750)

Spectrum Generator Assembly 724-0750 consists of a pulse generator, four band-pass filters, a series of four decade dividers, an input amplifier, and four output amplifiers. Output signals from the Spectrum Generator Assembly are applied to the various assemblies of the Synthesizer Module and to the Receiver Module. The output to the Receiver Module is the 1 MHz local oscillator number three injection signal. The remaining signals are:

- a. 20 MHz for Translator Assembly.
- b. 15 MHz for 14 MHz Up-Mixer and VFO Assembly.
- c. 12 MHz for HF VCO Assembly.
- d. 500 kHz for Second L.O. Assembly.
- e. 25 kHz for VHF Divider Assembly.
- f. 1 kHz for HF Divider Assembly.

The 5 MHz input from the Frequency Standard Module is amplified by A1, filtered by L1, and applied to NAND gate A2-C. Diodes CR1 and CR2 at the input of A1 clip the input signal to prevent saturation of the amplifier. From A1 the 5 MHz signal is squared by NAND gate A2-C and applied to one-shot pulse generator A2-A, A2-B, and A2-D and to decade divider A3. The one-shot pulse generator circuitry provides a 5 MHz pulse output signal to the 20 MHz and 15 MHz band-pass filters.

The 20 MHz band-pass filter extracts the fourth harmonic, 20 MHz, which is amplified by A8 and applied to pins V and 18 of J0751 for the Translator Assembly.

The 15 MHz band-pass filter extracts the third harmonic from the 5 MHz pulse. This signal is then amplified by A10 and applied to pins S and 15 of J0751 for the 14 MHz Up-Mixer and VFO Assembly.

The 5 MHz pulse from A2-C is applied to decade divider A3 where it is divided by five to provide a 1 MHz signal. This signal is shaped and amplified by Q3 and applied to pins E and 5 of J0751 as a 1 MHz sine wave.

The 1 MHz output of A3 is also applied to the 12 MHz band-pass filter where the twelfth harmonic is selected. The 12 MHz signal is then progressively amplified by A9 and Q1 and Q2. Transistor Q1 and Q2 are connected in a push-pull configuration with the output coupled by C45 to pins K and 9 of J0751.

At decade dividers A3, A4, A5, and A6, the 1 MHz signal is progressively divided to provide the 500 kHz, 25 kHz, and 1 kHz output signals. These signals are coupled by NAND gates A7-A, A7-B, and A7-C to the corresponding pins on connector J0751.



8.2.2 SECOND L.O. GENERATOR ASSEMBLY (724-0800)

The Receiver Module second local oscillator injection signal, 156.5 MHz, is provided by Second L.O. Generator Assembly 724-0800 in the Synthesizer Module. Basically the assembly consists of a 19.5625 MHz voltage controlled crystal oscillator (VCXO) circuit which is multiplied by eight to produce the required 156.5 MHz output signal. To maintain frequency accuracy, the output of the VCXO is mixed with a 160 MHz reference signal to provide a 3.5 MHz difference. This signal is then compared with a second 3.5 MHz reference signal in a phase detector. If the VCXO is off frequency then the error will be detected by the phase detector and applied as a dc feedback voltage to the VCXO. The two reference signals (160 MHz and 3.5 MHz) are derived directly from the 5 MHz frequency standard in the Spectrum Generator Assembly, and are therefore coherent with the frequency standard. The first reference signal is the 20 MHz output signal amplified and multiplied by eight in the Translator Assembly to provide the 160 MHz mixing signal. The second reference signal is the 500 kHz signal from the Spectrum Generator Assembly multiplied by seven, in the Second L.O. Generator Assembly, to provide the 3.5 MHz reference signal for the phase detector.

The VCXO is a dual emitter – coupled crystal oscillator, Q1 and Q2, with a fundamental frequency of 19.5625 MHz. Small adjustment of the crystal frequency is accomplished by the dc feedback voltage (error signal) which is applied to varactor diodes CR1 and CR2. Initial amplification of the VCXO is accomplished by Q3. Capacitor C18 couples the output of Q3 to the input of the pulse generator circuitry.

The pulse generator circuitry, NAND gates A3-A through A3-C, provide a pulse output signal at the frequency of the VCXO to the times eight multiplier circuit. Inductor L10 and capacitor C30 provide a series tuned circuit at 156.5 MHz to provide initial filtering of the eight harmonic of the VCXO. The signal is further filtered by the 156.5 MHz tuned filter at the input of output amplifier Q5. Capacitor C28 couples the 156.5 MHz signal at C30 to the input of 156.5 MHz buffer amplifier A4.

Output amplifier Q5 provides the final amplification of the 156.5 MHz signal which is coupled to pin V of J0801 by C55 as the 156.5 MHz second local oscillator injection signal.

The 156.5 MHz signal at A4 is amplified and applied to MOSFET mixer Q4. Also applied to Q4 is the 160 MHz reference signal from the Translator Assembly. The difference of the two signals at Q4, 3.5 MHz, is selected and amplified by 3.5 MHz buffer amplifier A5 and applied as one of the two inputs to the phase detector at A2-B.

At pin A of J0801, the 500 kHz reference signal is applied to a double tune tank which is tuned to the seventh harmonic (3.5 MHz) and amplified by A1. The output of A1, 3.5 MHz, is filtered and applied as the second input to the phase detector circuit at A2-A.

In the phase detector, diodes CR3 and CR5 prevent the input signals from exceeding +5 Vdc. Diodes CR4 and CR6 clamp the negative portion of the input signal to ground. The two input signals are then squared by A2-A and A2-B and coupled by C22 and C24 to A2-C and A2-D, respectively. A2-C and A2-D comprise a flip-flop with a high output when A2-D is pulsed and low when A2-C is pulsed. The output is filtered to a dc voltage by C27 and coupled back to the VCXO circuitry. This dc voltage is proportional to the phase difference between the two 3.5 MHz signals.

If the signal from A5 is not exactly on frequency, indicating that the VCXO has drifted from the 19.5625 MHz crystal frequency, then a beat frequency will develop in the dc output to the VCXO. This beat frequency will vary the VCXO frequency until the VCXO has adjusted to make the 3.5 MHz signal at the phase detector exactly the same frequency as the 3.5 MHz reference.

8.2.3 HF VCO ASSEMBLY (724-0550)

The HF Voltage Controlled Oscillator (HF VCO) Assembly generates the 10 kHz, 1 kHz, and 100 Hz portion of the first local oscillator injection signal. Part of the first local oscillator loop number 1, the HF VCO assembly consists of an hf vco (10.000 to 10.999 MHz); a 1 kHz loop filter containing



amplifying stages Q1, Q2, Q5 and Q6; MOSFET mixer Q8; three amplifier stages A1, Q7, and Q9; and decade divider A2.

The hf vco, consisting of transistor Q4 and associated circuitry, is a grounded drain Clapp oscillator. Hf vco frequency control is maintained by the dc voltage from the 1 kHz loop filter (fine tuning) and by the vco steering voltage (coarse tuning). The vco steering voltage is controlled in turn by the position of the 10 kHz FREQUENCY MHz switch. The output frequency of the hf vco contains the 10 kHz, 1 kHz, and 100 Hz operating frequency digital information.

The control voltages are applied to varactor diodes CR3-CR6. Diodes CR3 and CR4 are controlled by the coarse tuning voltage (vco steering) and diodes CR5 and CR6 are controlled by the output of the 1 kHz loop filter (fine tuning). These varactor diodes vary the capacitance in parallel to the gate lead of Q4. Transistor Q3 provides a regulated dc supply at the drain lead of Q4 for stability and is controlled by zener diode CR8. The output of the hf vco is amplified by buffer amplifier A1 and applied to down mixer Q8 and to amplifier Q7.

Down mixer Q8 mixes the output of the hf vco with a fixed 12 MHz reference signal. The difference between these two signals is selected by low pass filter (L10, C37, C38, and C40) as the input to amplifier Q9. The amplified output from Q9 is applied to pin V of J0551 as the HF Divider Assembly 1.001 to 2.000 MHz input signal.

Amplifier Q7 applies the output of the hf vco to decade divider A2. Diodes CR9 and CR10 clip the input signal to provide a positive 5 volt pulse at pin 6 of A2. For each ten input pulses decade divider A2 provides one output pulse. A bandpass filter, consisting of C43, C46, C47, L8, and L9, couples and filters the output signal of A2 (1.0000 to 1.0999 MHz) to pin K of J0551.

Loop filter, consisting of Q1, Q2, Q5, and Q6 with associated circuitry, filters the output of the Divider Assembly phase detector and provides the fine tuning dc voltage to the hf vco. The tuning voltage is derived from the HF Divider Assembly Phase detector input signal at pin A of J0551. This signal is either a 1 kHz waveform, or if the hf vco is off

frequency, a high or low dc voltage. Initial filtering and averaging of the input signal is provided by C5, C6, C8, and C9. Diodes CR1 and CR2 shunt resistor R4 when a rapid change in voltage is applied to pin A thus shortening the lockup time of the loop. Amplified by transistors Q1 and Q2, an emitter follower pair, the signal is applied to a notch filter. The notch filter, consisting of C13, C16, C18, R13, and R14, provides the final filtering of any remaining 1 kHz oscillations on the dc signal and couples the signal to the base lead of transistor Q5. Transistors Q5 and Q6, a Darlington pair, provide the final amplification of the signal and couple the dc voltage through R19 and L4 to diodes CR5 and CR6 for fine tuning of the hf vco.

8.2.4 HF DIVIDER ASSEMBLY (724-0600)

The HF Divider Assembly provides the fine tuning voltage to the HF VCO Assembly for frequency control. Part of first local oscillator loop number 1, the HF Divider Assembly consists of input amplifier A1, NAND-gate pulse-shaper A2, four pre-settable decade counters (A4, A5, A6, A7), one shot multivibrator A3, and phase detector A9/A10. The input signals are the 1.001 to 2.000 MHz signal from the HF VCO Assembly, a 1 kHz reference signal from the Spectrum Generator Assembly, and the preset control lines from the 10 kHz, 1 kHz, and 100 Hz FREQUENCY MHz switches.

The 1.001 to 2.000 MHz input signal is amplified by A1, pulse shaped by A2, and applied to decade counters A4 through A7. The decade counters are preset by the FREQUENCY MHz switches to provide a 1 kHz output if the input signal is on the frequency corresponding to the frequency set on the front panel. In the phase detector this frequency is compared with the 1 kHz reference signal from the Spectrum Generator Assembly. The 1 kHz reference signal is considered to have no error since it is derived directly from the frequency standard signal. Therefore, any frequency error detected by the phase detector is the result of the hf vco being off frequency. The output signal of the phase detector is applied to the HF VCO Assembly to adjust the hf vco frequency until the error is cancelled.

The 1.001 to 2.000 MHz signal from the HF VCO Assembly is applied to pin V of J0601 and coupled



to amplifier A1 by C3. Capacitor C6 couples the output of A1 to the first stage (A2-A) of NAND-gate pulse shaper A2. Diode CR1 prevents the input gate of A2-A from going below 0.5 Vdc. The output of A2-A, a negative pulse, is inverted by A2-B. The leading edge of the pulse is then differentiated by capacitor C9 and applied as the positive input to A2-C. Diode CR2 shunts the portion of the waveform that swings below +0.5 volts. At A2-C output terminal, the negative pulse is inverted by A2-D and applied as the positive pulse to decade divider A4 and to NAND gate A8.

Divide by ten preset counters A4 through A6 and divide by two counter A7 are connected in series to solve the following equation:

$$\frac{F_{in(Hz)}}{1000} + F_{preset} = 1 \text{ kHz}$$

Where $F_{in(Hz)}$ is the frequency of the hf vco at A4, F_{preset} is derived from the operating frequency and is equal to $2,000 - F_{in} (kHz) = F_{preset}$. From this it is evident that if the input signal $F_{in(Hz)}$ is on frequency then the output will be exactly 1 kHz. If F_{in} is high the output will be high and if low the output will be low. Assume an operating frequency of 12.3456 MHz set by the front panel FREQUENCY MHz switches. The hf vco for this frequency should be 10.456 MHz and the input to the preset counters from A2 at 1,544 kHz (F_{in}). The positions of the front panel 10 kHz, 1 kHz, and 100 Hz FREQUENCY MHz switches provide the preset digits to the counters, $2^1 + 2^2$ or 6 for A4 (100 Hz), $2^0 + 2^2$ or 5 for A5 (1 kHz), and 2^2 or 4 for A6 (10 kHz). Starting at time zero, after the first four pulses are applied to A4 one pulse is applied to A5 and A4 switches to zero. A4 then starts counting by ten and it then takes ten more pulses for a second pulse at A5 or a total of 44 pulses at A4 for A5 to reach full count and supply the first pulse at A6. A5 starts counting by 10 as it takes a total of 544 pulses at A4 before A6 reaches full count and switches A7 output high at A8. After the next 999 pulses (the output of A6, A5, and A4 are all high) A6, A5, and A4 are all fully loaded with "9". These high signals are applied from pins 5 and 6 of each counter to NAND gate A8. When

the thousandth pulse is applied to the input of A4 it is also direct coupled to the last low input line of A8. NAND gate A8 conducts and supplies one output pulse to one shot multivibrator A3-D/A3-B. The same one thousandth pulse at A4 starts to switch A4 to zero, then A5 and A6 to zero and eventually A7 to zero. However, the total propagation time of this is large compared with the almost instantaneous output of A3-D, therefore, the output of A3-D/A3-B, through A3-C and A3-A, is applied to all counters to switch them back to the preset count and to start the cycle over again. All of this provides one output pulse at A8 for each 1,544 input pulses at A4 or 1,000 pulses for an input of 1,544 kHz. Any other input signal, if on frequency, will result in the same 1 kHz output.

If the synthesizer is in VFO operation, a ground is applied at pin 15 of J0601. This ground signal disables NAND gate A3-4 to keep counters A4 and A5 from presetting.

The counter output of one-shot multivibrator A3-D/A3-B is also applied to the input of phase detector at A9 pins 5 and 7. The second input to the phase detector, the 1 kHz reference signal at J0601 pin C, is applied at pin 1 and 3 of A9.

The phase detector compares the two input frequencies by alternately counting the pulses of each input signal in sequence. If both input signals have the same frequency the phase detector output will be a rectangular 1 kHz waveform. The width of the pulse represents the phase angle between the two signals. If the counter output frequency is higher than 1 kHz then the phase detector will eventually receive two counter pulses in between a pair of reference pulses. When this happens the phase detector gets out of sequence and locks high. The high signal is used to reduce the hf vco frequency until the phase detector counts two reference pulses between a pair of counter pulses. This causes the hf vco to increase in frequency, the phase detector comes out of lock, and the hf vco stops adjusting. The loop is then phase locked. Any minute adjustment required of the hf vco is accomplished by the pulse width from the phase detector. If the counter frequency is less than 1 kHz then the phase detector locks low until the hf vco frequency is corrected.



8.2.5 14 MHz UP-MIXER AND VFO ASSEMBLY (724-0900)

In the 14 MHz Up-Mixer and VFO Assembly the 1.0000 to 1.0999 MHz output of the HF VCO Assembly is mixed with either a 15 MHz reference signal or a variable 14.990 to 15.000 MHz signal. The difference between the two mixed frequencies, 14.000 to 13.900 MHz is selected and applied to Translator Assembly 724-0850. The variable 14.990 to 15.000 MHz signal is selected and controlled during vfo operation by the 1 kHz FREQUENCY MHz switch on the front panel of the unit.

The input signals to the 14 MHz Up-Mixer and VFO Assembly are the 1.0000–1.0999 MHz signal from the HF VCO Assembly, a 15 MHz reference signal from the Spectrum Generator Assembly, and the vfo control and command signals from the 1 kHz switch. Basically the assembly consists of a mixer stage, three amplifiers, one diode and three transistor switches, a VCXO, and a dc amplifier.

At A2 the 1.0000 to 1.0999 MHz input signal is mixed with either the 15 MHz reference signal from the Spectrum Generator Assembly or, for vfo operation, a 14.990 to 15.000 MHz VCXO signal. The output of A2 is tuned by a three pole band-pass filter to extract the 13.9001 to 14.0000 MHz difference frequency. This signal is then amplified by A4 and applied to pin H of J0901 for connection to the Translator Assembly.

When vfo operation is selected, by pulling out on the 1 kHz FREQUENCY MHz switch, the vfo command signal (ground) switches the 15 MHz reference signal buffer amplifier A1 off through diode switch CR1 and switches VCXO buffer amplifier A3 on through transistor switch Q2. The output of the selected buffer amplifier is applied on a common line to mixer A2, pin 10.

The variable vfo control voltage is applied to dc amplifier Q5 to control the frequency of the VCXO. The control voltage is adjustable by the rotation of the 1 kHz FREQUENCY MHz control to provide the proper VCXO output frequency at buffer amplifier A3.

8.2.6 TRANSLATOR ASSEMBLY (724-0850)

Translator Assembly 724-0850 provides the circuitry for transferring the 10 MHz, 1 MHz, and 100 Hz loop number one information of the first local oscillator to loop number two. This is accomplished by mixing the output of loop number one, converted up to 13.9001 to 14.0000 MHz by the 14 MHz Up-Mixer and VFO Assembly with a 160 MHz reference signal (the 20 MHz output of the Spectrum Generator Assembly multiplied by eight). The difference is then selected (approximately 146 MHz) and mixed with the output of the VHF VCO Assembly, first local oscillator output (156.0000 to 185.9999 MHz). The difference between these two signals is selected and applied as the 10.0 to 39.9 MHz input to the VHF Divider Assembly.

The 20 MHz output from the Spectrum Generator Assembly is applied to pins 18 and V of J0851, amplified by A1, and coupled to the input of pulse generator A2. Pulse generator A2 is a one shot with the output applied to a double tuned tank circuit, tuned to 160 MHz. The output of the tuned tank circuit is applied to Q1 and Q7. MOSFET Q1 provides the final amplification and filtering of the 160 MHz signal before it is applied to the input of the Second Local Oscillator Assembly 724-0800.

The 160 MHz signal at Q7 is amplified and applied as one input to MOSFET Up-Mixer Q2. The second signal at Q2 is the 13.9001 to 14.0000 MHz signal from the 14 MHz Up-Mixer and VFO Assembly.

The difference of the two frequencies (approximately 146 MHz) at Q2 is selected by the tuned input circuit of amplifier Q8. From Q8 the 146 MHz signal is applied as one of two input signals at MOSFET Down-Mixer Q4. The second input to Q4 is the first local oscillator output signal, applied at pins 1 and A of J0851 and amplified by Q3. The tuned input circuit of broadband amplifier Q5 and Q6 selects the difference of the two signals at Q4, 10.0 to 39.9 MHz as the output signal to VHF Divider 724-0700 at pins E and 5 of J0851.



8.2.7 VHF DIVIDER ASSEMBLY (724-0770)

VHF Divider Assembly 724-0770, part of loop number two, provides the 25 kHz fine tuning signal to the VHF VCO Assembly for frequency control. The assembly consists of an input broadband amplifier and driver, counters, gate and flip flop circuitry, and a phase detector. Input signals are the 10.0 to 39.9 MHz signal from the Translator Assembly, a 25 kHz reference signal from the Spectrum Generator Assembly, the 10 MHz BCD information from the VHF VCO Assembly, and the 1 MHz and 100 kHz preset control lines from the FREQUENCY MHz switches.

The 10.0 to 39.9 MHz input signal from the Translator Assembly is coupled to pin F of J0701, amplified by broadband amplifier Q1 through Q4 and driver amplifier Q5 and Q6 and applied to the input of divide by four counter A1.

The counters in the VHF Divider Assembly are preset by the FREQUENCY MHz switches (operating frequency) to count the input signal, 10.0 to 39.9 MHz, down to 25 kHz. The output of the counters is then applied to the phase detector where it is compared with the 25 kHz reference signal from the Spectrum Generator. If the input signal at the counters is off frequency (an error in the vhf vco output signal) then the input to the phase detector will contain that frequency error and the phase detector will come out of sync, 25 kHz, and lock either high or low depending on the error. This signal is applied to the VHF VCO Assembly to change the vhf vco frequency (fine tuning) in the direction that will result in eliminating the error in the 25 kHz signal at the phase detector.

A1 is a dual flip flop prescaler which divides the 10-40 MHz input signal by a factor of four. A2, A3 and A4 comprise a pre-settable counter having a full-count capacity of 399. A count is preset into the counter with the 10 MHz, 1 MHz and 100 kHz rotary switches on the front panel in such a way as to allow the counter to reach a full count after a group of pulses, equal in number to the switch setting, has occurred at the input of A2. For example, if the selected frequency is 12.3XXX MHz, the 100 kHz setting, set to 3, will preset A2 to a count of 7, while the 1 MHz setting, set to 2, will

preset A3 to 8. A4 is a dual J-K flip flop connected as a two-stage counter and is preset with a group of gates to allow control with the carry line (connected to the zero position of the 1 MHz switch). Note that counter A3 is inhibited from seeing the Q_D output of A2 by J-K flip flop A6 which changes state after this first pulse has arrived. Counter A4, conversely, is allowed to see the first pulse of the previous stage. This is corrected by setting it to one value lower than would normally be set.

After the full count has occurred, flip flop A5 is enabled for triggering on the next two pulses from the prescaler which first gates a pulse into the phase detector and presets the counters, then reverts back to a resting stage and allows the counters to resume counting.

8.2.8 VHF VCO ASSEMBLY (724-0650)

VHF VCO Assembly 724-0650, part of phase lock loop number two, provides the first local oscillator injection signal (156.0000 – 185.9999 MHz) to the Receiver Module and to the Translator Assembly. The output signal is generated by one of three selectable voltage controlled oscillators (vco). Each oscillator has a 10 MHz bandwidth and is selected by the 10 MHz FREQUENCY MHz switch. Coarse frequency control of the selected oscillator is accomplished by the 1 MHz FREQUENCY MHz control voltage. Fine tuning is provided by the 25 kHz phase detector output from the VHF Divider Assembly. The VHF VCO Assembly consists of three vco's (156-166 MHz, 166-176 MHz, and 176-186 MHz), two dual-stage emitter follower amplifiers, a 25 kHz loop filter, and two BCD converters.

The position of the 10 MHz FREQUENCY MHz switch supplies a closure to ground at either E11 (0 position), E12 (position 1), or E5 (position 2). The ground signal energizes, through transistor switch Q4, Q5, or Q6 respectively, the proper vco. The ground signal at E11 and E12 is also applied to BCD converters Q2 and Q3 which supply the 10 MHz BCD switching information to the VHF Divider Assembly.

Control of the selected vco is accomplished by varactor diodes, two in each vco. The capacitance of



one varactor is controlled by the coarse tuning voltage from the 1 MHz voltage divider network. The other varactor diode is controlled by the output of the 25 kHz loop filter, fine tuning.

The vco output is applied to two amplifiers. Amplifier Q2 and Q4 supply the output of the selected vco to the Translator Assembly as the feedback signal to complete loop number two, paragraph 8.2.6. The other amplifier, Q1 and Q3, supplies the vco output signal to the Receiver Module as the first local oscillator injection signal.

The 25 kHz loop filter adjusts the output of the vco by filtering the rectangular output of the VHF Divider to a dc level.

8.3 PERFORMANCE CHECKS

Perform the following check to determine the overall performance of the Synthesizer Module.

8.3.3 PROCEDURES

8.3.1 TEST EQUIPMENT

NOTE

The following test equipment or equivalent is required to perform the following procedures.

- a. Coax test cable – RF P/N 724-0032
- b. Rf vtvm – Boonton, Model 91C
- c. Frequency counter – Hewlett Packard, Model 5245L with 5253B plug-in head.
- d. BNC "T" adapter, UG/U No. 274A.

8.3.2 PRELIMINARY

- a. At Synthesizer Module disconnect coaxial cables P0505 (yellow), P0504 (green), and P0503 (red).
- b. At front panel of RF-505 set FREQUENCY MHz switches at 1.60000 MHz.

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.3.2. Set MODE switch at LSB.	
2.	Rf vtvm at J0504 (green) terminated with 50 ohm load.	Connect the rf vtvm at J0504 (green) using the coax test cable and measure the voltage.	Greater than 150 mVrms.
3.	Rf counter and rf vtvm terminated with 50 ohm lead at J0504 (green).	Reconnect J0504 (green) and disconnect P0304 (green) from the VHF Filter Assembly. Connect the coax test cable J0304 on the VHF Filter Assembly. Connect the counter, the rf vtvm and the coax test cable with the BNC "T" adapter and measure the frequency.	156.5000 MHz.
4.	Rf vtvm at J0503 (red) terminated with 50 ohm load.	Connect the rf vtvm at J0503 using the coax test cable and measure the voltage.	7 mVrms. Greater than 75 mVrms.
5.	Rf counter at J0503 (red).	Connect the counter to the coax test cable and measure the frequency.	1.0000 MHz.
6.	Rf counter and rf vtvm terminated with 50 ohm lead at J0505 (yellow).	Connect the rf counter at J0505 (yellow) using the coax test cable. Measure the frequency with the front panel FREQUENCY MHz switches set at the following positions: 01.2345 MHz 02.3456 MHz 03.4567 MHz 04.5678 MHz 15.6789 MHz 16.7890 MHz 17.8901 MHz 28.9012 MHz 29.0123 MHz 20.1234 MHz	Counter should indicate the following frequencies: 157.2345 MHz 158.3456 MHz 159.4567 MHz 160.5678 MHz 171.6789 MHz 172.7890 MHz 173.8901 MHz 184.9012 MHz 185.0123 MHz 176.1234 MHz
		Reconnect coaxial cables P0503 (red) and P0505 (yellow).	Greater than 150 mV for each setting.



8.4 FAULT ANALYSIS

The Synthesizer Module fault analysis table is presented in the following subparagraphs. This table is designed to isolate a faulty assembly first and then a faulty stage. If the defective assembly has already been isolated by substitution, then the technician can proceed directly to the appropriate paragraph and proceed from there to isolate the faulty stage. Once a defective stage has been found, refer to the appropriate circuit diagram and make voltage checks to locate the faulty component. Suspected faulty assemblies can be verified by substitution with a known good assembly.

NOTE

After a defective assembly or component has been replaced, proceed to the alignment procedures located in this chapter.

8.4.1 TEST EQUIPMENT

NOTE

The following test equipment or equivalent is required to perform the following procedures.

- a. Oscilloscope – Tektronix, Model 454.
- b. Rf vtvm – Boonton, Model 91C
- c. Frequency Counter – Hewlett-Packard, Model 5245L.
- d. Spectrum Analyzer – Nelson-Ross, Model PSA-11.

e. Rf Signal Generator – Hewlett-Packard, Model 608.

f. 50 ohm Probe Termination – Boonton, Model 91-8B.

g. Extender – RF Communications, RF P/N 724-0060.

h. Coaxial cable terminated with male BNC connector on one end and alligator clips on the other.

i. Coaxial adapter; BNC to miniature – Sealctro No. 51-074-680.

8.4.2 PRELIMINARY

a. At front panel, set MODE switch at OFF, FREQUENCY MHz switches at 1.6000 MHz, SPEAKER switch at OFF, PRESELECTOR switch at OUT.

b. At RF-505A, remove top and Synthesizer Module covers.

c. At Receiver Module, disconnect P1002 (yellow), P1003 (red), and P1004 (green).

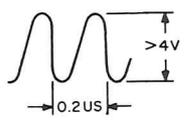
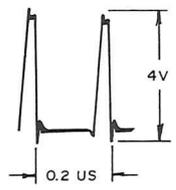
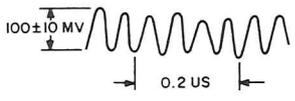
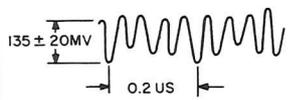
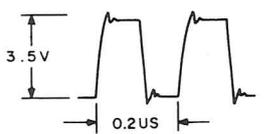
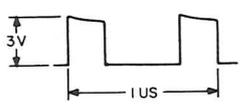
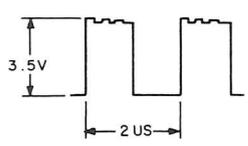
d. At RF-505A set MODE switch at LSB.

NOTE

During the following procedures refer to the circuit diagram associated with the assembly under test.

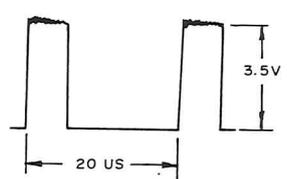
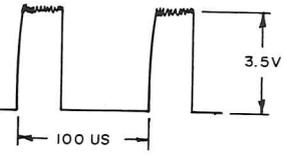
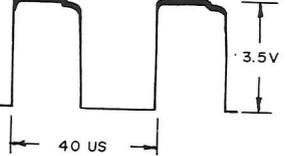
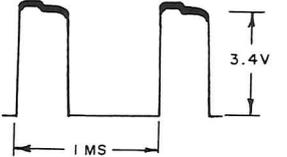


8.4.3 SPECTRUM GENERATOR ASSEMBLY

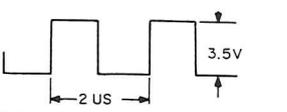
STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2. Using assembly extender (RF P/N 724-0060), extend the Spectrum Generator Assembly for access.	
2.	Oscilloscope probe at J0751 pin P, ground probe on chassis.	Check for proper waveform.	Greater than 500 mV, 5 MHz sinewave.
3.	Oscilloscope probe at A1 pin 6.	Check for proper waveform.	
4.	Oscilloscope probe at A2 pin 11.	Check for proper waveform.	
5.	Oscilloscope probe at A8 pin 2.	Check for proper waveform.	
6.	Oscilloscope probe at A8 pin 6.	Check for proper waveform.	Greater than 2.5 V, 20 MHz sinewave.
7.	Oscilloscope probe at A10 pin 2.	Check for proper waveform.	
8.	Oscilloscope probe at A10 pin 6.	Check for proper waveform.	4 V P-P, 15 MHz sinewave.
9.	Oscilloscope probe at A3 pin 6.	Check for proper waveform.	
10.	Oscilloscope probe at A3 pin 8.	Check for proper waveform.	
11.	Oscilloscope probe at A3 pin 5.	Check for proper waveform.	



8.4.3 SPECTRUM GENERATOR ASSEMBLY (CONT.)

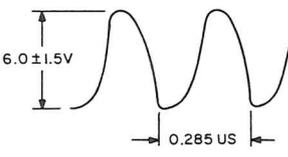
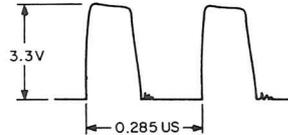
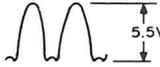
STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
12.	Oscilloscope probe at A4 pin 12.	Check for proper waveform.	
13.	Oscilloscope probe at A5 pin 12.	Check for proper waveform.	
14.	Oscilloscope probe at A5 pin 5.	Check for proper waveform.	
15.	Oscilloscope probe at A6 pin 12.	Check for proper waveform.	
16.	Oscilloscope probe at A9 pin 2.	Check for proper waveform.	 0.1 V pulse occurs every 40 μsec.
17.	Oscilloscope probe at A9 pin 6.	Check for proper waveform.	Greater than 400 mV P-P, 12 MHz sinewave.
18.	Oscilloscope probe at junction of R30 and R31.	Check for proper waveform.	Greater than 350 mV P-P, 12 MHz sinewave.
19.	Oscilloscope probe at junction of C54 and R39.	Check for proper waveform.	Greater than 350 mV P-P, 1 MHz sinewave.

8.4.4 SECOND LOCAL OSCILLATOR GENERATOR ASSEMBLY

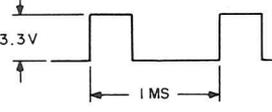
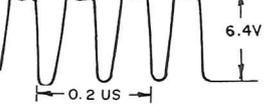
STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2.	
2.	Oscilloscope probe at J0801 pin A, ground probe on chassis.	Using assembly extender (RF P/N 724-0060), extend the Second Local Oscillator Generator Assembly for access. Check for proper waveform.	



8.4.4 SECOND LOCAL OSCILLATOR GENERATOR ASSEMBLY (CONT.)

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
3.	Oscilloscope probe at E2.	Check for proper waveform.	Greater than 4 V P-P, 3.5 MHz sinewave. 
4.	Oscilloscope probe at E1.	Check for proper waveform.	
5.	Oscilloscope probe at TP1.	Check for proper waveform to indicate phase lock.	
6.	Oscilloscope probe at TP2.	Check for proper 19.5625 MHz waveform.	
7.	Oscilloscope probe at A3 pin 8.	Check for proper 19.5625 MHz waveform.	
8.	Oscilloscope probe at J0801 pin V.	Check for proper waveform.	150 mV, 156.5 MHz sinewave.

8.4.5 HF VCO ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2.	
2.	Oscilloscope probe at J0551 pin A, ground probe on chassis.	Using assembly extender (RF P/N 724-0060), extend the Hf Vco Assembly for access. Check for proper waveform. Pulse width will vary slightly with preset frequency.	
3.	Oscilloscope probe at A1 pin 2.	At front panel, rotate 10 kHz, 1 kHz, and 100 Hz switches from 0.0000 to 0.0999 MHz. Check for proper waveform.	200 mV sinewave should vary from 10 MHz to 10.999 MHz.
4.	Oscilloscope probe at E1.	Same as step 3.	8V P-P distorted sinewave should vary from 10 MHz to 10.999 MHz.
5.	Oscilloscope probe at A2 pin 6.	At front panel, set 10 kHz, 1 kHz, and 100 Hz switches at 0.0000 MHz. Check for proper waveform.	



8.4.5 HF VCO ASSEMBLY (CONT.)

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
6.	Oscilloscope probe at E2.	Check for proper waveform.	
7.	Oscilloscope probe at J0551 pin K.	Check for proper waveform.	300 ± 30 mV, 1 MHz sine wave.
8.	Oscilloscope probe at J0551 pin R.	Check for proper 12 MHz waveform.	450 ± 100 mV P-P sinewave.
9.	Oscilloscope probe at base of Q9.	Same as step 3.	Greater than 500 mV, 2 MHz sinewave at 0.0000 MHz. Greater than 650 mV, 1 MHz sinewave at 0.0999 MHz.
10.	Oscilloscope probe at J0551 pin V.	Same as step 3.	

8.4.6 HF DIVIDER ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2. Using assembly extender (RF P/N 724-0060), extend the Hf Divider Assembly for access.	
2.	Oscilloscope probe at J0601 pin V, ground probe on chassis.	At front panel, rotate 10 kHz, 1 kHz, and 100 kHz switches from 0.0000 MHz to 0.0999 MHz. Check for proper waveform.	Same as paragraph 8.4.5, step 10 above.
3.	Oscilloscope probe at A1 pin 6.	Same as step 2.	
4.	Oscilloscope probe at A4 pin 8.	Same as step 2.	
5.	Oscilloscope probe at A4 pin 12.	At front panel, set 10 kHz, 1 kHz, and 100 Hz switches at 0. Rotate 100 Hz switch. Ghost pulse should appear and travel 1/10 of distance between pulses for each increment 100 Hz switch is turned.	



8.4.6 HF DIVIDER ASSEMBLY (CONT.)

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
6.	Oscilloscope probe at A5 pin 12.	At front panel, rotate both 1 kHz and 100 Hz switches to move ghost pulse. Pulses will also diverge as frequency increases.	
7.	Oscilloscope probe at A6 pin 12.	At front panel, rotation of 10 kHz, 1 kHz, and 100 Hz switches will make ghost pulse travel. Pulses will diverge as frequency increases.	
8.	Oscilloscope probe at A7 pin 8.	Check for proper waveform.	Square wave 3.7 V P-P, 1/2 frequency of A6 pin 12 at any one switch setting.
9.	Oscilloscope probe at A3 pin 9.	Check for proper waveform.	
10.	Oscilloscope probe at J0601 pin A.	Check for proper waveform. Pulse width will vary slightly with preset frequency.	Waveform should be the same at any preset frequency. 3.4 V, 1 kHz, variable duty-cycle square wave.

8.4.7 14 MHz UP-MIXER AND VFO ASSEMBLY

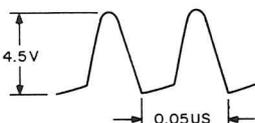
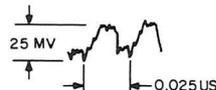
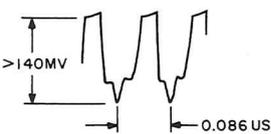
STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2.	
2.	Oscilloscope probe at J0901 pin A, ground probe on chassis.	Using assembly extender (RF P/N 724-0060), extend the 14 MHz Up-Mixer and Vfo Assembly for access.	300 ± 30 mV P-P, 1 MHz sinewave.
3.	Oscilloscope probe at J0901 pin N.	Check for proper waveform.	Greater than 500 mV P-P, 15 MHz sinewave.
4.	Oscilloscope probe at A1 pin 6.	Check for proper waveform.	Greater than 6 V P-P, 15 MHz sinewave.
5.	Oscilloscope probe at J0901 pin H.	Check for proper waveform.	Greater than 250 mV P-P, 14 MHz sinewave.



8.4.7 14 MHZ UP-MIXER AND VFO ASSEMBLY (CONT.)

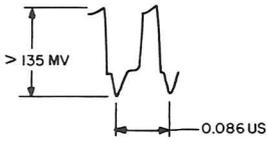
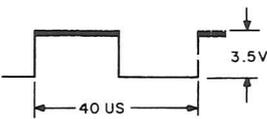
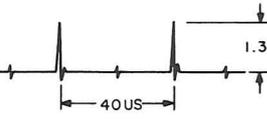
STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
6.	Oscilloscope probe at A3 pin 1.	At front panel, pull out 1 kHz knob and rotate from 0 to 9. Check for proper waveform.	Greater than 125 mV P-P, 1 MHz modulated 14 to 15 MHz waveform.
7.	Oscilloscope probe at A3 pin 6.	Same as step 6.	Greater than 4 V P-P, 1 MHz modulated 14 to 15 MHz sinewave.

8.4.8 TRANSLATOR ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2. Using assembly extender (RF P/N 724-0060), extend the Translator Assembly for access.	
2.	Oscilloscope probe at J0851 pin V, ground probe on chassis.	Check for proper waveform.	Greater than 600 mV P-P, 20 MHz sinewave.
3.	Oscilloscope probe at A1 pin 6.	Check for proper waveform.	Greater than 2.5 V P-P, 20 MHz sinewave.
4.	Oscilloscope probe at A2 pin 6.	Check for proper waveform.	
5.	Oscilloscope probe at J0851 pin R.	Check for proper waveform.	
6.	Rf vtm and oscilloscope probe at TP2.	Check for proper waveform.	Greater than 600 mVrms, 146.0 MHz sinewave.
7.	Rf vtm and oscilloscope probe at junction of R29 and R30.	Check for proper waveform.	Greater than 630 mVrms, 157.6 MHz sinewave.
8.	Oscilloscope probe at base of Q5.	Check for proper waveform.	
9.	Oscilloscope probe at J0851 pin E.	Check for proper waveform.	Same as above.



8.4.9 VHF DIVIDER ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2.	
2.	Oscilloscope probe at J0701 pin F, ground probe on chassis.	Using assembly extender (RF P/N 724-0060), extend Vhf Divider Assembly for access. Using test adapter (RF P/N 724-0708) extend Vhf Divider Board Number 2 for access. Check for proper waveform.	
3.	Oscilloscope probe at J0701 pin A.	Check for proper waveform.	
4.	Oscilloscope probe at J0701 pin B.	Check for proper waveform.	
<p>NOTE</p> <p><i>If waveform is not present, either a high or low condition will exist. By manipulation of the 10 MHz, 1 MHz, and 0.1 MHz switches, the phase detector should be made to change state. If this can be done, it can be assumed that the phase detector is working properly.</i></p>			
5.		At Vhf Vco Assembly 724-0650, ground junction of R11 and R12 to chassis.	
6.	Oscilloscope probe at A1 pin 9.	Set oscilloscope on expanded scale and focus on second pulse. At front panel set FREQUENCY MHz switches at 19.9000 MHz. Rotate 10 MHz switch.	Pulse would move to right in increments for each step.
7.	Same as step 5.	Same as step 5 except rotate 1 MHz switch.	Pulse should move to right in equal increments for each step. Increments should be smaller than in step 5.
8.	Same as step 5.	Same as step 5 except rotate 0.1 MHz switch.	Pulse should move to right in equal increments for each step. Increments should be smaller than in step 6.



8.4.10 VHF VCO ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2.	
2.	Connect frequency counter and rf vtvm with 50 ohm termination to P1002 (yellow) at the Receiver Module.	At front panel set FREQUENCY MHz switches to the following settings. Check for proper output frequency. 01.2345 MHz 02.3456 MHz 03.4567 MHz 04.5678 MHz 15.6789 MHz 16.7890 MHz 17.8901 MHz 28.9012 MHz 29.0123 MHz 20.1234 MHz NOTE <i>If improper results are obtained for any one position of the 10 MHz switch, the most probable fault is one of the vco's. If other improper results are obtained, make sure that none of the other assemblies is at fault before replacing the Vhf Vco Assembly.</i>	Rf vtvm should indicate greater than 75 mV for each reading. 157.2345 MHz 158.3456 MHz 159.4567 MHz 160.5678 MHz 171.6789 MHz 172.7890 MHz 173.8901 MHz 184.9012 MHz 185.0123 MHz 176.1234 MHz

8.5 ALIGNMENT PROCEDURES

8.5.1 SPECTRUM GENERATOR ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2.	
2.	Spectrum analyzer probe at J0751 pin V, ground probe on chassis.	Using assembly extender (RF P/N 724-0060), extend the Spectrum Generator Assembly for access. Tune L2, L3, L4 and L6 for maximum output at 20 MHz. NOTE <i>The adjustments of L2, L3, and L4 interact and the tuning sequence must be repeated until no further increase in output is obtained.</i>	Maximum output at 20 MHz. Undesired signals 5 MHz on either side of 20 MHz are normally present. The strongest of these must be at least 45 dB down from the 20 MHz signal.
3.	Disconnect spectrum analyzer probe from pin V and connect rf vtvm probe. Ground probe on chassis.	Measure 20 MHz output.	Greater than 90 mVrms.



8.5.1 SPECTRUM GENERATOR ASSEMBLY (CONT.)

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
4.	Spectrum analyzer probe at J0751 pin S.	Tune L10, L11, L12, and L14 for maximum output at 15 MHz. NOTE <i>The adjustments of L10, L11 and L12 interact and the tuning sequence must be repeated until no further increase in output is obtained.</i>	Maximum output at 15 MHz. Undesired signals 5 MHz on either side of 15 MHz are normally present. The strongest of these must be at least 28 dB down from the 15 MHz signal.
5.	Disconnect spectrum analyzer probe and connect rf vtvm probe to pin S.	Measure 15 MHz output.	Output greater than 150 mVrms.
6.		Connect rf signal generator to spectrum analyzer and establish 12 MHz as center frequency of spectrum analyzer screen. Disconnect rf signal generator from spectrum analyzer.	
7.	Spectrum analyzer probe at J0751 pin K.	Tune L5, L7, L8, L9, and L13 for maximum output at 12 MHz. NOTE <i>The adjustments of L5, L7, L8, and L9 interact and the tuning sequence must be repeated until no further increase in output is obtained.</i>	Maximum output at 12 MHz. Undesired signals at 1 MHz spacing are normally present. The first four of these, either side of 12 MHz, must be at least 40 dB down from the 12 MHz signal with the exception of the 10 MHz signal which should be greater than 30 dB down.
8.	Disconnect spectrum analyzer probe and connect rf vtvm probe to pin K.	Measure 12 MHz output.	Greater than 95 mVrms.

8.5.2 SECOND LOCAL OSCILLATOR GENERATOR ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
		NOTE <i>Perform the translator alignment procedures, paragraph 8.5.6, before performing the following.</i>	
1.		Perform the preliminary procedures outlined in paragraph 8.4.2. Using assembly extender (RF P/N 724-0060), extend Second Local Oscillator Generator Assembly for access.	
2.	Spectrum analyzer probe at TP2 ground probe on chassis.	Adjust L5 for maximum output at 19.5625 MHz.	Maximum output.
3.	Spectrum analyzer probe at J0801 pin V, ground probe at J0801 pin U. (Use as short a ground lead as possible.)	Adjust C26, C30, C33, C41, and C45 for maximum output at 156.5 MHz. Take care when adjusting C33 and C41, that the 156.5 MHz signal is peaked and not throwing Q5 into oscillation. If C45 can be adjusted through its entire range and not cause any frequency shifting, then C33 and C41 are in their proper range.	Maximum output. All spurious signals must be at least 25 dB down from the 156.5 MHz signal, with the exception of the 160 MHz signal which should be greater than 20 dB down.
4.	Disconnect spectrum analyzer probe and connect rf vtvm probe at pin V.	Measure output and readjust C26, C30, C33, C41, and C45 if necessary.	Greater than 150 mVrms.
5.	Spectrum analyzer probe at TP4.	Tune C40, C3, L15 and L19 for maximum 3.5 MHz signal with least magnitude and number of spurious signals.	Greater than 700 mVrms.



8.5.2 SECOND LOCAL OSCILLATOR GENERATOR ASSEMBLY (CONT.)

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
6.	Oscilloscope probe at TP4.	Tune C40, C3, L15, and L19 for maximum output at 3.5 MHz. NOTE <i>It is normal to observe slight clipping and harmonic distortion on peaks of this waveform.</i> NOTE <i>Because the extender does not present a 50 ohm match to the 160 MHz signal the adjustment of C3 may be different with the assembly on the extender. Therefore, adjust C3 with the assembly on the extender and then remove the extender, install the assembly and note the output. Repeat until a peak is obtained with the assembly in the module. (Marking the side of C3 with a fine pencil may be helpful in making this adjustment.)</i>	Output greater than 2 V peak-to-peak.
7.	Oscilloscope probe at E2.	Tune L3 and L4 for maximum output at 3.5 MHz. Hz.	Output greater than 1 V peak-to-peak.
8.	Oscilloscope probe at TP1.	Adjust L2 until locked waveform is obtained with 50% duty cycle. Slight adjustment of L5 may be necessary.	Locked square wave with 50% duty cycle.

8.5.3 HF VCO ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2. Using assembly extender (RF P/N 724-0060), extend the Hf Vco Assembly for access.	
2.		Turn C10 in all the way, then back off five turns. At front panel, set 1 kHz switch at 5.	
3.	Oscilloscope probe at J0551 pin A, ground probe on chassis.	Adjust L2 until oscilloscope displays 50% duty cycle.	Oscilloscope displays 50% duty cycle.
4.	Same as step 3.	Rotate 1 kHz switch from 0 to 9. NOTE <i>If loop does not stay in lock, back off 1 turn on C10 and repeat steps 3 and 4.</i>	Oscilloscope should display rectangular wave indicating loop lock. The duty cycle will vary between 30% and 70%.

8.5.4 HF DIVIDER ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
		Alignment of this assembly is not required.	



8.5.5 14 MHz UP-MIXER AND VFO ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Perform the preliminary procedures outlined in paragraph 8.4.2.	
2.		Using assembly extender (RF P/N 724-0060), extend the 14 MHz Up-Mixer and VFO Assembly for access.	
3.	Spectrum analyzer probe at J0901 pin H, ground probe on chassis.	Connect rf signal generator to the spectrum analyzer and establish a 14 MHz center frequency on the screen. Disconnect rf signal generator.	Peak 14 MHz signal.
4.	Same as step 3.	Adjust L3, L5, L6, and L7 in sequence for maximum 14 MHz output. Peak 14 MHz output and diminish 15 MHz sideband with L2.	Null 15 MHz signal.
5.	Same as step 3.	Null 15 MHz signal with C14.	Peak 14 MHz signal, balanced 1 MHz sidebands.
6.	Same as step 3.	Repeat steps 4 and 5.	
7.	Same as step 3.	Adjust L5, L6, and L7 for maximum output at 14 MHz.	Maximum output at 14 MHz.
8.	Same as step 3.	Repeat steps 3, 4, 5 and 6 until 1 MHz sidebands are suppressed more than 40 dB below 14 MHz at maximum.	1 MHz sidebands suppressed more than 40 dB below 14 MHz at maximum.
9.	Rf vtvm probe at J0901 pin H, ground probe on chassis.	Measure 14 MHz output voltage.	Greater than 100 mVrms.
10.		At front panel, pull out 1 kHz switch to activate vfo.	
11.	Frequency counter at A3 pin 6, ground probes on chassis.	At front panel set 1 kHz switch at 9 with switch still pulled out. Adjust L9 for 14.990 MHz \pm 200 Hz.	14.990 MHz \pm 200 Hz.
12.	Same as step 11.	Rotate 1 kHz switch to 5. Measure frequency.	14.995 MHz \pm kHz.
13.	Same as step 11.	Rotate 1 kHz switch to 0. Measure frequency.	15.000 MHz \pm kHz.
14.	Same as step 9.	Measure 14 MHz output voltage.	Greater than 100 mVrms

8.5.6 TRANSLATOR ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.		Refer to figure 8.1, remove Second Local Oscillator Assembly. Solder a 50 ohm resistor between pins R and P on the extender card as near to the top (female) connector as is possible. Keep the resistor leads also as short as possible.	
2.	Spectrum analyzer probe at J0851 pin R, ground probe at J0851 pin P. (Use as short a ground lead as possible.)	Perform the preliminary procedures outlined in paragraph 8.4.2. Using modified assembly extender (RF P/N 724-0060), extend Translator Assembly for access. Tune C6, C7, C8, C12, and C17 for maximum output at 160 MHz.	Maximum output at 160 MHz. Spurious signals should be greater than 30 dB down from the 160 MHz signal.
<p>NOTE</p> <p><i>The adjustments of C7, C8, and C12 interact slightly and must be repeated until no further increase in output is obtained.</i></p>			



8.5.6 TRANSLATOR ASSEMBLY (CONT.)

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
3.	Disconnect spectrum analyzer probe and connect rf vtvm probe to J0851 pin R, ground probe on chassis.		Output should be greater than 100 mVrms.
4.	Spectrum analyzer probe at TP1.	Tune C23 for maximum output at 160 MHz. Use BNC to miniature (Seaelectro No. 51-074-680) for making this measurement.	Maximum output at 160 MHz. Spurious signals should be greater than 20 dB down from the 160 MHz signal.
5.	Disconnect spectrum analyzer and connect rf vtvm probe at TP1.		Maximum output of 160 MHz. Greater than 50 mVrms.
6.	Spectrum analyzer probe at TP2.	Tune C28, C33, and C37 for maximum output at 146 MHz. Use BNC to miniature (Seaelectro No. 51-074-680) for making this measurement.	Maximum output at 146 MHz. Spurious signal at 160 MHz should be at least 35 dB down from the 146 MHz signal.
7.	Disconnect spectrum analyzer and connect rf vtvm probe at TP2.	Measure output voltage.	Greater than 125 mVrms.
8.		Remove 50 ohm resistor from P0801 and install Second Local Oscillator Assembly.	

8.5.7 VHF DIVIDER ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
		Alignment of this assembly is not required.	

8.5.8 VHF VCO ASSEMBLY

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
		Alignment of this assembly is not required.	



8.6 CIRCUIT DIAGRAMS AND PARTS LISTS

NOTE

The parts list of the assemblies are located on the backs of the circuit diagrams.

NOTES



USB/AM FILTER ASSEMBLY -- 724-1150

REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G	IC-0030
A2	Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G	IC-0030
C1	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C2	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C3	Capacitor, Ceramic, Disk, 0.1 UF +80% -20%; 50 Vdcw	C-3202
C4	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C5	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C6	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C7	Capacitor, Mica, 680 PF ± 5%; 500 Vdcw	C-0148
C8	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C9	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C10	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C11	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C12	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C13	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C14	Capacitor, Mica, 680 PF ± 5%; 500 Vdcw	C-0148
C15	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C16	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C17	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C18	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C19	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C20	Capacitor, Mica, 680 PF ± 5%; 500 Vdcw	C-0148
C21	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C22	Capacitor, Ceramic, Disk, 0.1 UF +80% -20%; 50 Vdcw	C-3202
C23	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C24	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C25	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C26	Capacitor, Mica, 680 PF ± 5%; 500 Vdcw	C-0148
C27	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C28	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C29	Capacitor, Tantalum, 22 UF ± 10%; 50 Vdcw	C-5935
C30	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C31	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C32	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C33	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065

USB/AM FILTER ASSEMBLY -- 724-1150 (Cont.)

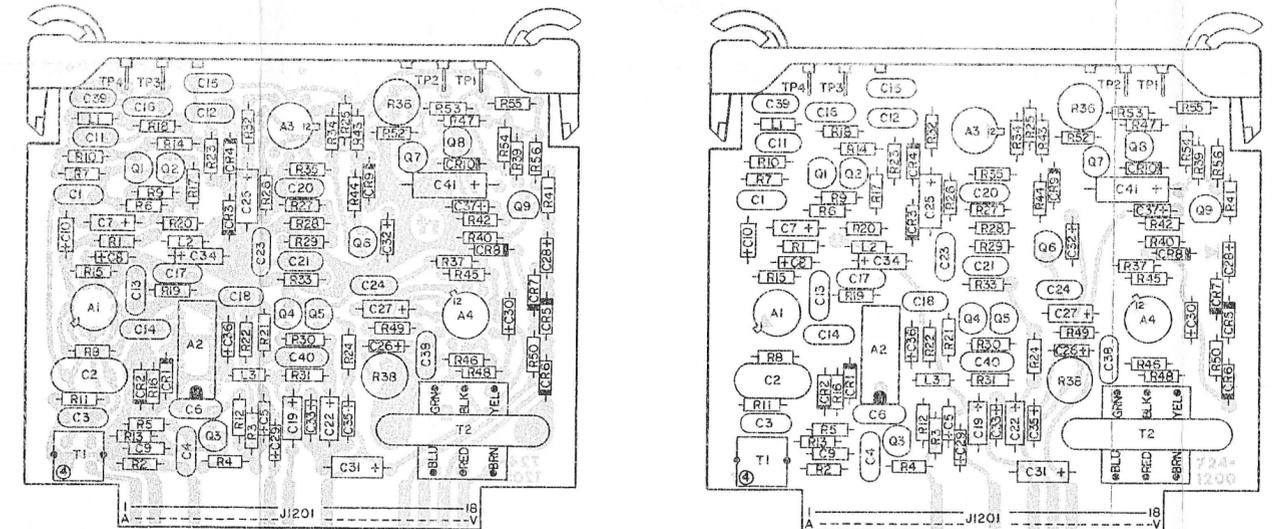
REF DESIG	DESCRIPTION	RF PART NUMBER
C34	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
CR1	Diode, Silicon, Type 1N4454	CR-0705
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Silicon, Type 1N4454	CR-0705
CR4	Diode, Silicon, Type 1N4454	CR-0705
FL1	Filter, Mechanical, 500 KHz, USB	724-1160
FL2	Filter, Ceramic, 500 KHz, AM	724-1161
L1	Coil, Rf, 1 MH	L-0652
L2	Coil, Rf, 1 MH	L-0652
L3	Coil, Rf, 1 MH	L-0652
L4	Coil, Rf, 1 MH	L-0652
L5	Coil, Rf, 1 MH	L-0652
L6	Coil, Rf, 1 MH	L-0652
L7	Coil, Rf, 1 MH	L-0652
L8	Coil, Rf, 1 MH	L-0652
Q1	Transistor, Silicon General Purpose, NPN, Type 2N4124	Q-0385
Q2	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
R1	Resistor, Carbon; 8200 ohms ± 5%; 1/4W	R-1271
R2	Resistor, Carbon; 180 ohms ± 5%; 1/4W	R-1231
R3	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R4	Resistor, Carbon; 1200 ohms ± 5%; 1/4W	R-1251
R5	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R6	Resistor, Carbon; 330 ohms ± 5%; 1/4W	R-1237
R7	Resistor, Carbon; 8200 ohms ± 5%; 1/4W	R-1271
R8	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R9	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R10	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R11	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R12	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R13	Resistor, Carbon; 22K ± 5%; 1/4W	R-1281
R14	Resistor, Carbon; 2700 ohms ± 5%; 1/4W	R-1259
R15	Resistor, Carbon; 18K ± 5%; 1/4W	R-1279
R16	Resistor, Carbon; 330 ohms ± 5%; 1/4W	R-1237
R17	Resistor, Variable, 1K ± 10%; 1/2W	R-7210
R18	Resistor, Carbon; 330 ohms ± 5%; 1/4W	R-1237
R19	Resistor, Carbon; 18K ± 5%; 1/4W	R-1279
R20	Resistor, Carbon; 4700 ohms ± 5%; 1/4W	R-1265
R21	Resistor, Carbon; 22K ± 5%; 1/4W	R-1281
R22	Resistor, Carbon; 15K ± 5%; 1/4W	R-1277
R23	Resistor, Carbon; 1200 ohms ± 5%; 1/4W	R-1251
R24	Resistor, Carbon; 47 ohms ± 5%; 1/4W	R-1217
R25	Resistor, Carbon; 470 ohms ± 5%; 1/4W	R-1241
R30	Resistor, Carbon; 330 ohms ± 5%; 1/4W	R-1237
R31	Resistor, Carbon; 330 ohms ± 5%; 1/4W	R-1237
T1	Transformer, Interstage, Variable, 500 KHz	724-1162
T2	Transformer, Interstage, Variable, 500 KHz	724-1162
T3	Transformer, Interstage, Variable, 500 KHz	724-1162
T4	Transformer, Interstage, Variable, 500 KHz	724-1162
-	Ejector, P.C. Board	MP-1434

LSB/CW FILTER ASSEMBLY -- 724-1175

REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G	IC-0030
A2	Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G	IC-0030
C1	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C2	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C3	Capacitor, Ceramic, Disk, 0.1 UF +80% -20%; 50 Vdcw	C-3202
C4	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C5	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C6	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C7	Capacitor, Mica, 680 PF ± 5%; 500 Vdcw	C-0148
C8	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C9	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C10	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C11	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C12	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C13	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C14	Capacitor, Mica, 680 PF ± 5%; 500 Vdcw	C-0148
C15	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C16	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C17	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C18	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C19	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C20	Capacitor, Mica, 680 PF ± 5%; 500 Vdcw	C-0148
C21	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C22	Capacitor, Ceramic, Disk, 0.1 UF +80% -20%; 50 Vdcw	C-3202
C23	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C24	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C25	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C26	Capacitor, Mica, 680 PF ± 5%; 500 Vdcw	C-0148
C27	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C28	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C29	Capacitor, Tantalum, 22 UF ± 10%; 50 Vdcw	C-5956
C30	Capacitor, Tantalum, 0.47 UF ± 10%; 50 Vdcw	C-5956
C31	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C32	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C33	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065

LSB/CW FILTER ASSEMBLY -- 724-1175 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
C34	Capacitor, Ceramic, Disk, 0.01 UF +60% -40%; 150 Vdcw	C-0065
CR1	Diode, Silicon, Type 1N4454	CR-0705
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Silicon, Type 1N4454	CR-0705
CR4	Diode, Silicon, Type 1N4454	CR-0705
FL1	Filter, Mechanical, 500 kHz, LSB	724-1185
*FL2	Filter, Mechanical, 500 kHz, CW	724-1186
L1	Coil, Rf, 1 MH	L-0652
L2	Coil, Rf, 1 MH	L-0652
L3	Coil, Rf, 1 MH	L-0652
L4	Coil, Rf, 1 MH	L-0652
L5	Coil, Rf, 1 MH	L-0652
L6	Coil, Rf, 1 MH	L-0652
L7	Coil, Rf, 1 MH	L-0652
L8	Coil, Rf, 1 MH	L-0652
Q1	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q2	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
R1	Resistor, Carbon; 8200 ohms ± 5%; 1/4W	R-1271
R2	Resistor, Carbon; 180 ohms ± 5%; 1/4W	R-1231
R3	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R4	Resistor, Carbon; 1200 ohms ± 5%; 1/4W	R-1251
R5	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R6	Resistor, Carbon; 330 ohms ± 5%; 1/4W	R-1237
R7	Resistor, Carbon; 8200 ohms ± 5%; 1/4W	R-1271
R8	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R9	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R10	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R11	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R12	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R13	Resistor, Carbon; 22K ± 5%; 1/4W	R-1281
R14	Resistor, Carbon; 2700 ohms ± 5%; 1/4W	R-1259
R15	Resistor, Carbon; 18K ± 5%; 1/4W	R-1279
R16	Resistor, Carbon; 330 ohms ± 5%; 1/4W	R-1237
R17	Resistor, Variable, 1K ± 10%; 1/2W	R-7210
R18	Resistor, Carbon; 330 ohms ± 5%; 1/4W	R-1237
R19	Resistor, Carbon; 18K ± 5%; 1/4W	R-1279
R20	Resistor, Carbon; 4700 ohms ± 5%; 1/4W	R-1265
R21	Resistor, Carbon; 22K ± 5%; 1/4W	R-1281
R22	Resistor, Carbon; 15K ± 5%; 1/4W	R-1277
R23	Resistor, Carbon; 1200 ohms ± 5%; 1/4W	R-1251
R24	Resistor, Carbon; 47 ohms ± 5%; 1/4W	R-1217
R25	Resistor, Carbon; 470 ohms ± 5%; 1/4W	R-1241
T1	Transformer, Interstage, Variable, 500 kHz	724-1162
T2	Transformer, Interstage, Variable, 500 kHz	724-1162
T3	Transformer, Interstage, Variable, 500 kHz	724-1162
T4	Transformer, Interstage, Variable, 500 kHz	724-1162
-	Ejector, P.C. Board	MP-1434

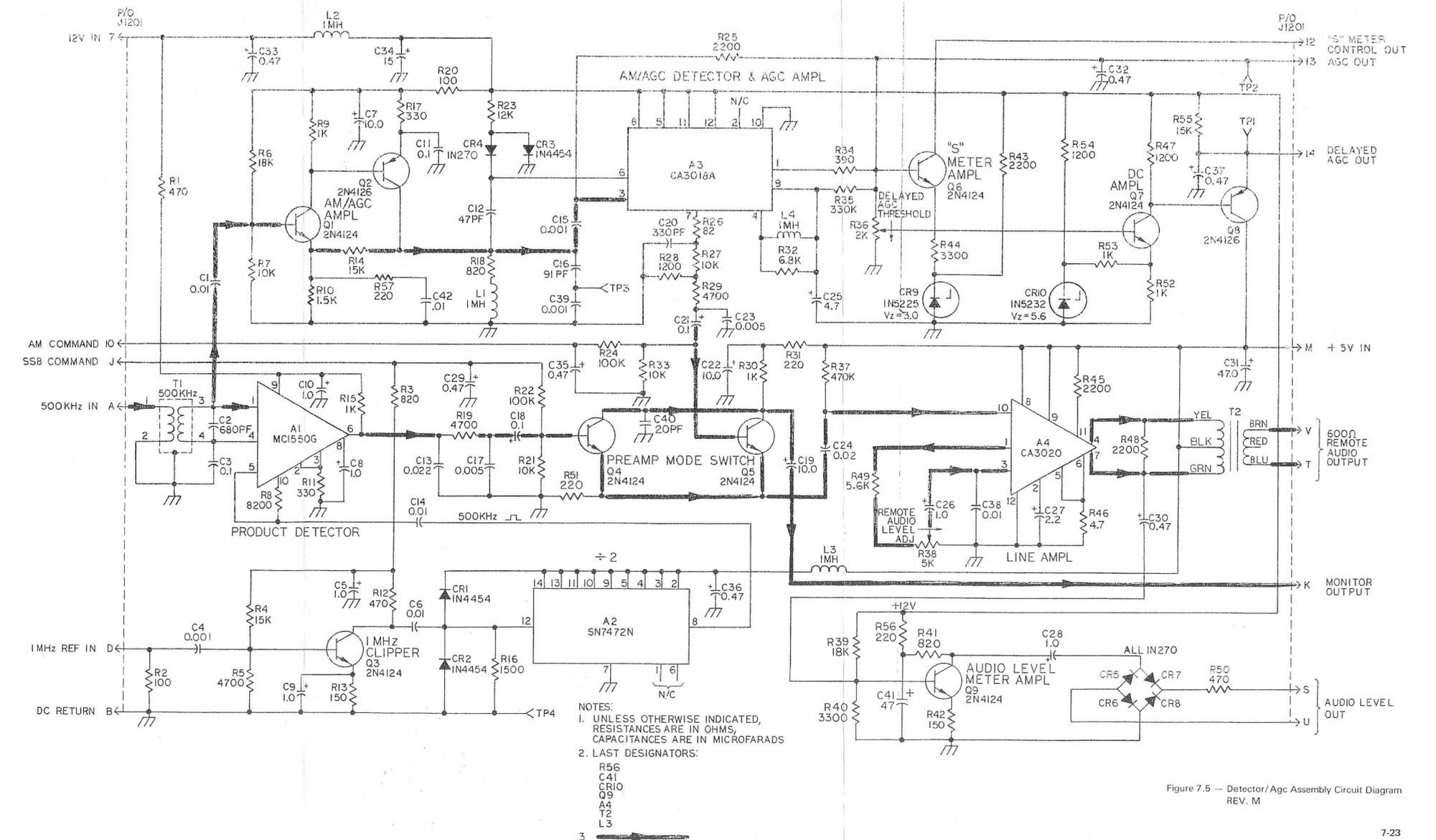


A. Component Locations with Opposite Side Foil
B. Component Locations with Adjacent Side Foil

DC VOLTAGES*

Stage	E	B	C	MODE Switch Position										
				Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12	Pin 13	Pin 14
Q1	0.53	1.20	8.40											
Q2	9.00	8.40	4.10											
Q3	0.87	1.50	4.30											
Q4	0.91	1.55	3.00	USB										
Q5	0.65	0.00	3.75	AM										
Q5	0.91	0.00	3.00	USB										
Q5	0.65	1.30	3.75	AM										
Q6	2.45	1.70	12.4											
Q7	2.55	1.50	11.0											
Q8	11.0	11.0	5.40											
Q9	1.05	1.70	5.40											
A1	1.75	1.00	1.00	1.75	6.00	9.80	0.00	6.20	11.0	6.0				
A2	0.00	5.00	5.00	5.00	5.00	0.00	0.00	6.40	5.00	5.00	5.00	7.60	5.00	5.00
A3	1.75	2.00	1.00	1.25	12.0	0.75	1.50	12.0	1.25	0.00	12.0			
A4	0.00	3.20	1.00	1.00	5.00	0.00	0.00	5.00	5.00	0.50	2.25			

*Referenced to ground.

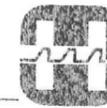


- NOTES:
1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS
2. LAST DESIGNATORS:

- R56
- C41
- CR10
- Q9
- A4
- T2
- L3

3 DENOTES SIGNAL FLOW.

Figure 7.5 - Detector/Agc Assembly Circuit Diagram REV. M



DETECTOR/AGC ASSEMBLY -- 724-1200

REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Integrated Circuit, Differential/Cascode Amplifier, Type MC 1550G	IC-0030
A2	Integrated Circuit, Flip Flop, Type SN7472N	IC-0016
A3	Integrated Circuit, Transistor Array, Type CA3018	IC-0035
A4	Integrated Circuit, Audio Amplifier, Type CA3020	IC-0037
C1	Capacitor, Ceramic, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C2	Capacitor, Mica, 680 PF ±5%; 500 Vdcw	C-0148
C3	Capacitor, Ceramic, 0.1 UF +80% -20%; 50 Vdcw	C-3202
C4	Capacitor, Ceramic, 0.001 UF; 500 Vdcw	C-0001
C5	Capacitor, Tantalum, Polar, 1.0 UF ±10%; 50 Vdcw	C-5958
C6	Capacitor, Ceramic, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C7	Capacitor, Tantalum, Polar, 10 UF ±10%; 50 Vdcw	C-5929
C8	Capacitor, Tantalum, Polar, 1.0 UF ±10%; 50 Vdcw	C-5958
C9	Capacitor, Tantalum, Polar, 1.0 UF ±10%; 50 Vdcw	C-5958
C10	Capacitor, Tantalum, Polar, 1.0 UF ±10%; 50 Vdcw	C-5958
C11	Capacitor, Ceramic, 0.1 UF +80% -20%; 50 Vdcw	C-3202
C12	Capacitor, Mica, 47 PF ±5%; 500 Vdcw	C-0117
C13	Capacitor, Ceramic, 0.02 UF +100% -20%; 30 Vdcw	C-0059
C14	Capacitor, Ceramic, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C15	Capacitor, Ceramic, 0.001 UF; 500 Vdcw	C-0001
C16	Capacitor, Mica, 91 PF ±5%; 500 Vdcw	C-0125
C17	Capacitor, Ceramic, 0.005 UF +60% -40%; 150 Vdcw	C-0064
C18	Capacitor, Ceramic, 0.1 UF +80% -20%; 50 Vdcw	C-3202
C19	Capacitor, Tantalum, Polar, 10 UF ±10%; 20 Vdcw	C-5929
C20	Capacitor, Mica, 330 PF ±5%; 500 Vdcw	C-0139
C21	Capacitor, Ceramic, 0.1 UF +80% -20%; 50 Vdcw	C-3202
C22	Capacitor, Tantalum, Polar, 10 UF ±10%; 20 Vdcw	C-5929
C23	Capacitor, Ceramic, 0.005 UF +60% -40%; 150 Vdcw	C-0064
C24	Capacitor, Ceramic, 0.022 UF +100% -20%; 30 Vdcw	C-0059
C25	Capacitor, Tantalum, Polar, 4.7 UF ±10%; 50 Vdcw	C-5962
C26	Capacitor, Tantalum, Polar, 1.0 UF ±10%; 50 Vdcw	C-5958
C27	Capacitor, Tantalum, Polar, 3.2 UF ±10%; 50 Vdcw	C-5960
C28	Capacitor, Tantalum, Polar, 1.0 UF ±10%; 50 Vdcw	C-5958
C29	Capacitor, Tantalum, Polar, 0.47 UF ±10%; 50 Vdcw	C-5956
C30	Capacitor, Tantalum, Polar, 0.47 UF ±10%; 50 Vdcw	C-5956
C31	Capacitor, Tantalum, Polar, 47 UF ±10%; 50 Vdcw	C-5941
C32	Capacitor, Tantalum, Polar, 0.47 UF ±10%; 50 Vdcw	C-5956

DETECTOR/AGC ASSEMBLY -- 724-1200 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
C33	Capacitor, Tantalum, Polar, 0.47 UF 10%; 50 Vdcw	C-5956
C34	Capacitor, Tantalum, Polar, 22 UF 10%; 50 Vdcw	C-5935
C35	Capacitor, Tantalum, Polar, 0.47 UF 10%; 50 Vdcw	C-5956
C36	Capacitor, Tantalum, Polar, 0.47 UF 10%; 50 Vdcw	C-5956
C37	Capacitor, Tantalum, Polar, 0.47 UF 10%; 50 Vdcw	C-5956
C38	Capacitor, Ceramic, 0.01 UF +60% -40%; 150 Vdcw	C-0065
C39	Capacitor, Ceramic, 0.001 UF; 500 Vdcw	C-0001
C40	Capacitor, Mica, 20 PF ±5%; 500 Vdcw	C-0108
C41	Capacitor, Tantalum, 47 UF ±10%; 50 Vdcw	C-5942
C42	Capacitor, Ceramic, 0.01 UF +60% -40%; 150 Vdcw	C-0065
CR1	Diode, Silicon, Type 1N4454	CR-0705
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Silicon, Type 1N4454	CR-0705
CR4	Diode, Silicon, Type 1N270	CR-0047
CR5	Diode, Silicon, Type 1N270	CR-0047
CR6	Diode, Silicon, Type 1N270	CR-0047
CR7	Diode, Silicon, Type 1N270	CR-0047
CR8	Diode, Silicon, Type 1N270	CR-0047
CR9	Diode, Zener 3.0 Vdc ±10%, Type 1N5225	CR-0204
CR10	Diode, Zener 5.6 Vdc ±10%, Type 1N5232	CR-0265
L1	Coil, Rf, 1 MH	L-0652
L2	Coil, Rf, 1 MH	L-0652
L3	Coil, Rf, 1 MH	L-0652
L4	Coil, Rf, 1 MH	L-0652
Q1	Transistor, Silicon, General Purpose, NPN, 2N4124	Q-0385
Q2	Transistor, Silicon, General Purpose, PNP, 2N4126	Q-0386
Q3	Transistor, Silicon, General Purpose, NPN, 2N4124	Q-0385
Q4	Transistor, Silicon, General Purpose, NPN, 2N4124	Q-0385
Q5	Transistor, Silicon, General Purpose, NPN, 2N4124	Q-0385
Q6	Transistor, Silicon, General Purpose, NPN, 2N4124	Q-0385
Q7	Transistor, Silicon, General Purpose, NPN, 2N4124	Q-0385
Q8	Transistor, Silicon, General Purpose, PNP, 2N4126	Q-0386
Q9	Transistor, Silicon, General Purpose, NPN, 2N4124	Q-0385
R1	Resistor, Carbon; 470 ohms ±5%; 1/4W	R-1241
R2	Resistor, Carbon; 100 ohms ±5%; 1/4W	R-1225
R3	Resistor, Carbon; 820 ohms ±5%; 1/4W	R-1247
R4	Resistor, Carbon; 15K ±5%; 1/4W	R-1277
R5	Resistor, Carbon; 4700 ohms ±5%; 1/4W	R-1265
R6	Resistor, Carbon; 18K ±5%; 1/4W	R-1279
R7	Resistor, Carbon; 10K ±5%; 1/4W	R-1273
R8	Resistor, Carbon; 8200 ohms ±5%; 1/4W	R-1271
R9	Resistor, Carbon; 1K ±5%; 1/4W	R-1249
R10	Resistor, Carbon; 1.5K ±5%; 1/4W	R-1253
R11	Resistor, Carbon; 330 ohms ±5%; 1/4W	R-1237
R12	Resistor, Carbon; 470 ohms ±5%; 1/4W	R-1241
R13	Resistor, Carbon; 150 ohms ±5%; 1/4W	R-1229
R14	Resistor, Carbon; 15K ±5%; 1/4W	R-1277
R15	Resistor, Carbon; 1K ±5%; 1/4W	R-1249

DETECTOR/AGC ASSEMBLY -- 724-1200 (Cont.)

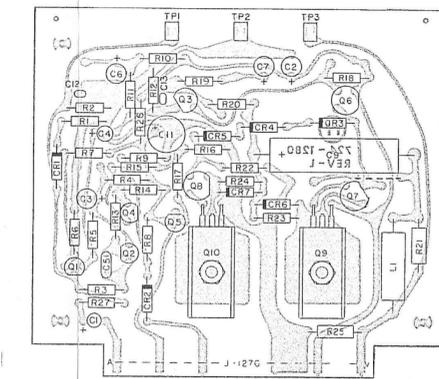
REF DESIG	DESCRIPTION	RF PART NUMBER
R16	Resistor, Carbon; 1500 ohms ±5%; 1/4W	R-1253
R17	Resistor, Carbon; 330 ohms ±5%; 1/4W	R-1237
R18	Resistor, Carbon; 820 ohms ±5%; 1/4W	R-1247
R19	Resistor, Carbon; 4700 ohms ±5%; 1/4W	R-1265
R20	Resistor, Carbon; 100 ohms ±5%; 1/4W	R-1225
R21	Resistor, Carbon; 10K ±5%; 1/4W	R-1273
R22	Resistor, Carbon; 100K ±5%; 1/4W	R-1297
R23	Resistor, Carbon; 12K ±5%; 1/4W	R-1275
R24	Resistor, Carbon; 100K ±5%; 1/4W	R-1297
R25	Resistor, Carbon; 2200 ohms ±5%; 1/4W	R-1257
R26	Resistor, Carbon; 82 ohms ±5%; 1/4W	R-1223
R27	Resistor, Carbon; 10K ±5%; 1/4W	R-1273
R28	Resistor, Carbon; 1200 ohms ±5%; 1/4W	R-1251
R29	Resistor, Carbon; 4700 ohms ±5%; 1/4W	R-1265
R30	Resistor, Carbon; 1K ±5%; 1/4W	R-1249
R31	Resistor, Carbon; 220 ohms ±5%; 1/4W	R-1233
R32	Resistor, Carbon; 6.8K ±5%; 1/4W	R-1269
R33	Resistor, Carbon; 10K ±5%; 1/4W	R-1273
R34	Resistor, Carbon; 390 ohms ±5%; 1/4W	R-1239
R35	Resistor, Carbon; 330K ±5%; 1/4W	R-1309
R36	Resistor, Variable, Single turn; 2K ±5%; 1/2W	R-7212
R37	Resistor, Carbon; 470K ±5%; 1/4W	R-1313
R38	Resistor, Variable, Single turn, 5K ±10%; 1/2W	R-7216
R39	Resistor, Carbon; 18K ±5%; 1/4W	R-1279
R40	Resistor, Carbon; 3300 ohms ±5%; 1/4W	R-1261
R41	Resistor, Carbon; 820 ohms ±5%; 1/4W	R-1247
R42	Resistor, Carbon; 150 ohms ±5%; 1/4W	R-1229
R43	Resistor, Carbon; 2200 ohms ±5%; 1/4W	R-1257
R44	Resistor, Carbon; 3300 ohms ±5%; 1/4W	R-1261
R45	Resistor, Carbon; 2200 ohms ±5%; 1/4W	R-1257
R46	Resistor, Composition; 4700 ohms ±5%; 1/4W	R-0856
R47	Resistor, Carbon; 1200 ohms ±5%; 1/4W	R-1251
R48	Resistor, Carbon; 2200 ohms ±5%; 1/4W	R-1257
R49	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R50	Resistor, Carbon; 470 ohms ±5%; 1/4W	R-1241
R51	Resistor, Carbon; 220 ohms ±5%; 1/4W	R-1233
R52	Resistor, Carbon; 1K ±5%; 1/4W	R-1249
R53	Resistor, Carbon; 1K ±5%; 1/4W	R-1249
R54	Resistor, Carbon; 1200 ohms ±5%; 1/4W	R-1251
R55	Resistor, Carbon; 15K ±5%; 1/4W	R-1277
R56	Resistor, Carbon; 220 ohms ±5%; 1/4W	R-1233
R57	Resistor, Carbon; 220 ohms ±5%; 1/4W	R-1233
T1	Transformer, Variable, 500 kHz	724-1210
T2	Transformer, Audio, 150 ohms C.T. to 500 ohms C.T.	724-1211
-	Ejector, P.C. Board, with jacks	MP-1434



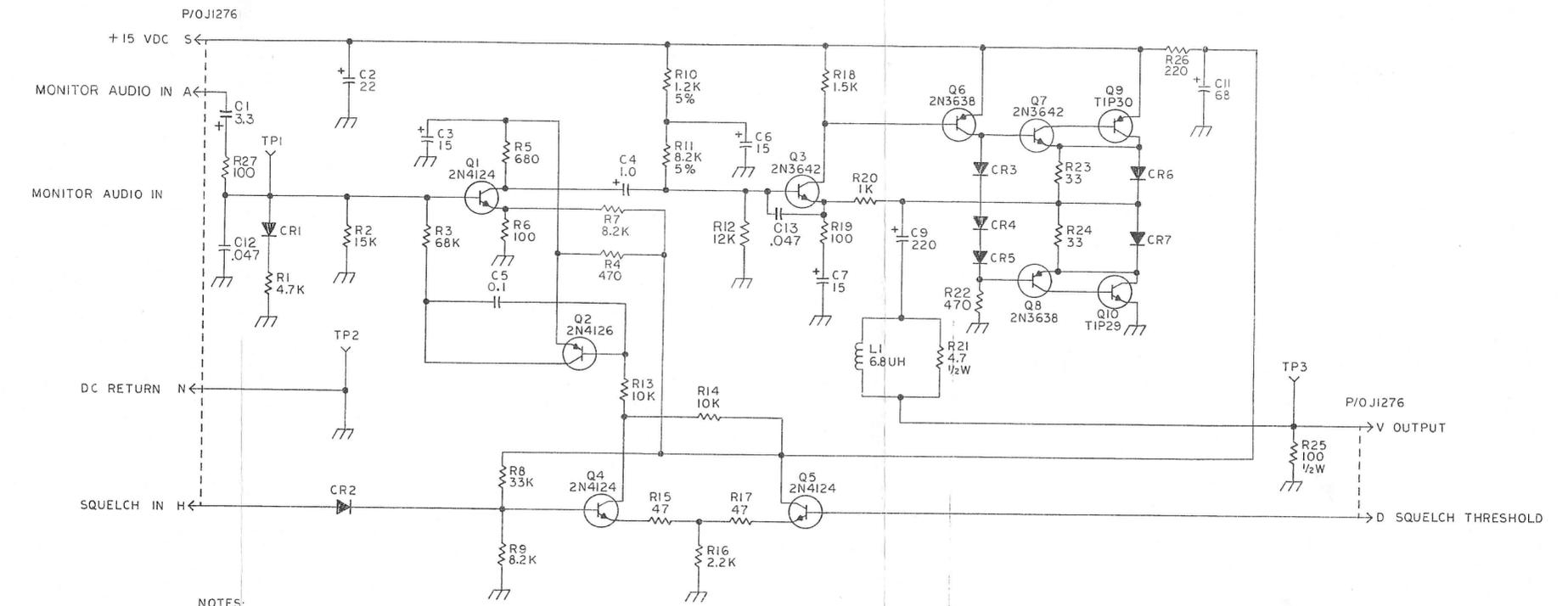
SPEAKER DRIVER
 DC VOLTAGES*

Stage	E	B	C	Squelch Knob Position
Q1	0.32	0.97	13.3	Fully clockwise
Q1	0.18	0.00	15.17	Fully counterclockwise
Q2	14.25	13.56	14.24	Fully clockwise
Q2	15.17	15.14	0.00	Fully counterclockwise
Q3	8.32	8.90	14.52	
Q4	2.58	3.22	8.44	Fully clockwise
Q4	6.58	3.26	15.16	Fully counterclockwise
Q5	2.52	1.98	15.19	Fully clockwise
Q5	6.76	7.32	15.17	Fully counterclockwise
Q6	15.2	14.52	8.74	
Q7	8.18	8.74	14.61	
Q8	7.33	6.74	0.57	
Q9	15.19	14.61	8.18	
Q10	0.00	0.57	7.33	

*Referenced to ground



Component Locations with Opposite Side Foil



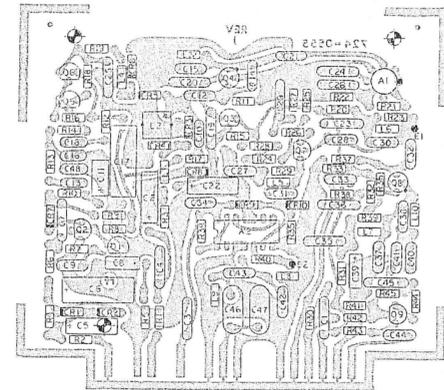
- NOTES:
- UNLESS OTHERWISE SPECIFIED:
 ALL DIODES ARE IN4004
 RESISTANCE VALUES ARE GIVEN IN OHMS
 CAPACITANCE VALUES ARE GIVEN IN MICROFARADS
 - LAST DESIGNATORS USED:
 C13
 CR7
 L1
 Q10
 R27
 TP3

Figure 7.6 - Speaker Driver and Squelch Gate Assembly Circuit Diagram
 REV. J

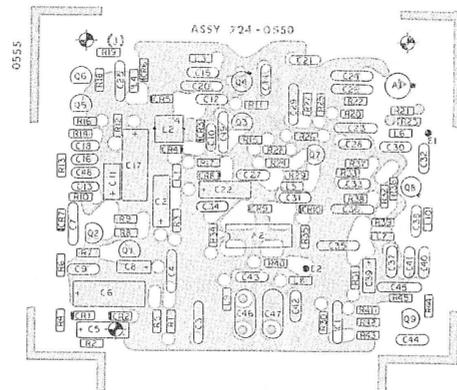


**SPEAKER DRIVER AND SQUELCH GATE
ASSEMBLY - 724-1275**

REF DESIG	DESCRIPTION	RF PART NUMBER
C1	Capacitor, Tantalum, 3.3 UF; 15 Vdcw	C-3101
C2	Capacitor, Tantalum, 22 UF; 35 Vdcw	C-6429
C3	Capacitor, Tantalum, 15 UF; 20 Vdcw	C-3103
C4	Capacitor, Tantalum, 1.0 UF; 35 Vdcw	C-3100
C5	Capacitor, Ceramic, 0.1 UF; 50 Vdcw; +80% -20%	C-3202
C6	Capacitor, Tantalum, 15 UF; 20 Vdcw	C-3103
C7	Capacitor, Tantalum, 15 UF; 20 Vdcw	C-3103
C9	Capacitor, Tantalum, 220 UF; 20 Vdcw	C-4166
C11	Capacitor, Tantalum, 68 UF; 25 Vdcw	C-3105
C12	Capacitor, Ceramic, .047 UF; 50 Vdcw; +80% -20%	C-3201
C13	Capacitor, Ceramic, .047 UF; 50 Vdcw; +80% -20%	C-3201
CR1	Diode, Type 1N4004	CR-0725
CR2	Diode, Type 1N4004	CR-0725
CR3	Diode, Type 1N4004	CR-0725
CR4	Diode, Type 1N4004	CR-0725
CR5	Diode, Type 1N4004	CR-0725
CR6	Diode, Type 1N4004	CR-0725
CR7	Diode, Type 1N4004	CR-0725
L1	Choke, Filament, 6.8 UH	L-0511
Q1	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q2	Transistor, Silicon, General Purpose, NPN, Type 2N4126	Q-0386
Q3	Transistor, Type 2N3642	Q-0320
Q4	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q5	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q6	Transistor, Type 2N3638	Q-0306
Q7	Transistor, Type 2N3642	Q-0320
Q8	Transistor, Type 2N3638	Q-0306
Q9	Transistor, Silicon, PNP, Type TIP30A	Q-0037
Q10	Transistor, Silicon, PNP, Type TIP29A	Q-0049
R1	Resistor, Carbon; 4.7K \pm 5%; 1/4W	R-1265
R2	Resistor, Carbon; 15K \pm 5%; 1/4W	R-1277
R3	Resistor, Carbon; 68K \pm 5%; 1/4W	R-1293
R4	Resistor, Carbon; 470 ohms \pm 5%; 1/4W	R-1241
R5	Resistor, Carbon; 680 ohms \pm 5%; 1/4W	R-1245
R6	Resistor, Carbon; 100 ohms \pm 5%; 1/4W	R-1225
R7	Resistor, Carbon; 8.2K \pm 5%; 1/4W	R-1271
R8	Resistor, Carbon; 33K \pm 5%; 1/4W	R-1285
R9	Resistor, Carbon; 8.2K \pm 5%; 1/4W	R-1271
R10	Resistor, Carbon; 1.2K \pm 5%; 1/4W	R-1251
R11	Resistor, Carbon; 8.2K \pm 5%; 1/4W	R-1271
R12	Resistor, Carbon; 12K \pm 5%; 1/4W	R-1275
R13	Resistor, Carbon; 10K \pm 5%; 1/4W	R-1273
R14	Resistor, Carbon; 10K \pm 5%; 1/4W	R-1273
R15	Resistor, Carbon; 47 ohms \pm 5%; 1/4W	R-1217
R16	Resistor, Carbon; 2.2K \pm 5%; 1/4W	R-1257
R17	Resistor, Carbon; 47 ohms \pm 5%; 1/4W	R-1217
R18	Resistor, Carbon; 1.5K \pm 5%; 1/4W	R-1253
R19	Resistor, Carbon; 100 ohms \pm 5%; 1/4W	R-1225
R20	Resistor, Carbon; 1K \pm 5%; 1/4W	R-1249
R21	Resistor, Carbon; 4.7 ohms \pm 5%; 1/2W	R-1560
R22	Resistor, Carbon; 470 ohms \pm 5%; 1/4W	R-1241
R23	Resistor, Carbon; 33 ohms \pm 5%; 1/4W	R-1213
R24	Resistor, Carbon; 33 ohms \pm 5%; 1/4W	R-1213
R25	Resistor, Carbon; 220 ohms \pm 5%; 1/4W	R-1233
R26	Resistor, Carbon; 220 ohms \pm 5%; 1/4W	R-1233
R27	Resistor, Carbon; 100 ohms \pm 5%; 1/4W	R-1225
TP1	Tip, Jack, White	J-0386
TP2	Tip, Jack, White	J-0386
TP3	Tip, Jack, White	J-0386



A. Component Locations with Opposite Side Foil

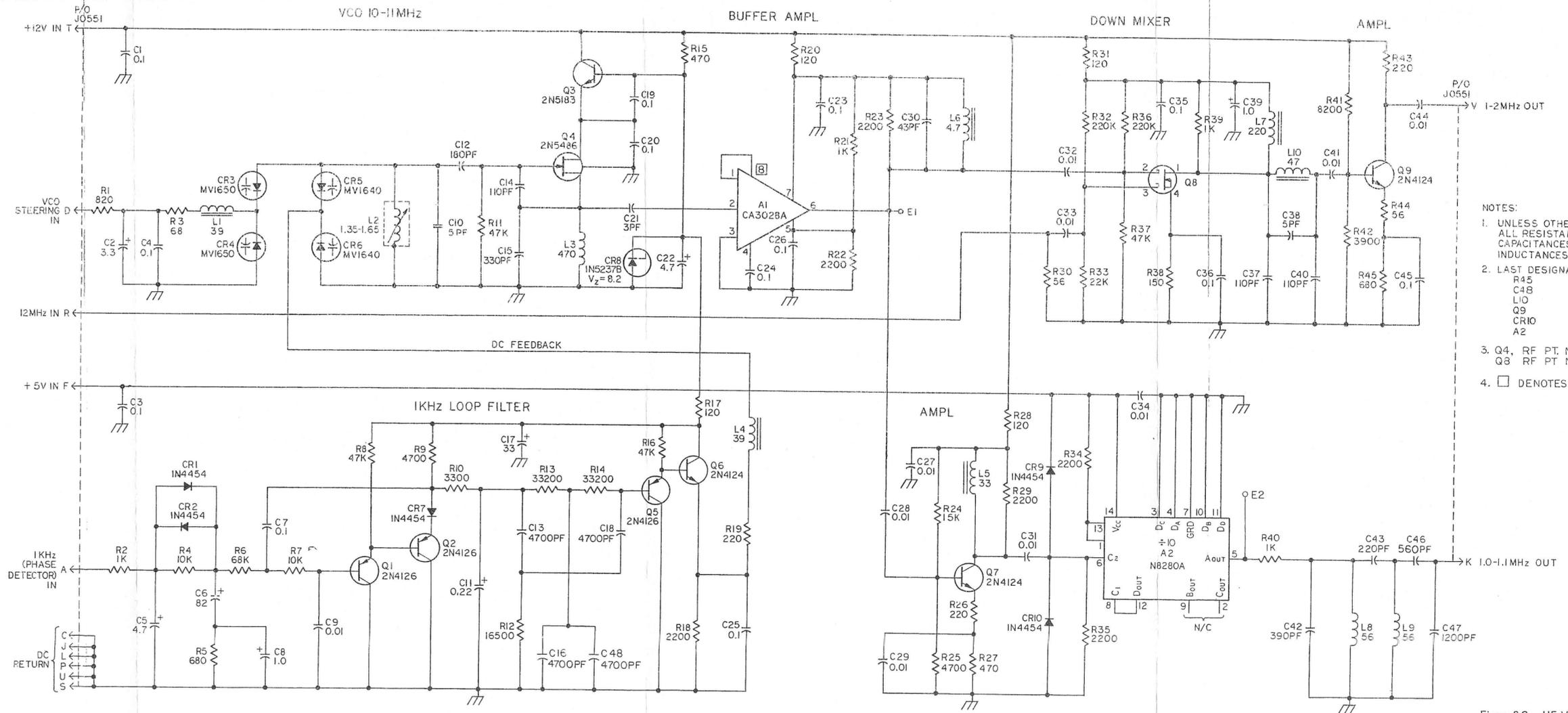


B. Component Locations with Adjacent Side Foil

DC VOLTAGES*

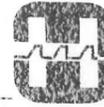
Stage	E	B	C											
Q1	1.30 V	0.67 V	0.00 V											
Q2	1.80 V	1.20 V	0.00 V											
Q3	7.30 V	7.90 V	12.0 V											
Q5	3.00 V	2.40 V	0.00 V											
Q6	2.35 V	3.00 V	7.60 V											
Q7	4.10 V	2.70 V	11.2 V											
Q9	3.50 V	4.20 V	11.1 V											
Q4	Gate	Source	Drain											
	0.00 V	7.30 V	0.25 V											
Q8	Pin 1	Pin 2	Pin 3	Pin 4										
	11.1 V	2.10 V	1.10 V	1.00 V										
A1	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8						
	0.59 V	3.70 V	0.00 V	3.00 V	7.00 V	10.8 V	10.8 V	0.59 V						
A2	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12	Pin 13	Pin 14
	5.00 V	1.40 V	0.00 V	0.00 V	1.55 V	3.10 V	0.00 V	0.81 V	0.81 V	0.00 V	0.00 V	0.81 V	5.00 V	5.00 V

* Referenced to ground.



- NOTES:
- UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS, INDUCTANCES ARE IN MICROHENRYS.
 - LAST DESIGNATORS:
R45
C48
L10
Q9
CR10
A2
 - Q4, RF PT. NO. 2N5486
Q8 RF PT NO Q-0325
 - DENOTES LOCATING TAB ON IC.

Figure 8.2 - HF VCO Assembly Circuit Diagram REV. G



HF VCO ASSEMBLY -- 724-0550

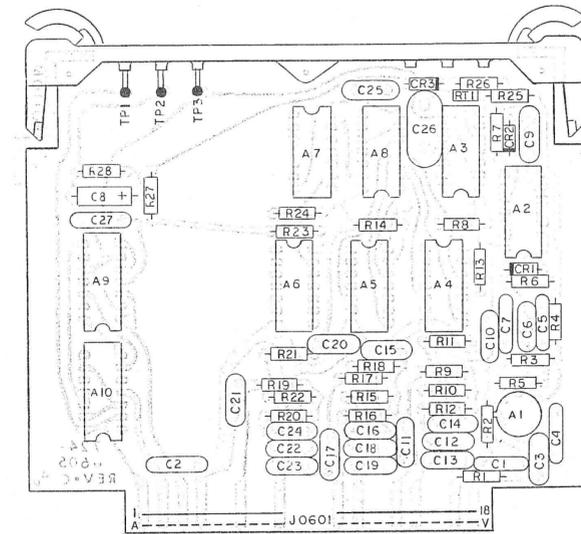
REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Integrated Circuit, Differential/Cascode Amplifier, Type CA3028A	IC-0036
A2	Integrated Circuit, Decode Counter, Type N8280A	IC-0020
C1	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C2	Capacitor, Tantalum, Polar, 3.3 UF 20%; 10 Vdcw	C-6305
C3	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C4	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C5	Capacitor, Tantalum, Polar, 4.7 UF ± 10%; 20 Vdcw	C-5923
C6	Capacitor, Tantalum, 82 UF ± 10%; 10 Vdcw	C-5987
C7	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C8	Capacitor, Tantalum, Polar, 1.0 UF ± 10%; 50 Vdcw	C-5958
C9	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C10	Capacitor, Variable, 5 UF; 500 Vdcw	C-0103
C11	Capacitor, Tantalum, Polar, 0.22 UF ± 10%; 50 Vdcw	C-5954
C12	Capacitor, Mica, 180 PF ± 5%; 500 Vdcw	C-0132
C13	Capacitor, Mylar, 4700 PF ± 2%; 50 Vdcw	C-2180
C14	Capacitor, Mica, 110 PF ± 5%; 500 Vdcw	C-0127
C15	Capacitor, Mica, 330 PF ± 5%; 500 Vdcw	C-0139
C16	Capacitor, Mylar, 4700 PF ± 2%; 50 Vdcw	C-2180
C17	Capacitor, Tantalum, Polar, 33 UF ± 20%; 10 Vdcw	C-5938
C18	Capacitor, Mylar, 4700 PF ± 2%; 50 Vdcw	C-2180
C19	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C20	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C21	Capacitor, Mica, 3 PF ± 5%; 500 Vdcw	C-0102
C22	Capacitor, Tantalum, Polar, 4.7 UF ± 10%; 10 Vdcw	C-5923
C23	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C24	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C25	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C26	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C27	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C28	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C29	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C30	Capacitor, Mica, 43 PF ± 5%; 500 Vdcw	C-0116
C31	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C32	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C33	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C34	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C35	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066

HF VCO ASSEMBLY -- 724-0550 (Cont.)

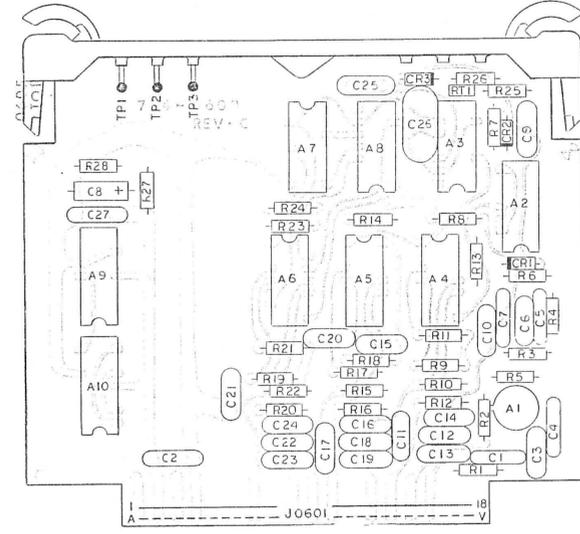
REF DESIG	DESCRIPTION	RF PART NUMBER
C36	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C37	Capacitor, Mica, 110 PF ± 5%; 500 Vdcw	C-0127
C38	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C39	Capacitor, Tantalum, Polar, 1.0 UF ± 10%; 50 Vdcw	C-5958
C40	Capacitor, Mica, 100 PF ± 5%; 500 Vdcw	C-0127
C41	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C42	Capacitor, Mica, 390 PF ± 5%; 500 Vdcw	C-0141
C43	Capacitor, Mica, 220 PF ± 5%; 500 Vdcw	C-0134
C44	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C45	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C46	Capacitor, Mica, 560 PF ± 5%; 500 Vdcw	C-0146
C47	Capacitor, Mica, 1200 PF ± 5%; 500 Vdcw	C-0154
C48	Capacitor, Mylar, 4700 PF ± 2%; 50 Vdcw	C-2180
CR1	Diode, Silicon, Type 1N4454	CR-0705
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Voltage Variable Capacitance, Type MV1650	CR-0095
CR4	Diode, Voltage Variable Capacitance, Type MV1650	CR-0095
CR5	Diode, Voltage Variable Capacitance, Type MV1640	CR-0090
CR6	Diode, Voltage Variable Capacitance, Type MV1640	CR-0090
CR7	Diode, Silicon, Type 1N4454	CR-0705
CR8	Diode, Zener, 8.2V ± 10%; Type 1N5237B	CR-0216
CR9	Diode, Silicon, Type 1N4454	CR-0705
CR10	Diode, Silicon, Type 1N4454	CR-0705
L1	Coil, Rf, Molded, 39 UH	L-0635
L2	Coil, Rf, Shielded, Tunable, 1.35-1.65 UH	L-0715
L3	Coil, Rf, Molded, 470 UH	L-0648
L4	Coil, Rf, Molded, 39 UH	L-0635
L5	Coil, Rf, Molded, 33 UH	L-0634
L6	Coil, Rf, Molded, 4.7 UH	L-0624
L7	Coil, Rf, Molded, 220 UH	L-0644
L8	Coil, Rf, Molded, 56 UH	L-0637
L9	Coil, Rf, Molded, 56 UH	L-0637
L10	Coil, Rf, Molded, 47 UH	L-0636
Q1	Transistor, Silicon, General Purpose, PNP, Type 2N4126	Q-0386
Q2	Transistor, Silicon, General Purpose, PNP, Type 2N4126	Q-0386
Q3	Transistor, Silicon, Amplifier, NPN, Type 2N5183	Q-0006
Q4	Transistor, FET, Amplifier, Type 2N5486	Q-0376
Q5	Transistor, Silicon, General Purpose, PNP, Type 2N4126	Q-0386
Q6	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q7	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q8	Transistor, MOSFET, Dual Gate, VHF Amplifier/Mixer	Q-0325
Q9	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
R1	Resistor, Carbon; 820 ohms ± 5%; 1/4W	R-1247
R2	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R3	Resistor, Carbon; 68 ohms ± 5%; 1/4W	R-1221
R4	Resistor, Carbon; 10K ± 5%; 1/4W	R-1273
R5	Resistor, Carbon; 680 ohms ± 5%; 1/4W	R-1245
R6	Resistor, Carbon; 68K ± 5%; 1/4W	R-1293

HF VCO ASSEMBLY -- 724-0550 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
R7	Resistor, Carbon, 10K ± 5%; 1/4W	R-1273
R8	Resistor, Carbon; 47K ± 5%; 1/4W	R-1289
R9	Resistor, Carbon; 4700 ohms ± 5%; 1/4W	R-1265
R10	Resistor, Carbon; 3300 ohms ± 5%; 1/4W	R-1261
R11	Resistor, Carbon; 47K ± 5%; 1/4W	R-1289
R12	Resistor, Metal Film; 16500 ohms ± 1%; 1/8W	R-7287
R13	Resistor, Metal Film; 33200 ohms ± 1%; 1/8W	R-7288
R14	Resistor, Metal Film; 33200 ohms ± 1%; 1/8W	R-7288
R15	Resistor, Carbon, 470 ohms ± 5%; 1/4W	R-1241
R16	Resistor, Carbon; 47K ± 5%; 1/4W	R-1289
R17	Resistor, Carbon; 120 ohms ± 5%; 1/4W	R-1227
R18	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R19	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R20	Resistor, Carbon; 120 ohms ± 5%; 1/4W	R-1227
R21	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R22	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R23	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R24	Resistor, Carbon; 15K ± 5%; 1/4W	R-1277
R25	Resistor, Carbon; 4700 ohms ± 5%; 1/4W	R-1265
R26	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R27	Resistor, Carbon; 470 ohms ± 5%; 1/4W	R-1241
R28	Resistor, Carbon; 120 ohms ± 5%; 1/4W	R-1227
R29	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R30	Resistor, Carbon; 56 ohms ± 5%; 1/4W	R-1219
R31	Resistor, Carbon; 120 ohms ± 5%; 1/4W	R-1227
R32	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R33	Resistor, Carbon; 22K ± 5%; 1/4W	R-1281
R34	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R35	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R36	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R37	Resistor, Carbon; 47K ± 5%; 1/4W	R-1289
R38	Resistor, Carbon; 150 ohms ± 5%; 1/4W	R-1229
R39	Resistor, Carbon; 1K ± 5%; 1/4W	R-1244
R40	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R41	Resistor, Carbon; 8200 ohms ± 5%; 1/4W	R-1277
R42	Resistor, Carbon; 3900 ohms ± 5%; 1/4W	R-1263
R43	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R44	Resistor, Carbon; 56 ohms ± 5%; 1/4W	R-1219
R45	Resistor, Carbon; 680 ohms ± 5%; 1/4W	R-1245



A. Component Locations with Opposite Side Foil

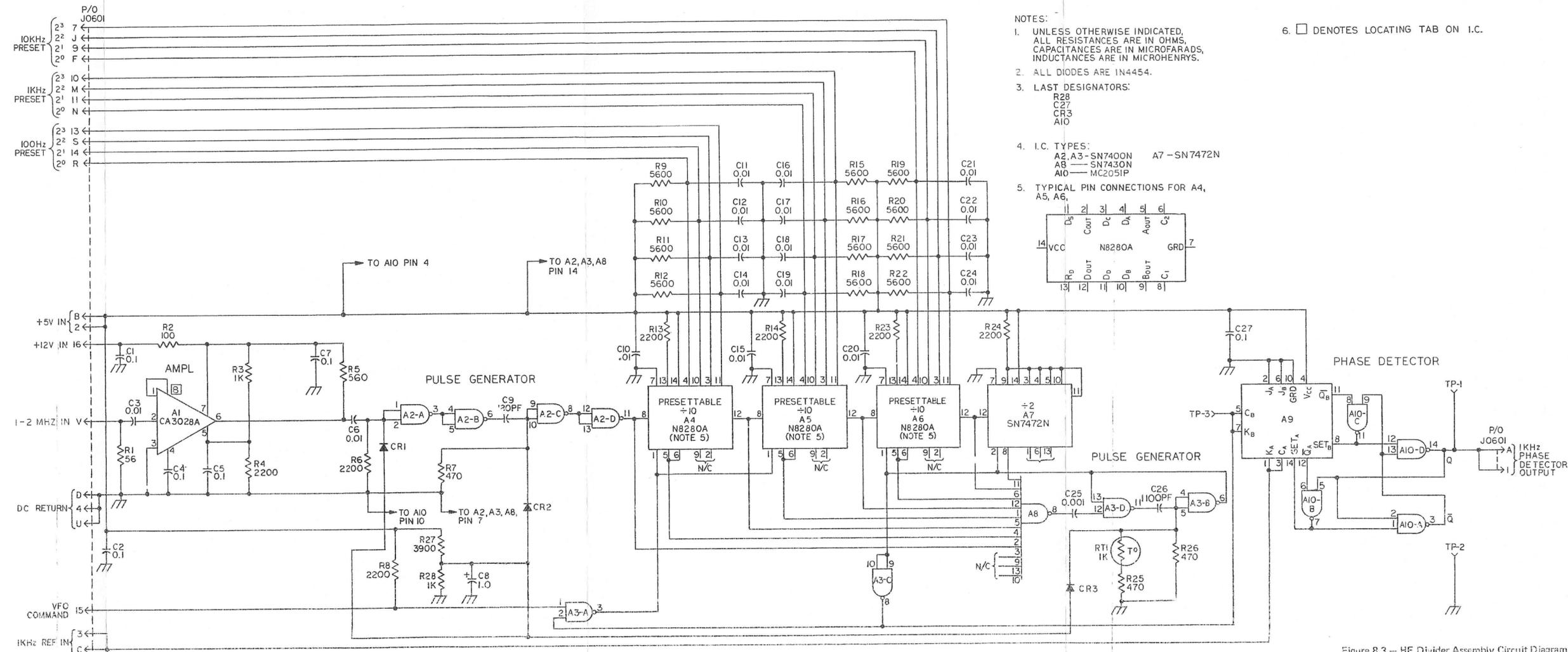


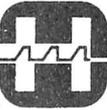
B. Component Locations with Adjacent Side Foil

DC VOLTAGES*

Stage	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
A1	0.50 V	3.60 V	0.00 V	2.90 V	7.00 V	10.8 V	10.8 V	0.50 V

*Referenced to ground.



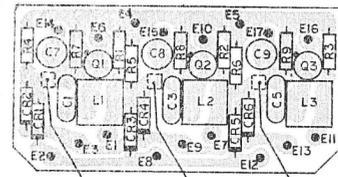


HF DIVIDER ASSEMBLY - 724-0600

REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A	IC-0036
A2	Integrated Circuit, NAND Gate, Type SN7400N	IC-0010
A3	Integrated Circuit, NAND Gate, Type SN 7400N	IC-0010
A4	Integrated Circuit, Counter/Storage, Type N8280A	IC-0020
A5	Integrated Circuit, Counter/Storage, Type N8280A	IC-0020
A6	Integrated Circuit, Counter/Storage, Type N8280A	IC-0020
A7	Integrated Circuit, Flip Flop, Type SN7472N	IC-0016
A8	Integrated Circuit, NAND Gate, Type SN7430N	IC-0014
A9	Integrated Circuit, Flip Flop, Type MC2023L	IC-0025
A10	Integrated Circuit, NAND Gate, Type MC2051P	IC-0024
C1	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C2	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C3	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C4	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C5	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C6	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C7	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C8	Capacitor, Tantalum, Polar, 1.0 UF ± 20%; 25 Vdcw	C-5958
C9	Capacitor, Mica, 180 PF +5%; 500 Vdcw	C-0132
C10	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C11	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C12	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C13	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C14	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C15	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C16	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C17	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C18	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C19	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C20	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C21	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C22	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C23	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C24	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952

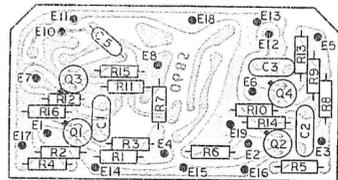
HF DIVIDER ASSEMBLY - 724-0600 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
C25	Capacitor, Ceramic, Disk, 0.001 UF ±20%; 250 Vdcw	C-2262
C26	Capacitor, Mica, 1100 PF +5%; 500 Vdcw	C-0153
C27	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
CR1	Diode, Silicon, Type 1N4454	CR-0705
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Silicon, Type 1N4454	CR-0705
R1	Resistor, Carbon; 56 ohms ±5%; 1/4W	R-1219
R2	Resistor, Carbon; 100 ohms ±5%; 1/4W	R-1225
R3	Resistor, Carbon; 1K ±5%; 1/4W	R-1249
R4	Resistor, Carbon; 2200 ohms ±5%; 1/4W	R-1257
R5	Resistor, Carbon; 560 ohms ±5%; 1/4W	R-1243
R6	Resistor, Carbon; 2200 ohms ±5%; 1/4W	R-1257
R7	Resistor, Carbon; 470 ohms ±5%; 1/4W	R-1241
R8	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1257
R9	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R10	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R11	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R12	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R13	Resistor, Carbon; 2200 ohms ±5%; 1/4W	R-1257
R14	Resistor, Carbon; 2200 ohms ±5%; 1/4W	R-1257
R15	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R16	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R17	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R18	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R19	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R20	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R21	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R22	Resistor, Carbon; 5600 ohms ±5%; 1/4W	R-1267
R23	Resistor, Carbon; 2200 ohms ±5%; 1/4W	R-1257
R24	Resistor, Carbon; 2200 ohms ±5%; 1/4W	R-1257
R25	Resistor, Carbon; 470 ohms ±5%; 1/4W	R-1241
R26	Resistor, Carbon; 470 ohms ±5%; 1/4W	R-1241
R27	Resistor, Carbon; 3900 ohms ±5%; 1/4W	R-1263
R28	Resistor, Carbon; 1K ± 10%; 1/4W	R-1249
RT1	Thermistor, Disk; 1K ± 10%	R-3167
-	Ejector, P.C. Board, with jacks	MP-4340
-	Socket, 14 pin, Dual In-line	X-0107
TP1	Jack, Tip	J-0386
TP2	Jack, Tip	J-0386
TP3	Jack, Tip	J-0386

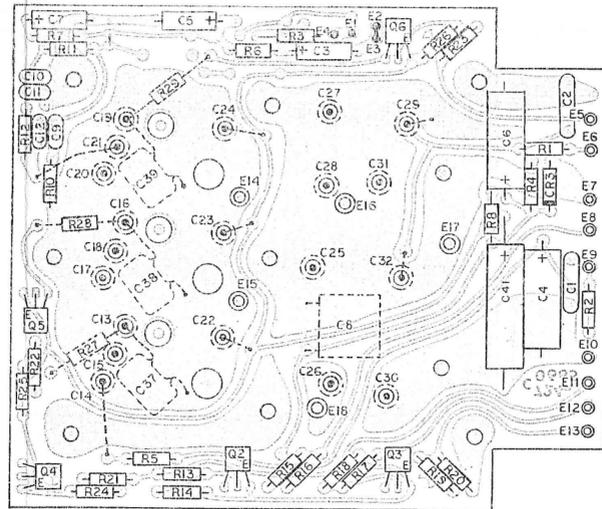


NOTE: C2, C4, & C6 SOLDERED TO WIRING SIDE OF BOARD.

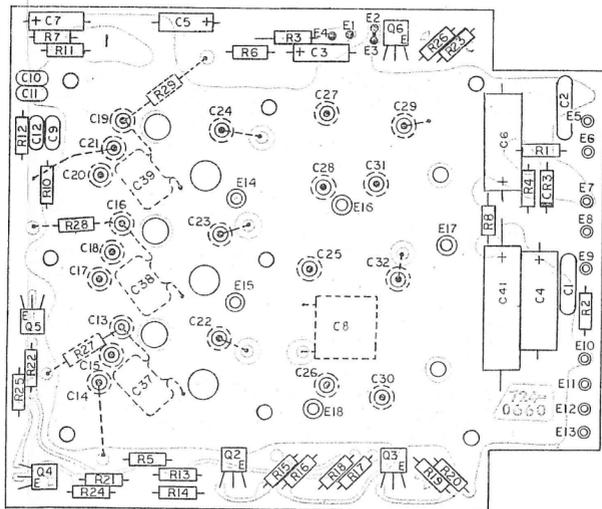
C. 724-0670 Assembly Component Locations with Opposite Side Foil



D. 724-0680 Assembly Component Locations with Opposite Side Foil



A. 724-0661 Assembly Component Locations with Opposite Side Foil



B. 724-0661 Component Locations with Adjacent Side Foil

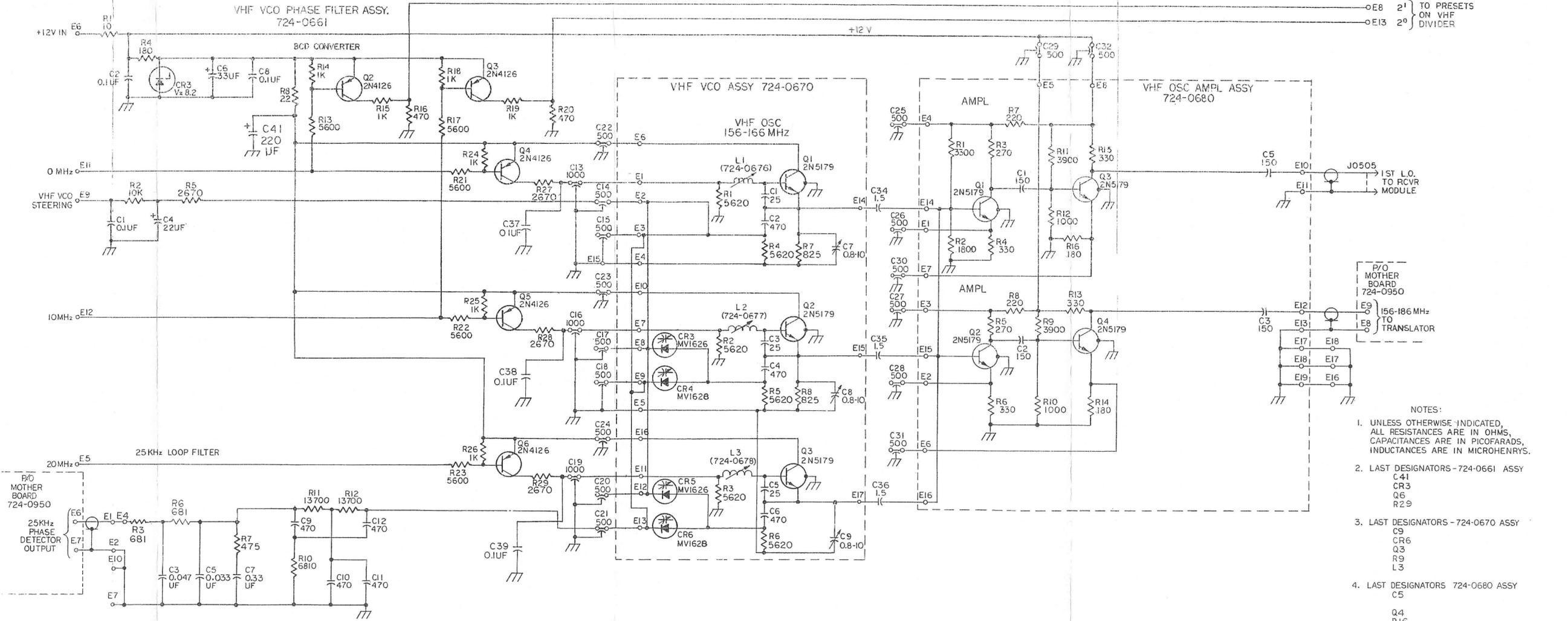
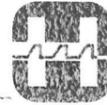


Figure 8.4 - VHF VCO Assembly Circuit Diagram REV. C



VHF VCO ASSEMBLY - 724-0651

REF DESIG	DESCRIPTION	RF PART NUMBER
C13	Capacitor, Feed-thru, 1000 PF \pm 20%; 500 Vdcw	C-6631
C14	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C15	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C16	Capacitor, Feed-thru, 1000 PF \pm 20%; 500 Vdcw	C-6631
C17	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C18	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C19	Capacitor, Feed-thru, 1000 PF \pm 20%; 500 Vdcw	C-6631
C20	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C21	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C22	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C23	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C24	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C25	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C26	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C27	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C28	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C29	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C30	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C31	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C32	Capacitor, Feed-thru, 500 PF \pm 20%; 500 Vdcw	C-6630
C34	Capacitor, Ceramic, 1.5 PF \pm 5%; 500 Vdcw	C-4612
C35	Capacitor, Ceramic, 1.5 PF \pm 5%; 500 Vdcw	C-4612
C36	Capacitor, Ceramic, 1.5 PF \pm 5%; 500 Vdcw	C-4612
C37	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C38	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C39	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
J0505	Connector, Coaxial, Male VHF VCO PHASE FILTER SUB-ASSEMBLY	J-0033 724-0661
	VHF VCO BOARD SUB-ASSEMBLY	724-0670
	VHF OSCILLATOR AMPLIFIER SUB-ASSEMBLY	724-0680
R27	Resistor, Metal Film, 2670 ohms \pm 1%; 1/8W	R-7299
R28	Resistor, Metal Film, 2670 ohms \pm 1%; 1/8W	R-7299
R29	Resistor, Metal Film, 2670 ohms \pm 1%; 1/8W	R-7299

VHF VCO PHASE FILTER SUB-ASSEMBLY - 724-0661

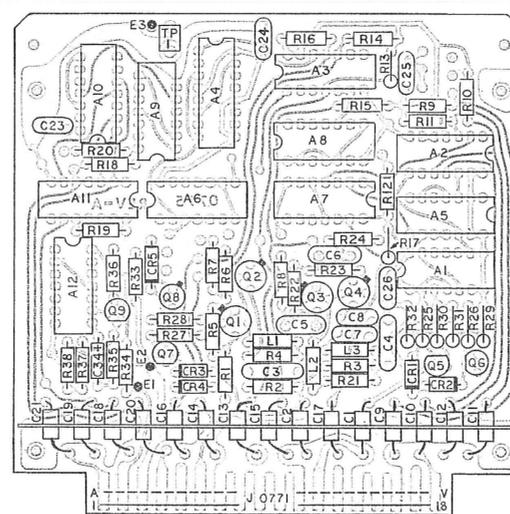
REF DESIG	DESCRIPTION	RF PART NUMBER
C1	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C2	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C3	Capacitor, Tantalum, Polar, 0.047 UF \pm 10%; 50 Vdcw	C-5972
C4	Capacitor, Tantalum, Polar, 22 UF \pm 10%; 15 Vdcw	C-5935
C5	Capacitor, Tantalum, Polar, 0.033 UF \pm 10%; 50 Vdcw	C-5971
C6	Capacitor, Tantalum, Polar, 33 UF \pm 10%; 50 Vdcw	C-5938
C7	Capacitor, Tantalum, Polar, 0.33 UF \pm 10%; 50 Vdcw	C-5955
C8	Capacitor, Ceramic, Monolythic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C9	Capacitor, Silver Mica, 470 PF \pm 2%	C-2179
C10	Capacitor, Silver Mica, 470 PF \pm 2%	C-2179
C11	Capacitor, Silver Mica, 470 PF \pm 2%	C-2179
C12	Capacitor, Silver Mica, 470 PF \pm 2%	C-2179
C41	Capacitor, Tantalum, 220 UF, 20 Vdcw	C-4166
CR3	Diode, Zener, 8.2V \pm 10%; Type 1N5237	CR-0216
Q2	Transistor, Silicon, General Purpose PNP, Type 2N4126	Q-0386
Q3	Transistor, Silicon, General Purpose PNP, Type 2N4126	Q-0386
Q4	Transistor, Silicon, General Purpose PNP, Type 2N4126	Q-0386
Q5	Transistor, Silicon, General Purpose PNP, Type 2N4126	Q-0386
Q6	Transistor, Silicon, General Purpose PNP, Type 2N4126	Q-0386
R1	Resistor, Carbon; 10 ohms \pm 5%; 1/4W	R-1201
R2	Resistor, Carbon; 10K \pm 5%; 1/4W	R-1273
R3	Resistor, Metal Film; 681 ohms \pm 1%; 1/8W	R-7297
R4	Resistor, Carbon; 180 ohms \pm 5%; 1/4W	R-1231
R5	Resistor, Metal Film; 2670 ohms \pm 1%; 1/8W	R-7299
R6	Resistor, Metal Film; 681 ohms \pm 1%; 1/8W	R-7297
R7	Resistor, Metal Film; 475 ohms \pm 1%; 1/8W	R-7296
R8	Resistor, Carbon; 22 ohms \pm 10%; 1/4W	R-1209
R10	Resistor, Metal Film; 6810 ohms \pm 1%; 1/8W	R-7285
R11	Resistor, Metal Film; 13700 ohms \pm 1%; 1/8W	R-7286
R12	Resistor, Metal Film; 13700 ohms \pm 1%; 1/8W	R-7286
R13	Resistor, Carbon; 5600 ohms \pm 5%; 1/4W	R-1267
R14	Resistor, Carbon; 1K \pm 5%; 1/4W	R-1249
R15	Resistor, Carbon; 1K \pm 5%; 1/4W	R-1249
R16	Resistor, Carbon; 470 ohms \pm 5%; 1/4W	R-1241
R17	Resistor, Carbon; 5600 ohms \pm 5%; 1/4W	R-1267
R18	Resistor, Carbon; 1K \pm 5%; 1/4W	R-1249
R19	Resistor, Carbon; 1K \pm 5%; 1/4W	R-1249
R20	Resistor, Carbon; 470 ohms \pm 5%; 1/4W	R-1241
R21	Resistor, Carbon; 5600 ohms \pm 5%; 1/4W	R-1267
R22	Resistor, Carbon; 5600 ohms \pm 5%; 1/4W	R-1267
R23	Resistor, Carbon; 5600 ohms \pm 5%; 1/4W	R-1267
R24	Resistor, Carbon; 1K \pm 5%; 1/4W	R-1249
R25	Resistor, Carbon; 1K \pm 5%; 1/4W	R-1249
R26	Resistor, Carbon; 1K \pm 5%; 1/4W	R-1249

VHF VCO BOARD SUB-ASSEMBLY - 724-0670

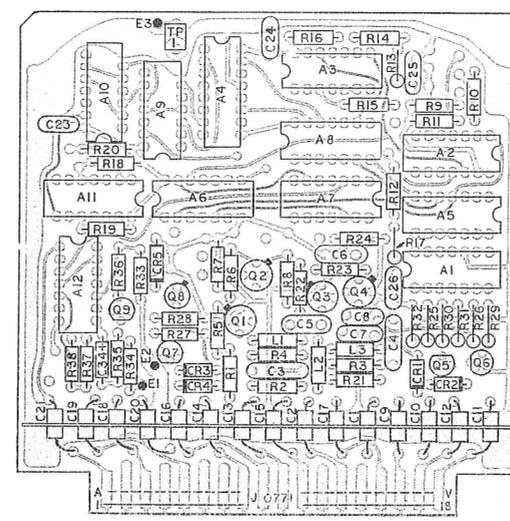
REF DESIG	DESCRIPTION	RF PART NUMBER
C1	Capacitor, Disk, 25 PF \pm 5%; 1000 Vdcw	C-2188
C2	Capacitor, VHF, 470 PF \pm 20%	C-1191
C3	Capacitor, Disk, 25 PF \pm 5%; 1000 Vdcw	C-2188
C4	Capacitor, VHF, 470 PF \pm 20%	C-1191
C5	Capacitor, Disk, 25 PF \pm 5%; 1000 Vdcw	C-2188
C6	Capacitor, VHF, 470 PF \pm 20%	C-1191
C7	Capacitor, Variable, 0.8 - 10.0 PF,	C-2178
C8	Capacitor, Variable, 0.8 - 10.0 PF,	C-2178
C9	Capacitor, Variable, 0.8 - 10.0 PF,	C-2178
CR1	Diode, Varactor, Type MV1626	CR-0083
CR2	Diode, Varactor, Type MV1628	CR-0084
CR3	Diode, Varactor, Type MV1626	CR-0083
CR4	Diode, Varactor, Type MV1628	CR-0084
CR5	Diode, Varactor, Type MV1626	CR-0083
CR6	Diode, Varactor, Type MV1628	CR-0084
L1	Coil, VHF, Close Wound #28 enamel 1-1/2 turns	724-0676
L2	Coil, VHF, Close Wound #24 enamel 1-1/2 turns	724-0677
L3	Coil, VHF, Close Wound #24 enamel 1-1/4 turns	724-0678
Q1	Transistor, Silicon, UHF, NPN, Type 2N5179	Q-0390
Q2	Transistor, Silicon, UHF, NPN, Type 2N5179	Q-0390
Q3	Transistor, Silicon, UHF, NPN, Type 2N5179	Q-0390
R1	Resistor, Metal Film; 5620 ohms \pm 1%; 1/8W	R-7300
R2	Resistor, Metal Film; 5620 ohms \pm 1%; 1/8W	R-7300
R3	Resistor, Metal Film; 5620 ohms \pm 1%; 1/8W	R-7300
R4	Resistor, Metal Film; 5620 ohms \pm 1%; 1/8W	R-7300
R5	Resistor, Metal Film; 5620 ohms \pm 1%; 1/8W	R-7300
R6	Resistor, Metal Film; 5620 ohms \pm 1%; 1/8W	R-7300
R7	Resistor, Metal Film; 825 ohms \pm 1%; 1/8W	R-7298
R8	Resistor, Metal Film; 825 ohms \pm 1%; 1/8W	R-7298
R9	Resistor, Metal Film; 825 ohms \pm 1%; 1/8W	R-7298

VHF OSCILLATOR AMPLIFIER SUB-ASSEMBLY - 724-0680

REF DESIG	DESCRIPTION	RF PART NUMBER
C1	Capacitor, Ceramic, Disk 150 PF; 250 Vdcw	C-2263
C2	Capacitor, Ceramic, Disk, 150 PF; 250 Vdcw	C-2263
C3	Capacitor, Ceramic, Disk, 150 PF; 250 Vdcw	C-2263
C5	Capacitor, Ceramic, Disk, 150 PF; 250 Vdcw	C-2263
Q1	Transistor, Silicon, UHF, NPN, Type 2N5179	Q-0390
Q2	Transistor, Silicon, UHF, NPN, Type 2N5179	Q-0390
Q3	Transistor, Silicon, UHF, NPN, Type 2N5179	Q-0390
Q4	Transistor, Silicon, UHF, NPN, Type 2N5179	Q-0390
R1	Resistor, Carbon; 3300 ohms \pm 5%; 1/4W	R-1261
R2	Resistor, Carbon; 1800 ohms \pm 5%; 1/4W	R-1255
R3	Resistor, Carbon; 270 ohms \pm 5%; 1/4W	R-1235
R4	Resistor, Carbon; 330 ohms \pm 5%; 1/4W	R-1237
R5	Resistor, Carbon; 270 ohms \pm 5%; 1/4W	R-1235
R6	Resistor, Carbon; 330 ohms \pm 5%; 1/4W	R-1237
R7	Resistor, Carbon; 220 ohms \pm 5%; 1/4W	R-1233
R8	Resistor, Carbon; 220 ohms \pm 5%; 1/4W	R-1233
R9	Resistor, Carbon; 3900 ohms \pm 5%; 1/4W	R-1263
R10	Resistor, Carbon; 1000 ohms \pm 5%; 1/4W	R-1249
R11	Resistor, Carbon; 3900 ohms \pm 5%; 1/4W	R-1263
R12	Resistor, Carbon; 1000 ohms \pm 5%; 1/4W	R-1249
R13	Resistor, Carbon; 330 ohms \pm 5%; 1/4W	R-1237
R14	Resistor, Carbon; 180 ohms \pm 5%; 1/4W	R-1231
R15	Resistor, Carbon; 330 ohms \pm 5%; 1/4W	R-1237
R16	Resistor, Carbon; 180 ohms \pm 5%; 1/4W	R-1231



A. 724-0770 Assembly Component Locations with Opposite Side Foil

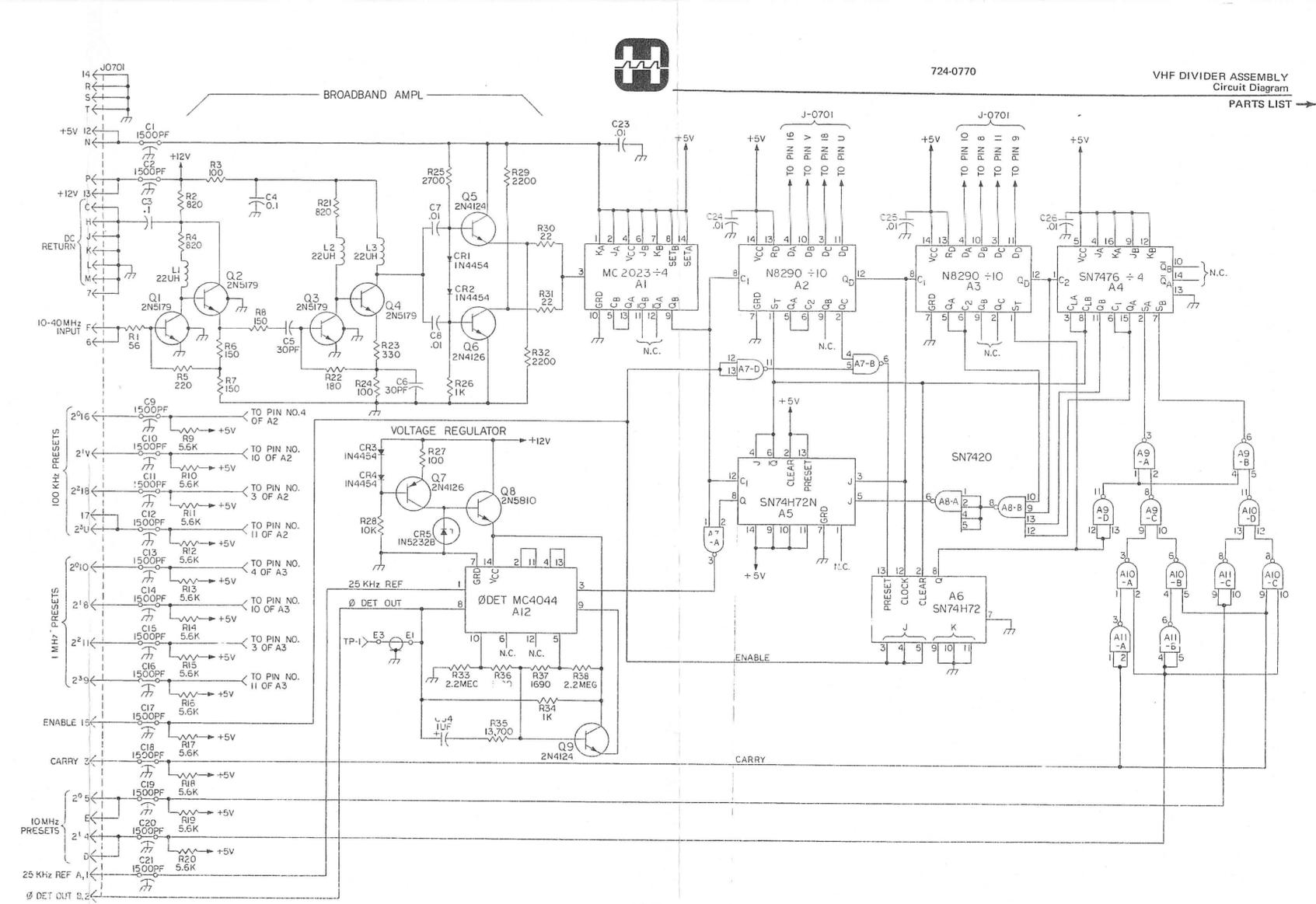


B. 724-0770 Assembly Component Locations with Adjacent Side Foil

724-0770 ASSEMBLY
DC VOLTAGES*

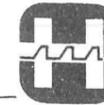
Stage	E	B	C
Q1	0V	.74V	1.08V
Q2	1.81V	1.08V	4.29V
Q3	0V	.76V	2.64V
Q4	3.58V	2.64V	10.7V
Q5	2.00V	2.34V	5.00V
Q6	0V	1.08V	1.61V
Q7	1.57V	.89V	5.41V
Q8	4.80V	5.41V	12.1V
Q9	1.42V	1.88V	4.81V

*Referenced to ground



- NOTES:
1. LAST DESIGNATORS:
A12 C9
CR5 R36
C34 L3
 2. UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE IN OHMS.
ALL CAPACITORS ARE IN MICROFARADS.
 3. A7, A9, A10 & A11 ARE TYPE SN7400 GATE.

Figure 8.5 - VHF Divider Assembly Circuit Diagram
REV. C



VHF DIVIDER ASSEMBLY - 724-0770

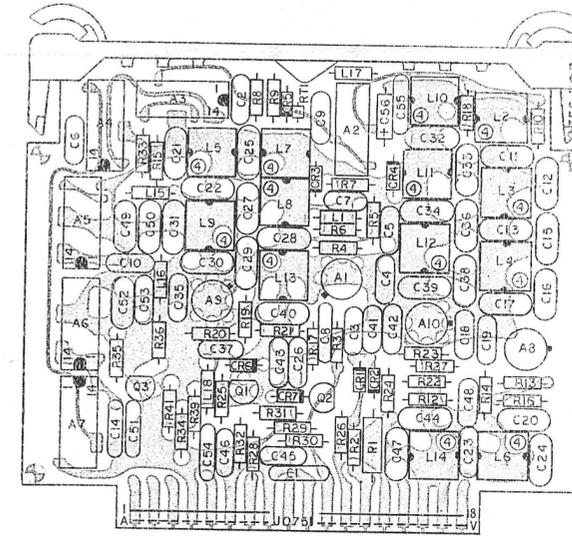
REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Integrated Circuit, Dual Flip-Flop Type MC2023L	IC-0025
A2	Integrated Circuit, Decade Counter Type N8290A	IC-0051
A3	Integrated Circuit, Decade Counter Type N8290A	IC-0051
A4	Integrated Circuit, Dual Flip-Flop Type SN7476N	IC-0017
A5	Integrated Circuit, Flip-Flop Type SN74H72N	IC-0019
A6	Integrated Circuit, Flip-Flop Type SN74H72N	IC-0019
A7	Integrated Circuit, 2-IN NAND Gate Type SN74H00N	IC-0018
A8	Integrated Circuit, 4-IN NAND Gate Type SN7420N	IC-0013
A9	Integrated Circuit, 2-IN NAND Gate Type SN7400N	IC-0010
A10	Integrated Circuit, 2-IN NAND Gate Type SN7400N	IC-0010
A11	Integrated Circuit, 2-IN NAND Gate Type SN7400N	IC-0010
A12	Integrated Circuit, Phase Detector Type MC4044L	IC-0052
C1	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C2	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C3	Capacitor, Monolithic; 0.1 UF +80% -20%; 25 Vdcw	C-5066
C4	Capacitor, Monolithic; 0.1 UF +80% -20%; 25 Vdcw	C-5066
C5	Capacitor, Mica; 30 pF ± 5%; 500 Vdcw	C-0112
C6	Capacitor, Mica; 30 pF ± 5%; 500 Vdcw	C-0112
C7	Capacitor, Desk Ceramic; 0.01 UF ± 20%; 50 Vdcw	C-4952
C8	Capacitor, Desk Ceramic; 0.01 UF ± 20%; 50 Vdcw	C-4952
C9	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C10	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C11	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C12	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C13	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C14	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C15	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C16	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C17	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C18	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C19	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C20	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C21	Capacitor, Feed-thru; 1500 pF ± 20%	C-6398
C23	Capacitor, Disk Ceramic; 0.01 UF ± 20%; 50 Vdcw	C-4952
C24	Capacitor, Disk Ceramic; 0.01 UF ± 20%; 50 Vdcw	C-4952
C25	Capacitor, Disk Ceramic; 0.01 UF ± 20%; 50 Vdcw	C-4952
C26	Capacitor, Disk Ceramic; 0.01 UF ± 20%; 50 Vdcw	C-4952
C34	Capacitor, Tantalum; 1 UF ± 10%; 50 Vdcw	C-5953
CR1	Diode, Type 1N4454	CR-0705
CR2	Diode, Type 1N4454	CR-0705
CR3	Diode, Type 1N4454	CR-0705
CR4	Diode, Type 1N4454	CR-0705
CR5	Diode, Type 1N5232B	CR-0265
L1	Inductor; 22 uH ± 10%	L-0632

VHF DIVIDER ASSEMBLY - 724-0770 (Cont.)

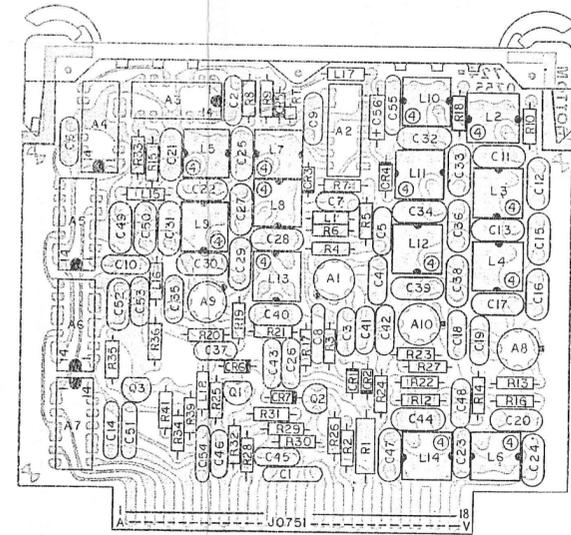
REF DESIG	DESCRIPTION	RF PART NUMBER
L2	Inductor; 22 uH ± 10%	L-0632
L3	Inductor; 22 uH ± 10%	L-0632
Q1	Transistor Type 2N5179	Q-0390
Q2	Transistor Type 2N5179	Q-0390
Q3	Transistor Type 2N5179	Q-0390
Q4	Transistor Type 2N5179	Q-0390
Q5	Transistor Type 2N4124	Q-0385
Q6	Transistor Type 2N4126	Q-0386
Q7	Transistor Type 2N4126	Q-0386
Q8	Transistor Type 2N5810	Q-0006
Q9	Transistor Type 2N4124	Q-0385
R1	Resistor, Composition; 56 ohms ± 5%; 1/4W	R-1219
R2	Resistor, Composition; 820 ohms ± 5%; 1/4W	R-1247
R3	Resistor, Composition; 100 ohms ± 5%; 1/4W	R-1225
R4	Resistor, Composition; 820 ohms ± 5%; 1/4W	R-1247
R5	Resistor, Composition; 220 ohms ± 5%; 1/4W	R-1233
R6	Resistor, Composition; 150 ohms ± 5%; 1/4W	R-1229
R7	Resistor, Composition; 150 ohms ± 5%; 1/4W	R-1229
R8	Resistor, Composition; 150 ohms ± 5%; 1/4W	R-1229
R9	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R10	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R11	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R12	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R13	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R14	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R15	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R16	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R17	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R18	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R19	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R20	Resistor, Composition; 5.6K ± 5%; 1/4W	R-1267
R21	Resistor, Composition; 820 ohms ± 5%; 1/4W	R-1247
R22	Resistor, Composition; 180 ohms ± 5%; 1/4W	R-1231
R23	Resistor, Composition; 330 ohms ± 5%; 1/4W	R-1237
R24	Resistor, Composition; 100 ohms ± 5%; 1/4W	R-1225
R25	Resistor, Composition; 2.7K ± 5%; 1/4W	R-1259
R26	Resistor, Composition; 1K ± 5%; 1/4W	R-1249
R27	Resistor, Composition; 100 ohms ± 5%; 1/4W	R-1225
R28	Resistor, Composition; 10,000 ohms ± 5%; 1/4W	R-1273
R29	Resistor, Composition; 2,200 ohms ± 5%; 1/4W	R-1257
R30	Resistor, Composition; 22 ohms ± 5%; 1/4W	R-1209
R31	Resistor, Composition; 22 ohms ± 5%; 1/4W	R-1209
R32	Resistor, Composition; 2,200 ohms ± 5%; 1/4W	R-1257
R33	Resistor, Composition; 2.2M ohms ± 5%; 1/4W	R-1329
R34	Resistor, Metal Film; 1,000 ohms ± 1%; 1/4W	R-7270

VHF DIVIDER ASSEMBLY - 724-0770 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
R35	Resistor, Metal Film; 13,700 ohms 1%; 1/4W	R-7286
R36	Resistor, Metal Film; 1,690 ohms 1%; 1/4W	R-7276
R37	Resistor, Metal Film; 1,690 ohms 1%; 1/4W	R-7276
R38	Resistor, Composition; 2.2M ohms 5%; 1/4W	R-1329
TP1	Tip, Jack	J-0386



B. Component Locations with Adjacent Side Foil

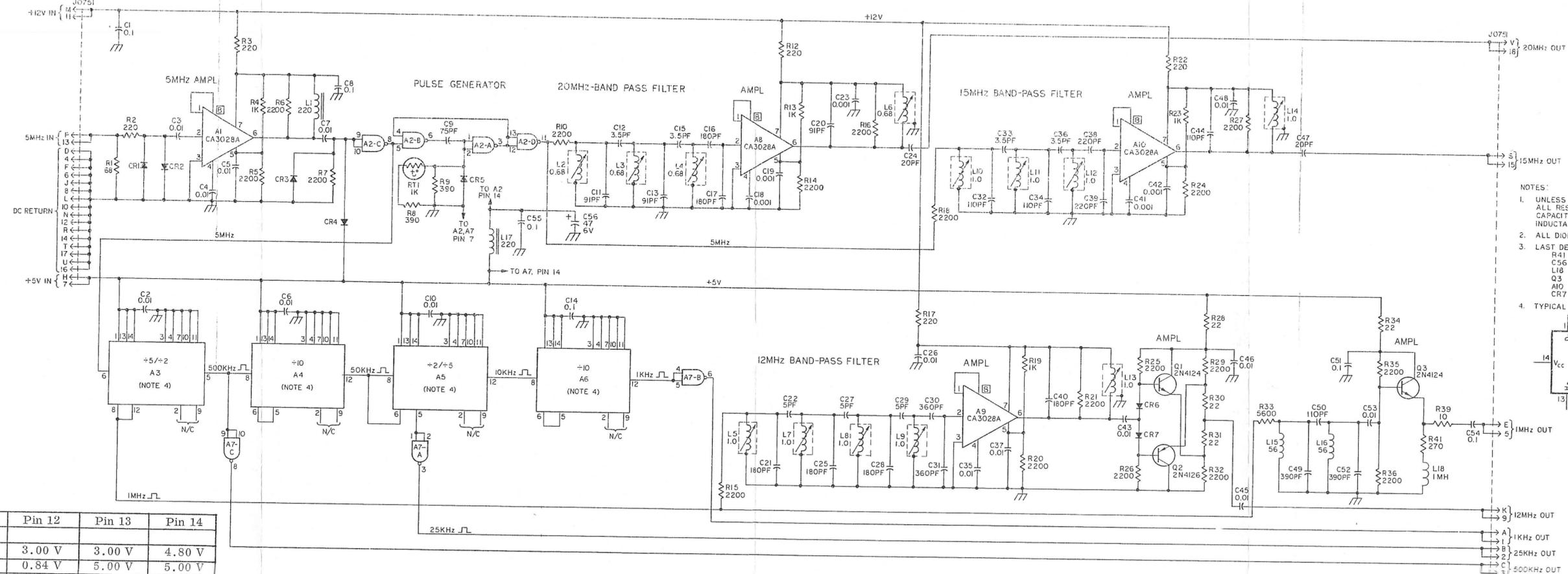


A. Component Locations with Opposite Side Foil

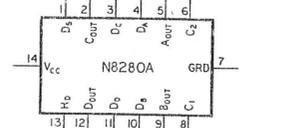
DC VOLTAGES*

Stage	E	B	C	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12	Pin 13	Pin 14
Q1	2.45 V	3.10 V	5.00 V											
Q2	2.45 V	1.90 V	0.00 V											
Q3	1.78 V	2.46 V	4.84 V											
Q4	2.50 V	1.95 V	0.00 V											
	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12	Pin 13	Pin 14
A1	0.20 V	3.40 V	0.00 V	2.80 V	6.50 V	9.90 V	10.0 V	0.20 V						
A2	0.51 V	0.51 V	3.00 V	3.00 V	1.30 V	2.10 V	0.00 V	1.30 V	2.80 V	2.80 V	0.42 V	3.00 V	3.00 V	4.80 V
A3	5.00 V	0.00 V	0.00 V	0.00 V	1.90 V	1.30 V	0.00 V	0.71 V	0.00 V	0.00 V	0.00 V	0.84 V	5.00 V	5.00 V
A4	5.00 V	0.00 V	0.00 V	0.00 V	1.90 V	1.90 V	0.00 V	1.90 V	0.00 V	0.00 V	0.00 V	0.87 V	5.00 V	5.00 V
A5	5.00 V	0.00 V	0.00 V	0.00 V	1.90 V	0.87 V	0.00 V	0.87 V	0.00 V	0.00 V	0.00 V	0.87 V	5.00 V	5.00 V
A6	5.00 V	0.00 V	0.00 V	0.00 V	1.90 V	1.90 V	0.00 V	0.84 V	0.00 V	0.00 V	0.00 V	0.84 V	5.00 V	5.00 V
A7	1.90 V	1.90 V	2.30 V	0.85 V	0.85 V	3.20 V	0.00 V	1.80 V	1.90 V	1.90 V	0.00 V	0.00 V	0.00 V	5.00 V
A8	0.00 V	3.30 V	0.00 V	2.60 V	6.80 V	9.90 V	9.90 V	0.00 V						
A9	0.00 V	3.40 V	0.00 V	2.60 V	6.80 V	9.90 V	9.90 V	0.00 V						
A10	0.00 V	3.40 V	0.00 V	2.60 V	6.80 V	9.90 V	9.90 V	0.00 V						

* Referenced to ground.

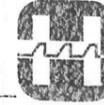


- NOTES:
- UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS, INDUCTANCES ARE IN MICRORHENRYS.
 - ALL DIODES ARE IN4454
 - LAST DESIGNATORS:
R41
C56
L18
Q3
A10
CR7
 - TYPICAL PIN CONNECTIONS FOR A3,A4,A5,A6:



5. □ DENOTES LOCATING TAB ON I.C.

Figure 8.6 - Spectrum Generator Assembly Circuit Diagram



SPECTRUM GENERATOR ASSEMBLY - 724-0750

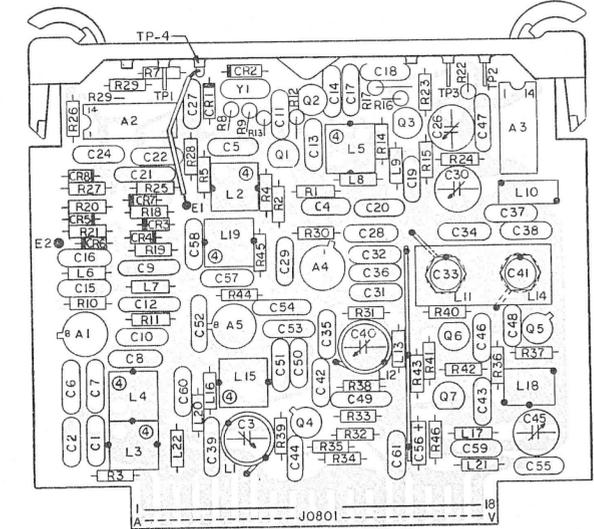
REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A	IC-0036
A2	Integrated Circuit, NAND Gate, Type SN74H00N	IC-0018
A3	Integrated Circuit, Counter/Storage, Type N8280A	IC-0020
A4	Integrated Circuit, Counter/Storage, Type N8280A	IC-0020
A5	Integrated Circuit, Counter/Storage, Type N8280A	IC-0020
A6	Integrated Circuit, Counter/Storage, Type N8280A	IC-0020
A7	Integrated Circuit, NAND Gate, Type SN7400N	IC-0010
A8	Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A	IC-0036
A9	Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A	IC-0036
A10	Integrated Circuit, Differential/Cascade Amplifier, Type CA3028A	IC-0036
C1	Capacitor, Ceramic, Monolithic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C2	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C3	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C4	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C5	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C6	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C7	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C8	Capacitor, Ceramic, Monolithic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C9	Capacitor, Mica, 75 PF ± 5%; 500 Vdcw	C-0123
C10	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C11	Capacitor, Mica, 91 PF ± 5%; 500 Vdcw	C-0125
C12	Capacitor, Mica, 3 PF ± 5%; 500 Vdcw	C-0102
C13	Capacitor, Mica, 91 PF ± 5%; 500 Vdcw	C-0125
C14	Capacitor, Ceramic, Monolithic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C15	Capacitor, Mica, 3 PF ± 5%; 500 Vdcw	C-0102
C16	Capacitor, Mica, 180 PF ± 5%; 500 Vdcw	C-0132
C17	Capacitor, Mica, 180 PF ± 5%; 500 Vdcw	C-0132
C18	Capacitor, Ceramic, Disk, 0.001 UF ± 20%; 250 Vdcw	C-2262
C19	Capacitor, Ceramic, Disk, 0.001 UF ± 20%; 250 Vdcw	C-2262
C20	Capacitor, Mica, 91 PF ± 5%; 500 Vdcw	C-0125
C21	Capacitor, Mica, 180 PF ± 5%; 500 Vdcw	C-0132
C22	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C23	Capacitor, Ceramic, Disk, 0.001 UF ± 20%; 250 Vdcw	C-2262
C24	Capacitor, Mica, 20 PF ± 5%; 500 Vdcw	C-0108
C25	Capacitor, Mica, 180 PF ± 5%; 500 Vdcw	C-0132
C26	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C27	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C28	Capacitor, Mica, 180 PF ± 5%; 500 Vdcw	C-0132
C29	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C30	Capacitor, Mica, 360 PF ± 5%; 500 Vdcw	C-0140
C31	Capacitor, Mica, 360 PF ± 5%; 500 Vdcw	C-0140
C32	Capacitor, Mica, 100 PF ± 5%; 500 Vdcw	C-0127

SPECTRUM GENERATOR ASSEMBLY -
724-0750 (Cont.)

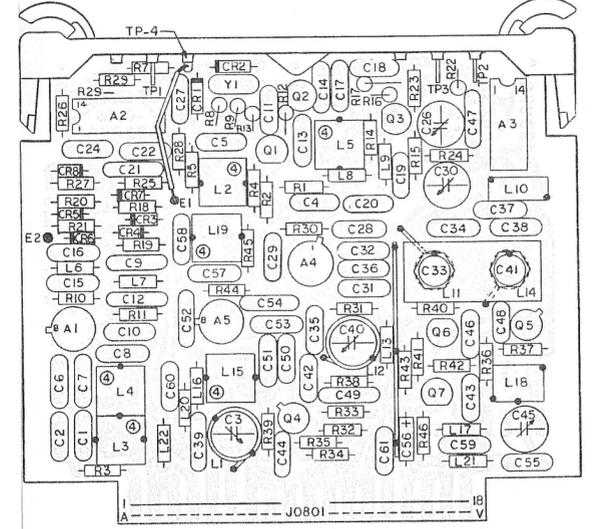
REF DESIG	DESCRIPTION	RF PART NUMBER
C33	Capacitor, Mica, 3 PF ± 5%; 500 Vdcw	C-0102
C34	Capacitor, Mica, 110 PF ± 5%; 500 Vdcw	C-0127
C35	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C36	Capacitor, Mica, 3 PF ± 5%; 500 Vdcw	C-0102
C37	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C38	Capacitor, Mica, 200 PF ± 5%; 500 Vdcw	C-0134
C39	Capacitor, Mica, 220 PF ± 5%; 500 Vdcw	C-0134
C40	Capacitor, Mica, 180 PF ± 5%; 500 Vdcw	C-0132
C41	Capacitor, Ceramic, Disk, 0.001 UF ± 20%; 100 Vdcw	C-2262
C42	Capacitor, Ceramic, Disk, 0.001 UF ± 20%; 100 Vdcw	C-2262
C43	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C44	Capacitor, Mica, 110 PF ± 5%; 500 Vdcw	C-0127
C45	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C46	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C47	Capacitor, Mica, 20 PF ± 5%; 500 Vdcw	C-0108
C48	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C49	Capacitor, Mica, 390 PF ± 5%; 500 Vdcw	C-0141
C50	Capacitor, Mica, 110 PF ± 5%; 500 Vdcw	C-0127
C51	Capacitor, Ceramic, Monolithic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C52	Capacitor, Mica, 390 PF ± 5%; 500 Vdcw	C-0141
C53	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C54	Capacitor, Ceramic, Monolithic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C55	Capacitor, Ceramic, Monolithic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C56	Capacitor, Tantalum, 47 UF ± 10%; 6 Vdcw	C-5941
CR1	Diode, Silicon, Type 1N4454	CR-0705
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Silicon, Type 1N4454	CR-0705
CR4	Diode, Silicon, Type 1N4454	CR-0705
CR5	Diode, Silicon, Type 1N4454	CR-0705
CR6	Diode, Silicon, Type 1N4454	CR-0705
CR7	Diode, Silicon, Type 1N4454	CR-0705
L1	Coil, Rf, 220 UH	L-0644
L2	Coil, Shielded, Tunable, 0.612-0.748 UH	L-0711
L3	Coil, Shielded, Tunable, 0.612-0.748 UH	L-0711
L4	Coil, Shielded, Tunable, 0.612-0.748 UH	L-0711
L5	Coil, Shielded, Tunable, 0.900-1.100 UH	L-0713
L6	Coil, Shielded, Tunable, 0.612-0.748 UH	L-0711
L7	Coil, Shielded, Tunable, 0.900-1.100 UH	L-0713
L8	Coil, Shielded, Tunable, 0.900-1.100 UH	L-0713
L9	Coil, Shielded, Tunable, 0.900-1.100 UH	L-0713
L10	Coil, Shielded, Tunable, 0.900-1.100 UH	L-0713
L11	Coil, Shielded, Tunable, 0.900-1.100 UH	L-0713
L12	Coil, Shielded, Tunable, 0.900-1.100 UH	L-0713
L13	Coil, Shielded, Tunable, 0.900-1.100 UH	L-0713
L14	Coil, Shielded, Tunable, 0.900-1.100 UH	L-0713
L15	Coil, Rf, 56 UH	L-0637
L16	Coil, Rf, 56 UH	L-0637
L17	Coil, Rf, 220 UH	L-0644
L18	Coil, Rf, 1.0 MH	L-0652
Q1	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q2	Transistor, Silicon, General Purpose, PNP, Type 2N4126	Q-0386

SPECTRUM GENERATOR ASSEMBLY -
724-0750 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
Q3	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
R1	Resistor, Carbon; 68 ohms ± 5%; 1/2W	R-1241
R2	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R3	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R4	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R5	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R6	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R7	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R8	Resistor, Carbon; 390 ohms ± 5%; 1/4W	R-1239
R9	Resistor, Carbon; 390 ohms ± 5%; 1/4W	R-1239
R10	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R12	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R13	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R14	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R15	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R16	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R17	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R18	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R19	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R20	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R21	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R22	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R23	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R24	Resistor, Carbon; 2200 ohms ± 10%; 1/4W	R-1257
R25	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R26	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R27	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R28	Resistor, Carbon; 22 ohms ± 5%; 1/4W	R-1209
R29	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R30	Resistor, Carbon; 22 ohms ± 5%; 1/4W	R-1209
R31	Resistor, Carbon; 22 ohms ± 5%; 1/4W	R-1209
R32	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R33	Resistor, Carbon; 5600 ohms ± 5%; 1/4W	R-1267
R34	Resistor, Carbon; 22 ohms ± 5%; 1/4W	R-1209
R35	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R36	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R39	Resistor, Carbon; 10 ohms ± 5%; 1/4W	R-1201
R41	Resistor, Carbon; 270 ohms ± 5%; 1/4W	R-1235
RT1	Thermistor, Disk, 1K ± 10%	R-3167
-	Ejector, P.C. Board	MP-4341



B. Component Locations with Adjacent Side Foil

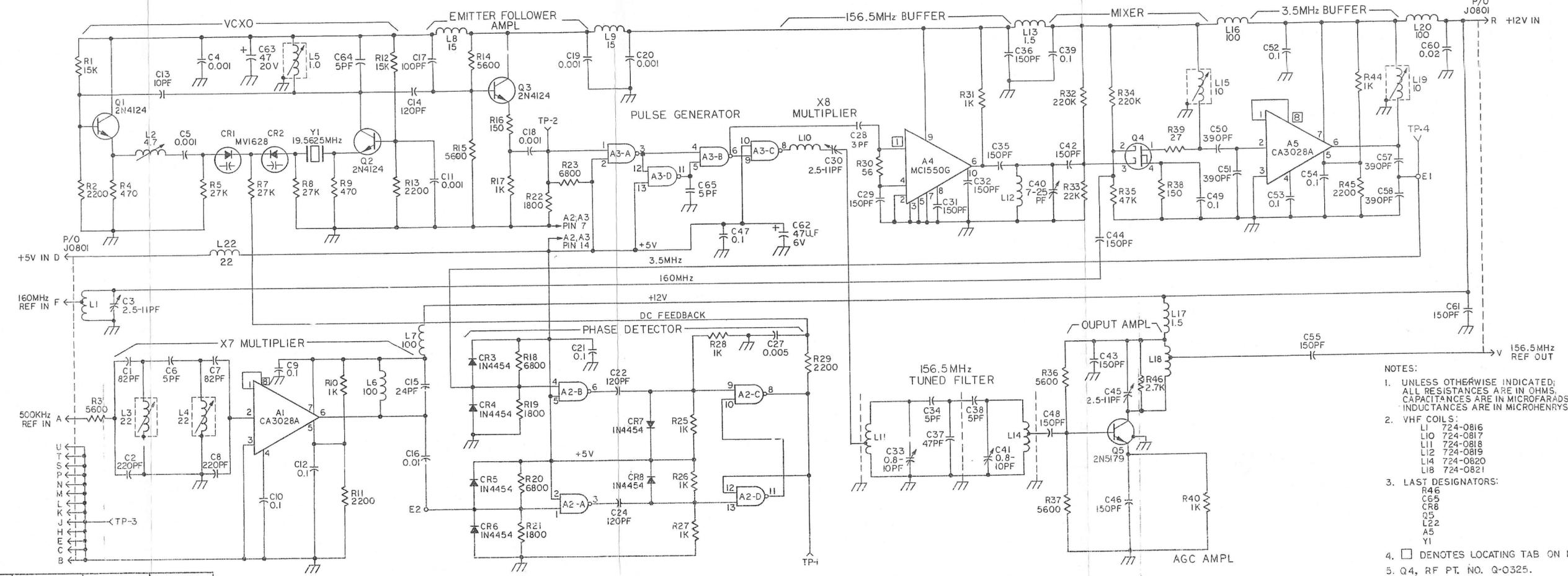


A. Component Locations with Opposite Side Foil

DC VOLTAGES *

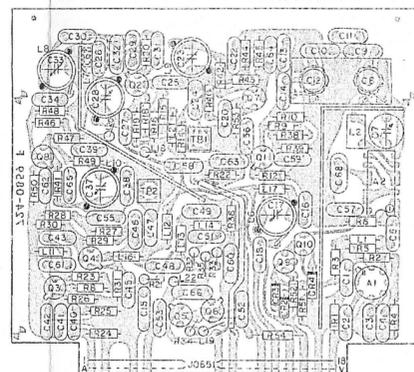
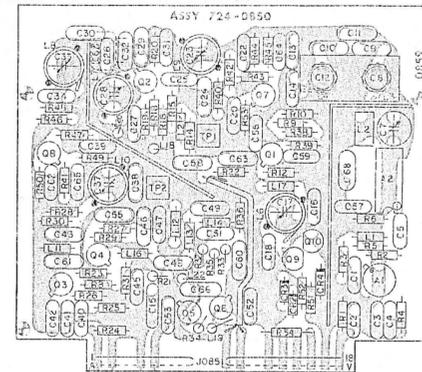
Stage	E	B	C	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12	Pin 13	Pin 14
Q1	4.20 V	1.50 V	11.5 V											
Q2	1.50 V	1.50 V	11.5 V											
Q3	5.90 V	5.70 V	11.5 V											
Q5	5.30 V	6.00 V	12.0 V											
Q6	5.30 V	0.00 V	12.0 V											
Q7	11.4 V	10.9 V	0.00 V											
Q4	11.5 V	2.10 V	1.10 V	1.20 V										
A1	0.16 V	3.80 V	0.00 V	3.00 V	7.90 V	12.0 V	0.16 V							
A2	1.70 V	4.90 V	1.40 V	2.20 V	4.90 V	1.40 V	0.00 V	2.70 V	2.50 V	1.00 V	1.00 V	2.70 V	2.50 V	4.90 V
A3	2.10 V	4.90 V	1.60 V	0.00 V	4.90 V	2.20 V	0.00 V	1.50 V	2.20 V	2.20 V	0.00 V	1.70 V	1.70 V	4.90 V
A4	0.75 V	0.00 V	0.00 V	0.75 V	0.00 V	9.80 V	0.00 V	5.90 V	11.6 V	5.10 V				
A5	0.00 V	4.00 V	5.00 V	3.30 V	6.50 V	12.0 V	12.0 V	0.00 V						

* Referenced to ground.



- NOTES:
- UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS, INDUCTANCES ARE IN MICROHENRYS.
 - VHF COILS:
L1 724-0816
L10 724-0817
L11 724-0818
L12 724-0819
L14 724-0820
L18 724-0821
 - LAST DESIGNATORS:
R46
C65
CR8
Q5
L22
A5
Y1
 - DENOTES LOCATING TAB ON I.C.
 - Q4, RF PT. NO. Q-0325.

Figure 8.7 - Second L.O. Generator Assembly Circuit Diagram REV. N



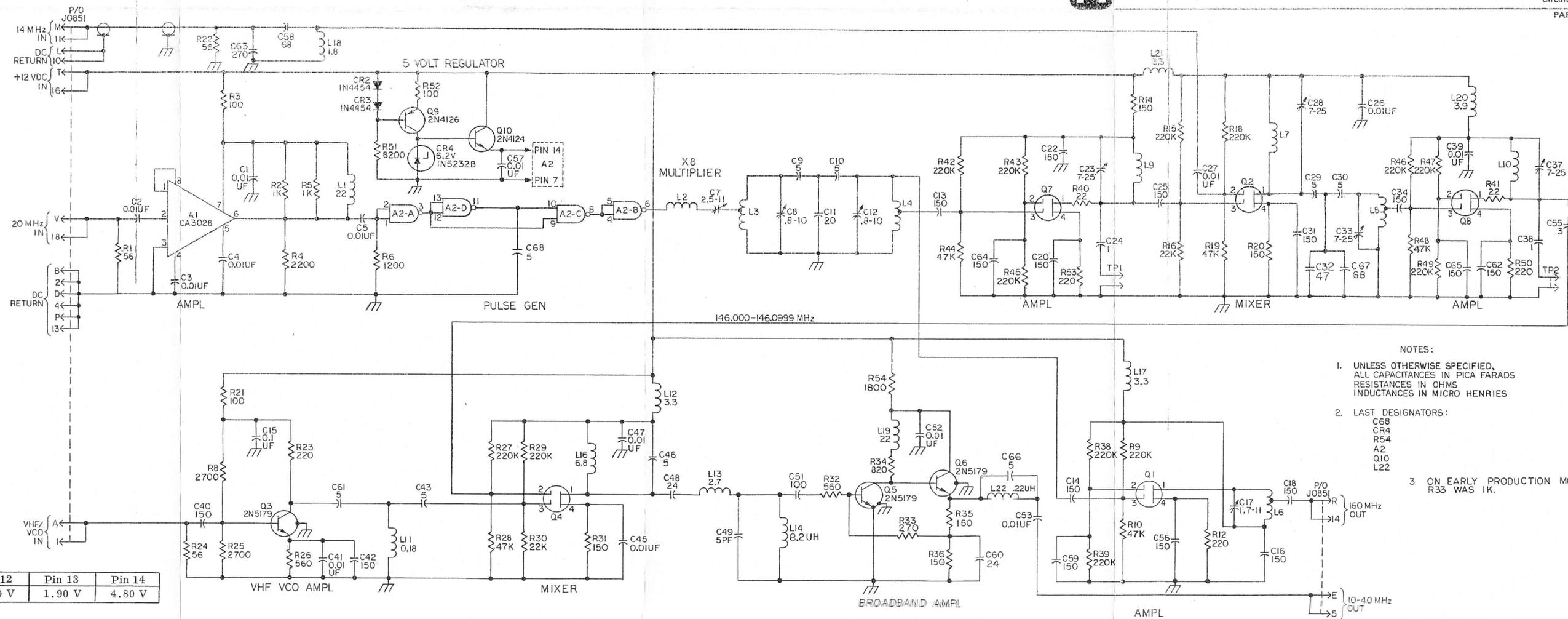
B. Component Locations with Adjacent Side Foil

A. Component Locations with Opposite Side Foil

DC VOLTAGES*

Stage	E	B	C											
Q3	4.50 V	5.10 V	9.30 V											
Q5	0.00 V	0.78 V	1.40 V											
Q6	1.85 V	1.40 V	5.00 V											
Q9	11.5 V	11.0 V	5.50 V											
Q10	4.90 V	5.50 V	12.0 V											
	Pin 1	Pin 2	Pin 3	Pin 4										
Q1	12.0 V	6.00 V	2.10 V	2.25 V										
Q2	12.0 V	2.15 V	1.20 V	1.00 V										
Q4	12.0 V	2.15 V	1.20 V	1.00 V										
Q7	10.7 V	5.60 V	1.80 V	2.00 V										
Q8	12.0 V	6.10 V	2.10 V	2.20 V										
	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8						
A1	2.00 V	3.60 V	0.00 V	3.20 V	7.50 V	11.0 V	11.0 V	2.00 V						
	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12	Pin 13	Pin 14
A2	1.30 V	1.30 V	1.90 V	2.40 V	2.40 V	1.10 V	0.00 V	2.40 V	0.68 V	0.68 V	1.70 V	1.90 V	1.90 V	4.80 V

* Referenced to ground.



- NOTES:
- UNLESS OTHERWISE SPECIFIED, ALL CAPACITANCES IN PICA FARADS, RESISTANCES IN OHMS, INDUCTANCES IN MICRO HENRIES
 - LAST DESIGNATORS:
C68
CR4
R54
A2
Q10
L22
 - ON EARLY PRODUCTION MODELS R33 WAS 1K.

Figure 8.8 - Translator Assembly Circuit Diagram REV. L



TRANSLATOR ASSEMBLY -- 724-0850

REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Integrated Circuit, IF Amplifier, Type CA3028A	IC-0036
A2	Integrated Circuit, NAND Gate, Type SN74H00N	IC-0057
C1	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C2	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C3	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C4	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C5	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C7	Capacitor, Variable, Ceramic, 2.5-11 PF; 350 Vdcw	C-2303
C8	Capacitor, Variable, 0.8-10.0 PF; 250 Vdcw	C-2178
C9	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C10	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C11	Capacitor, Mica, 20 PF ± 5%; 500 Vdcw	C-0108
C12	Capacitor, Variable, 0.8-10.0 PF; 250 Vdcw	C-2178
C13	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C14	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C15	Capacitor, Ceramic, Monolithic, 0.01 UF +80% -20%; 25 Vdcw	C-5066
C16	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C17	Capacitor, Variable, Ceramic, 1.7-11 PF; 250 Vdcw	C-1190
C18	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C20	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C22	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C23	Capacitor, Variable, Ceramic, 7-25 PF; 350 Vdcw	C-2304
C24	Capacitor, Mica, 1 PF ± 5%; 500 Vdcw	C-0100
C25	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C26	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C27	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C28	Capacitor, Variable, Ceramic, 7-25 PF; 350 Vdcw	C-2304
C29	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C30	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C31	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C32	Capacitor, Mica, 47 PF ± 5%; 500 Vdcw	C-0117
C33	Capacitor, Variable, Ceramic, 7-25 PF; 350 Vdcw	C-2304
C34	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C37	Capacitor, Variable, Ceramic, 7-25 PF; 350 Vdcw	C-2304
C38	Capacitor, Mica, 1 PF ± 5%; 500 Vdcw	C-0100
C39	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C40	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263

TRANSLATOR ASSEMBLY -- 724-0850 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
C41	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C42	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C43	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C45	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C46	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C47	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C48	Capacitor, Mica, 24 PF ± 5%; 500 Vdcw	C-0110
C49	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C51	Capacitor, Ceramic, Disk, 100 PF ± 5%; 500 Vdcw	C-0126
C52	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C53	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C55	Capacitor, Mica, 3 PF ± 5%; 500 Vdcw	C-0102
C56	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C57	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C58	Capacitor, Mica, 68 PF ± 5%; 500 Vdcw	C-0122
C59	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C60	Capacitor, Mica, 24 PF ± 5%; 500 Vdcw	C-0110
C61	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C62	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C63	Capacitor, Mica, 270 PF ± 5%; 500 Vdcw	C-0137
C64	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C65	Capacitor, Ceramic, Disk, 150 PF ± 20%; 250 Vdcw	C-2263
C66	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C67	Capacitor, Mica, 68 PF ± 5%; 500 Vdcw	C-0122
C68	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Silicon, Type 1N4454	CR-0705
CR4	Diode, Zener, 5.6V 10%; Type 1N5232B	CR-0265
L1	Coil, Rf, 22 UH	L-0632
L2	Coil, Inductor, VHF, Air Wound	724-0860
L3	Coil, Inductor, VHF, Air Wound	724-0861
L4	Coil, Inductor, VHF, Air Wound	724-0862
L6	Coil, Inductor, VHF, Air Wound	724-0863
L7	Coil, Inductor, VHF, Air Wound	724-0864
L8	Coil, Inductor, VHF, Air Wound	724-0865
L9	Coil, Inductor, VHF, Air Wound	724-0866
L10	Coil, Inductor, VHF, Air Wound	724-0866
L11	Coil, Rf, 0.18 UH	L-0607
L12	Coil, Rf, 3.3 UH	L-0622
L13	Coil, Rf, 2.7 UH	L-0621
L14	Coil, Rf, 8.2 UH	L-0627
L16	Coil, Rf, 6.8 UH	L-0626
L17	Coil, Rf, 3.3 UH	L-0622
L18	Coil, Rf, 1.8 UH	L-0619
L19	Coil, Rf, 22 UH	L-0632
L20	Coil, Rf, 3.9 UH	L-0623
L21	Coil, Rf, 3.3 UH	L-0622
L22	Coil, Rf, 0.22 UH	L-0608
Q1	Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer	Q-0325
Q2	Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer	Q-0325

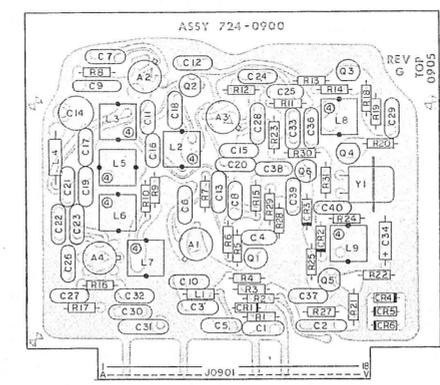
TRANSLATOR ASSEMBLY -- 724-0850 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
Q3	Transistor, Silicon, UHF, Type 2N5179	Q-0390
Q4	Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer	Q-0325
Q5	Transistor, Silicon, UHF, Type 2N5179	Q-0390
Q6	Transistor, Silicon, UHF, Type 2N5179	Q-0390
Q7	Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer	Q-0325
Q8	Transistor, Mosfet, Dual Gate, VHF Amplifier/Mixer	Q-0325
Q9	Transistor, Silicon, General Purpose, PNP, Type 2N4126	Q-0386
Q10	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
R1	Resistor, Carbon; 56 ohms ± 5%; 1/4W	R-1219
R2	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R3	Resistor, Carbon; 100 ohms ± 5%; 1/4W	R-1225
R4	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R5	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R6	Resistor, Carbon; 1200 ohms ± 5%; 1/4W	R-1251
R8	Resistor, Carbon; 2700 ohms ± 5%; 1/4W	R-1259
R9	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R10	Resistor, Carbon; 47K ± 5%; 1/4W	R-1289
R12	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R14	Resistor, Carbon; 150 ohms ± 5%; 1/4W	R-1229
R15	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R16	Resistor, Carbon; 22K ± 5%; 1/4W	R-1281
R18	Resistor, Carbon; 230K ± 5%; 1/4W	R-1305
R19	Resistor, Carbon; 47K ± 5%; 1/4W	R-1289
R20	Resistor, Carbon; 150 ohms ± 5%; 1/4W	R-1229
R21	Resistor, Carbon; 100 ohms ± 5%; 1/4W	R-1225
R22	Resistor, Carbon; 56 ohms ± 5%; 1/4W	R-1219
R23	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R24	Resistor, Carbon; 56 ohms ± 5%; 1/4W	R-1219
R25	Resistor, Carbon; 2700 ohms ± 5%; 1/4W	R-1259
R26	Resistor, Carbon; 560 ohms ± 5%; 1/4W	R-1243
R27	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R28	Resistor, Carbon; 47K ± 5%; 1/4W	R-1289
R29	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R30	Resistor, Carbon; 22K ± 5%; 1/4W	R-1281
R31	Resistor, Carbon; 150 ohms ± 5%; 1/4W	R-1229
R32	Resistor, Carbon; 560 ohms ± 5%; 1/4W	R-1243
R33	Resistor, Carbon; 270 ohms ± 5%; 1/4W	R-1235
R34	Resistor, Carbon; 820 ohms ± 5%; 1/4W	R-1247
R35	Resistor, Carbon; 150 ohms ± 5%; 1/4W	R-1229
R36	Resistor, Carbon; 150 ohms ± 5%; 1/4W	R-1229
R38	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R39	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R40	Resistor, Carbon; 22 ohms ± 5%; 1/4W	R-1209
R41	Resistor, Carbon; 22 ohms ± 5%; 1/4W	R-1209
R42	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R43	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R44	Resistor, Carbon; 47K ± 5%; 1/4W	R-1289
R45	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R46	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R47	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R48	Resistor, Carbon; 47K ± 5%; 1/4W	R-1289
R49	Resistor, Carbon; 220K ± 5%; 1/4W	R-1305
R50	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R51	Resistor, Carbon; 8200 ohms ± 5%; 1/4W	R-1271
R52	Resistor, Carbon; 100 ohms ± 5%; 1/4W	R-1225
R53	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R54	Resistor, Carbon; 1800 ohms ± 5%; 1/4W	R-1255
TP1	Connector, Coaxial, Male	J-0031
TP2	Connector, Coaxial, Male	J-0031
-	Ejector, P.C. Board	MP-4341

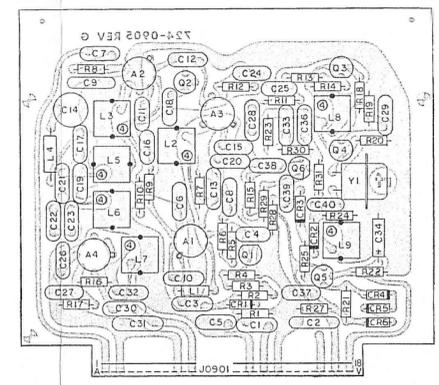
DC VOLTAGES*

Stage	E	B	C	VFO							
Q1	0.00 V	0.67 V	0.00 V	Off							
Q1	0.00 V	0.00 V	10.1 V	On							
Q2	12.0 V	11.5 V	12.0 V	Off							
Q2	12.0 V	12.0 V	2.40 V	On							
Q3	11.0 V	11.1 V	0.00 V	Off							
Q3	10.1 V	9.50 V	10.1 V	On							
Q4	0.00 V	0.00 V	11.0 V	Off							
Q4	0.00 V	1.25 V	10.2 V	On							
Q5	0.56 V-	1.10 V-	12.0 V-	Off							
	2.60 V	3.20 V	11.4 V								
Q5	0.56 V-	1.10 V-	12.0 V-	On							
	2.60 V	3.20 V	11.4 V								
Q6	0.75 V	1.40 V	11.0 V	Off							
Q6	0.75 V	1.25 V	10.1 V	On							
Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	VFO	
A1	0.76 V	0.00 V	0.00 V	0.76 V	0.00 V	12.0 V	0.00 V	5.50 V	12.0 V	4.75 V	Off
A1	0.76 V	0.00 V	0.00 V	0.76 V	10.1 V	12.0 V	0.00 V	6.80 V	12.0 V	7.20 V	On
A2	0.72 V	0.00 V	0.00 V	0.72 V	0.00 V	10.1 V	0.00 V	5.00 V	10.0 V	3.90 V	Off
A2	0.72 V	0.00 V	0.00 V	0.72 V	0.00 V	10.1 V	0.00 V	5.00 V	10.0 V	4.30 V	On
A3	0.75 V	0.00 V	0.00 V	0.75 V	12.0 V	12.0 V	0.00 V	6.50 V	12.0 V	7.20 V	Off
A3	0.75 V	0.00 V	0.00 V	0.75 V	2.40 V	12.0 V	0.00 V	6.10 V	12.0 V	5.60 V	On
A4	0.00 V	2.80 V	0.00 V	2.10 V	5.70 V	8.30 V	8.30 V	0.00 V			Off
A4	0.00 V	2.80 V	0.00 V	2.10 V	5.70 V	8.30 V	8.30 V	0.00 V			On

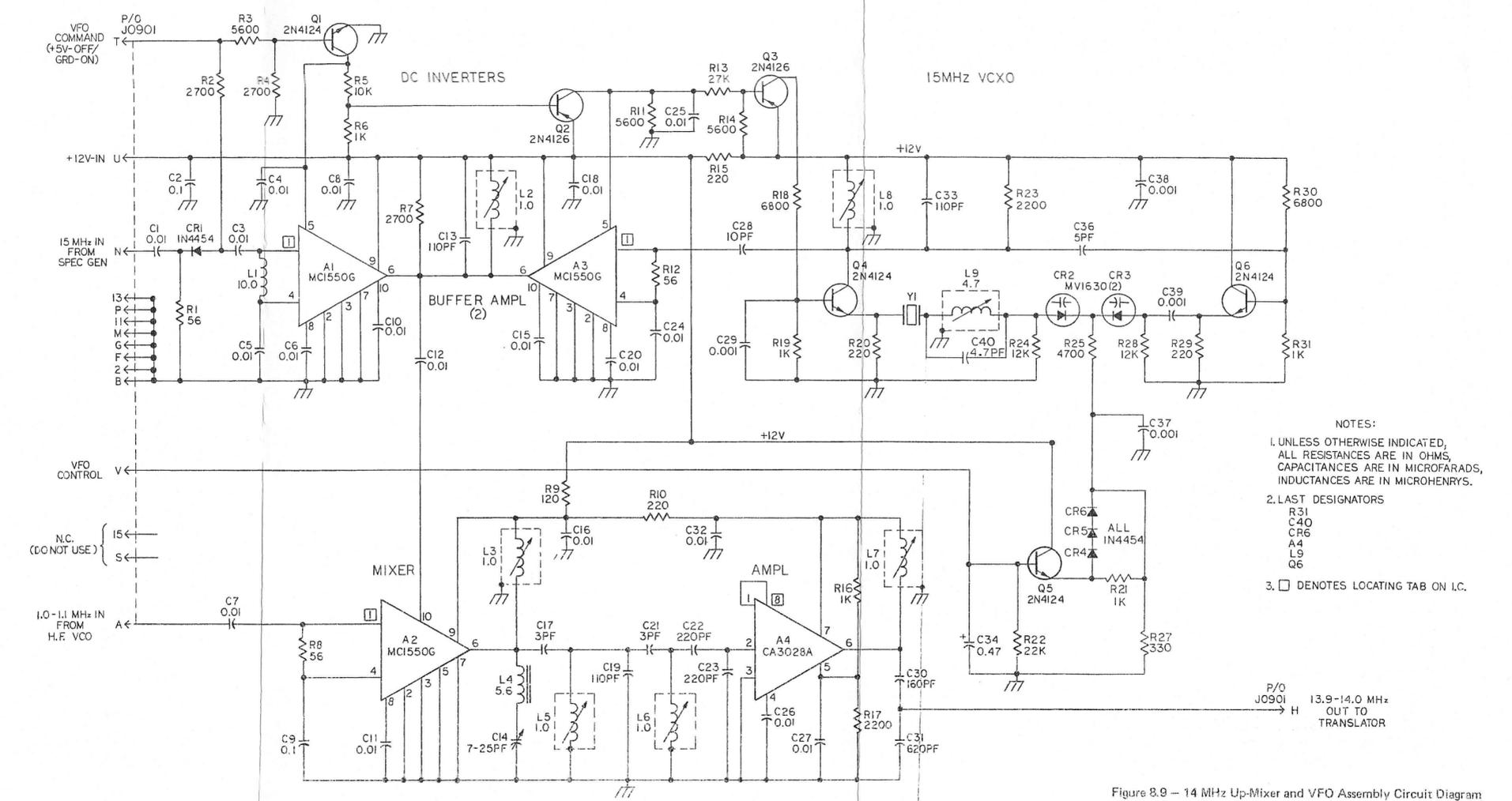
* Referenced to ground.



B. Component Locations with Adjacent Side Foil

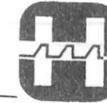


A. Component Locations with Opposite Side Foil



- NOTES:
 1. UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS, INDUCTANCES ARE IN MICROHENRYS.
 2. LAST DESIGNATORS
 R31
 C40
 CR6
 A4
 L9
 Q6
 3. □ DENOTES LOCATING TAB ON I.C.

Figure 8.9 - 14 MHz Up-Mixer and VFO Assembly Circuit Diagram
REV. H



14 MHz MIXER AND VFO ASSEMBLY –
724-0900

REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Integrated Circuit, Differential/Cascode Amplifier, Type MC1550G	IC-0030
A2	Integrated Circuit, Differential/Cascode Amplifier, Type MC1550G	IC-0030
A3	Integrated Circuit, Differential/Cascode Amplifier, Type MC1550G	IC-0030
A4	Integrated Circuit, Differential/Cascode Amplifier, Type CA3028A	IC-0036
C1	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C2	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C3	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C4	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C5	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C6	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C7	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C8	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C9	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C10	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C11	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C12	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C13	Capacitor, Mica, 110 PF ± 5%; 500 Vdcw	C-0127
C14	Capacitor, Ceramic, Trimmer, 7-25 PF; 350 Vdcw	C-2304
C15	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C16	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C17	Capacitor, Mica, 3 PF ± 5%; 500 Vdcw	C-0102
C18	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C19	Capacitor, Mica, 110 PF ± 5%; 500 Vdcw	C-0127
C20	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C21	Capacitor, Mica, 3 PF ± 5%; 500 Vdcw	C-0102
C22	Capacitor, Mica, 220 PF ± 5%; 500 Vdcw	C-0134
C23	Capacitor, Mica, 220 PF ± 5%; 500 Vdcw	C-0134
C24	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C25	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C26	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C27	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C28	Capacitor, Mica, 10 PF ± 5%; 500 Vdcw	C-0104
C29	Capacitor, Ceramic, Disk, 0.001 UF ± 20%; 100 Vdcw	C-2262
C30	Capacitor, Mica, 160 PF ± 5%; 500 Vdcw	C-0131
C31	Capacitor, Mica, 620 PF ± 5%; 500 Vdcw	C-0147
C32	Capacitor, Ceramic, Disk, 0.01 UF ± 20%; 50 Vdcw	C-4952
C33	Capacitor, Mica, 110 PF ± 5%; 500 Vdcw	C-0127

14 MHz MIXER AND VFO ASSEMBLY –
724-0900 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
C34	Capacitor, Tantalum, Polar, 0.47 UF ± 10%; 50 Vdcw	C-5956
C36	Capacitor, Mica, 5 PF ± 5%; 500 Vdcw	C-0103
C37	Capacitor, Ceramic, Disk, 0.001 UF ± 20%; 100 Vdcw	C-2262
C38	Capacitor, Ceramic, Disk, 0.001 UF ± 20%; 100 Vdcw	C-2262
C39	Capacitor, Ceramic, Disk, 0.001 UF ± 20%; 100 Vdcw	C-2262
C40	Capacitor, Ceramic, Disk, Temp. Compensating, 4.7 pF; 1000 Vdcw	C-1283
CR1	Diode, Silicon, Type 1N4454	CR-0705
CR2	Diode, Varactor, Type MV1630	CR-0085
CR3	Diode, Varactor, Type MV1630	CR-0085
CR4	Diode, Silicon, Type 1N4454	CR-0705
CR5	Diode, Silicon, Type 1N4454	CR-0705
CR6	Diode, Silicon, Type 1N4454	CR-0705
L1	Coil, Rf, Molded, 10 UH	L-0628
L2	Coil, Rf, Shielded, Tunable, 0.9-1.1 UH	L-0713
L3	Coil, Rf, Shielded, Tunable, 0.9-1.1 UH	L-0713
L4	Coil, Rf, 5.6 UH	L-0080
L5	Coil, Rf, Shielded, Tunable, 0.9-1.1 UH	L-0713
L6	Coil, Rf, Shielded, Tunable, 0.9-1.1 UH	L-0713
L7	Coil, Rf, Shielded, Tunable, 0.9-1.1 UH	L-0713
L8	Coil, Rf, Shielded, Tunable, 0.9-1.1 UH	L-0713
L9	Coil, Rf, Shielded, Tunable, 4.23-5.17 UH	L-0721
Q1	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q2	Transistor, Silicon, General Purpose, PNP, Type 2N4126	Q-0386
Q3	Transistor, Silicon, General Purpose, PNP, Type 2N4126	Q-0386
Q4	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q5	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q6	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
R1	Resistor, Carbon; 56 ohms ± 5%; 1/4W	R-1219
R2	Resistor, Carbon; 2700 ohms ± 5%; 1/4W	R-1259
R3	Resistor, Carbon; 5600 ohms ± 5%; 1/4W	R-1267
R4	Resistor, Carbon; 2700 ohms ± 5%; 1/4W	R-1259
R5	Resistor, Carbon; 10K ± 5%; 1/4W	R-1273
R6	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R7	Resistor, Carbon; 2700 ohms ± 5%; 1/4W	R-1257
R8	Resistor, Carbon; 56 ohms ± 5%; 1/4W	R-1219
R9	Resistor, Carbon; 120 ohms ± 5%; 1/4W	R-1227
R10	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R11	Resistor, Carbon; 5600 ohms ± 5%; 1/4W	R-1267
R12	Resistor, Carbon; 56 ohms ± 5%; 1/4W	R-1219
R13	Resistor, Carbon; 27K ± 5%; 1/4W	R-1283
R14	Resistor, Carbon; 5600 ohms ± 5%; 1/4W	R-1267
R15	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R16	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R17	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R18	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R19	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R20	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R21	Resistor, Carbon; 22K ± 5%; 1/4W	R-1249
R22	Resistor, Carbon; 22K ± 5%; 1/4W	R-1281
R23	Resistor, Carbon; 2200 ohms ± 5%; 1/4W	R-1257
R24	Resistor, Carbon; 12K ± 5%; 1/4W	R-1275
R25	Resistor, Carbon; 4700 ohms ± 5%; 1/4W	R-1265
R27	Resistor, Carbon; 2700 ohms ± 5%; 1/4W	R-1237

14 MHz MIXER AND VFO ASSEMBLY –
724-0900 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
R28	Resistor, Carbon; 12K ± 5%; 1/4W	R-1275
R29	Resistor, Carbon; 220 ohms ± 5%; 1/4W	R-1233
R30	Resistor, Carbon; 6800 ohms ± 5%; 1/4W	R-1269
R31	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
Y1	Crystal, 14.995 MHz	724-0855
-	Ejector, P.C. Board	MP-4341



CHAPTER 9 POWER SUPPLY MODULES

9.1 INTRODUCTION

The RF 505 Receiver is supplied with either the 1402 or the 1500 Power Supply Module. The application and primary power source available are the deterring factors. The 1402 is the standard module, used for AC applications ONLY. Coupled with the available High Frequency Standard Unit, the 1402 provides necessary voltage to operate the crystal oven. This provides the accuracy required for telegraph, teletype, facsimile, and data transmissions. The 1500 is used to operate either a fixed station or mobile unit, where universal power applications are required.

9.2 AC POWER SUPPLY MODULE (1402)

9.2.1 GENERAL

AC Power Supply Module 724-1402 provides the +5 Vdc, +12 Vdc, and +15 Vdc operating voltages required by the RF-505A for operation and the +28 Vdc required when the RF-508 High Stability Standard is installed. Operation is provided on ac primary power sources (48 to 65 Hz) of either 115 volts (+20% -10%) or 230 volts (+20% -10%). Dc output voltage control is provided by four series regulators and overload protection circuits.

9.2.2 THEORY OF OPERATION

NOTE

Refer to figures 1 and 3 during the following discussion.

Input ac power is connected to the primary winding of step-down transformer T1. The output from the secondary is applied to four full-wave rectifiers (CR1 through CR8) each with a capacitive output filter. From the output filter the dc voltage is supplied to the input of the +28 Vdc regulator, +15 Vdc regulator, +12 Vdc regulator and the +5 Vdc regulator.

+15 Vdc Regulator

Since the operation of the +15 Vdc, +12 Vdc, and the +5 Vdc regulators are nearly identical, only the +15 Vdc regulator will be explained.

The +15 Vdc regulator utilizes an integrated circuit (IC1), a series regulator transistor (Q2), and associated circuitry. The regulator provides a constant voltage output with current limiting. The integrated circuit contains a temperature compensated Zener reference and an output error amplifier. The output of IC1 is applied to the base of transistor Q2. The integrated circuit monitors the output voltage level supplied at pin 4 by the voltage divider network consisting of resistors R4 and R5. The values of R4 and R5 are adjusted to provide the desired output voltage, in this case +15 Vdc.

Transistor Q2 functions as a variable resistance, connected in series with the regulator load. The output control signal from IC1 at the base of Q2 controls the resistance of Q2 to maintain a constant output voltage by adjusting the voltage drop across the transistor.

If a short circuit develops across the output terminal of the regulator, the voltage drop across R6 increases to a point where the circuit switches into current limiting at three amperes. However, fuse F1, a one amp fuse, will open the circuit long before Q2 is damaged.

An overvoltage protection circuit has been added to the +5 Vdc regulator to provide added protection. If the voltage exceeds 6.2 volts, Zener CR6 will conduct and develop a voltage drop across resistor R17. This voltage is applied to SCR CR7 to gate it on. When CR7 is switched on it shorts the output terminal of the regulator to ground and switches the regulator into current limiting to open the fuse.

+28 Vdc Regulator Circuit

The +28 Vdc regulator circuit is basically an emitter follower type of series regulator. Zener CR2 maintains a fixed referenced voltage to the base of Q1. Transistor Q1 functions as an emitter follower to maintain a fixed output voltage level. Note that the power for the 15V, 12V, and 5V integrated circuit regulators is supplied by the 28V output from Q1.

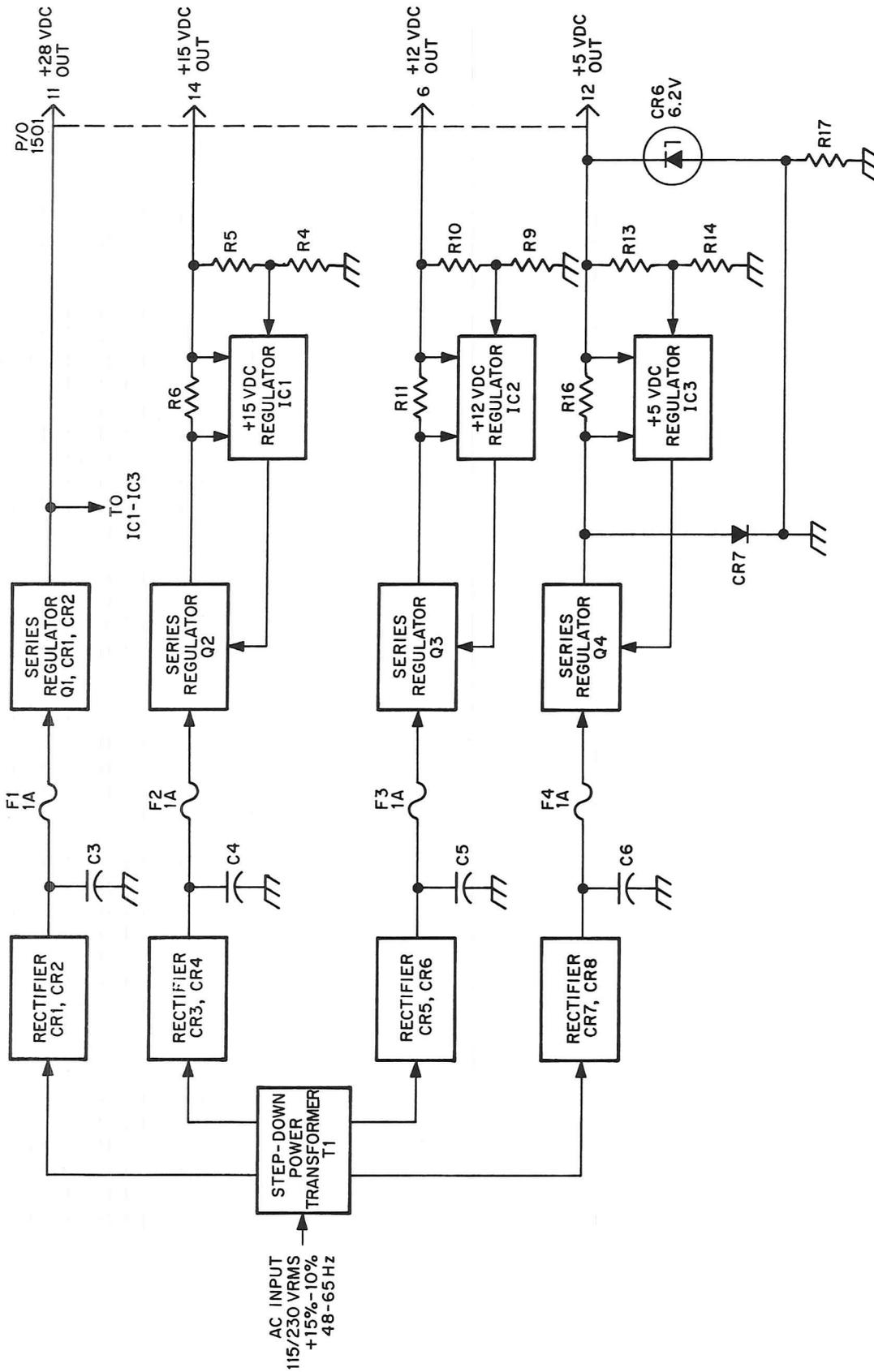


Figure 9-1. AC Power Supply Module Block Diagram



9.2.3 TEST PROCEDURES

WARNING

Dangerous voltages are present on the terminals of the Power Supply Module.

- a. DC Voltmeter – Simpson, Model 260
- b. Adjustable Auto-Transformer (Variac®)
- c. AC Voltmeter – Ballentine, Model 314
- d. Oscilloscope – Tektronix, Model 531

Test EquipmentPreliminary**NOTE**

The following test equipment or equivalent is required to perform the test procedures.

NOTE

The following tests can be performed with the AC Power Supply Module installed in the unit.

PROCEDURES

Step No.	Test Equipment and Test Point	Procedure	Performance
1.	Connect input ac line to the auto-transformer. Connect ac vtvm across output terminals of auto-transformer.	Adjust input level to nominal line voltage in use, either 115 or 230 Vac.	
2.	Connect dc voltmeter to pin 5 of J1401, refer to figures 2 and 3.	If installed in unit, set MODE switch at LSB. Voltage should be +15 Vdc \pm .75 V.	Measure +15 Vdc \pm 5%.
3.	Connect dc voltmeter to pin 10 of J1401.	Voltage should be +12 Vdc \pm 0.6 V.	Measure +12 Vdc \pm 5%
4.	Connect dc voltmeter to pin 13 of J1401.	Voltage should be +5 Vdc \pm 0.25 V.	Measure +5 Vdc \pm 5%.
5.	Connect dc voltmeter to pin 8 of J1401.		Measure 28 Vdc \pm 15%.
6.	As outlined above in steps 1 through 5, refer to figures 2 and 3.	Repeat step 2 through 5 with the input voltage first at -10% and then at +15% of nominal. Check for proper output.	Measure +15 \pm 5% Vdc, +12 \pm 5% Vdc, +5 \pm 5% Vdc.
7.	Disconnect dc voltmeter.	Set input voltage back to nominal value.	
8.	Connect oscilloscope probe to J1401 pins 5, 10, 13, 8.	Check for ac ripple on dc output voltages.	Less than 20 millivolts peak-to-peak for all dc voltages.
9.	Disconnect oscilloscope and auto-transformer.	Set MODE switch at OFF. Disconnect test equipment.	



9.2.4 FAULT ANALYSIS

Fault analysis procedures for the AC Power Supply Module are presented below in tabular form. Refer to page 6 for dc voltage values to figures 2 and 3 for component locations.

Symptom	Possible Trouble	Checks and Corrective Measures
No output.	<ul style="list-style-type: none"> a) Fuse F1 open. b) Faulty input circuitry, T1, C1, C2, Q1, or CR2 on Regulator Board. c) Diode Board Assembly defective. 	<ul style="list-style-type: none"> a) Replace fuse. b) Make voltage measurements. Replace defective component. c) Check diodes CR1 through CR8.
+15 Vdc output absent. All other dc outputs normal.	<ul style="list-style-type: none"> a) Fuse F2 open. b) Defective +15 Vdc regulator circuit or diodes CR3, CR4. 	<ul style="list-style-type: none"> a) Replace open fuse. b) Refer to Table 1 and make dc voltage checks. Replace defective component.
+12 Vdc output absent. All other dc outputs normal.	<ul style="list-style-type: none"> a) Fuse F3 open. b) Defective +12 Vdc regulator circuit or diodes CR5, CR6. 	<ul style="list-style-type: none"> a) Replace open fuse. b) Refer to Table 1 and make dc voltage checks. Replace defective component.
+5 Vdc output absent. All other dc outputs normal.	<ul style="list-style-type: none"> a) Fuse F4 open. b) Defective +5 Vdc regulator circuit or diodes CR7, CR8. 	<ul style="list-style-type: none"> a) Replace open fuse. b) Refer to Table 1 and make dc voltage checks. Replace defective component.

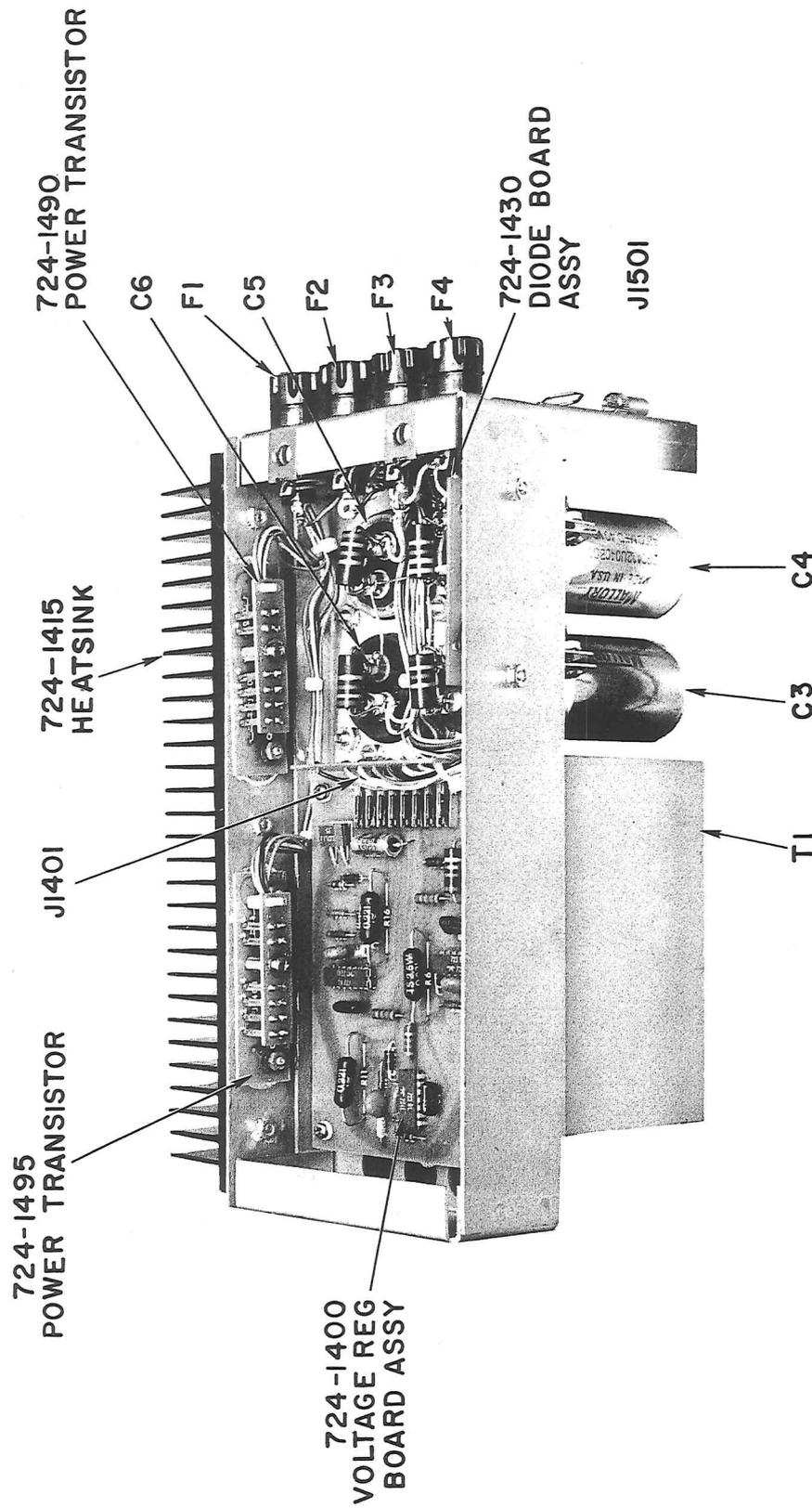


Figure 9-2. Major Assemblies Locations

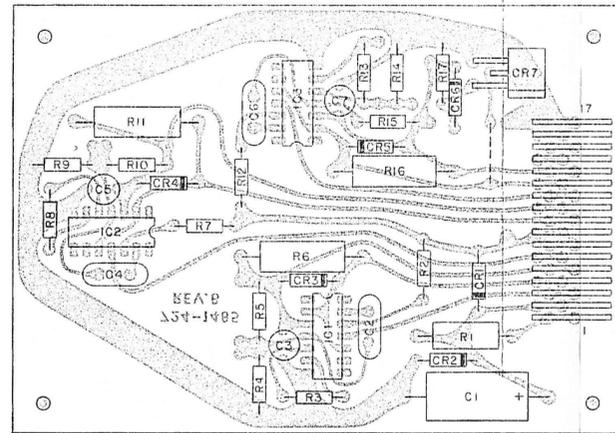


DC VOLTAGES*

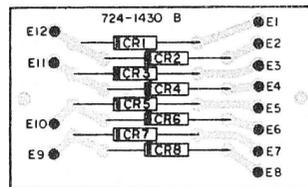
STAGE	EMITTER PIN 1	BASE PIN 2	COLLECTOR PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10	PIN 11	PIN 12	PIN 13
Q1	29.1	30.1	48.4										
Q2	27.1	25.9	15										
Q3	22.6	21.3	12.4										
Q4	12.3	11.6	5.2										
IC1	---	15.1	15.1	7.3	7.3	7.3	0	—	—	15.1	25.8	27.8	16.3
IC2	---	12.3	12.2	4.3	7.3	7.3	0	—	—	12.3	21.2	27.8	13.6
IC3	---	5.2	5.1	5.1	5.1	7.3	0	—	—	5.3	11.0	23.1	6.5

* All voltages taken with Simpson model 260. Input voltage 120 Vac, 60 Hz.

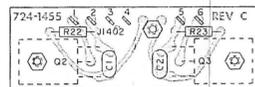
9.2.5 CIRCUIT DIAGRAM AND PARTS LIST



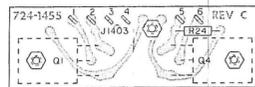
724-1480 Voltage Regulator Board Assembly



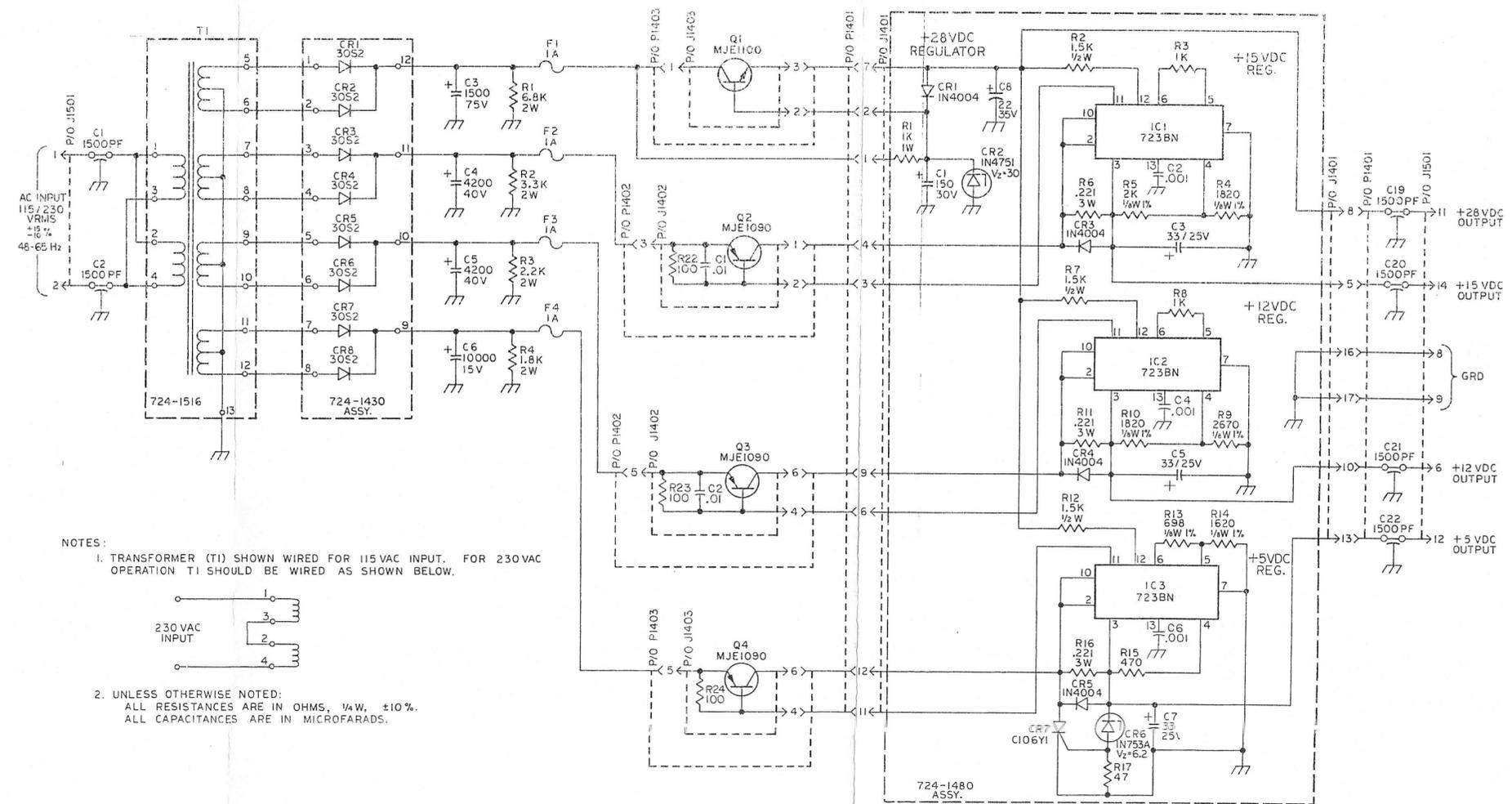
724-1430 Diode Board Assembly



724-1495 Power Transistor Board Assembly



724-1490 Power Transistor Board Assembly



NOTES:

1. TRANSFORMER (T1) SHOWN WIRED FOR 115 VAC INPUT. FOR 230 VAC OPERATION T1 SHOULD BE WIRED AS SHOWN BELOW.
2. UNLESS OTHERWISE NOTED: ALL RESISTANCES ARE IN OHMS, 1/4W, ±10%. ALL CAPACITANCES ARE IN MICROFARADS.

Figure 9-3. AC Power Supply Module Circuit Diagram REV. E



AC POWER SUPPLY ASSEMBLY -- 724-1402
PARTS LIST

Reference Designation	Description	RF P/N
	Voltage Reg. Board Assembly	724-1480
	Diode Board Assembly	724-1430
	Power Transistor Board I Assembly	724-1495
	Power Transistor Board II Assembly	724-1490
C1	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
C2	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
C3	Capacitor, Alum, Electrolyte; 1500 uF; 75 Vdcw	C-4002
C4	Capacitor, Alum, Electrolyte; 4200 uF; 40 Vdcw	C-6360
C5	Capacitor, Alum, Electrolyte; 42200 uF; 40 Vdcw	C-6360
C6	Capacitor, Alum, Electrolyte; 10,000 uF; 15 Vdcw	C-4003
C19	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
C20	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
C21	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
C22	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
F1	Fuse, 3AG, Quick Acting; 1.0 amp	F-0010
J1501	Connector, Power, Receptical, Ribbon, 14 Contact	J-0051
R1	Resistor, Carbon; 6.8K, ± 10%; 2W	R-0334
R2	Resistor, Carbon; 3.3K, ± 10%; 2W	R-0330
R3	Resistor, Carbon; 2.2K, ± 10%; 2W	R-0328
R4	Resistor, Carbon; 1.8K, ± 10%; 2W	R-0327
T1	Transformer, Power	724-1516
XF1	Fuse Holder, Clip Fuse (for AG Fuse)	X-0330
XF2	Fuse Holder, Clip Fuse (for AG Fuse)	X-0330
XF3	Fuse Holder, Clip Fuse (for AG Fuse)	X-0330
XF4	Fuse Holder, Clip Fuse (for AG Fuse)	X-0330

VOLTAGE REGULATOR BOARD ASSEMBLY -- 724-1480
PARTS LIST

Reference Designation	Description	RF P/N
C1	Capacitor, Tantalum, 150 uF; 30 Vdcw	C-2851
C2	Capacitor, Mica; 0.001 uF; 500 Vdcw	C-3513
C3	Capacitor, Tantalum; 33 uF; 25 Vdcw	C-3104
C4	Capacitor, Mica; 0.001 uF; 500 Vdcw	C-3513
C5	Capacitor, Tantalum; 33 uF; 25 Vdcw	C-3104
C6	Capacitor, Mica; 0.001 uF; 500 Vdcw	C-3513
C7	Capacitor, Tantalum; 33 uF; 25 Vdcw	C-3104
CR1	Diode, Type 1N4004	CR-0725
CR2	Diode, Zener, Type 1N4751	CR-0300
CR3	Diode, Type 1N4004	CR-0725
CR4	Diode, Type 1N4004	CR-0725
CR5	Diode, Type 1N4004	CR-0725
CR6	Diode, Zener, Type 1N753A	CR-0046
CR7	Diode, SCR; Type C106Y1	CR-0665
IC1	Integrated Circuit, 723BL	IC-0058
IC2	Integrated Circuit, 723BL	IC-0058
IC3	Integrated Circuit, 723BL	IC-0058
R1	Resistor, Carbon; 1K ± 5%; 1W	R-1649
R2	Resistor, Carbon; 1.5K ± 5%; 1/2W	R-1453
R3	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R4	Resistor, Metal Film; 1820 ohms ± 1%; 1/8W	R-7292
R5	Resistor, Metal Film; 2000 ohms ± 1%; 1/8W	R-7278
R6	Resistor, Wirewound; 0.221 ohms ± 10%; 1W	R-7161
R7	Resistor, Carbon; 1.5K ± 5%; 1/2W	R-1453
R8	Resistor, Carbon; 1K ± 5%; 1/4W	R-1249
R9	Resistor, Metal Film; 2670 ohms ± 1%; 1/8W	R-7299
R10	Resistor, Metal Film; 1820 ohms ± 1%; 1/8W	R-7292
R11	Resistor, Wirewound; 0.221 ohms ± 10%; 1/4W	R-7161
R12	Resistor, Carbon; 1.5K ± 5%; 1/2W	R-1453
R13	Resistor, Metal Film; 698 ohms ± 1%; 1/8W	R-7274
R14	Resistor, Metal Film; 1620 ohms ± 1%; 1/8W	R-7280
R15	Resistor, Carbon; 470 ohms ± 5%; 1/4W	R-1241
R16	Resistor, Wirewound; 0.221 ohms ± 10%; 1/4W	R-7161
R17	Resistor, Carbon; 47 ohms ± 5%; 1/4W	R-1217

DIODE BOARD ASSEMBLY -- 724-1430
PARTS LIST

Reference Designation	Description	RF P/N
CR1	Diode, Silicon, Type 30S2	CR-0748
CR2	Diode, Silicon, Type 30S2	CR-0748
CR3	Diode, Silicon, Type 30S2	CR-0748
CR4	Diode, Silicon, Type 30S2	CR-0748
CR5	Diode, Silicon, Type 30S2	CR-0748
CR6	Diode, Silicon, Type 30S2	CR-0748
CR7	Diode, Silicon, Type 30S2	CR-0748
CR8	Diode, Silicon, Type 30S2	CR-0748

POWER TRANSISTOR BOARD ASSEMBLY -- 724-1490
PARTS LIST

Reference Designation	Description	RF P/N
Q1	Transistor, Silicon, NPN, MJE-1100	Q-1142
Q4	Transistor, Silicon, PNP Darlington MJE-1090	Q-399
R24	Resistor, Carbon; 100 ohms ± 5%; 1/4W	R-1225

POWER TRANSISTOR BOARD ASSEMBLY -- 724-1495
PARTS LIST

Reference Designation	Description	RF P/N
C1	Capacitor, Ceramic; 0.01 uF, 50 Vdcw	C-4 952
C2	Capacitor, Ceramic; 0.01 uF, 50 Vdcw	C-4 952
Q2	Transistor, Silicon, PNP Darlington MJE-1090	Q-C 399
Q3	Transistor, Silicon, PNP Darlington MJE-1090	Q-C 399
R22	Resistor, Carbon; 100 ohms ± 5%; 1/4W	R-1 225
R23	Resistor, Carbon; 100 ohms ± 5%; 1/4W	R-1 225



9.3 UNIVERSAL POWER SUPPLY MODULE (1500)

9.3.1 GENERAL

Power Supply Module 724-1500 provides the +5 vdc, +12 vdc, and +15 vdc operating voltages for the unit from the input primary power source. Primary power can be either ac (100 to 260 Vrms, 40 to 1000 Hz) or dc (10 to 40 volts). Ac input voltages are rectified and applied in the same manner as dc primary power sources. Output voltage control over the specified input voltage range is maintained by a proportional control circuit. For higher voltage primary power sources, either ac or dc, the conduction time of the dc-to-ac inverter is reduced thereby lowering the dc output level to the specified value. Basically the Power Supply Module consists of a 5 kHz multivibrator, a monostable multivibrator, a dc to ac inverter, an input rectifier bridge, an output rectifier bridge, two NAND gates, a +5V post-regulator, and a +12V post-regulator.

9.3.2.1 THEORY OF OPERATION

NOTE

Refer to figures 9.1 and 9.2 during the following discussion.

9.3.2.2 GENERAL

The dc-to-ac inverter is controlled by the two NAND gates A1-B and A1-C, one NAND gate for each half cycle of the inverter frequency. Conduction time of each half cycle of the inverter is adjusted by the 10 kHz pulses from the monostable multivibrator while the inverter frequency is maintained by the two 5 kHz clock pulses supplied by the 5 kHz multivibrator. The 5 kHz clock pulse with the 10 kHz monostable pulse at the NAND gates alternately switch on each half of the dc-to-ac inverter, thereby providing a 5 kHz ac voltage on the secondary winding of T2. The ac voltage is in turn rectified, filtered, and regulated to +5 vdc (regulated), +12 vdc (regulated), and +15 vdc.

The width of the 10 kHz pulse is controlled in turn by the dc feedback loop which monitors the output level of the power supply at the primary of T2.

When operating from low level power sources, either ac or dc, the pulse width of the monostable is increased. This increases the on time of the dc-to-ac inverter, thereby raising the average output level up to the pre-set value. For high level input voltages, the conduction time of the dc-to-ac inverter is reduced to maintain the same pre-set output level.

9.3.2.3 INPUT RECTIFIER

Input ac primary power is applied to step down transformer T1, rectified by diodes CR2 and CR3, and filtered by capacitor C2 and the inductor winding of T1. When operating from dc primary power, the input dc voltage is applied directly to C2. The input voltage at C2, proportional to the input voltage level (either ac or dc), is applied as the input to the 724-1520 assembly. Transistor Q1 and Zener diode CR4 maintain a regulated supply buss at 5 volts below the positive voltage at C2 for the two multivibrators and NAND gate circuitry.

9.3.2.4 5KHz MULTIVIBRATOR

The 5 kHz multivibrator, consisting of transistors Q2 and Q3, provide the basic timing clock pulses for the power supply. The output pulses from both Q2 and Q3 collectors (180 degrees out of phase) are applied to the monostable as trigger pulses and as inputs to NAND gates A1-C and A1-B, respectively. Variable resistor R4 is adjusted for symmetry between the two output pulses.

9.3.2.5 TRIGGER NETWORKS

The pulse at the collector of Q2 is differentiated by C6 and R7 and is applied through diode CR5 to the collector of Q4 as one trigger pulse. Diode CR5 passes only the negative portion of the differentiated pulse. In a similar manner the pulse at the collector of Q3, which is 180 degrees out of phase from the pulse at Q2, is differentiated by C7 and R9 and applied through diode CR6 to the collector of Q4. This signal is also a negative trigger pulse, therefore, the monostable is triggered twice during each cycle of the 5 kHz multivibrator, thereby operating at 10 kHz.

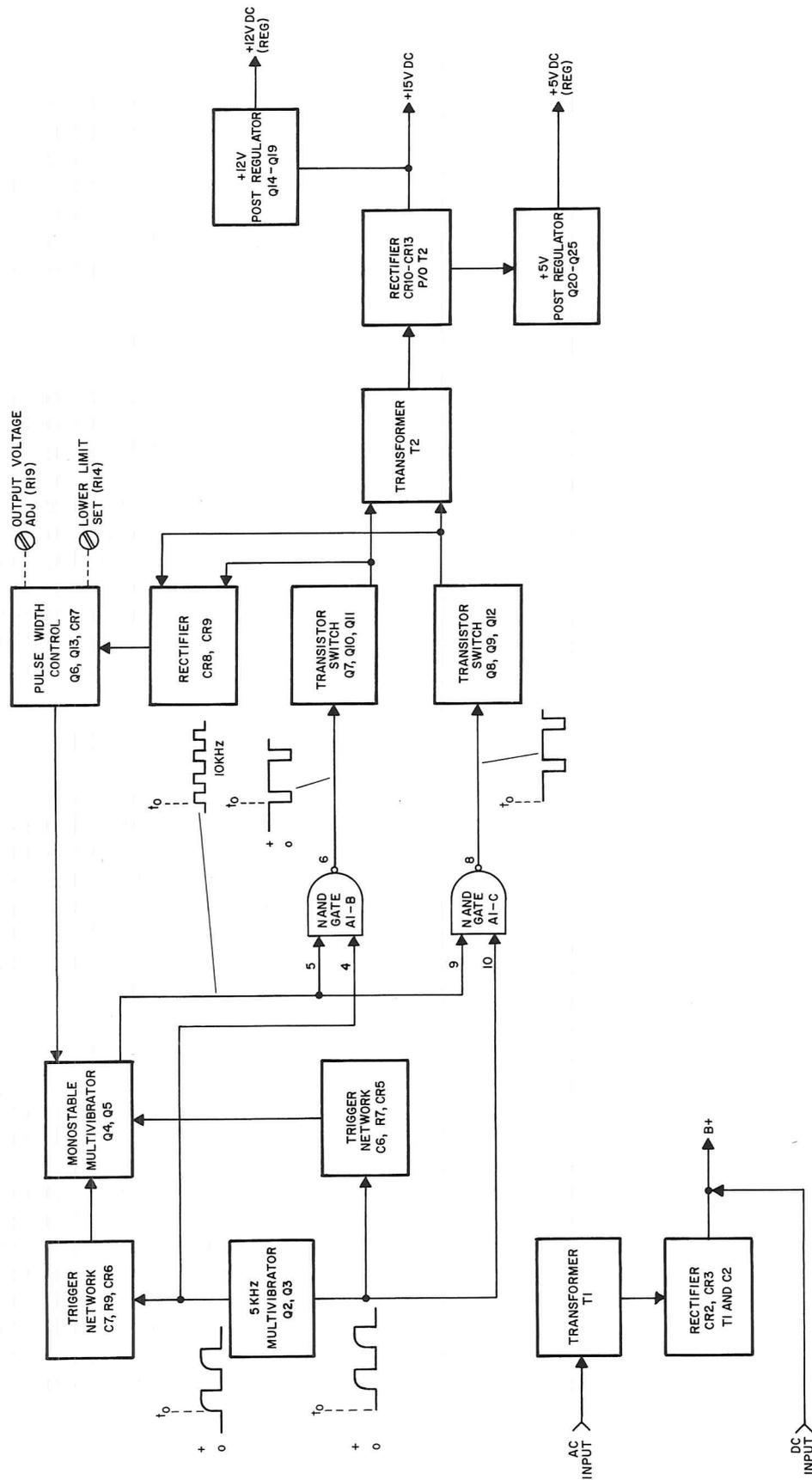


Figure 9.4 — Power Supply Block Diagram



9.3.2.6 MONOSTABLE MULTIVIBRATOR

Transistors Q4 and Q5 form the monostable multivibrator. Pulse width control is provided by transistor Q13 which is in turn controlled by the dc feedback signal. The output of the monostable is coupled from the collector of Q5 to one of the input leads on NAND gates A1-B and A1-C.

Monostable transistors Q4 and Q5 are biased with Q5 on and Q4 off. When a negative pulse is applied to the collector of Q4, transistor Q5 is switched off and Q4 is biased on. The base bias at Q5 determines the duration that Q4 will conduct and is adjusted by variable resistor R14, lower limit set. With the input voltage across C2 below the minimum value (10 vdc or rectified ac equivalent) the pulse width of the monostable is adjusted by R14 to the maximum width that will allow a 10 kHz trigger rate.

For higher input voltage levels, transistor Q13 shunts R13 and R14 and increases the base current at Q5 to shorten the pulse width. Refer to paragraph 9.2.8.

9.3.2.7 NAND GATES A1-B AND A1-C

The operation of the two NAND gates are identical, therefore only the operation of NAND gate A1-B will be explained below.

With reference to pin 7 (common) of A1, the output of the NAND gate is low (less than 0.5 vdc) only if the two inputs leads, pins 4 and 5, are both high (greater than 1.5 vdc). If either or both of the two inputs goes low, then the output is high.

One input to A1-B is the 5 kHz clock pulse from the collector of Q3. The other input is the 10 kHz output of the monostable. When both Q3 and Q5 are biased off, the output of A1-B, pin 6, is low. This low signal biases on transistor switch Q7. In a similar manner, when transistors Q2 and Q5 are biased off, NAND gate A1-C will be low, turning on transistor switch Q8.

9.3.2.8 TRANSISTOR SWITCHES Q7 THROUGH Q12

Transistor Q8 is switched on by the negative output pulse from NAND gate A1-C. When conducting, Q8 forward biases transistors Q9 and Q12, a Darlington pair, causing current to flow from the center tap through one half of T2 primary winding. In the same manner, when Q8 is biased off, Q7 is

switched on by the negative pulse from NAND gate A1-B. This causes current to flow through the other half of T2 primary winding. The current flowing alternately from the center tap through each half of the primary winding is induced into the secondary as a 5 kHz ac voltage.

9.3.2.9 RECTIFIERS CR8/CR9

Diodes CR8/CR9, resistors R27/R28, and capacitor C10 rectify and filter the ac output pulses at transistors Q11 and Q12 to supply a negative dc voltage to the base of Q6. The negative voltage across C10 is proportional to the average value of the full wave rectified transformer primary voltage and is used to control the pulse width of the monostable.

For high voltage primary power sources the voltage at Q6 base is increased in a negative value until it is sufficient to bias Q6 on. When conducting, Q6 drives the base of Q13 to increase the current at the base of Q5. This shortens the output pulse applied to NAND gates A1-B and A1-C to reduce the duty cycle of the dc-to-ac inverter and lower the output voltage. Variable resistor R19 controls the voltage level at Q6 and is adjusted to provide 15 Vdc output at pin 14 of J1501 with an input ac primary power source of 150 Vrms.

When the average value at C10 increases, Q6 is turned on harder to further reduce the pulse width and lower the average value at C10. This will continue until the voltage at the base of Q6 is 0.6 volts more negative than the voltage across Zener diode CR7. At this level, the pulse width of the monostable will stabilize and further correction by the dc feedback loop of the output level ceases. Variable resistor R19, output level adjust, and R20 with R27 provide a voltage divider network for output level control.

9.3.2.10 OUTPUT RECTIFIER AND POST REGULATORS

Two fullwave rectifier circuits supply the +15 Vdc and +6.5 Vdc to two filter circuits. Fuses F1 and F2 provide circuit protection against shorts or overloads in the system. The +15 Vdc is applied to the output at J1501 pin 14 and to a 12 volt post regulator. The +6.5 Vdc is applied directly to a 5 volt post regulator. These regulators in turn supply +12 Vdc and +5 Vdc to J1501 pin 6 and J1501 pin 12 respectively. The +12 Vdc post regulator output is also used as a bias voltage in the +5 Vdc regulator.



9.5 FAULT ANALYSIS

Fault analysis procedures for Power Supply Module 724-1500 are presented below in tabular form.

Refer to figure 9.5 for ac waveforms, and to figure 9.9 for dc and ac voltages charts, printed circuit component locations, and the schematic diagram.

Table 9.1 – Fault Analysis

SYMPTOM	POSSIBLE TROUBLE	CHECKS AND CORRECTIVE MEASURES
No output with either ac or dc input voltages.	Faulty circuitry.	Refer to figures 9.2 and 9.6. Make voltage waveform and dc voltage measurements. Replace faulty components.
No output with dc input voltage. Ac operation normal.	Diode CR6 open on main frame of unit.	Check diode and replace if faulty, refer to chapter 7.
No output with ac input voltage. Dc operation normal.	Transformer T1 or associated circuitry defective.	Check transformer windings and diodes CR2 and CR3. Replace defective components.
All output voltages out of spec with input voltage greater than 90 Vrms or 10 vdc.	R14 or R19 improperly adjusted.	Refer to paragraph 9.3 and perform alignment procedures.
+12 V and +5 V outputs out of spec. +15 V output proper.	a. R35 improperly adjusted. b. +12 V post-regulator circuit defective.	Refer to paragraph 9.3 and perform alignment procedures. Refer to figure 9.6. Make voltage measurements. Replace defective component.
+5 V output out of spec. +12 V and +15 V outputs proper	R41 improperly adjusted. +5 V post-regulator circuit defective.	Refer to paragraph 9.3 and perform alignment procedures. Refer to figure 9.6. Make voltage measurements. Replace defective component.

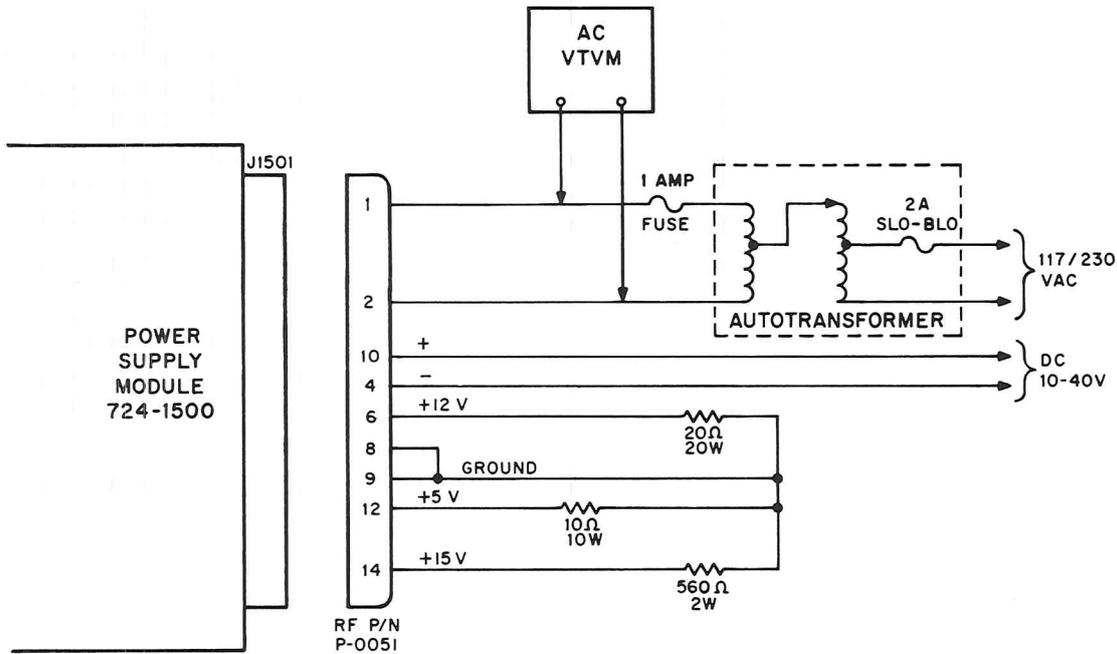


Figure 9.6 – Fabricated Test Circuit

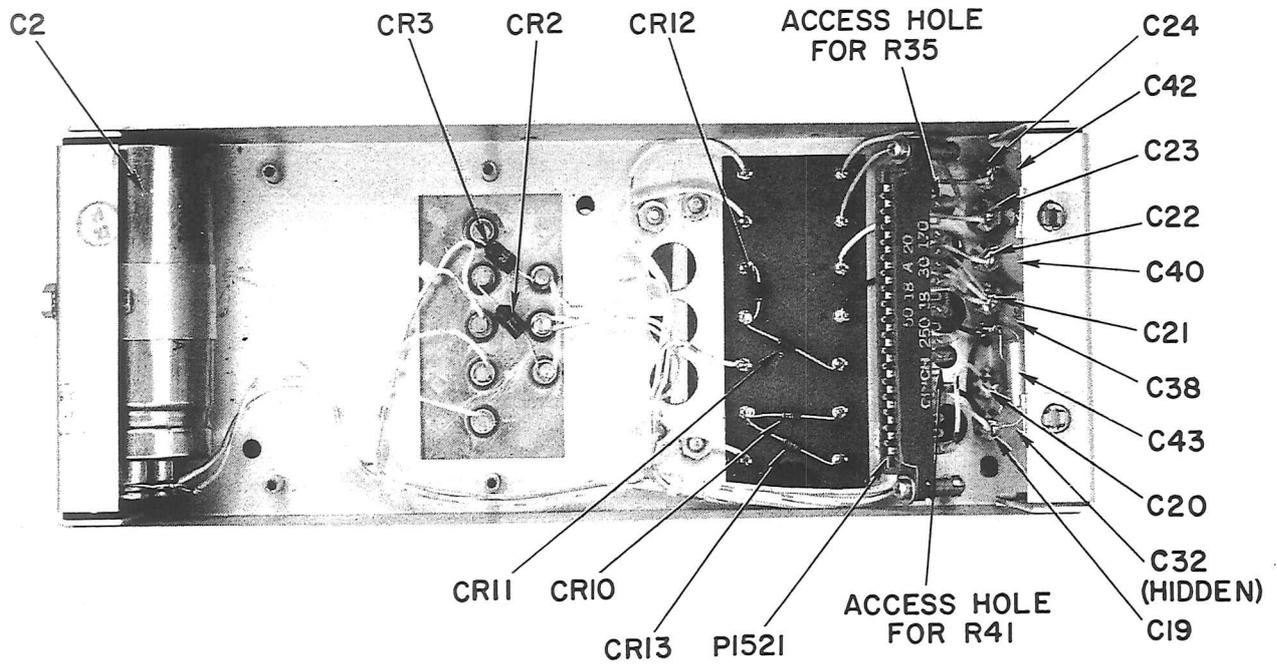


Figure 9.7 – Component Locations, Top View

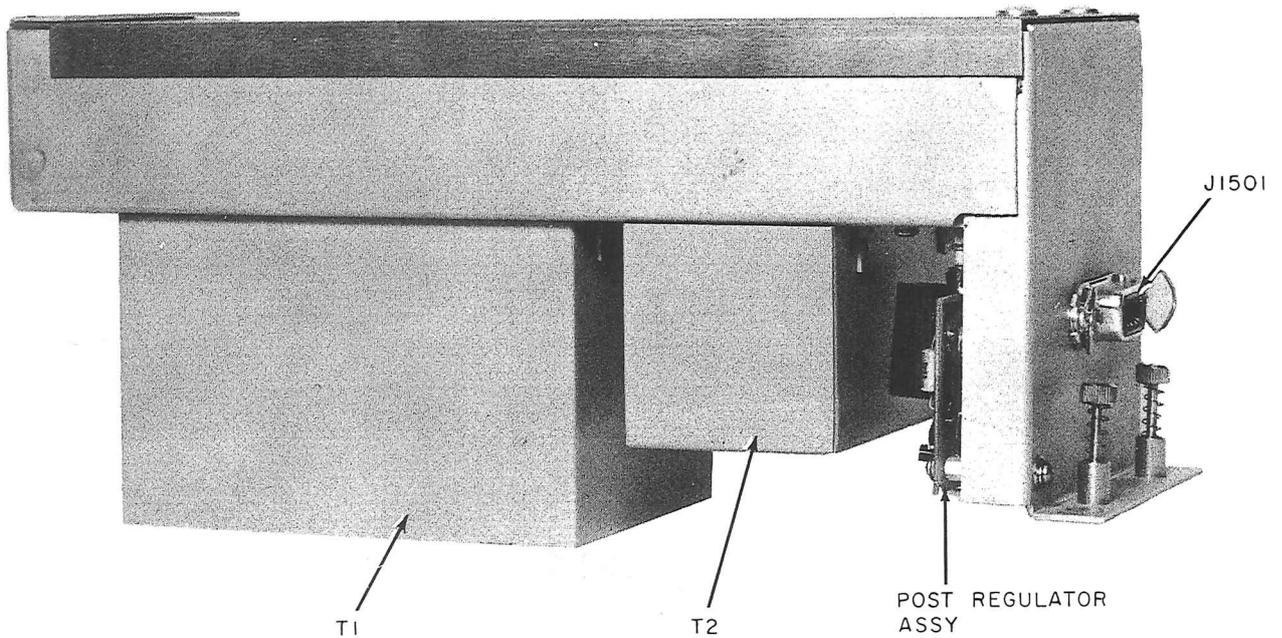


Figure 9.8 – Component Locations, Side View



AC VOLTAGES*

Stage	E	B	C
Q1	0.80	0.78	2.8
Q2	0.80	1.6	1.9
Q3	0.69	0.96	2.0
Q4	0.78	9.9	1.8
Q5	1.8	0.31	0.77
Q6	0.74	0.77	0.37
Q7	1.4	1.1	5.9
Q8	0.82	0.89	5.9
Q9	3.3	3.7	23.0
Q10	3.2	3.7	19.0
Q11	2.8	3.3	25.0
Q12	2.8	3.2	21.0
Q13	0.51	0.37	0.81

*Referenced to TP2

DC VOLTAGES*

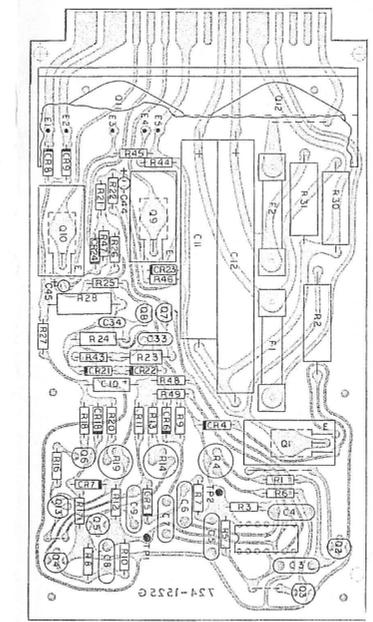
Stage	E	B	C
Q1	0	-0.64	-6.8
Q2	0	-0.42	2.45
Q3	0	-0.42	2.45
Q4	0	0.28	2.7
Q5	0	0.12	0.76
Q6	0.10	5.0	5.0
Q7	4.0	3.4	-5.4
Q8	4.0	3.4	-5.4
Q9	4.9	-6.6	-6.6
Q10	4.9	-6.6	-6.8
Q11	-6.8	4.9	4.8
Q12	-6.8	4.9	4.8
Q13	2.4	2.0	-0.22

*Referenced to TP2, Maximum Load

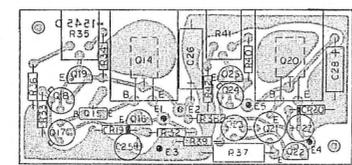
POST REGULATOR
DC VOLTAGES*

Stage	E	B	C
Q14	+12.5	11.5	11.5
Q15	11.5	11.0	11.5
Q16	5.0	5.5	12.5
Q17	4.5	5.0	11.0
Q18	4.5	5.5	11.5
Q19	5.1	5.6	11.5
Q20	5.4	4.5	4.4
Q21	4.5	3.8	2.7
Q22	2.2	2.6	5.4
Q23	1.7	2.2	3.8
Q24	1.7	2.3	4.4
Q25	2.3	2.8	4.4

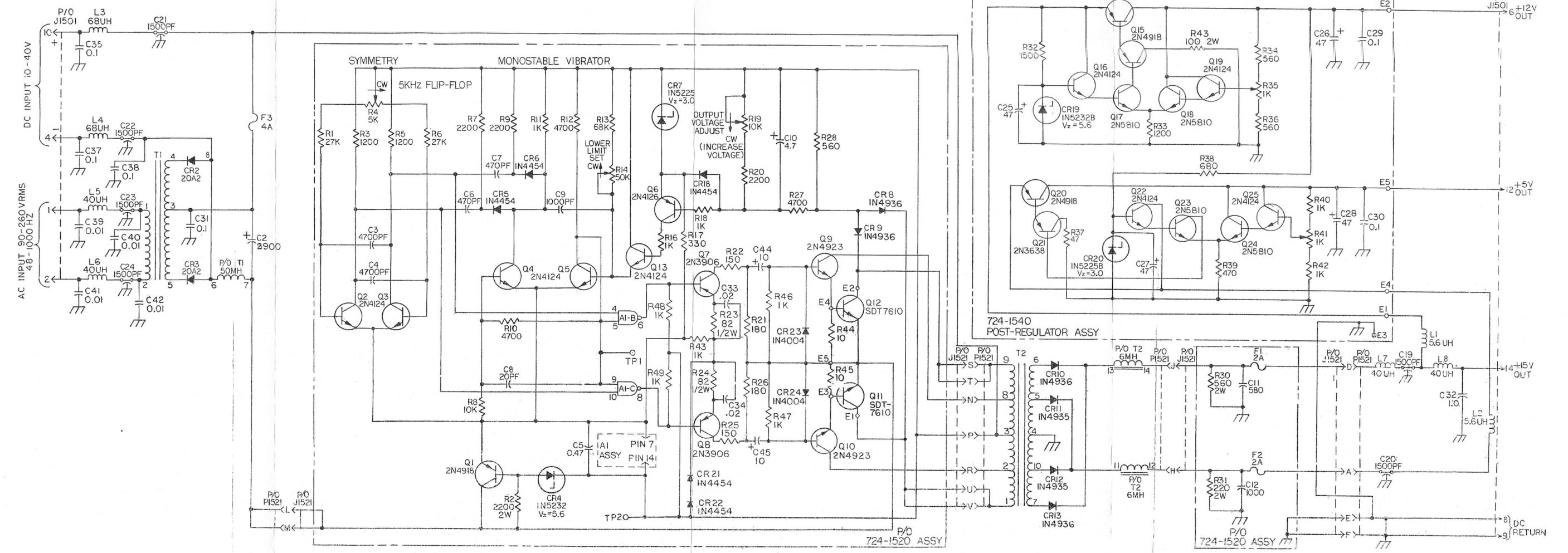
*Referenced to ground.



724-1520 Assembly



724-1540
Post Regulator Assembly



NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES ARE IN OHMS,
ALL CAPACITANCES ARE IN MICROFARADS.

Figure 9.9 -- Power Supply Module Circuit Diagram
REV. AA



POWER SUPPLY MODULE - 724-1500

REF DESIG	DESCRIPTION	RF PART NUMBER
C2	Capacitor, Aluminum, Electrolyte, 2900 UF; 50 Vdcw	C-4001
C19	Capacitor, Feed-thru, 1500 PF ± 20%; 500 Vdcw	C-2651
C20	Capacitor, Feed-thru, 1500 PF ± 20%; 500 Vdcw	C-2651
C21	Capacitor, Feed-thru, 1500 PF ± 20%; 500 Vdcw	C-2651
C22	Capacitor, Feed-thru, 1500 PF ± 20%; 500 Vdcw	C-2651
C23	Capacitor, Feed-thru, 1500 PF ± 20%; 500 Vdcw	C-2651
C24	Capacitor, Feed-thru, 1500 PF ± 20%; 500 Vdcw	C-2651
C31	Capacitor, Ceramic, 0.1 UF +80% -20%; 75 Vdcw	C-0063
C32	Capacitor, Ceramic, 1.0 UF +80% -20%; 35 Vdcw	C-3100
C35	Capacitor, Ceramic, 0.1 UF +80% -20%; 75 Vdcw	C-0063
C37	Capacitor, Ceramic, 0.1 UF +80% -20%; 75 Vdcw	C-0063
C38	Capacitor, Ceramic, 0.1 UF +80% -20%; 75 Vdcw	C-0063
C39	Capacitor, Ceramic, 0.1 UF GMV; 1K	C-0008
C40	Capacitor, Ceramic, 0.1 UF GMV; 1K	C-0008
C41	Capacitor, Ceramic, 0.1 UF GMV; 1K	C-0008
C42	Capacitor, Ceramic, 0.1 UF GMV; 1K	C-0008
CR2	Diode, Silicon, Type 20A2	CR-0706
CR3	Diode, Silicon, Type 20A2	CR-0706
CR10	Diode, Silicon, Type 1N4936	CR-0281
CR11	Diode, Silicon, Type 1N4935	CR-0280
CR12	Diode, Silicon, Type 1N4935	CR-0280
CR13	Diode, Silicon, Type 1N4936	CR-0281
J1501	Connector, Power	J-0051
L1	Coil, Rf, 5.6 UH	L-0331
L2	Coil, Rf, 5.6 UH	L-0331
L3	Choke, 68 UH	L-0109
L4	Choke, 68 UH	L-0109
L5	Choke, 40 UH	L-0108
L6	Choke, 40 UH	L-0108
L7	Choke, 40 UH	L-0108
L8	Choke, 40 UH	L-0108
P1521	Connector, 18 Pin	724-0148
T1	Input Power Transformer	724-1515
T2	Toroidal Transformer	724-1518

BOARD ASSEMBLY - 724-1520

REF DESIG	DESCRIPTION	RF PART NUMBER
A1	Integrated Circuit, Quad, 2 Input Gate SN7400N	IC-0010
C3	Capacitor, Mica, 4700 PF ± 5%; 500 Vdcw	C-0169
C4	Capacitor, Mica, 4700 PF ± 5%; 500 Vdcw	C-0169
C5	Capacitor, Ceramic, 0.47 UF +80% -20%; 10 Vdcw	C-0058
C6	Capacitor, Mica, 470 PF ± 5%; 500 Vdcw	C-0143
C7	Capacitor, Mica, 470 PF ± 5%; 500 Vdcw	C-0143
C8	Capacitor, Mica, 20 PF ± 5%; 500 Vdcw	C-0108
C9	Capacitor, Mica, 1000 PF ± 5%; 500 Vdcw	C-0152
C10	Capacitor, Tantalum, Polar, 4.7 UF ± 20%; 20 Vdcw	C-6313
C11	Capacitor, 580 UF 15 Vdcw	C-4162
C12	Capacitor, Electrolytic, Aluminum, 1000 UF; 7 Vdcw	C-6361
C33	Capacitor, Ceramic, 0.02 UF +60% -40%; 150 Vdcw	C-0066
C34	Capacitor, Ceramic, 0.02 UF +60% -40%; 150 Vdcw	C-0066
C44	Capacitor, Tantalum, 10 UF ± 20%; 20 Vdcw	C-6448
C45	Capacitor, Tantalum, 10 UF ± 20%; 20 Vdcw	C-6448
CR4	Diode, Zener, 5.6V ± 10%; Type 1N5232	CR-0265
CR5	Diode, Silicon, Signal; Type 1N4454	CR-0705
CR6	Diode, Silicon, Signal; Type 1N4454	CR-0705
CR7	Diode, Zener, 3.0V ± 10%; Type 1N5225	CR-0204
CR8	Diode, Silicon, Type 1N4936	CR-0281
CR9	Diode, Silicon, Type 1N4936	CR-0281
CR18	Diode, Silicon, Signal; Type 1N4454	CR-0705
CR21	Diode, Silicon, Signal; Type 1N4454	CR-0705
CR22	Diode, Silicon, Signal; Type 1N4454	CR-0705
CR23	Diode, Silicon, Signal; Type 1N4454	CR-0705
CR24	Diode, Silicon, Signal; Type 1N4454	CR-0705
F1	Fuse, Type 3 AG, 2 Amperes	F-0012
F2	Fuse, Type 3 AG, 2 Amperes	F-0012
Q1	Transistor, Silicon, Power, PNP, 2N4918	Q-0337
Q2	Transistor, Silicon, NPN, Type 2N4124	Q-0385
Q3	Transistor, Silicon, NPN, Type 2N4124	Q-0385
Q4	Transistor, Silicon, NPN, Type 2N4124	Q-0385
Q5	Transistor, Silicon, NPN, Type 2N4124	Q-0385
Q6	Transistor, Silicon, PNP, Type 2N4126	Q-0386
Q7	Transistor, Silicon, PNP, Type 2N3906	Q-0029
Q8	Transistor, Silicon, PNP, Type 2N3906	Q-0029
Q9	Transistor, Silicon, NPN, Type 2N4923	Q-0336
Q10	Transistor, Silicon, NPN, Type 2N4923	Q-0336
Q11	Transistor, Silicon, NPN, Type SDT7609	Q-0032
Q12	Transistor, Silicon, NPN, Type SDT7609	Q-0032
Q13	Transistor, Silicon, NPN, Type 2N4124	Q-0385
R1	Resistor, Carbon, 27K ± 10%; 1/4W	R-0041
R2	Resistor, Carbon, 2.2K ± 10%; 2W	R-0228
R3	Resistor, Carbon, 1.2K ± 10%; 1/4W	R-0025
R4	Resistor, Variable, Single turn, 5K ± 10%; 1/2W	R-7216
R5	Resistor, Carbon, 1.2K ± 10%; 1/4W	R-0025
R6	Resistor, Carbon, 27K ± 10%; 1/4W	R-0041
R7	Resistor, Carbon, 2.2K ± 10%; 1/4W	R-0028
R8	Resistor, Carbon, 10K ± 10%; 1/4W	R-0036
R9	Resistor, Carbon, 2.2K ± 10%; 1/4W	R-0028
R10	Resistor, Carbon, 4.7K ± 10%; 1/4W	R-0032
R11	Resistor, Carbon, 1K ± 10%; 1/4W	R-0024
R12	Resistor, Carbon, 4.7K ± 10%; 1/4W	R-0032
R13	Resistor, Carbon, 68K ± 10%; 1/4W	R-0046
R14	Resistor, Variable, Single turn, 50K ± 10%; 1/2W	R-7226

BOARD ASSEMBLY - 724-1520 (Cont.)

REF DESIG	DESCRIPTION	RF PART NUMBER
R16	Resistor, Carbon, 1K ± 10%; 1/4W	R-0024
R17	Resistor, Carbon, 330 ohms ± 10%; 1/4W	R-0018
R18	Resistor, Carbon, 1K ± 10%; 1/4W	R-0024
R19	Resistor, Variable, Single Turn, 10K ± 10%; 1/2W	R-7220
R20	Resistor, Carbon, 2.2K ± 10%; 1/4W	R-0028
R21	Resistor, Carbon, 180 ohms ± 10%; 1/4W	R-0015
R22	Resistor, Carbon, 150 ohms ± 10%; 1/4W	R-0014
R23	Resistor, Carbon, 82 ohms ± 10%; 1/2W	R-0111
R24	Resistor, Carbon, 82 ohms ± 10%; 1/2W	R-0111
R25	Resistor, Carbon, 150 ohms ± 10%; 1/4W	R-0014
R26	Resistor, Carbon, 180 ohms ± 10%; 1/4W	R-0015
R27	Resistor, Carbon, 4.7K ± 10%; 1/4W	R-0032
R28	Resistor, Carbon, 650 ohms ± 10%; 1W	R-0221
R30	Resistor, Carbon, 560 ohms ± 10%; 2W	R-0321
R31	Resistor, Carbon, 220 ohms ± 10%; 2W	R-0316
R43	Resistor, Carbon, 1K ± 10%; 1/4W	R-0024
R44	Resistor, Carbon, 10 ohms ± 10%; 1/4W	R-0000
R45	Resistor, Carbon, 10 ohms ± 10%; 1/4W	R-0000
-	Socket, 14 pin, Dual In-line	X-0107

POST REGULATOR ASSEMBLY - 724-1540

REF DESIG	DESCRIPTION	RF PART NUMBER
C25	Capacitor, Tantalum, 47 UF ± 20%; 20 Vdcw	C-5842
C26	Capacitor, Tantalum, 47 UF ± 20%; 20 Vdcw	C-5842
C27	Capacitor, Tantalum, Polar, 47 UF ± 20%; 20 Vdcw	C-5941
C28	Capacitor, Tantalum, Polar, 47 UF ± 20%; 6 Vdcw	C-6357
C29	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
C30	Capacitor, Ceramic, 0.1 UF +80% -20%; 25 Vdcw	C-5066
CR19	Diode, Zener, 5.6V ± 10%; Type 1N5232	CR-0265
CR20	Diode, Zener, 3.0V ± 10%; Type 1N5225	CR-0204
Q14	Transistor, NPN, Power, Type 2N4918	Q-0337
Q15	Transistor, NPN, Power, Type 2N4918	Q-0337
Q16	Transistor, Silicon, Type NPN, 2N4124	Q-0385
Q17	Transistor, Amplifier, NPN, Type 2N5810	Q-0006
Q18	Transistor, Amplifier, NPN, Type 2N5810	Q-0006
Q19	Transistor, Silicon, NPN, Type 2N4124	Q-0385
Q20	Transistor, NPN, Power, Type 2N4918	Q-0337
Q21	Transistor, NPN, Type 3638A	Q-0319
Q22	Transistor, Silicon, NPN, Type 2N4124	Q-0385
Q23	Transistor, Amplifier, NPN, Type 2N5810	Q-0006
Q24	Transistor, Amplifier, NPN, Type 2N5810	Q-0006
Q25	Transistor, Silicon, NPN, Type 2N4124	Q-0385
R32	Resistor, Carbon, 1.5K ± 5%; 1/4W	R-1253
R33	Resistor, Carbon, 1.2K ± 5%; 1/4W	R-1251
R34	Resistor, Carbon, 560 ohms ± 5%; 1/4W	R-1243
R35	Resistor, Variable, Single turn, 1K ± 10%; 1/2W	R-7209
R36	Resistor, Carbon, 560 ohms ± 5%; 1/4W	R-1243
R37	Resistor, Carbon, 47 ohms ± 5%; 1/4W	R-1617
R38	Resistor, Carbon, 680 ohms ± 5%; 1/4W	R-1245
R39	Resistor, Carbon, 470 ohms ± 5%; 1/4W	R-1241
R40	Resistor, Carbon, 1K ± 5%; 1/4W	R-1249
R41	Resistor, Variable, Single turn, 1K ± 10%; 1/2W	R-7209
R42	Resistor, Carbon, 1K ± 5%; 1/4W	R-1249
R44	Resistor, Carbon, 100 ohms ± 10%; 2W	R-0312



CHAPTER 10

FREQUENCY STANDARD MODULE

10.1 GENERAL

Frequency Standard Module 724-1600/724-1601 provides the 5.0 MHz reference signal for Synthesizer Module 724-0500. Basically, Frequency Standard Module consists of a crystal oscillator (frequency standard), a distribution amplifier, and a mode select switch.

The normally supplied 724-1600 Frequency Standard Module, figure 10.1, is equipped with a temperature compensated crystal oscillator (TCXO) standard, RF P/N 724-0150. This module is accurate to ± 1 part per 10^6 and requires no warm-up time. The optional (special order) 724-1601 module is supplied with a high stability oven-controlled crystal oscillator standard, RF P/N 724-0151. Frequency accuracy is ± 1 part per 10^8 after a 30 minute warm-up period. Power for the oven is supplied only from ac primary power sources thereby restricting the unit to ac operation only.

10.2 THEORY OF OPERATION

Mode select switch S1F1 provides for the three different operating configurations of the module. When S1F1 is set at INT ONLY, the output of the frequency standard is supplied as the 5 MHz reference signal to the Synthesizer Module connected to J1602. The INT OUT position of S1F1 connects the output of the frequency standard to the Synthesizer Module and to frequency standard input/output connector J1601. In turn, J1601 is connected by the main frame harness to rear panel connector J1. This allows for up to three additional units to operate off of one frequency standard. When set at EXT IN, an external, 5 MHz, frequency standard source is used in place of the connected standard. The external source, such as a master clock or a second unit with the mode switch set at INT OUT, is also connected to rear panel connector, J2.

The distribution amplifier is a two transistor power amplifier with an output of up to 1 Vrms. Diodes

CR3 through CR5 limit the input level to 1 Vrms. The signal is then amplified by Q1 and Q2 and applied to J1602 and through the INT OUT contacts of S1F1 to J1601.

10.3 TEST AND ALIGNMENT

WARNING

Dangerous voltages are present on various terminals in the immediate vicinity of the Frequency Standard Module.

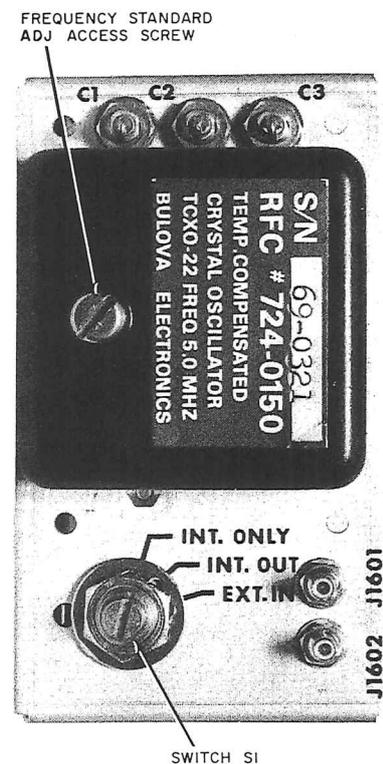


Figure 10.1 – Frequency Standard Module 724-1600



10.3.1 TEST EQUIPMENT

NOTE

The following test equipment or equivalent is required to perform the following procedures.

- a. Oscilloscope – Tektronix, Model 454
- b. Electronic Counter – Hewlett-Packard, Model 5245
- c. Adjustment Tool – J.F.D., No. 5284
- d. Coax Test Cable – RF P/N 724-0032

e. Coax T Connector

10.3.2 PRELIMINARY

NOTE

The following tests are performed with the module installed in the unit.

- a. At front panel of unit set MODE switch at ISB.
- b. At Frequency Standard Module J1602 (blue) disconnect P1602 and connect oscilloscope and counter to J1602 using the coax test cable and T connector. Set S1F1 at INT ONLY.

10.3.3 PROCEDURES

STEP NO.	TEST EQUIPMENT AND TEST POINT	PROCEDURE	PERFORMANCE
1.	Oscilloscope and counter at J1602.	Measure frequency and check displayed waveform. If frequency as displayed on counter is out of spec refer to step 2.	5.000000 MHz \pm 5 Hz, 1.35 \pm 0.2V p-p. Refer to figure 10.2.
2.	Same as step 1.	Remove access screw on frequency standard, figure 10.1 and adjust standard frequency control for proper frequency.	5.000000 MHz \pm 5 Hz.
3.	Same as step 1.	Set switch S1F1 at INT OUT. Reconnect P1602 to J1602. Connect coax T connector and test equipment to rear panel FREQ STD IN/OUT connector J2.	Same as step 1, except 0.8 \pm 0.2V p-p.



10.4 FAULT ANALYSIS

Fault analysis procedures for Frequency Standard Modules 724-1600/1601 are presented below in tabular form. Refer to figure 10.3 for the circuit diagram, dc voltage chart, and printed circuit component locations.

NOTE

Extend the module from the unit for access to the printed circuit board and voltage test points.

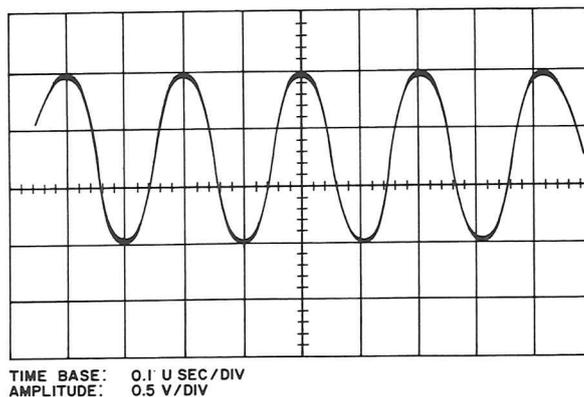


Figure 10.2 – Terminal E4 Waveform

Table 10.1 – Fault Analysis

SYMPTOM	POSSIBLE TROUBLE	CHECKS AND CORRECTIVE MEASURES
5 MHz output signal at J1602 absent or improper.	<ul style="list-style-type: none"> a. Mode switch S1F1 set at EXT IN. b. Defective switch S1F1. c. Frequency standard defective. d. Distribution amplifier defective. 	<ul style="list-style-type: none"> a. Set switch S1F1 at INT ONLY. b. Refer to figure 10.3 and make continuity checks. Replace or repair defective switch. c. Refer to figures 10.2 and 10.3, make waveform and voltage measurements. Replace defective standard and perform the procedures of paragraph 10.3. d. Refer to figures 10.2 and 10.3. Make voltage and waveform measurements. Replace defective component and perform the procedures of paragraph 10.3.

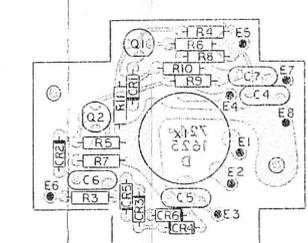


10.5 CIRCUIT DIAGRAM AND PARTS LIST

NOTE

The parts list of the assemblies are located on the backs of the circuit diagram.

NOTES

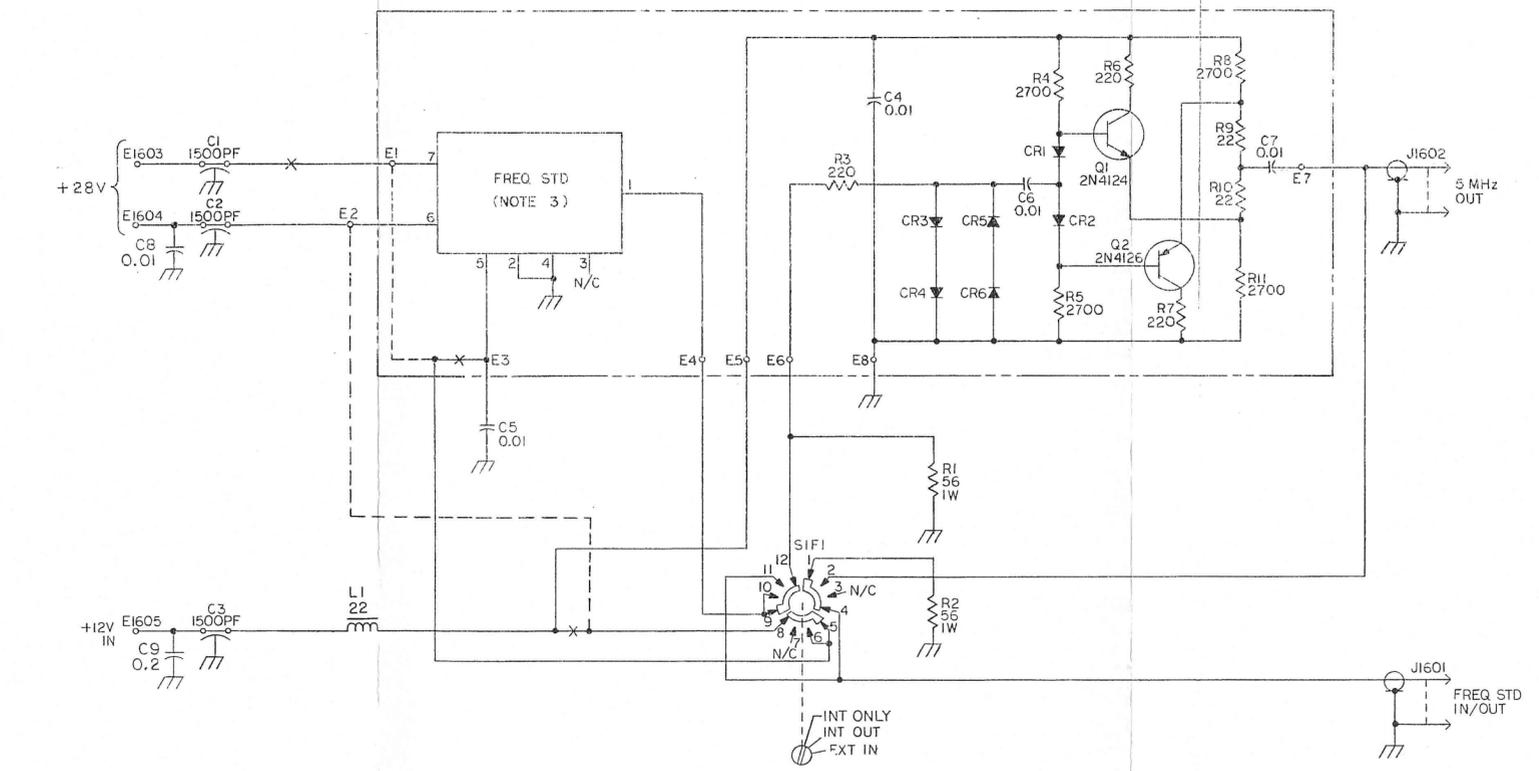


724-1620 Assembly
Component Locations

DC VOLTAGE TABLE*

Stage	Emitter	Base	Collector
Q1	7.0	6.5	12.0
	6.0	6.5	0

*All dc voltages taken with multi-meter (Simpson 260), referenced to ground at E8.



- NOTES:
- UNLESS OTHERWISE INDICATED, ALL RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS.
 - ALL DIODES ARE IN4454.
 - TCXO 724-0150 SUPPLIED WITH 724-1600 ASSY HIGH STABILITY OVEN. A 724-0151 IS OPTIONAL, 724-1601 ASSY.
 - LAST DESIGNATORS:
R11
C9
Q2
CR6
L1
 - CHANGE WIRING ON UNITS WITH HIGH STABILITY OVEN 724-0151 BY:
ADDING JUMPERS DENOTED - - - - -
& BREAKING CONNECTIONS DENOTED X

Figure 10.3 - Frequency Standard Module Circuit Diagram
REV. G



FREQUENCY STANDARD MODULE --
724-1600/1601

REF DESIG	DESCRIPTION	RF PART NUMBER
C1	Capacitor, Feed-thru, 1500 UF \pm 20%; 500 Vdcw	C-2651
C2	Capacitor, Feed-thru, 1500 UF \pm 20%; 500 Vdcw	C-2651
C3	Capacitor, Feed-thru, 1500 UF \pm 20%; 500 Vdcw	C-2651
C4	Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw	C-0065
C5	Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw	C-0065
C6	Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw	C-0065
C7	Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw	C-0065
C8	Capacitor, Ceramic, .01 UF +60% -40%; 150 Vdcw	C-0065
C9	Capacitor, Ceramic, 0.2 UF +80% -20%; 20 Vdcw	C-0067
CR1	Diode, Silicon, Type 1N4454	CR-0705
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Silicon, Type 1N4454	CR-0705
CR4	Diode, Silicon, Type 1N4454	CR-0705
CR5	Diode, Silicon, Type 1N4454	CR-0705
CR6	Diode, Silicon, Type 1N4454	CR-0705
J1601	Connector, Coaxial	J-0030
J1602	Connector, Coaxial	J-0030
L1	Choke, Rf, 22 UH	L-0632
Q1	Transistor, Silicon, General Purpose, NPN, Type 2N4124	Q-0385
Q2	Transistor, Silicon, General Purpose, NPN, Type 2N4126	Q-0386
R1	Resistor, Carbon; 56 ohms \pm 5%; 1/2W	R-1419
R2	Resistor, Carbon; 56 ohms \pm 5%; 1/2W	R-1419
R3	Resistor, Carbon; 220 ohms \pm 5%; 1/4W	R-1233
R4	Resistor, Carbon; 2700 ohms \pm 5%; 1/4W	R-1259
R5	Resistor, Carbon; 2700 ohms \pm 5%; 1/4W	R-1259
R6	Resistor, Carbon; 220 ohms \pm 5%; 1/4W	R-1233
R7	Resistor, Carbon; 220 ohms \pm 5%; 1/4W	R-1233
R8	Resistor, Carbon; 2700 ohms \pm 5%; 1/4W	R-1259
R9	Resistor, Carbon; 22 ohms \pm 5%; 1/4W	R-1209
R10	Resistor, Carbon; 22 ohms \pm 5%; 1/4W	R-1209
R11	Resistor, Carbon; 2700 ohms \pm 5%; 1/4W	R-1259
S1F1	Switch	724-0019
-	Tube, Socket; PC Mounting	X-1003
X1	Crystal Oscillator For 724-1600	724-0150
	For 724-1601	724-0151



APPENDIX

GENERAL SERVICING NOTES AND PROCEDURES

Special handling of printed circuit boards, semi-conductors, and integrated circuits (IC) is necessary to avoid damage.

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, IC, 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.

NOTE

Faulty flat pack IC can be removed by clipping the package from the leads and then removing one lead at a time from the pc board with a soldering iron.

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 toothpick 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 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.

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.

IC CIRCUIT DIAGRAMS

The following figures illustrate the pin locations and circuit diagram of the IC that are used in the RF-505 Receiver. Corresponding pin numbers are shown on the various assembly circuit diagrams in this manual.

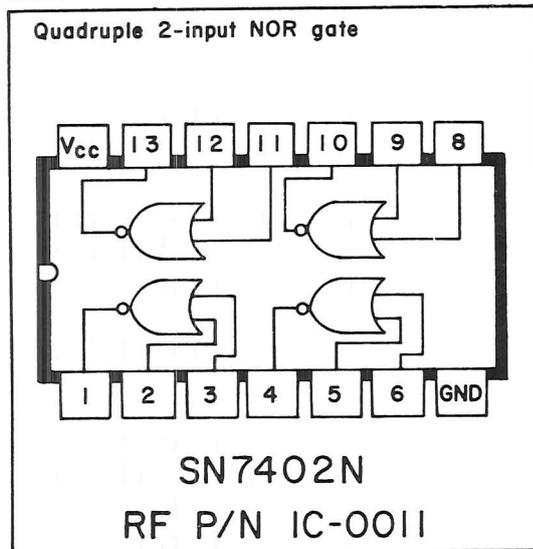
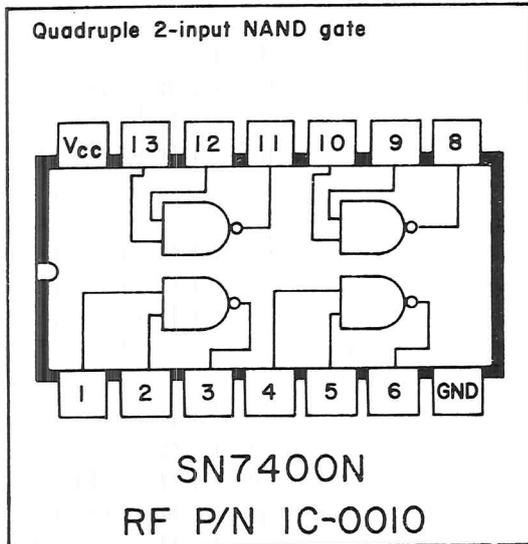


Figure 1 – Circuit Diagrams for IC-0010 and IC-0011

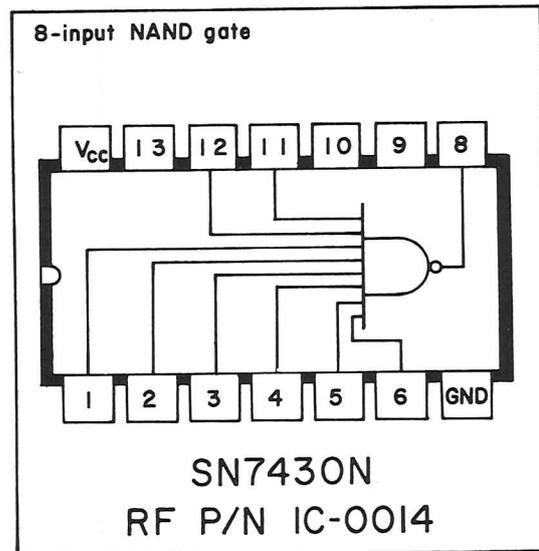
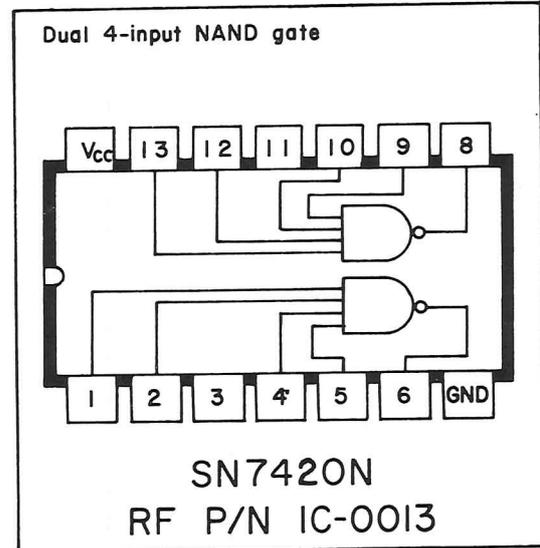


Figure 2 – Circuit Diagrams for IC-0013 and IC-0014

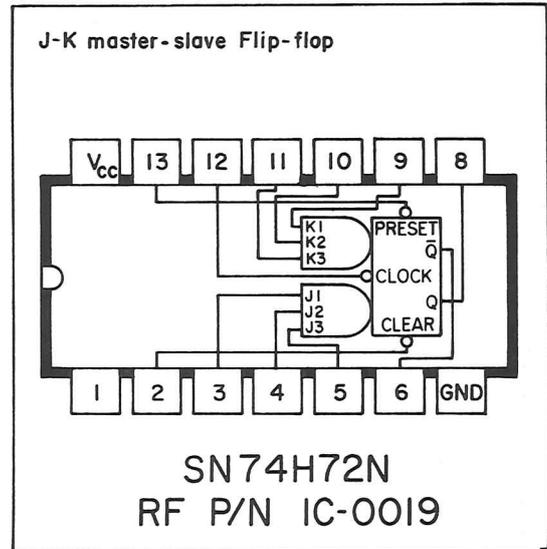
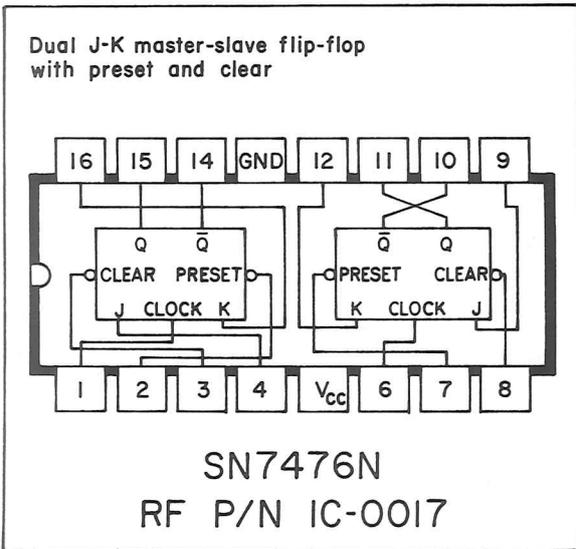
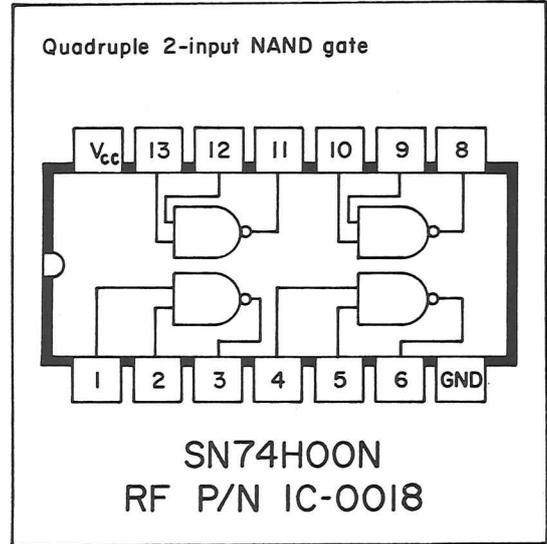
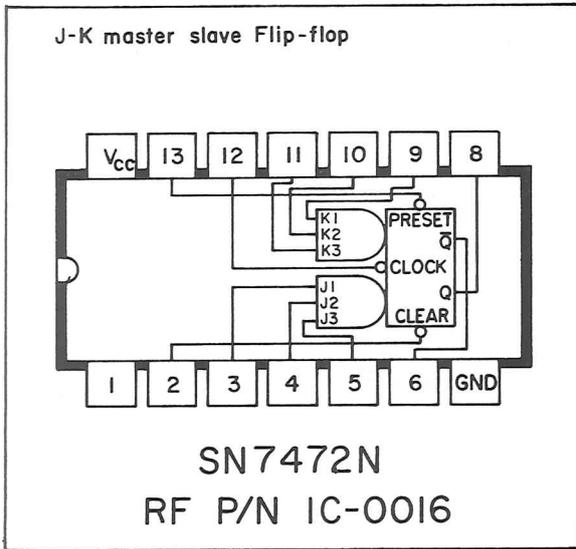


Figure 3 – Circuit Diagrams for IC-0016 and IC-0017

Figure 4 – Circuit Diagrams for IC-0018 and IC-0019

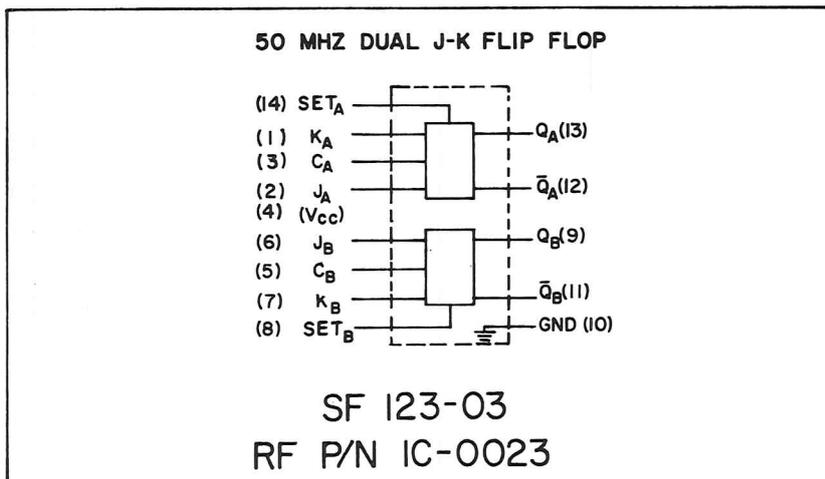
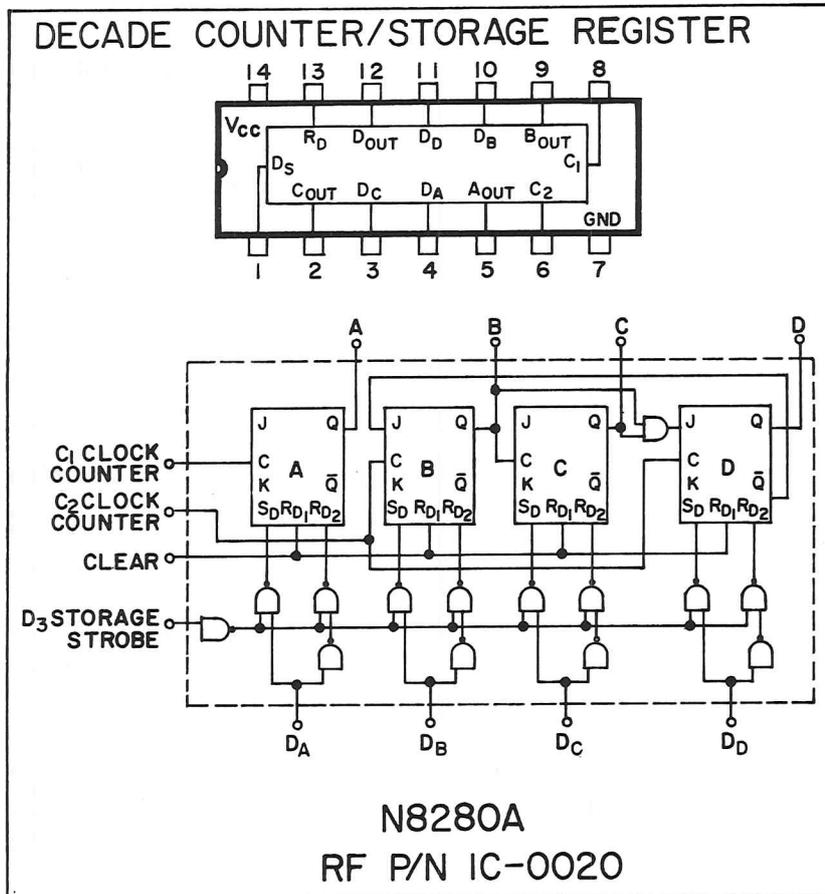
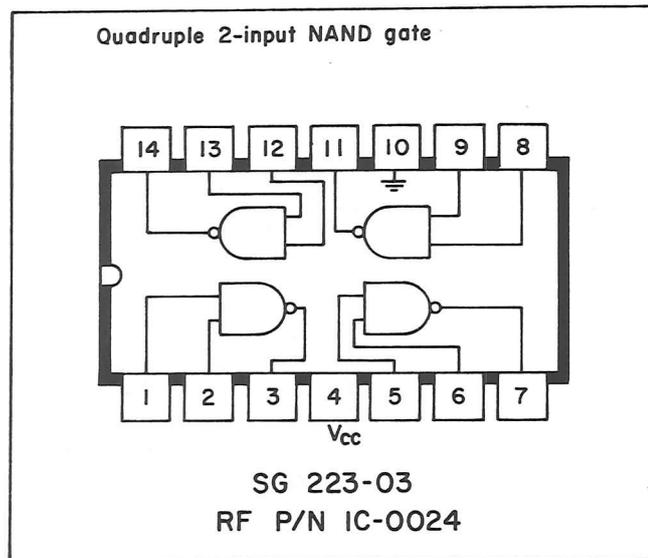


Figure 5 – Circuit Diagrams for IC-0020 and IC-0023



NOTE: IC-0025 IS ELECTRICALLY THE SAME AS IC-0023

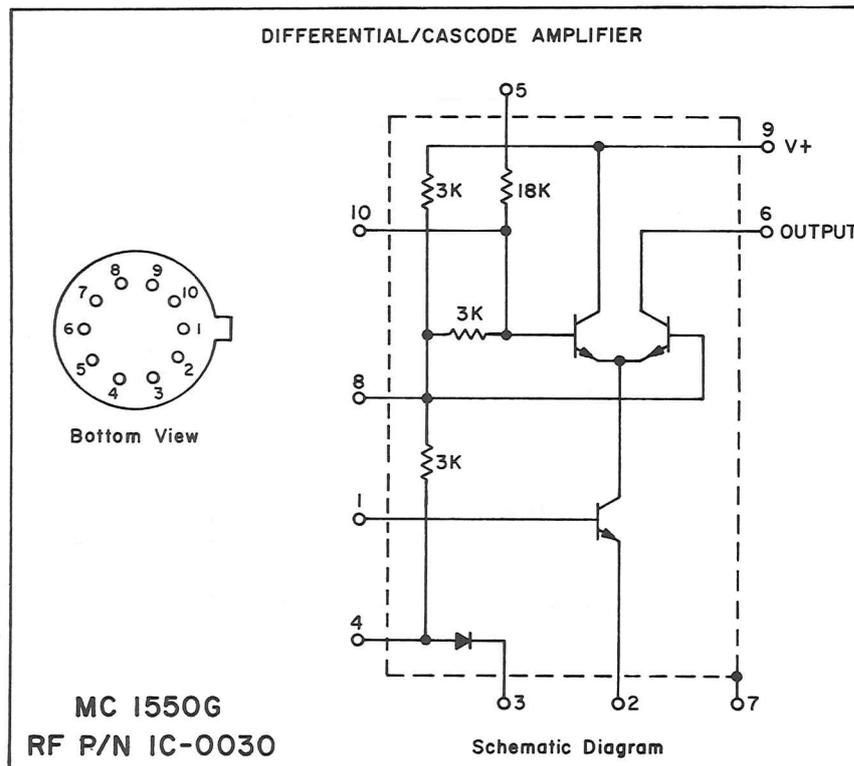


Figure 6 – Circuit Diagrams for IC-0024, IC-0025 and IC-0030

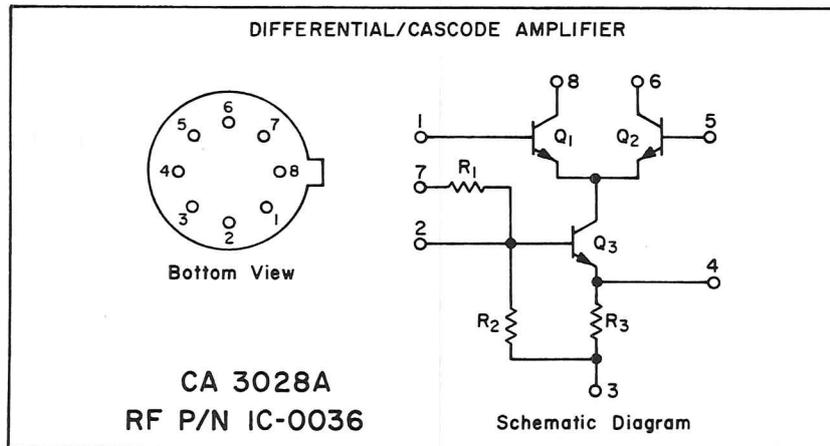
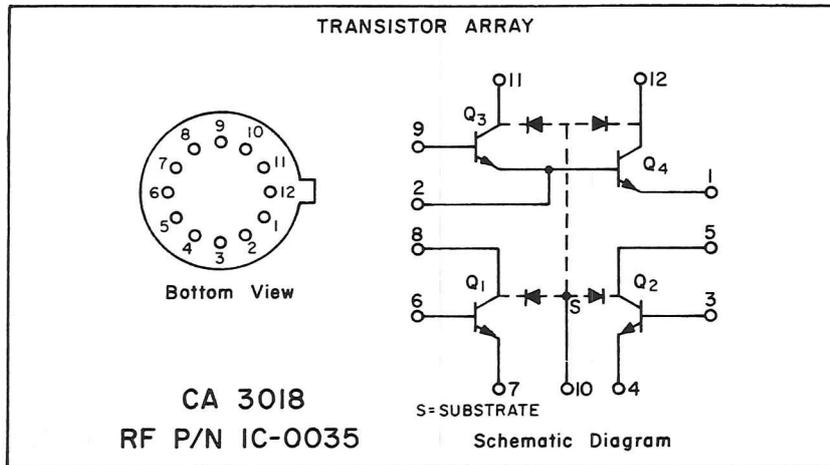


Figure 7 – Circuit Diagrams for IC-0035 and IC-0036

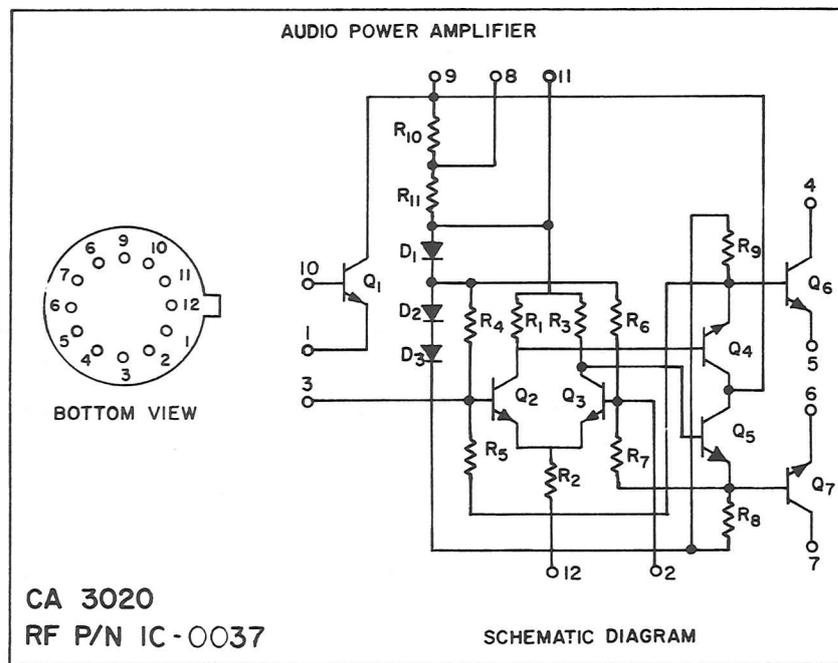


Figure 8 – Circuit Diagram for IC-0037 and IC-0051



PHASE-FREQUENCY DETECTOR

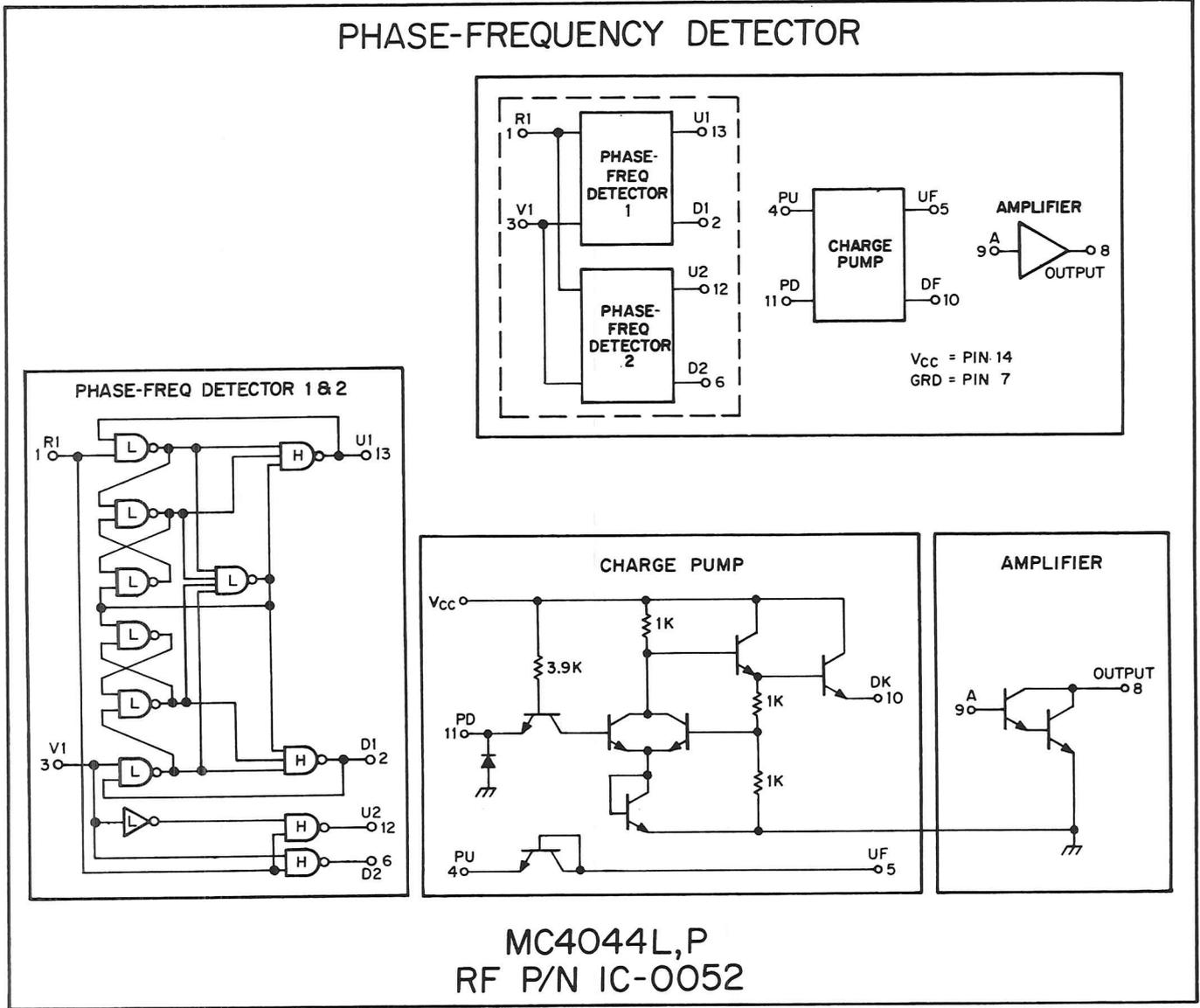


Figure 9 – Circuit Diagram for IC-0052



RF-506 NOISE BLANKER ASSEMBLY INSTRUCTION SHEET PM-0796A

GENERAL

The RF-506 Noise Blanker Assembly option is designed to mute noise spikes entering the receiver thru the antenna. The assembly is mounted in the Receiver Module and is controlled by the NOISE BLANKER control on the front panel of the RF-505A. The RF-506 can be installed in any existing RF-505A Receiver. However, RF COMMUNICATIONS recommends factory installation.

INSTALLATION

The 724-1100 Front End Assembly and the Receiver Module mother board must be modified before installation of the RF-506 Noise Blanker. Perform the following steps to accomplish the modifications and installation.

NOTE

Refer to appropriate pages in the RF-505A Instruction Manual during the following procedure.

1. Loosen four captive screws and remove top cover from RF-505A.
2. Loosen four screws and remove top cover from Receiver Module.
3. Remove the 724-1100 Front End Assembly from Receiver Module.
4. At the first L.O. Amplifier, remove 724-1106 shield from bottom of 724-1100 assembly.
5. Mount supplied 150 PF capacitor (RF P/N C-4794) between ground foil and pin D on the bottom of the 724-1100 assembly.
6. Mount supplied 10 UF capacitor (RF P/N C-6327) in parallel with capacitor C6 on the bottom of the 724-1100 assembly.
7. Mount supplied 1.0 UH choke (RF P/N L-0616) from junction of R3, C45 and R4 to pin D on the 724-1100 assembly. Dress components.
8. Replace the shield on the 724-1100 assembly.
9. Insert 724-1100 assembly into Receiver Module.
10. Insert 724-1300 Noise Blanker assembly into Receiver Module and install module and install module cover.
11. Refer to modules removal procedure, page 5-7 in Instruction Manual PM-0711, and remove Receiver Module from RF-505A.
12. Place module on its cover on a flat surface and determine whether mother board is revision A or later. If mother board is revision A, proceed to step 15; if later, proceed to step 13.
13. Connect supplied coaxial cable between P 1101 pin A and P 1301 pin A. Dress cable
14. Proceed to step 23.
15. Loosen nuts securing J-1002, J-1004 and J-1005 to module case and slide connectors from mounting holes.
16. Bend capacitor C5 upright.
17. Break foil connection from P-1301 pin S to P-1251 pin 16.
18. Break foil connection from P-1301 pin S to P-1251 pin 3.
19. Connect supplied jumper wire from P-1251 pin 3 to P-1301 pin S.
20. Connect supplied coaxial cable from P-1101 pin A to P-1301 pin C. Ground shield to ad-



jacent ground foil.

21. Dress capacitor C5, jumper and cable to mother board.
22. Reinstall J-1002, J-1004 and J-1005 on module case in proper sequence.
23. Refer to modules installation procedure, page 5-7 in Instruction Manual PM-0711, and install Receiver Module.
24. Reinstall RF-505A top cover and secure with the four captive screws.

OPERATION

The RF-506 is activated by turning the NOISE BLANK control clockwise. The control determines the amplitude of the spike needed to blank the receiver. Blanking consists of muting the first local oscillator injection to the Front End Assembly for the duration of the noise pulse. Maximum blanking time, however, is 50 usec so that received intelligence is not perceptibly interrupted.

Some receive conditions are such that noise blanking is not advisable. The adjustment must be done by ear to suit the particular condition of the interference. If noise is encountered, the radio operator should adjust the NOISE BLANKER control for optimum reception of the desired signal.

THEORY OF OPERATION

The Rf input to the Noise Blanker assembly is connected from the preselector thru J-1005. The signal is ac

coupled by capacitor C3 to emitter follower Q1 which presents a high impedance to the antenna input so as not to load the antenna. Transistors Q2/Q3 and Q5/Q6 are broad-band feedback amplifiers which amplify the noise pulse. Their gain is controlled by transistor Q4 thru diodes CR1/CR2 and CR3/CR4. Transistor Q4 is in turn controlled by the setting of the threshold input from the NOISE BLANKER control on the RF-505A front panel. A noise pulse of sufficient magnitude from Q6 turns on the switching transistor Q7 or Q8; depending upon the polarity of the pulse. The blanking pulse is applied to the MUTE terminal of the Front End Assembly. This removes base bias from the first L.O. amplifier, Q1, on the Front End assembly thereby muting the receiver.

TEST PROCEDURE

1. Connect an unshielded wire antenna to RF INPUT J1 on rear panel of RF-505A.
2. Set front panel controls for USB operation at 10 MHz and activate receiver.
3. Locate spark coil or similar noise generating device near antenna wire and activate. Note that loud "hash" is present at the receiver output.
4. Extend Noise Blanker assembly, 724-1300, and connect oscilloscope probe to J-1301 pin K, ground probe on chassis.
5. Advance NOISE BLANKER control clockwise and observe negative going pulses which should come within 0.5V of ground. A noticeable decrease in "hash" should occur.
6. Decrease NOISE BLANKER control. Pulses should disappear when control is fully off and "hash" should increase in level.

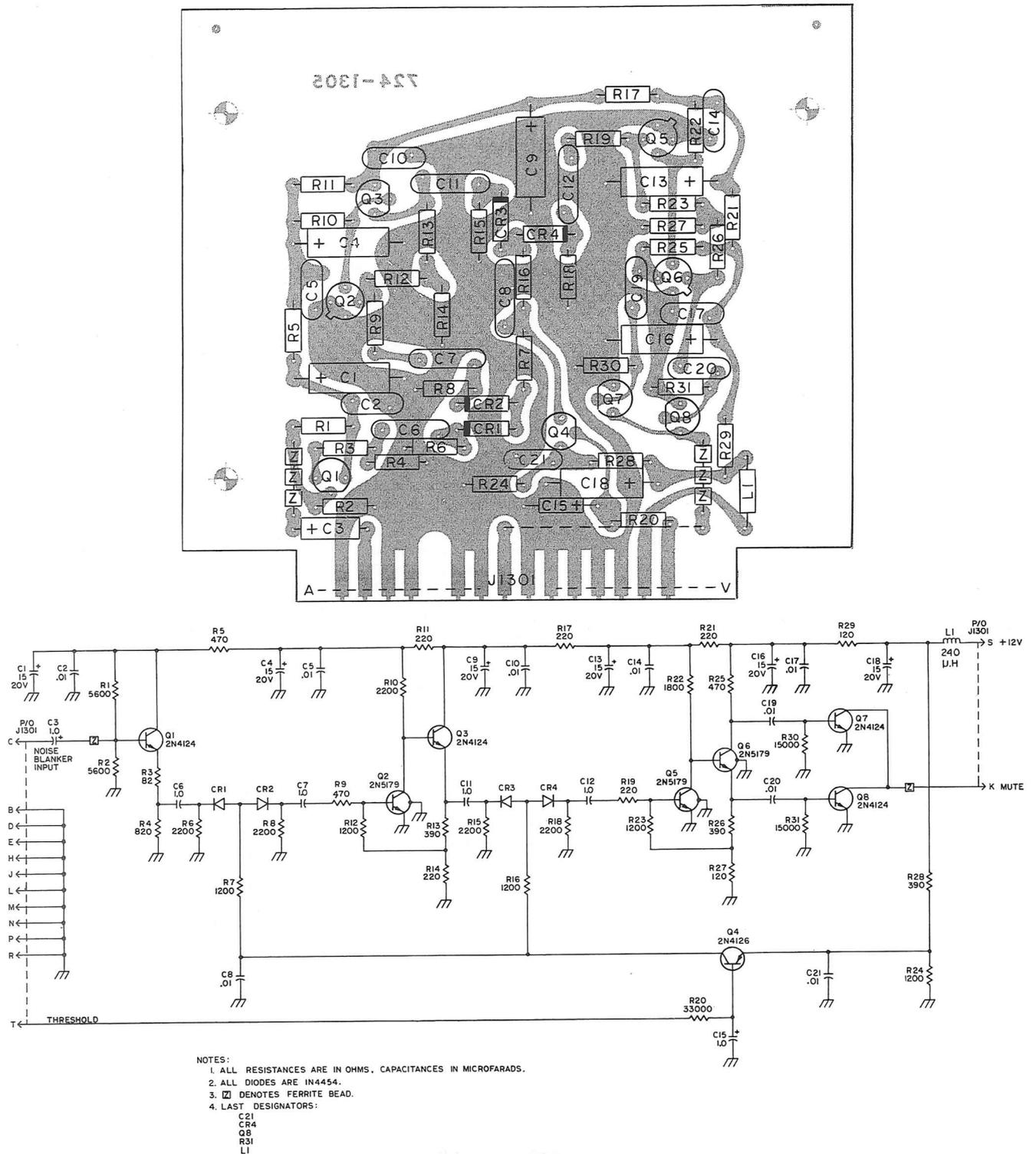


Figure 1. RF-506 Noise Blanker Assembly Component Locations and Circuit Diagram



Reference Designation	Description	RF P/N
C1	Capacitor, Tantalum, Polar, 15 UF \pm 20%; 20 Vdcw	162-0273
C2	Capacitor, Ceramic, Disc, 0.01 UF \pm 20%; 100 Vdcw	C-2261
C3	Capacitor, Tantalum, Polar, 1.0 UF \pm 20%; 25 Vdcw	C-6291
C4	Capacitor, Tantalum, Polar, 15 UF \pm 20%; 20 Vdcw	162-0273
C5	Capacitor, Ceramic, Disc, 0.01 UF \pm 20%; 100 Vdcw	C-2261
C6	Capacitor, Ceramic, 0.1 UF +100% -0%; 3V	C-0053
C7	Capacitor, Ceramic, 0.1 UF +100% -0%; 3V	C-0053
C8	Capacitor, Ceramic, Disc, 0.01 UF \pm 20%; 100 Vdcw	C-2261
C9	Capacitor, Tantalum, Polar, 15 UF \pm 20%; 20 Vdcw	162-0273
C10	Capacitor, Ceramic, Disc, 0.01 UF \pm 20%; 100 Vdcw	C-2261
C11	Capacitor, Ceramic, 0.1 UF +100% -0%; 3V	C-0053
C12	Capacitor, Ceramic, 0.1 UF +100% -0%; 3V	C-0053
C13	Capacitor, Tantalum, Polar, 15 UF \pm 20%; 20 Vdcw	162-0273
C14	Capacitor, Ceramic, Disc, 0.01 UF \pm 20%; 20 Vdcw	C-2261
C15	Capacitor, Tantalum, Polar, 1.0 UF \pm 20%; 25 Vdcw	C-6291
C16	Capacitor, Tantalum, Polar, 15 UF \pm 20%; 20 Vdcw	162-0273
C17	Capacitor, Ceramic, Disc, 0.01 UF \pm 20%; 100 Vdcw	C-2261
C18	Capacitor, Tantalum, Polar, 15 UF \pm 20%; 20 Vdcw	162-0273
C19	Capacitor, Ceramic, Disc, 0.01 UF \pm 20%; 100 Vdcw	C-2261
C20	Capacitor, Ceramic, Disc, 0.01 UF \pm 20%; 100 Vdcw	C-2261
C21	Capacitor, Durez, .01 UF; 50 Vdcw	C-4952
CR1	Diode, Silicon, Type 1N4454	CR-0705
CR2	Diode, Silicon, Type 1N4454	CR-0705
CR3	Diode, Silicon, Type 1N4454	CR-0705
CR4	Diode, Silicon, Type 1N4454	CR-0705
L1	Inductor, 240 UH	L-0052
Q1	Transistor, Silicon, General Purpose, Type 2N4124	Q-0385
Q2	Transistor, Silicon, General Purpose, Type 2N5179	724-1118
Q3	Transistor, Silicon, General Purpose, Type 2N4124	Q-0385
Q4	Transistor, Silicon, General Purpose, Type 2N4126	Q-0386
Q5	Transistor, Silicon, General Purpose, Type 2N5179	724-1118
Q6	Transistor, Silicon, General Purpose, Type 2N5179	724-1118
Q7	Transistor, Silicon, General Purpose, Type 2N4124	Q-0385
Q8	Transistor, Silicon, General Purpose, Type 2N4124	Q-0385
R1	Resistor, Carbon, 5600 Ohms \pm 10%; 1/4W	R-0033
R2	Resistor, Carbon, 5600 Ohms \pm 10%; 1/4W	R-0033
R3	Resistor, Carbon, 82 Ohms \pm 10%; 1/4W	R-0011
R4	Resistor, Carbon, 820 Ohms \pm 10%; 1/4W	R-0023
R5	Resistor, Carbon, 470 Ohms \pm 10%; 1/4W	R-0020
R6	Resistor, Carbon, 2200 Ohms \pm 10%; 1/4W	R-0028
R7	Resistor, Carbon, 1200 Ohms \pm 10%; 1/4W	R-0025
R8	Resistor, Carbon, 2200 Ohms \pm 10%; 1/4W	R-0028
R9	Resistor, Carbon, 470 Ohms \pm 10%; 1/4W	R-0020
R10	Resistor, Carbon, 2200 Ohms \pm 10%; 1/4W	R-0028
R11	Resistor, Carbon, 220 Ohms \pm 10%; 1/4W	R-0016
R12	Resistor, Carbon, 1200 Ohms \pm 10%; 1/4W	R-0025
R13	Resistor, Carbon, 390 Ohms \pm 10%; 1/4W	R-0019
R14	Resistor, Carbon, 220 Ohms \pm 10%; 1/4W	R-0016
R15	Resistor, Carbon, 2200 Ohms \pm 10%; 1/4W	R-0028
R16	Resistor, Carbon, 1200 Ohms \pm 10%; 1/4W	R-0025
R17	Resistor, Carbon, 220 Ohms \pm 10%; 1/4W	R-0016
R18	Resistor, Carbon, 2220 Ohms \pm 10%; 1/4W	R-0028
R19	Resistor, Carbon, 220 Ohms \pm 10%; 1/4W	R-0016
R20	Resistor, Carbon, 33K \pm 10%; 1/4W	R-0042
R21	Resistor, Carbon, 220 Ohms \pm 10%; 1/4W	R-0016
R22	Resistor, Carbon, 1800 Ohms \pm 10%; 1/4W	R-0027
R23	Resistor, Carbon, 1200 Ohms \pm 10%; 1/4W	R-0025
R24	Resistor, Carbon, 1200 Ohms \pm 10%; 1/4W	R-0025
R25	Resistor, Carbon, 470 Ohms \pm 10%; 1/4W	R-0020
R26	Resistor, Carbon, 390 Ohms \pm 10%; 1/4W	R-0019
R27	Resistor, Carbon, 120 Ohms \pm 10%; 1/4W	R-0013
R28	Resistor, Carbon, 390 Ohms \pm 10%; 1/4W	R-0019
R29	Resistor, Carbon, 120 Ohms \pm 10%; 1/4W	R-0013
R30	Resistor, Carbon, 15K Ohms \pm 10%; 1/4W	R-0038
R31	Resistor, Carbon, 15K Ohms \pm 10%; 1/4W	R-0038
Z	Ferrite Bead	E-0652



RF-508 HIGH STABILITY FREQUENCY STANDARD PM-0978

GENERAL

The RF-508 High Stability Frequency Standard, utilizing a crystal oscillator in a proportional controlled oven, provides a 5 MHz reference signal that is accurate to ± 1 part in 10^8 . The RF-508 is an accessory for the Frequency Standard Module and is used in place of the TCXO frequency standard when a higher degree of stability is required. A frequency adjustment control is provided on the RF-508 with sufficient range to compensate for normal crystal aging.

NOTE

Because the RF-508 oven requires 28 Vdc, the 724-1400 AC Power Supply Module must be installed in the RF-505 Receiver for operation. This in turn limits the RF-505 to "ac only operation", 115 or 230 volts (+20%, -10%).

INSTALLATION

To install the RF-508 High Stability Frequency on the Frequency Standard Module, proceed as follows:

- a. Refer to paragraph 5.5.3 in the RF-505A Receiver Manual and remove the Frequency Standard Module.
- b. Remove the four nuts securing the TCXO standard and remove the standard from the module.
- c. Mount the RF-508 on the module and secure with four 4-40 nuts. Replace the Frequency Standard Module in the RF-505A Receiver.

CAUTION

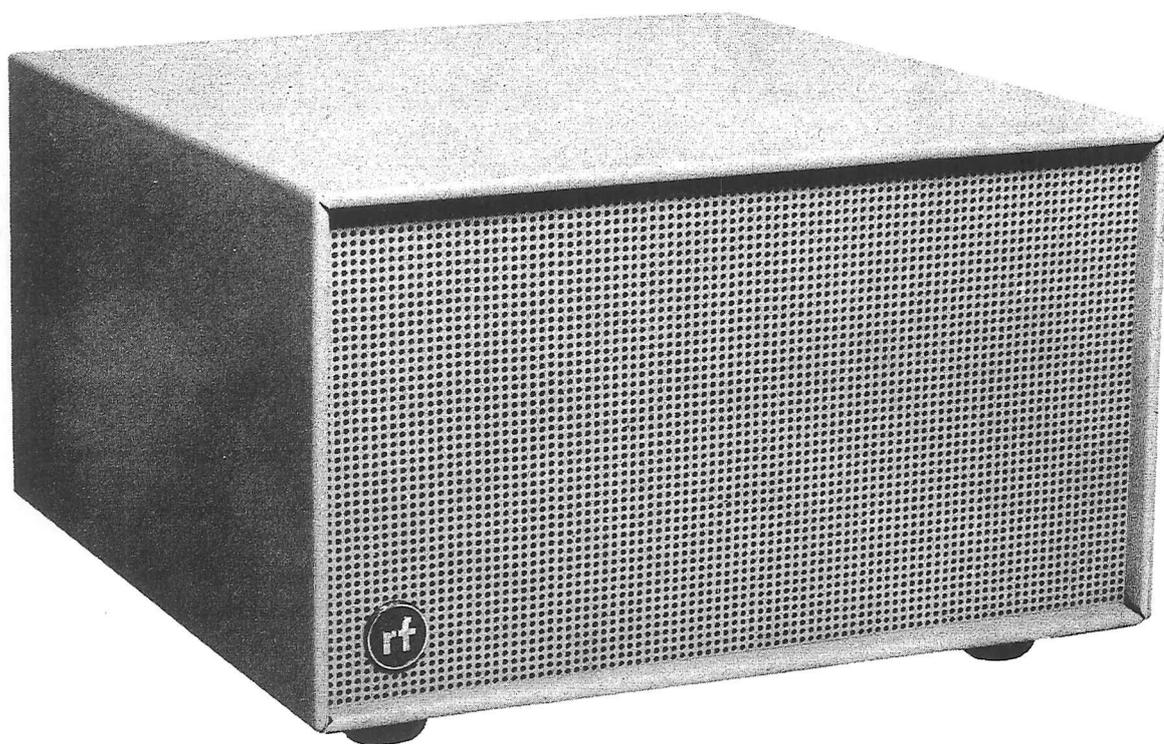
The RF-508 was precisely adjusted to the exact frequency at the factory. Under no circumstances should the frequency adjustment be altered unless a frequency calibration standard of at least 1 part in 10^9 accuracy is used. It is recommended that the RF-508 frequency be checked once every six months and adjusted if necessary.

SPECIFICATIONS

Output Frequency	5.0000 MHz																
Frequency Stability:	<ol style="list-style-type: none"> a. ± 3 parts in 10^9 maximum per day after three days of continuous operation. b. ± 1 part in 10^8 maximum over a temperature range of -30° to 70°C. c. ± 1 part in 10^{10} maximum drift over a one second averaging period. d. ± 5 parts in 10^9 maximum for a 10% variation in oscillator and oven voltage. e. ± 1 part in 10^9 maximum for a 10% change in load impedance. 																
Warm-up	± 3 parts in 10^8 of the stabilized frequency within one hour after turn on at 25°C .																
Frequency Adjustment	Able to maintain specified frequency for a period of five years.																
Output	Sine wave of 0.2 Vrms minimum to 1 Vrms maximum into a 50 ohm resistive load.																
Harmonic Output	Greater than 30 dB below the fundamental frequency.																
Input Voltages:																	
Oscillator	28 Vdc $\pm 10\%$																
Oven	28 Vdc $\pm 10\%$ at 18 watts maximum.																
Environmental:																	
Temperature Operating	-30° to $+75^\circ\text{C}$																
Storage	-55° to $+85^\circ\text{C}$																
Humidity	Per Class II of MIL-E-16400																
Pin Connections	<table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Pin No.</th> <th style="text-align: left; border-bottom: 1px solid black;">Functions</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Output</td> </tr> <tr> <td>2</td> <td>Ground</td> </tr> <tr> <td>3</td> <td>No Connection</td> </tr> <tr> <td>4</td> <td>DC Return</td> </tr> <tr> <td>5</td> <td>No Connection</td> </tr> <tr> <td>6</td> <td>+28 Vdc Oven Power</td> </tr> <tr> <td>7</td> <td>+28 Vdc Oscillator Power</td> </tr> </tbody> </table>	Pin No.	Functions	1	Output	2	Ground	3	No Connection	4	DC Return	5	No Connection	6	+28 Vdc Oven Power	7	+28 Vdc Oscillator Power
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RF-511 REMOTE MONITOR SPEAKER INSTRUCTION SHEET PM-0754



GENERAL

The RF-511 Remote Monitor Speaker is designed to complement the RF-505A ISB Receiver. However, the RF-511 will function equally as well with any receiver or transmitter possessing a 3.2 ohm remote audio output. The RF-511 contains a high efficiency, 3.2 ohm, 5 watt, five by seven inch, ferrite magnet speaker. The attractive steel enclosure is acoustically damped to obtain quality sound reproduction.



INSTALLATION

To install the RF-511, perform the following steps:

1. Carefully remove the RF-511 from the packing carton.
2. Inspect the unit for damage. If damage is discovered, save packing carton to substantiate claim with transportation agency.
3. Place speaker in desired location (unit is equipped with 30 feet of two-wire cable).

NOTE

Refer to Instruction Manual PM-0711, figure 2.3, for illustration of installation of RF-511 with RF-505A Receiver.

4. Connect one wire of supplied two-wire cable to ground terminal on receiver.

5. Connect remaining wire to remote audio output (3.2 ohm) terminal on receiver.

OPERATION

For the RF-505A Receiver, the SPEAKER switch on the front panel must be in the REMOTE or BOTH position for the Remote Speaker to operate. For other receivers, refer to the appropriate instruction manual for proper operation.

PARTS LIST

<u>Description</u>	<u>RF P/N</u>
RF-511 Remote Speaker Assembly	724-0200
Speaker, 3.2 ohm	724-0209
Case, Steel	724-0205
Grille, Steel	724-0206
Feet, Front, Rubber	X-0199
Feet, Rear, Rubber	H-4298



RF-520 MUTING CONVERSION MODULE INSTRUCTION SHEET PM-0765

GENERAL

The RF-520 Muting Conversion Module is designed to disable the receiver module of the RF-505A Receiver during transmissions, when the RF-505A is used in conjunction with a transmitter. This prevents the undesired reception of the transmitted information by the RF-505A. Operated from the keyline of the transmitter, such as the RF-130, RF-730, or RF-470, the RF-520 eliminates the need for separate T/R relay contacts to switch off receiver module power during transmission.

INSTALLATION

R.F. Communications recommends factory installation of the RF-520. However, the RF-520 may be installed in existing installations. To install the Muting Module in the RF-505A perform the following procedures:

1. Loosen the four captive fasteners on the top cover of the RF-505A and remove the cover.
2. Loosen and remove screw securing TB-2.
3. Secure RF-520 on chassis with hardware supplied as shown in figure 1.

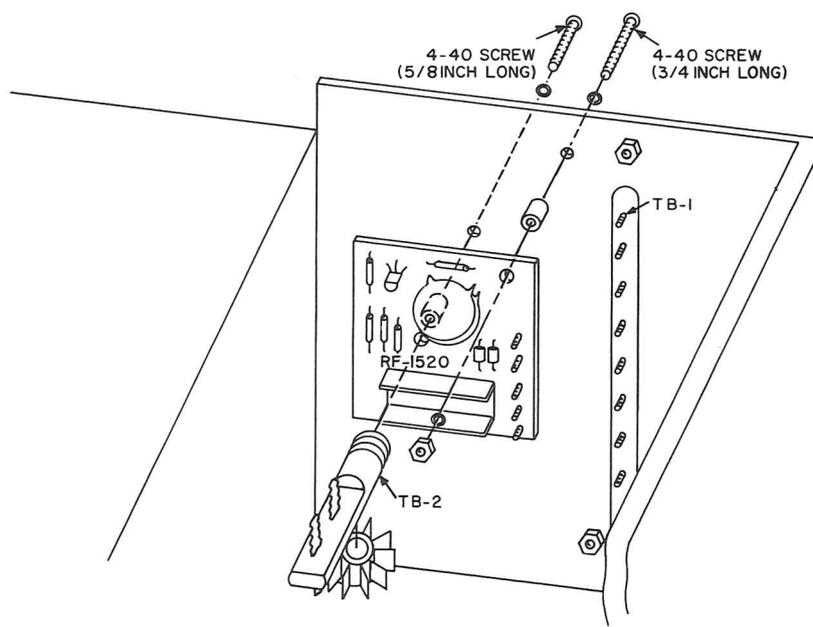


Figure 1. RF-520 Muting Conversion Module Installation



NOTE

Solder wires in following steps to appropriate terminals on the inside of TB-1.

4. Solder wire from E4 to terminal 9.
5. Solder wire from E5 to terminal 8.
6. Solder wire from E2 to terminal 7.
7. Solder wire from E1 to terminal 6.
8. Remove jumper between terminals 8 and 9 of TB-1.
9. Secure top cover to RF-505A.
10. Connect keyline and ground from transmitter to RF-505A as shown in figure .

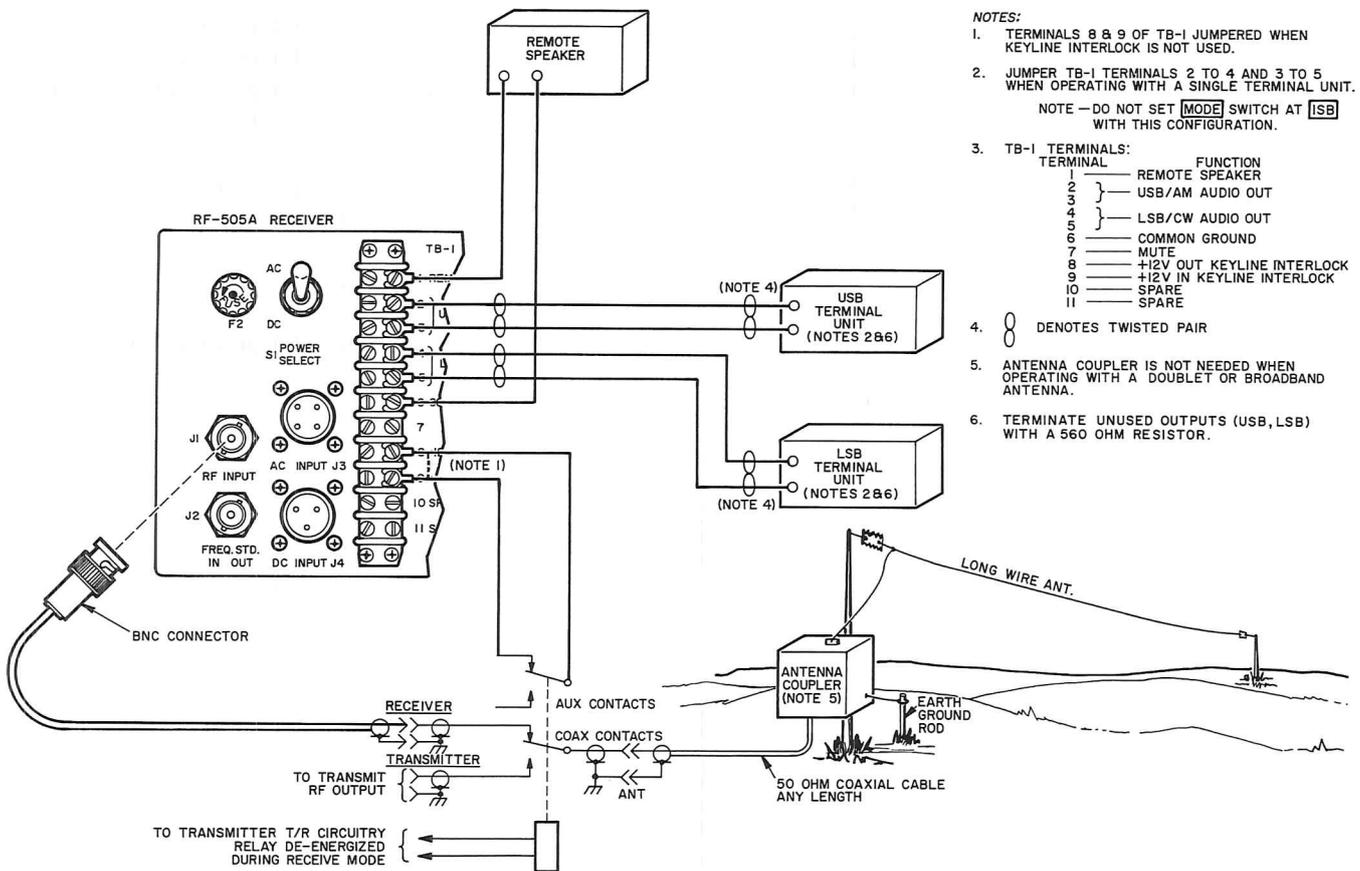


Figure 2. Typical Keyline Installation



OPERATION

The RF-520 disconnects power to the receiver module of the RF-505A Receiver whenever the voltage at the MUTE terminal (7) of TB-1 is less than two volts. A voltage higher than four volts at terminal 7 re-establishes +12V to the receiver module. Voltage or ground conditions are supplied to TB-1 terminal 7 by the transmitter keyline.

NOTE

Refer to figure 3 during the following discussion.

Assuming the mute inputs to the RF-520 are disconnected or above a four volt level, transistor Q2 is biased on through resistor R2. Transistor Q1 is also biased on through resistors R1 and R4 allowing +12 Vdc to be applied to the receiver module. As soon as either mute input is brought within two volts of ground, Q2 is biased off. This in turn biases Q1 off and switches off the +12 Vdc to the receiver module. A filter network composed of inductor L1 and capacitors C1 and C2 attenuates any rf signals which may appear on the transmitter T/R line. Zener diode CR1 maintains a constant Q2 emitter voltage and stabilizes the switching crossover voltage.

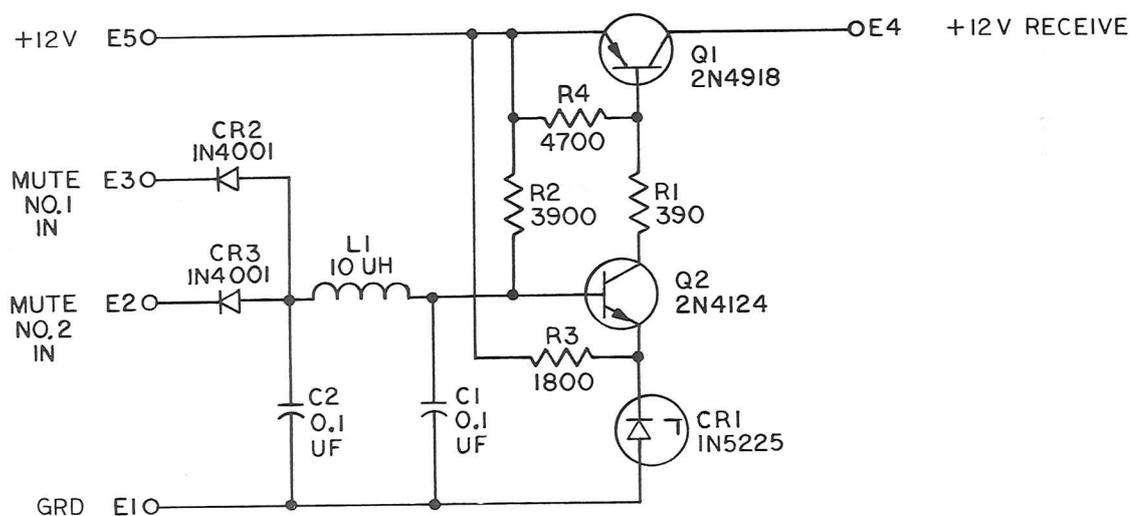
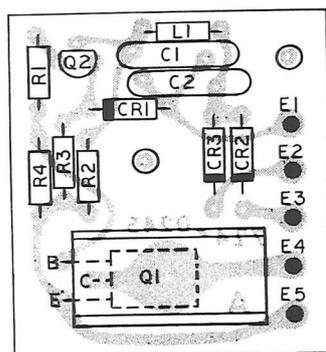


Figure 3. RF - 520 Muting Conversion Module Component Locations and Circuit Diagram

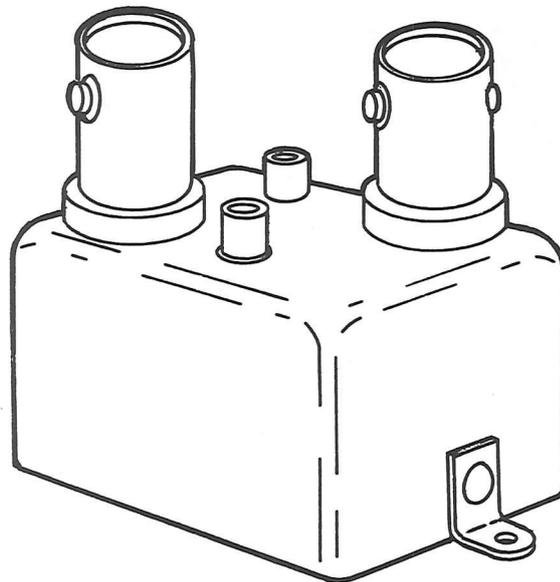


PARTS LIST

Reference Designation	Description	RF P/N
C1	Capacitor, Ceramic Disk, 0.1 UF $\pm 20\%$; 30 Vdcw	C-2210
C2	Capacitor, Ceramic Disk, 0.1 UF $\pm 20\%$; 30 Vdcw	C-2210
CR1	Diode, Zener, 3.0 Vdc $\pm 10\%$, Type 1N5225	CR-0204
CR2	Diode, Silicon, Type 1N4001	CR-0725
CR3	Diode, Silicon, Type 1N4001	CR-0725
L1	Coil, Rf, 10 UH	L-0628
Q1	Transistor, General Purpose, PNP, Type 2N4918	Q-0337
Q2	Transistor, General Purpose, NPN, Type 2N4124	Q-0385
R1	Resistor, Composition, 390 Ohms $\pm 10\%$; 1/4W	R-1239
R2	Resistor, Composition, 3900 Ohms $\pm 10\%$; 1/4W	R-1263
R3	Resistor, Composition, 1800 Ohms $\pm 10\%$; 1/4W	R-1255
R4	Resistor, Composition, 4700 Ohms $\pm 10\%$; 1/4W	R-1265



RF-522 RECEIVER PROTECTOR INSTRUCTION SHEET PM-0930



GENERAL

The RF-522 Receiver Protector Assembly provides the rapid action required to prevent damage by large RF signals to the sensitive front end circuitry of solid state receivers. The solid state circuitry of the RF-522 furnishes protection against all large received RF signals, even those in the microwave band, without generating significant intermodulation products of its own. With the RF-522, a receiver has full protection at all times, even when set at off, standby, or when tuned to other frequencies. When ordered separately the RF-522 is supplied with mounting hardware and a short coax cable with BNC connectors.



INSTALLATION

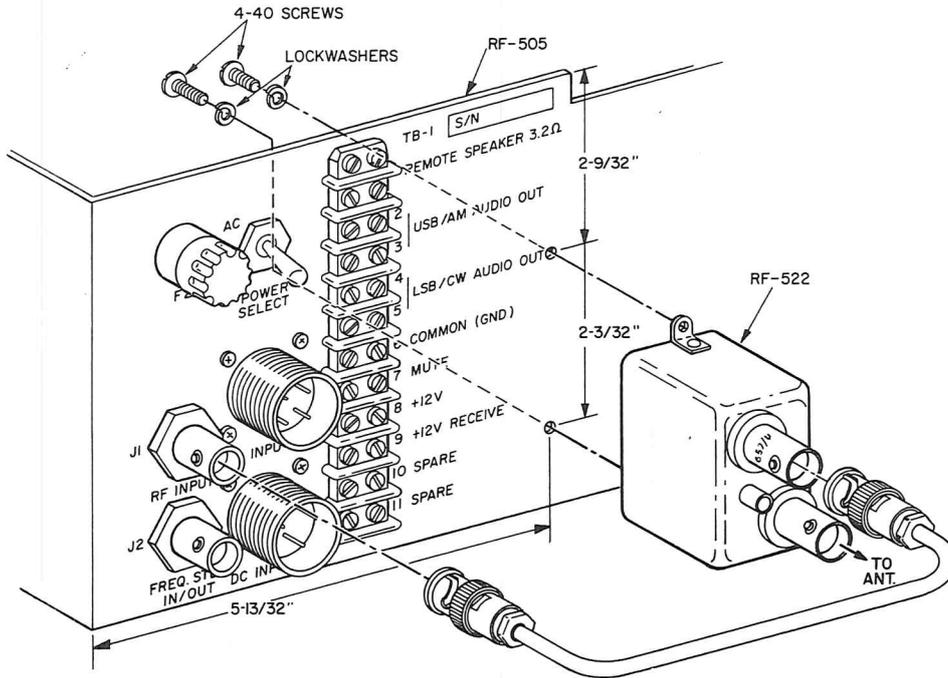


Figure 1 – RF-522 Mounted on a RF-505 Receiver

Figure 1 shows the mounting location of the RF-522 on the RF-505A Receiver.

NOTE

For the RF-522 purchased separately, drill the holes as indicated using a 1/8" drill and mount the RF-522 as shown in figure 1. Units purchased with a RF-505A will be installed at the factory.

Since operating power is not required by the RF-522 it can be installed at any convenient location and connected in series with the antenna lead-in. A minimum heat sink of 16 square inches is required for full power ratings.

SPECIFICATIONS

(In a 50 ohm load)

Insertion Loss	Less than 0.5 dB
Maximum Input Level:	
a) CW or FSK	a) 6 amps peak to peak (300 volts peak to peak behind 50 ohms.)
b) SSB or Pulse	b) 12 amps peak to peak (600 volts peak to peak behind 50 ohms.)

Receiver Operating Frequency Range

Intermodulation Distortion:

Temperature, Operating
Temperature, Storage
Humidity

Mechanical:
Connectors
Size (inches)

Installation

DC to 50 MHz

- a) Typically 40 dB below two tones of 200 mV emf each
- b) Typically 60 dB below two tones of 20 mV emf each

-30°C to +65°C

-55°C to +75°C

Up to 95%

Input/Output BNC

1-5/8 x 1-11/16 x 1-3/16

- a) Minimum heat sink area of 16 in.² required for full ratings.
- b) Coaxial cables should be sufficiently large to handle anticipated current levels.

WARRANTY

Harris Corporation/RF Communications Div. warrants the equipment purchased hereunder to be free from defects in material and workmanship under normal use and service when used for the purpose for which the same is designed, for a period of one year from date of receipt, provided that notice of such defect is given to RF Communications or its authorized service depot, within 60 days after discovery thereof and provided that inspection by RF Communications or its authorized service depot, indicates the parts are defective to RF Communications' reasonable satisfaction. RF 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 RF Communications' option, any defective part shall be returned to RF 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. 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 Harris Corporation/RF Communications Div. 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.

NOTE

Certain fixed price repair charges may be established by Harris Corporation/RF Communications Div. with authorized service depots providing for labor coverage during the warranty period. The customer is advised to ascertain these charges from his dealer at the time of purchase.

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 RF part number and the schematic designation number. Standard parts can be obtained from your local parts distributor.

RETURN OF EQUIPMENT

No equipment or part thereof shall be returned to Harris Corporation/RF Communications Div. unless the purchaser first obtains a return merchandise number from RF Communications. This number is to be marked on the shipping container. Equipment should be returned to Harris Corporation/RF Communications, 1680 University Avenue, Rochester, New York 14610 USA.



HARRIS CORPORATION RF Communications Division
1680 University Avenue, Rochester, New York 14610



724-1402

AC POWER SUPPLY MODULE

GENERAL

AC Power Supply Module 724-1402 provides the +5 Vdc, +12 Vdc, and +15 Vdc operating voltages required by the RF-505A for operation and the +28 Vdc required when the RF-508 High Stability Standard is installed. Operation is provided on ac primary power sources (48 to 65 Hz) of either 115 volts (+20% -10%) or 230 volts (+20% -10%). Dc output voltage control is provided by four series regulators and overload protection circuits.

THEORY OF OPERATION

NOTE

Refer to figures 1 and 3 during the following discussion.

Input ac power is connected to the primary winding of step-down transformer T1. The output from the secondary is applied to four full-wave rectifiers (CR1 through CR8) each with a capacitive output filter. From the output filter the dc voltage is supplied to the input of the +28 Vdc regulator, +15 Vdc regulator, +12 Vdc regulator and the +5 Vdc regulator.

+15 Vdc Regulator

Since the operation of the +15 Vdc, +12 Vdc, and the +5 Vdc regulators are nearly identical, only the +15 Vdc regulator will be explained.

The +15 Vdc regulator utilizes an integrated circuit (IC1), a series regulator transistor (Q2), and associated circuitry. The regulator provides a constant voltage output with current limiting. The integrated circuit contains a temperature

compensated Zener reference and an output error amplifier. The output of IC1 is applied to the base of transistor Q2. The integrated circuit monitors the output voltage level supplied at pin 4 by the voltage divider network consisting of resistors R4 and R5. The values of R4 and R5 are adjusted to provide the desired output voltage, in this case +15 Vdc.

Transistor Q2 functions as a variable resistance, connected in series with the regulator load. The output control signal from IC1 at the base of Q2 controls the resistance of Q2 to maintain a constant output voltage by adjusting the voltage drop across the transistor.

If a short circuit develops across the output terminal of the regulator, the voltage drop across R6 increases to a point where the circuit switches into current limiting at three amperes. However, fuse F1, a one amp fuse, will open the circuit long before Q2 is damaged.

An overvoltage protection circuit has been added to the +5 Vdc regulator to provide added protection. If the voltage exceeds 6.2 volts, Zener CR6 will conduct and develop a voltage drop across resistor R17. This voltage is applied to SCR CR7 to gate it on. When CR7 is switched on it shorts the output terminal of the regulator to ground and switches the regulator into current limiting to open the fuse.

+28 Vdc Regulator Circuit

The +28 Vdc regulator circuit is basically an emitter follower type of series regulator. Zener CR2 maintains a fixed referenced voltage to the base of Q1. Transistor Q1 functions as an emitter follower to maintain a fixed output voltage level. Note that the power for the 15V, 12V, and 5V integrated circuit regulators is supplied by the 28V output from Q1.

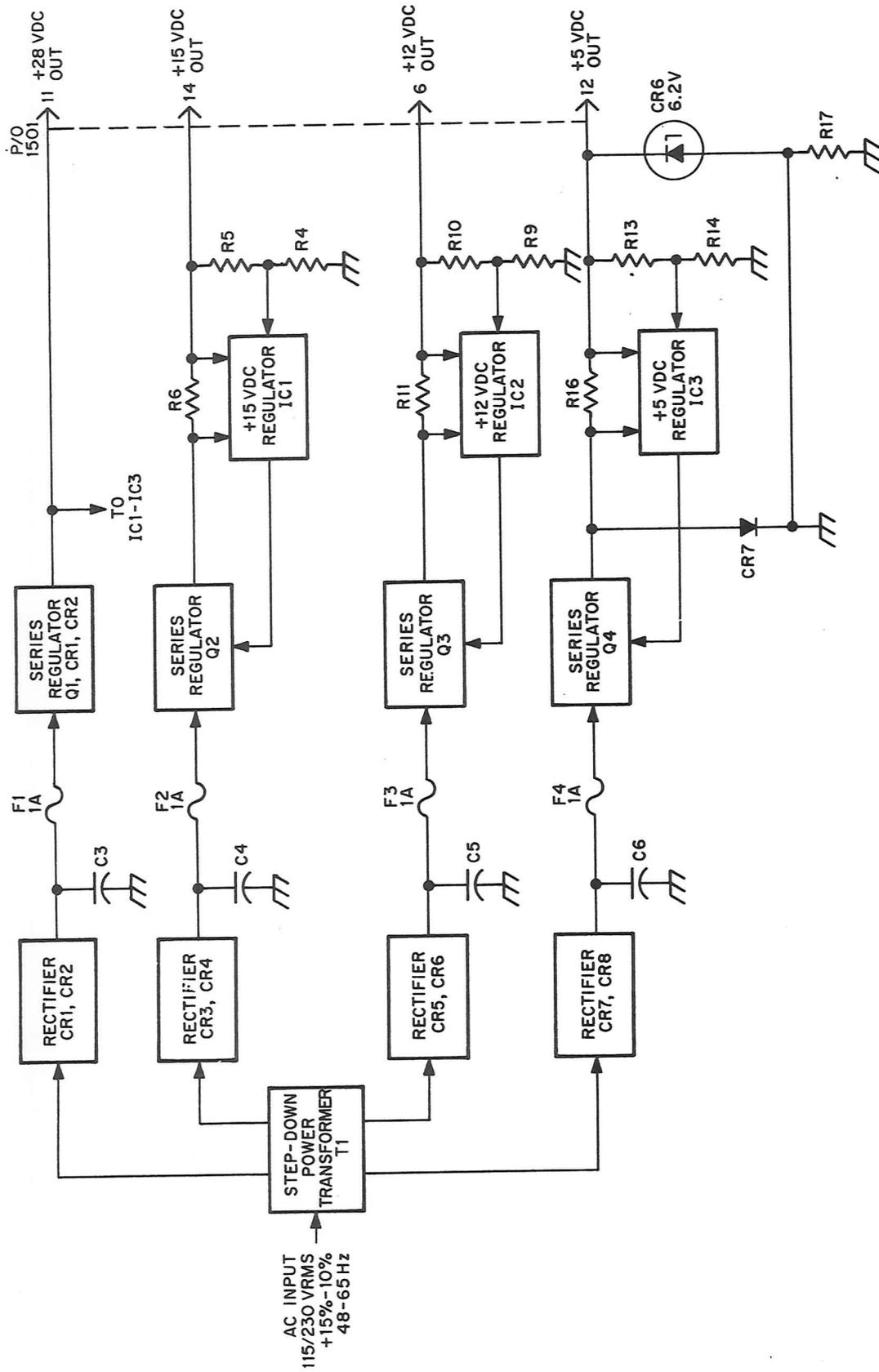


Figure 1. AC Power Supply Module Block Diagram



TEST PROCEDURES

WARNING

Dangerous voltages are present on the terminals of the Power Supply Module.

- a. DC Voltmeter — Simpson, Model 260
- b. Adjustable Auto-Transformer (Variac®)
- c. AC Voltmeter — Ballentine, Model 314
- d. Oscilloscope — Tektronix, Model 531

Test EquipmentPreliminary**NOTE**

The following test equipment or equivalent is required to perform the test procedures.

NOTE

The following tests can be performed with the AC Power Supply Module installed in the unit.

PROCEDURES

Step No.	Test Equipment and Test Point	Procedure	Performance
1.	Connect input ac line to the auto-transformer. Connect ac vtvm across output terminals of auto-transformer.	Adjust input level to nominal line voltage in use, either 115 or 230 Vac.	
2.	Connect dc voltmeter to pin 5 of J1401, refer to figures 2 and 3.	If installed in unit, set MODE switch at LSB. Voltage should be +15 Vdc \pm .75 V.	Measure +15 Vdc \pm 5%.
3.	Connect dc voltmeter to pin 10 of J1401.	Voltage should be +12 Vdc \pm 0.6 V.	Measure +12 Vdc \pm 5%
4.	Connect dc voltmeter to pin 13 of J1401.	Voltage should be +5 Vdc \pm 0.25 V.	Measure +5 Vdc \pm 5%.
5.	Connect dc voltmeter to pin 8 of J1401.		Measure 28 Vdc \pm 15%.
6.	As outlined above in steps 1 through 5, refer to figures 2 and 3.	Repeat step 2 through 5 with the input voltage first at -10% and then at +15% of nominal. Check for proper output.	Measure +15 \pm 5% Vdc, +12 \pm 5% Vdc, +5 \pm 5% Vdc.
7.	Disconnect dc voltmeter.	Set input voltage back to nominal value.	
8.	Connect oscilloscope probe to J1401 pins 5, 10, 13, 8.	Check for ac ripple on dc output voltages.	Less than 20 millivolts peak-to-peak for all dc voltages.
9.	Disconnect oscilloscope and auto-transformer.	Set MODE switch at OFF. Disconnect test equipment.	



FAULT ANALYSIS

Fault analysis procedures for the AC Power Supply Module are presented below in tabular form. Refer to page 6 for dc voltage values to figures 2 and 3 for component locations.

Symptom	Possible Trouble	Checks and Corrective Measures
No output.	a) Fuse F1 open. b) Faulty input circuitry, T1, C1, C2, Q1, or CR2 on Regulator Board. c) Diode Board Assembly defective.	a) Replace fuse. b) Make voltage measurements. Replace defective component. c) Check diodes CR1 through CR8.
+15 Vdc output absent. All other dc outputs normal.	a) Fuse F2 open. b) Defective +15 Vdc regulator circuit or diodes CR3, CR4.	a) Replace open fuse. b) Refer to Table 1 and make dc voltage checks. Replace defective component.
+12 Vdc output absent. All other dc outputs normal.	a) Fuse F3 open. b) Defective +12 Vdc regulator circuit or diodes CR5, CR6.	a) Replace open fuse. b) Refer to Table 1 and make dc voltage checks. Replace defective component.
+5 Vdc output absent. All other dc outputs normal.	a) Fuse F4 open. b) Defective +5 Vdc regulator circuit or diodes CR7, CR8.	a) Replace open fuse. b) Refer to Table 1 and make dc voltage checks. Replace defective component.

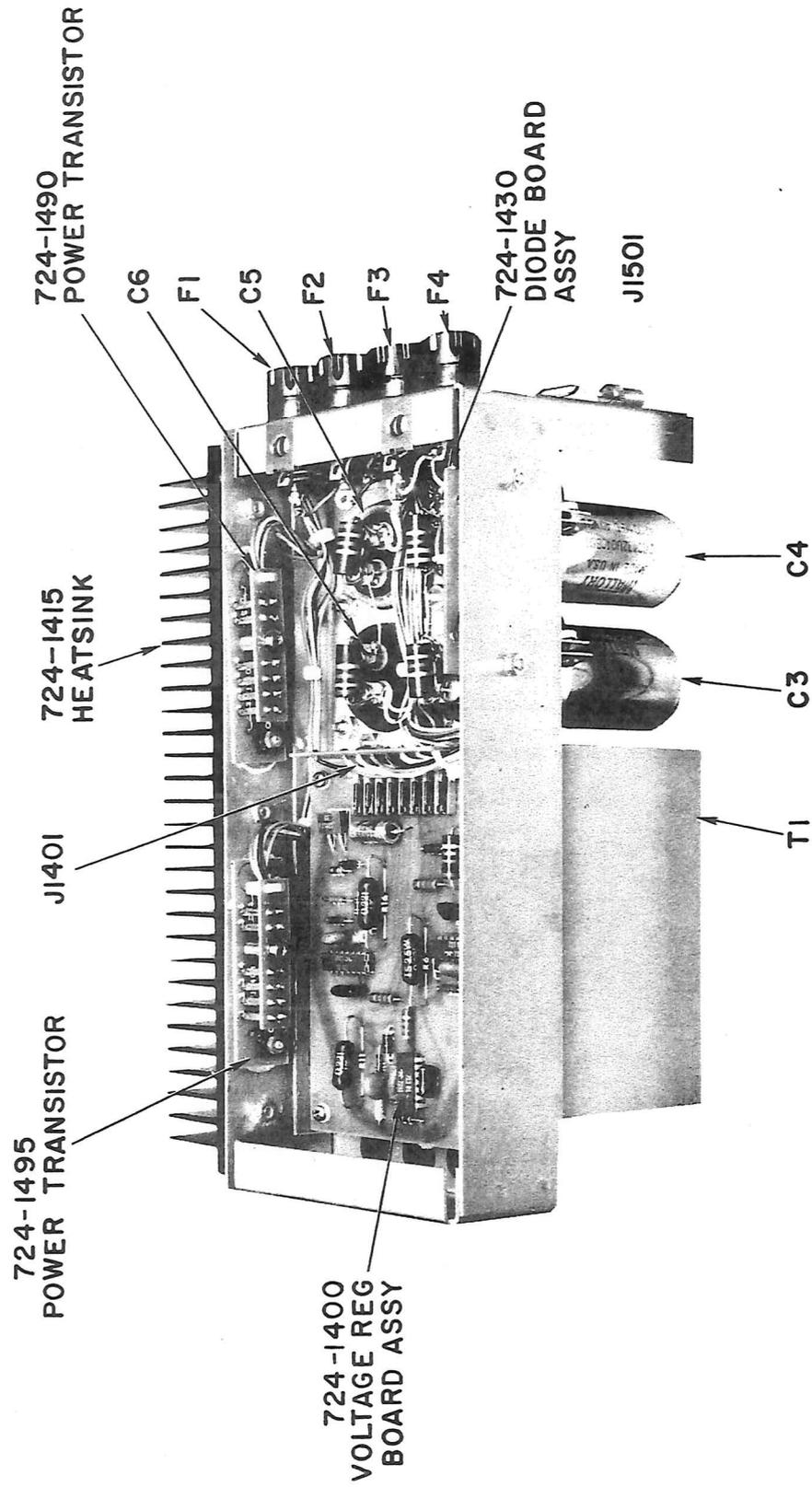


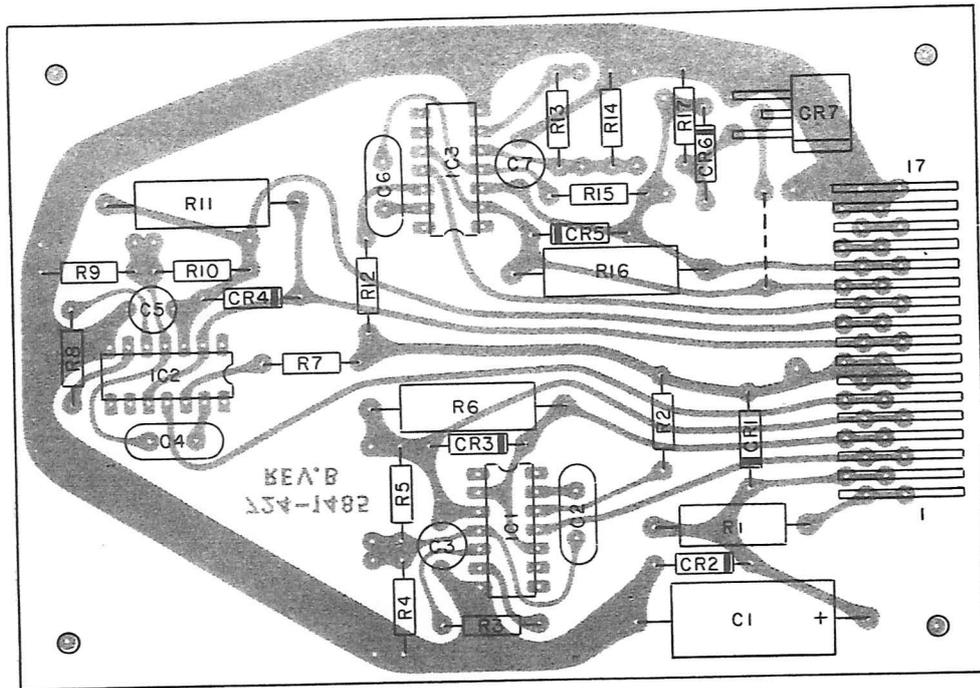
Figure 2. Major Assemblies Locations



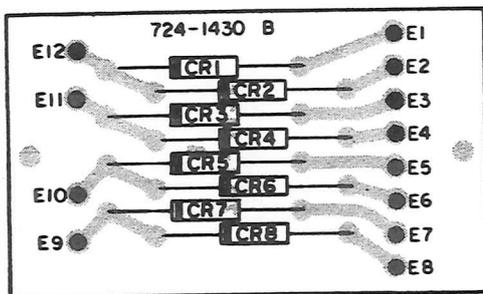
DC VOLTAGES*

STAGE	EMITTER PIN 1	BASE PIN 2	COLLECTOR PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10	PIN 11	PIN 12	PIN 13
Q1	29.1	30.1	48.4										
Q2	27.1	25.9	15										
Q3	22.6	21.3	12.4										
Q4	12.3	11.6	5.2										
IC1	---	15.1	15.1	7.3	7.3	7.3	0	-	-	15.1	25.8	27.8	16.3
IC2	---	12.3	12.2	4.3	7.3	7.3	0	-	-	12.3	21.2	27.8	13.6
IC3	---	5.2	5.1	5.1	5.1	7.3	0	-	-	5.3	11.0	23.1	6.5

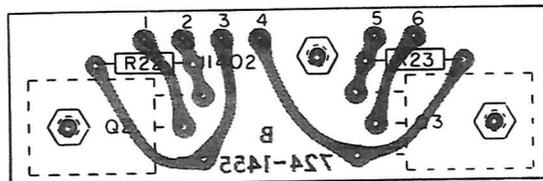
* All voltages taken with Simpson model 260. Input voltage 120 Vac, 60 Hz.



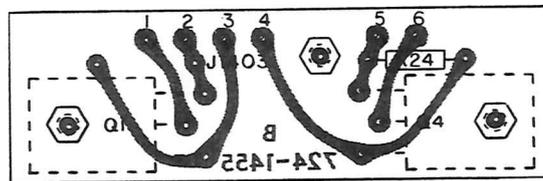
724-1480 Voltage Regulator Board Assembly



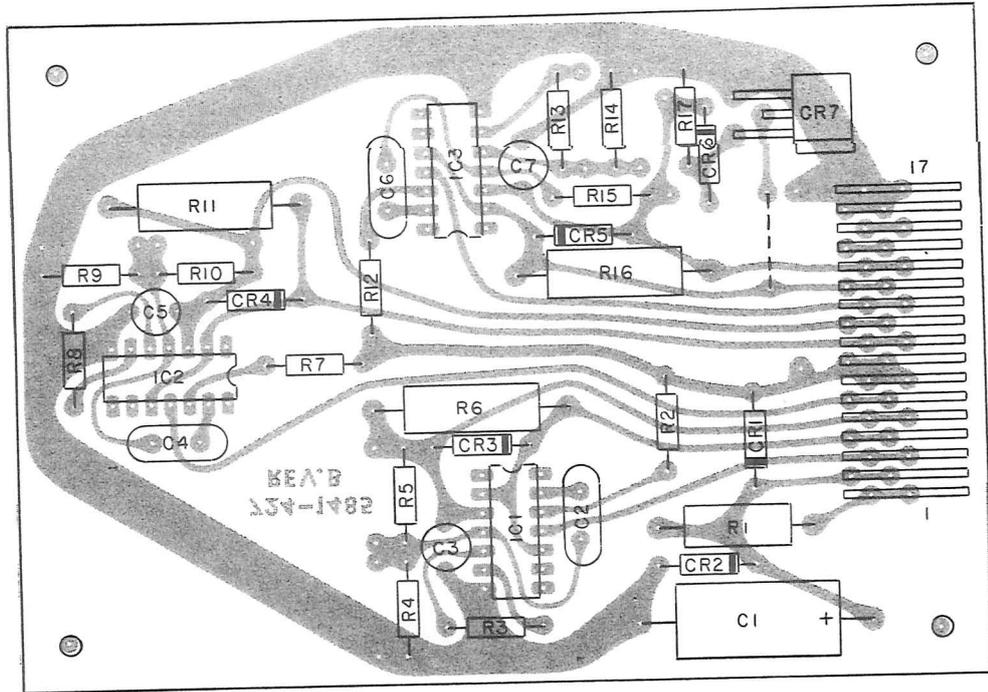
724-1430 Diode Board Assembly



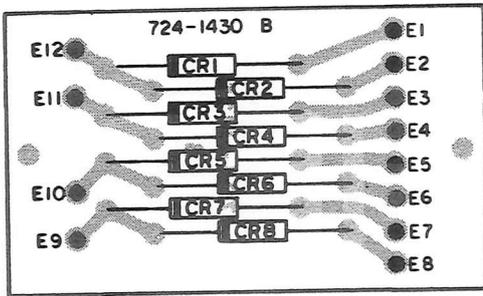
724-1495 Power Transistor Board Assembly



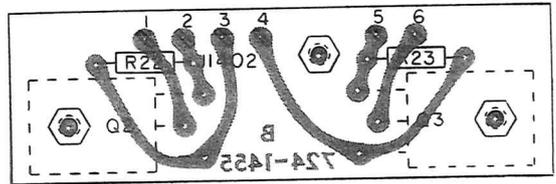
724-1490 Power Transistor Board Assembly



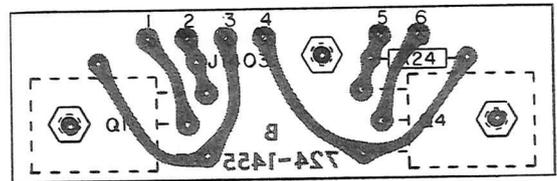
724-1480 Voltage Regulator Board Assembly



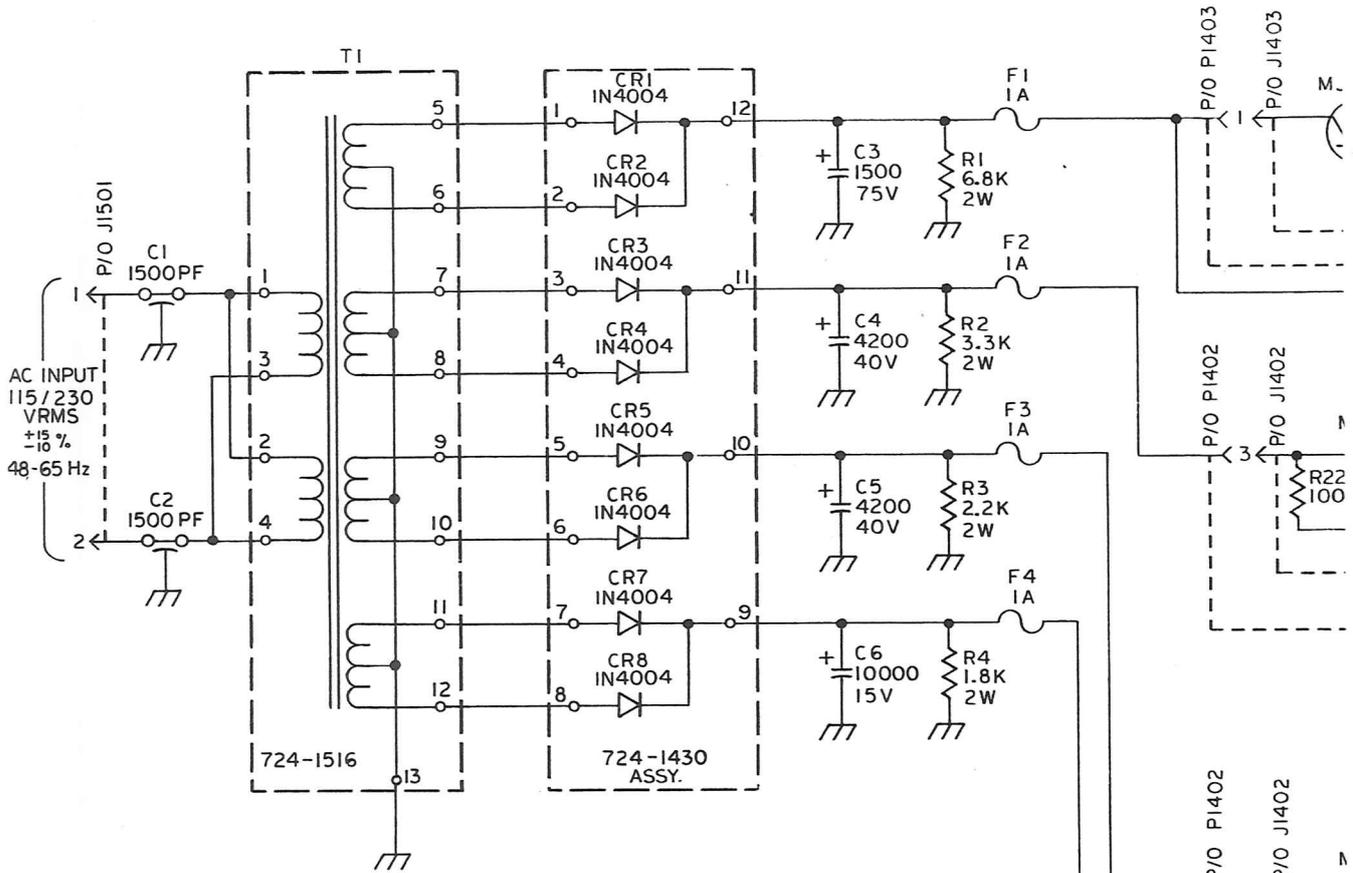
724-1430 Diode Board Assembly



724-1495 Power Transistor Board Assembly

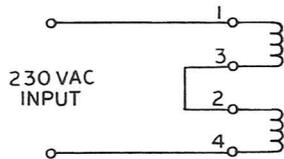


724-1490 Power Transistor Board Assembly

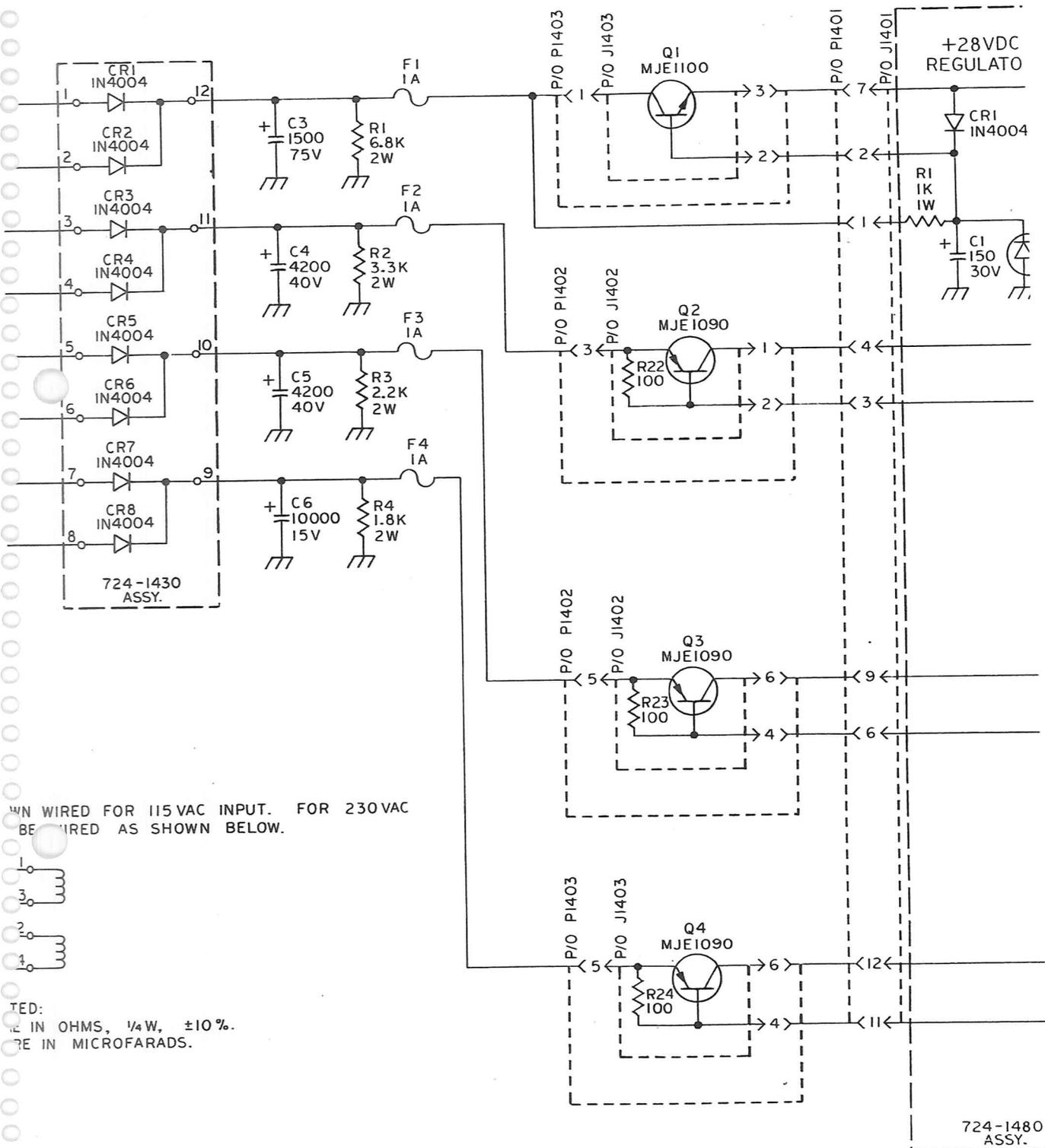


NOTES:

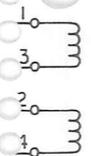
1. TRANSFORMER (T1) SHOWN WIRED FOR 115VAC INPUT. FOR 230VAC OPERATION T1 SHOULD BE WIRED AS SHOWN BELOW.



2. UNLESS OTHERWISE NOTED:
ALL RESISTANCES ARE IN OHMS, 1/4W, ±10%.
ALL CAPACITANCES ARE IN MICROFARADS.



WINDING WIRE WOUND FOR 115 VAC INPUT. FOR 230 VAC INPUT, WINDING WIRE REQUIRED AS SHOWN BELOW.



RESISTOR TOLERANCE: ±10%
RESISTOR VALUE: 1/4 W, 100 OHMS
CAPACITOR VALUE: IN MICROFARADS

724-1480 ASSY.

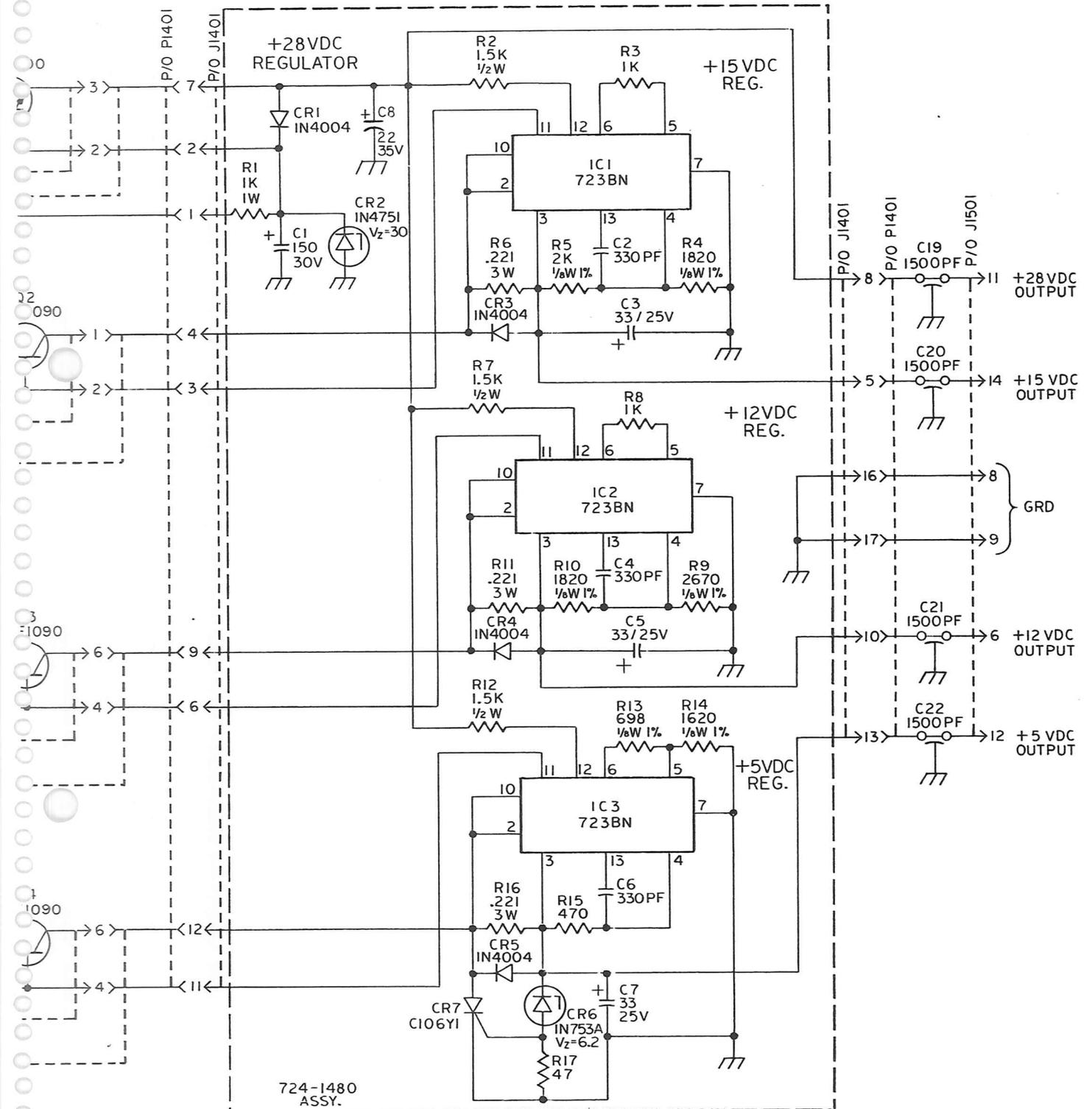


Figure 3. AC Power Supply Module Circuit Diagram



**AC POWER SUPPLY ASSEMBLY – 724-1402
PARTS LIST**

Reference Designation	Description	RF P/N
	Voltage Reg. Board Assembly	724-1480
	Diode Board Assembly	724-1430
	Power Transistor Board I Assembly	724-1495
	Power Transistor Board II Assembly	724-1490
C1	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
C2	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
C3	Capacitor, Alum, Electrolyte; 1500 uF; 75 Vdcw	C-4002
C4	Capacitor, Alum, Electrolyte; 4200 uF; 40 Vdcw	C-6360
C5	Capacitor, Alum, Electrolyte; 42200 uF; 40 Vdcw	C-6360
C6	Capacitor, Alum, Electrolyte; 10,000 uF; 15 Vdcw	C-4003
C19	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
C20	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
C21	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
C22	Capacitor, Feedthrough; 1500 pF ± 20%; 500 Vdcw	C-2651
F1	Fuse, 3AG, Quick Acting; 1.0 amp	F-0010
J1501	Connector, Power, Receptical, Ribbon, 14 Contact	J-0051
R1	Resistor, Carbon; 3.3K, 10%; 2W	R-0327
R2	Resistor, Carbon; 2.2K, 10%; 2W	R-0328
R3	Resistor, Carbon; 1.8K, 10%; 2W	R-0330
T1	Transformer, Power	724-1516
	Fuse Holder, Clip Fuse (for AG Fuse)	X-0330

VOLTAGE REGULATOR BOARD ASSEMBLY - 724-1480
PARTS LIST

Reference Designation	Description	RF P/N
C1	Capacitor, Tantalum, 150 uF; 30 Vdcw	C-2851
C2	Capacitor, Mica; 330 pF; 500 Vdcw	C-2492
C3	Capacitor, Tantalum; 33 uF; 25 Vdcw	C-3104
C4	Capacitor, Mica; 330 pF; 500 Vdcw	C-2492
C5	Capacitor, Tantalum; 33 uF; 25 Vdcw	C-3104
C6	Capacitor, Mica; 330 pF; 500 Vdcw	C-2492
C7	Capacitor, Tantalum; 33 uF; 25 Vdcw	C-3104
CR1	Diode, Type 1N4004	CR-0725
CR2	Diode, Zener; Type 1N4751	CR-0300
CR3	Diode, Type 1N4004	CR-0725
CR4	Diode, Type 1N4004	CR-0725
CR5	Diode, Type 1N4004	CR-0725
CR6	Diode, Zener; Type 1N753A	CR-0046
CR7	Diode, SCR; Type C106Y1	CR-0665
IC1	Integrated Circuit, 723BL	IC-0058
IC2	Integrated Circuit, 723BL	IC-0058
IC3	Integrated Circuit, 723BL	IC-0058
R1	Resistor, Carbon; 1K \pm 5%; 1W	R-1649
R2	Resistor, Carbon; 1.5K \pm 5%; 1/2W	R-1453
R3	Resistor, Carbon; 1K \pm 5%; 1/4W	R-1249
R4	Resistor, Metal Film; 1820 ohms \pm 1%; 1/8W	R-7292
R5	Resistor, Metal Film; 2000 ohms \pm 1%; 1/8W	R-7278
R6	Resistor, Wirewound; 0.221 ohms \pm 10%; 1W	R-7161
R7	Resistor, Carbon; 1.5K \pm 5%; 1/2W	R-1453
R8	Resistor, Carbon; 1K \pm 5%; 1/4W	R-1249
R9	Resistor, Metal Film; 2670 ohms \pm 1%; 1/8W	R-7299
R10	Resistor, Metal Film; 1820 ohms \pm 1%; 1/8W	R-7292
R11	Resistor, Wirewound; 0.221 ohms \pm 10%; 1/4W	R-7161
R12	Resistor, Carbon; 1.5K \pm 5%; 1/2W	R-1453
R13	Resistor, Metal Film; 698 ohms \pm 1%; 1/8W	R-7274
R14	Resistor, Metal Film; 1620 ohms \pm 1%; 1/8W	R-7280
R15	Resistor, Carbon; 470 ohms \pm 5%; 1/4W	R-1241
R16	Resistor, Wirewound; 0.221 ohms \pm 10%; 1/4W	R-7161
R17	Resistor, Carbon; 47 ohms \pm 5%; 1/4W	R-1217

**DIODE BOARD ASSEMBLY – 724-1430
PARTS LIST**

Reference Designation	Description	RF P/N
CR1	Diode, Silicon, Type 1N4004	CR-0725
CR2	Diode, Silicon, Type 1N4004	CR-0725
CR3	Diode, Silicon, Type 1N4004	CR-0725
CR4	Diode, Silicon, Type 1N4004	CR-0725
CR5	Diode, Silicon, Type 1N4004	CR-0725
CR6	Diode, Silicon, Type 1N4004	CR-0725
CR7	Diode, Silicon, Type 1N4004	CR-0725
CR8	Diode, Silicon, Type 1N4004	CR-0725

**POWER TRANSISTOR BOARD ASSEMBLY – 724-1490
PARTS LIST**

Reference Designation	Description	RF P/N
Q1	Transistor, Silicon, NPN, MJE-1100	Q-0142
Q4	Transistor, Silicon, PNP Darlington MJE-1090	Q-0399

**POWER TRANSISTOR BOARD ASSEMBLY – 724-1495
PARTS LIST**

Reference Designation	Description	RF P/N
Q2	Transistor, Silicon, PNP Darlington MJE-1090	Q-0399
Q3	Transistor, Silicon, PNP Darlington MJE-1090	Q-0399

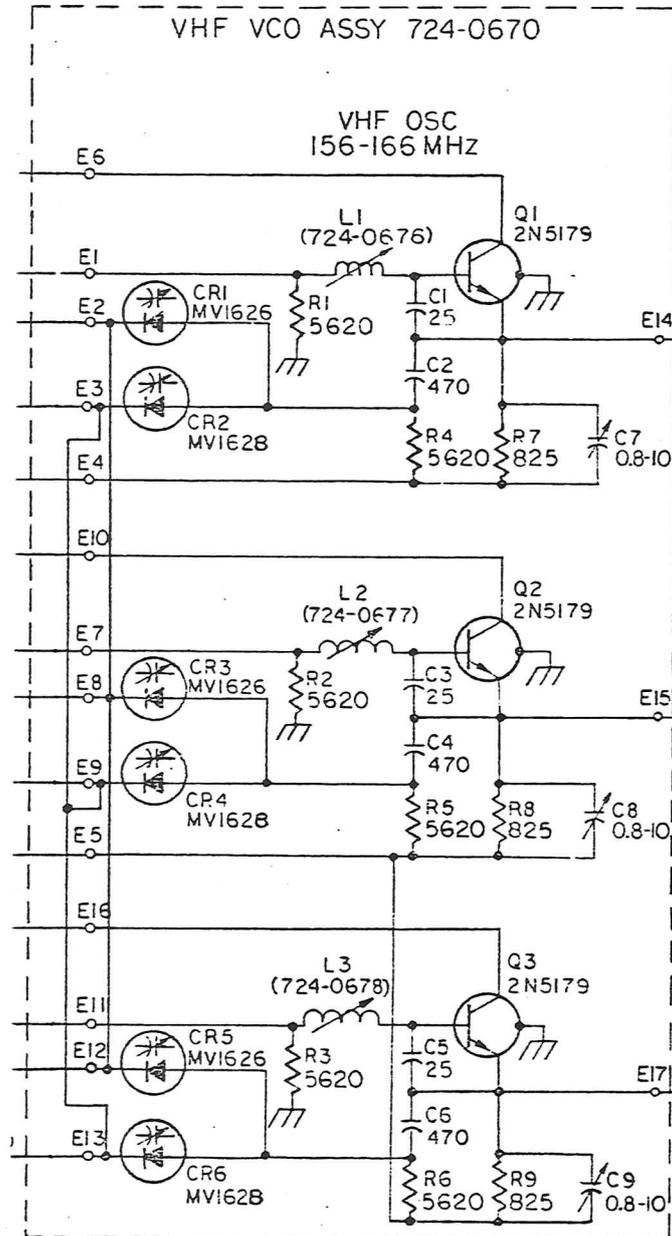
for RF-505A Receiver

Feb. 13, 1978

Applies to: All Units

L123

INSTRUCTIONS: On page 8-29, in figure 8.4, add Varactors CR1 and CR2 to the VHF VCO ASSY 724-0670 portion of the schematic as shown below:



ADDENDUM

FOR INSTRUCTION MANUAL

PM-0711C

ADDENDUM NO.

DATE

L165A

8/24/79

FOR:

RF-505A Receiver

APPLIES TO:

All Units with RF-527 High Stability 5 MHz Frequency Standard Option

PURPOSE:

This addendum provides information on the RF-527 Optional High Stability 5 MHz Frequency Standard that is available for use with the RF-505A Receiver. The frequency stability of the standard is ± 1 part in 10^7 .

PROCEDURE:

Make the following pen-and-ink changes in the Instruction Manual:

1. Page 1-2, Table 1.1, left column, under "Frequency Stability"; add the following line:
" ± 1 part in 10^7 Optional (with RF-527 High Stability 5 MHz Oven)".
2. Page 1-3/1-4, Table 1.2, add the following line:

MODEL NO.

DESCRIPTION

RF PART NO.

RF-527

High Stability Frequency
Std. (± 1 part in 10^7)

724-1603
(includes 724-
0152 oven)

3. Page 4-1, paragraph 4.2; change to read:
"Basically the RF-505A Receiver consists of a main frame chassis, Receiver Module 724-1000, Synthesizer Module 724-0500, Power Supply Module 724-1500, (or for AC only, Power Supply Module 724-1400), Frequency Standard Module 724-1600, (or optional high stability Frequency Standard Module 724-1601 for ± 1 part in 10^8 accuracy, or optional high stability Frequency Standard Module 724-1603 for ± 1 part in 10^7 accuracy), Preselector Assembly 724-1750, and VHF Filter Assembly 724-0300."
4. Page 4-2; insert the following after the 3rd paragraph:
"In addition, optional high stability module 724-1603 (RF-527) is available by special order, providing an accuracy of ± 1 part in 10^7 . Refer to Table 1.2."
5. Page 10-1, paragraph 10.1; change first sentence to begin; "Frequency Standard Module 724-1600, 724-1601, or 724-1603 provides"
6. Page 10-1, 2nd paragraph 3rd sentence; change to read:
"The optional (special order) 724-1601 and 724-1603 modules are supplied with a high-stability oven-controlled crystal oscillator standard. The 724-1603 module has a frequency accuracy of ± 1 part in 10^7 after a 30-minute warm-up period. The 724-1601 module has a frequency accuracy of ± 1 part in 10^8 after a 30-minute warm-up period."



HARRIS CORPORATION RF COMMUNICATIONS DIVISION ROCHESTER, NEW YORK U.S.A.

SHEET 1 OF 2

ADDENDUM

FOR INSTRUCTION MANUAL

PM-0711C

ADDENDUM NO.

DATE

L165A

8/24/79

7. Page 10-3/10-4, paragraph 10.4; change the first sentence to begin as follows:
"Fault analysis procedures for Frequency Standard Modules 724-1600, 724-1601, and 724-1603 are presented"
8. Page 10-7, figure 10.3, Note 3: change to read:
"TCXO 724-0150 is supplied with 724-1600 assembly. Optional high stability ovens 724-0150 and 724-0152 are supplied with the 724-1601 and 724-1603 assemblies, respectively."
9. Add the following material to the Accessories Section of the manual on the back of page C-1/C-2:
RF-527 HIGH STABILITY FREQUENCY STANDARD

GENERAL:

The RF-527 High Stability Frequency Standard, utilizing a crystal oscillator in a proportional controlled oven, provides a 5 MHz reference signal that is accurate to ± 1 part in 10^7 . The RF-527 is an accessory for the Frequency Standard Module and is used in place of the TCXO frequency standard when a higher degree of stability is required. A frequency adjustment control is provided on the RF-527 with sufficient range to compensate for crystal aging.

NOTE

Because the RF-527 oven requires 28 Vdc, the 724-1400 AC Power Supply Module must be installed in the RF-505 Receiver for operation. This in turn limits the RF-505 to "ac only operation", 115 or 230 volts (+20%, -10%).

INSTALLATION:

To install the RF-527 High Stability Frequency Standard Module, proceed as follows:

- a. Refer to paragraph 5.5.3 in the RF-505A Receiver Manual and remove the Frequency Standard Module.
- b. Remove the four nuts securing the TCXO standard and remove the standard from the module.
- c. Mount the RF-527 on the module and secure with four 4-40 nuts. Replace the Frequency Standard Module in the RF-505A Receiver.

CAUTION

The RF-527 was precisely adjusted to the exact frequency at the factory. Under no circumstances should the frequency adjustment be altered unless a frequency calibration standard of at least 1 part in 10^9 accuracy is used. It is recommended that the RF-527 frequency be checked once every six months and adjusted if necessary.



HARRIS
COMMUNICATION AND
INFORMATION PROCESSING

HARRIS CORPORATION RF COMMUNICATIONS DIVISION ROCHESTER, NEW YORK U.S.A.

SHEET 2 OF 2

RF-P-448-B

for RF-505A Receiver

Applies to: All units

L102

The RF-505A Receiver Manual (PM-0711C), page B1 of Accessories, step 13, should read:
"Connect supplied coaxial cable between P1101, pin A and P1301, pin C (or between E1 and E16). Connect shield of coaxial cable to E2 or E3."

Refer to Receiver Module Circuit Diagram, Figure 7.2, page 7-17.

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