INSTRUCTION BOOK

FREQUENCY DISPLAY UNIT

TYPE 14E1

GENERAL ELECTRONIC LABORATORIES, INC.
Research Development Manufacturing
NASHUA, NEW HAMPSHIRE

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SECTION 1 - GENERAL

INTRODUCTION

The Type 14-- series Frequency Display Units are normally used in conjunction with a GEL Receiver. One purpose is to provide a visual display of signals occurring in a band of frequencies around the signal frequency to which the receiver is tuned. A further purpose is to provide a means for visual analysis of the signal to which the receiver is tuned.

Signals received in a three megacycle band centered at the frequency to which the receiver is tuned are displayed on a cathode ray tube to give an indication of relative frequency and amplitude. Received signals appear as pips or spectrum lines with the position of the pip along a baseline indicating its relative frequency and the amplitude of the pip indicating its relative strength. A sweep width control is provided to reduce the width of the display as desired to facilitate analysis of the signal to which the receiver is tuned and a gain control is provided to adjust the pip amplitude.

TECHNICAL SUMMARY

Display----------------	3 inch CRT type 3RP1A
Input center frequency--	21.4 or 30 mc - Dependent on receiver
Sweep width-----------	Continuously adjustable zero to 3 mc
Amplitude constancy over display range---	Within 3 db of response at center frequency
Resolution*-----------	Approximately 20 dc
Sensitivity------------	Dependent on receiver
Gain control range-----	80 db or greater
Image rejection-------	60 db or greater
Second IF frequency---	4.3 mc
Oscillator mean frequency----------	25.7 mc

*Two equal amplitude signals 20 kc apart will appear as two separate pips with their point of intersection at least 6 db down.

Tube complement----------	0A2WA (2), 3RP1A (1), 5Y3WGTA (1), 6AH6 (1), 6AU6WA (4), 12AT7WA (2), 5726/6AL5 (1), 5749/6BA6W (3), 5750/6BE6W (1), 5814A (1)
Power input---------------	115 volts 50-60 cycles 95 watts

DESCRIPTION OF THE EQUIPMENT

The unit is packaged for mounting in standard 19 inch relay racks, requiring seven inches of panel space and extending 15 inches (overall) behind the panel. The chassis itself is only 16-1/8 inches wide allowing ample room for the installation of chassis slides, if required.

The three operating controls are located on the panel under the cathode ray tube. A flush mounted plate, removable by disengaging two quarter-turn fasteners, provides easy access to a group of controls used for initial set-up of the cathode ray tube. A flat-faced 3 inch cathode ray tube is used. The CRT is provided with an edge lighted scale. Lighting intensity is adjustable.

CONTROL FUNCTION AND LOCATION

Front Panel Operating Controls

GAIN (R-541) adjusts the vertical amplitude of the CRT display.

CENTER FREQUENCY (C-527) adjusts the center frequency of the CRT display to correspond with the exact center frequency of the receiver's IF amplifier.

SWEEP WIDTH (R-509) controls the sweepwidth of the CRT display.

Screwdriver Adjustments Accessible from Front Panel

SCALE (R-503) adjusts brightness of CRT scale.

SWEEP (R-513) adjusts the maximum sweep width of the local oscillator.

H GAIN (R-514) controls the horizontal length of the CRT trace.

H POS (R-523) adjusts the horizontal position of the CRT baseline.

V POS (R-526) adjusts the vertical position of the CRT baseline.

INT (R-529) adjusts the brightness of the CRT trace.

FOCUS (R-532) focuses the CRT display.

SYNC (R-511) synchronizes the CRT trace.

Screwdriver Adjustments Available from Top of Chassis

ASTIG (R-528) is set in conjunction with the focus control to obtain the best overall focus of the CRT display.

Linearity Control (L-501) is set for best sweep linearity.

Bias Control (R-548) adjusts the operating point of the reactance tube.

Reactance Tube Filament Voltage (R-543) adjusts the filament voltage applied to the reactance tube.

USING THE EQUIPMENT

Normal Operation

The normal operating controls are SWEEP WIDTH, CENTER FREQ and GAIN.

The SWEEP WIDTH control is used to adjust the bandwidth of the display. At maximum sweep width the band being displayed is 3 mc wide and the CRT baseline is calibrated directly in frequency with respect to the signal frequency of the receiver. As sweep width is reduced the band of frequencies being displayed is decreased and the display appears magnified. In general, maximum sweep width is used to search for signals and sweep width is reduced to analyze the signal to which the receiver is tuned.

The CENTER FREQ control is used to make up for slight differences between the center frequency of the discriminator in the receiver and the mean frequency of the local oscillator in the display unit. Its effect is to change the position of a display on the baseline.

The GAIN control is used to adjust the height of the display. There is an excess of gain so that in general it is desirable to reduce the gain to observe the weakest signals. As a practical operating condition the gain can be reduced until there is about a 1/8 inch CRT deflection due to noise when observing the weakest signals. At a particular gain control setting, signals many times stronger than those required for full deflection can be tolerated without overload problems. At maximum sweep, signals about 40 db stronger than those producing full deflection (5 divisions) can be handled without generating spurious spikes due to overload and without unreasonable widening of a spectrum line. As sweep width is reduced the overload point is also reduced.

Operating Adjustments of CRT

The eight controls located under the access plate on the panel should require only infrequent adjustment. The SCALE, V POS, INT, and FOCUS controls can be adjusted whenever it is necessary to do so without requiring any special precautions. The SYNC control will rarely ever require adjustment but it can be easily checked following the procedure given in the paragraph titled "Adjustment of Sync Control."

The three controls marked in red should not be adjusted except as follows:

1. The H POS control can be adjusted to set the received signal to zero on the CRT scale at maximum sweep. This should be done after it has been ascertained that the signal is tuned in exactly using the Tuning Meter on the receiver. After adjusting the H POS control reduce the sweep width, adjusting the CENTER FREQ control to keep the pip centered. If the sweep width can be reduced until the pip is about 1/2 inch wide at the base without requiring more than a 10 degree (approximately) rotation of the center frequency control satisfactory operation is being obtained. If the center frequency control requires more adjustment than this, refer to the paragraph on Normal Field Adjustments of Local Oscillator and Reactance Tube Circuits.

2. The H GAIN control should not be adjusted without referring to paragraph on Normal Field Adjustments of Local Oscillator and Reactance Tube Circuits.

3. The SWEEP control should not be adjusted without referring to the paragraph on Normal Field Adjustments of Local Oscillator and Reactance Tube Circuits.

Notes on Original Installation

The first IF amplifier has been adjusted using a receiver simulator and a 5-foot interconnecting cable. The receiver simulator consists only of those circuits from the applicable GEL Receiver that determine the IF response at the FDU output of the receiver. The interconnecting cable is made up from RG-55/U coaxial cable. As discussed in the section on "Theory of Operation", transformation occurring in this cable affects the tuning of Z-502 and therefore the amplitude compensation. For this reason it is desirable to check the tuning of Z-502 with the receiver and interconnecting cable that it will be used with.

The procedure is as follows:

Connect the FDU output of the receiver to the signal input of the Display Unit. Connect a suitable signal generator to the receiver antenna terminal. Set the frequency to about the center of the receiver's tuning range and the output to about 5 uv and tune in this signal on the receiver using the tuning meter of the receiver for an indication of proper tuning. Adjust the Center Frequency, Sweep Width, and Gain controls of the display unit to give a suitable pip approximately 1/2 inch wide at the base. Adjust the core in Z-502 for maximum pip amplitude.

If the flattest possible amplitude characteristic is desired it is recommended that the first IF amplifier be tuned up following the procedure given in the section on "Alignment of First IF Amplifier".

THEORY OF OPERATION

General

A block diagram is shown in Figure 1. The Frequency Display Unit is essentially a swept receiver tuned to the receiver's IF center frequency. Signals in a band 3 mc wide centered on the signal frequency of the receiver are translated in the mixer of the receiver to a band centered at this frequency. Signals in this band are amplified by the first IF amplifier in the FDU and mixed with the FDU local oscillator frequency. The amplitude response of the first IF amplifier compensates for the response at the FDU output of the receiver to produce the flattest possible amplitude response over the 3 mc display range.

The second IF amplifier is tuned to 4.3 mc and has a very narrow bandwidth. At maximum sweep width the local oscillator is swept from 27.2 to 24.2 mc at a 30 cycle rate. A signal in the range of the first IF will, at some part of the cycle, give a mixer output at 4.3 mc. As the signal at the mixer output passes through 4.3 mc it is amplified by the second IF amplifier and a pulse is produced at the detector. This pulse is amplified by the vertical amplifier and applied to the vertical deflection plates of the CRT to produce a pip on the CRT baseline.

The sweep generator produces a 30 cycle sawtooth output. This output is amplified by the horizontal amplifier and applied to the horizontal deflection plates of the CRT to produce the baseline. The sweep output is also applied to a reactance tube. The reactance tube varies the local oscillator frequency in synchronism with the CRT horizontal sweep. This allows the baseline of the CRT to be calibrated over a range of plus and minus 1.5 mc with respect to the signal frequency to which the receiver is tuned.

First IF Amplifier

Refer to Section 5.

Mixer

The first IF signal and the swept local oscillator are combined in a pentagrid mixer V-510. Present in the output of the mixer is the instantaneous difference between the local oscillator signal and a signal passing through the first IF amplifier. The plate circuit of the mixer is tuned to 4.3 mc and as the instantaneous frequency difference passes through this frequency a signal is applied to the second IF amplifier.

A pentagrid mixer is desirable from the standpoint of circuit operation due to the isolation between the oscillator grid and the signal grid as well as the relative independence of conversion transconductance on oscillator injection.

Second IF Amplifier and Detector

The second IF amplifier is tuned to 4.3 mc and has a bandwidth of approximately 12 kc. The selectivity curve is that of four, double-tuned transformers very lightly coupled. Two stages, V-511 and V-512 are gain-controlled. The cathode resistor of each gain-controlled stage is partially unbypassed to compensate for input capacity variations that occur with changes in transconductance.

Gain control R-541 varies the resistance in the cathode circuit of V-511 and V-512 in the second IF amplifier as well as that of V-515 in the first IF amplifier. As this resistance is increased, bias is increased and the gain of all three stages decreases. The gain control potentiometer has a counterclockwise, logarithmic taper to produce a smooth gain versus rotation characteristic allowing approximately 80 db of range in one control.

Detector V-514 is arranged to give an output of positive polarity in series with the dc voltage of approximately 50 volts appearing across R-537. As the signal output of the mixer passes through 4.3 mc the detector output traces out the 2nd IF response curve to produce a positive pulse in series with this fixed dc voltage. This is applied to the signal grid of vertical amplifier V-507.

Vertical Amplifier

The vertical amplifier is a cathode coupled differential amplifier with the push-pull plates wired directly to the vertical deflection plates of the cathode ray tube. The dc voltage across R-537 is applied to both grids to set the operating point of the tube. The voltage drop across a portion of R-536 is applied to the non-signal grid to adjust the vertical position of the baseline.

Sweep Generator

V-504A operates as a conventional blocking oscillator synchronized to one-half the power line frequency. SYNC control R-511 adjusts the grid time constant as required to maintain synchronization. During the "off" time of the oscillator time base capacitor C-508 charges through R-517 to produce the sweep voltage. C-508 is discharged by the plate current drawn during the "on" time of the oscillator.

The sawtooth is directly coupled to the grid of cathode follower V-504B. A voltage divider in the cathode circuit contains the SWEEP and H GAIN controls. The SWEEP control sets the sawtooth amplitude fed to the reactance tube. The H GAIN control sets the sawtooth amplitude fed to the horizontal amplifier.

Horizontal Amplifier

The horizontal amplifier is a cathode coupled differential amplifier with the push-pull plates wired directly to the horizontal deflection plates of the cathode ray tube. A positive dc voltage is applied to both grids to set the operating point of the tube. The dc level at the non-signal grid is set by horizontal position control R-533. The sawtooth sweep is capacitively coupled to the signal grid and the amplitude of this voltage sets the CRT base-line length. In normal operation the baseline extends slightly off the screen to the right and considerably off the screen to the left.

Reactance Tube and Local Oscillator

The sawtooth applied to the grid of reactance tube V-506 sweeps the frequency of the oscillator at a 30 cycle rate around a mean frequency of 12.85 mc. Sweep width is controlled by the adjustment of SWEEP WIDTH control R-509. The maximum sweep width is set by adjustment of SWEEP control R-513.

C-520, R-547, and L-501 comprise the phase shift network for applying RF voltage to the grid of the reactance tube. The phase shift of this network causes the tube to act as a capacitive reactance shunting the tuned circuit of the oscillator. The change in reactance tube plate current caused by the sawtooth applied to the grid changes this reactance and consequently the oscillator frequency. L-501 controls the frequency-amplitude characteristic of the phase shift network and is adjusted to give the most nearly linear frequency shift about the mean frequency. Bias control R-548 selects the proper operating point for the reactance tube.

Since the GM and consequently the reactance of the reactance tube varies with filament voltage, this voltage is stabilized against line voltage changes by the use of a ballast tube (R-545).

T-503 in the plate circuit of the oscillator is tuned to 25.7 mc, the second harmonic of the oscillator mean frequency. T-503 is an overcoupled, double-tuned circuit with a reasonably constant response over a plus and minus 1.5 mc range. Due to variations in reactance tube loading the oscillator output varies with its instantaneous frequency. Since it is desirable to have an essentially constant injection voltage at grid 1 of the mixer the tuning of T-503 is adjusted to give the most nearly constant injection voltage with the oscillator being swept the maximum amount. This adjustment is possible because T-503 has a high Q ratio allowing primary tuning to slide its response curve and secondary tuning to tilt its response curve to produce a curve that will compensate the variation in second harmonic energy content in the oscillator output.

Power Supply

The B plus power supply is a conventional full-wave rectifier capacitor input filter configuration. Two levels of unregulated B plus and two sources of plus 150 volts regulated are used. The regulated 150 volt sources use 0A2WA voltage regulator tubes.

A negative voltage of approximately 700 volts is obtained from a voltage doubler circuit operating across one-half of the power transformer high voltage winding. This voltage is used to operate the cathode ray tube.

ADJUSTMENT OF SYNC CONTROL

Recommended Equipment

DuMont 401-A Oscilloscope

Procedure

1. Connect the horizontal amplifier of the oscilloscope across R-512 (located on TB-501) to sample the 30 cycle sawtooth sweep. Connect the oscilloscope vertical amplifier across the 6.3 volt filament bus at a convenient point.

2. Adjust the sync control for two cycles of the 60 cycle filament voltage showing on the oscilloscope.

3. Remove the oscilloscope connections.

ALIGNMENT OF SECOND IF AMPLIFIER

Recommended Equipment

Hewlett-Packard Model 606A Signal Generator

RCA Model WV-98A VTVM

Microlab AF-10 - 10 db coaxial pad

Coax cables and adaptors as required

Procedure

1. Ground C-585 using a short clip lead. Connect the VTVM to pin 2 of V-507. Remove oscillator tube V-509. Disconnect the input cable to the local oscillator mixer subchassis at J-502. Using 50 ohm cable connect the signal generator to the pad and the pad to J-502. Set the front panel gain control to maximum. Set the generator frequency to 4.30 mc.

2. Keeping the voltage read at the VTVM approximately 3.5 volts by adjusting the signal generator output, tune T-507A, T-507B, T-506A, T-506B, T-505A, T-505B, T-504A, and T-504B for maximum VTVM reading.

3. Remove the VTVM. Remove the clip lead. Reconnect the cable to J-502. Replace V-509.

NORMAL FIELD ADJUSTMENTS OF THE LOCAL OSCILLATOR AND REACTANCE TUBE CIRCUITS

Recommended Equipment

Hewlett-Packard Model 608-D Signal Generator

Hewlett-Packard Model 606A Signal Generator

General Radio Model 1000-P6 Crystal Diode Modulator

DuMont Model 401A Oscilloscope

Microlab Model AF-10 - 10db coaxial pad

A 1.5 volt battery

Coaxial cables and adaptors as required

General Instructions

This adjustment procedure should suffice to set up the local oscillator reactance tube circuits for conditions normally encountered. Exceptions to this would be if an adjustment were attempted without following the procedure or if certain parts were replaced in the local oscillator circuit, the reactance tube circuit, or the sweep generator circuit.

It is possible to make the adjustments using only one signal generator (that has been calibrated accurately for frequency) although it will be considerably more difficult and time consuming. All that is required for this is to feed in the appropriate frequency during each step of the procedure.

The adjustments should be made in the order given starting with the calibration check.

Calibration Check

1. Remove the interconnecting cable from J-502. Using 50 ohm cable connect the 608-D signal generator to the coaxial pad and the pad to the input of the diode modulator. Connect the output of the modulator to J-502. Connect the bias battery to the diode modulator. Connect the 606A signal generator to the modulation input of the diode modulator. Set the

608-D signal generator accurately to 30 mc with an output of 5000 microvolts. Set the 606-A generator to 1.5 mc with an output of 0.5 volts.

2. Set the display unit SWEEP WIDTH and GAIN controls to maximum. Set the CENTER FREQUENCY control to the center of its range (pointer vertical).

3. Adjust the H POS Control as required to set the center frequency pip to zero on the CRT. Reduce the SWEEP WIDTH until the Center frequency pip is about an inch wide at the base keeping the pip centered by adjusting the CENTER FREQUENCY control if required. If the CENTER FREQUENCY control pointer is more than 10 degrees (approximately) from the vertical, adjust the slug in Z-501 to center-up the pip with the pointer vertical.

4. Return the SWEEP WIDTH control to maximum and readjust the H POS control for pip centering if necessary. If the three pips fall in their proper places no further adjustment is required. If the pips are out of place make the trace length check and adjustment.

Trace Length Check and Adjustment.

1. Using the H POS control move the center frequency pip to the minus 0.5 mc mark on the CRT scale. Observe the length of the right side of the trace. It should extend to the plus 1.5 mc mark on the scale. If not, use the H GAIN control to correct the trace length.

2. Reposition the center frequency pip to zero and check the position of the pip at the minus 1.5 mc end of the trace. If it is not in its proper position the unit will require adjustment of the sweep control. If all three pips fall in their proper places no further adjustment is required.

Sweep Control Adjustment

1. Set the SWEEP control to properly position the pip at the minus 1.5 mc end of the trace. Readjust the H POS control to keep the center frequency pip at zero if required.

2. Observe the position of the pip at the plus 1.5 mc end of the trace. If it is not satisfactory the unit will require a linearity adjustment. If it is satisfactory repeat steps 3 and 4 of the Calibration Check.

Linearity Adjustment

1. As the inductance of L-501 is increased from a value below its proper value the pip at the 1.5 mc end of the trace moves in toward the center until the proper value of inductance is reached. Increasing the inductance beyond this point causes the pip to move out again. Check the adjustment of L-501 to see that the pip at the plus 1.5 mc end of the trace is in toward the center as far as it will go. After making this check adjust the H POS and SWEEP controls for proper positioning of the pips at center frequency and at the minus 1.5 mc end.

2. Observe the position of the pip at the plus 1.5 mc end. If it is too far out make an incremental adjustment of Bias Control R-548 in a counterclockwise direction, or if it is too far in make an incremental adjustment of R-548 in a clockwise direction.

3. Reduce the sweep width using the SWEEP WIDTH control adjusting Z-501 as required to keep the center frequency pip centered. Set the SWEEP WIDTH control back to maximum.

4. Check the adjustment of L-501 to see that the pip at the plus 1.5 mc end is in as far as it will go.

5. Adjust the SWEEP control to set the pip at the minus 1.5 mc end in the proper position, readjusting the H POS control for proper position of the center frequency pip if required.

6. Repeat Step #3.

7. Repeat Steps #2 through #6 as required to properly position all three pips with the SWEEP WIDTH control set to maximum.

Adjustment of T-503

Connect the oscilloscope vertical input across C-538. Connect the oscilloscope horizontal amplifier across R-512. Set the Display Unit SWEEP WIDTH to maximum and adjust T-503 for the flattest response curve.

COMPLETE ADJUSTMENT PROCEDURE FOR LOCAL OSCILLATOR AND REACTANCE TUBE CIRCUITS

Recommended Equipment

RCA Model WR-59C Sweep Generator

Hewlett-Packard Model 608-D Signal Generator

Hewlett-Packard Model 606-A Signal Generator

General Radio Model 1000-P6 Crystal Diode Modulator

DuMont Model 401-A Oscilloscope

Microlab Model AF-10 db coaxial pad

A 1.5 volt battery

Coaxial cables and adaptor as required

Preliminary Adjustment of T-503

1. Connect a short clip lead across L-503 in the cathode circuit of V-509. Connect the sweep generator from pin 1 of V-509 to ground on the side of the subchassis. Connect the oscilloscope to C-538. Set the sweep generator output to maximum.

2. Adjust T-503 for a response curve centered at 25.7 mc. The response should be overcoupled with about a 15% dip and should be about 3 mc wide across the portion of the response curve where the amplitude is equal to or greater than at center frequency.

3. Remove the sweep generator connections.

Reactance Tube and Oscillator Set-up

1. Set the filament voltage at pin 3 of V-508 at 6.3 VAC by adjusting R-543 and using a nominal 115V line input to the unit. CAUTION: Use a meter that draws negligible current.

2. Set the stud length on L-501 (as measured from the top of the mounting bushing) to 3/16 inch.

3. Set the SWEEP WIDTH control to minimum, adjust R-548 for 2.0 volts measured from pin 7 of V-508 to ground. Remove the clip lead and install the bottom cover on the oscillator mixer subchassis.

4. Check C-527 to see that the capacitor plates are fully meshed when the CENTER FREQ knob pointer points to the left. Set the CENTER FREQ knob pointer straight up.

5. Remove the interconnecting cable from J-502. Using 50 ohm cable connect the 608-D signal generator to the coaxial pad and the pad to the input of the diode modulator. Connect the bias battery to the diode modulator. Connect the 606-A signal generator to the modulation input of the diode modulator. Set the 608-D signal generator accurately to 30 mc with an output of 5000 microvolts. Set the 606-A signal generator to zero output.

6. Set the GAIN control to maximum. Set the SWEEP control to maximum. Set the SWEEP WIDTH control to minimum then advance the control approximately 10 degrees.

7. Adjust Z-501 for a pip centered on the CRT baseline. Adjust the GAIN control as required to keep the pip on the CRT face. After the adjustment is completed set the GAIN control back to maximum.

8. Set the 606-A generator to 1.5 mc with an output of approximately 0.5 volts.

9. Set the SWEEP WIDTH control to maximum. Set the SWEEP control to maximum. Set the H GAIN control to minimum. Adjust the H POS control to center up the trace.

10. Adjust L-501 (turning it clockwise) to move the sideband at the plus 1.5 mc end of the trace in toward the center as far as it will go. Note: If the sideband at plus 1.5 mc is not visible, adjust L-501 and observe that the center frequency pip moves toward the minus 1.5 mc end of the trace. When the sideband at plus 1.5 mc appears, use it to make the final adjustment. All three pips should be visible on the CRT trace.

11. Reduce the sweep width (using the SWEEP WIDTH control), adjusting Z-501 to keep the center frequency pip on the trace, continuing until the response is about ¼ inch wide at the base.

12. Set the SWEEP WIDTH control back to maximum and adjust the H POS control to locate the center frequency pip at minus .5 mc on the CRT scale.

13. Adjust the H GAIN control for a trace that extends to the plus 1.5 mc position on the scale, readjusting the H POS control, if required, to keep the center frequency pip at minus .5 mc on the CRT scale. Readjust L-501 to move the sideband at the plus 1.5 mc end in toward the center as far as it will go. Using the H POS control reset the center frequency pip to zero.

14. Adjust the SWEEP control to place the sideband at the minus 1.5 mc end in proper position, readjusting the H POS control if required.

15. Observe the position of the sideband at the plus 1.5 mc end. If it is too high make an incremental adjustment of bias control R-548 in a counter-clockwise direction or, if it is too low, make an incremental adjustment of R-548 in a clockwise direction and proceed to step 16.

16. Reduce the sweep width (using the SWEEP WIDTH control) adjusting Z-501 to keep the center frequency pip centered. Set the SWEEP WIDTH control back to maximum.

17. Adjust the SWEEP control to set the sideband at the minus 1.5 mc end in proper position, readjusting the H POS control for proper position of the center frequency pip if required.

18. Check the adjustment of L-501 to see that the sideband at the plus 1.5 mc end is in as far as it will go.

19. Repeat step 16.

20. Repeat steps 15 through 19 as required to properly position all three pips with the SWEEP WIDTH control set to maximum, and having the center frequency pip remain essentially centered as the sweep width is reduced. Note: As the sweep width is reduced the mean frequency of the oscillator will vary slightly, causing the center frequency pip to move a little, but when a proper set of adjustments has been reached it takes only a small change in position of the CENTER FREQ control to center up the pip.

Final Adjustment of T-503

Connect the oscilloscope vertical amplifier to C-538. Connect the oscilloscope horizontal amplifier across R-512. Set the FDU Sweep Width to maximum and adjust T-503 for the flattest response curve.

DC VOLTAGE TABLE
FOR VTVM WITH 11 MEGOHM INPUT RESISTANCE

TUBE NUMBER	PIN NUMBERS AND VOLTAGES									
	1	2	3	4	5	6	7	8	9	10
V-501		335						335		
V-502	148				148					
V-503	148				148					
V-504	147	44	49			44	-19			
V-505	155	45	50			150	44	50		
V-506		-730	-710	-470		150	155	170	210	149
V-507	210	45	49			149	45	49		
V-508	0	0			195	146	2.6			
V-509	-3.7	0			195	144	.35			
V-510	-8.7	1.26			138	100	0			
V-511	0	0			190	86	1.2			
V-512	0	0			190	83	1.2			
V-513	0	0			141	100	1.48			
V-514	46	0			0	0	45			
V-515	0	0			137	82	1.35			
V-516	0	0			142	102	1.55			
V-517	0	0			140	97	1.6			
ALL VOLTAGES MEASURED TO GROUND										

TEST CONDITIONS

LINE VOLTAGE - 115 VOLTS

GAIN CONTROL SET TO MAXIMUM

SWEEP WIDTH CONTROL SET TO MINIMUM

NO SIGNAL BEING RECEIVED

SECTION 4

MAINTENANCE PARTS LIST

Note:

The parts listed in this section are common to all Type 14-- Frequency Display Units. Those parts contained in the First IF Sub-chassis are listed in Section 5 of this manual.

The 500 and 600 series of numbers have been assigned to this equipment. When ordering material or servicing the unit always refer to the parts by their number.

When ordering replacement parts be sure to indicate equipment type number and serial number as well as description and symbol number of the part. Replacement parts supplied may differ slightly in mechanical or electrical characteristics but this will in no way impair the operation of the equipment.

SYMBOL	DESCRIPTION
C-501	Capacitor, Paper 2 uf ± 10% 600V Aerovox CP70E1EF205K
C-502	Capacitor, Fixed Electrolytic 20-20-20 uf, 450V Aerovox AEP-444J
C-503	Capacitor, Fixed Paper 1 uf ± 10% 1000V Aerovox CP70E1EG105K
C-504	Capacitor, Fixed Paper 1 uf ± 10% 1000V Aerovox CP70E1EG105K
C-505	Capacitor, Fixed Electrolytic 20-20-20 uf, 450V Aerovox AEP-444J
C-506	Capacitor, Fixed Paper 0.22 uf ± 20% 200V Aerovox P-123ZGP
C-507	Capacitor, Fixed Paper .01 uf ± 25% 200V Aerovox P-123ZGP
C-508	Capacitor, Fixed Paper .047 uf ± 20% 200V Aerovox P-123ZGP
C-509	Capacitor, Fixed Paper .22 uf ± 20% 200V Aerovox P-123ZGP
C-510	Capacitor, Fixed Paper .1 uf ± 20% 200V Aerovox P-123ZGP
C-511	Capacitor, Fixed Paper .1 uf ± 20% 200V Aerovox P-123ZGP
C-512	Capacitor, Fixed Paper .1 uf ± 20% 200V Aerovox P-123ZGP
C-513	Capacitor, Fixed Ceramic Tubular 470 uuf ± 10% Erie GP2-331
C-514	Capacitor, Fixed Ceramic Tubular 470 uuf ± 10% Erie GP2-331
C-515	Not Assigned

SYMBOL	DESCRIPTION
C-516	Not Assigned
C-517	Not Assigned
C-518	Capacitor, Fixed Ceramic Feed-thru 47 uuf ± 20% Erie GP1-327
C-519	Capacitor, Fixed Ceramic Standoff .001 uf ± 20% Erie Style 326
C-520	Capacitor, Fixed Ceramic Tubular 3.9 uuf ± .25 uuf Erie NPO-A
C-521	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-522	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-523	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-524	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2-327
C-525	Capacitor, Fixed Ceramic Tubular 1.5 uuf ± 0.1 uuf Erie NPO-A
C-526	Capacitor, Fixed Ceramic Tubular 15 uuf ± 5% Erie NPO-A
C-527	Capacitor, Variable 1.4 - 5 uuf Hammarlund MAC-5
C-528	Capacitor, Fixed Ceramic Tubular 33 uuf ± 5% Erie NPO-T
C-529	Capacitor, Fixed Ceramic Tubular 33 uuf ± 5% Erie NPO-T
C-530	Capacitor, Fixed Ceramic Standoff .0015 uf ± 20% Erie Style 326

SYMBOL	DESCRIPTION
C-531	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-532	Capacitor, Fixed Ceramic Tubular 33 uuf ± 5% Erie NPO-T
C-533	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-534	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-535	Capacitor, Fixed Ceramic Tubular 3.9 uuf ± 0.25 uuf Erie NPO-A
C-536	Capacitor, Fixed Ceramic Tubular 5.1 uuf ± 0.25 uuf Erie NPO-A
C-537	Capacitor, Fixed Ceramic Tubular 33 uuf ± 5% Erie NPO-T
C-538	Capacitor, Fixed Ceramic Feed-thru 47 uuf ± 20% Erie GP1-327
C-539	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Er ie CK62Y472Z
C-540	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-541	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-542	Capacitor, Fixed Silvered Mica 100 uuf ± 2% Elmenco CM15E101G
C-543	Capacitor, Fixed Ceramic Tubular 1.5 uuf ± 0.1 uuf Erie NPO-A
C-544	Capacitor, Fixed Ceramic Tubular 1.5 uuf ± 0.1 uuf Erie NPO-A
C-545	Capacitor, Fixed Silvered Mica 200 uuf ± 2% Elmenco CM15E201G

SYMBOL	DESCRIPTION
C-546	Capacitor, Fixed Silvered Mica 200 uuf ± 2% Elmenco CM15E201G
C-547	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2-327
C-548	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2-327
C-549	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2-327
C-550	Not Assigned
C-551	Not Assigned
C-552	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-553	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-554	Capacitor, Fixed Ceramic Disc .0047 uf ± 20% Erie HR829X5T
C-555	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-556	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2-327
C-557	Capacitor, Fixed Silvered Mica 100 uuf ± 2% Elmenco CM15E101G
C-558	Capacitor, Fixed Ceramic Tubular 1.5 uuf ± 0.1 uuf Erie NPO-A
C-559	Capacitor, Fixed Ceramic Tubular 1.5 uuf ± 0.1 uuf Erie NPO-A
C-560	Capacitor, Fixed Silvered Mica 220 uuf ± 2% Elmenco CM15E221G

SYMBOL	DESCRIPTION
C-561	Capacitor, Fixed Silvered Mica 200 uuf ± 2% Elmenco CM15E201G
C-562	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-563	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-564	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-565	Capacitor, Fixed Ceramic Disc .0047 uf ± 20% Erie HR829-X5T
C-566	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-567	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2-327
C-568	Capacitor, Fixed Silvered Mica 100 uuf ± 2% Elmenco CM15E101G
C-569	Capacitor, Fixed Ceramic Tubular 1.5 uuf ± 0.1 uuf Erie NPO-A
C-570	Capacitor, Fixed Ceramic Tubular 1.5 uuf ± 0.1 uuf Erie NPO-A
C-571	Not Assigned
C-572	Capacitor, Fixed Silvered Mica 100 uuf ± 2% Elmenco CM15E101G
C-573	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-574	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-575	Capacitor, Fixed Ceramic Disc .0047 uf ± 20% Erie HR829-X5T

SYMBOL	DESCRIPTION
C-576	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-577	Capacitor, Fixed Silvered Mica 100 uuf ± 2% Elmenco CM15E101G
C-578	Capacitor, Fixed Ceramic Tubular 1.5 uuf ± 0.1 uuf Erie NPO-A
C-579	Capacitor, Fixed Ceramic Tubular 1.2 uuf ± 0.1 uuf Erie NPO-A
C-580	Capacitor, Fixed Silvered Mica 100 uuf ± 2% Elmenco CM15E101G
C-581	Capacitor, Fixed Ceramic Tubular 47 uuf ± 5% Erie NPO-T
C-582	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-583	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-584	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2-327
C-585	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2-327
C-586	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-587	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2-327
F-501	Fuse, Cartridge, 1 Amp Slo-blo, Littlefuse 313001
I-501	Lamp, Pilot, GE #47
I-502	Lamp, Pilot, GE #328
I-503	Lamp, Pilot, GE #328

SYMBOL	DESCRIPTION
J-501	Connector, Motor base, Hubbel #7486
J-502	Connector, Coaxial, UG-1094/U
J-503	Connector, Coaxial, UG-1094/U
L-501	Inductor, Variable C. T. C. #X2060-3
L-502	Integral Part of Z501
L-503	Inductor, Fixed 75 uh ± 10% Wilco #1075-15
L-504	Integral Part of T-503A
L-505	Integral Part of T-503B
L-506	Integral Part of T-504A
L-507	Integral Part of T-504B
L-508	Inductor, Fixed 2.7 uh GEL Part/Dwg. #PL-151
L-509	Not Assigned
L-510	Not Assigned
L-511	Integral Part of T-505A
L-512	Integral Part of T-505B
L-513	Inductor, Fixed 2.7 uh GEL Part/Dwg. #PL-151
L-514	Inductor, Fixed 2.7 uh GEL Part/Dwg. #PL-151
L-515	Integral Part of T-506A
L-516	Integral Part of T-506B
L-517	Inductor, Fixed 2.7 uh GEL Part/Dwg. #PL-151
L-518	Integral Part of T-507A
L-519	Integral Part of T-507B

SYMBOL	DESCRIPTION
L-520	Not Assigned
L-521	Not Assigned
P-501	Integral Part of W-501
P-503	Integral Part of W-502 (UG-260/U)
R-501	Resistor, Fixed, Wire wound 5.1K ± 3% 25W Dale Products Co. Dalohm PH-25
R-502	Resistor, Fixed, Composition 47K ± 5% ½W Allen Bradley EB-4735
R-503	Rheostat, Wire-wound 15 ohms 2W P. R. Mallory Co. #C15R
R-504	Resistor, Fixed, Wire wound 5.1K ± 3% 25W Dale Products Co. Dalohm PH-25
R-505	Resistor, Fixed Composition 470 ohm ± 5% 1W Allen Bradley GB-4715
R-506	Resistor, Fixed, Wire wound 5.1K ± 3% 25W Dale Products Co. Dalohm PH-25
R-507	Resistor, Fixed, Composition 470 ohm ± 5% 1W Allen Bradley GB-4715
R-508	Resistor, Fixed, Composition 10K ± 5% 1W Allen Bradley GB-1035
R-509	Potentiometer, Composition 500K ± 10% 2W Ohmite CU-5041
R-510	Resistor, Fixed, Composition 1.2 meg ± 5% ½W Allen Bradley EB-1255
R-511	Potentiometer, Composition 1 meg ± 20% 2W Ohmite CLU-1052
R-512	Resistor, Fixed, Composition 750 ohm ± 5% ½W Allen Bradley EB-7515

SYMBOL	DESCRIPTION
R-513	Potentiometer, Composition 10K ± 10% 2W Ohmite CLU-1031
R-514	Potentiometer, Composition 10K ± 10% 2W Ohmite CLU-1031
R-515	Resistor, Fixed, Composition 7.5K ± 5% ½W Allen Bradley EB-7525
R-516	Resistor, Fixed, Composition 100 ohm ± 10% ½W Allen Bradley EB-1011
R-517	Resistor, Fixed, Composition 2.0 meg ± 5% ½W Allen Bradley EB-2055
R-518	Resistor, Fixed, Composition 470K ± 10% ½W Allen Bradley EB-4741
R-519	Resistor, Fixed, Composition 33K _ 5% ½W Allen Bradley EB-3335
R-520	Resistor, Fixed Composition 150K ± 5% ½W Allen Bradley EB-1545
R-521	Resistor, Fixed, Composition 150K ± 5% ½W Allen Bradley EB-1545
R-522	Resistor, Fixed, Composition 470K ± 10% ½W Allen Bradley EB-4741
R-523	Potentiometer, Composition 25K ± 10% 2W Ohmite CLU-2531
R-524	Resistor, Fixed, Composition 100K ± 5% ½W Allen Bradley EB-1045
R-525	Resistor, Fixed, Composition 8.2K ± 5% ½W Allen Bradley EB-8225
R-526	Resistor, Fixed, Composition 8.2K ± 5% ½W Allen Bradley EB-8225
R-527	Resistor, Fixed, Composition 47K ± 5% ½W Allen Bradley EB-4735

SYMBOL	DESCRIPTION
R-528	Potentiometer, Composition 250K ± 10% 2W Ohmite CLU-2541
R-529	Potentiometer, Composition 50K ± 10% 2W Ohmite CU-5031
R-530	Resistor, Fixed, Composition 120K ± 5% ½W Allen Bradley EB-1245
R-531	Resistor, Fixed, Composition 56K ± 5% ½W Allen Bradley EB-5635
R-532	Potentiometer, Composition 250K ± 10% 2W Ohmite CU-2541
R-533	Resistor, Fixed, Composition 330K ± 5% 1W Allen Bradley GB-3345
R-534	Resistor, Fixed, Composition 180K ± 5% 1W Allen Bradley GB-1845
R-535	Resistor, Fixed, Composition 470K ± 10% ½W Allen Bradley EB-4741
R-536	Potentiometer, Composition 5K ± 10% 2W Ohmite CLU-5021
R-537	Resistor, Fixed, Composition 36K ± 5% ½W Allen Bradley EB-3635
R-538	Resistor, Fixed, Composition 27K ± 5% ½W Allen Bradley EB-2735
R-539	Resistor, Fixed, Composition 100K ± 5% ½W Allen Bradley EB-1045
R-540	Resistor, Fixed Composition 100K ± 5% ½W Allen Bradley EB-1045
R-541	Potentiometer, Composition 10K ± 10% 2W Ohmite CB-1031

SYMBOL	DESCRIPTION
R-542	Resistor, Fixed, Composition 10K ± 10% ½W Allen Bradley EB-1031
R-543	Potentiometer, Composition 250 ohm ± 10% 2W Ohmite CLU-2511
R-544	Resistor, Fixed, Composition 33 ohm ± 10% 2W Allen Bradley HB-3301
R-545	Resistor, Ballast Tube, Amperite Type 5-4
R-546	Resistor, Fixed, Composition 10K ± 5% ½W Allen Bradley EB-1035
R-547	Resistor, Fixed, Composition 330 ohms ± 5% ½W Allen Bradley EB-3315
R-548	Potentiometer, Composition, Miniature 500 ohms ± 10% ½W Ohmite AS-3603
R-549	Resistor, Fixed, Composition 100 ohms ± 5% ½W Allen Bradley EB-1015
R-550	Resistor, Fixed, Composition 270 ohms ± 10% ½W Allen Bradley EB-2711
R-551	Resistor, Fixed, Composition 1K ± 10% ½W Allen Bradley EB-1021
R-552	Resistor, Fixed, Composition 24K ± 5% ½W Allen Bradley EB-2435
R-553	Resistor, Fixed, Composition 1K ± 10% ½W Allen Bradley EB-1021
R-554	Resistor, Fixed, Composition 1K ± 10% ½W Allen Bradley EB-1021
R-555	Resistor, Fixed, Composition 5.1K ± 5% ½W Allen Bradley EB-5125
R-556	Resistor, Fixed, Composition 100K ± 10% ½W Allen Bradley EB-1041

SYMBOL	DESCRIPTION
R-557	Resistor, Fixed, Composition 100K ± 10% ½W Allen Bradley EB-1041
R-558	Resistor, Fixed, Composition 150 ohm ± 5% ½W Allen Bradley EB-1515
R-559	Resistor, Fixed, Composition 47 ohm ± 5% ½W Allen Bradley EB-4705
R-560	Resistor, Fixed, Composition 1K ± 10% ½W Allen Bradley EB-1021
R-561	Resistor, Fixed, Composition 6.8K ± 5% ½W Allen Bradley EB-6825
R-562	Not Assigned
R-563	Not Assigned
R-564	Resistor, Fixed, Composition 470K ± 10% ½W Allen Bradley EB-4741
R-565	Resistor, Fixed, Composition 100 ohm ± 5% ½W Allen Bradley EB-1015
R-566	Resistor, Fixed, Composition 33 ohm ± 5% ½W Allen Bradley EB-3305
R-567	Resistor, Fixed, Composition 24K ± 5% ½W Allen Bradley EB-2435
R-568	Resistor, Fixed Composition 33 ohm ± 5% ½W Allen Bradley EB-3305
R-569	Resistor, Fixed, Composition 1K ± 10% ½W Allen Bradley EB-1021
R-570	Resistor, Fixed, Composition 470K ± 10% ½W Allen Bradley EB-4741
R-571	Resistor, Fixed, Composition 100 ohm ± 5% ½W Allen Bradley EB-1015

SYMBOL	DESCRIPTION
R-572	Resistor, Fixed, Composition 24K ± 5% ½W Allen Bradley EB-2435
R-573	Resistor, Fixed, Composition 1K ± 10% ½W Allen Bradley EB-1021
R-574	Resistor, Fixed, Composition 270 ohm ± ½W Allen Bradley EB-2711
R-575	Resistor, Fixed, Composition 390 ohm ± ½W Allen Bradley EB-3915
R-576	Resistor, Fixed, Composition 39K ± 5% ½W Allen Bradley EB-3935
R-577	Resistor, Fixed, Composition 1K ± 10% ½W Allen Bradley EB-1021
R-578	Resistor, Fixed, Composition 270 ohm ± ½W Allen Bradley EB-2711
R-579	Resistor, Fixed, Composition 10K ± 10% ½W Allen Bradley EB-1031
R-580	Resistor, Fixed, Composition 4.7 ohm ± 10% 1W Allen Bradley GB-47G1
R-581	Resistor, Fixed, Composition 180K ± 5% ½W Allen Bradley EB-1845
R-582	Resistor, Fixed, Composition 62K ± 5% ½W Allen Bradley EB-6235
R-583	Resistor, Fixed, Composition 220K ± ½W Allen Bradley EB-2241
R-584	Resistor, Fixed, Composition 470K ± 10% ½W Allen Bradley EB-4741
R-585	Not Assigned
R-586	Not Assigned

SYMBOL	DESCRIPTION
S-501	Switch DPST H. H. Smith #522
T-501	Power Transformer, GEL Part/Dwg. #C-10-424
T-502	Blocking Osc. Transformer, GEL Part/Dwg. #B-10-105
T-503A	I. F. Transformer, GEL Part/Dwg. #B-10-094
T-503-B	I. F. Transformer, GEL Part/Dwg. #B-10-095
T-504A	I. F. Transformer, GEL Part/Dwg. #C-10-067
T-504B	I. F. Transformer, GEL Part/Dwg. #C-10-078
T-505A	I. F. Transformer, GEL Part/Dwg. #C-10-067
T-505B	I. F. Transformer, GEL Part/Dwg. #C-10-079
T-506A	I. F. Transformer, GEL Part/Dwg. #C-10-067
T-506B	I. F. Transformer, GEL Part/Dwg. #C-10-077
T-507A	I. F. Transformer, GEL Part/Dwg. #C-10-067
T-507B	I. F. Transformer, GEL Part/Dwg. #C-10-076
T-508	Not Assigned
V-501	Electron tube, 5Y3WGTA
V-502	Electron tube, 0A2WA
V-503	Electron tube, 0A2WA
V-504	Electron tube, 5814A
V-505	Electron tube, 12AT7WA
V-506	Cathode Ray Tube, 3RP1A
V-507	Electron tube, 12AT7WA
V-508	Electron tube, 6AH6

SYMBOL	DESCRIPTION
V-509	Electron tube, 6AU6WA
V-510	Electron tube, 5750/6BE6W
V-511	Electron tube, 5749/6BA6W
V-512	Electron tube, 5749/6BA6W
V-513	Electron tube, 6AU6WA
V-514	Electron tube, 5726/6AL5W
W-501	Cable Assembly, Power GEL Part/Dwg. #10-335
W-502	Cable Assembly, Coaxial GEL Part/Dwg. #B-10-101
Z-501	Oscillator Coil Assembly GEL Part/Dwg. #B-10-093
CR-501	Rectifier, Selenium Sarkes Tarzian #026-30H-QC
CR-502	Rectifier, Selenium Sarkes Tarzian #026-30H-QC
CR-503	Not Assigned

SECTION 5 - FIRST IF AMPLIFIER

GENERAL

The amplitude response at the FDU output of the receiver is that of one slightly overcoupled double-tuned circuit with a 3 db bandwidth of approximately 1.6 mc. In order to obtain the required response over a band 3 mc wide the first IF amplifier in the display unit compensates this response by amplifying the shirts of the FDU output more than the center frequency.

T-509 and T-510 are overcoupled, double-tuned circuits which increase the amplitude response out on the skirts of receiver FDU output response. This is done by overcoupling to the extent that the receiver response effectually fills the valley of the overcoupled circuits. Z-502 is a relatively low Q circuit tuned to center frequency. It produces some step up of the input signal while providing a value of source impedance for V-515 that maintains a reasonable noise figure for the Display Unit. The tuning of this network is somewhat sensitive to changes in the length of the cable connecting the two units due to impedance transformation in this cable.

V-515 is one of the gain controlled stages. The cathode resistor is partially unbypassed to compensate for input capacity variations that occur with changes in transconductance.

A detector has been incorporated in the first IF subchassis to facilitate visual alignment of the first IF amplifier. The gain of V-517 brings the signal at the signal grid of mixer V-510 up to a level suitable for detection and at the same time isolates this detector from the signal circuits. T-508 is a heavily loaded single tuned circuit using a bifilar winding. The response of the detector is down about 7% at 21.4 mc plus and minus 1.5 mc. The first IF amplifier is normally aligned by observing the composite response shape of the FDU output of the receiver, the first IF amplifier, and this detector, using visual alignment techniques. This is covered in the paragraph on alignment of the First IF Amplifier.

ALIGNMENT

Recommended Equipment

RCA Model WR-59C Sweep Generator

DuMont Model 401A Oscilloscope

Hewlett Packard Model 606A Signal Generator

General Instructions

Because the amplitude constancy over the Display Range is due to the composite response of the FDU output of the receiver and the first IF response of the Display Unit, it is necessary to tune the first IF amplifier with a signal fed through the shape determining circuits of the receiver. This is done by feeding the sweep generator signal to the grid of the mixer in the receiver, using the mixer as an amplifier. It is recommended that the interconnecting cable between the FDU output of the receiver and the signal input of the Display Unit be the same cable that will be used in the actual installation.

A low capacity cable such as RG-62/U coaxial should be used for connection to the oscilloscope. Cable capacity plus oscilloscope input capacity should be held to a maximum of 100 uufd. The marker generator signal should be coupled in as required to produce a suitable marker pip. Check that the marker generator connection does not upset the response shape by disconnecting the marker generator and observing that the response shape does not change. In general, the marker signal can be coupled through a small capacitor (around 4.7 uufd) connected to the sweep generator lead near the point of connection to the circuit under test.

Alignment of Detector

1. Remove the local oscillator tube V-509. Set the gain control to maximum. Connect the oscilloscope (using the direct coupled vertical amplifier) to the test point C-610 and ground. Remove the bottom cover from the first IF amplifier subassembly. Connect a short clip lead from terminal D of T-510A to ground on the sidewall of the chassis. Connect the sweep generator between pin 1 of V-517 and ground on the strap nut on this tube. Connect the marker generator.

2. Adjust the sweep generator output as required to produce an oscilloscope deflection of approximately 1 volt and adjust the slug in T-511 for a response centered at 21.4 mc. The response should be round nosed and down approximately 7% at plus or minus 1.5 mc.

3. Remove the sweep and marker generator leads. Remove the clip lead.

Alignment of Compensating Networks

1. Connect a short clip lead from terminal D of T-509A to ground on the sidewall of the chassis. Connect the sweep generator between pin 1 of V-516 and ground on the strap nut of this tube. Connect the marker generator.

2. Adjust the sweep generator output as required to produce an oscilloscope deflection of approximately 1 volt and adjust the slugs in T-510A and T-510B for a response centered at 21.4 mc. The response should be strongly overcoupled with a peak separation of approximately 3.1 mc.

3. Remove the sweep and marker generator leads. Remove the clip lead.

4. Connect the sweep generator between pin 1 of V-515 and ground on the strap nut of this tube. Connect the marker generator.

5. Adjust the sweep generator output as required to produce an oscilloscope deflection of approximately 1 volt and adjust the slugs in T-509A and T-509B for a symmetrical response centered at 21.4 mc. The response should be overcoupled with a peak separation of approximately 3.1 mc and have about a 50% dip in the middle.

6. Remove the sweep and marker generator. Replace the first IF bottom cover.

7. Remove the receiver bottom cover from the front end assembly of the receiver. Solder a .001 ufd ceramic disc capacitor (CK61Y102Z or equivalent) to the signal grid (pin 1) of the mixer tube V-403. Remove the receiver local oscillator tube (V-404).

8. Connect the receiver FDU output to the signal input Jack J-504 on the display unit, using a cable of the same length and type as that used to connect the two units while in normal operation.

9. Connect the sweep generator between the .001 mfd capacitor and ground at a convenient spot close to the mixer tube. Connect the marker generator.

10. Adjust the sweep generator output as required to produce an oscilloscope deflection of approximately 1 volt. Adjust the tuning slug in Z-502 for maximum response at center frequency (21.4 mc). Readjust the tuning slugs in T-509A and T-509B for a symmetrical response centered at 21.4 mc if necessary.

The response will have five peaks with Z-502 controlling the center peak, T-510A and T-510B controlling the two outside peaks, and T-509A and T-509B controlling the two inside peaks.

11. Disconnect the sweep and marker generator leads. Remove the .001 ufd capacitor. Install the receiver local oscillator tube. Replace the bottom cover on the receiver front end. Replace V-509. Disconnect the oscilloscope.

PARTS LIST

Replace with EPL-15C for 14F1

SYMBOL	DESCRIPTION
C-591	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-592	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-593	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-594	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-595	Capacitor, Fixed Ceramic Tubular 30 uuf ± 5% Erie NPO-T
C-596	Capacitor, Fixed Ceramic Tubular 22 uuf ± 5% Erie NPO-A
C-597	Capacitor, Fixed Ceramic Tubular 10 uuf ± 5% Erie NPO-A
C-598	Capacitor, Fixed Ceramic Tubular 12 uuf ± 5% Erie NPO-A
C-599	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-600	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-601	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-602	Capacitor, Fixed Ceramic Tubular 30 uuf ± 5% Erie NPO-T
C-603	Capacitor, Fixed Ceramic Tubular 15 uuf ± 5% Erie NPO-A
C-604	Capacitor, Fixed Ceramic Tubular 22 uuf ± 5% Erie NPO-A

SYMBOL	DESCRIPTION
C-605	Capacitor, Fixed Ceramic Tubular 22 uuf ± 5% Erie NPO-A
C-606	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-607	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-608	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-609	Capacitor, Fixed Ceramic Tubular 470 uuf ± 10% Erie GP2 Style 331
C-610	Capacitor, Fixed Ceramic Feed-thru 47 uuf ± 20% Erie GP1 Style 327
C-611	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2 Style 327
C-612	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2 Style 327
C-613	Capacitor, Fixed Ceramic Feed-thru .001 uf ± 20% Erie GP2 Style 327
C-614	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
C-615	Capacitor, Fixed Ceramic Disc .0047 uf + 100% -20% Erie CK62Y472Z
J-504	Integral Part of W-503 (UG-291/U)
L-522	Integral Part of Z-502
L-523-A	Integral Part of T-509A
L-523-B	Integral Part of T-509B
L-524-A	Integral Part of T-510A
L-524-B	Integral Part of T-510B

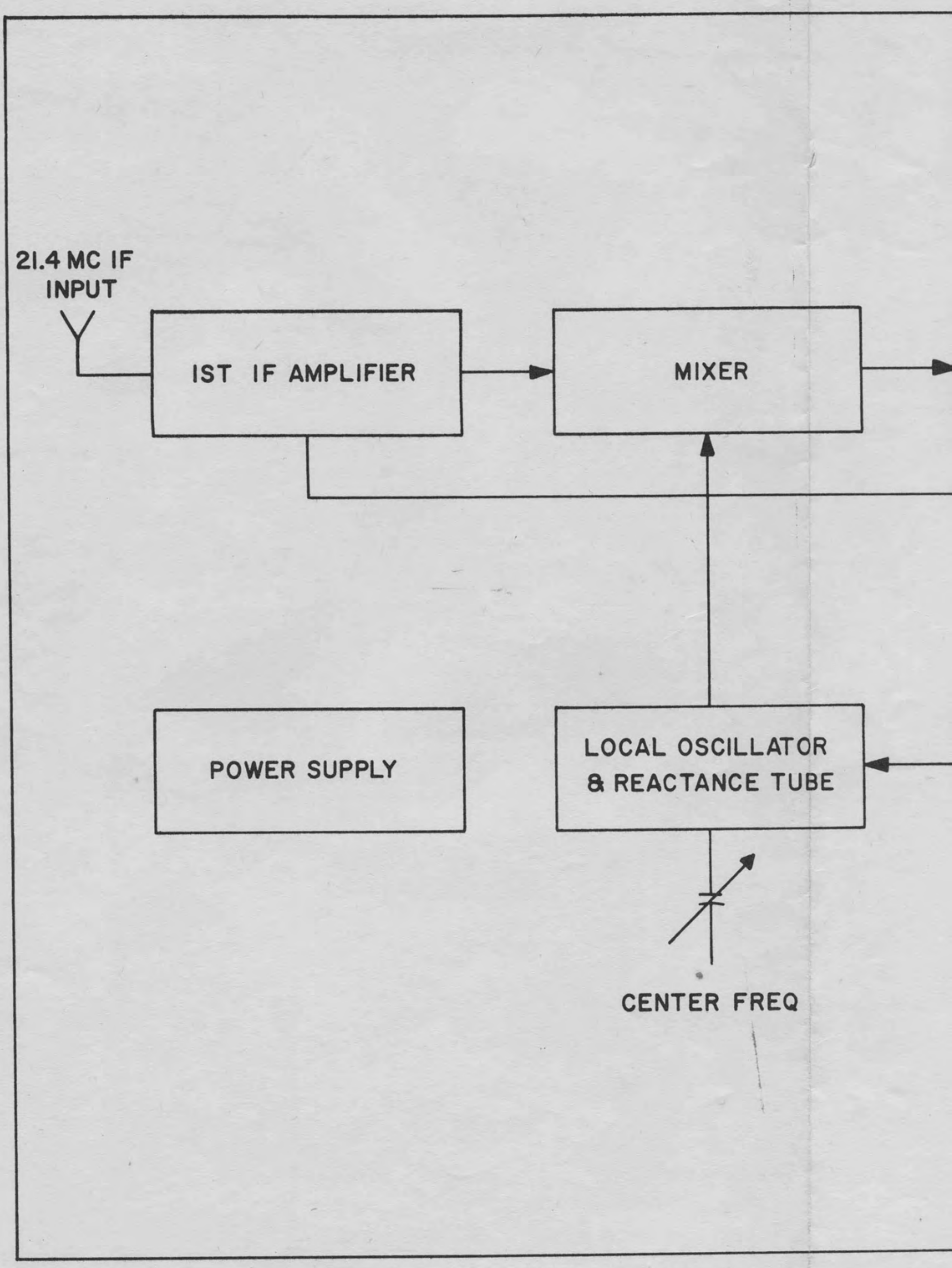
SYMBOL	DESCRIPTION
L-525	Integral Part of T-511
L-526	Inductor, Fixed 2.7 uh GEL Part/Dwg. PL-151
L-527	Inductor, Fixed 2.7 uh GEL Part/Dwg. PL-151
P-502	Integral Part of W-504 (UG-260/U)
R-588	Resistor, Fixed, Composition 20 K ± 5% ½ W Allen Bradley EB-1315
R-590	Resistor, Fixed, Composition 33 ohm ± 5% ½ W Allen Bradley EB-3305
R-591	Resistor, Fixed, Composition 24 K ± 5% ½ W Allen Bradley EB-2435
R-592	Resistor, Fixed, Composition 1 K ± 10% ½ W Allen Bradley EB-1021
R-593	Resistor, Fixed, Composition 3.6 K ± 5% ½ W Allen Bradley EB-3625
R-594	Resistor, Fixed, Composition 390 ohm ± 5% ½ W Allen Bradley EB-3915
R-595	Resistor, Fixed, Composition 39 K ± 5% ½ W Allen Bradley EB-3935
R-596	Resistor, Fixed, Composition 1 K ± 10% ½ W Allen Bradley EB-1021
R-597	Resistor, Fixed, Composition 33 K ± 5% ½ W Allen Bradley EB-3335
R-598	Resistor, Fixed, Composition 390 ohm ± 5% ½ W Allen Bradley EB-3915
R-599	Resistor, Fixed, Composition 39 K ± 5% ½ W Allen Bradley EB-3935
R-600	Resistor, Fixed, Composition 2 K ± 5% ½ W Allen Bradley EB-2025

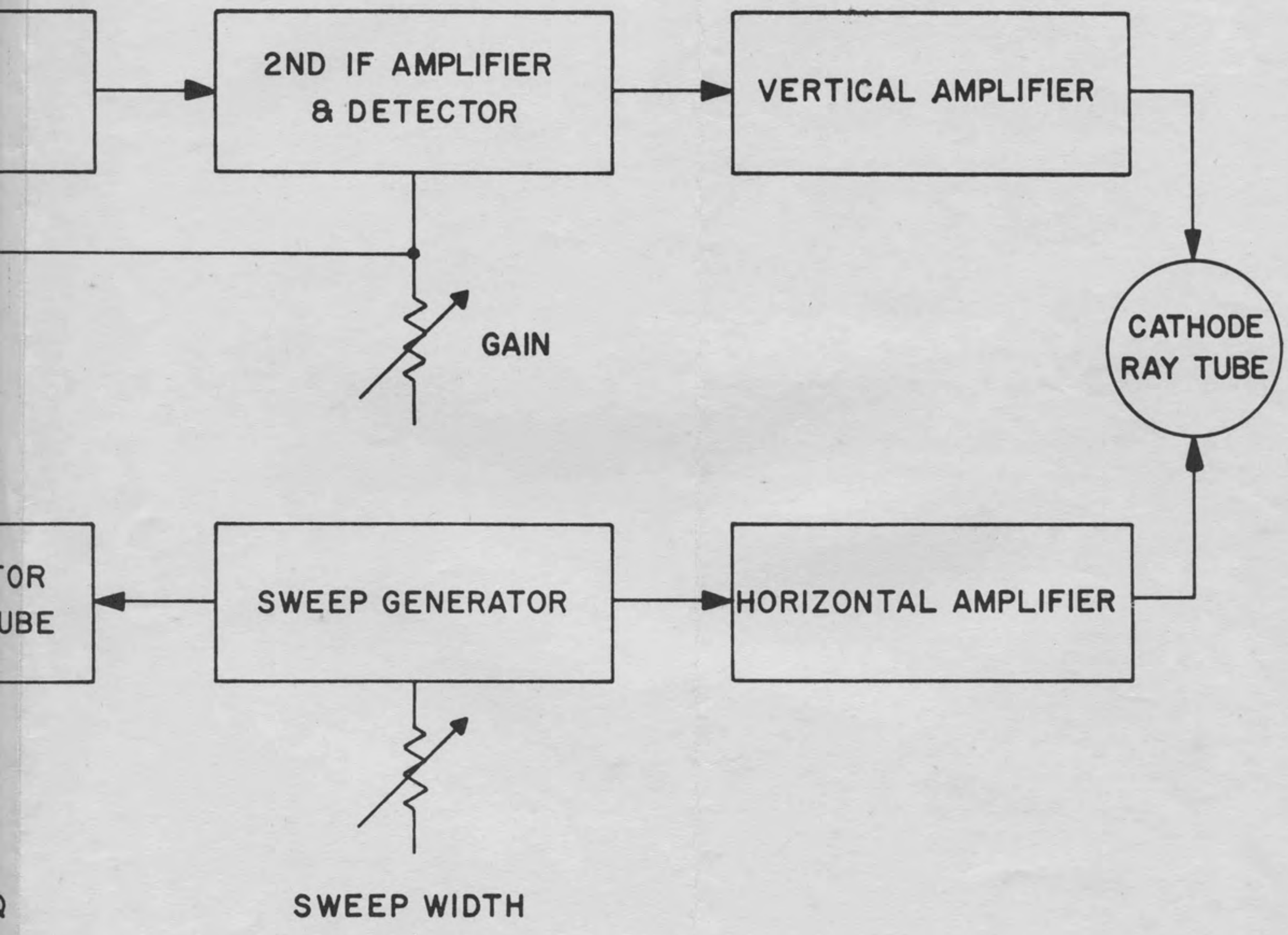
SYMBOL	DESCRIPTION
R-601	Resistor, Fixed, Composition 1 K ± 10% ½ W Allen Bradley EB-1021
R-602	Resistor, Fixed, Composition 47 K ± 10% ½ W Allen Bradley EB-4731
T-509A	IF Transformer, GEL Part/ Dwg. #B-10-489
T-509B	IF Transformer, GEL Part/Dwg. #B-10-488
T-510A	IF Transformer, GEL Part/Dwg. #B-10-489
T-510B	IF Transformer, GEL Part/Dwg. #B-10-488
T-511	IF Transformer, GEL Part/Dwg. #B-10-099
V-515	Electron tube, 5749/6BA6W
V-516	Electron tube, 6AU6WA
V-517	Electron tube, 6AU6WA
W-503	Cable Assembly, Coaxial GEL Part/Dwg. #B-10-050
W-504	Cable Assembly, Coaxial GEL Part/Dwg. #B-10-051
Z-502	Input Network Assembly GEL Part/Dwg. #B-10-096
CR-504	Diode, Germanium IN198

FREQUENCY DISPLAY UNIT

TYPE 14

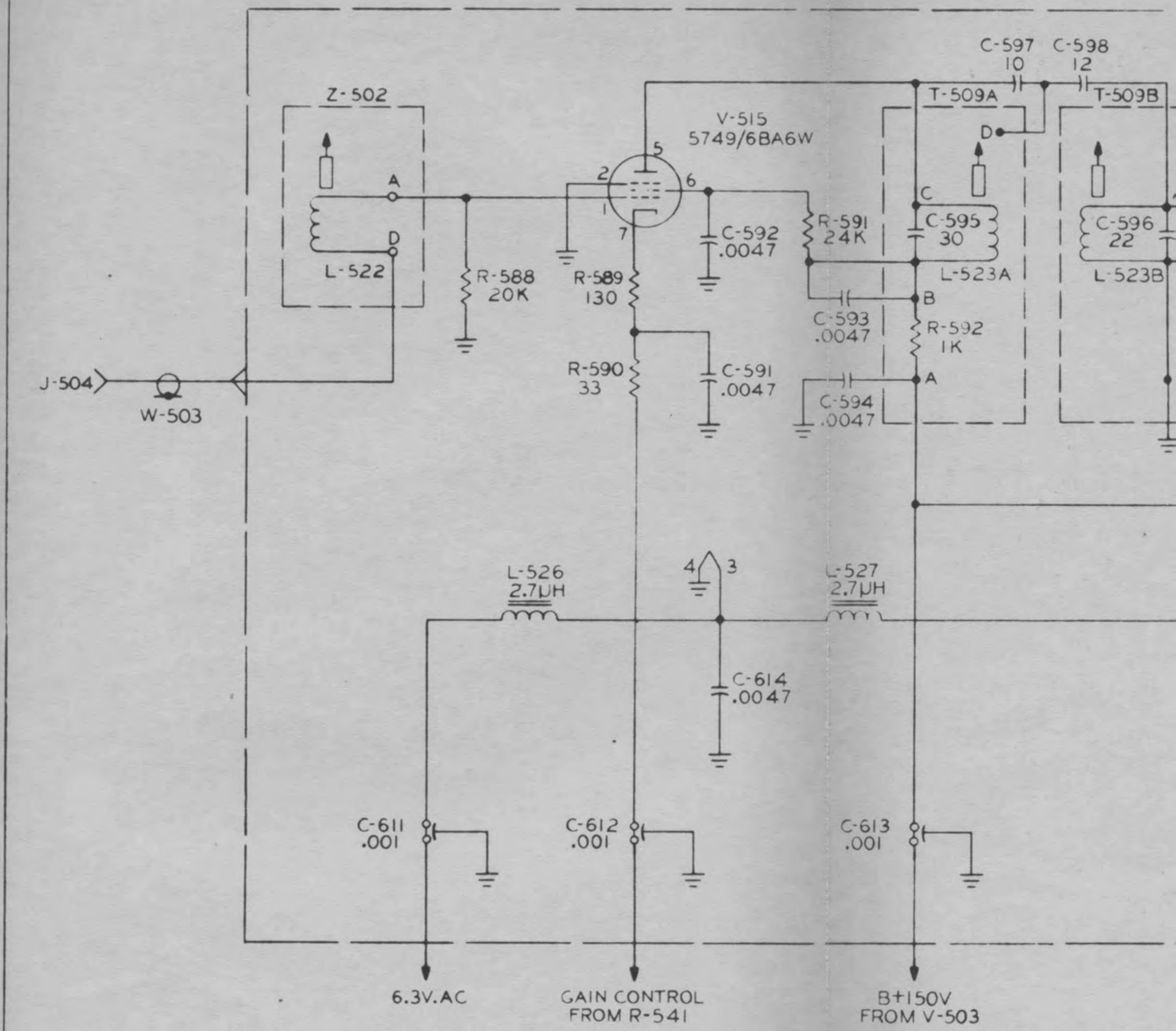
(FRONT DOOR REMOVED)


21.4 MC IF
INPUT
1ST IF AMPLIFIER
MIXER
POWER SUPPLY
LOCAL OSCILLATOR
& REACTANCE TUBE
CENTER FREQ

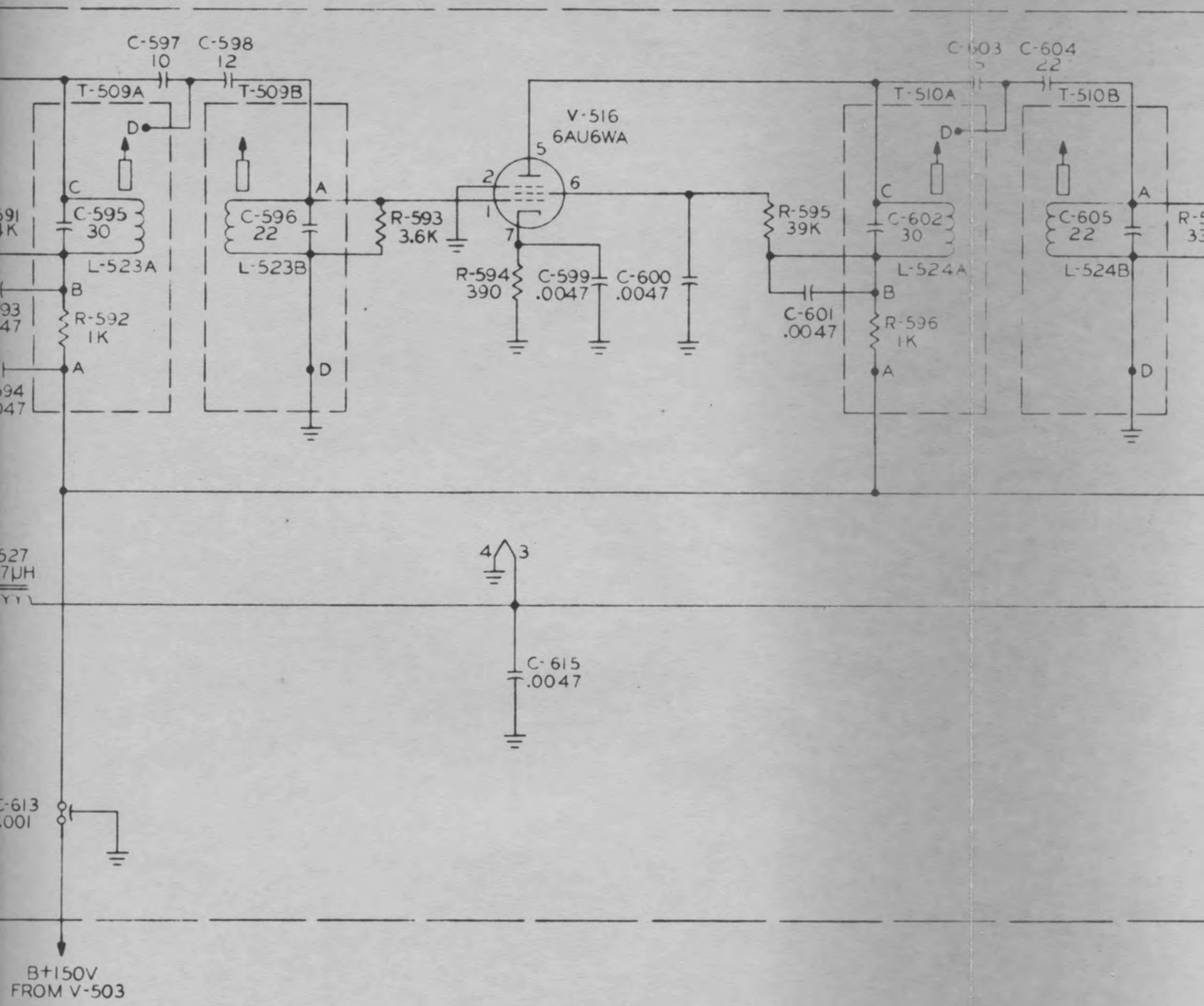


BLOCK DIAGRAM

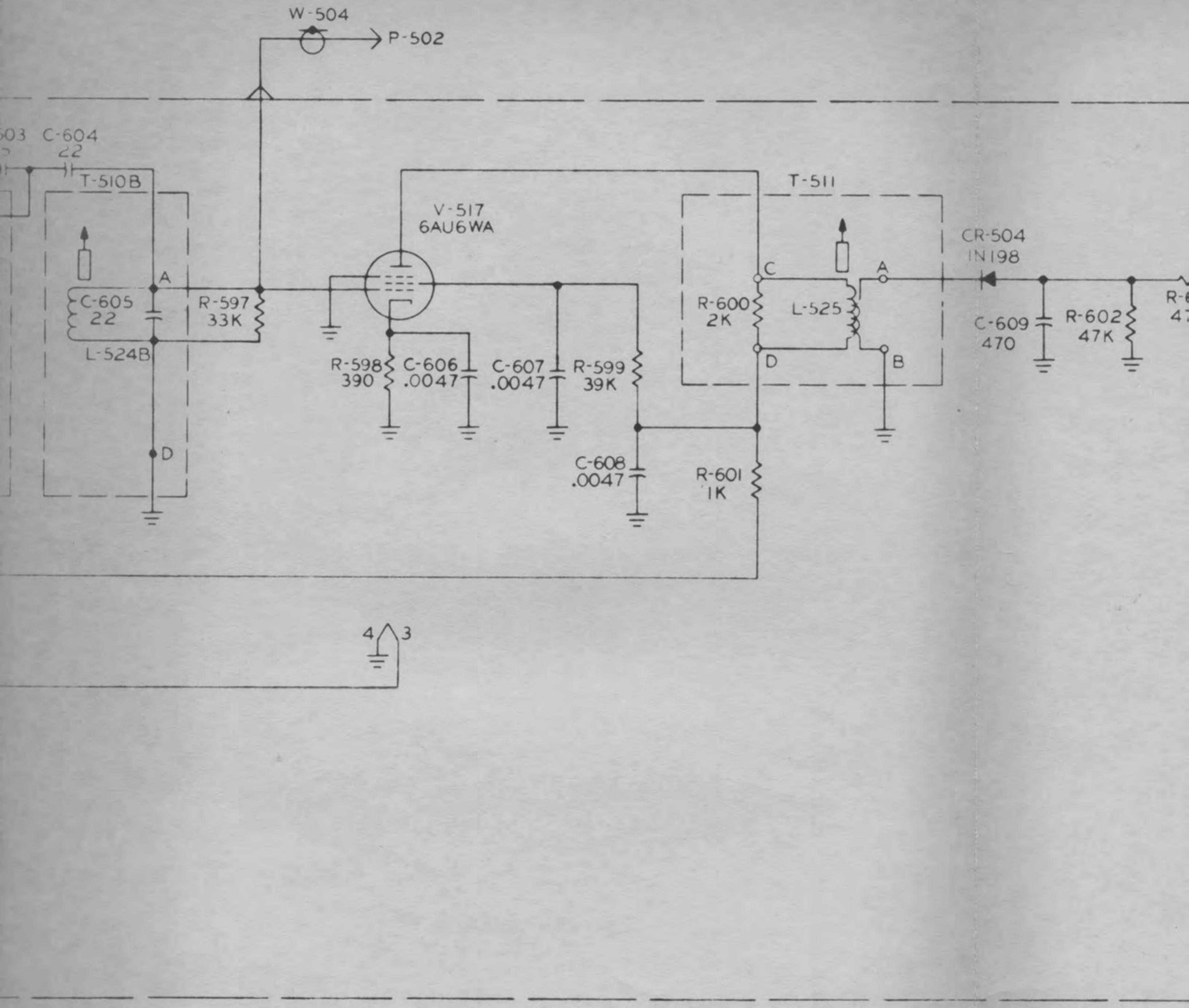
FIGURE I



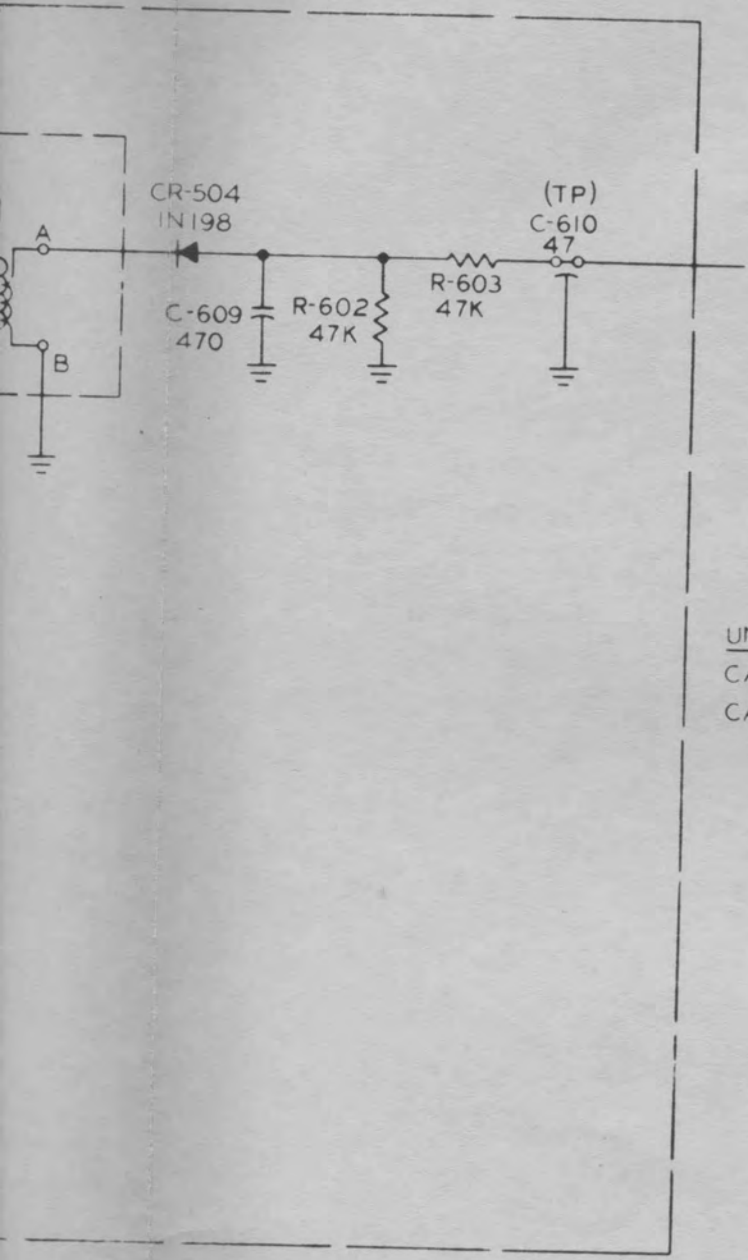
C-597
10
C-598
12
Z-502
T-509A
T-509B
V-515
5749/6BA6W
D
C
A
L-522
R-588
20K
R-589
130
R-590
33
C-592
.0047
C-591
.0047
R-591
24K
C-595
30
L-523A
C-596
22
L-523B
B
C-593
.0047
R-592
1K
C-594
.0047
J-504
W-503
L-526
2.7µH
L-527
2.7µH
C-614
.0047
C-611
.001
C-612
.001
C-613
.001
6.3V.AC
GAIN CONTROL
FROM R-541
B+150V
FROM V-503



C-597
10
C-598
12
T-509A
T-509B
D
C
A
C-595
30
C-596
22
L-523A
L-523B
B
R-592
1K
A
D
R-593
3.6K
V-516
6AU6WA
5
2
6
1
7
R-594
390
C-599
.0047
C-600
.0047
R-595
39K
C-601
.0047
C-603
C-604
22
T-510A
T-510B
D
C
A
C-602
30
C-605
22
L-524A
L-524B
B
R-596
1K
A
D
4
3
C-615
.0047
B+150V
FROM V-503



W-504
P-502
C-604
22
T-510B
A
C-605
22
L-524B
D
R-597
33K
V-517
6AU6WA
R-598
390
C-606
.0047
C-607
.0047
R-599
39K
C-608
.0047
T-511
C
D
R-600
2K
L-525
A
B
R-601
1K
CR-504
IN198
C-609
470
R-602
47K
4
3



for 14F1

Replace

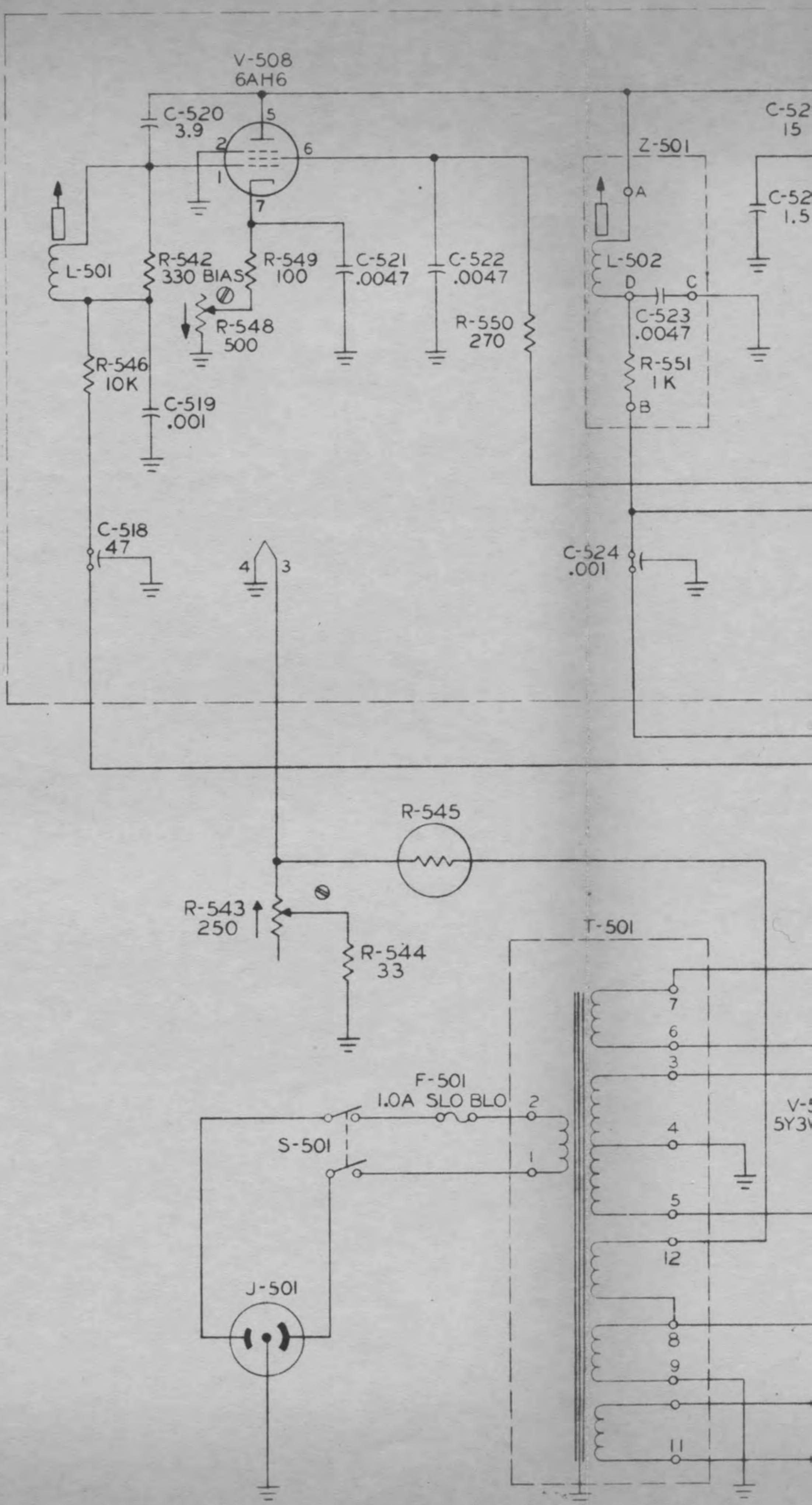
R11-631

UNLESS OTHERWISE NOTED:

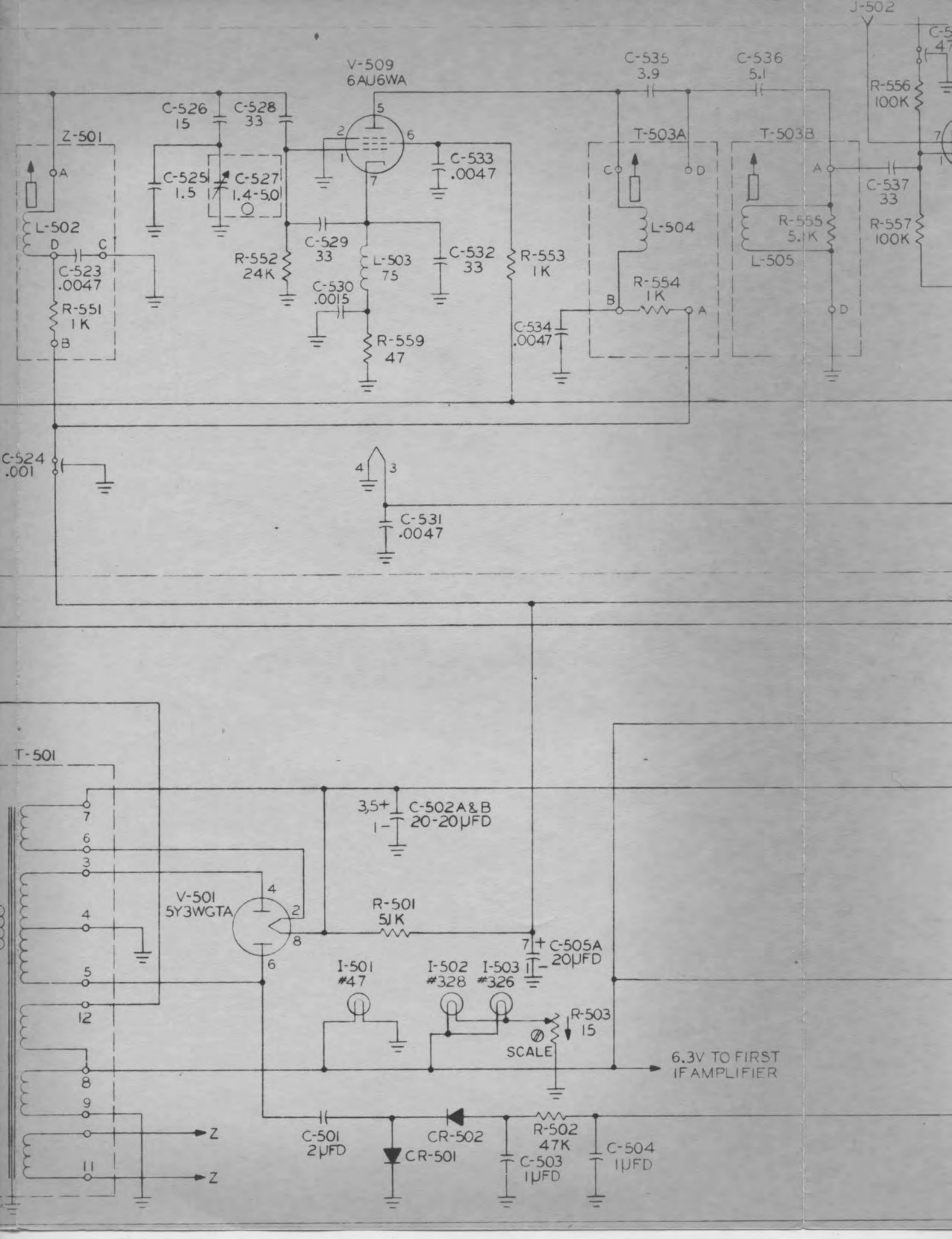
CAPACITOR VALUES LESS THAN ONE SIGNIFY µFD

CAPACITOR VALUES GREATER THAN ONE SIGNIFY µµFD

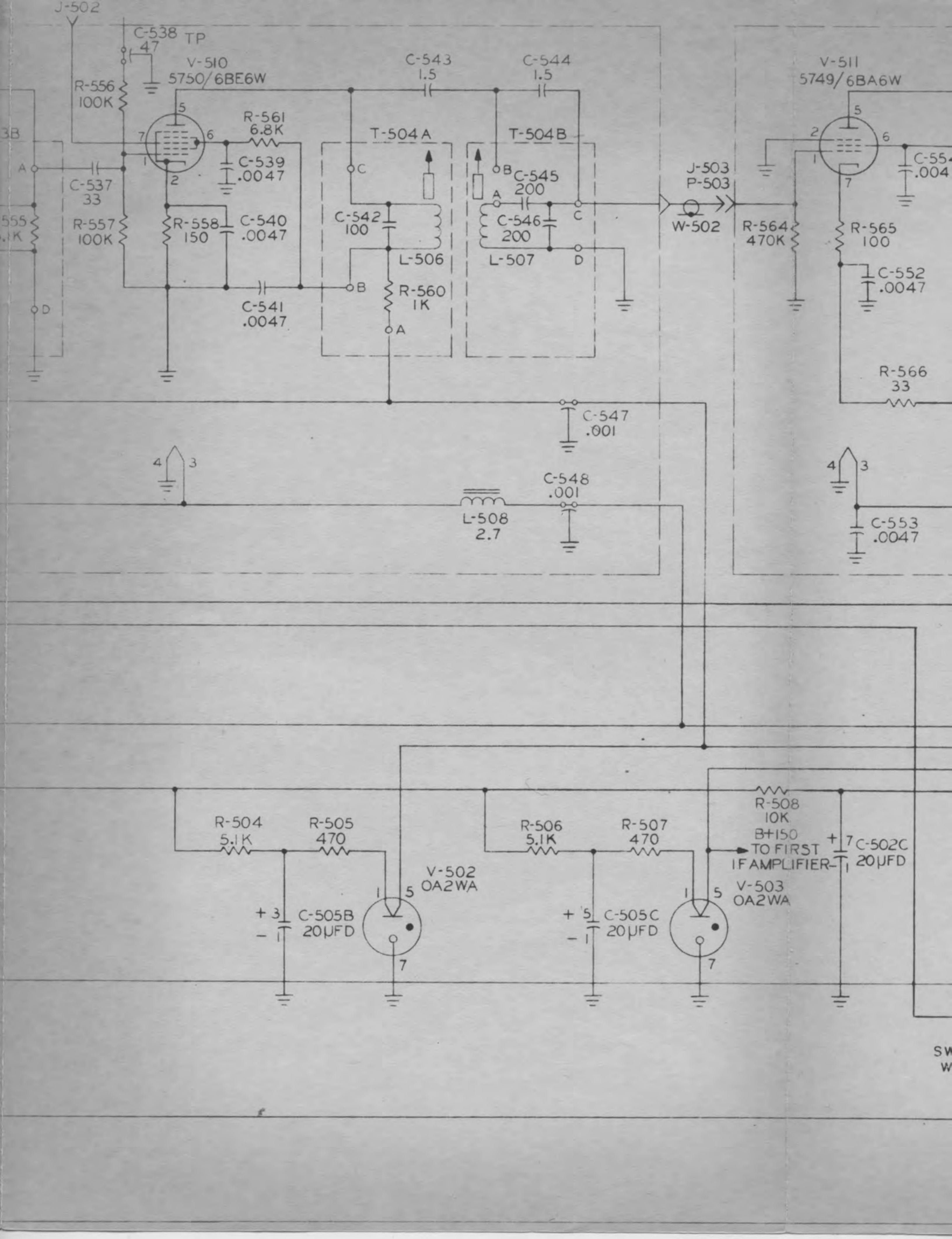
SCHEMATIC DIAGRAM
TYPE 14E1 FREQUENCY DISPLAY UNIT
FIRST I.F. AMPLIFIER

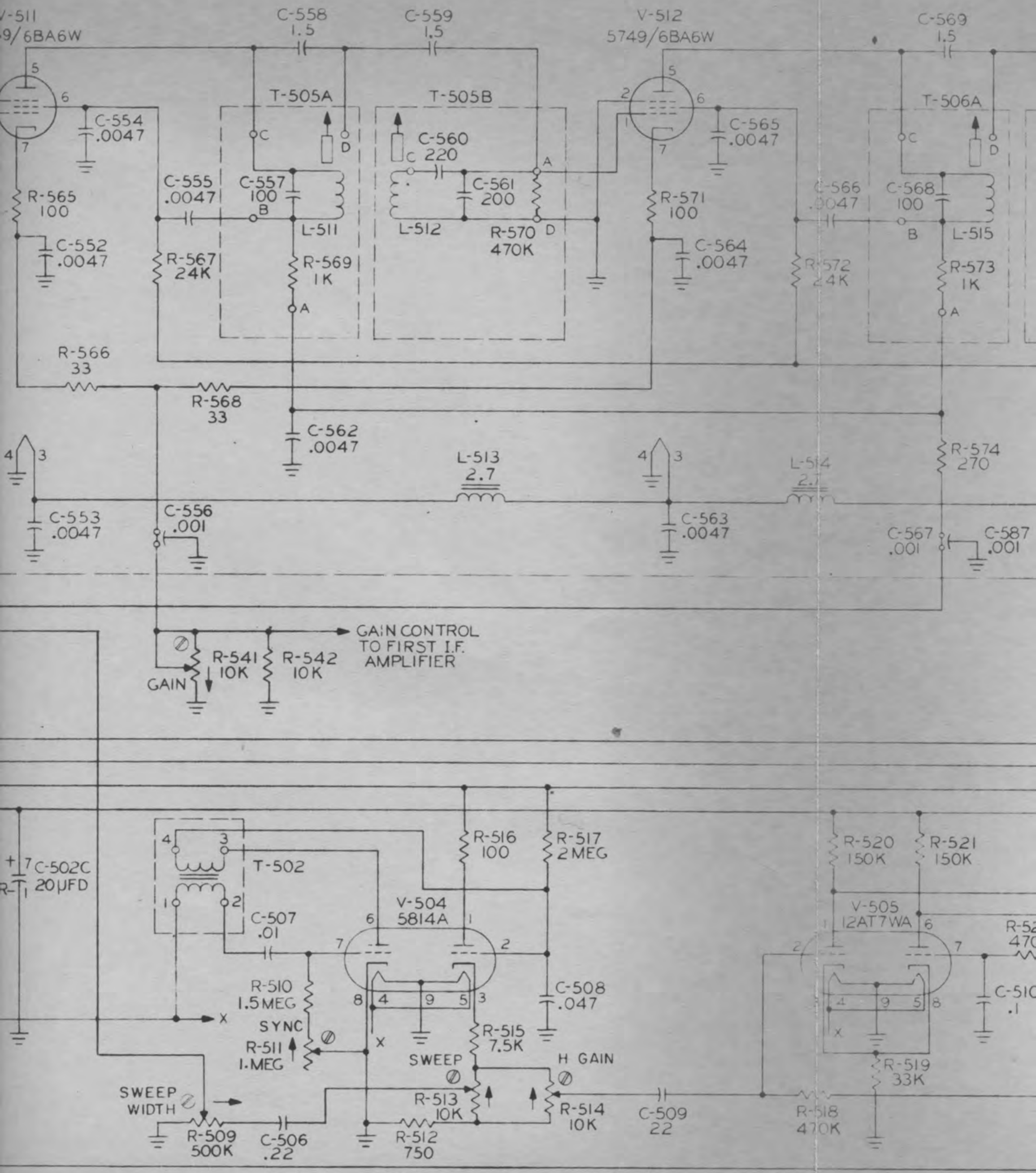


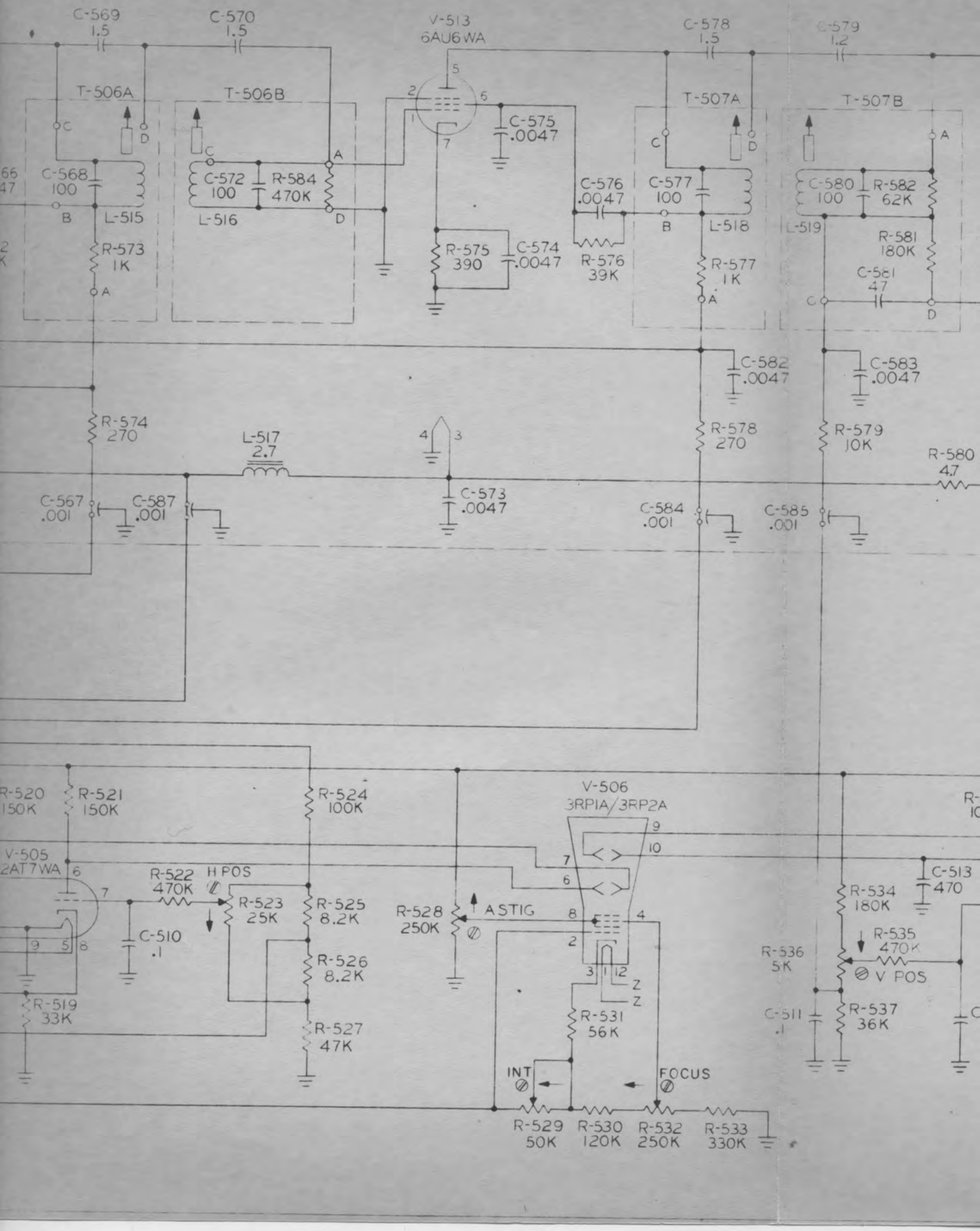
V-508
6AH6
C-520
3.9
C-52
15
Z-501
A
C-52
1.5
L-501
R-542
330 BIAS
R-549
100
C-521
.0047
C-522
.0047
L-502
D
C
C-523
.0047
R-548
500
R-550
270
R-546
10K
R-551
1K
B
C-519
.001
C-518
47
C-524
.001
R-545
R-543
250
R-544
33
T-501
F-501
1.0A SLO BLO
S-501
V-5
5Y3W
J-501

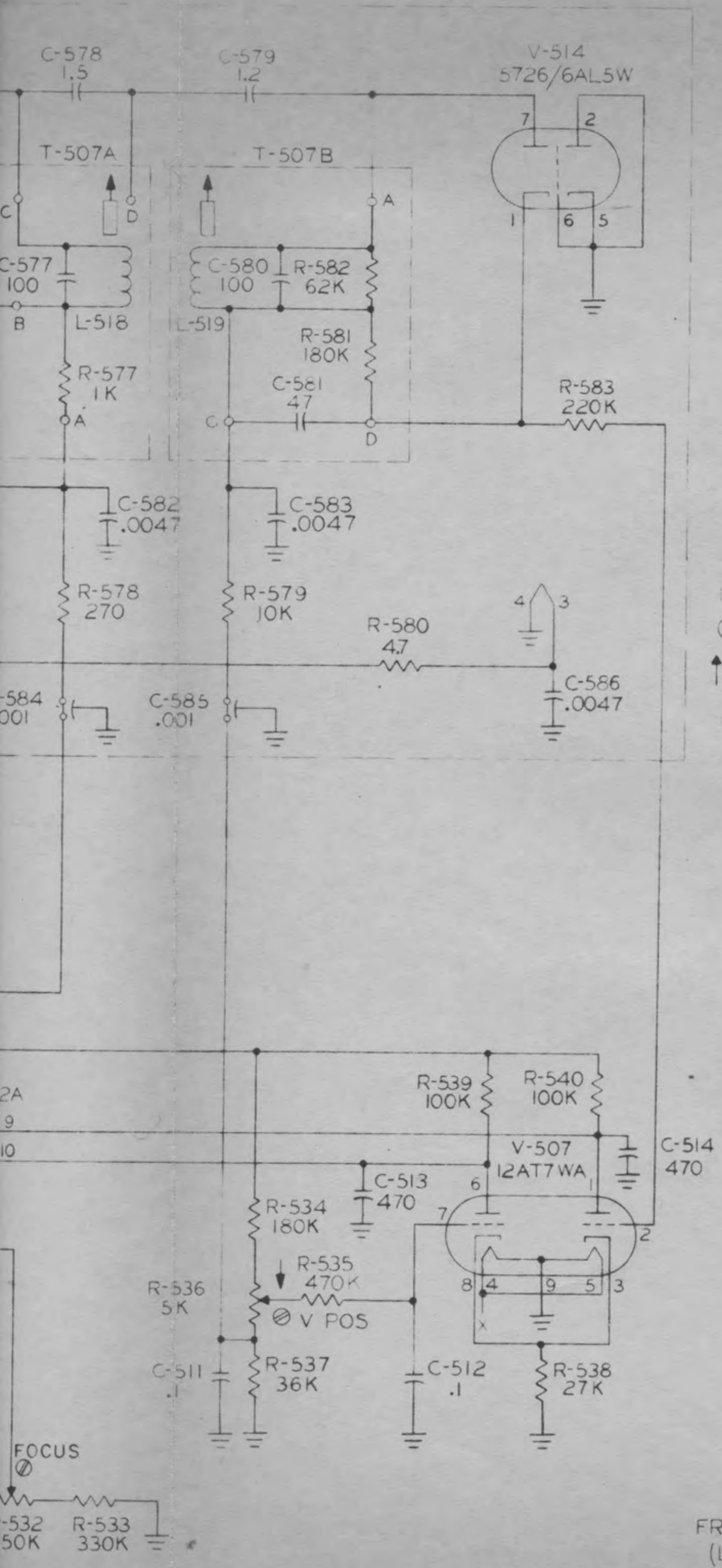


J-502
V-509
6AU6WA
C-535
3.9
C-536
5.1
R-556
100K
C-526
15
C-528
33
Z-501
T-503A
T-503B
C-525
1.5
C-527
1.4-5.0
C-533
.0047
C-537
33
L-502
R-555
5.1K
R-557
100K
L-504
C-523
.0047
C-529
33
R-552
24K
L-503
75
C-532
33
R-553
1K
L-505
C-530
.0015
R-554
1K
R-551
1K
C-534
.0047
R-559
47
C-524
.001
C-531
.0047
T-501
C-502A & B
20-20 μFD
V-501
5Y3WGTA
R-501
5.1K
C-505A
20μFD
I-501
#47
I-502
#328
I-503
#326
R-503
15
SCALE
6.3V TO FIRST
IF AMPLIFIER
C-501
2μFD
CR-502
CR-501
R-502
47K
C-503
1μFD
C-504
1μFD


J-502
C-538
47
TP
R-556
100K
V-510
5750/6BE6W
C-543
1.5
C-544
1.5
V-511
5749/6BA6W
R-561
6.8K
T-504 A
T-504 B
C-539
.0047
C-537
33
C-545
200
J-503
P-503
W-502
C-542
100
C-546
200
R-557
100K
R-558
150
C-540
.0047
L-506
L-507
R-564
470K
R-565
100
C-552
.0047
R-560
1K
C-541
.0047
R-566
33
C-547
.001
C-548
.001
L-508
2.7
C-553
.0047
R-504
5.1K
R-505
470
R-506
5.1K
R-507
470
R-508
10K
B+150
TO FIRST
IF AMPLIFIER
C-502C
20 μFD
V-502
OA2WA
V-503
OA2WA
C-505B
20 μFD
C-505C
20 μFD


V-511
9/6BA6W
C-558
1.5
C-559
1.5
V-512
5749/6BA6W
C-569
1.5
T-505A
T-505B
T-506A
C-554
.0047
C-560
220
C-565
.0047
C-555
.0047
C-557
100
C-561
200
C-566
.0047
C-568
100
R-565
100
L-511
L-512
R-570
470K
R-571
100
L-515
C-552
.0047
R-567
24K
R-569
1K
C-564
.0047
R-572
24K
R-573
1K
R-566
33
R-568
33
C-562
.0047
L-513
2.7
L-514
2.7
R-574
270
C-553
.0047
C-556
.001
C-563
.0047
C-567
.001
C-587
.001
GAIN CONTROL
TO FIRST I.F.
AMPLIFIER
R-541
10K
R-542
10K
GAIN
C-502C
20μFD
T-502
R-516
100
R-517
2 MEG
R-520
150K
R-521
150K
V-504
5814A
V-505
12AT7WA
C-507
.01
R-510
1.5 MEG
C-508
.047
C-510
.1
SYNC
R-511
1.MEG
R-515
7.5K
R-519
33K
SWEEP
H GAIN
SWEEP
WIDTH
R-513
10K
R-514
10K
C-509
22
R-518
470K
R-509
500K
C-506
.22
R-512
750


C-569 1.5
C-570 1.5
V-513 6AU6WA
C-578 1.5
C-579 1.2
T-506A
T-506B
T-507A
T-507B
C-568 100
L-515
C-572 100
R-584 470K
L-516
C-575 .0047
R-575 390
C-574 .0047
C-576 .0047
R-576 39K
C-577 100
L-518
C-580 100
R-582 62K
L-519
R-581 180K
C-581 47
R-573 1K
R-577 1K
C-582 .0047
C-583 .0047
R-574 270
L-517 2.7
R-578 270
R-579 10K
R-580 4.7
C-567 .001
C-587 .001
C-573 .0047
C-584 .001
C-585 .001
R-520 150K
R-521 150K
R-524 100K
V-506 3RP1A/3RP2A
V-505 12AT7WA
R-522 470K
H POS
R-523 25K
R-525 8.2K
R-528 250K
ASTIG
C-513 470
R-534 180K
C-510 .1
R-526 8.2K
R-536 5K
R-535 470K
V POS
R-519 33K
R-527 47K
R-531 56K
C-511 .1
R-537 36K
INT
FOCUS
R-529 50K
R-530 120K
R-532 250K
R-533 330K



OPERATING CONTROL

SCREW DRIVER ADJUSTMENT

ARROW DENOTES CLOCKWISE ROTATION

UNLESS OTHERWISE NOTED:

CAPACITOR VALUES LESS THAN ONE SIGNIFY μFD

CAPACITOR VALUES GREATER THAN ONE SIGNIFY μFD

SCHEMATIC DIAGRAM
FREQUENCY DISPLAY UNIT
(LESS FIRST I.F. AMPLIFIER)