TM 11-5825-231-24

TECHNICAL MANUAL

ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT

MAINTENANCE MANUAL

DIRECTION FINDER SETS AN/TRD-23, AN/TRD-23A AND DIRECTION FINDER SETS AN/TRD-15 AND AN/TRD-15A

This copy is a reprint which includes current pages from Changes 1 through 3. title was changed by Change 3.

HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1973

and power output stages energized by the self-contained dc power supply, A source of 115-volt, 60-Hz power is required, which connects at J1.

(2) Line power is applied to power transformer T4 and fan motor B1 by way of on-off switch S1 and 8-ampere fuse F1. Rectifiers CR8 and CR9, in a full-wave configuration, supply dc voltage for energizing the tuning fork and the stages of the amplifier after filtering by choke L1 and capacitors C10 and C11. Resistor R27 is a load resistance across the dc supply voltage. Transistor Q10 is a series voltage-regulating element to maintain a constant dc voltage supply for the tuning fork, and stages Q1, Q2, Q3. Resistor R18 establishes appropriate current flow for reference Zener diode CR5, which provides a fixed base bias voltage for transistor Q10. Filtering of this voltage is accomplished by capacitor C5.

(3) Dc voltage is fed to socket XMP1 at pins 7 and 6 (GRD) to energize plug-in tuning fork MP1. The tuning fork output (180Hz) is taken at pins 9 and 6 and fed through coupling capacitor C1 to the base of first emitter-follower transistor Q1. From the arm of divider R4 in the emitter of Q1, the output is passed through diodes CR1 and CR2 before reaching the base of second emitter follower Q3. Decoupling from the dc levels established by dividers R5, R6, R10, and R11 is accomplished by capacitors C2 and C3.

(4) The output (partially squared 180 Hz voltage) from the emitter of second stage Q3 is fed through coupling capacitor C4 to the primary of transformer T1, where coupling and wave-shaping is provided for the push-pull input to the bases of Q4 and Q5. Resistor R17 provides the proper input impedance for the push-pull voltage amplifier stage Q4, Q5.

(5) Interstage transformer T2 provides coupling from the output (collector to collector) of Q4, Q5 to the input (base to base) of driver stage Q6, Q7. The collectors of driver stage are direct coupled to the bases of push-pull power output stage Q8, Q9 where sufficient 180-Hz power is developed to drive the synchronous motor.

(6) The output transformer T3 provides the appropriate turns ratio and impedance to transform the power developed in the output stage to a voltage and current (115 volts at 1 ampere) to match the requirements of the motor load. Transformer T3 also serves to decouple the output from the dc supply voltage.

(7) Resistors R19 through R22 provide bias voltages for the driver and output stages while R23 and R24 limit the emitter current in the latter. Resistor R26 drops the 115 volts, 180 Hz output voltage to illuminate neon indicating lamp DS1. The amplifier is protected from loads in excess of 1 ampere by fuse F2 in the output.

(8) Additional protection for the amplifier is provided by an output current monitor circuit. The output current is sensed across R25 and rectified by diodes CR6 and CR7. The negative voltage thus developed is passed to the base of switching transistor Q2. Also appearing on this base is a positive voltage which has been developed across CR3 and CR4. When the output load is correct, these voltages balance out slightly negative, keeping transistor Q2 cutoff. In a no-load condition, no negative voltage is developed across CR6 and CR7 to balance out the positive voltage from the tuning fork; thus, the base of Q2 goes positive and it begins conducting, shorting the isolation amplifier output to ground, removing signal input to the driver and output stages. When the load begins to draw excessive current, sufficient negative voltage is developed by CR6 and CR7 to overcome the positive voltage across CR4. This action causes CR3 to become forward biased, and shorts the tuning fork output directly to ground.

2-8. Receiver, Radio R-725/URR

a. General.

(1) For a detailed discussion and circuit analysis of the R-725/URR, refer to TM 11-5820-358-35 which covers Receiver, Radio R-390A/URR. The information is unchanged except as listed below.

(*a*) A hum-bucking circuit has been added to the R-390A/URR as shown in figure 6-5 to improve performance. This modification places a positive dc voltage on the filament of the variable frequency oscillator (vfo) (V701) in the receiver, reducing the heater-to-cathode leakage of 60 Hz into the signal.

(*b*) The if. amplifier subchassis has been replaced in its entirety. Refer to *b* and *c* below for detailed discussion of this chassis.

(2) The receiver provides continuous-wave (cw), modulated continuous wave (mcw), and am. reception over a frequency range from 0.54 to 32 MHz. The receiver is basically a superheterodyne of the multiple conversion type. Triple-conversion is used for lower frequencies (0.5 to 8 MHz). The receiver normally operates from a self-contained power supply designed to operate at a nominal input of 115 or 230 volts over a frequency range from 48 to 62 Hz. However, provision is made to use a dynamotor in

place of the ac power supply for dc operation.

(3) The tuning system of the R-725/URR provides linear tuning over the entire frequency range of the receiver. Permeability tuning (insertion of powered-iron cores into coils) and a system of gears and cams make linear tuning possible and permit the use of a counter-type indicator on the front panel to show the frequency selected.

(4) The receiver power supply provides dc for the antenna and break-in relays, ac to the filament and oven circuits, and B+ voltage to the voltage regulator circuit. All B+ voltages supplied to the receiver are regulated. The voltage regulator circuit consists of a series regulator, a dc amplifier, and voltage reference tubes. The power supply consists of a transformer and two rectifiers The transformer has two primary windings which are connected in series for 230-volt operation, and in parallel for 115-volt operation.

b. *If. Strip Block Diagram* (fig. 2-11).

(1) The if. subchassis contains six voltage amplifier stages, a detector, automatic gain contro (agc), beat frequency oscillator (bfo), limiter, and cathode-follower output stages.

(2) A 455-kHz signal from the third mixer of the main receiver is amplified by the first five stages of the if. amplifier. The output of the fifth stage goes to the agc circuit, the sixth if. amplifier, and the cathode-follower output stage, which supplies the 455-kHz signal to the rf detector.

(3) The output of the sixth if. stage is mixed with the output of the bfo, detected, and passed through a limiter to the audio amplifier on the main chassis.

c. *If. Strip, Stage Analysis* (fig. FO-4).

(1) The 455-kHz signal from the third mixer in the main receiver enter the if. chassis at J518. The signal is then routed to the first if. amplifier through cyrstal filter Z501. For the two narrow pass bands, 0.1 and 1 kHz, the crystal filter is used. Four additional degrees of selectivity which do not use the crystal filter are accomplished in the if. stages by the BANDWIDTH KC switch which varies the coupling between the primary and secondary circuits of the if. transformers. The if. amplifier consists of six stages, V501 through V5C6 which, together with the associated transformers, provide the required pass band.

(2) The output of fifth if. amplifier V505 is divided to supply a 455-kHz signal to each of three stages: sixth if. amplifier V506, agc amplifier V509, and the cathode follower, one-half of V511. The output signal of the sixth if. amplifier is demodulated in the detector circuit, one-half of V507. An external load may be connected from DIODE LOAD (terminal 14) to ground, with the jumper between terminals 14 and 15 removed. The output of the fifth if. amplifier is amplified in agc amplifier V509, and the resulting signal is rectified by the agc rectifier, one-half of V510. When the FUNCTION switch is set for AGC operation, the gain of rf amplifier V201 and if. amplifiers V501 and V505 is controlled automatically by a dc voltage developed by the agc rectifier, one-half of V510, to keep the output level of the receiver relatively constant and independent of signal strength variation at the antenna. Thus for strong signals, the grid bias is high and the gain of the controlled stages is reduced. The reverse action occurs for weak signals. The response rate of the agc circuits can be controlled to satisfy reception requirements through the use of the AGC switch, the agc time constant circuit, and one-half of tube V511. For MGC operation, the agc bus is grounded by the FUNCTION switch. The cathode follower, one-half of V511, provides a low-impedance connection (50 ohms) from the output of the fifth if. stage, through J514 to the rf detector.

(3) To facilitate operation in the reception of radiotelegraph signals, in certain system applications and in calibration, bfo tube V508 provides a signal in the frequency range from 452 to 458 kHz. This signal is mixed with the 455-kHz if. output signal of the sixth if. amplifier to produce a beat frequency in the output of the detector which is in the audiofrequency (af) range.

(4) The output of the detector (one-half of V507) is coupled to the af amplifier (V602A) through a negative peak limiter (one-half of V507) and a positive peak limiter (one half of V510) which prevents noise peaks from exceeding average signal level. If operation without limiting is desired, the limiters can be disabled by a front panel control.

(5) In addition to supplying signals to the limiter, the detector (one-half of V507) supplies a dc signal to the squelch tube, V606, which is a voltage amplifier. The average dc output voltage of the squelch tube varies in proportion to the average signal level. When the signal level drops below some predetermined noise level established by the setting of the RF GAIN control, and when the FUNCTION switch is set for SQUELCH operation, this voltage operates squelch relay K602. Squelch relay K602 short circuits the output of af amplifier V602B to quiet the receiver output.

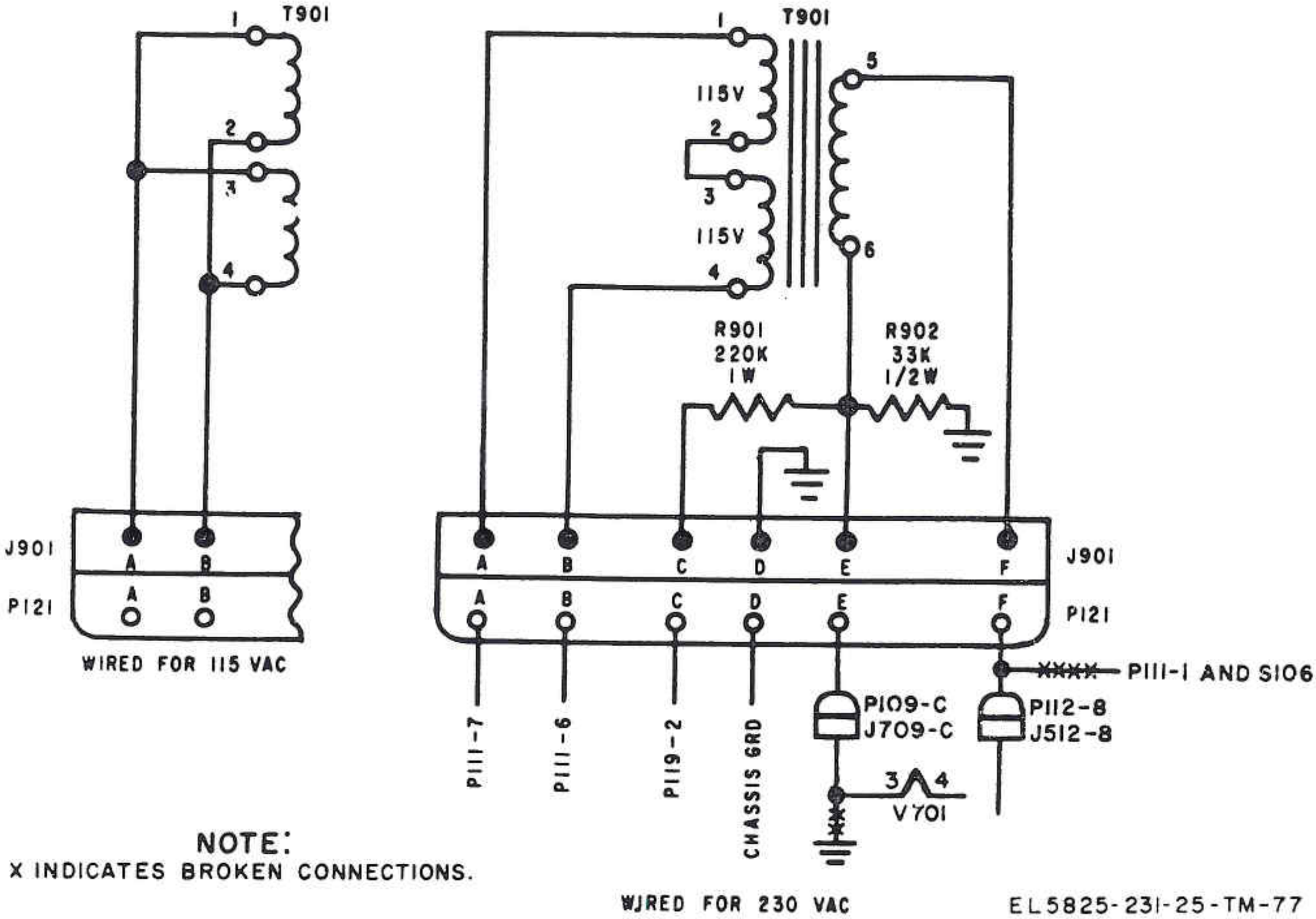


Figure 6-5. R-390A/URR receiver modification.

probe on TP10, observe exactly two cycles of the tuning fork output for every sync pulse. This test indicates that the control amplifier has enough power output to run the goniometer drive motor at the proper speed.

(4) *No load test.* Turn off the control amplifier and remove fuse F2. Turn on the control amplifier and with the scope probe, check for 180-Hz signal at TP4. None should be present.

d. Isolating Troubles. If the previous tests have not uncovered the defective components, continue troubleshooting with the following procedures:

(1) *Voltage measurements.* Voltage measurements for two control amplifier load conditions are given in the following chart. Ac voltages are peak to peak. Measurements are taken with ME-26B/U.

(2) *Signal tracing.* Refer to the schematic diagram (fig. 6-13) and the unit function given in paragraph 2-7.

4-8. Receiver, Radio R-725/URR

a. Modification Data. The R-725/URR is a modified R-390A/URR receiver. The following modifications have been accomplished:

(1) Replaced if. subchassis to improve performance when receiver is used in conjunction with direction finding equipment (fig. FO-4).

(2) The following wiring modifications have been made to reduce hum (fig. 6-5):

(*a*) Open small enclosure at end of vfo unit and lift pin 3 of V701 from ground.

(*b*) Connect a 0.01-uf capacitor between V701-3 and ground.

(*c*) Connect V701-3 to J709-C. Solder connections and close up vfo.

(*d*) Connect P109-C to P121-E (filament return).

(*e*) Disconnect and dead-end wire (with tape) from P112-8.

Chart 4-7. Troubleshooting—Control Amplifier

Item	Trouble	Probable cause	Remedy
1	No output voltage	*a.* Defective tuning fork	*a.* Replace.
		b. No B+	*b.* See item 3.
		c. Shorted transistor	*c.* Check Q2.
		d. Defective amplifier	*d.* Check driver and final amplifier stages.
2	Low power output	*a.* Gain set too low	*a.* Check setting of R4.
		b. Defective power supply	*b.* See items 3 and 4.
		c. Defective transistor	*c.* Check transistors.
3	No B+	*a.* Defective rectifier	*a.* Check CR8 and CR9.
		b. Defective filter	*b.* Check C11 and R27.
		c. Defective transformer	*c.* Check T4.
4	No regulated B+	*a.* Open transistor	*a.* Check Q10.
		b. No regulator bias	*b.* Check Zener diode CR5 and bias resistor R18.
		c. Shorted component	*c.* Check for shorts.
5	No-load circuit	*a.* Shorted transistor	*a.* Check Q2.
		b. Defective sensing circuit	*b.* Check R25.
		c. Defective component	*c.* Check components.
6	Incorrect tuning fork frequency	Defective tuning fork	Replace.

Chart 4-8. Voltage Measurements—Control Amplifier

Load	100 watts across J2						No load across J2					
Stage	Base		Emitter		Collector		Base		Emitter		Collector	
	VDC	VAC	VDC	VAC	VDC	VAC	VDC	VAC	VDC	VAC	VDC	VAC
Q1	5.8	2.5	5.4	2.4	10.5	0	6.0	2.6	5.4	2.6	10.7	0
Q2	0	0.3	0	0	5.8	1.9	0.6	0	0	0	0.1	0
Q3	5.8	1.8	4.2	1.0	10.5	0	4.8	0	4.2	0	10.7	0
Q4	0.5	0.7	0	0	12.0	25.0	0.5	0	0	0	15.0	0
Q5	0.5	0.9	0	0	11.7	25.0	0.5	0	0	0	15.0	0.2
Q6	3.0	14.0	0	0	12.1	2.0	0	0	0	0	15.0	0.2
Q7	4.1	13.0	0	0	12.1	1.8	0	0	0	0	15.0	0.2
Q8	12.1	2.0	12.3	1.4	2.3	24.0	15.0	0.2	15.0	0.2	0	0
Q9	12.1	1.8	12.3	1.4	2.2	22.0	15.0	0.2	15.0	0.2	0	0
Q10	11.2	0	10.5	0	12.9	0.5	11.4	0	10.7	0	15.4	0.3

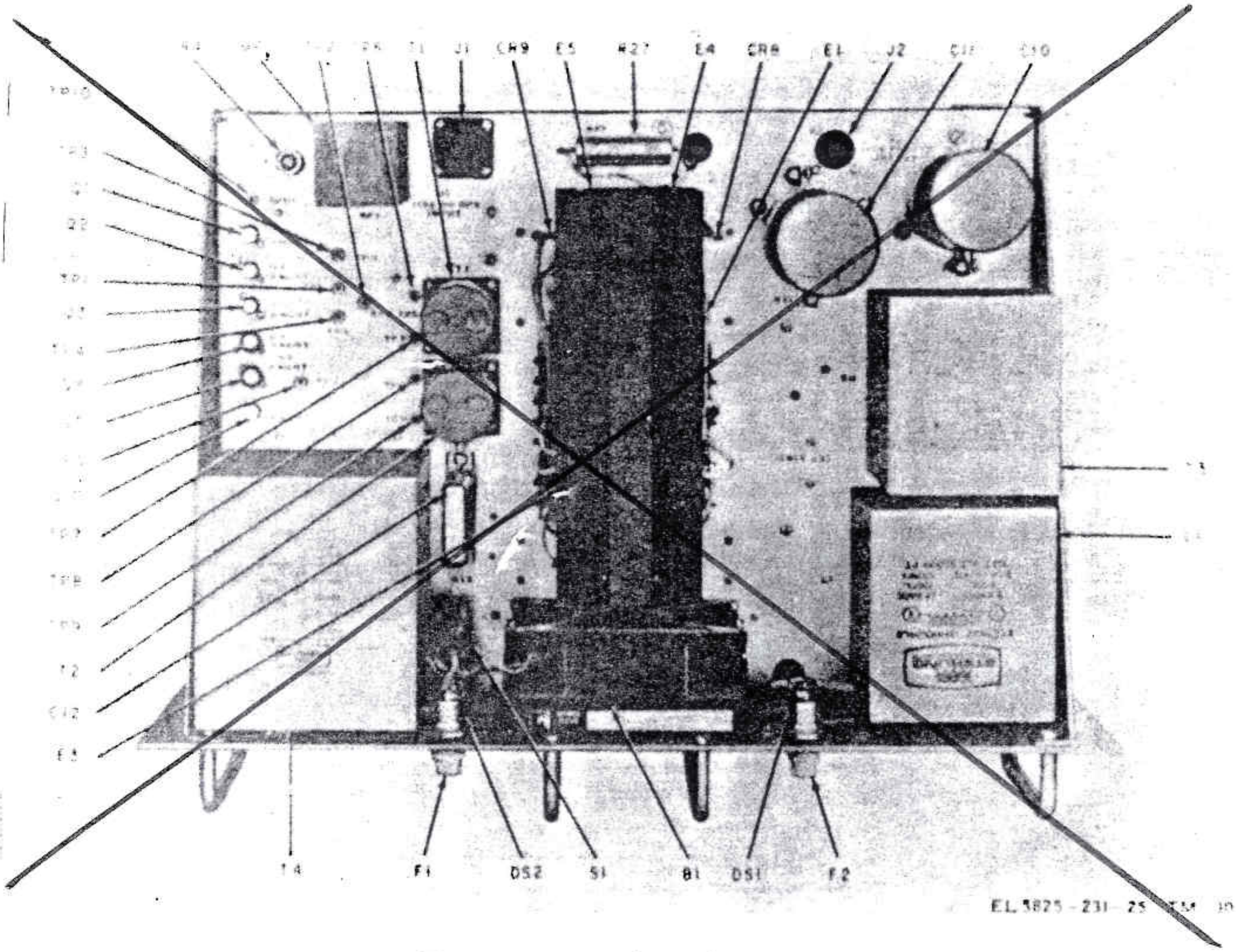


Figure 4-10. Control amplifier, top view.

(*f*) Connect P112-8 to P121-F (filament supply).

(*g*) Parallel-connect a wire from P111-7 to P121-A (primary supply).

(*h*) Parallel-connect a wire from P111-6 to P121-B (primary supply).

(*i*) Parallel-connect a wire from P11902 to P121-C (B+ supply).

(*j*) Connect a wire from P121-D to chassis ground.

(3) See figure 61 in TM 11-5820-358-35 for results of wiring modification. Filament voltage of the vfo from V701-3 to ground now measures 25 volts dc. Resistance from V701-3 to ground now measures 33 K. These are the only voltage/resistance changes caused by the wiring modification described in (2) above.

b. Checking B+ and Filament Circuits for Shorts. Refer to paragraph 4-*d*(1) for a general description of these tests. The information supplied in TM 11-5820-358-35 covers these tests, except that the resistance at test point J512-2 should be 35K.

c. Bench Test Procedures. Procedures for the receiver are described in TM 11-5820-358-35. Follow normal procedures for testing the receiver as outlined in this section, except for the following:

(1) If. troubleshooting chart below is substituted for troubleshooting chart in TM 11-5820-358-35.

(2) If. subchassis components are identified in figures 4-13, 4-14, and 4-15.

(3) Tube voltage and resistance diagram, if subchassis, in TM 11-5820-358-35 is replaced by the diagram in figure 6-10.

(4) Substitute if. stage gain test (*f* below) for if. test TM 11-5820-358-35.

d. If. Subchassis. The troubleshooting chart below outlines procedures for localizing troubles to a stage in the if. subchassis, and indicates probable cause and recommended solutions. If recom-

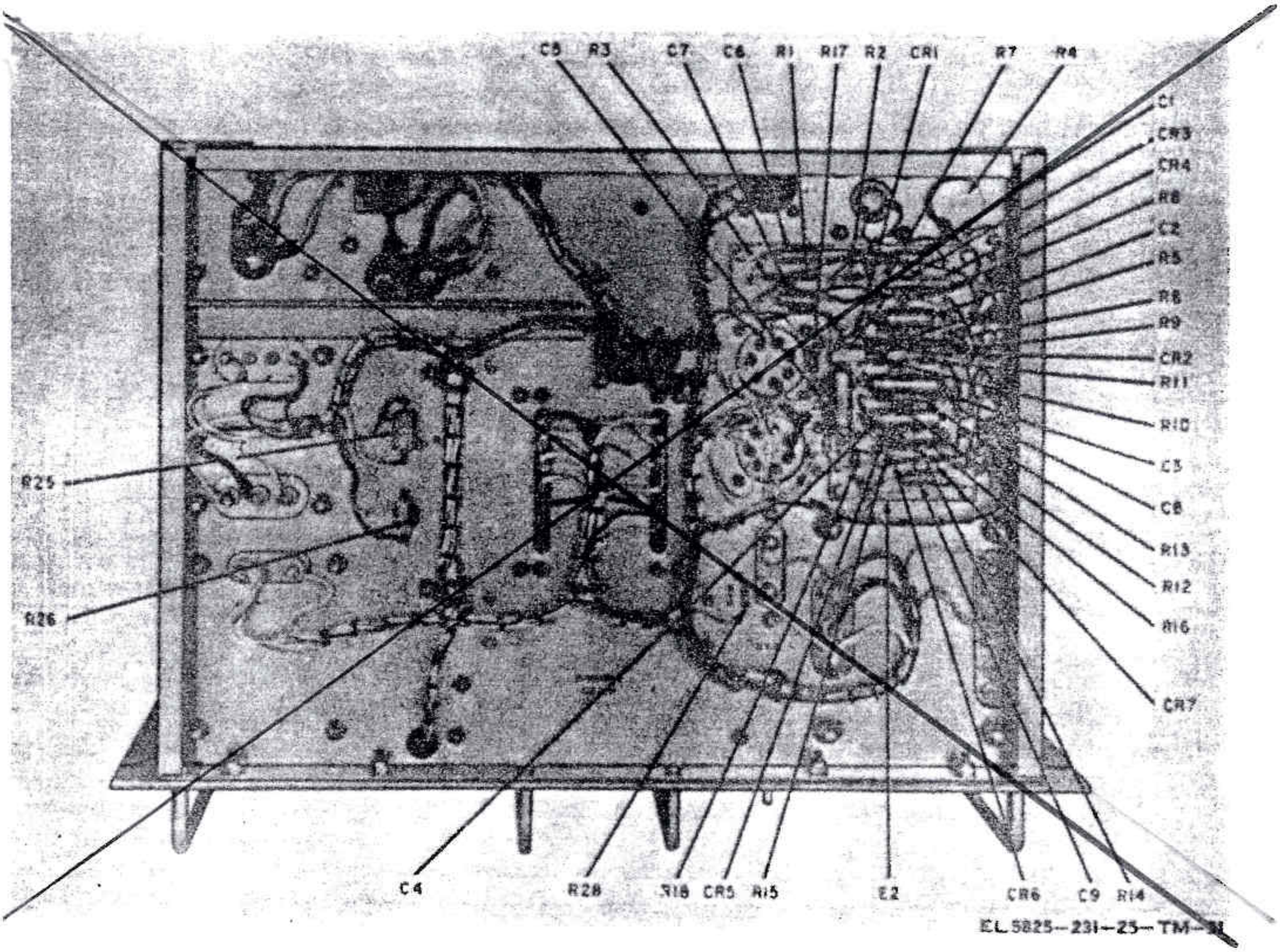


Figure 4-11. Control amplifier, bottom view.

mended solution does not solve problem, make voltage and resistance checks in accordance with figure 6-10 and correct deficiency. Figures 4-13, 4-14, and 4-15 show the location of components.

e. If. Stage Gain Test. This test supplements tests in TM 11-5820-358-35, and will indicate trouble in the first six stages of the if. subchassis. If a stage reads outside charted values, replace faulty component before proceeding to the next stage.

(1) The stage gain chart below lists the minimum and maximum voltages required at each of the if. stages of the receiver to produce a voltage of −7 volts dc across the diode load. Use this chart as a standard when troubleshooting to check the gain of each if. stage or group of stages. When the receiver output is low and the tubes are operating satisfactorily (as indicated by a tube tester), localize the defective stage by checking the signal voltage level of each state against the chart while using the signal substitution method of troubleshooting, or by measuring the individual stage gain.

(2) To obtain the stage gain readings, connect a multimeter between terminals 14 (DIODE LEVEL) and 16 (GND) of the terminal strip on the back of the receiver. Terminal 14 must be jumpered to terminal 15. Connect the ground lead of the rf generator to the receiver ground, and connect the generator output lead through a 0.1 μf capacitor to the receiver points indicated in the chart. When checking the 455-kHz if. stages, the injection points can be reached by operating the subchassis outside the receiver, using the extension cables, or by inserting a short length of wire into the tube socket terminal. Check the output from the rf generator required to obtain the diode load reference voltage of −7 volts dc against the figures given in the charts.

Chart 4-9. Troubleshooting—Receiver If. Strip

Item	Trouble	Probable cause	Remedy
1	No signal or weak signal when af signal is applied to pins 1 and 2 of tube socket XV510, anode of positive peak limiter.	Capacitor C259, V510	Check components and replace defective part.
2	Weak signal output when af signal is applied to pin 3 of tube socket.	V510 defective, or R542, R544 open	Check and replace component if defective.
3	Weak signal output when af signal is applied to pin 3 of tube socket XV507, cathode of positive peak limiter.	V510 defective or R542, R544 open	Check and replace component if defective.
4	Weak or no output signal when 455-kc modulated signal is applied at pins 1 and 2 of tube socket XV507.	Defective tube or loose jumper between terminals 14 and 15 or rear terminal strip.	Tighten terminals 14 and 15 jumper connections and replace V507 if defective. If trouble persists, check voltage and resistance of circuit components.
5	Weak output when 455-kHz modulated signal is applied to pin 5 of tube socket XV506, plate of sixth if. amplifier.	T506 open or shorted or not properly aligned.	Check and replace T506 if open or shorted. For alignment, refer to chapter 4.
6	Apply 455-kHz modulated signal to pin 1 of V506, grid of sixth if. amplifier. Output should be louder than in step 5.	Open C523 or C524, or defective tube.	Shunt capacitors with ones of like value and replace if defective. Check V506.
7	If. subchassis still defective	Defective if. stage	Refer to paragraph 3-9e for if. stage gain test and replace defective component.

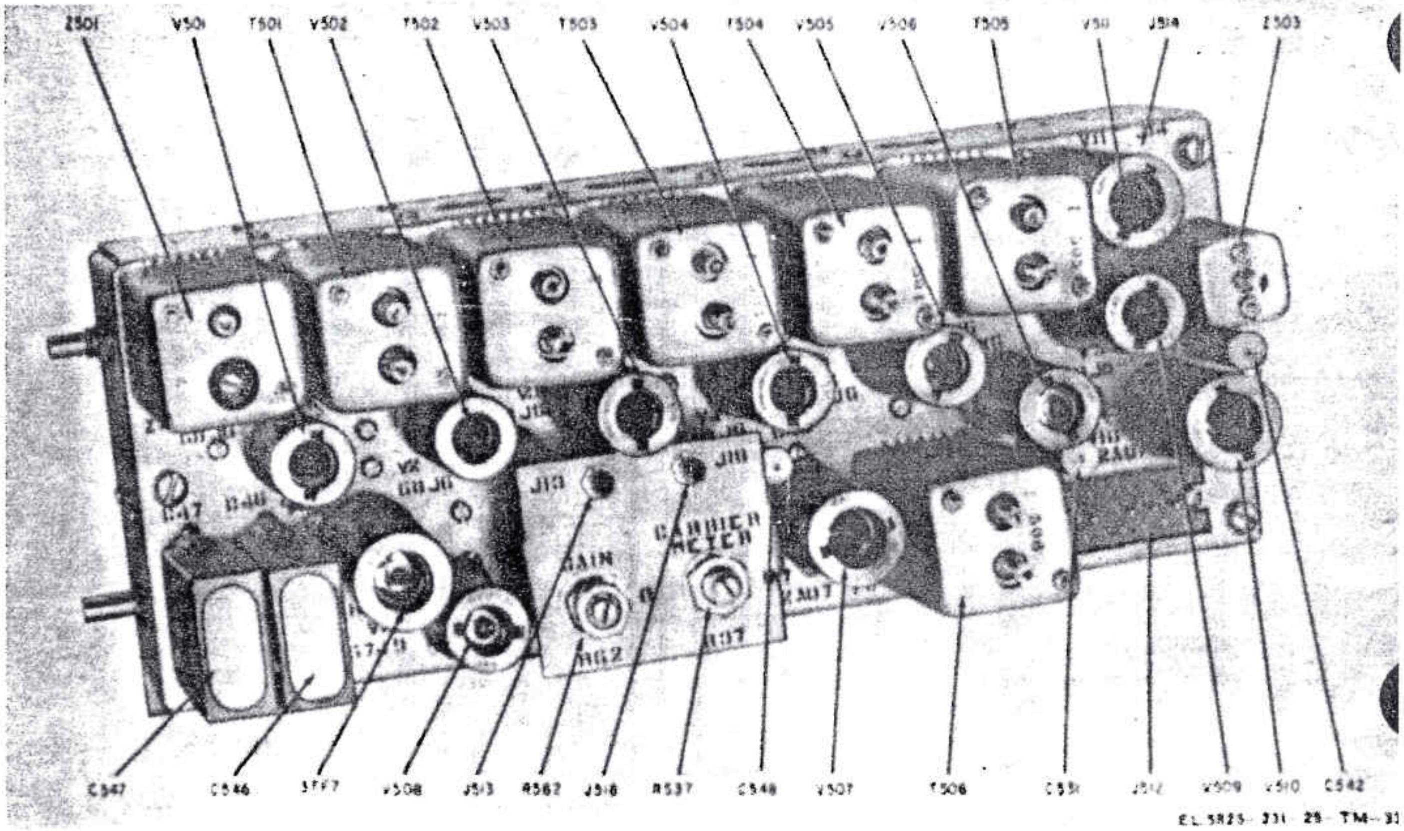


Figure 4-13. If. subchassis, top view, location of components, tubes, transformers & controls.

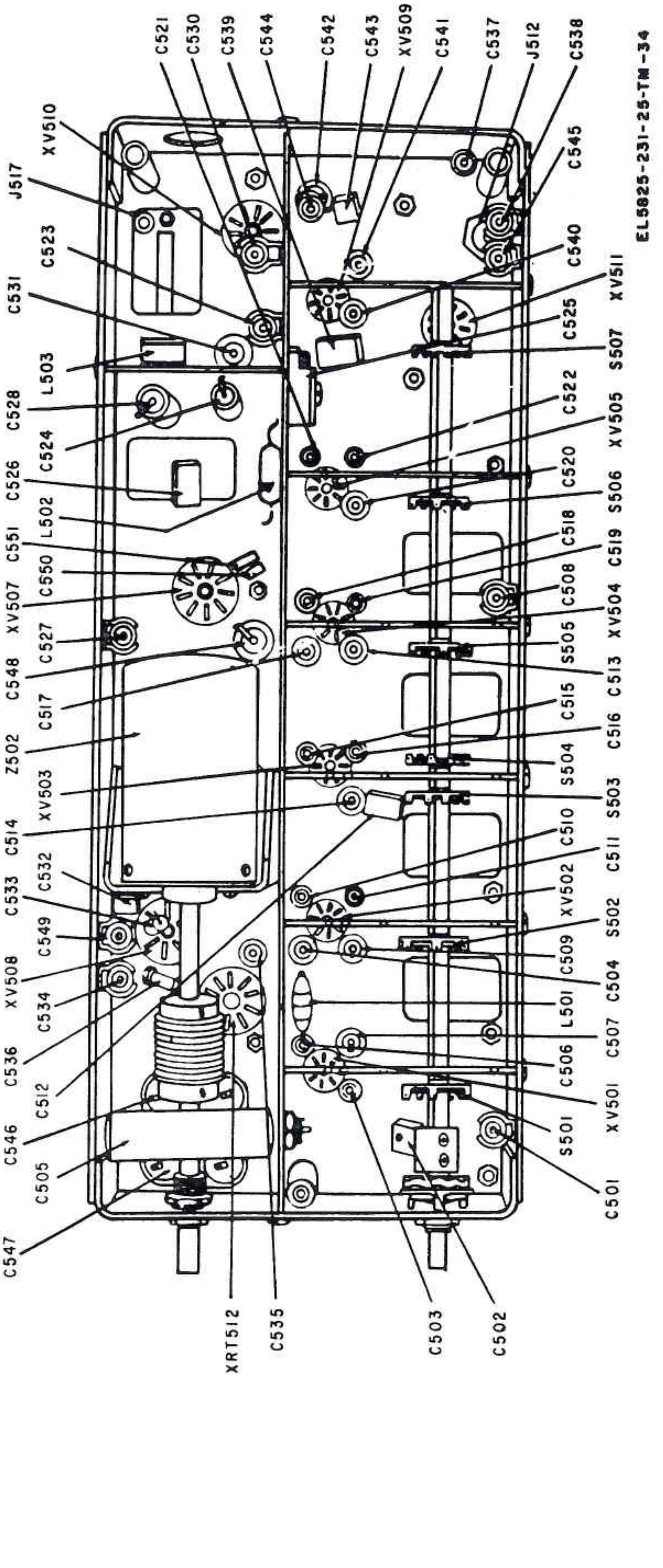


Figure 4-14. If. subchassis, location of components, capacitors.

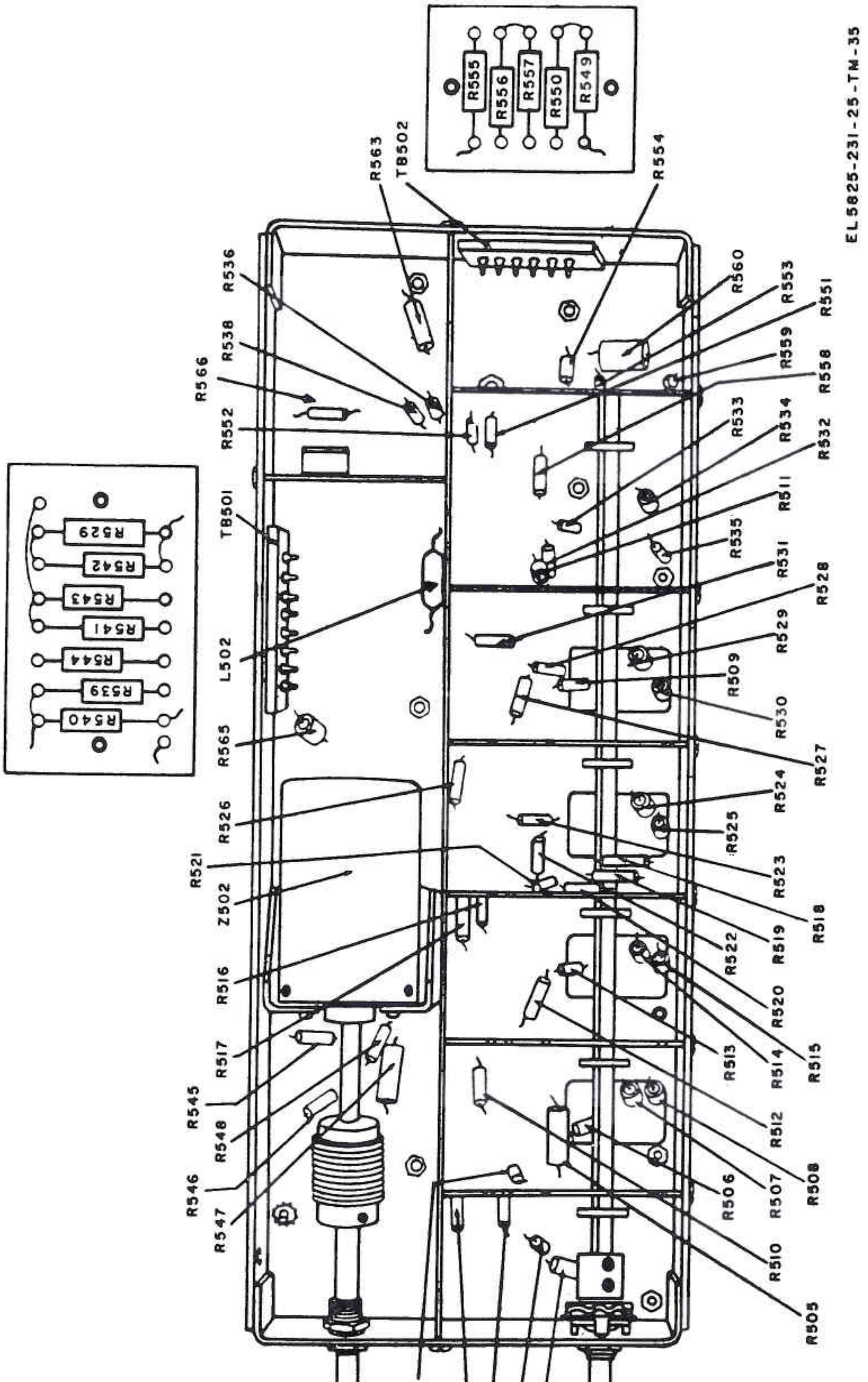


Figure 4-15. If. subchassis, location of components, resistors.

The lowest figure is the minimum and the highest is the maximum that should be required over the specified frequency range for normal operation. However, a reading that is slightly outside this range does not necessarily indicate improper functioning.

Chart 4-10. If. Stage Gain

Signal injection point	Rf generator output (millivolts) bandwidth			
	2 kHz	4 kHz	8 kHz	16 kHz
V501 grid	0.13–0.18	—	—	—
V502 grid	1.5–1.9	1.4–2.0	0.88–1.4	0.86–1.7
V503 grid	2.3–5.0	3.0–5.0	1.1–2.0	0.77–1.3
V504 grid	7.0–12.0	7.0–11.5	6.0–8.7	5.2–7.6
V505 grid	16.0–20.0	16.0–18.0	23.0–28.0	32.0–38.0
V506 grid	420–500	420–500	420–500	420–500

4-9. Detector, Radiofrequency RF-159(*)/TRD

a. Checking B+ and Filament Circuits for Shorts. Refer to paragraph 4-2*d*(1) for a general description of these tests.

Chart 4-11. Short Circuit Tests—Rf Detector

Test points	*Resistance*	*Isolating procedure*
TP 13 to ground	240 K	A low resistance indicates: (1) Breakdown of wiring insulation. Check all B+ wiring and lead dress of components for possible short or arc-over chassis. (2) Component failure. Remove all tubes one at a time observing any significant change in B+ resistance to ground. Return tubes to appropriate socket immediately after it has been determined that the tube is not defective. Check capacitors for leakage, especially C4, C11, C16, C22, C26, C31, C36, C41, C47, C51, C55, C61, C63, C65, C71, C76, C78, C80, C81, and C90.
J8-A to ground	Infinite	Remove all tubes identifying each with the location from which they were taken. Measure infinite resistance across the test points as a check against filament wiring shorts.
J8-B to ground	Infinite	Same as above.
J8-A to J8-B	Infinite	Same as above. Replace tubes in sockets from which they were removed.

b. Bench Test Setup.

(1) Bench testing of rf detector is required when interunit tests indicate that failure of system operations is caused by a malfunction within the unit.

(2) The following test equipment is required:

Federal stock No.	*Equipment*	*References*
6625-553-0142	Multimeter TS-352B/U	TM 11-6625-366-15
6625-643-1670	Voltmeter, Electronic ME-30B/U	TM 11-6625-320-12
6625-783-5965	Generator, Signal AN/URM-127	TM 11-6625-683-15
6625-911-6368	Counter, Electronic Digital Readout AN/URM-207	TM 11-6625-700-10
6625-228-2201	Oscilloscope AN/USM-281A	TM 11-6625-1703-15
NSN	Phase shift network (locally fabricated)	Fabricate as directed in figure 4-17, TM 11-5825-231-25
5825-914-8831	Power Supply PP-4482/TRD	TM 11-5825-231-25
6625-868-8353	Generator, Signal AN/GRM-50	TM 11-6625-573-15
5950-235-2086	Transformer, Power, Variable CN-16/U	
6625-868-8352	Generator, Signal AN/URM-103	TM 11-6625-586-12
5820-069-8915	Receiver, Radio R-725/URR	TM 11-5825-231-25

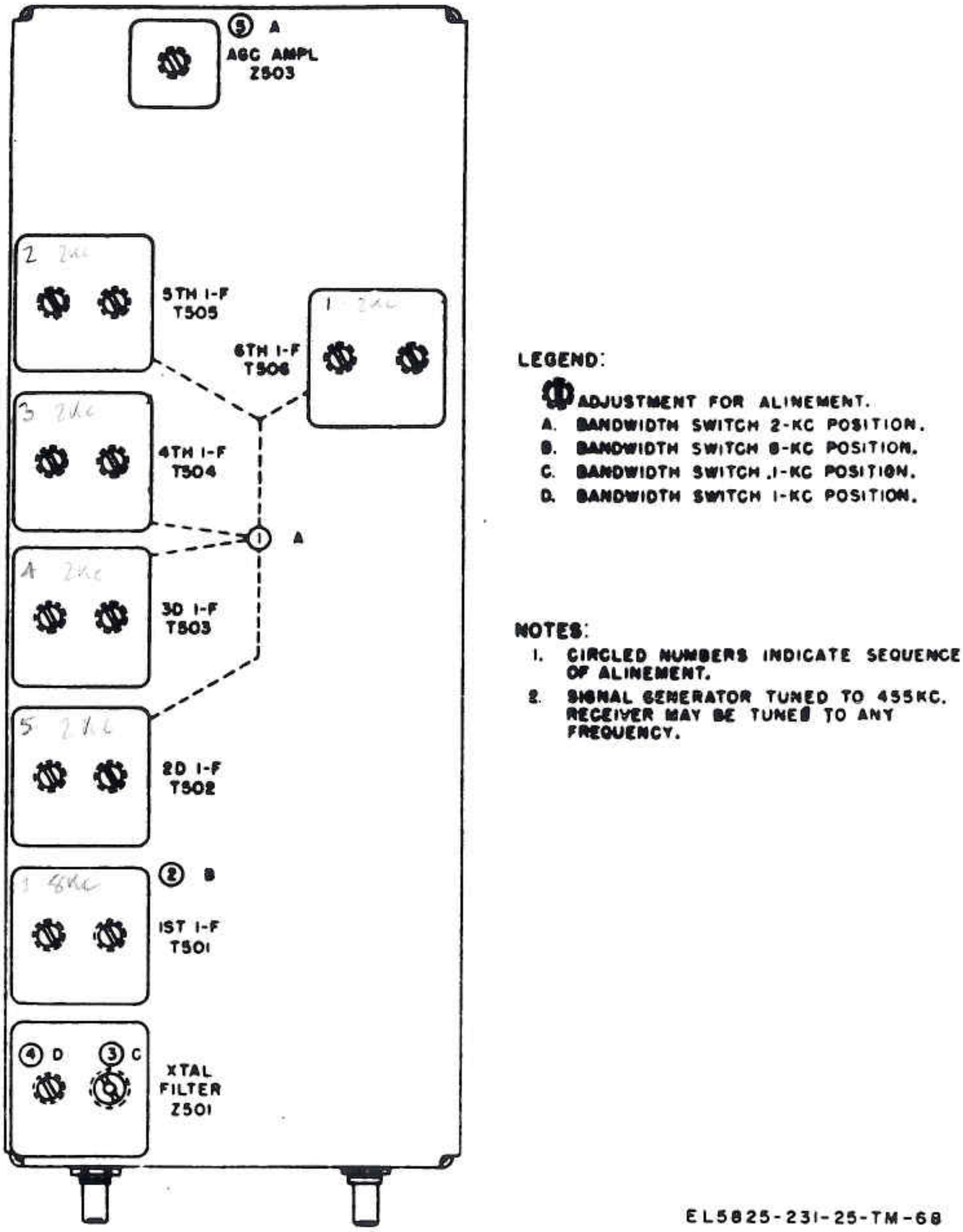


Figure 4-49. If. subchassis, alignment chart.

b. Alignment Test Setup and Control Settings.

(1) Connect Radio Receiver R-725/URR as shown in figure 4-50. Use the variac to maintain the supply at 115 volts ac.

(2) Before performing the alignments, allow the receiver to warm up for 1 hour minimum.

(3) Connect the signal generator to test point E211 (control grid of third mixer tube V204).

(4) For an output meter, connect the

unded lead of the dc vtvm to the receiver assis, and connect the other lead to DIODE)AD terminal 14 of the rear terminal strip. Set e function switch of the dc vtvm for measur- g negative dc voltage.

(5) Set the receiver BANDWIDTH KC itch to .1, RF GAIN control to 10, BFO switch OFF, and FUNCTION switch to MGC.

:. *Alignment procedure.* Tune the rf generator 455 kHz (unmodulated); then adjust its fre- ency control for peak reading on the dc vtvm. obtain a peak reading, it may be necessary to t the attenuation of the signal generator for gh amplitude output signal (3 volts). If no ading on the dc vtvm is obtained, perform the ocedure in *d* below.

l. Approximate Alignment.

(1) Tune the rf generator to 455 kHz and set e attenuator for full output. Turn the receiver ANDWIDTH switch to 16 kHz. If the output ading is not yet obtained, proceed with (2) be- w. If it is obtained, adjust the cores of trans- mers T506 through T501 and T208 in that der, for peak reading on the dc vtvm. Then, set e receiver BANDWIDTH KC switch at the t lower position, and repeat the adjustment the transformer cores for peak output. Repeat is procedure for each setting of the ANDWIDTH KC switch until peak output is tained at .1 position of the switch; then pro- ed to *e* below.

NOTE

The frequency will decrease as the slugs are screwed further into the coils, and will increase as the slugs are withdrawn.

(2) Perform the procedures outlined below only when the transformer cores have been displaced greatly from their normal positions within the coils. Set the receiver BANDWIDTH KC switch to 2 and proceed as follows:

(*a*) Tune the rf generator to 455 kHz and set the attenuator for maximum output. Remove sixth if. amplifier tube V506, and wrap a thin wire lead around pin 1 (grid). Replace the tube, and connect the other end of the lead to the rf generator output.

(*b*) Adjust the cores of transformer T506 for peak reading on the dc vtvm.

(*c*) Apply the dc generator output to fifth if. amplifier V505 the same way as for V506 (*a* above), and adjust the cores of transformer T505 for maximum indication on the dc vtvm.

(*d*) Repeat the above procedure for each remaining set of if. tubes and transformers in the following order: V504 and T504, V503 and T503, V502 and T502, V501 and T501, and V204 and T208.

(*e*) Set the receiver BANDWIDTH KC switch to .1 and proceed as outlined in *e* below.

e. If. Alignment.

NOTE

Resistors R519, R520, R521, and R561 have the following nominal values: R519—1 K ohm; R520—3.3 K ohm; R521—3.9 K ohm; and R561—2.7 K ohm. These resistors directly affect bandwidth and gain, and their values may have to be changed later in the test procedure (*i* below).

(1) Connect the rf generator output to test point E211 and set the rf generator frequency at

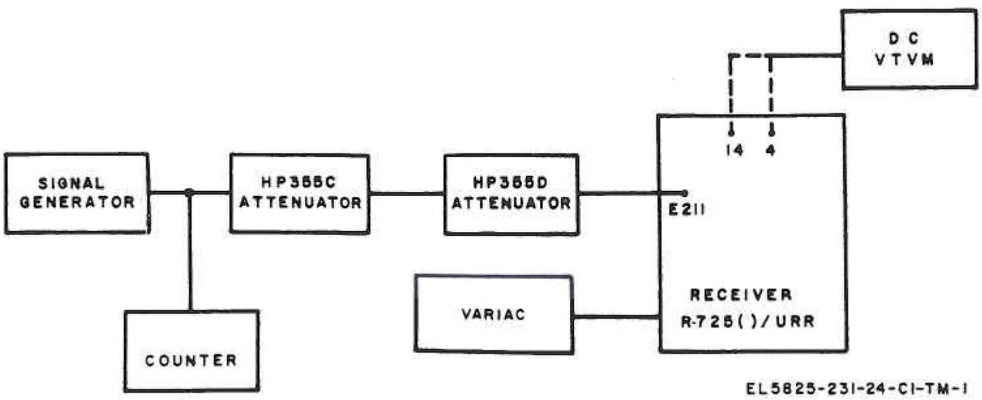


Figure 4-50. Radio Receiver R-725/URR, test setup, alignment.

455 kHz. Carefully tune the rf generator to the exact frequency required to obtain peak output reading on the dc vtvm. While adjusting the rf generator attenuator to maintain an output of approximately 6 volts (as read on the dc vtvm). Do not disturb this frequency setting while performing the instructions in (2), (3), and (4) below. Check the setting repeatedly to make sure it has not changed.

(2) Set the receiver BANDWIDTH KC switch to 2.

(3) Adjust the cores of transformers T506, T505, T504, T503, T502, and T208, in that order, for peak output reading, while continuously adjusting the attenuator of the signal generator to maintain a reading of approximately 6 volts on the dc vtvm. Repeat these adjustments until no further increase in output is noticeable.

(4) Change the setting of the receiver BANDWIDTH KC switch to 8, and adjust the cores of transformer T501 for maximum output. Repeat the adjustment of cores until no further increase in output can be produced.

(5) Return the receiver BANDWIDTH KC switch to .1.

f. Phasing Capacitor Adjustment.

(1) Set the rf generator attenuator for a reading of approximately 6 volts on the dc vtvm and note the attenuator setting. Increase the output 60 db above this setting and decrease the generator frequency until 6 volts is again obtained on the dc vtvm.

(2) Adjust the phasing capacitor in crystal filter Z501 for a minimum dc vtvm reading, and note the position of the capacitor slot.

(3) Tune the signal generator to the high side of the center frequency as required to obtain 6 volts on the dc vtvm.

(4) Adjust the phasing capacitor for minimum reading, and note the position; then set the capacitor approximately halfway between the two settings. To avoid incorrect readings, caused by tuning through the positions of minimum or maximum capacitance, the two settings for minimum or maximum capacitance, the two settings for minimum output must be less than 45° apart.

g. Crystal Filter Adjustment.

(1) With the receiver BANDWIDTH KC switch at .1, tune the rf generator to obtain peak output.

(2) Set the BANDWIDTH KC switch to 1. Adjust the core of the tuning coil in crystal filter Z501 until the frequency reading required for obtaining peak output corresponds exactly with the frequency reading required for peak output with the receiver BANDWIDTH KC switch at .1. Retune the rf generator, and alternately change positions of the BANDWIDTH KC switch as required to complete this adjustment.

h. Agc Adjustment.

(1) Set the receiver BANDWIDTH KC switch to .1, and tune the rf generator for maximum output as described in *e* above. Do not disturb this frequency setting during the adjustment of the agc tuning circuit in the steps in (2), (3), and (4) below.

(2) Disconnect the dc vtvm lead from terminal 14 of the rear terminal strip, and connect it to terminal 4 of the rear terminal strip.

(3) Set the receiver FUNCTION switch to AGC and the BANDWIDTH KC switch to 2.

(4) Adjust the core of Z503 for a maximum voltage reading on the dc vtvm while adjusting the rf generator attenuator to maintain a peak reading of approximately 2 volts. When the adjustment is completed, reconnect the meter to terminal 14 (diode load).

i. Resistor Selection (fig. 4–50).

(1) Switch the receiver BANDWIDTH KC switch to .1, 1, 2, 4, 8, and 16 and observe the output reading on the dc vtvm. If the output changes by more than 10 db, the corresponding resistor must be reselected to maintain the overall gain of the if.

(2) The resistors affecting the corresponding bandwidths are as follows:

R519:	8 kHz
R520:	4 kHz
R521:	0.1 kHz, 1 kHz, 2 kHz
R561:	0.1 kHz

j. Overall Gain Adjustment.

(1) Connect equipment as shown in figure 4–51 and set the controls as follows:

Control	*Setting*
Rf generator:	
Frequency	4.0 MHz
Output level	1.0 to 4.0 uV
Mode	CW
Receiver:	
FUNCTION	MGC
BANDWIDTH KC	8
RF GAIN	Maximum cw

(2) Tune the receiver ANT TRIM control for maximum as read on the dc vtvm. This reading shall be 7 volts minimum.

(3) If the above reading of 7 volts is not obtained, adjust R62.

k. If. Selectivity.

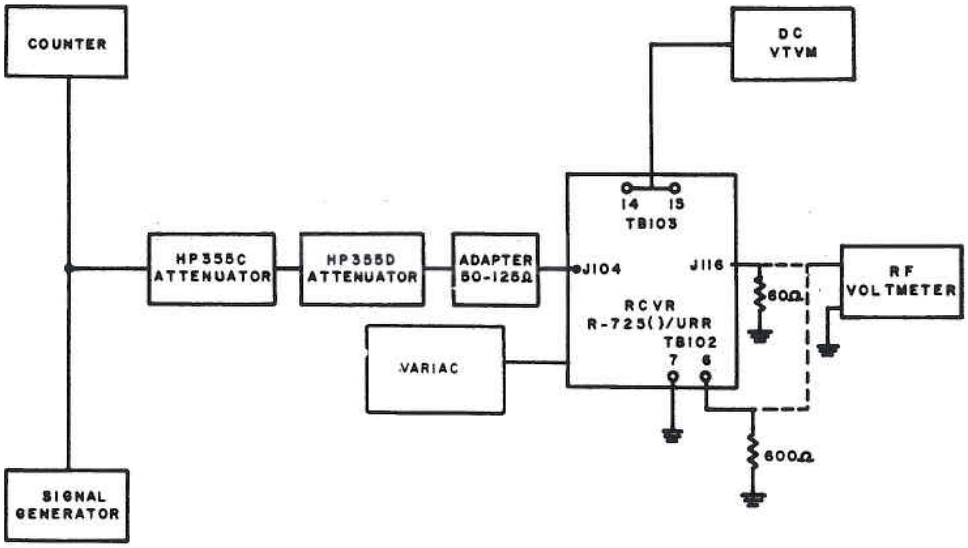


Figure 4-51. Radio Receiver R-725/URR, gain test setup.

(1) Using the test setup in figure 4-51, set controls as follows:

Control	*Setting*
Rf Generator:	
Output level	0.3 V
Frequency	550 kHz
Attenuators	70 db minimum
Receiver:	
FUNCTION	MGC
BANDWIDTH KC	.1 position
RF GAIN	Maximum
Dc vtvm	.1 V position-connected to terminal 14

(2) Tune the receiver for a maximum output as read on the dc vtvm.

(3) With the dc vtvm in the 0.1-volt range (-20 dbm), insert additional attenuation and reduce the receiver RF GAIN control to obtain 0 db on the voltmeter scale. Check the output for overload by observing that 1 db attenuation of input level results in 1 db decrease in output level as indicated by the dc vtvm.

NOTE

If an overload is observed, the receiver RF GAIN must be decreased until the overload condition is removed as determined by (3) above.

(4) Tune rf generator to the low side of center frequency until the output on the dc vtvm decreases by 6.0 db and note this frequency. Repeat this procedure on the high side of center frequency and note the results.

(5) The difference between the two frequencies noted in (4) above shall be between 0.1 kHz and 0.18 kHz. If not, R561 must be reselected.

(6) Remove 60 db of attenuation and tune the generator to the low side of center frequency until the output read on the dc vtvm indicates 0 db. Note this frequency. Repeat this procedure on the high side of center frequency and note the result.

(7) The difference between the two frequencies noted in (6) above shall be a maximum of 5.4 kHz. If not, R561 must be reselected.

(8) Repeat the steps in (4) and (6) above for the 1 position. The limit for the 6-db bandwidth is 0.9 kHz minimum to 1.5 kHz maximum and the 60-db measurement shall be a maximum of 7.2 kHz. If the bandwidths do not meet those specifications, adjust the core of T501.

(9) Repeat the steps in (4) and (6) above for the 2.0 kHz position. The limit for the 6-db bandwidth is 1.7 kHz minimum to 2.5 kHz maximum and the 60-db measurement shall be a maximum of 9.5 kHz. If the bandwidths do not meet these specifications, R521 must be reselected.

(10) Tune the rf generator to 4.4 MHz, and with the receiver BANDWIDTH KC switch at 4, tune the receiver for maximum output, using the dc vtvm as a tuning indicator.

(11) Repeat the steps of (4) and (6) above for the 4.0 kHz position. The limit for the 6-db bandwidth is 3.2 kHz to 4.6 kHz and the 60-db measurement shall be a maximum of 11.0 kHz. If the bandwidths do not meet these specifications, R520 must be reselected.

(12) Repeat the steps of (4) and (6) above for the 8 position. The limit for the 6-db bandwidth is a maximum of 11.5 kHz and the 60-db measurement shall be a maximum of 22.0 kHz.

(13) Repeat the above procedure for the 3-db points with the limit of a minimum of 6.6 kHz frequency difference.

NOTE

If the bandwidths for the 8 position are not within specification, R519 must be reselected or T501 stagger-tuned. In the case of stagger tuning, refer to the procedure in (14) through (20) below.

(14) Refer to figure 4–51, and set the controls as follows:

Rf generator	Setting
Frequency	4.4 MHz
Output	0.3 V (0 dbm or higher)
Attenuator	70 db minimum

Receiver	
FUNCTION	MGC
BFO	OFF
BANDWIDTH KC	8
RF GAIN	————
Dc vtvm	Connected to terminal 14

(15) Tune the receiver to maximum output as indicated on the dc vtvm, and with the meter in the 0.1-volt range (–20 dbm), insert additional attenuation and reduce RF GAIN control to obtain 0 db reference on the dc vtvm.

(16) Check output for overload as in (3) above.

(17) Tune the rf generator to the low side of center frequency until the dc vtvm reading decrease 3.0 db and note this frequency. Repeat this procedure for the high side of center frequency. The difference between the two frequencies is the 3-db bandwidth.

(18) If the bandwidth is too narrow (the limit is 6.6 kHz minimum), stagger tuning is accomplished by slightly tuning T501 to meet the bandwidth and peak-to-valley requirements.

(19) Turn the receiver BANDWIDTH KC switch to the 16 and check bandwidth as before. The limit for the 3-db points is a minimum of 10.0 kHz; the limits for the 6-db points is a maximum of 17.0 kHz; and the limit for the 60-db points is a maximum of 31.0 kHz.

(20) Check the peak-to-valley ratio by slowly tuning the signal generator through the 6-db bandpass and looking for maximum and minimum indications on the dc vtvm. The peak-to-valley difference will be 4 db maximum.

l. If. Output Characteristics.

(1) Refer to figure 4–51, and set the equipment as follows:

Rf generator	Setting
Frequency	1.55 MHz
Function	CW
Output	3 microvolts

Receiver	
BANDWIDTH	8

Receiver	
BFO	OFF
FUNCTION	MGC
RF GAIN	Maximum

Attenuators set for 0 db
Dc vtvm connected to terminal 14

(2) Tune receiver for maximum output as indicated by the dc vtvm, and turn receiver FUNCTION switch to AGC.

(3) There will be a minimum reading of 20 millivolts. If not, readjust R62.

(4) Switch receiver FUNCTION switch to MGC and adjust the rf GAIN control for a 20-millivolt reading on the dc vtvm.

(5) Set the rf generator output to 30 microvolts and observe that the dc vtvm now reads from 170 millivolts to 230 millivolts.

m. Am. Sensitivity.

(1) Connect the equipment as shown in figure 4–51 with the RF voltmeter connected to TB102, pins 6 and 7.

(2) Set the receiver controls as follows:

FUNCTION	MGC
BANDWIDTH	8
BFO	OFF
KILOCYCLE CHANGE	16 MHz

(3) Set rf generator to 16 MHz at an output of 3.3 microvolts, 30 percent 400-Hz modulation.

(4) Adjust the receiver LOCAL GAIN control for a reading of 0 db on the RF voltmeter and then turn the rf generator modulation off and note the db difference as indicated on the meter. This will be a minimum of 10 db.

n. Bfo Operation.

(1) Using the same test setup as in *m* (1) above, turn the rf generator modulation off and turn the receiver BFO switch to ON.

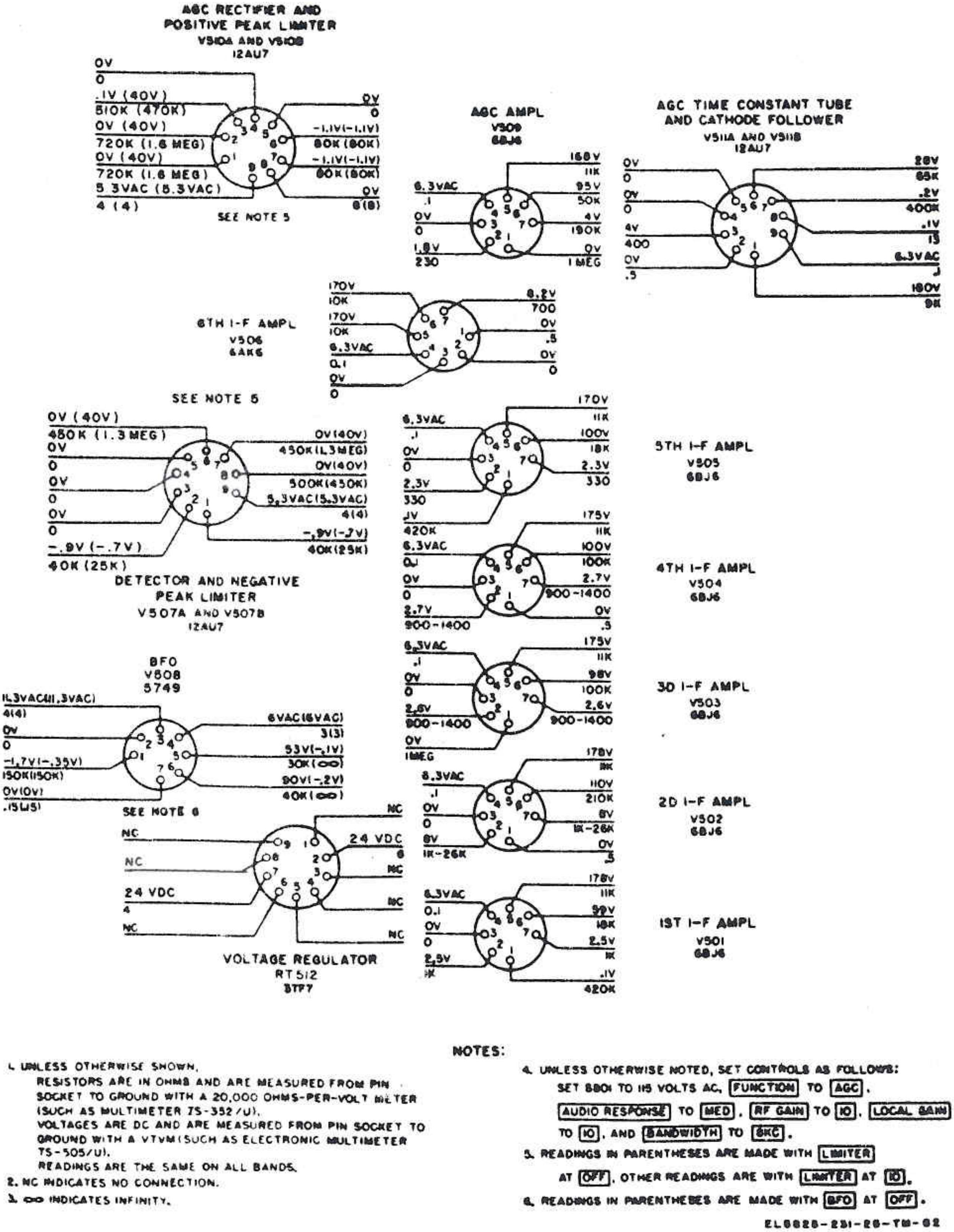
(2) Connect a headset or speaker to J102 (PHONES). The tone frequency should change as the BFO PITCH CONTROL is rotated.

4–27. Rf Detector Alignment

The alignment procedures for the rf detector should be performed for each section of the circuitry when a component in that circuit has been repaired or replaced.

a. Test Equipment Required. Refer to paragraph 4–3 for common names.

R-725



NOTES:

1. UNLESS OTHERWISE SHOWN,
   RESISTORS ARE IN OHMS AND ARE MEASURED FROM PIN SOCKET TO GROUND WITH A 20,000 OHMS-PER-VOLT METER (SUCH AS MULTIMETER TS-352/U).
   VOLTAGES ARE DC AND ARE MEASURED FROM PIN SOCKET TO GROUND WITH A VTVM (SUCH AS ELECTRONIC MULTIMETER TS-505/U).
   READINGS ARE THE SAME ON ALL BANDS.
2. NC INDICATES NO CONNECTION.
3. ∞ INDICATES INFINITY.
4. UNLESS OTHERWISE NOTED, SET CONTROLS AS FOLLOWS:
   SET 8801 TO 115 VOLTS AC, FUNCTION TO AGC, AUDIO RESPONSE TO MED, RF GAIN TO 10, LOCAL GAIN TO 10, AND BANDWIDTH TO 8KC.
5. READINGS IN PARENTHESES ARE MADE WITH LIMITER AT OFF. OTHER READINGS ARE WITH LIMITER AT 10.
6. READINGS IN PARENTHESES ARE MADE WITH BFO AT OFF.

EL5825-231-25-TM-62

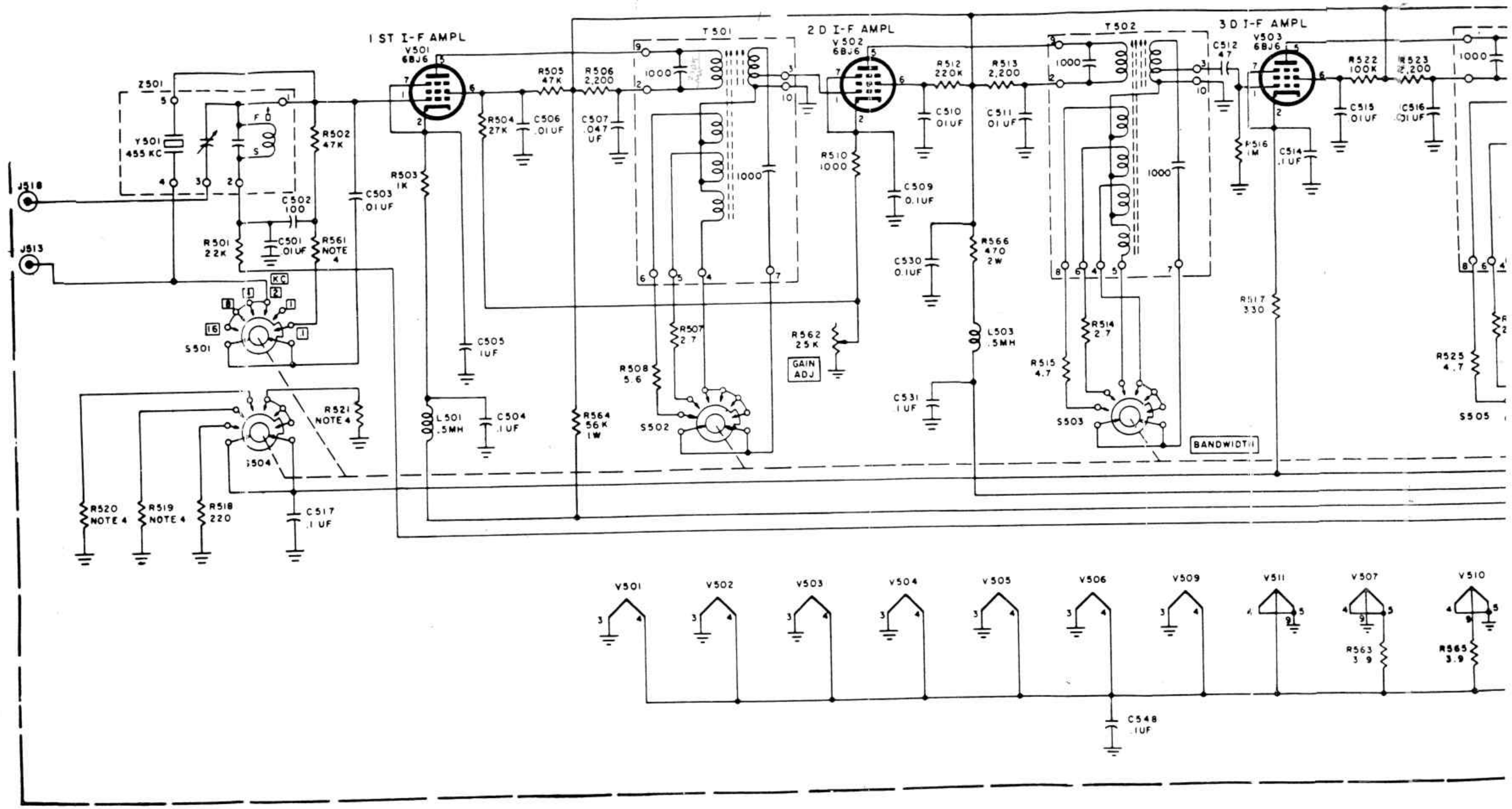
Figure 6-10. If. subchassis, vr measurements.

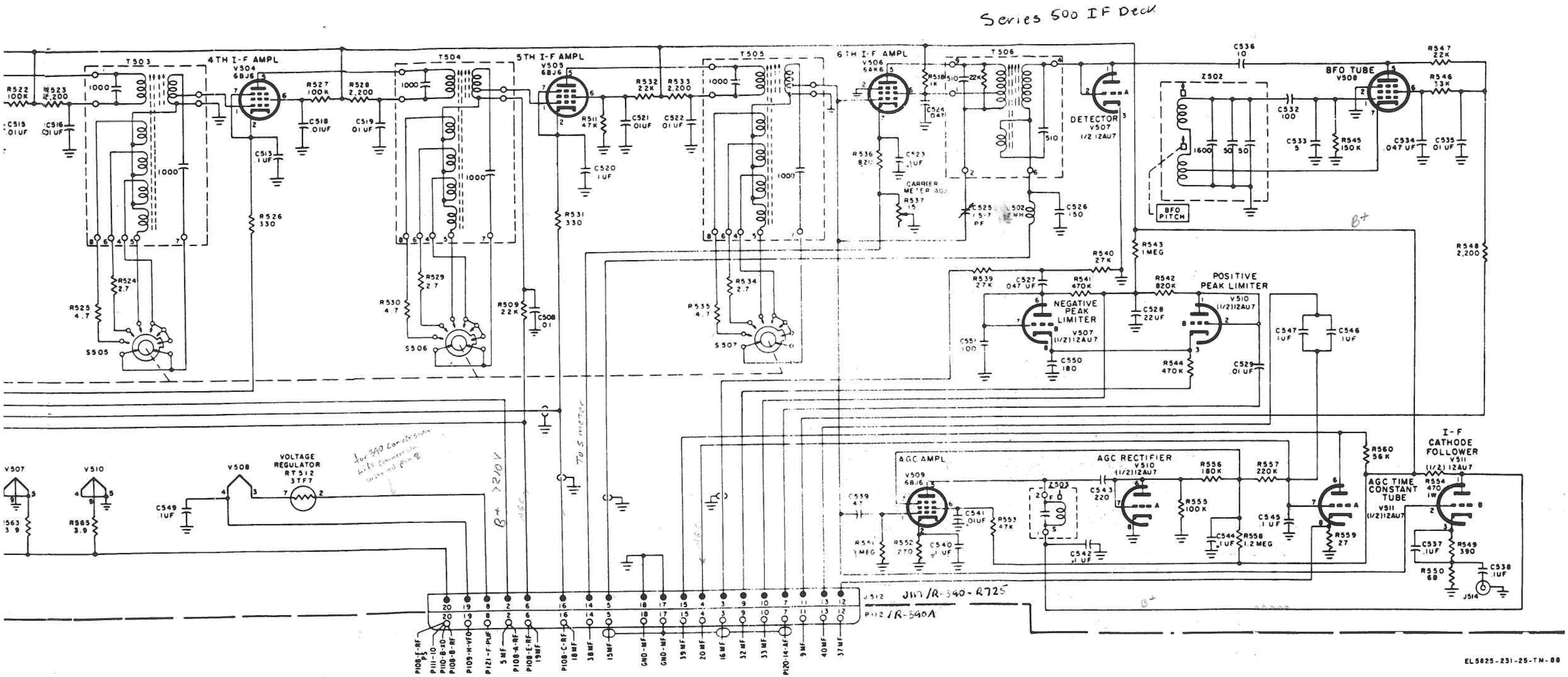
IF DECK

390 390A

J526 P218

J525 P213





FO-4. If. subchassis, schematic diagram