

Mobile Communication Equipment

ML
1000

Transmitter/Receiver Unit Tuning Instructions

Standard & Options Housing
150 MHz Band

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TABLE 1. TECHNICAL DATA

TRANSMITTER/RECEIVER

Power Output (EIA-RS152A)

1 & 2.5 Watts, Intermittent Duty (PA MI-559531)
 25/35 Watts, Intermittent Duty (PA MI-559435, -1)
 70 Watts, Intermittent Duty (PA MI-559436-A)
 110 Watts, Intermittent Duty (PA MI-559810, -A)

Multi-frequency Operation

Standard: 1 to 4 frequencies

Power Requirements

Receiver, Squelched (Standby): 240-370 mA @ +13.8VDC

Receiver, Unsquelched (Receive - 10W output): 1.36-2.04 A @ +13.8VDC

Transmit:

PA MI-559531:	640 mA @ +13.8 VDC	(1 & 2.5 watts output)
PA MI-559435, -1:	6-8 A @ +13.6 VDC	(24/35 watts output)
PA MI-559436-A:	16-18 A @ +13.4 VDC	(70 watts output)
PA MI-559810, -A:	26-28 A @ +13.4 VDC	(110 watts output)

Polarity: Negative ground only

Impedance

Antenna: 50 ohms, nominal
 Microphone: 1000 ohms, nominal

Carrier Frequency Range

Commercial: 148 - 174 MHz
 Government: 132 - 148 MHz

TRANSMITTER

TCXO Frequency Range

Oscillator Freq. = $\frac{\text{Carrier Freq.}}{12}$

Frequency Stability (-30°C to +60°C)

Standard: +0.0005%
 Optional: \pm 0.0002%

Frequency Deviation

Rated: +5kHz @ 1.0 VRMS Input
 Maximum: over 7kHz

Audio Response

Within +1dB and -3dB of 6dB/octave pre-emphasis characteristic from 300 to 2500 Hz with 6dB roll-off above 2500 Hz

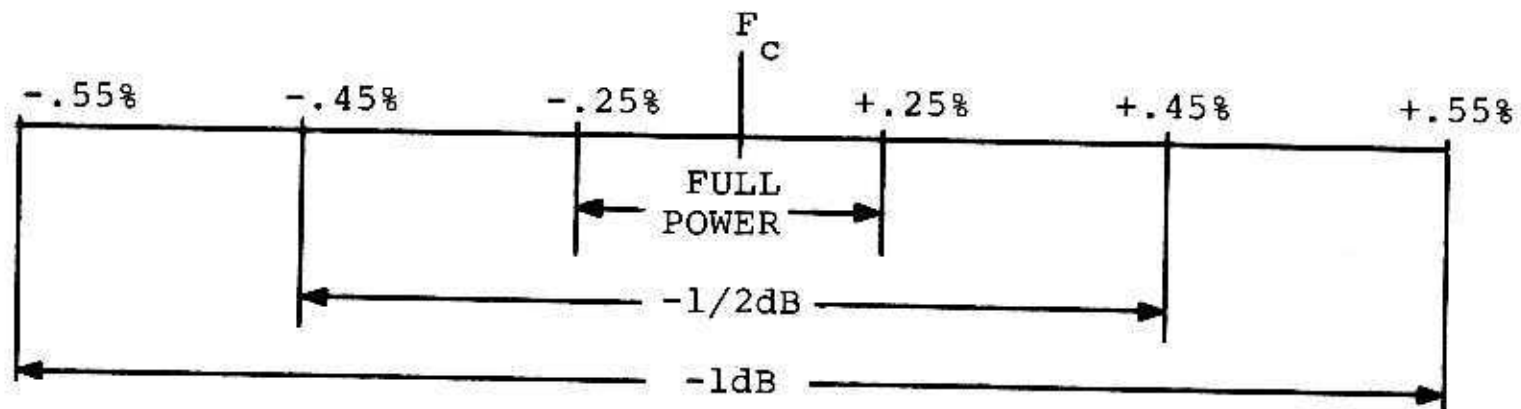
Audio Distortion

Less than 2% at 60% deviation

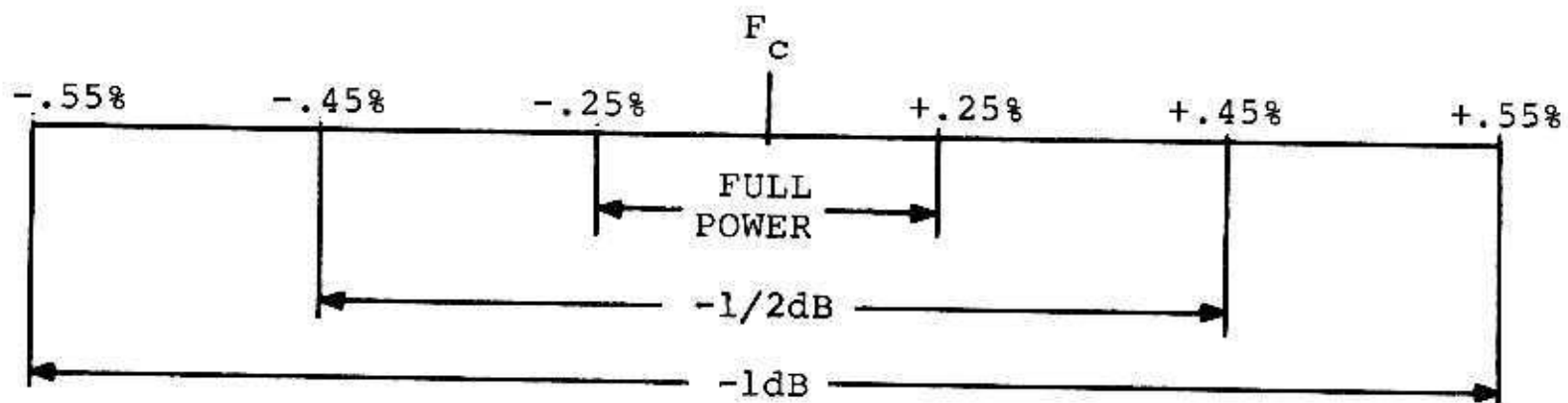
TABLE 1. TECHNICAL DATA (Continued)

AM Hum and Noise	FM Hum and Noise			
-50dB	-70dB			
Spurious Emissions				
	PA MI-559531	PA MI-559435,-1	PA MI-559436-A	PA MI-559810,-A
Conducted:	-60dB	-70dB	-85dB	-85dB
Radiated:	-60dB	-60dB	-65dB	-82dB
Duty Cycle (EIA RS 152-A)				
Continuous duty capability				
Intermittent rating - 20% duty cycle				
Output Matching Range				
2:1 VSWR				
Multi-Channel Spacing (% Fc)				
<p>Power Level Degradation PA-MI-559531 (1W/2.5W)</p>				
<p>Power Level Degradation PA MI-559435, -1 (25/35W)</p>				

TABLE 1. TECHNICAL DATA (Continued)



Power Level Degradation
PA MI-559436-A
(70W)



Power Level Degradation
PA MI-559810, -A
(110W)

RECEIVER

Channel Spacing

30kHz

Impedances

Speaker: 8 ohms, nominal
Antenna: 50 ohms, nominal

TCXO (First Local Oscillator) Frequency Range

Commerical:

Oscillator Freq. = $\frac{\text{Carrier} - 6.7 \text{ MHz}}{9}$

15.7 to 18.9 MHz

Government:

= $\frac{\text{Carrier} + 6.7 \text{ MHz}}{9}$

15.4 to 17.2 MHz

Intermediate Frequency

6.7 MHz High IF
455 kHz Low IF

Second Oscillator Frequency (Crystal Controlled)

7.155 MHz $\pm 0.006\%$

$$175.43 T = 15.414444$$

$$144.83 R = 15.347777$$

$$146.88 T = 15.575555$$

$$146.28 R = 15.508888$$

TABLE 1. TECHNICAL DATA (Continued)

Audio Frequency Response

Audio frequency will not deviate more than +1dB to -8dB from a standard 6dB per octave de-emphasis curve over the frequency range of 300 Hz to 3000 Hz, with a reference frequency of 1000 Hz.

Audio Output (5% Distortion Max.)

10 watts (8-ohm load)

Residual Hum and Noise

Unsquelled: -45dB min.
Squelled: -70dB min.

Spurious Response Attenuation
Better than -100 dB min.

Sensitivity

20dB Quieting	0.50uV
Usable (SINAD).	0.35uV
Threshold Squelch	0.25V
Tight Squelch	0.50uV

Selectivity

20dB Quieting: -100dB at ± 15 kHz
EIA Method: -85dB at adjacent channel (30kHz)

INTRODUCTION

This Instruction Book contains TRANSMITTER TUNING and RECEIVER ALIGNMENT procedures for the 150 MHz Band, Series ML1000, Mobile Transmitter/Receiver Unit. The procedures herein, cover all power levels within the 150 MHz band and applies to both dash and trunk mount versions of mobile units. Additionally, adjustment information is provided on optional equipment which is directly wired to, and housed within, the T/R Unit proper.

Refer to Table 1 for detailed TECHNICAL DATA on the 150 MHz Band Mobile T/R Unit. Complete servicing information, including exploded views and replacement parts, is provided in a separate instruction book (see System Index).

TUNING INSTRUCTIONS

GENERAL

The general test setup for a T/R unit is shown in Figure 1. Additional test connections are described in the text of the procedures. Note that T/R Units equipped with an options housing require different test meter connections than a standard unit. Where applicable, a second entry for these socket connections (for adjusting options housing units) is provided in the "Meter Switch" column of the procedures. All other metering specified in the procedures is identical for both standard and options housing units. These procedures are applicable to the following Series ML1000 Mobile Equipment listed in Table 2.

TABLE 2. EQUIPMENT COVERED

Basic Unit	Dash Mount T/R Unit				
		MI-559951 3727253-501 (25W)	MI-559951-A 3727253-502 (35W)	MI-559951-B 3727253-514 (2.5W)	
Power Amplifier	MI-559935 3457885-501	MI-559435-1 3457885-503	MI-559531 3720790-501		
Receiver/Exciter	MI-559959 3727254-501	MI-559959 3727254-501	MI-559959 3727254-501		
Basic Unit	Trunk Mount T/R Unit				
	MI-559954 3727253-503 (25W)	MI-559954-A 3727253-504 (35W)	MI-559954-B 3727253-505 (70W)	MI-559954-C*,D** 3727253-506*,507** (110W)	MI-559954-E 3727253-515 (1W/2.5W)
Power Amplifier	MI-5599435 3457885-501	MI-559435-1 3457885-503	MI-559436-A 3720610-503	MI-559810* MI-559810-A** 3723680-501	MI-559531 3720790-501
Receiver/Exciter	MI-559962 3727254-502	MI-559962 3727254-502	MI-559962 3727254-502	MI-559962 3727254-502	MI-559962 3727254-502
* Used on 150-162 MHz range.					
** Used on 162-174 MHz range.					

INITIAL ADJUSTMENTS AND FCC CHECKS

At the time of installation, certain initial adjustments and checks must be performed on the transmitter section to ensure that the equipment is operating in compliance with FCC regulations. As an alternative to performing the entire transmitter tuning procedures at this time, the steps marked with an asterisk need only be performed to ensure proper transmitter operation. Note, however, that the complete transmitter tuning procedures must be performed if the initial adjustments and checks do not bring the transmitter up to performance standards (see Technical Data). An outline of initial adjustments and FCC checks is provided below. In addition to transmitter adjustments, the receiver antenna coil should be peaked, and its frequency should be adjusted to maintain optimum station efficiency.

1. Adjust transmitter frequency.
2. Adjust transmitter power output.
3. Adjust transmitter modulation deviation.

After performing the Initial Adjustment and FCC Checks with the equipment connected to a dummy antenna load, connect the antenna to the system and recheck all adjustments. The station is designed to operate into a nominal antenna impedance of 50 ohms, resistive. If the adjustments are not correct after connecting the system antenna, check antenna system.

RECOMMENDED TEST EQUIPMENT

The following test equipment of Table 3 is required to tune the transmitter and align the receiver. Equipment equivalent to the models indicated may be used.

TABLE 3. TEST EQUIPMENT

Type	Designation
Test Meter or VOM (50uA @ 5000 ohms) with Test Adapter	RCA TM-868, Stock No. 640726 Simpson Model 260 or 270 RCA CX-40 (MI-559234)
Frequency and Deviation Meter calibrated for desired frequency and indicating peak frequency deviation.	Cushman Model CE-2B or CE-3B
Loading RF Wattmeter 2 Watts (Multiplier) 5 Watts (1/2.5-watt PA)	Bird Model 612
In-Line RF Wattmeter 5 Watts (1/2.5-watt PA) 50 Watts (25/35-watt PA) 100 Watts (70-watt PA) 250 Watts (110-watt PA)	Bird Model 43 5-watt element 50-watt element 100-watt element 250-watt element
VTVM	RCA WV-98C (with RF probe)
Center Frequency Alignment Oscillator (CFAO) for use in-multi-frequency units.	RCA Stock No. 643065

TABLE 3. TEST EQUIPMENT (Continued)

Type	Designation
IF Signal and Audio Generator	Hewlett Packard 606A
RF Signal Generator	Measurements FM560 or Marconi TF1066B
Coaxial Adapter	
Low IF discriminator adjust	BNC female jack to phono plug
6.7 MHz IF adjust	BNC female jack to phono plug with series 10K 1/8W resistor
Attenuator, 20dB, 50-ohm	Measurements M342 or Tektronix 011-059
Attenuator, 6dB, 50-ohm	
Receivers with Noise Clipper:	
Impulse Noise Generator	Empire Devices NF-105
Frequency Counter	Hewlett Packard 5245L
Tools Required:	
Phillips Screwdriver	
Hexagonal Alignment tools	
.1 in. across flats for receiver/exciter tuning	RCA No. 424562*
.075 in. across flats for multiplier tuning	
Non-metallic screwdriver	RCA No. 228788*
.1 in. blade for PA tuning	
Long-nose pliers	
* The hexagonal alignment tools are supplied with the T/R unit, clipped to the Mixer/Multiplier Board.	

TRANSMITTER TUNING (Figure 2)

Table 4 provides the transmitter tuning procedures for the Exciter and Multiplier stages. Tables 5 through 8 provide the tuning procedures for the various power amplifiers associated with the 150 MHz band transmitters. Tuning for the 110-watt unit (MI-559810) is limited to setting the input power limit to the final stage. A single control is provided on the assembly for this purpose. Complete tuning for the 110-watt PA is provided in a separate instruction book (see System Index). Should difficulty be experienced in adjusting the DC Control Module associated with PA MI-559531 and MI-559436, refer to the troubleshooting chart of the equipment servicing book (see System Index). Table 9 contains the frequency deviation and transmit TCXO adjustments. These procedures must be performed as a part of the FCC checks.

RECEIVER ALIGNMENT (Figure 3)

Table 10 provides the receiver alignment procedures for the T/R unit.

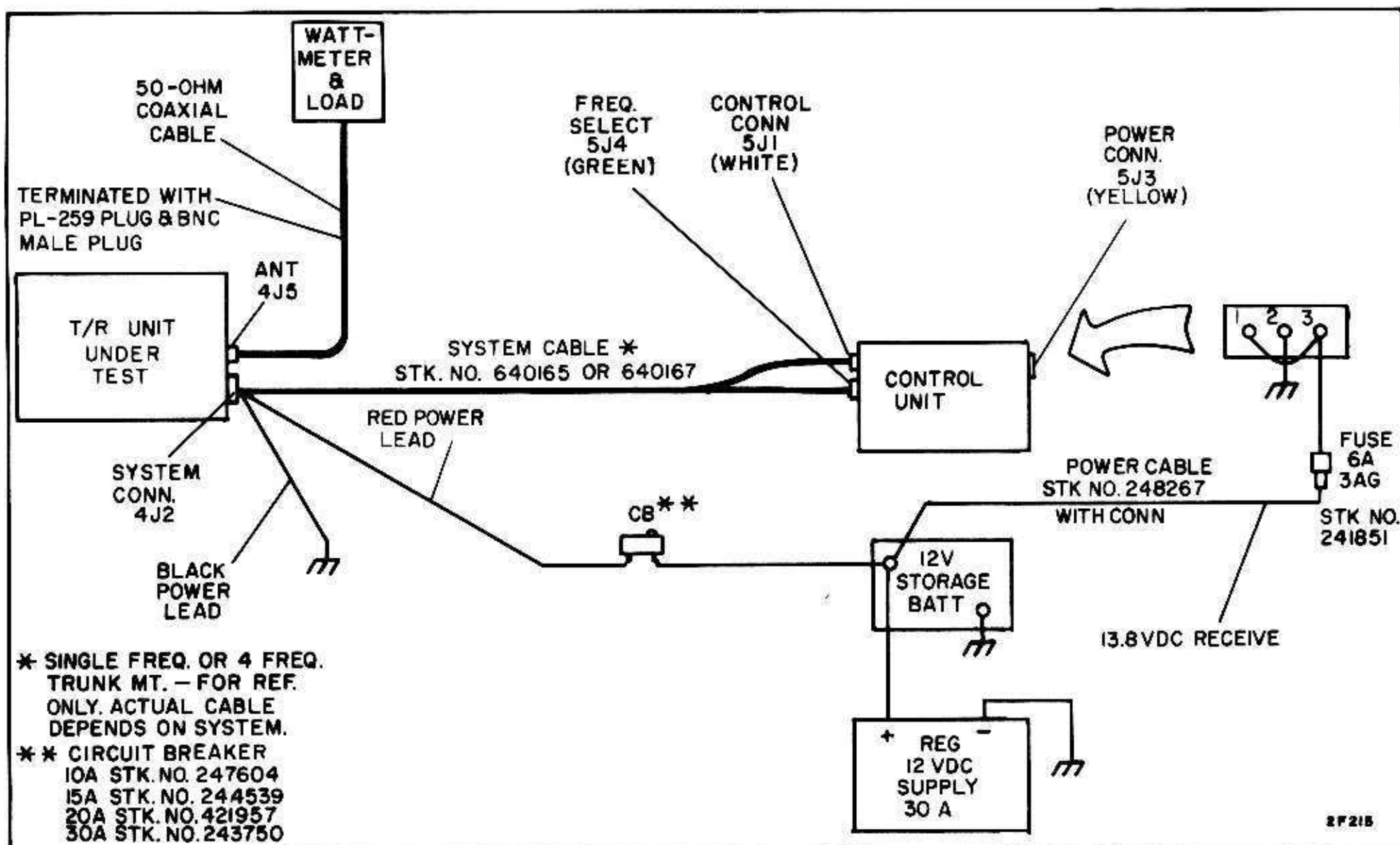


Figure 1. T/R Unit Test Setup

NOTES:

1. FCC rules specify that transmitter tuning must be made by (or under the supervision of) a holder of a current FIRST- or SECOND-CLASS Commercial Radio Operator's License.
2. Prior to performing either the transmitter tuning or receiver alignment procedures, check the 9-volt regulated supply for 9VDC at any wired 9V pin. The supply and adjustment potentiometer is located on the Low IF and Audio Module.
3. The "Typical Readings" of the procedures may vary considerably from one unit to another and may actually fall outside of the tabulated values.

CAUTIONS:

1. Turn off station power before removing modules or components to protect equipment from possible damage. The Control Unit power switch, when in the OFF position, does not remove all DC power from the unit. The system plug must be disconnected from the unit to ensure removal of all power.
2. Solid-state devices in this unit can be permanently damaged if the full-load to no-load voltage regulation and transients exceed a 20% voltage increase of specified input voltage.
3. Do not attempt to tune the transmitter into the antenna system. Tune only into a 50-ohm load to prevent transmitter misadjustment.

TABLE 4. 150 MHz TRANSMITTER TUNING

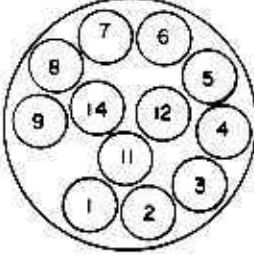
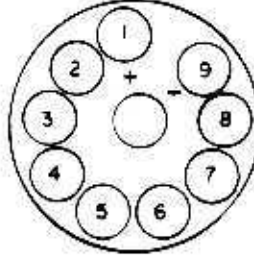
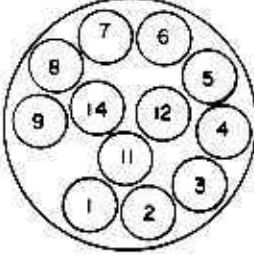
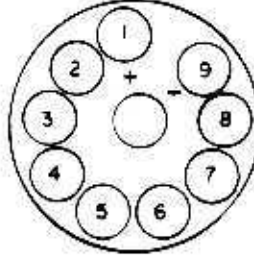
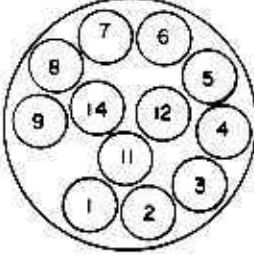
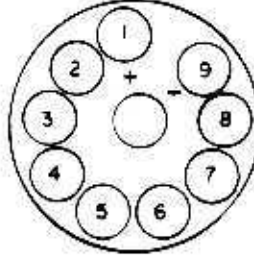
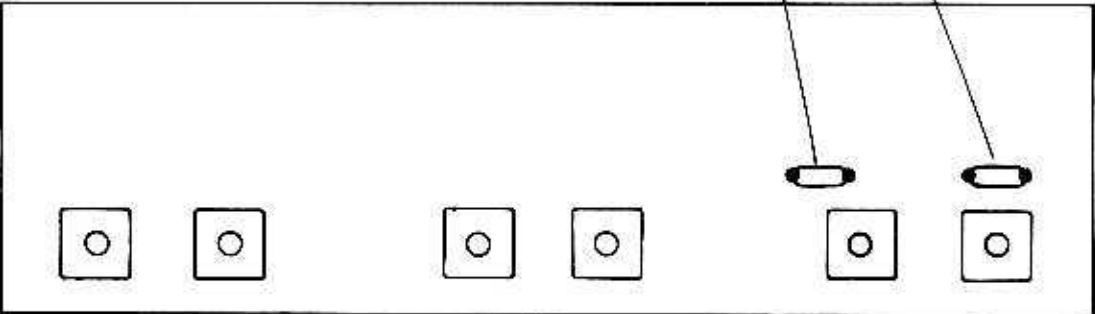
Step	Meter Switch	Typical Reading	Procedure																																																																
			<table border="1" data-bbox="600 394 1928 778"> <thead> <tr> <th data-bbox="607 400 741 484">SWITCH POSITION</th> <th colspan="2" data-bbox="741 400 965 484">7J4 AND 26J2 PIN CONNECTIONS</th> <th data-bbox="965 400 1263 484">7J4 AND 26J2 TOP VIEW</th> <th data-bbox="1263 400 1397 484">SWITCH POSITION</th> <th colspan="2" data-bbox="1397 400 1621 484">7J1 AND 7J8 PIN CONNECTIONS</th> <th data-bbox="1621 400 1928 484">7J1 AND 7J8 TOP VIEW</th> </tr> </thead> <tbody> <tr> <td data-bbox="607 484 741 526">A</td> <td data-bbox="741 484 965 526">14</td> <td data-bbox="965 484 1263 526">12</td> <td data-bbox="965 526 1263 778" rowspan="6">  </td> <td data-bbox="1263 484 1397 526">1</td> <td data-bbox="1397 484 1621 526">1</td> <td data-bbox="1621 484 1928 526">9</td> <td data-bbox="1621 526 1928 778" rowspan="6">  </td> </tr> <tr> <td data-bbox="607 526 741 568">B</td> <td data-bbox="741 526 965 568">11</td> <td data-bbox="965 526 1263 568">5</td> <td data-bbox="1263 526 1397 568">2+</td> <td data-bbox="1397 526 1621 568">2</td> <td data-bbox="1621 526 1928 568">9</td> </tr> <tr> <td data-bbox="607 568 741 610">C</td> <td data-bbox="741 568 965 610">9</td> <td data-bbox="965 568 1263 610">4</td> <td data-bbox="1263 568 1397 610">2-</td> <td data-bbox="1397 568 1621 610">2</td> <td data-bbox="1621 568 1928 610">9</td> </tr> <tr> <td data-bbox="607 610 741 652">D</td> <td data-bbox="741 610 965 652">8</td> <td data-bbox="965 610 1263 652">3</td> <td data-bbox="1263 610 1397 652">3</td> <td data-bbox="1397 610 1621 652">3</td> <td data-bbox="1621 610 1928 652">9</td> </tr> <tr> <td data-bbox="607 652 741 694">E</td> <td data-bbox="741 652 965 694">7</td> <td data-bbox="965 652 1263 694">2</td> <td data-bbox="1263 652 1397 694">4</td> <td data-bbox="1397 652 1621 694">4</td> <td data-bbox="1621 652 1928 694">9</td> </tr> <tr> <td data-bbox="607 694 741 778">F</td> <td data-bbox="741 694 965 778">6</td> <td data-bbox="965 694 1263 778">1</td> <td data-bbox="1263 694 1397 778">5</td> <td data-bbox="1397 694 1621 778">5</td> <td data-bbox="1621 694 1928 778">9</td> </tr> <tr> <td data-bbox="607 778 741 820"></td> <td data-bbox="741 778 965 820"></td> <td data-bbox="965 778 1263 820"></td> <td data-bbox="1263 778 1397 820">6</td> <td data-bbox="1397 778 1621 820">6</td> <td data-bbox="1621 778 1928 820">9</td> </tr> <tr> <td data-bbox="607 820 741 862"></td> <td data-bbox="741 820 965 862"></td> <td data-bbox="965 820 1263 862"></td> <td data-bbox="1263 820 1397 862">7</td> <td data-bbox="1397 820 1621 862">7</td> <td data-bbox="1621 820 1928 862">9</td> </tr> <tr> <td data-bbox="607 862 741 904"></td> <td data-bbox="741 862 965 904"></td> <td data-bbox="965 862 1263 904"></td> <td data-bbox="1263 862 1397 904">8</td> <td data-bbox="1397 862 1621 904">8</td> <td data-bbox="1621 862 1928 904">9</td> </tr> </tbody> </table>	SWITCH POSITION	7J4 AND 26J2 PIN CONNECTIONS		7J4 AND 26J2 TOP VIEW	SWITCH POSITION	7J1 AND 7J8 PIN CONNECTIONS		7J1 AND 7J8 TOP VIEW	A	14	12		1	1	9		B	11	5	2+	2	9	C	9	4	2-	2	9	D	8	3	3	3	9	E	7	2	4	4	9	F	6	1	5	5	9				6	6	9				7	7	9				8	8	9
SWITCH POSITION	7J4 AND 26J2 PIN CONNECTIONS		7J4 AND 26J2 TOP VIEW	SWITCH POSITION	7J1 AND 7J8 PIN CONNECTIONS		7J1 AND 7J8 TOP VIEW																																																												
A	14	12		1	1	9																																																													
B	11	5		2+	2	9																																																													
C	9	4		2-	2	9																																																													
D	8	3		3	3	9																																																													
E	7	2		4	4	9																																																													
F	6	1		5	5	9																																																													
			6	6	9																																																														
			7	7	9																																																														
			8	8	9																																																														
1			<p data-bbox="1205 904 1711 940" style="text-align: center;">TEST SOCKET CONNECTIONS</p> <ol data-bbox="860 954 2063 1612" style="list-style-type: none"> Connect test meter Rec/Exc cable to Test Socket 7J1 (standard housing) or 7J8 (options housing) as indicated in "Meter Switch" column. Connect the transmitter cable to Test Socket 7J4. Connect wattmeter and 50-ohm load of appropriate wattage to antenna jack. Check DC supply for unit - it should be set to 13.8 ±0.1V DC, measured at any wired A+ pin. Adjust 9V regulator on Low IF and Audio board for 9.0V DC, measured at any wired 9V pin. Temporarily remove transmit TCXO. Key transmitter and adjust 21R8 for 11.3VDC at pin 15 of Voltage Regulator board (located on underside of unit, beneath Multiplier). Replace TCXO. <div data-bbox="936 1803 1944 2178" style="text-align: center;">  </div> <p data-bbox="1218 2410 1688 2447" style="text-align: center;">MULTIPLIER - TOP VIEW</p>																																																																

TABLE 4. 150 MHZ TRANSMITTER TUNING (Continued)

Step	Meter Switch	Typical Reading	Procedure												
			<p>f. Remove the plate over the Multiplier board. Check that the Multiplier board has the following plug-in capacitors. Replace plate.</p> <table border="1" data-bbox="1093 515 2018 702"> <thead> <tr> <th>Freq.</th> <th>24C19 (PF)</th> <th>24C24 (PF)</th> </tr> </thead> <tbody> <tr> <td>136 - 148</td> <td>15</td> <td>10</td> </tr> <tr> <td>148 - 162</td> <td>6</td> <td>7</td> </tr> <tr> <td>162 - 174</td> <td>Not Used</td> <td>Not used</td> </tr> </tbody> </table> <p>g. On multi-frequency units replace F1 TCXO with CFAO (see test equipment table). Set transmitter to F1. If a CFAO is not available, tune on the highest channel frequency. Bandwidth degradation may result from this procedure (see Table 1).</p>	Freq.	24C19 (PF)	24C24 (PF)	136 - 148	15	10	148 - 162	6	7	162 - 174	Not Used	Not used
Freq.	24C19 (PF)	24C24 (PF)													
136 - 148	15	10													
148 - 162	6	7													
162 - 174	Not Used	Not used													
2			<p>EXCITER</p> <p>a. Remove leads from Exciter pins 92 and 93 (gnd) and terminate pins with a 50-ohm wattmeter (2-watt range). As an alternate, terminate pins 92 and 93 with a 50-ohm, 1-watt composition resistor and VTVM (with a RF probe).</p> <p>b. Preset cores of ①, ②, and ③ (top core) to top of forms. Preset bottom core of ③ to bottom of form.</p> <div data-bbox="1041 1618 2033 2186"> </div> <p style="text-align: center;">EXCITER - TEST SETUP</p> <p>c. Peak ① .</p> <p>d. Peak ② .</p>												
	<p>STD OPT 7J1 7J8</p> <p>1 1</p> <p>1 1</p>	<p>10-35uA</p> <p>20-35uA</p>													

TABLE 4. 150 MHz TRANSMITTER TUNING (Continued)

Step	Meter Switch	Typical Reading	Procedure
3	Watt-meter	20mW	<p>e. Peak (3), top and bottom cores, for maximum power output. Repeak (1), (2), and (3)</p> <p>f. Remove load and wattmeter and reconnect pins 92 and 93 of Exciter.</p> <div data-bbox="1182 638 1809 1153" style="text-align: center;"> </div> <p style="text-align: center;">13T4 (3) CORE ADJUSTMENT</p>
			<p>MULTIPLIER</p> <p>a. Remove the feedthru plate over the Multiplier, being careful not to ground feedthru capacitor leads. Remove leads from Multiplier pins 7 (gnd) and 8 and terminate with a 50-ohm wattmeter (2-watt range). As an alternate, terminate pins 7 and 8 with a 50-ohm, 1-watt composition resistor and VTVM (with RF probe).</p> <p>b. Preset cores of (4) through (9) to top of forms.</p> <div data-bbox="985 1889 1982 2366" style="text-align: center;"> </div> <p style="text-align: center;">MULTIPLIER - TEST SETUP</p>

TABLE 4. 150 MHZ TRANSMITTER TUNING (Continued)

Step	Meter Switch	Typical Reading	Procedure
4	STD OPT.		
	7J1 7J8		
	6 2+	15-35uA	c. Dip (4) .
	7J4		
	A 3	20-30uA	d. Peak (5) .
	A 3	20-40uA	e. Repeak (3) through (5) .
	A 3	20-35uA	f. Dip (6) (may be slight dip).
	B 4	20-40uA	g. Peak (7) , then peak (6) .
	B 4	20-40uA	h. Dip (8) (may be slight dip).
	Watt-meter	110-115mW	i. Alternately peak (9) and (8) for maximum power output. j. Remove load and wattmeter and reconnect leads to pins 7 and 8 of Multiplier. Replace feedthru plate.
			POWER AMPLIFIER
			Proceed to the appropriate table for tuning the power amplifier of the T/R Unit.

TABLE 5. 150 MHz 1W/2.5W PA MI-559531 TUNING

Step	Meter Switch	Typical Reading	Procedure																																			
1*			<p>a. Check that a 5-watt, 50-ohm load and wattmeter is connected to the antenna jack. The wattmeter should be connected as close as possible to the antenna jack, preferably by a connector arrangement rather than a cable.</p> <p>b. Connect the Test Meter Transmitter cable to Test Socket 7J4. For options housing units only, connect Rec/Exc cable to Test Socket 7J8. The proper Test Meter switch position is indicated in the "Meter Switch" column.</p> <p>c. Remove the alignment plate cover from the PA.</p> <p style="text-align: center;">CAUTION</p> <p style="text-align: center;">Use an insulated alignment tool for adjustments. Observe 20% duty cycle.</p> <p>d. Connect the unit to a DC supply capable of providing 13.8VDC at 640 mA.</p>																																			
2			<p>PA TUNING</p> <p style="text-align: center;">NOTE: In earlier version PA's, an adjustment (11) (32R10) may be present. This adjustment is obsolete and is not connected to the circuit. Also, there are no adjustments for tuning locations (10) and (14).</p>																																			
	<table border="0"> <tr> <td>STD</td> <td>OPT</td> <td></td> </tr> <tr> <td>7J4</td> <td>7J8</td> <td></td> </tr> <tr> <td>C</td> <td>5</td> <td>25-50uA</td> </tr> <tr> <td>D</td> <td>6</td> <td>35-45uA</td> </tr> <tr> <td>D</td> <td>6</td> <td>15-40uA</td> </tr> </table>	STD	OPT		7J4	7J8		C	5	25-50uA	D	6	35-45uA	D	6	15-40uA	<table border="0"> <tr> <td></td> <td>2.5W</td> <td>a. Peak (12) .</td> </tr> <tr> <td></td> <td></td> <td>b. Peak (13) .</td> </tr> <tr> <td></td> <td></td> <td>c. Repeak (8) , (9) , (12) and (13) .</td> </tr> <tr> <td>*</td> <td></td> <td>d. Adjust (15) and (16) for 2.5W power output.</td> </tr> <tr> <td>*</td> <td></td> <td>e. Remove the PA case (8 screws) and connect the VOM between 32C13 (plus lead) and 32C17 (common lead) and set to 50uA range.</td> </tr> <tr> <td>*</td> <td>29.7uA (619mA)</td> <td>f. Measure DC collector current, $I_c \text{ (amp)} = \frac{\text{Meter Reading (uA)}}{48}$</td> </tr> <tr> <td>*</td> <td>11.3VDC</td> <td>g. Measure DC collector voltage between 32C17 and ground.</td> </tr> </table>		2.5W	a. Peak (12) .			b. Peak (13) .			c. Repeak (8) , (9) , (12) and (13) .	*		d. Adjust (15) and (16) for 2.5W power output.	*		e. Remove the PA case (8 screws) and connect the VOM between 32C13 (plus lead) and 32C17 (common lead) and set to 50uA range.	*	29.7uA (619mA)	f. Measure DC collector current, $I_c \text{ (amp)} = \frac{\text{Meter Reading (uA)}}{48}$	*	11.3VDC	g. Measure DC collector voltage between 32C17 and ground.
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* For initial adjustment and FCC checks, perform steps with asterisk only.

TABLE 5. 150 MHz 1W/2.5W PA MI-5599531 TUNING (Continued)

Step	Meter Switch	Typical Reading	Procedure
*			<p>h. Calculate DC input power.</p> <p>Example:</p> $29.7\mu\text{A} = 0.619\text{A}$ $0.619\text{A } I_C \times 11.3\text{VDC } I_C = 7 \text{ watts}$
*			<p>i. For 3-watt input (1-watt output) units, adjust (16) CW for 13uA I_C. If 13uA cannot be obtained, adjust (13) CW for I_C.</p> <p>Calculate DC input power.</p> <p>Example:</p> $13\mu\text{A} = 0.271\text{A}$ $0.271\text{A } I_C \times 11.3\text{VDC } V_C = 3 \text{ watts}$
3			<p>ANTENNA SWITCH</p>
			<p style="text-align: center;">CAUTION</p> <p>DO NOT key transmitter during antenna switch adjustments. As a precaution, temporarily remove the transmitter TCXO.</p> <div style="text-align: center;"> </div> <p style="text-align: center;">ANT SW TEST SETUP</p>

TABLE 5. 150 MHz 1W/2.5W PA MI-5599531 TUNING (Continued)

Step	Meter Switch	Typical Reading	Procedure
			<p>a. Disconnect receiver antenna input plug 1P3 from antenna switch jack 32J3 on the PA. Connect a 50-ohm, 1/2 watt composition resistor to 32J3 via 2 inches of RG-58 coaxial cable terminated with a male phono plug.</p> <p>b. Connect a VTVM with RF probe across the resistor.</p> <p>c. Connect a RF signal generator through 6dB, 50-ohm attenuator to the unit antenna jack. Set generator to receive frequency (or to center frequency in multi-channel units), and adjust generator output for 4mV measured at antenna jack.</p> <p>d. Adjust (17) for a maximum VTVM indication.</p> <p>e. Replace transmitter TCXO.</p>
4*			<p>FREQUENCY DEVIATION & TRANSMIT TCXO FREQUENCY</p> <p>See Table 9 for the frequency deviation and transmit TCXO frequency adjustment procedure.</p>

TABLE 6. 150 MHz 25/35W PA MI-559435,-1 TUNING

Step	Meter Switch	Typical Reading	Procedure
1 *			<p>a. Check that a 50-watt, 50-ohm load and wattmeter is connected to the antenna jack. The wattmeter should be connected as close as possible to the antenna jack, preferably by a connector arrangement rather than a cable.</p> <p>b. Connect the Test Meter Transmitter cable to Test Socket 7J4. For options housing units only, connect Rec/Exc cable to Test Socket 7J8. The proper Test Meter switch position is indicated in the "Meter Switch" column.</p> <p>c. Remove the alignment plate cover from the PA.</p> <p style="text-align: center;">CAUTION Use an insulated alignment tool for adjustments. Observe 20% duty cycle.</p> <p>d. Connect the unit to a DC supply capable of providing 13.6VDC at 6 to 8A.</p>
2	<p>STD OPT 7J4 7J8</p> <p>C 5</p> <p>D 6</p> <p>D 6</p> <p>E -</p> <p>* F -</p>	<p>25-50uA</p> <p>10-20uA (35-40uA)</p> <p>10-20uA (40-50uA)</p> <p>10-20uA (35-50uA)</p> <p>Min. 40-50W (30-35W)</p>	<p>PA TUNING</p> <p>NOTE: Preset adjustments only if the PA is severely out of tune or if a frequency change is made outside of the power degradation limits. DO NOT preset control (17) unless parts are replaced in the Antenna Switch circuit.</p> <p>a. Turn adjustments (10) through (16) fully CW until snug.</p> <p>NOTE: "Typical Readings" in parenthesis are for PA MI-559435 only.</p> <p>b. Peak (10) . Then repeak (9) and (8) (Multiplier).</p> <p>c. Peak (11) .</p> <p>d. Repeak (10) and (11) .</p> <p>e. Peak (12) .</p> <p>f. Peak (14) first. Then alternately peak (13) through (16) . Peak (12) for maximum output power with lowest Test Meter indication. If power output exceeds 42W (32W), reduce the regulated voltage with 21R8 until 42 watts (32W) are obtained.</p>

* For Initial adjustment and FCC checks, perform steps with asterisk only.

TABLE 6. 150 MHz 25/35W PA MI-559435,-1 TUNING (Continued)

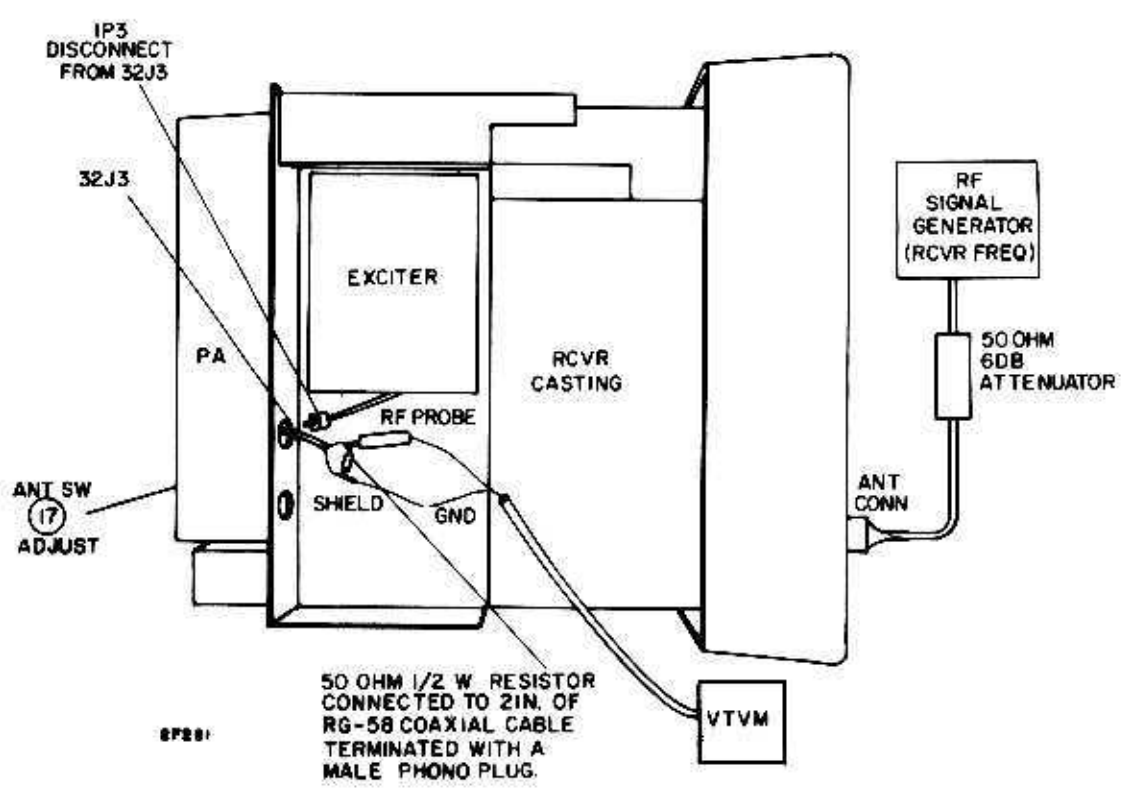
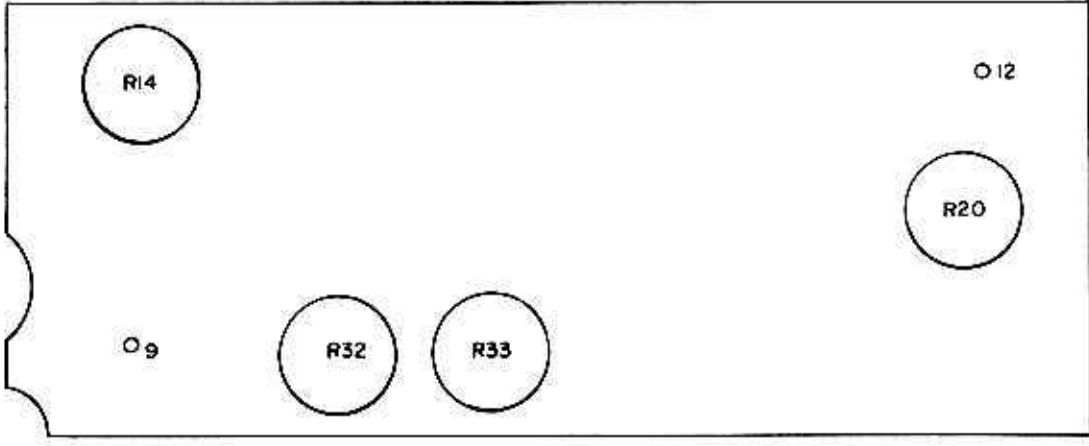
Step	Meter Switch	Typical Reading	Procedure
*	STD OPT 7J4 7J8 F -	29uA or 5.4A (25uA or 4.62A)	<p>g. Repeat step f several times, then repeat steps c through f as necessary to obtain specified power outputs.</p> <p>h. Measure DC collect current. I_c (amp) = $\frac{\text{Meter Reading (uA)}}{5.4}$</p> <p>If meter indication exceeds 29uA (25uA) repeat step f.</p> <p>i. Measure DC collector voltage between pin 6 of 7J4 and ground.</p> <p>j. Calculate DC input power.</p> <p>Example: $29\mu\text{A} = 5.4\text{A}$ $5.4\text{A} I_c \times 13 \text{ VDC } V_c = 70 \text{ watts}$</p>
3		13.0VDC (12.5 VDC)	<p>ANTENNA SWITCH</p>
			<p style="text-align: center;">CAUTION</p> <p style="text-align: center;">DO NOT key transmitter during antenna switch adjustments. As a precaution, temporarily remove the transmitter TCXO.</p> <div style="text-align: center;">  <p style="text-align: center;">ANT SW TEST SETUP</p> </div> <p>a. Disconnect receiver antenna input plug 1P3 from antenna switch jack 32J3 on the PA. Connect a 50-ohm (51-ohm standard) 1/2 watt composition resistor to 32J3 via 2 inches of RG-58 coaxial cable terminated with a male phono plug.</p>

TABLE 6. 150 MHz 25/35W PA MI-559435,-1 TUNING (Continued)

Step	Meter Switch	Typical Reading	Procedure
4*		Max.	b. Connect a VTVM with RF probe across the resistor. c. Connect a RF signal generator through 6dB, 50-ohm attenuator to the unit antenna jack. Set generator to receive frequency (or to center frequency in multi-channel units), and adjust generator output for 0.04 VRMS measured at antenna jack. d. Adjust (17) for a maximum VTVM indication. e. Replace transmitter TCXO.
			FREQUENCY DEVIATION & TRANSMIT TCXO FREQUENCY
			See Table 9 for the frequency deviation and transmit TCXO frequency adjustment procedures.

TABLE 7. 150 MHz 70W PA MI-559436-A TUNING

Step	Meter Switch	Typical Reading	Procedure
1 *			<p>a. Check that a 100-watt, 50-ohm load and wattmeter is connected to the antenna jack. The wattmeter should be connected as close as possible to the antenna jack, preferably by a connector arrangement rather than a cable.</p> <p>b. Connect the Test Meter Transmitter cable to Test Socket 26J2.</p> <p>c. Remove the alignment plate cover from the PA - DO NOT remove the alignment plate.</p> <p style="text-align: center;">CAUTION Use an insulated alignment tool for adjustments. Observe 20% duty cycle.</p> <p>d. Connect the unit to a DC supply capable of providing 13.4VDC at 16 to 19A.</p>
2		9VDC	<p>DC CONTROL MODULE CHECK & ADJUSTMENTS</p> <p>a. Turn unit on its side and remove PA bottom cover. Connect VOM between pin 9 and ground of DC Control board.</p> <div style="text-align: center;">  <p>The diagram shows a rectangular board with a wavy edge on the left. It contains five circular components: R14 (top left), R20 (top right), R32 (bottom center), R33 (bottom center, to the right of R32), and O9 (bottom left). Pin O12 is located at the top right corner. A small label '3720681-504' is at the bottom left of the board.</p> </div> <p style="text-align: center;">DC CONTROL BD 3720681-504</p> <p>b. Remove transmitter TCXO and key transmitter. Measured voltage should be approximately 9VDC.</p> <ol style="list-style-type: none"> 1. If voltage is not obtained, DC Control board is not properly adjusted. Proceed with the procedures of this step. Refer to the module servicing instruction book if these procedures cannot be completed. 2. If voltage is obtained, DC Control board is properly adjusted. Proceed to step 3.

* For Initial adjustment and FCC checks, perform steps with asterisk only.

TABLE 7. 150 MHz 70W PA MI-559436-A TUNING (Continued)

Step	Meter Switch	Typical Reading	Procedure
3		8.0VDC 40W min.	<p>c. Preset the following controls on the DC Control board:</p> <p style="padding-left: 40px;">22R14 fully CW 22R20 fully CCW 22R32 fully CW (final setting) 22R33 fully CW</p> <p>d. With transmitter TCXO still removed, key transmitter and adjust 22R14 for 8.0VDC at pin 9.</p> <p>e. Replace transmitter TCXO. Perform step 3 to tune the PA at this reduced supply voltage. Reduced output power should be greater than 40W.</p> <p style="padding-left: 40px;">NOTE: When performing PA tuning at this time, disregard typical readings since PA is now operating at reduced power.</p>
		12-14 VDC 7VDC	<p>f. After tuning PA at reduced power, key transmitter and adjust 22R14 fully CW, then turn CCW until voltage just starts to drop at pin 9.</p> <p>g. Detune (16) until output power drops by 20W. Adjust 22R20 CW until voltage at pin 9 just starts to drop. Then peak (16) for maximum power output.</p> <p>h. Pull lead from pin 12. Key transmitter and adjust 22R33 for +7VDC at pin 9. Replace lead. Adjustment is completed. Proceed with step 3 to tune PA at its rated output power.</p>
			PA TUNING
			<p style="text-align: center;">NOTE: Preset adjustments only if the PA is severely out of tune or if a frequency change is made outside of the power degradation limits.</p> <p>a. Turn adjustments (10) through (19) fully CW until snug. Then preset these adjustments as follows:</p> <p style="padding-left: 40px;">(10) through (13) ONE full turn CCW (18) and (19) ONE full turn CCW (14) ONE-HALF turn CCW (16) and (17) TWO full turns CCW</p> <p style="text-align: center;">CAUTION</p> <p>Key transmitter when making adjustments only. Observe 20% duty cycle. Allow PA heat sink to cool to ambient temperature between adjustments, or use a blower to cool the unit.</p>

TABLE 7. 150 MHz 70W PA MI-559436-A TUNING (Continued)

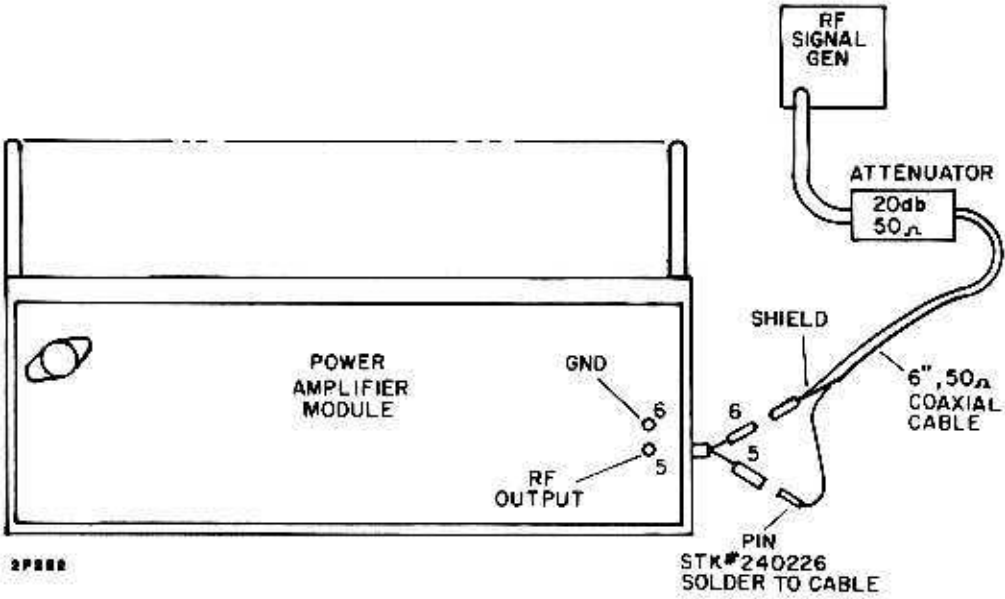
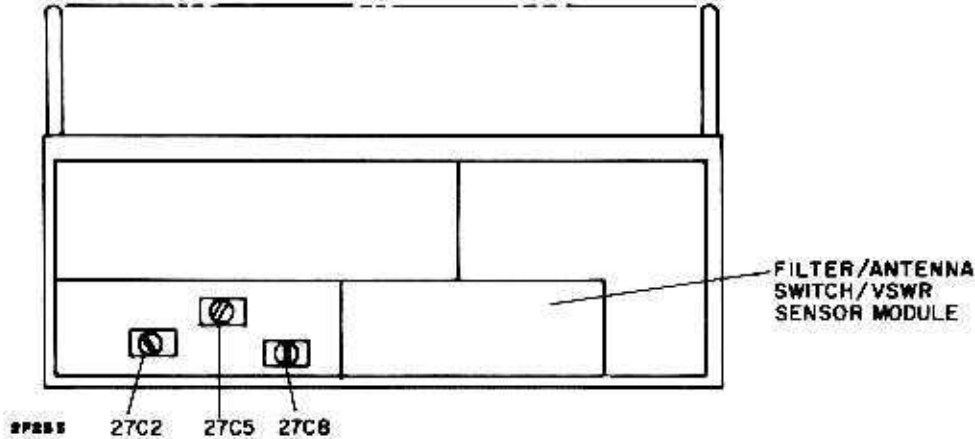
Step	Meter Switch	Typical Reading	Procedure
5			<p>NOTE: DO NOT adjust antenna switch or VSWR sensor unless parts are replaced. Variable controls are factory set. Transmitter must be tuned, receiver aligned, and heat sink cool to the touch prior to performing these adjustments.</p>
			<p>ANTENNA SWITCH ADJUSTMENT</p>
			<p style="text-align: center;">CAUTION</p> <p>DO NOT key transmitter during antenna switch adjustments. As a precaution, temporarily remove the transmitter TCXO.</p> <div style="text-align: center;">  <p style="text-align: center;">ANT SW-TEST SETUP</p>  <p style="text-align: center;">ANT SW ADJUSTMENTS</p> </div>

TABLE 7. 150 MHz 70W PA MI-559436-A TUNING (Continued)

Step	Meter Switch	Typical Reading	Procedure											
	A	10-45uA	b. Peak (10). Then repeak (9) and (8) (Multiplier).											
	B	20-40uA	c. Peak (11). Then alternately peak (10) and (9).											
	C	10-20uA	d. Alternately peak (12) and (13).											
	D	25-40uA	e. Turn (15) CCW to first peak (if previously pre-set, only). Alternately peak (14) and (15).											
*	E	35-50uA	f. Turn (16) CW for peak power.											
		25W	g. Alternately peak (18) and (19) for maximum power.											
		60-90W	h. Turn (17) CW in 1/4 turn steps, each time peaking (16) for maximum power. Continue until no further improvement is obtained.											
		75-90W	i. Alternately tune (18) and (19) in 1/4 turn steps CW for maximum power.											
		75-90W	j. Repeak (14) and (15) for maximum power. If this procedure is being performed for reduced power adjustment of DC Control board, return to step 2f at this point.											
		85W max.	k. If power output exceeds 85 watts, adjust 21R8 on Voltage Regulator board to reduce output power to 85 watts. For continuous duty rating, set 21R8 for 75 Watts. Recheck DC Voltage Control Module - Step 2a and b.											
			<table border="0"> <thead> <tr> <th rowspan="2">Frequency</th> <th colspan="2">Power Output</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td>148 to 162 MHz</td> <td>85W</td> <td>85W</td> </tr> <tr> <td>162 to 174 MHz</td> <td>75W</td> <td>85W</td> </tr> </tbody> </table>	Frequency	Power Output		Min.	Max.	148 to 162 MHz	85W	85W	162 to 174 MHz	75W	85W
Frequency	Power Output													
	Min.	Max.												
148 to 162 MHz	85W	85W												
162 to 174 MHz	75W	85W												
*	F	10uA (10A)	l. Measure DC collector current. I_C (amp) = Meter Reading (uA)											
		12VDC	m. Remove test cable from 26J2. Connect VOM between pin 1 of 26J2 and chassis ground. Measure DC collector voltage.											
			n. Multiply readings of steps l and m to obtain DC input power.											
			Example: 10A x 12VDC = 120W											
			NOTE: Maximum FCC rated input power is 150 watts.											
4			PA REDUCED POWER OUTPUT											
			For applications requiring operation at reduced power output (from 40 to 75 watts), adjust 22R14 on DC Control board for desired output power. Then repeak (16) through (19).											

TABLE 7. 150 MHz 70W PA MI-559436-A TUNING (Continued)

Step	Meter Switch	Typical Reading	Procedure
6	8	5uA	NOTE: On recent production units, the antenna switch is not adjustable (27C2 removed).
			a. Remove alignment plate from PA. Pull leads from pins 5 and 6 (PA output) of the PA board and connect the RF signal generator through a 20 dB attenuator to the leads (pin 6 is shield).
			b. Connect the Test Meter Rec/Exc cable to Test Socket 7J1.
			c. Set the RF signal generator to receive frequency (or to center frequency in multi-channel receivers). Be sure the receive TCXO is in place. Adjust output of generator for a small indication on Test Meter.
			d. Dip 27C2. Antenna switch adjustment is complete. Remove generator and replace PA leads.
			VSWR REVERSE POWER SENSOR
			a. Connect Test Meter Transmitter Cable to Test Socket 7J4 for standard housings, or connect Rec/Exc test cable to Test Socket 7J8 for options housing units. Replace transmitter TCXO.
			b. Preset capacitor 27C5 fully CW. Then turn 3/4 turn CCW.
			c. Key transmitter and dip 27C5.
7			VSWR FORWARD POWER SENSOR
			Adjust 27C8 fully CW, then back out 2 full turns.
8*			FREQUENCY DEVIATION & TRANSMIT TCXO FREQUENCY
			See Table 9 for the frequency deviation and transmit TCXO frequency adjustment procedures.

TABLE 8. 150 MHz 110W PA MI-559810,-A TUNING

Step	Meter Switch	Typical Reading	Procedure
1*			<p>NOTE: Complete tuning procedures for the PA are covered in a separate instruction book. The procedures of this table are limited to adjusting R11 on the PA Dissipation Control Module.</p> <p>a. Check that a 200-watt, 50-ohm load and wattmeter is connected to the antenna jack. The wattmeter should be connected as close as possible to the antenna jack, preferably by a connector arrangement rather than a cable.</p> <p>b. Connect the Test Meter Transmitter cable to Test Socket 7J4. For options housing units only, connect Rec/Exc cable to Test Socket 7J8. The proper Test Meter switch position is indicated in the "Meter Switch" column.</p>
2*			<p>PA INPUT</p>
	STD OPT 7J4 7J8 D 6	25-50uA (110- 115mW) 12 VDC 17.5A	<p>a. Check the input RF level to the PA.</p> <p>b. Connect VOM between TP2 (green) and TP3 (black) on the Dissipation Control Module. Set VOM to its 50uA scale.</p> <p>c. Key transmitter and calculate V_{cc} as follows: $V_{cc} = \frac{\text{Meter Reading}}{2}$</p> <p>d. Connect VOM between TP1 (red) and TP2 (green) on the Dissipation Control Module.</p> <p>e. Key transmitter and calculate I_c as follows: $I_c = \frac{\text{Meter Reading}}{2}$</p> <p>f. Calculate DC input power</p> <p>Example: $17.5A I_c \times 12VDC V_c = 110 \text{ watts}$</p>
3*			<p>RF OUTPUT POWER ADJUSTMENT</p> <p>a. Adjust R11 on Dissipation Control Module, as required, for desired power output.</p> <p>b. Remove test equipment and restore equipment. Transmitter adjustments are complete.</p>

* For Initial adjustment and FCC checks, perform steps with asterisk only.

TABLE 8. 150 MHz 110W PA MI-559810,-A TUNING (Continued)

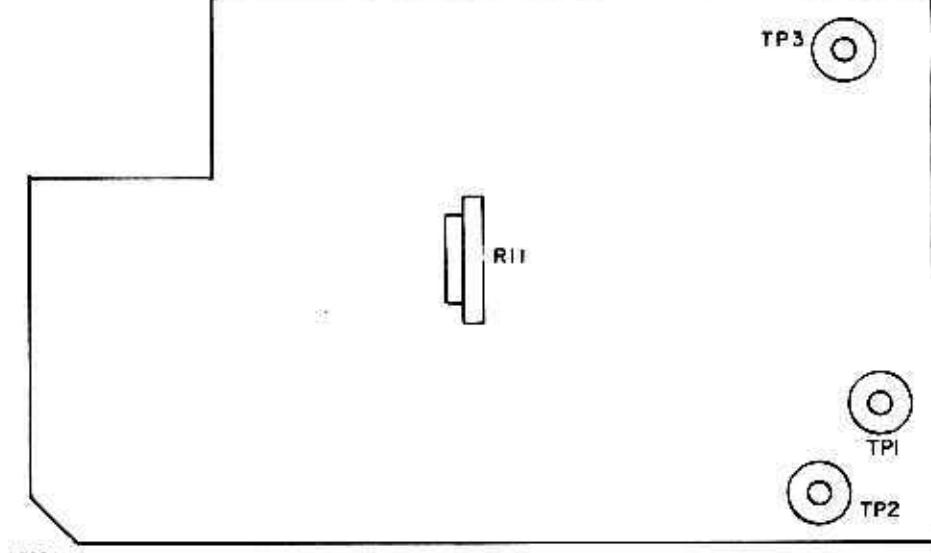
Step	Meter Switch	Typical Reading	Procedure
4*			 <p style="text-align: center;">DISSIPATION CONTROL BD (LOCATED BENEATH PA TOP COVER)</p>
			FREQUENCY DEVIATION & TRANSMIT TCXO FREQUENCY
			<p>See Table 9 for the frequency deviation and transmit TCXO frequency adjustment procedures.</p>

TABLE 9. FREQUENCY DEVIATION & TRANSMIT TCXO FREQUENCY

Step	Meter Switch	Typical Reading	Procedure
1*		<p>1.0VRMS 1 kHz</p> <p><u>+5.0kHz</u></p> <p><u>+5.0kHz</u></p>	<p style="text-align: center;">FREQUENCY DEVIATION</p> <p style="text-align: center;">CAUTION DO NOT Adjust deviation limit controls without an accurate means of checking peak frequency.</p> <div style="text-align: center;"> </div> <p style="text-align: center;">EXCITER - TEST SETUP</p> <p>a. Remove leads from Exciter R and V pins. Connect test circuit to pins R and V and set voltage level at pins to 1.0 VRMS at 1 kHz.</p> <p>b. Connect a coaxial cable to the frequency deviation meter. Place the cable end near the PA to loosely couple the transmitter RF to the meter.</p> <p>c. For units without Quiet Channel: Key transmitter and adjust 23R27 for <u>+5.0 kHz</u> (or <u>+4.5 kHz USFS</u>) maximum indication.</p> <p style="text-align: center;">NOTE: The maximum positive or negative deviation must not exceed the FCC specified 5 kHz deviation limit.</p> <p>d. For units with Quiet Channel: Reduce generator output to zero; key transmitter and adjust 82R16 (located on QC board) for <u>+0.5kHz</u> deviation. Then reset generator output to <u>1</u> volt. Key transmitter and adjust 23R27 for <u>+5.0 kHz</u> (or <u>+4.5 kHz USFS</u>) maximum deviation, <u>INCLUDING</u> the <u>previously</u> obtained <u>+0.5 kHz</u> deviation.</p> <p>e. Disconnect test circuit from Exciter and replace leads on R and V.</p>

* For initial adjustments and FCC checks, perform steps with asterisk only.

TABLE 9. FREQUENCY DEVIATION & TRANSMIT TCXO FREQUENCY (Continued)

Step	Meter Switch	Typical Reading	Procedure
2*			<p data-bbox="869 347 1370 380">TRANSMIT TCXO FREQUENCY</p> <ol style="list-style-type: none"> <li data-bbox="869 420 2042 526">a. Connect a coaxial cable to the RF frequency meter. Place the cable near the PA to loosely couple the transmitter RF to the meter. <li data-bbox="869 565 2020 711">b. Check assigned frequency stamped on TCXO can. Adjust TCXO. On multi-frequency units, check frequency for each channel and adjust the corresponding TCXO. <li data-bbox="869 750 2083 823">c. Remove test equipment and restore equipment. Transmitter adjustments are complete.

TABLE 10. 150 MHz RECEIVER ALIGNMENT

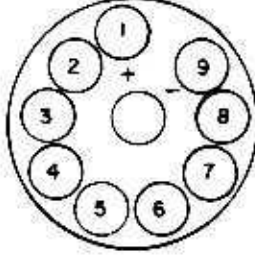
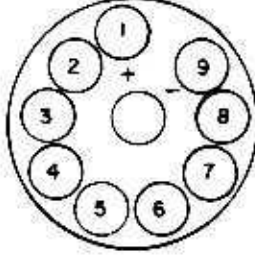
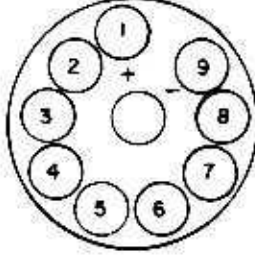
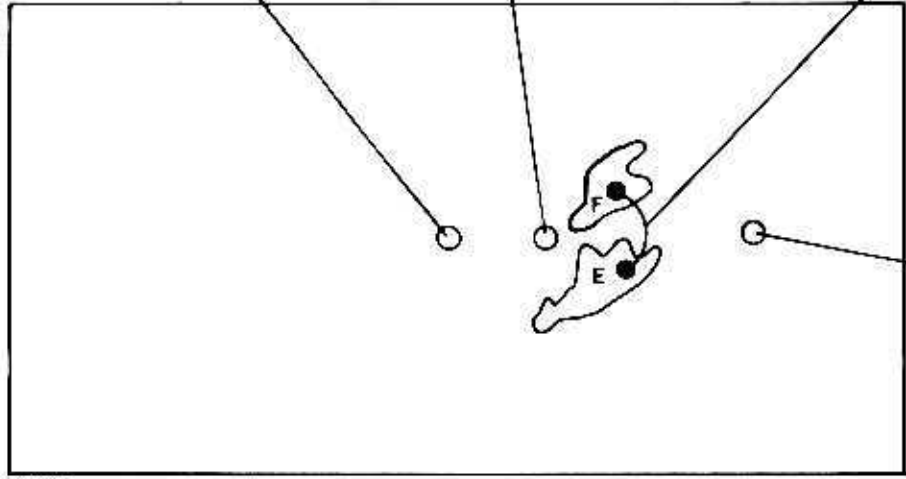
Step	Meter Switch	Typical Reading	Procedure																																
1			<table border="1" data-bbox="1137 422 1800 806"> <thead> <tr> <th data-bbox="1144 431 1279 515">SWITCH POSITION</th> <th colspan="2" data-bbox="1279 431 1503 515">7J1 PIN CONNECTIONS</th> <th data-bbox="1503 431 1794 515">7J1 TOP VIEW</th> </tr> </thead> <tbody> <tr> <td data-bbox="1144 515 1279 562">1</td> <td data-bbox="1279 515 1503 562">1</td> <td data-bbox="1503 515 1794 562">9</td> <td data-bbox="1503 515 1794 806" rowspan="8">  </td> </tr> <tr> <td data-bbox="1144 562 1279 610">2+</td> <td data-bbox="1279 562 1503 610">2</td> <td data-bbox="1503 562 1794 610">9</td> </tr> <tr> <td data-bbox="1144 610 1279 658">2-</td> <td data-bbox="1279 610 1503 658">2</td> <td data-bbox="1503 610 1794 658">9</td> </tr> <tr> <td data-bbox="1144 658 1279 705">3</td> <td data-bbox="1279 658 1503 705">3</td> <td data-bbox="1503 658 1794 705">9</td> </tr> <tr> <td data-bbox="1144 705 1279 753">4</td> <td data-bbox="1279 705 1503 753">4</td> <td data-bbox="1503 705 1794 753">9</td> </tr> <tr> <td data-bbox="1144 753 1279 800">5</td> <td data-bbox="1279 753 1503 800">5</td> <td data-bbox="1503 753 1794 800">9</td> </tr> <tr> <td data-bbox="1144 800 1279 848">6</td> <td data-bbox="1279 800 1503 848">6</td> <td data-bbox="1503 800 1794 848">9</td> </tr> <tr> <td data-bbox="1144 848 1279 896">7</td> <td data-bbox="1279 848 1503 896">7</td> <td data-bbox="1503 848 1794 896">9</td> </tr> <tr> <td data-bbox="1144 896 1279 943">8</td> <td data-bbox="1279 896 1503 943">8</td> <td data-bbox="1503 896 1794 943">9</td> </tr> </tbody> </table> <p data-bbox="1137 814 1189 834">2F243</p> <p data-bbox="1167 898 1675 932">TEST SOCKET CONNECTIONS</p> <ol data-bbox="869 968 2078 1584" style="list-style-type: none"> Connect test meter Rec/Exc cable to Test Socket 7J1. Connect 50-ohm load to antenna input jack. Check DC supply for unit - it should be set to +13.8 \pm0.1V DC, measured at any wired A+ pin. Jumper pins 23 and 27 on Low IF & Audio Board. If Quiet channel is installed, jumper areas marked E and F on copper path side of Low IF & Audio Board. Remove phono plug 7P1 from 13J1 of 6.7 MHz IF. Board (or 16J1 of Noise Clipper option). Connect IF. signal generator to 7P1 (via BNC to phono plug adapter and 10K series resistor). Apply power and adjust 9-volt regulator on Low IF and Audio board for 9.0V DC at any wired 9V pin. 	SWITCH POSITION	7J1 PIN CONNECTIONS		7J1 TOP VIEW	1	1	9		2+	2	9	2-	2	9	3	3	9	4	4	9	5	5	9	6	6	9	7	7	9	8	8	9
SWITCH POSITION	7J1 PIN CONNECTIONS		7J1 TOP VIEW																																
1	1	9																																	
2+	2	9																																	
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5	5	9																																	
6	6	9																																	
7	7	9																																	
8	8	9																																	
2	8	10uA Max.	<p data-bbox="869 1626 1312 1660">LOW IF DISCRIMINATOR</p> <ol data-bbox="869 1696 2078 1920" style="list-style-type: none"> Set IF. signal generator to 455 kHz \pm100 Hz, using frequency counter. Adjust output level for a meter indication (not greater than 10uA). If an indication cannot be obtained, proceed to steps b and c. Then return to this step (step a) and repeat procedure. <div data-bbox="972 1948 2002 2503">  <p data-bbox="972 2503 1032 2522">2F244</p> </div> <p data-bbox="1128 2522 1771 2578">LOW IF MODULE (LOCATED ON UNDERSIDE OF UNIT)</p>																																

TABLE 10. 150 MHz RECEIVER ALIGNMENT (Continued)

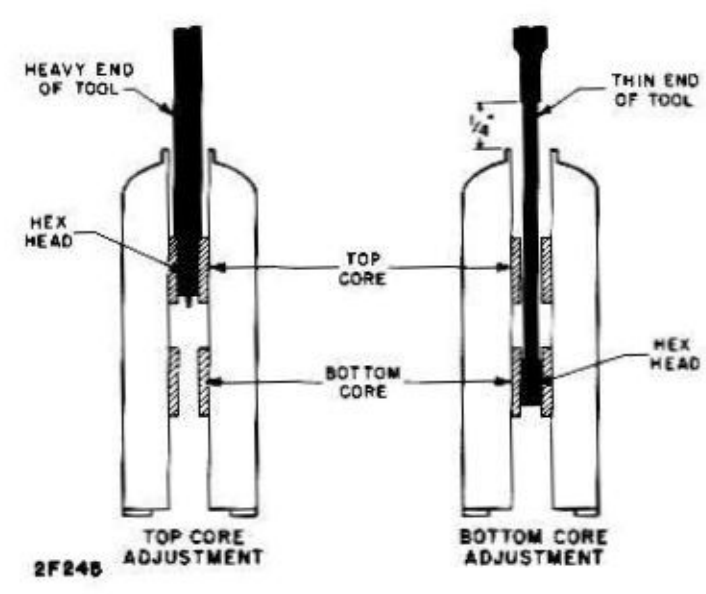
Step	Meter Switch	Typical Reading	Procedure
3	3	35-40uA	b. Peak discriminator primary 14L2.
	2+ or 2-	0uA (null)	c. Remove jumper of step 1d. Adjust discriminator secondary 14L3 for zero meter reading.
			6.7 MHz IF.
			a. Preset 13T2 and 13T3 cores to approximately 5/8 in. from top of form; set 13T1 and 13T4 bottom cores to approximately 1/8 in. from bottom of form, and set top cores to approx. 5/16 in. from top of form.
			 <p style="text-align: center;">13T1 & 13T4 CORES ADJUSTMENT</p>
8		5-10uA	<p>b. Reconnect 7P1 to 13J1.</p> <p>c. Connect IF. signal generator to 13J2 (or 16J2 of Noise Clipper option) using BNC to phono plug adapter. DO NOT use 10K series resistor. Adjust generator to 6.708 MHz using frequency counter.</p> <p>d. Adjust 13T1 through 13T4 for peak. Repeat adjustments as necessary while reducing the generator output for less than 10uA meter reading. Be sure to peak both cores of 13T1 and 13T4. Repeat this procedure at least twice.</p> <p>e. As an alternative to steps c and d above, the 6.7 MHz IF. may be aligned with an rf signal of carrier frequency, assuming all other modules are PROPERLY ALIGNED. Apply the signal to the antenna input via 20 dB pad. Check that the discriminator output is nulled (position 2+ or 2-). Then offset the signal frequency to produce a -27 uA meter reading on position 2+ or 2-. This represents a +8kHz frequency deviation. Adjust 13T1 through 13T4 for peak meter reading on position 8. Note that band-pass degradation may result from this procedure.</p>

TABLE 10. 150 MHz RECEIVER ALIGNMENT (Continued)

Step	Meter Switch	Typical Reading	Procedure
4			NOTE: Proceed to steps 4 and 5 for single frequency units. For multi-frequency units, proceed to steps 6 and 7. A CFAO must be used to align multi-frequency receivers.
			BUFFER/MULTIPLIER & MIXER/MULTIPLIER -SINGLE FREQ. UNITS
	4	16uA	a. Remove IF. signal generator from 13J2. Set receiver to receive frequency. b. Peak 11Z1 and dip 11Z2. Peak 10Z4 - this peak may be small.
	5	32uA	c. Repeak 11Z2 and 10Z4. Dip 10Z3 and tune 10Z2 for a slight peak.
5	7	14uA	d. Repeak 10Z3 and 10Z2. If there is a small or no peak, slightly detune 10Z1 and repeat 10Z3 and 10Z2.
			HELICAL RESONATORS - SINGLE FREQ. UNITS
	2+ or 2-	0uA (null)	a. Connect RF signal generator to antenna input jack - DO NOT connect attenuator at this time. b. Adjust generator output level to 100mV. Locate carrier frequency by adjusting generator frequency for discriminator null. If carrier frequency cannot be found (discriminator null); disconnect ground by unscrewing the antenna coaxial connector until only the center pin is connected. Then adjust generator frequency for null indication.
	8	less than 10uA	c. Peak 1Z1 through 1Z5 and 10Z1 while reducing generator output to keep meter reading below 10uA. Note that if a meter reading cannot be obtained, turn 1Z1 through 1Z5 CW until they are approximately 1/8 to 1/4 inch from full in position. Then consecutively adjust each resonator one turn CCW until a meter indication is obtained. Then proceed peaking adjustments. d. Disconnect generator and connect the 20dB attenuator to the generator output lead. Place the attenuator as close as possible to the receiver antenna jack. e. Repeat step c.
6	7	Max.	f. Repeak 10Z3 and 10Z2.
			BUFFER/MULTIPLIER & MIXER MULTIPLIER -MULTI-FREQ. UNITS
			a. Remove IF. signal generator from 13J2. b. Preset 10Z1, 10Z2, and 10Z3 to minimum capacity (plates fully unmeshed). c. Preset cores of 10Z4, 11Z1, and 11Z2 to top of form.

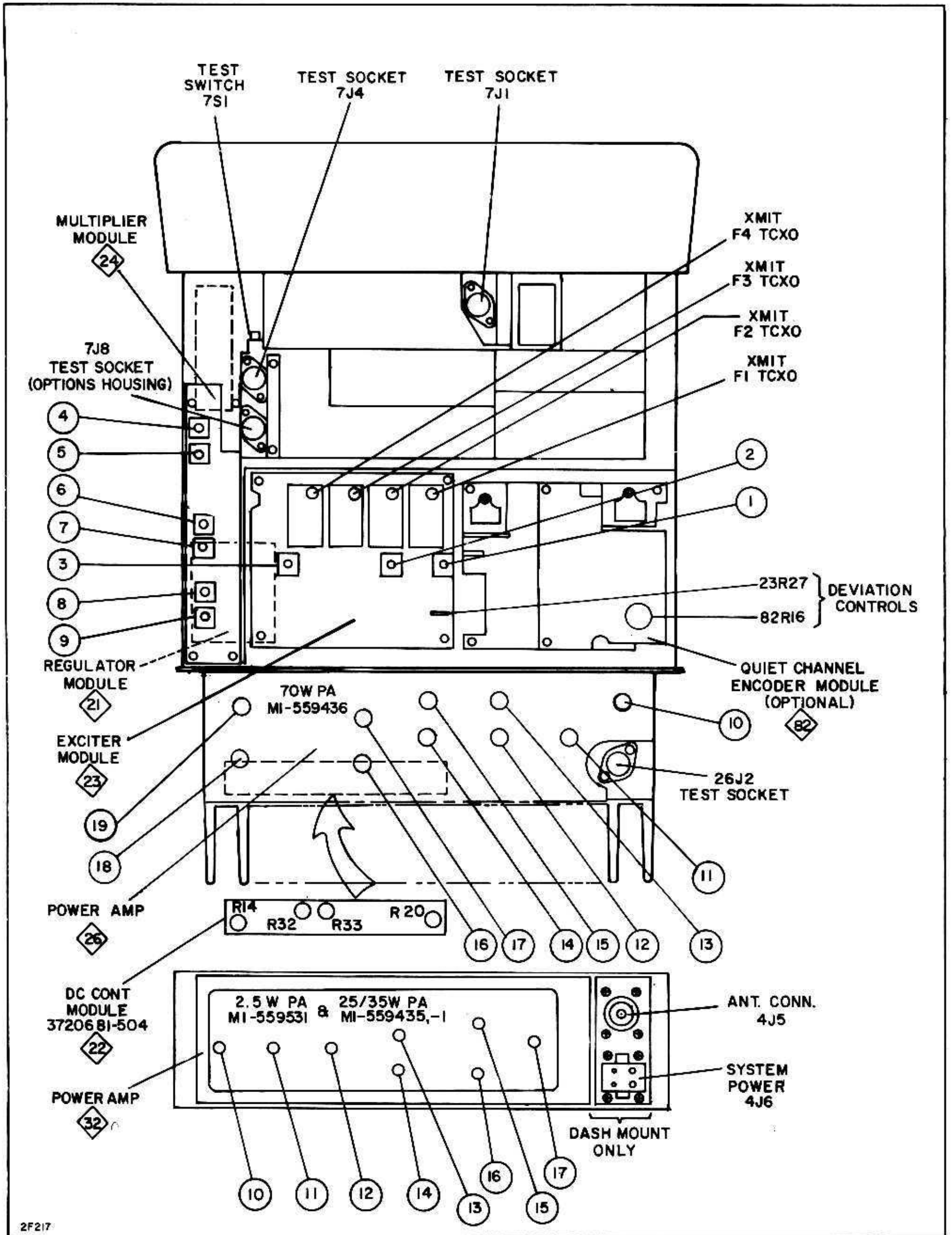
TABLE 10. 150 MHz RECEIVER ALIGNMENT (Continued)

Step	Meter Switch	Typical Reading	Procedure
7	4	16uA	d. Replace the F1 TCXO with CFAO (see test equipment table). Set receiver to F1.
	5	32uA	e. Peak 11Z2 and dip 11Z2.
	7	14uA	f. Peak 10Z4. DO NOT repeak 11Z2. Carefully dip 10Z3.
			g. Peak 10Z2 (slight peak).
			h. Peak 10Z2. DO NOT repeak 10Z3. Peak 10Z1.
			HELICAL RESONATORS - MULTI-FREQ. UNITS
8	8	less than 10uA	a. Perform steps 5a and 5b for test setup.
			b. Peak 1Z1 through 1Z5 while reducing generator output to keep meter reading below 10uA. Note that if a meter reading cannot be obtained, turn 1Z1 through 1Z5 CW until they are approximately 1/8 to 1/4 inch from full in position. Then consecutively adjust each resonator one turn CCW until a meter indication is obtained. Then proceed peaking adjustments.
			c. Alternately repeak 10Z1 and 1Z5 until no further increase is observed. This procedure should require no more than two repetitions.
			ANTENNA PEAKING - HELICAL RESONATOR 1Z1
9	8	less than 10uA	With antenna connected to receiver, loosely couple a weak on-frequency carrier (less than 10uA meter reading). Then peak 1Z1. DO NOT adjust 1Z2 through 1Z5.
10	2+ or 2-	0uA (null)	Adjust F1 TCXO frequency for discriminator null. Repeat on all channels.
			NOISE CLIPPER OPTION
			a. Connect an impulse noise generator to the antenna jack. Set output pulse rate to 1000 PPS with an amplitude of 37dB.

TABLE 10. 150 MHz RECEIVER ALIGNMENT (Continued)

Step	Meter Switch	Typical Reading	Procedure
11			<p>b. Connect the oscilloscope to the BIAS point (junction of R28 and R31) on Noise Clipper board.</p> <div data-bbox="1025 461 1921 1058" style="text-align: center;"> <p>16J2 (THRU CONNECTION TO 13J2 ON 6.7 MHz IF BOARD)</p> <p>16R2 SENSITIVITY CONTROL</p> <p>BIAS TEST POINT (JUNCTION R28 & R31)</p> <p>13T1* 13T2* 13T3* 13T4*</p> <p>16J1 (THRU CONNECTION TO 13J1 ON 6.7 MHz IF BOARD)</p> <p>* WHEN INSTALLED OVER 6.7 MHz IF BOARD SP247</p> </div> <p style="text-align: center;">NOISE CLIPPER</p> <p>c. Adjust SENSITIVITY control on Noise Clipper full CW. Negative pulses should appear on oscilloscope.</p> <p>d. Adjust SENSITIVITY control CCW until the pulses just disappear. Check operation by increasing generator level to 41 dB; pulses should reappear.</p>
			FINAL CHECK
	8	10uA	<p>Check that a rf signal input at the antenna of approximately 2 to 6 uV is required to produce a 10 uA meter reading.</p>

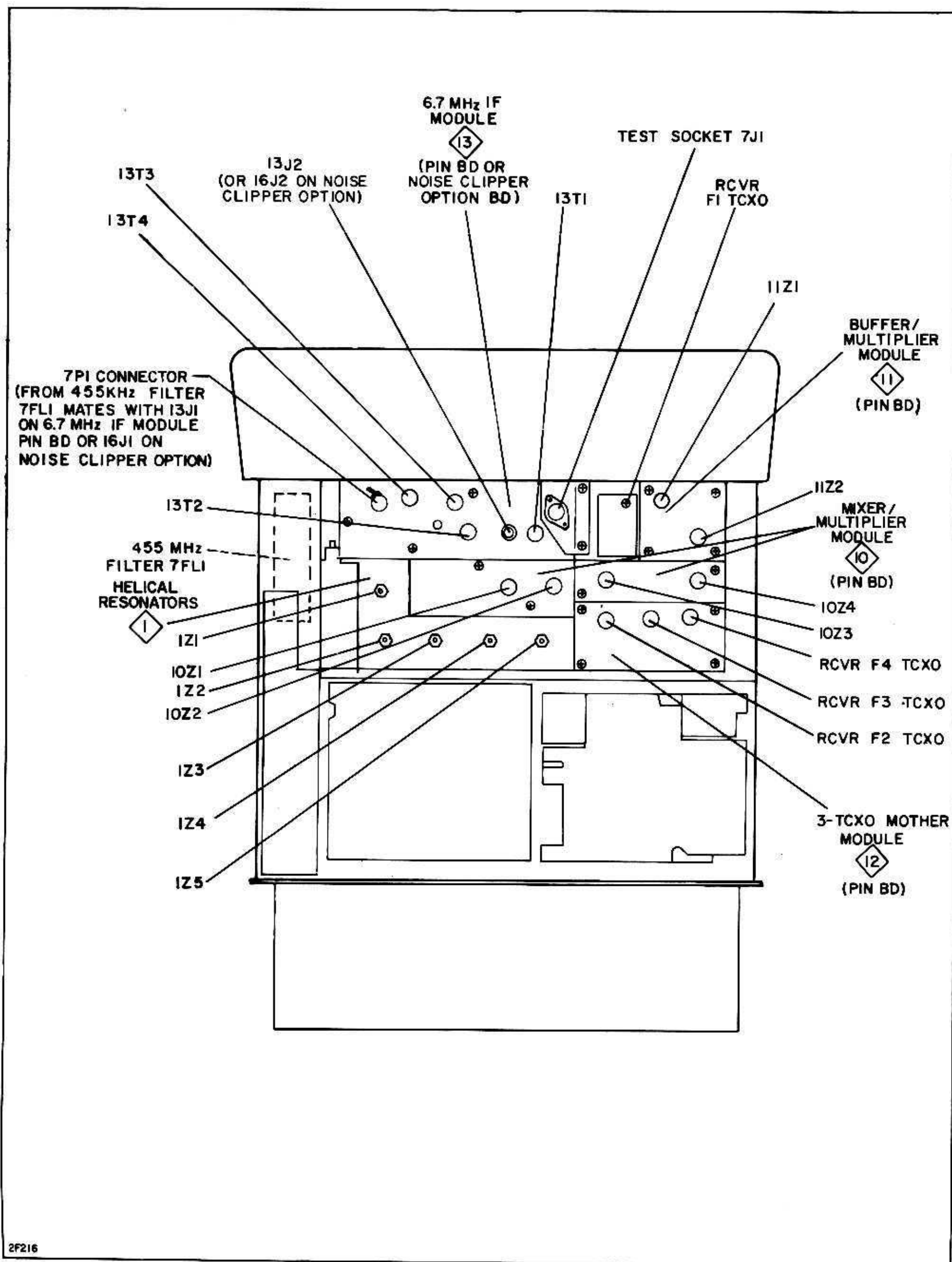
NOTES:



2F217

Figure 2. Transmitter Tuning Adjustments

NOTES:



2F216

Figure 3. Receiver Alignment Adjustments