SECTION IV

MAINTENANCE

4.1 GENERAL

This section provides detailed procedures to perform preventive and corrective maintenance on the WJ-8718 Series HF Receiver. Preventive maintenance helps prevent malfunctions or breakdowns. Corrective maintenance includes procedures for returning a malfunctioning receiver to operating condition.

4.2 PREVENTIVE MAINTENANCE

Preventive maintenance consists of visual inspection, cleaning and lubrication. Although the WJ-8718 Series HF Receiver is designed for extended operation with little or no routine servicing, optimum long-term performance can only be achieved by a periodic preventive maintenance schedule.

4.2.1 VISUAL INSPECTION

A visual inspection of the receiver should be performed every 1200 hours of operation or less. The inspection should be performed thoroughly to uncover existing or potential component malfunctions. At a minimum, the following items should be checked.

1. Inspect the equipment covers and front panel for condition of finish and panel markings.
2. Inspect for dents, punctures, or warped areas.
3. Inspect quarter-turn fasteners and receptacles.
4. Inspect the external surfaces for loose or missing screws or washers.
5. Inspect the receptacles for conditions of pins, contacts, and mountings.
6. Inspect the internal components for signs of deterioration, discoloration, or charring. Check for melted insulation and damaged, cracked, or broken components.
7. Inspect the printed circuit boards for damaged tracks, loose connections, corrosion, or other signs of deterioration.
8. Inspect the PC connectors, interface connectors, and chassis wiring for excessive wear, looseness, misalignment, corrosion, or other signs of deterioration.

4.2.2 CLEANING

Receiver cleaning should be performed every 1200 hours of operation. Complete removal of dust, grease and other contamination is of prime importance in maintaining the reliability and useful life of the receiver. At a minimum, the following items should be cleaned.

CAUTION

Avoid the use of chemical cleaning agents containing benzene, toluene, zylene, acetone, or similar solvents. These chemicals may damage the plastics used in this receiver.

1. Exterior - Dust the cabinet off with a soft cloth. Dust the front panel controls with a small soft-bristled paint brush. Dirt clinging to the cabinet may be removed with a clean, lint-free cloth dampened with a mild detergent and water solution. Avoid using abrasive cleaners. They will scratch the front panel.

2. Interior - Dust in the interior of the unit should be removed before it builds up enough to cause arcing and short circuits during periods of high humidity. Dust is best removed by dry, low-pressure air. Dirt clinging to surfaces may be removed with a soft-bristled paint brush or a clean, lint-free cloth dampened with a mild detergent and water solution. Use a cotton-tipped applicator for cleaning in narrow spaces and on the circuit boards.

3. Switch Contacts - When maintenance is necessary due to accumulated dirt and dust on the contacts, observe the following precautions: Clean the switch contacts with isopropyl alcohol or a mild detergent solution. Avoid cleaning solutions containing benzene, acetone, or similar solvents.

4.2.3 LUBRICATION

The optical encoder assembly shaft requires lubrication every 720 hours of operation to prevent excessive wear. The other rotating assemblies in the receiver are sealed and do not require lubrication. To lubricate the encoder assembly shaft, perform the following steps:

CAUTION

Excessive lubrication of the encoder shaft may destroy the optical characteristics of the encoder wheel.

1. Place the receiver in a vertical position and remove the encoder knob.

2. Apply one (1) drop of SAE 5W-20W oil to the encoder shaft at the retaining ring.

3. Reassemble the encoder assembly knob and rotate the knob several times to distribute the lubricant.

4.3 CORRECTIVE MAINTENANCE

4.3.1 GENERAL

Corrective maintenance procedures consist of testing, troubleshooting, repairing and alignment information necessary to restore a malfunctioning receiver to normal operation. Maintenance information provided in this paragraph is divided into the following categories.

1. Checkout procedures to generate receiver fault symptoms (**Table 4-2**).

2. Troubleshooting procedures keyed to the checkout procedures to locate a malfunctioning module within the receiver (**Table 4-3**).

3. Individual module checkout and troubleshooting procedures to locate a defective component on a malfunctioning module (**Paragraph 4.3.5**).

4. Receiver alignment procedures to be performed after module or component replacement (**Paragraph 4.3.7**).

A receiver will normally require corrective maintenance for one of the following reasons:

1. Failure to pass any initial inspection testing.

2. Failure to meet minimum performance standards tested by the Receiver Checkout Procedure, **Table 4-2.**

3. Operator-observed malfunctions during normal operation of the receiver.

4.3.2 TEST EQUIPMENT REQUIRED

Table 4-1 lists the test equipment required for corrective maintenance of the WJ-8718 Series HF Receiver. Equivalent equipment may be used.

Table 4-1. Test Equipment Required

Instrument Type	Required Characteristics	Recommended Instrument
Signal Generator	AM, FM, CW, RF output, from -111 dBm to 0 dBm	HP8640B
Oscilloscope	dc to 50 MHz	HP180C
RF Voltmeter	1 mV to 3.0 V; -50 dBm to +20 dBm	Boonton 92B
Digital Counter	0 to 500 MHz	HP5303A
AC Voltmeter	1 mV to 300 V, full scale	HP-400E
Digital Voltmeter	dc ranges; 1% or better	Fluke 8100A
Dummy Load, 600 Ω	4-W dissipation	Two 1200 Ω, 2-W resistors in parallel
Dummy load, 600 Ω	1/2-W dissipation	Two 1200 Ω, 1/4 - or 1/2-W resistors in parallel
Headphones	Stereo, 600 Ω impedance, or Mono	Telex 325-02 or Telex 820-4
Sweep Generator	100 kHz to 11.0 MHz	HP8601A

4.3.3 RECEIVER CHECKOUT PROCEDURES

The checkout procedures test the receiver's ability to meet the minimum performance standards necessary for satisfactory receiver operation. The procedures are to be used to isolate and identify malfunctioning modules within the receiver and to verify receiver peformance after module or component replacement. They may also be used as an "Operational Quick Check" of receiver performance as part of a periodic maintenance schedule.

Checkout procedures for the receiver are contained in **Table 4-2**. **Figure 4-1** details the overall connections between the receiver and the test equipment.

4.3.3.1 Procedure Guidelines

The checkout procedures in **Table 4-2** are keyed to troubleshooting tables in **paragraph 4.3.4** by a step number in the IF INDICATION IS ABNORMAL column. To properly check out and troubleshoot a receiver, the following guidelines should be utilized:

1. Perform the preliminary set up procedure in **paragraph 4.3.3.2.**

2. Beginning with Step 1 in **Table 4-2,** perform each of the check-out procedures. Continue until a malfunction is encountered.

3. At the step where the malfunction is encountered, refer to the IF INDICATION IS ABNORMAL column. This column refers to a corresponding step in **Table 4-3,** Troubleshooting Procedures, listing the probable cause and additional test steps necessary to locate the defective receiver module.

4. Locate the step in **Table 4-3** referred to from the IF INDICATION IS ABNORMAL column in **Table 4-2.** Perform the additional test steps indicated for the fault. Replace the receiver module(s) indicated in the CORRECTIVE ACTION column and perform any required alignment(s).

5. Following module replacement, verify corrective action by reperforming the Checkout Procedure in **Table 4-2** that identified the malfunction. Additional troubleshooting will be necessary if the receiver still fails to produce the required NORMAL INDICATION.

6. Proceed to the next Checkout Procedure step in **Table 4-2** only after obtaining the required response as indicated in the NORMAL INDICATION column.

7. Defective receiver modules removed in Step 4 above may be repaired by referring to the appropriate module checkout and troubleshooting procedure in **Paragraph 4.3.4.**

4.3.3.2 PRELIMINARY SET-UP PROCEDURE

Prior to performing the Checkout Procedures in **Table 4-2,** perform the following Preliminary Setup Procedure.

1. With the receiver deenergized, connect the test equipment as shown in **Figure 4-1.** Remove receiver top and bottom covers.

2. Set the receiver input voltage selector to match the available AC line voltage.

3. Set the receiver to AM Detection Mode, 16 kHz Bandwidth and MAN Gain Mode. Rotate the PHONE LEVEL, RF GAIN and LINE AUDIO controls fully CCW.

4. Energize the receiver and test equipment. Allow 30 minutes for warm-up before proceeding to the Checkout Procedure.

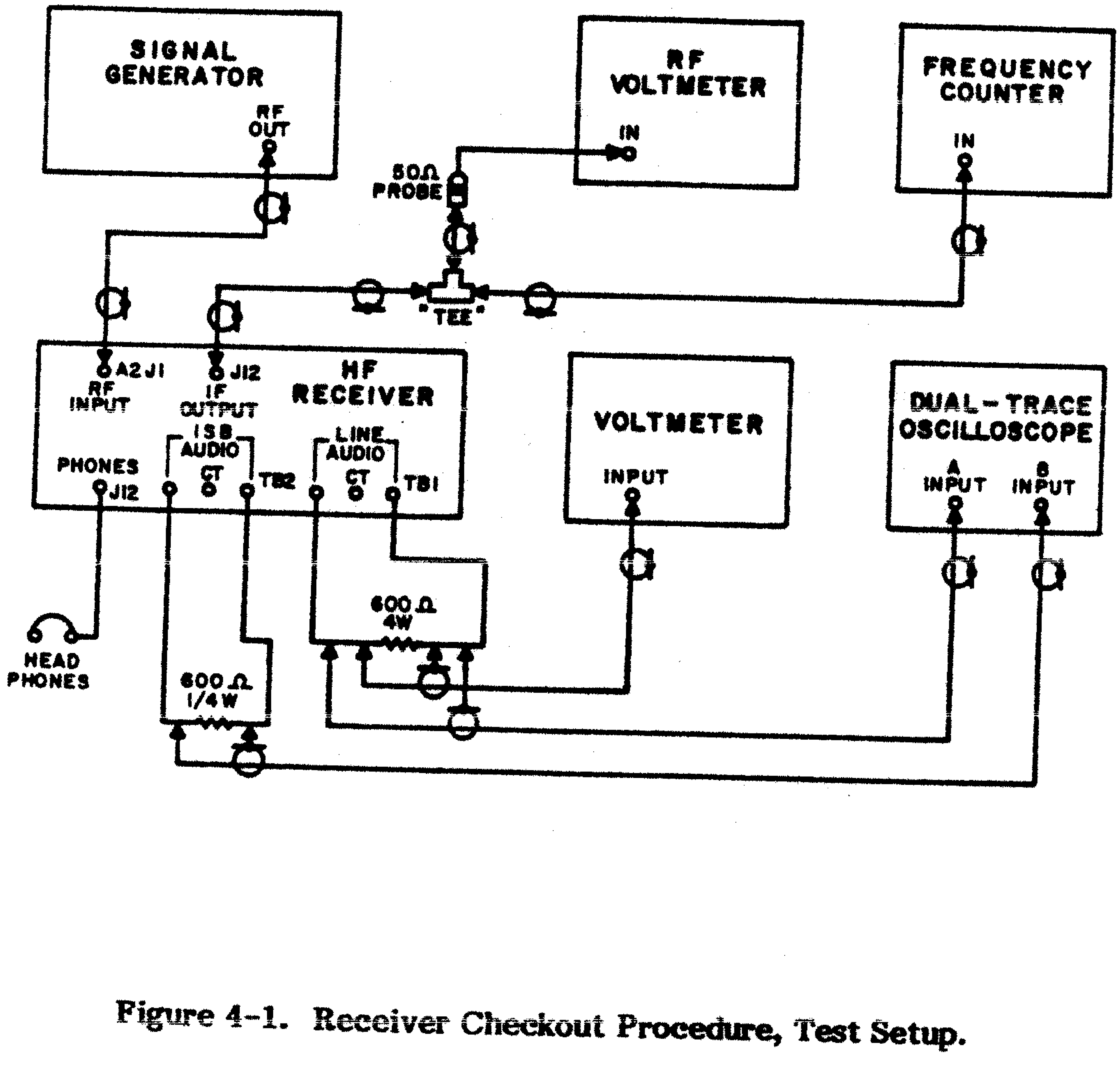

Figure 4-1. Receiver Checkout Procedure, Test Setup.

Table 4-2. WJ-8718 Series HF Receiver Checkout Procedure.

Step	Test Equipment	Control Settings and Instructions	Normal Indication	IF Indication is Abnormal
1. Prelimi-nary		a. After power-up in Par. 4.3.3.2, observe Freq. Display for bright-ness.		Refer to Table 4-3, Steps 1a, 1b.
		b. Tune receiver to 15.00500 MHz using all Tuning Res. positions.	All digits must increment smoothly	Refer to Table 4-3, Steps 1c, 1d, 1e.
2. Power Supply	Fluke 8100A	a. Refer to Fig. 5-4 for location of Power Supply Test Points.		
		b. Measure Voltage at E1.	+15Vdc ±0.75	Refer to Table-4-3, step 2a
		c. Measure Voltage at E2.	-15Vdc ±0.75	Refer to Table 4-3, step 2b
		d. Measure Voltage at E3.	+10Vdc (min.)	Refer to Table 4-3, step 2c
		e. Measure Voltage at C8 (WJ-8718A/8718-9 only)	+12Vdc ±0.75	Refer to Table 4-3, step 2d
3. IF Gain	HP8640B Boonton 92B	a. Set Sig. Gen. to 15.00500 MHz, -97dBm, Set RF Voltmeter to -10 dBm range		
		b. Adjust receiver RF Gain for -15 dBm on RF Voltmeter	-15 dBm	Refer to Table 4-3, step 3a, 3b, 3c
		c. Depress 6 kHz, 3.2 kHz, 1.0 kHz and 0.3 kHz BW Switches. Read RF V.M. indica-tion at each B.W.	-15 dBm ±4	Refer to Table 4-3, step 3a, 3b, 3c
		d. Increase Sig. Gen to 15.00650 MHz. Depress USB Mode Switch. Read RF V.M. indication.	-15 dBm ±4	Refer to Table 4-3, step 3d

Table 4-2. WJ-8718 Series HF Receiver Checkout Procedure. (Cont'd)

Step	Test Equipment	Control Settings and Instructions	Normal Indication	IF Indication is Abnormal
3. IF Gain (Cont'd)		e. Depress ISB Mode Switch. Read RF V.M. indication.	-15 dBm ±4	Refer to Table 4-3, step 3e
		f. Decrease Sig. Gen. to 15.00350 MHz. Depress LSB Mode Switch. Read RF V.M. indication.	-15 dBm ±4	Refer to Table 4-3, step 3f.
4. Detection Mode	HP8640B HP400-EL HP180C Boonton 92B	a. Set Sig. Gen. to 15.00500 MHz, -97dBm, 30% AM at 400 Hz. Set receiver to AM Mode, 16 kHz BW. On WJ-8718A/8718-9 Receivers, ensure that USB and LSB Audio buttons are deenergized. Set AC V.M. to 50 Vac range. Set HP180C A-input to 20 V/cm, B-input to 5 V/cm, time base to 1 msec. Set RF Gain for -15 dBm on RF V.M.		
		b. Rotate PHONE LEVEL control until 400 Hz is heard in headphones.	Clear, distinct tone, no distortion.	Refer to Table 4-3, step 4a.
		c. Rotate LINE AUDIO LEVEL control until AC V.M. indicates 24.5 Vrms.	24.5 Vrms	Refer to Table 4-3, step 4b.
		d. Depress A-Input switch on oscilloscope and observe Line Audio waveform.	Clean sine wave, no clipping.	Refer to Table 4-3, step 4c.
		e. Turn off Sig. Gen. modulation. Set receiver to CW mode, 1 kHz BW, -0.4 kHz BFO offset. Monitor Headphone.	Clear, distinct 400 Hz tone, no distortion.	Refer to Table 4-3, step 4d.

Table 4-2. WJ-8718 Series HF Receiver Checkout Procedure. (Cont'd)

Step	Test Equipment	Control Settings and Instructions	Normal Indication	IF Indication is Abnormal
4. Detection Mode (Cont'd)		f. Increase Sig. Gen. to 15.00540 MHz. Depress USB and ISB Mode Switches. Monitor headphones in both modes.	Clear, distinct 400 Hz tone, no distortion	Refer to Table 4-3, step 4e.
		g. Decrease Sig. Gen. to 15.00460 MHz. Depress LSB Mode Switch. Monitor headphones.	Clear, distinct 400 Hz tone,	Refer to Table
		h. Depress ISB Mode switch. Depress B-input switch on oscilloscope and observe ISB Audio Waveform.	22 Vpp minimum at 400 Hz, no clipping.	Refer to Table 4-3, step 4g
5. SNR	HP8640B HP400-EL	a. Set Sig. Gen. to 15.00500 MHz, -97 dBm, 50% AM at 400 Hz. Set RF Gain for -15 dBm on RF V.M. Set AC V.M. for convenient meter indication and note level.		
		b. Turn off Gen. modulation and note reduction in AC V.M. indication.	>10 dB reduction	Refer to Table 4-3, step 5a
6. MAN/AGC Operation	HP8640B HP400-EL Boonton 92B	a. Set Sig. Gen. to 15.00500 MHz, -97 dBm, 30% AM at 400 Hz. Set receiver to AM Mode, 6 kHz BW, MAN GAIN mode. Set RF GAIN for -15 dBm on RF V.M.		
		b. Increase Sig. Gen. output to +3 dBm. Reduce RF GAIN setting until RF V.M. indicates -15 dBm or less.	MAN GAIN reduction >100 dB.	Refer to Table 4-3, step 6a

Table 4-2. **WJ-8718 Series HF Receiver Checkout Procedure.** (Cont'd)

Step	Test Equipment	Control Settings and Instructions	Normal Indication	IF Indication is Abnormal
6. MAN/AGC Operation (Cont'd)		c. Reduce Sig. Gen. output to -87 dBm. Set receiver to AGC Mode. Note AC V.M. reading.		
		d. Increase Sig. Gen. output to -7 dBm. Note increase in AC V.M. indication.	<6 dB increase, no clipping.	Refer to Table 4-3, step 6b
7. Freq. Tuning Accuracy	HP8640B Boonton 92B HP5303A	a. Set Sig. Gen. to 00.50000 MHz, -60 dBm, unmodulated. Set receiver to 00.50000 MHz AM Mode, 1 kHz BW, MAN GAIN Mode. Set RF GAIN control for -15 dBm on RF V.M.		
		b. Read IF Frequency on Freq. Counter.	455.000 kHz ±0.100 kHz	Refer to Table 4-3, step 7a
		c. Increase both Sig. Gen. and receiver to 29.99990 MHz.		
		d. Read IF Frequency on Freq. Counter.	455.000 MHz ±0.100 kHz	Refer to Table 4-3, step 7a

4.3.4 RECEIVER TROUBLESHOOTING PROCEDURES

The troubleshooting procedures contained in **Table 4-3** are to be used in conjunction with the Receiver Checkout Procedures in **Table 4-2.** The checkout procedures are keyed to the troubleshooting procedures when a malfunction of the receiver is indicated. The troubleshooting procedures provide a listing of specific malfunctions that will result in failure to obtain the specific test results called for in the checkout procedures. Probable causes of the malfunctions and necessary corrective action are also listed. When a malfunction can be caused by more than a single source, the procedures give additional test steps that will permit more positive identification of the trouble.

Table 4-3 will aid the location of a defective module in the receiver. To locate a defective component on a module known to be defective, refer to **paragraph 4.3.5** for individual module testing and troubleshooting.

Table 4-3. WJ-8718 Series HF Receiver Troubleshooting Procedures.

Step	Fault	Probable Cause	Additional Test	Corrective Action
1.	a. No display brightness	Misadjusted Display brightness control.		Adjust A8R2 for for proper brightness.
	b. Same	Defective Frequency Display		Replace A8.
	c. Display will not increment	Up/Down Counter circuit malfunctioning.	Check CLOCK and DIR outputs from Encoder U5.	Replace U5 if incorrect. Replace A6A1 if correct.
	d. Same	Tuning Res. Faulty		Check or replace A7
	e. Not all Freq. digits increment.	Faulty Up/Down Counter or Display.	Check BCD data on lines corresponding to faulty digit.	IF data increments replace A8. IF not, replace A6A1.
2.	a. Incorrect +15 V at E1	Faulty U1	Check for +24 V at A1J7	IF correct, replace U1. If not, check components on A1.
	b. Incorrect -15 V at E2	Faulty U2	Check for -24 V at A1J12	If correct, replace U2. If not, check components on A1.
	c. Incorrect +10 V at E3.	Faulty CR1, CR3		Check CR1 and CR3
	d. Incorrect voltage at C8.	Faulty U4 (8718A/8718-9)		Replace U4
3.	a. IF output dead on all	Faulty LO signals	Check 1st LO at A1J2: 57.91 MHz at +20 dBm.	Check BCD presets to A5A1. If correct, replace A5A1. If not replace A6A1

Table 4-3. WJ-8718 Series HF Receiver Troubleshooting Procedures. (Cont'd)

Step	Fault	Probable Cause	Additional Test	Corrective Action
3.			Check 2nd LO at A2J1: 32.20500 MHz at 0 dBm.	Check BCD presets to A5A2. If correct, replace A5A2. If not replace A6A1.
			Check 3rd LO at A4A2-13: 11.155 MHz at -6 dBm.	If incorrect replace A5A1.
		Faulty A4A7	Check A4A7-47 for 0 Vdc.	If correct, replace A4A7,repeat step 3b Table 4-2. If not, check or replace A4A6.
		Faulty A4A2		Replace A4A2. Repeat step 3b, Table 4-2
		Faulty A3	Check A3C1 for 0 Vdc.	If correct, replace A3, repeat step 3b Table 4-2. If not, check or replace A4A6.
	b. If output dead on 1 or more BWs.	Faulty Filter Switch A4A1 or A4A3.	Check BW Select voltages, pins 15, 17, 19 or A4A1 and A4A3: +3 Vdc for selected BW.	If correct, replace A4A1 or A4A3, repeat Step 3b, 3c, Table 4-2. If not, check or replace A6A2.
	c. IF output level out of limits on 1 or more BWs.	Incorrect Alignment.		Perform A4A1 Alignment, Para. 4.3.7.3.2 and and A4A7 Alignment, Para. 4.3.7.3.4.
	d. Incorrect USB IF output in USB Mode.	Faulty A4A4	Check USB Select voltage at A4A4-49: +3 Vdc in USB Mode.	If correct, replace A4A4, repeat step 3d, Table 4-2. If not, check or replace A6A2.
		Incorrect Alignment		Adjust A4A4R23 for -15 dBm IF output level.

Table 4-3. **WJ-8718 Series HF Receiver Troubleshooting Procedures.** (Cont'd)

Step	Fault	Probable Cause	Additional Test	Corrective Action
	e. Incorrect USB IF output in ISB Mode.	Faulty A6A2		Check or replace A6A2.
	f. Incorrect LSB IF output in LSB Mode.	Faulty A4A5	Check LSB Select voltage at A4A5-49: +3 Vdc in LSB Mode.	If correct, replace A4A5, repeat step 3f, Table 4-2. If not, check or replace A6A2.
4.	a. No 400 Hz tone in earphone (AM Mode)	Faulty A4A10	Check signal at A4A10-51: 0.7 Vrms at 400 Hz.	If incorrect, replace A4A7. If correct, perform next test.
			Check signal at A4A10-55: 0.7 Vrms at 400 Hz.	If incorrect replace A4A10. If correct, check Headphone Amp. A10A2U1.
	b. No Line Audio Output (AM Mode)	Faulty A4A10	Check signal at A4A10-11, 13 with R1 at max CW: 3 Vrms at 400 Hz	If incorrect, replace A4A10. If correct, replace T2.
	c. Line Audio Output distorted. (AM Mode)	Faulty A4A10		Replace A4A10. If problem not corrected, replace T2.
	d. No 400 Hz tone in earphone (CW Mode)	Faulty A4A9	Check Audio Signal at A4A9-57. 0.7 Vrms at 400 Hz.	If correct, replace A4A10. If correct, perform next test.
			Check BFO Signal at A4A9-17: 454.600 kHz at 40 mV.	If incorrect, check or replace A5A3. If correct, perform next test.
			Check CW/SSB Select voltage, A4A9-43: 3 Vdc in CW mode.	If incorrect, check or replace A6A2. If correct, replace A4A9.

Table 4-3. WJ-8718 Series HF Receiver Troubleshooting Procedures. (Cont'd)

Step	Fault	Probable Cause	Additional Test	Corrective Action
4.	e. No 400 Hz tone in earphone (USB,ISB)	Faulty A6A2	Check SSB Select Voltages at A4A4-49 (USB), A4A4-51 (ISB), A4A9-43 (SSB): 3 Vdc in selected modes.	If incorrect, check or replace A6A2. If correct, perform next test.
		Faulty A5A3	Check BFO Signal at A4A9-17: 455.000 kHz at 40 mV.	If incorrect, check or replace A5A3. If correct, check A4A9.
	f. No 400 Hz tone in earphone, (LSB Mode)	Faulty A6A2		Check or replace A6A2.
	g. No ISB Line Audio Output.	Faulty A4A8		Check or replace A4A8.
5.	a. Low SNR.	Faulty RF Filter		Check or replace RF Filter.
		Faulty A3	Check 1st and 2nd LO signals for adequate levels: 1st LO: +20 dBm 2nd LO: 0 dBm	If incorrect, replace A5A1 or A5A2 If correct, substitute new A3 and repeat Step 5, Table 4-2.
6.	a. MAN GAIN range is 100 dB	Faulty A4A6	Check AGC outputs for correct swing as RF Gain is rotated CCW to CW: A4A6-47, 0 to -3.5 V, A4A6-19, 0 to +0.8 V.	If either output is incorrect check or replace A4A6. If both outputs are correct, check A3, then check A4A7.
	b. AGC control range is 80 dB.	Faulty A4A6	Check input to AGC at A4A6-51: 2 Vdc.	If correct, replace A4A6. If incorrect, receiver gain is low Repeat step 3, Table 4-2.

Table 4-3. WJ-8718 Series HF Receiver Troubleshooting Procedures. (Cont'd)

Step	Fault	Probable Cause	Additional Test	Corrective Action
7.	a. IF output freq. error >±100 Hz.	Time Base misadjusted.	With receiver and sig. gen. tuned to 29.99990 MHz, adjust A5A1U14 for 0 Hz error in IF output. Repeat step 7, Table 4-3.	If receiver still fails test, check BCD presets to A5A1 and A5A2 at 00.50000 and 29.99990 MHz receiver tuned frequencies. If correct, replace A5A1 or A5A2. If incorrect, replace A6A1.

4.3.5 MODULE TROUBLESHOOTING PROCEDURES

Module troubleshooting procedures consist of checkout, fault-isolation and repair information necessary to restore a malfunctioning module to normal operation. Troubleshooting information provided in this paragraphs consists of the following categories:

1. Module checkout procedures to verify module fault symptoms.
2. Fault isolation tables to help isolate defective components on the modules. Semiconductor voltage tables are also provided to help locate defective transistors and integrated circuits.
3. A Parts Replacement Guide, **Paragraph 4.3.6**, to assist in repairing a defective module.

In addition to using the information provided in this paragraph, reference to the Circuit Description in Section III and Schematic Diagrams in Section VI is essential for efficient module troubleshooting.

4.3.5.1 Procedure Guidelines

To properly check-out and troubleshoot a defective module, the following guidelines should be utilized:

1. Allow the test equipment a 30 minute warm-up before any check out.
2. Refer to the Testing and Troubleshooting paragraph for the desired module. Configure the receiver and test equipment as stated in the Checkout Procedure for the desired module.

3. Perform the Checkout Procedure in the sequence given. If any desired result is not obtained, refer to the Fault Isolation paragraph for the module to locate the defective component.

4. Refer to the Parts Replacement Guide, **Paragraph 4.3.6**, to assist in replacing any components found to be defective. Following component replacement, re-perform the Module Checkout Procedure. If the module still fails, additional troubleshooting using the Circuit Descriptions in Section III and Schematic Diagrams in Section VI is necessary.

4.3.5.2 RF Filter Testing And Troubleshooting

RF Filter Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator, an RF Voltmeter, and a Digital Voltmeter (see **Table 4-1**) are required to perform the tests outlined below.

4.3.5.2.1 RF Filter Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.2.2** for fault isolation.

1. Disconnect A2P1 from A3A1J1 on the Input Converter.
2. Connect an RF Voltmeter and 50 Ω adapter to A2P1.
3. Connect the output of a Signal Generator to A2J1 on the rear panel of the receiver.
4. Set the RF Voltmeter to the 0 dBm range.
5. Set the Signal Generator output frequency to 1.0 MHz and output level to 0 dBm.
6. The RF Voltmeter should indicate a level between 0 dBm and -1.0 dBm.
7. Tune the Signal Generator to 10 MHz and 20 MHz, and 30 MHz successively, maintaining the output level at 0 dBm for each frequency. The filter output level should not be less than -3.0 dBm for each frequency.
8. Disconnect the test equipment from the receiver.
9. Reconnect A2P1 to A3A1J1.

4.3.5.2.2 RF Filter Fault Isolation

1. Remove the filter from the receiver and remove the filter's protective cover.
2. Check all capacitors and the two Zener diodes for leakage to ground.
3. Check all inductors for continuity.
4. Field realignment of the filter is not practical.

4.3.5.3 Input Converter Testing And Troubleshooting

Input Converter Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator and an RF Voltmeter (**see Table 4-1**) are required to perform the tests outlined below.

4.3.5.3.1 Input Converter Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.3.2** for fault isolation.

1. Deenergize the receiver.
2. Disconnect A2P1 from A3A1J1 and P28 from A3A2J2. Terminate A3A2J2 with 50 Ω.
3. Set the receiver front panel controls as follows:

   a. Gain Mode - Manual
   b. RF Gain - Maximum Clockwise

4. Connect the RF Voltmeter to connector A3A2J2 using a short coaxial cable (a "TEE" connector should be used to maintain 50 Ω termination).
5. Connect the Signal Generator to connector A3A1J1 using a short coaxial cable. Set the Generator output frequency to 15.00500 MHz and output level to -7 dBm.
6. Energize the receiver and tune to 15.00500 MHz.
7. The RF Voltmeter should display a level of 350 mV.

8. Deenergize the receiver and disconnect test equipment, if no further tests are to be performed.

4.3.5.3.2 **Input Converter, A3, Fault Isolation**

Table 4-4, Input Converter Fault Isolation Chart, is used to isolate the module fault to a stage or circuit. Set up the Test Equipment as stated in **Paragraph 4.3.5.3.1** and check the Test Points given in **Table 4-4** with an RF Voltmeter and high impedance probe. When a faulty signal is encountered, replace the key components indicated and repeat the Checkout Procedure in **Paragraph 4.3.5.3.1**. **Table 4-5**, Input Converter Voltage Table, and **Figure 6-2**, Input Converter Schematic Diagram should be referred to if additional signal tracing/fault isolation is necessary.

Table 4-4. Input Converter Fault Isolation Chart

Test Point	Normal Signal	Key Components	Comments
A1J2	1.8 V at 57.91 MHz	Check 1st LO	1st LO Signal
U1-8	74 mV at 42.905 MHz	U1	1st IF
FL1-IN	200 mV at 42.905 MHz	U2	
FL1-OUT	80 mV at 42.905 MHz	FL1	
A2Q2-S	40 mV at 42.905 MHz	Input Matching Network	
A2Q2-D	500 mV at 42.905 MHz	A2Q2, T1, C16, CR2	
A2J1	260 mV at 32.205 MHz	Check 2nd LO	2nd LO Signal
A2Q6-B	500 mV at 32.205 MHz	A2Q5	
A2Q6-C	1.3 V at 32.205 MHz	A2Q6	
A201-3	130 mV at 10.7 MHz	A2U1	2nd IF
A2Q3-C	1.3 V at 10.7 MHz	Q3, Q4, T2	
A252	350 mV at 10.7 MHz	FL1	

Table 4-5. Input Converter Voltage Table

TRANSISTOR PIN		VOLTAGE	TRANSISTOR PIN		VOLTAGE
A2Q1	E B C	+ 0.45 + 1.1 + 1.9	A2Q4	E B C	+ 1.25 + 1.95 + 7
A2Q2	S G D	+ 1.95 0.0 + 15	A2Q5	E B C	- 12 - 11 0.0
A2Q2	S G C	+ 1.95 + 1.1 + 1.9	A2Q6	E B C	- 10 - 9.5 0.0
A2Q3	E B C	+ 8 + 8.8 + 14	A2Q6	E B C	- 10 - 9.5 0.0

4.3.5.4 **10.7 MHz Filter Switch Testing and Troubleshooting**

10.7 MHz Filter Switch Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator and an RF Voltmeter (Table 4-1) are required to perform the tests outlined below.

4.3.5.4.1 **10.7 MHz Filter Switch Checkout Procedure**

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to paragraph 4.3.5.4.2 for fault isolation.

1. Deenergize the receiver.
2. Disconnect connector P19 from A4XA1.
3. Place PC board A4A1 in an extender.
4. Depress the receiver 3.2 kHz BW button.

5. Connect the RF Voltmeter to A4XA1 pin 57 using a short coaxial cable with clip leads on one end.

6. Connect the Signal Generator to A4XA1 pin 13 using a short coaxial cable with clip leads on one end. Set the Generator output frequency to 10.7 MHz and output level to -27 dBm.

7. Energize the receiver. The RF Voltmeter should display a level of 50 mV.

8. Depress the 6 kHz BW button and then the 16 kHz BW button. The RF Voltmeter should display a level of 50 mV in both BW position.

9. Deenergize the receiver and disconnect test equipment if no further tests are to be performed.

4.3.5.4.2 10.7 MHz Filter Switch, A4A1, Fault Isolation

Table 4-6, 10.7 MHz Filter Switch Fault Isolation Chart, is used to isolate the module fault to a stage or circuit. Set up the Test Equipment as stated in **paragraph 4.3.5.4.1** and check the Test Points given in **Table 4-6** with an RF Voltmeter and high impedance probe. When faulty signal is encountered, replace the key components indicated and repeat the Checkout Procedure in **paragraph 4.3.5.4.1. Table 4-7,** 10.7 MHz Filter Switch Voltage Table, and **Figure 6-4,** 10.7 MHz Filter Switch Schematic Diagram should be referred to if additional signal tracing/fault isolation is necessary.

Table 4-6. 10.7 MHz Filter Switch Fault Isolation Chart.

Test Point	Normal Signal	Key Components	Comments
C1/L1 junction	33 mV at 10.7 MHz	C1, L1	All BW positions
Q1-C	110 mV at 10.7 MHz	Q1	Depress 3 kHz BW
FL1-OUT	65 mV at 10.7 MHz	FL1	
Q4-B	12 mV at 10.7 MHz	R26, Q4	
Q2-C	120 mV at 10.7 MHz	Q2	Depress 6 kHz BW
FL2-OUT	65 mV at 10.7 MHz	FL2	
Q5-B	10 mV at 10.7 MHz	R28, Q5	
Q3-C	90 mV at 10.7 MHz	Q3	Depress 16 kHz BW
Q6-B	10 mV at 10.7 MHz	R30, Q6	
A1-57	50 mV at 10.7 MHz	Q4, Q5, Q6, U1, U2	All BW positions

Table 4-7. 10.7 MHz Filter Switch Voltage Chart

PIN	Bandwidth (kHz)			PIN	Bandwidth (kHz)		
	16	6	3.2		16	6	3.2
Q1 C B E	+15.26 - 2.38 0.00	+15.26 - 2.38 0.00	+14.50 + 2.68 + 2.04	Q4 C B E	+15.32 - 2.24 0.00	+15.32 - 2.24 0.00	+15.29 + 2.48 + 1.83
Q2 C B E	+15.26 - 2.53 0.00	+14.49 + 2.85 + 2.19	+15.26 - 2.53 0.00	Q5 C B E	+15.32 - 2.21 0.00	+15.29 + 2.44 + 1.78	+15.32 - 2.21 0.00
Q3 C B E	+15.17 + 2.76 + 2.01	+15.25 - 2.36 0.00	+15.26 - 2.36 0.00	Q6 C B E	+15.29 + 2.50 + 1.88	+15.32 - 2.23 0.00	+15.32 - 2.23 0.00

4.3.5.5 <u>10.7 MHz/455 kHz Converter Testing and Troubleshooting</u>

10.7 MHz/455 kHz Converter Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator and an RF Voltmeter (**Table 4-1**) are required to perform the tests outlined below.

4.3.5.5.1 10.7 MHz/455 kHz Converter Checkout Procedure

Perform the following in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.5.2** for fault isolation.

1. Deenergize the receiver.
2. Place PC board A4A2 on an extender. Remove PC board A4A1.
3. Connect the RF Voltmeter to A4XA2 pin 19 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane.
4. Connect the Signal Generator RF output to A4XA2 pin 57 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane. Set the Generator output frequency to 10.7 MHz and output level to -27 dBm.

5. Energize the receiver. The Oscilloscope should display a level of 22 mV.

6. Deenergize the receiver and disconnect Test Equipment if no further tests are to be performed. Replace A4A1.

4.3.5.5.2 **10.7 MHz/455 kHz Converter, A4A2, Fault Isolation**

Table 4-8, 10.7 MHz/455 kHz Converter Fault Isolation Chart, is used to isolate the module fault to a stage or circuit. Set up the Test Equipment as stated in **paragraph 4.3.5.5.1** and check the Test Points given in **Table 4-7** with an RF Voltmeter and high impedance probe. When a faulty signal is encountered, replace the key components indicated and repeat the Checkout Procedure in **paragraph 4.3.5.5.1. Table 4-9**, 10.7 MHz/455 kHz Converter Voltage Table, and **Figure 6-5**, 10.7 MHz/455 kHz Converter Schematic Diagram should be referred to if additional signal tracing/fault isolation is necessary.

Table 4-8. 10.7 MHz/455 kHz Converter Fault Isolation Chart.

Test Point	Normal Signal	Key Components	Comments
A4A2-13	150 mV at 11.155 MHz	Check 3rd LO	3rd LO Signal
Q1-C	2.5 V at 11.155 MHz	Q1	
U1-2	350 mV at 11.155 MHz	L2, C6, C7, C8	
U1-4	5 mV at 455 kHz	U1	3rd IF Signal
A4A2-19	22 mV at 455 kHz	L3, L4, C9, C10, C11	

Table 4-9. 10.7 MHz/455 kHz Converter Voltage Table.

A2Q1	EMITTER	+ 3.24
	BASE	+ 3.96
	COLLECTOR	+14.8

4.3.5.6 **455 kHz Filter Switch Testing and Troubleshooting**

455 kHz Filter Switch Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator and an RF Voltmeter (**Table 4-1**) are required to peform the following tests.

4.3.5.6.1 455 kHz Filter Switch Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.6.2** for fault isolation.

1. Deenergize the receiver.
2. Remove PC board A4A2. Place PC board A4A3 on an extender.
3. Depress the receiver 3.2 kHz BW button.
4. Connect the RF Voltmeter input to A4XA3 pin 57 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane.
5. Connect the Signal Generator RF output to A4XA3 pin 13 using a short coaxial cable with clip leads on one end. Terminate the generator with a 50 Ω load. Connect cable shield to the IF Motherboard ground plane. Set the Generator output frequency to 455 kHz and output level to -27 dBm.
6. Energize the receiver. The RF Voltmeter should display a level of 25 mV.
7. Depress the 1.0 kHz BW button and then the 0.3 kHz BW button. The RF Voltmeter should display no less than 20 mV in both BW positions.
8. Deenergize the receiver and disconnect test equipment if no further tests are to be performed.

4.3.5.6.2 455 kHz Filter Switch, A4A3, Fault Isolation

Table 4-10, 455 kHz Filter Switch Fault Isolation Chart, is used to isolate the module fault to a stage or circuit. Set up the Test Equipment as stated in **paragraph 4.3.5.6.1** above and check the Test Points given in **Table 4-10** with an RF Voltmeter and high impedance probe. When a faulty signal is encountered, replace the key components indicated and repeat the Checkout Procedure in **paragraph 4.3.5.6.1**. **Table 4-11**, 455 kHz Filter Switch Voltage Table, and **Figure 6-6**, 455 kHz Filter Switch Schematic Diagram should be referred to if additional signal tracing/fault isolation is necessary.

Table 4-10. 455 kHz Filter Switch Fault Isolation Chart.

Test Point	Normal Signal	Key Components	Comments
Q5-C	23 mV at 455 kHz	Q5	Depress 3.2 kHz BW
Q3-C	27 mV at 455 kHz	Q3	Depress 1.0 kHz BW
Q4-B	17 mV at 455 kHz	FL2, Q4	
Q1-C	19 mV at 455 kHz	Q1	Depress 0.3 kHz BW
Q2-B	17 mV at 455 kHz	Fl1, Q2	
A4A3-57	25 mV at 455 kHz	Q2, Q4, Q6	3.2 kHz BW
A4A3-57	20 mV at 455 kHz	Q2, Q4, Q6	1.0, 0.3 kHz BW

Table 4-11. 455 kHz Filter Switch Voltage Table

BANDWIDTH (kHz)

	PIN	16/6/3.2	1.0	0.3
U1	1	- 12.9	+ 13.5	- 12.9
	3	0.0	+ 4.6	0.0
	5	+ 4.4	0.0	0.0
	7	+ 13.6	- 13	- 13
	11	- 14	- 14	- 14
	12	0.0	0.0	+ 4.6
	13	+ 2.7	+ 2.7	+ 2.7
	14	- 13	- 13	+ 13.6
Q1	E	0.0	0.0	0.0
	B	- 1.8	- 1.8	+ 1.8
	C	+ 14.9	+ 14.9	+ 14.9
Q2	E	0.0	0.0	+ 0.9
	B	- 1.5	- 1.5	+ 1.5
	C	14	14	14
Q3	E	0.0	+ 2.3	0.0
	B	- 3	+ 3	- 3
	C	14.9	14.3	14.8
Q4	E	0.0	0.8	0.0
	B	- 1.4	+ 1.4	- 1.4
	C	14	14	14

Table 4-11. 455 kHz Filter Switch Voltage Table (Cont'd)

BANDWIDTH (kHz)

	PIN	16/6/3.2	1.0	0.3
Q5	E B C	1.25 + 1.9 + 14.7	0.0 - 1.9 + 14.7	0.0 - 1.9 + 14.7
Q6	E B C	+ 0.8 + 1.4 + 14	0.0 - 1.4 + 14	0.0 - 1.4 + 14

4.3.5.7 **USB Filter Switch Testing and Troubleshooting**

USB Filter Switch Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator and an RF Voltmeter (Table 4-1) are required to perform the tests outlined below.

4.3.5.7.1 **USB Filter Switch Checkout Procedure**

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to paragraph 4.3.5.7.2 for fault isolation.

1. Deenergize the receiver.

2. Remove PC board A4A2. Place PC board A4A4 on an extender board.

3. Connect the RF Voltmeter Input to A4XA4 pin 57 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane.

4. Connect the Signal Generator RF output to A4XA4 pin 13 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane. Terminate the generator with a 50 Ω load. Set the Generator output frequency to 456.8 kHz and output level to -27 dBm.

5. Energize the receiver and depress the USB and then the ISB Mode buttons. The RF Voltmeter should display a level of 25 mV in both modes.

6. Deenergize the receiver and disconnect test equipment if no further tests are to be performed.

4.3.5.7.2 USB Filter Switch, A4A4, Fault Isolation

Table 4-12, USB Filter Switch Fault Isolation Chart, is used to isolate the module fault to a stage or circuit. Set up the Test Equipment as stated in **paragraph 4.3.5.7.1** and check the Test Points given in **Table 4-12** with an RF Voltmeter and high impedance probe. When a faulty signal is encountered, replace the key components indicated and repeat the Checkout Procedure in **paragraph 4.3.5.7.1. Table 4-13**, USB Filter Switch Voltage Table, and **Figure 6-7**, USB Filter Switch Schematic Diagram should be referred to if additional signal tracing/fault isolation is necessary.

Table 4-12. USB Filter Switch Fault Isolation.

Test Point	Normal Signal	Key Components	Comments
Q1-C	38 mV at 456.8 kHz	Q1, L1, CR1, U1	Depress USB Switch
Q2-B	14 mV at 456.8 kHz	FL1, Q2	Depress USB Switch
Q2-C	28 mV at 456.8 kHz	Q2, L2	Depress USB Switch
Q2-C	28 mV at 456.8 kHz	CR2	Depress ISB Switch

Table 4-13. USB Filter Switch,A4A4,Voltage Table

PIN		USB MODE	OTHER MODE
Q1	C	+ 14.69	+ 15.38
	B	+ 2.34	- 2.15
	E	+ 1.68	0.00
Q2	C	+ 14.78	+ 15.38
	B	+ 1.80	- 1.76
	E	+ 1.14	0.00

4.3.5.8 ISB/LSB Filter Switch Testing and Troubleshooting

ISB/LSB Filter Switch Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator and an RF Voltmeter (**Table 4-1**) are required to perform the tests outlined below.

6. Move the RF Voltmeter clip lead to A4XA7 pin 13. The Oscilloscope should display a level of 20 mV.

7. Turn on the Signal Generator AM Modulation and set it for 50% modulation at 400 Hz.

8. Connect the Oscilloscope vertical input to A4XA7 pin 51 using a coaxial with clip leads on one end. The Oscilloscope should display a level of 1.0 V p-p at ≈400 Hz superimposed on a dc level of + 3.8 Vdc.

9. Deenergize the receiver and disconnect test equipment if no further tests are done.

4.3.5.9.2 455 kHz Amplifier/AM Detector, A4A7, Fault Isolation

Table 4-16, 455 kHz Amplifier/AM Detector Fault Isolation Chart, is used to isolate the module fault to a stage or circuit. Set up the Test Equipment as stated in **paragraph 4.3.5.9.1** and check the Test Points given in **Table 4-16** with an oscilloscope or RF Voltmeter with high impedance probe, as indicated. When a faulty signal is encountered, replace the key components indicated and repeat the Checkout Procedure in **paragraph 4.3.5.9.1.** **Table 4-17,** 455 kHz Amplifier/AM Detector Voltage Table, and **Figure 6-10,** 455 kHz Amplifier/AM Detector Schematic Diagram should be referred to if additional signal tracing/fault isolation is necessary.

Table 4-16. Amplifier/AM Detector Fault Isolation Chart.

Test Point	Normal Signal	Key Components	Comments
Q1-1	12 mV at 455 kHz	Q1, CR1, L1	No Gen. Modulation
Q2-1	19 mV at 455 kHz	Q2, CR2, L2, R7	
Q3-E	20 mV at 455 kHz	Q3, L3	
Q4-C	300 mV at 455 kHz	Q4, T1	
A4A7-17	90 mV at 455 kHz	T1	
Q5-B	1 V at 455 kHz	Q5	
CR3/L6 junction	3.1 V at 455 kHz	Q5, L5	
Q6-B	4.6 Vdc/1 Vpp - 400 Hz	CR3, Q6	Turn on Gen. Modulation; use oscilloscope.
A4A7-51	3.8 Vdc/1 Vpp - 400 Hz	Q6, L7	Turn on Gen. Modulation; use oscilloscope.

Table 4-17. 455 kHz Amplifier/AM Detector Voltage Table.

	PIN	VOLTAGE		PIN	VOLTAGE
Q1	1 2 3 3 4	+ 13.7 + 3.75 + 0.87 + 0.87	Q4	E B C C	+ 3.5 + 4.1 + 14.4 + 14.4
Q2	1 2 3 4	+ 15 + 3.8 + 0.9 + 1.4	Q5	E B C	- 0.7 - 0.1 + 14.2
Q3	E B C	- 0.5 0.0 + 15.0	Q6	E B C	+ 3.3 + 0.95 + 15.0

NOTE

Above readings taken in Fast AGC Mode with no RF input signal.

4.3.5.10 FM/CW/SSB Detector Testing and Troubleshooting

FM/CW/SSB Detector Detector Testing and Troubleshooting includes a CW/SSB Detector Checkout procedure, an FM Detector Checkout Procedure and fault isolation information. A Signal Generator, RF Voltmeter and an Oscilloscope (Table 4-1) are required to perform the tests outlined below.

4.3.5.10.1 CW/SSB Detector Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.10.3** for fault isolation.

1. Deenergize the receiver.
2. Remove PC board A4A7. Place PC board A4A9 on an extender.
3. Connect the Oscilloscope Vertical Input to A4XA9 pin 57 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane.

4. Connect the Signal Generator RF output to A4XA9 pin 13 using a short coaxial cable with clip leads on one end. Connect cable shield to the ground plane. Terminate the generator with a 50 Ω load. Set the Generator output frequency to 455.4 MHz and output level to -33 dBm.

5. Energize the receiver and depress the USB Mode button. The Oscilloscope should display a level of 0.5 V p-p at 400 Hz. The waveform should be a clean sine save.

6. Deenergize the receiver and disconnect test equipment if no further tests are to be done.

4.3.5.10.2 FM Detector Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.10.3** for fault isolation.

1. Deenergize the receiver.

2. Remove PC board A4A7. Place PC board A4A9 on an extender.

3. Connect the Oscilloscope Vertical Input to A4XA9 pin 57 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane.

4. Connect the Signal Generator RF output to A4XA9 pin 13 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane. Terminate the generator with a 50 Ω load. Set the generator output frequency to 455 kHz and output level to -33 dBm. Set the Generator for FM Modulation at 400 Hz and 4.8 kHz deviation.

5. Energize the receiver and depress the FM Mode button. The Oscilloscope should display a level of 1 V p-p at 400 Hz. The waveform should be a clean sine wave.

6. Deenergize the receiver and disconnect test equipment if no further tests are to be done.

4.3.5.10.3 FM/CW/SSB Detector, A4A9, Fault Isolation

Table 4-18, FM/CW/SSB Detector Fault Isolation Chart, is used to isolate the module fault to a stage or circuit. Set up the Test Equipment as stated in **paragraph 4.3.5.10.1** and check the Test Points given in **Table 4-18** with an oscilloscope or RF Voltmeter with high impedance probe, as indicated. When a faulty signal is encountered, replace the key components indicated and repeat the Checkout Procedure in **paragraph 4.3.5.10.1**. **Table 4-19**, FM/CW/SSB Detector Voltage Table, and **Figure 6-12**, FM/CW/SSB Detector Schematic Diagram should be referred to if additional signal tracing/fault isolation is necessary.

Table 4-18. FM/CW/SSB Detector Fault Isolation Chart.

Test Point	Normal Signal	Key Components	Comments
U2-8	200 mV at 455 kHz	Check BFO	Depress CW Switch
U3-5	4 Vpp at 400 Hz	U2, Q3, Q4	Depress CW Switch Use oscilloscope
A4A9-57	0.5 Vpp at 400 Hz	U3	Depress CW Switch Use oscilloscope
U1-5	2 V at 455 kHz	U1, Q1, Q2	Depress FM Switch
U3-3	4 Vpp at 400 Hz	CR1, CR2, T1	Turn on FM Modulation. Use Oscilloscope.
A4A9-57	1 Vpp at 400 Hz	U3	Turn on FM Modulation. Use Oscilloscope.

Table 4-19. FM/CW/SSB Detector Voltage Table

Component Pin	AM	FM	CW & SB
Q1 E	9.6	8.1	9.2
Q1 B	9.5	7.3	9.2
Q1 C	0.0	8.0	0.0
Q2 E	0.0	2.0	0.0
Q2 B	0.0	0.62	0.0
Q2 C	9.9	0.0	9.2
Q3 E	9.6	8.7	9.0
Q3 B	9.6	8.7	8.4
Q3 C	-1.8	-1.8	9.0
Q4 E	0.0	0.0	0.0
Q4 B	0.0	0.0	0.7
Q4 C	9.6	8.8	0.0
U1 1	0.0	2.0	0.0
U1 2	0.0	2.0	0.0
U1 3	0.0	2.0	0.0
U1 4	0.0	2.0	0.0
U1 5	0.0	5.6	0.0
U1 6	0.0	0.0	0.0
U1 7	0.0	0.0	0.0
U1 8	0.0	0.0	0.0
U1 9	0.0	0.3	0.0
U1 10	0.0	5.6	0.0

Component Pin	AM	FM	CW & SB
U2 1	- 1.6	- 1.6	- 1.6
U2 3	- 1.7	- 1.7	- 1.7
U2 4	- 1.6	- 1.6	- 1.6
U2 5	- 3.8	- 3.8	- 3.8
U2 6	- 0.7	- 0.7	3.8
U2 7	0.0	0.0	0.0
U2 8	- 0.1	- 0.1	0.0
U2 9	- 0.0	0.0	0.0
U2 12	- 0.7	- 0.7	4.0
U2 13	- 0.7	- 0.7	4.0
U2 14	-13.0	-13.0	-13.0
U3 1	0.0	0.3	0.0
U3 2	0.0	0.63	0.0
U3 3	0.0	0.64	0.0
U3 4	14.0	12.5	13.5
U3 5	0.0	0.0	0.0
U3 6	0.0	0.0	0.0
U3 7	0.0	0.0	0.0
U3 8	0.0	- 0.0	0.0
U3 9	0.0	0.0	0.0
U3 10	0.0	0.0	0.0
U3 11	-13.0	-13.0	-13.0
U3 12	9.4	8.5	9.1
U3 13	9.4	8.5	9.1

4.3.5.11 Audio Amplifier Testing and Troubleshooting

Audio Amplifier Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator and an Oscilloscope (**Table 4-1**) are required to perform the tests outlined below.

4.3.5.11.1 Audio Amplifier Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.11.2** for fault isolation.

1. Deenergize the receiver.
2. Remove PC boards A4A6, A4A7, and A4A9. Place PC board A4A10 on an extender.
3. Set the receiver Line Audio Level control to Maximum Clockwise and the Phone Level control to mid-range.
4. Connect the Oscilloscope Vertical Input to A4XA10 pin 55 using a short coaxial cable with clip leads on one end. Connect shield to IF Motherboard ground plane.
5. Connect the Signal Generator AM output to A4XA10 pin 51 using a short coaxial cable with clip leads on one end. Connect cable shield to IF Motherboard ground plane. Set the Signal Generator Modulation Frequency to 400 Hz, set Audio Output Level to 0.2 V rms and set AM switch to INT.
6. Energize the receiver and depress the AM Mode button. The Oscilloscope should display a level of 0.3 V p-p at 400 Hz. The waveform should be a clean sine wave.
7. Use the Oscilloscope lead to probe A4XA10 pin 13 and A4XA10 pin 11. The Oscilloscope should display a level of 15 V p-p at 400 Hz on each pin.
8. Connect the Oscilloscope clip lead to A4XA10 pin 41. The Oscilloscope should indicate a level of -10.8 Vdc.
9. Move the Oscilloscope clip lead to A4XA10 pin 19. The Oscilloscope should display a level of 7 V p-p at 400 Hz.
10. Deenergize the receiver and disconnect test equipment if no further tests are to be done.

4.3.5.11.2 **Audio Amplifier, A4A10, Fault Isolation**

Table 4-20, Audio Amplifier Fault Isolation Chart, is used to isolate the module fault to a stage or circuit. Set up the Test Equipment as stated in **paragraph 4.3.5.11.2** and check the Test Points given in **Table 4-20** with an oscilloscope. When a faulty signal is encountered, replace the key components indicated and repeat the Checkout Procedure in **paragraph 4.3.5.11.2**. **Table 4-21**, Audio Amplifier Voltage Table, and **Figure 6-13**, Audio Amplifier Schematic Diagram (Type 746001) should be referred to if additional signal tracing/fault isolation is necessary.

Table 4-20. Audio Amplifier Fault Isolation Chart.

Test Point	Normal Signal	Key Components	Comments
Q1-D	0.45 Vpp at 400 Hz	Q1, U1, CR1	Select AM Mode
U1-14	0.3 Vpp at 400 Hz	U1	
C8, R18 junction	300 mVpp at 400 Hz	Line Audio Control	
U2-2, 13	15 Vpp at 400 Hz	U2	
R7, R8	20 mVpp at 400 Hz	Phone Level Control	
T1-5	7 Vpp at 400 Hz	U1, T1	

Table 4-21. Audio Amplifier Voltage Table

	PIN	AM MODE ACTIVE	OTHER MODES ACTIVE
Q1	S	0.0	0.0
	D	0.0	0.0
	G	0.0	- 13
U1	1	+ 14	- 14
	2	+ 1.6	+ 1.6
	3	+ 5	0.0
U2	2	+ 6	+ 6
	13	+ 6	+ 6
	14	+ 12	+ 12

4.3.5.12 ISB Detector/Audio Testing and Troubleshooting

ISB Detector/Audio Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator, an RF Voltmeter and an Oscilloscope (**Table 4-1**) are required to perform the tests outlined below.

4.3.5.12.1 ISB Detector/Audio Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.12.2** for fault isolation.

1. Deenergize the receiver.
2. Remove PC board A4A5. Place PC board A4A8 on an extender.
3. Connect the Oscilloscope Vertical Input to A4XA8 pin 41 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane.
4. Connect the Signal Generator RF output to A4XA8 pin 53 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane. Terminate the generator with a 50 Ω load. Set the Generator output frequency to 454.6 kHz and output level to -47 dBm.
5. Energize the receiver and depress the ISB Mode button. The Oscilloscope should display a level of 0.7V p-p at 400 Hz. The waveform should be a clean sine wave.
6. Move the Oscilloscope clip lead to A4XA8 pin 44. Move shield clip lead to A4XA8 pin 48. Adjust A8R36 for an Oscilloscope reading of 8 V p-p at 400 Hz. The waveform should be a clean sine wave.
7. Move the Oscilloscope clip lead to A4XA8 pin 43. Connect cable shield to IF Motherboard ground plane. The Oscilloscope should display 0.0 Vdc.
8. Increase the Generator output level to -20 dBm. The level displayed on the Oscilloscope should increase to -6 Vdc.
9. Deenergize the receiver and disconnect the test equipment if no further tests are to be done..

4.3.5.12.2 ISB Detector/Audio, A4A8, Fault Isolation

Table 4-22, ISB Detector/Audio Fault Isolation Chart, is used to isolate the module fault to a stage or circuit. Set up the Test Equipment as stated in **paragraph 4.3.5.12.1** and check the Test Points given in **Table 4-22** with an oscilloscope or RF Voltmeter and high impedance probe as indicated. When a faulty signal is encountered, replace the key components indicated and repeat the Checkout Procedure in paragraph 4.3.5.12.1. Table 4-23, ISB Detector/Audio Voltage Table, and Figure 6-11, ISB Detector/Audio Schematic Diagram should be referred to if additional signal tracing/fault isolation is necessary.

Table 4-22. ISB Detector/Audio Fault Isolation Chart.

Test Point	Normal Signal	Key Components	Comments
Q1-1	3.5 mV at 455 kHz	Q1, CR1, L1	Use RF Voltmeter
Q2-3	0.9 mV at 455 kHz	R8	Use RF Voltmeter
Q2-1	9.5 mV at 455 kHz	Q2	Use RF Voltmeter
U1-8	200 mV at 455 kHz	Check BFO	BFO Signal
R33/C18 junction	50 mV at 400 Hz	U1	Use Oscilloscope
U3-1	4 Vpp at 400 Hz	U3	Use Oscilloscope
U2-7, 8	20 Vpp at 400 Hz	U2	Use Oscilloscope
A4A8-44 to 48	8 Vpp at 400 Hz	T1	Use Oscilloscope
U2-12	+2.1 Vdc	Q4, CR4	Increase Gen. to -20 dBm. Use Oscilloscope.
U3-14	-5.8 Vdc	U2, U3, Q3	Increase Gen. to -20 dBm. Use Oscilloscope.
U3-8	-3.35 Vdc	U3, Q5	Increase Gen. to -20 dBm. Use Oscilloscope.

Table 4-23. ISB Detector/Audio Voltage Table

	PIN	ISB	OTHER MODES
U1	1	- 7.5	- 7.5
	4	- 7	- 7
	5	- 13.5	- 13.5
	6	+ 1.3	- 0.8
	12	+ 1	- 0.8
	14	+ 15	+ 15
U2	1	+ 14	- 13.5
	2	+ 1.5	+ 1.5
	3	+ 5	0.0
	4	+ 15	+ 15
	11	- 15	- 15
	12	0.0	0.0
	13	+ 1	+ 5
	14	+ 1	+ 5
U3	4	+ 15	+ 15
	8	0.0	0.0
	9	0.0	0.0
	10	0.0	0.0
	11	- 15	- 15
	12	0.0	0.0
	13	0.0	0.0
	14	0.0	0.0

	PIN	ISB	OTHER MODES
Q1	1	+ 14.5	+ 14.5
	2	+ 3.3	+ 3.3
	3	+ 0.9	+ 0.9
	4	+ 1	+ 1
Q2	1	+ 14	+ 14
	2	+ 3.3	+ 3.3
	3	+ 0.8	+ 0.8
	4	+ 1	+ 1
Q3	E	0.0	+ 7.5
	B	+ 0.2	+ 0.2
	C	0.0	0.0
Q4	E	0.0	0.0
	B	0.0	0.0
	C	+ 15	+ 15
Q5	E	0.0	0.0
	B	+ 2.8	- .5
	C	0.0	0.0

4.3.5.13 AGC Testing and Troubleshooting

AGC Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator and a Digital Voltmeter (**Table 4-1**) are required to perform the tests outlined below.

4.3.5.13.1 AGC Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.13.2** for fault isolation.

1. Deenergize the receiver.
2. Remove PC boards A4A3, A4A4, A4A5, and A4A10.
3. Set the receiver Gain Mode to Fast AGC and Meter switch to Line Audio.

4. Connect the Digital Voltmeter input to A4XA6 pin 47 using a short cable with clip leads on one end. Connect the common lead to the IF Motherboard ground plane. Set the Digital Voltmeter to the 20 Vdc range.

5. Connect the Signal Generator output to A4XA7 pin 57 using a short coaxial cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane. Set the Generator output frequency to 455 kHz and output level to -40 dBm.

6. Energize the receiver. The Digital Voltmeter should indicate -3.5 Vdc.

7. Select the receiver MAN Gain Mode. Adjust the RF Gain control until the Digital Voltmeter indicates the same level indicated in step 7.

8. Select the Fast AGC Mode.

9. Connect the Digital Voltmeter clip lead to A4XA6 pin 19. The Voltmeter should indicate +0.7 Vdc.

10. Connect the Digital Voltmeter clip lead to A4XA6 pin 41. The Voltmeter should indicate -3.0 Vdc.

11. Deenergize the receiver and disconnect test equipment if no further tests are to be done.

4.3.5.13.2 AGC, A4A6, Fault Isolation

Table 4-24, AGC Fault Isolation Chart, is used to isolate the module fault to a stage or circuit. Set up Test Equipment as stated in **paragraph 4.3.5.13.2** and check the Test Points given in **Table 4-24** with a Digital Voltmeter. When a fault signal is encountered, replace the key components indicated and repeat the Checkout Procedure in **paragraph 4.3.513.2. Table 4-25**, AGC Voltage Table, and **Figure 6-9**, AGC Schematic Diagram should be referred to if additional signal tracing/fault isolation is necessary.

Table 4-24. AGC Fault Isolation Chart.

Test Point	Normal Signal	Key Components	Comments
A4A6-51	+3.2 Vdc	Check A4A7	AGC Mode
Q1-E	+2.7 Vdc	Q1	
U1-1	+2.7 Vdc	U1	
Q2-C	+0.13 Vdc	CR9, Q2, Q6	
U2-7	-6.6 Vdc	U2	
U1-14	-3.5 Vdc	U1	
U2-10	-0.06 Vdc	Q5	
U2-8	-0.32 Vdc	U2	
U2-1	+1.07 Vdc	U2	

Table 4-25. AGC Voltage Table

		INPUT SIGNAL			NO SIGNAL		
TRANSISTOR		MAN	SLOW	FAST	MAN	SLOW	FAST
Q1	E	1.7	3.2	3.2	0.05	0.06	0.06
	B	2.0	2.7	2.7	+ 0.4	0.38	0.38
	C	14.3	14.3	14.4	14.4	14.3	14.4
Q2	E	0.77	0.77	0.77	0.06	0.06	0.06
	B	0.18	0.20	0.20	0.02	0.2	0.02
	C	0.0	0.13	0.13	0.0	0.0	0.0
Q3	E	0.0	0.0	0.0	0.0	0.0	0.0
	B	0.6	0.0	0.0	0.59	0.0	0.0
	C	0.0	0.0	0.0	0.01	0.0	0.0
Q4	E	0.0	0.0	0.0	0.0	0.0	0.0
	B	- 2.3	- 2.3	- 2.3	- 2.3	- 2.3	- 2.3
	C	- 0.06	- 0.6	- 0.6	0.0	0.0	0.0
Q5	E	- 2.9	- 2.8	- 2.8	- 0.50	0.07	0.07
	B	- 2.3	- 2.3	- 2.3	- 2.3	- 2.3	- 2.3
	C	- 0.6	- 0.6	- 0.6	0.0	0.0	0.0
Q6	E	0.0	0.0	0.0	0.0	0.0	
	B	0.58	0.0	0.54	0.0	0.0	
	C	0.05	0.13	0.13	0.01	0.0	0.0
Q7	E	0.0	0.0	0.0	0.0	0.0	0.0
	B	- 3.9	0.62	- 3.9	- 3.9	0.63	- 3.9
	C	N/A	N/A	N/A	N/A	N/A	N/A
U1	1	2.0	2.7	2.7	0.06	0.07	0.07
	2	2.0	2.7	2.7	0.06	0.07	0.07
	3	2.0	2.7	2.7	0.05	0.06	0.05
	4	14.3	14.3	14.4	14.4	14.3	14.4
	5	0.0	5.0	0.0	0.0	5.0	0.0
	6	1.5	1.7	1.7	1.7	1.7	1.7
	7	-12.6	12.9	-12.6	-12.9	12.9	-12.6
	8	- 2.0	- 2.2	- 2.2	- 0.05	- 0.05	- 0.05
	9	0.0	0.0	0.0	0.0	0.0	0.0
	10	0.0	0.0	0.0	0.0	0.0	0.0
	11	-13.8	-13.8	-13.8	-13.8	-13.9	-13.8
	12	- 3.5	- 3.5	- 3.5	- 0.5	0.07	0.07
	13	- 3.5	- 3.5	- 3.5	- 0.5	0.07	0.07
	14	- 3.5	- 3.5	- 3.5	- 0.5	0.07	0.07

Table 4-25. **AGC Voltage Table** (Concluded)

		INPUT SIGNAL			NO SIGNAL		
TRANSISTOR		MAN	SLOW	FAST	MAN	SLOW	FAST
U2	1	0.86	0.82	0.83	- 0.08	- 0.08	- 0.08
	2	0.86	0.82	0.83	- 0.08	- 0.8	- 0.8
	3	0.86	0.82	0.83	- 0.08	- 0.08	- 0.08
	4	14.3	14.4	14.4	14.3	14.3	
	5	0.0	0.0	0.0	0.0		
	6	0.0	0.0	0.0	0.0	0.0	0.0
	7	- 6.6	- 6.6	- 6.6	- 0.8	0.12	0.12
	8	- 0.32	- 0.32	- 0.32	0.03	0.03	0.03
	9	- 0.05	- 0.06	0.0	0.0	0.0	
	10	- 0.06	- 0.06	- 0.06	0.0	0.0	0.0
	11	-13.8	-13.8	-13.8	-13.8	-13.9	-13.8
	12	0.0	0.0	0.0	0.0	0.0	0.0
	13	0.0	0.0	0.0	0.0	0.0	0.0
	14	0.85	0.82	0.8	0.0	0.0	0.0

NOTE

Two sets of data are given: one with an input signal and one without. When using the input signal data, tune the receiver to 15.00500 MHz and inject an unmodulated signal of 15.00500 MHz at -40 dBm into RF Input jack A2J1. Nominal voltage values are given for each of the three gain modes: Manual, Fast AGC, and Slow AGC. The RF Gain Control must be set maximum clockwise while using Manual Mode No Signal data. To use data for Manual Mode with Input Signal, reduce gain control setting to achieve the same meter reading as in AGC Mode.

4.3.5.14 Front Panel Interconnect Testing and Troubleshooting

Front Panel Interconnect Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Digital Voltmeter (**Table 4-1**) is required to perform the tests outlined below.

4.3.5.14.1 Front Panel Interconnect Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.14.2** for fault isolation.

1. Deenergize the receiver.

2. Connect the common (-) input of the Digital Voltmeter to A6XA2 pin 5 using a short test lead.

3. Energize the receiver.

4. Refer to **Table 4-15** and depress the indicated Mode and BW pushbuttons in succession. For each Mode or BW selected, use the Digital Voltmeter positive (+) test lead to probe for high (>2.5 Vdc) or low (<0.5 Vdc) conditions as indicated.

5. Deenergize the receiver and disconnect test equipment.

Table 4-26. Front Panel Interconnect Voltage Table

Pin Nos.	AM	CW	FM	USB	LSB	ISB
A6XA2-5	LO	LO	LO	LO	HI	LO
A6XA2-3	LO	LO	LO	HI	LO	LO
A6XA2-1	LO	LO	LO	LO	LO	HI
A6XA2-18	LO	HI	LO	HI	HI	HI
A6XA2-16	LO	LO	HI	LO	LO	LO
A6XA2-48	HI	LO	LO	LO	LO	LO
A6XA2-58	HI	HI	HI	LO	LO	LO
A6XA2-60	HI	LO	HI	LO	LO	LO
A10J1-22	HI	HI	HI	LO	LO	LO
A10J1-37	HI	HI	HI	LO	LO	LO
A10J1-16	HI	HI	HI	LO	LO	LO
Pin Nos.	**16 kHz**	**6 kHz**	**3 kHz**	**1 kHz**	**.3 kHz**	**USB/LSB/ISB**
A6XA2-49	HI	HI	HI	LO	LO	LO
A6XA2-51	HI	LO	LO	HI	HI	HI
A6XA2-53	LO	HI	LO	LO	LO	LO
A6XA2-55	LO	LO	HI	LO	LO	LO
A6XA2-47	LO	LO	LO	HI	LO	LO
A6XA2-45	LO	LO	LO	LO	HI	LO

4.3.5.14.2 Front Panel Interconnect Fault Isolation

The following list of Supplementary Troubleshooting Data should be used to isolate the fault and locate the defective component or connection. After the fault has been corrected, check the Front Panel Interconnect for normal operation by repeating the Checkout Procedure in **paragraph 4.3.5.14.1** above.

1. Figure 6-22. Front Panel Interconnect Schematic
2. Paragraph 3.4.24. Front Panel Interconnect Circuit Description

4.3.5.15 Lower Panel Control Testing and Troubleshooting

Lower Panel Control Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Signal Generator and an Oscilloscope **(Table 4-1)** are required to perform the tests outlined below. Procedures in this paragraph are applicable to both Type 791826 and Type 796054 Lower Panel Controls, except where noted.

4.3.5.15.1 Lower Panel Control Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.15.2** for fault isolation.

1. Deenergize the receiver. Select any mode other than ISB. On the WJ-8718A/8718-9 Receiver, ensure that USB and LSB Audio buttons are deenergized.
2. Remove the front panel and gently pull it out several inches from the receiver main chassis, being careful not to place any strain on the interconnecting cables.
3. Connect the Oscilloscope Vertical input to connector A10A2J3 using a short coaxial cable with clip leads on one end. Connect cable shield to terminal A10A2E1.
4. Connect the Signal Generator AM Output to terminal A10A2E3 using a short coaxial cable with clip leads on one end. Connect cable shield to terminal A10A2E1. Set the Signal Generator Modulation Frequency to 400 Hz, set Audio Output Level to 70 mV and set AM switch to INT.
5. Energize the receiver and rotate the Phone Level control fully clockwise. The Oscilloscope should display a level of >20 V p-p. The waveform should be a clean sine wave.
6. Move the Oscilloscope input lead to connector A10A2-J2. The Oscilloscope should display a level of >20 V p-p. The waveform should be a clean sine wave.
7. Deenergize the receiver and disconnect test equipment

4.3.5.15.2 Lower Panel Control Fault Isolation

The following list of Supplementary Troubleshooting Data should be used to isolate the fault and locate the defective component or connection. After the fault has been corrected, check the Lower Panel Control for normal operation by repeating the procedure in **paragraph 4.3.5.15.1.**

1.	Figure 6-24.	Lower Panel Control Schematic Diagram (Type 796054)
2.	Figure 6-24.	Lower Panel Control Schematic Diagram (Type 791826)
3.	Paragraph 3.4.42.	Lower Panel Control Circuit Description

4.3.5.16 1st LO Synthesizer Testing and Troubleshooting

1st LO Synthesizer Testing and Troubleshooting includes a checkout procedure and fault isolation. A Frequency Counter, wideband Oscilloscope and RF Voltmeter (**Table 4-1**) are required to perform the tests outlined below.

4.3.5.16.1 1st LO Synthesizer Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.16.2** for Fault Isolation.

1. Deenergize the receiver.
2. Disconnect connector from A1J2.
3. Connect the Frequency Counter to W2P3.
4. Energize the receiver and tune it to 00.00000 MHz. The Frequency Counter should indicate 42.91 MHz.
5. Rotate the tuning knob counterclockwise and tune receiver to 29.99999 MHz. The Frequency Counter should indicate 72.90 MHz.
6. Disconnect the Frequency Counter and connect the RF Voltmeter and 50 Ω Probe to W2P3. The Voltmeter should indicate +20 dBm ±2dBm.
7. Deenergize the receiver and disconnect test equpment. Reconnect W2P3.

4.3.5.16.2 1st LO Synthesizer, P/O A5A1, Fault Isolation

1st LO Synthesizer Fault Isolation includes Troubleshooting Tests to aid in isolating a fault to a defective stage or circuit. Supplementary Troubleshooting Data is provided in paragraph 4.3.15.16.3 to aid in tracing the fault to a defective component or connection.

1. VCO Band Select Circuitry - **Table 4-27** below checks for proper operation of U13, diodes CR8 through CR10, and Q1 through Q3, while dialing different frequencies on the front panel.

Table 4-27. VCO Band Select Code

TUNED FREQUENCY	BAND SELECT OUTPUT (Vdc)		
	E3	E2	E1
0.00 - 3.99 MHz	+ 15	+ 15	+ 15
4.00 - 7.99 MHz	+ 15	+ 15	- 12
8.00 - 11.99 MHz	+ 15	- 12	+ 15
12.00 - 15.99 MHz	+ 15	- 12	- 12
16.00 - 19.99 MHz	- 12	+ 15	+ 15
20.00 - 23.99 MHz	- 12	+ 15	- 12
24.00 - 27.99 MHz	- 12	- 12	+ 15
28.00 - 29.99 MHz	- 12	- 12	- 12

2. Divider Section - With a tuned frequency of 00.00000 MHz, or a 1st LO input to J1 of 171.64 MHz, the following frequencies in **Table 4-28** should be found at the corresponding IC pins using a Digital Counter.

Table 4-28. Ist LO Frequency Chart

IC	PIN	FREQ (Hz)	IC	PIN	FREQ (Hz)
U1	7	17 MHz	U9	7	1.68 MHz
U1	9	3.4 MHz	U9	9	80 kHz
U1	10	40 kHz	U9	15	40 kHz
U2	12	3.4 MHz	U10	7	840 kHz
U3	7	40 kHz	U10	7	200 kHz
U3	9	40 kHz	U11	6	40 kHz
U6	3	40 kHz	U11	7	40 kHz
U8	7	340 kHz	U12	5	40 kHz
U9	1	40 kHz	U12	9	40 kHz

3. Phase Detector U5 - Check for 40 kHz signal at input pin 3 of U5. If signal is not present, troubleshoot Time Base Circuits.

Check for 40 kHz signal at pin 1 of U5. If not present, troubleshoot 1st LO counter circuits. Refer to **Figure 4-2** to understand the function of the phase detector.

4. 1st LO VCO - The 1st LO VCO is located on the 1st and 3rd LO PC board. It is recommended to read the circuit description of the VCO before troubleshooting (**paragraph 3.4.17**). The frequency of the oscillator, Q1, is controlled by the band select code and the tuning voltage. The correct VCO output frequency can be found by adding 42.91 MHz to the tuned frequency in **Table 4-28** and multiplying the result by 4.

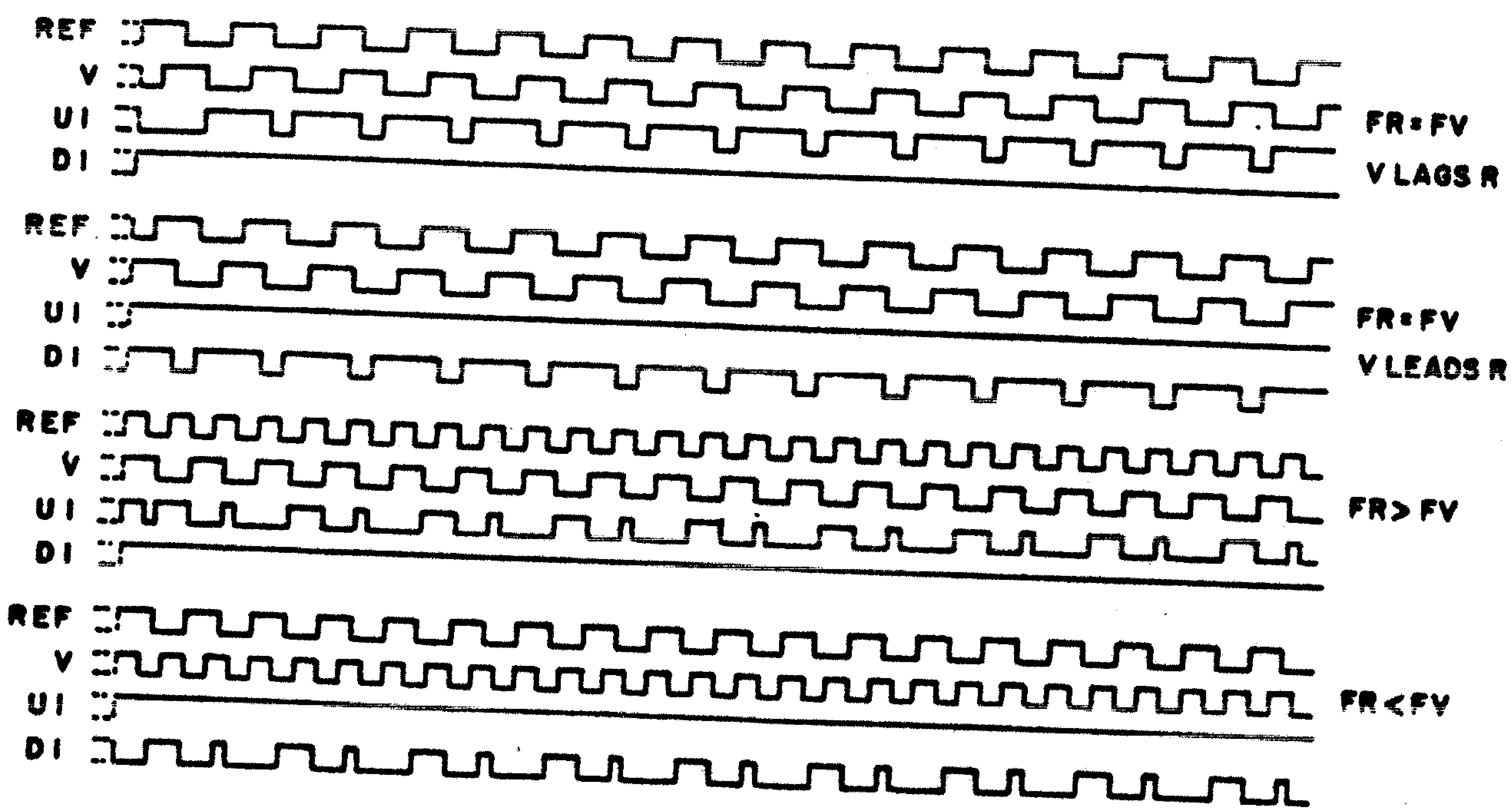

Figure 4-2. Phase Detector Timing Diagram

4.3.5.16.3 1st LO Synthesizer Supplementary Troubleshooting Data

The following Supplementary Troubleshooting Data is used in conjunction with the Troubleshooting Tests above as an aid in correcting 1st LO Synthesizer faults.

1.	Figure 6-15.	1st LO Synthesizer Schematic Diagram
2.	Paragraph 3.4.16.	1st LO Synthesizer Circuit Description
3.	Paragraph 4.3.7.2.1.	1st LO Synthesizer Alignment

4.3.5.17 2nd LO Synthesizer Testing and Troubleshooting

2nd LO Synthesizer Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Frequency Counter, wideband Oscilloscope, and RF Voltmeter (**Table 4-1**) are required to perform the tests outlined below.

4.3.5.17.1 2nd LO Synthesizer Checkout Procedure

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.17.2** for fault isolation.

1. Deenergize the receiver.
2. Disconnect connector W4P4 from A2J1.
3. Connect the Frequency Counter to P4.
4. Energize the receiver and tune to 00.00000 MHz. The Frequency Counter should indicate 32.21 MHz.
5. Tune the receiver to 00.00999 MHz. The Frequency Counter should indicate 32.20001 MHz.
6. Disconnect the Frequency Counter and connect the RF Voltmeter and 50 Ω probe to W4P4. The Voltmeter should indicate 0 dBm ± 2 dBm.
7. Deenergize the receiver and disconnect test equipment. Reconnect P4.

4.3.5.17.2 2nd LO Synthesizer, A5A2, Fault Isolation

2nd LO Synthesizer Fault Isolation includes Troubleshooting Tests to aid in isolating a fault to a defective stage or circuit. Supplementary Troubleshooting Data is provided in **paragraph 4.3.5.17.3** to aid in tracing the fault to a defective component or connection.

1. Determine which of the phase lock loops is causing the problem. When the problem loop is determined, troubleshoot as described below.

   a. 32 MHz Loop - Proper operation of this loop is indicated by a 32.00000 MHz signal on the transistor case (or collector) of Q1. If not, proceed to Step 2 below.

b. Programmable Loop - Proper operation of this loop is indicated by a 200 kHz signal at pin 1 of U6 when the receiver is tuned to 15.00999 MHz and a 210 kHz signal at pin 1 of U6 when the receiver is tuned to 15.00000 MHz. Illumination of LED CR1 indicates a faulty loop. If a problem is not detected, proceed to step 3 below.

c. Output Loop - Troubleshooting this loop is required when no problems exist in the two loops tested above and 32.20001 to 32.21 MHz is not seen at module pin B15. If this loop has failed, proceed to Step 4.

2. 32 MHz Loop

a. U3 and U2 - U3 is a divide-by-2 counter. The time for two input waveforms at pin 3 of U3 equals the time for one output waveform at pin 5 of U3. If not, determine that the input levels are correct for TTL (low state less than 0.8 V, high state greater than 2.0 V). If these levels do exist and the output is not correct, replace U3. U2 is a divide-by-16 counter. The time for 16 input waveforms at pin 8 of U2 equals the time for one output waveform at pin 12 of U2. If not, replace U2.

b. Verify proper operation of phase detector U1. Check 1 MHz reference at pin 1 of U1. If wrong or no signal, troubleshoot Time Base circuits. A working voltage may vary from 2.0 to 3.5 Vdc (at pin 8 of U1).

c. Vary capacitor C51 (inside shielded unit) until 2.7 Vdc (nominal) is seen at test point E1, when the tuning tool is withdrawn from the shield.

3. Programmable Loop

a. U19, U17 and U6 - The time for one waveform at pin 5 of U19 equals 10 waveforms at pin 6 of U19. If not, replace U19. The time for one waveform at pin 12 of U17 equals 10 waveforms at pin 8 of U17. If not, replace U17. The time for one waveform at pin 7 of U16 equals 10 waveforms at pin 15 of U16 (difficult to read with scope since frequency at pin 15 varies from 200 - 210 MHz). If not, replace U16.

b. Operation of 100/ 101 prescaler - Tune the receiver to 15.00999 MHz. The time for 10 input waveforms at pin 2 of U14 equals one output waveform at pin 11 of U14. If not, replace U14.

c. Operation of Counters - Tune the receiver to 15.00000 MHz. This sets all inputs (A, B, C, and D) to U7, U8 and U9 with 0 Vdc. Using a frequency counter with an input impedance of greater than 1000 Ω, the frequencies in **Table 4-29** should be found at the corresponding pins. If not, replace that IC.

d. Phase Detector U12 - Check for 10 kHz signal at Pin 1 of U12. If incorrect or no signal, troubleshoot Time Base Circuits. Compare inputs (pins 1 and 3) and outputs 2 and 13 to **Figure 4-2** of the lst LO Troubleshooting Test.

e. Tune the receiver to 15.00499 MHz. Spread or compress the turns of coil L8 until 4.0 Vdc is seen at test point E3. Recheck the voltage at test point E3 to be certain that it remains between +2.0 Vdc and 6.5 Vdc as the receiver is tuned from 15.00000 to 15.00999 MHz.

f. If the problem appears to be in the VCO, read Section III, **paragraph 3.4.18** then troubleshoot.

4. Output Loop

a. Measure the frequency of the output at module pin B15. If no signal is present, there is a problem in the VCO or its output amplifier. Check gate 1 of Q3 (pin 3) for signal. If there is none, the problem is with the VCO circuit of Q6. If the signal is there, the problem is in the circuit of amplifier Q3. If the signal is present at pin B15, adjust C61 to bring it as close as practical to 32.300 MHz.

b. With the VCO very near 32.200 MHz, check the signals at pins 1 and 3 of U6. Both should be TTL level signals of approximately 200 kHz (that is low less than 0.8 V and high greater than 2.0 V). If the wrong signal is at pin 1, troubleshoot the programmable loop Step 3; if the wrong signal is at pin 3, proceed below.

c. Check the base of Q2. The signal there should be roughly sinusoidal and about 0.5 V p-p. If so, the problem is in the circuits of U14 and U5.

Table 4-29. 2nd LO Frequency Chart

IC PIN	FREQUENCY	IC PIN	FREQUENCY
U7 Pin 14	2.09 MHz	U9 Pin 3	1.05 MHz
U7 Pin 13	100 kHz	U9 Pin 13	130 kHz
U8 Pin 4	100 kHz	U10 Pin 14	130 kHz
U8 Pin 13	10 kHz	U10 Pin 12	10 kHz
U9 Pin 14	2.09 MHz	U10 Pin 11	10 kHz

d. Because of the low signal levels at the inputs of U4 and U5, signal tracing is difficult. The signal at U4 pin 1 should be 32.2 MHz, at U4 pin 7 should be 32.0 MHz, and at U5 pins 1 and 2 should be 200 kHz. Grounding of the scope probe is critical if the true signal is to be isolated. It is more likely that careful visual inspection of these circuits and a few voltage checks will be useful. The voltage at pins 1 and 2 of U15 will be approximately +5 V and must be equal within 0.2 Vdc. If they differ by more than this, replace U4. If the 200 kHz at pins 1 and 2 of U5 can be measured, the output at pin 6 should be amplified by about 10 times from that level. There may be some distortion present at the output of U5 which is reduced at the base of Q2.

e. If the signals at Pins 1 and 3 of U6 both appear correct, compare its outputs at Pins 2 and 13 with those of **Figure 4-2.** If these appear correct the problem must be in the amplifier section of U6 pins 8 and 9 and its connection to the VCO.

4.3.5.17.3 2nd LO Synthesizer Supplementary Troubleshooting Data

The following Supplementary Troubleshooting Data is used in conjunction with the Troubleshooting Tests above as an aid in correcting 2nd LO Synthesizer faults:

1. Figure 6-18. 2nd LO Synthesizer Schematic Diagram
2. Paragraph 3.4.18. 2nd LO Synthesizer Circuit Description
3. Paragraph 4.3.7.2.2. 2nd LO Synthesizer Alignment

4.3.5.18 <u>3rd LO Synthesizer Testing and Troubleshooting</u>

3rd LO Synthesizer Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Frequency Counter, wideband Oscilloscope, and RF Voltmeter (**Table 4-1**) are required to perform the tests outlined below.

4.3.5.18.1 **3rd LO Synthesizer Checkout Procedure**

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.18.2** for fault isolation.

1. Deenergize the receiver.
2. Disconnect connector W6P10 from J7.
3. Connect the Frequency Counter to W6P10.
4. Energize the receiver. The Frequency Counter should indicate 11.155 MHz.
5. Disconnect the Frequency Counter and connect the RF Voltmeter and 50 Ω probe to W6P10. The Voltmeter should indicate -8 dBm minimum.
6. Deenergize the receiver and disconnect test equipment. Reconnect W6P10.

4.3.5.18.2 **3rd LO Synthesizer, P/O A5A1, Fault Isolation**

3rd LO Synthesizer Fault Isolation includes Troubleshooting Tests to aid in isolating a fault to a defective stage or circuit. Supplementary Troubleshooting Data is provided in **paragraph 4.3.5.18.3** to aid in tracing the fault to a defective component or connection.

1. Verify all inputs to the 3rd LO circuitry are correct. If not, troubleshoot Time Base circuits.
   a. 50 kHz signal at pin 11 of U21.
   b. 10 kHz signal at pin of U21.
2. <u>Operation of U21</u> - The time for two input waveforms at Pin 3 of U21 equals one output waveform at pin 5 of U21. If not, replace U21.
3. <u>Operation of U22</u> - Observe inputs (pins 1 and 3) and output voltage (pins 2 and 13) and compare to Figure 4-18. If a difference exists, replace U22. A normal value for the output (pin 8) is 2.0 to 3.0 Vdc.
4. Proper alignment of C33 is indicated by an approximate 2.75 Vdc at pin 8 of U22.
5. If problems lead to the VCO, read **paragraph 3.4.19** in the Circuit Description Section and troubleshoot.

4.3.5.18.3 **3rd LO Synthesizer Supplementary Troubleshooting Data**

The following Supplementary Troubleshooting Data is used in conjunction with the Troubleshooting Tests above as an aid in correcting 3rd LO Synthesizer faults.

1. Figures 6-17. 1st & 3rd LO Synthesizer Schematic Diagram
2. Paragraph 3.4.19. 3rd LO Synthesizer Circuit Description
3. Paragraph 4.3.7.2.4. 3rd LO Synthesizer Alignment

4.3.5.19 **BFO Synthesizer Testing and Troubleshooting**

BFO Synthesizer Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Frequency Counter and wideband Oscilloscope (**Table 4-1**) are required to perform the tests outlined below.

4.3.5.19.1 **BFO Synthesizer Checkout Procedure**

Perform the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.19.2** for Fault Isolation.

1. Deenergize the receiver.
2. Disconnect connector W7P11 from J8.
3. Connect the Frequency Counter to W7P11.
4. Energize the receiver and select CW Mode. Set the BFO offset to +0.0 kHz. The Frequency Counter should read 455.000 kHz.
5. Set the BFO Offset first to +8.9 kHz and then to -8.9 kHz. The Frequency Counter should read 463.900 kHz and 446.1 kHz respectively.
6. Disconnect the Frequency Counter and reconnect W7P11 to J8.
7. Connect the Oscilloscope input to A4TP15 using a shielded cable with clip leads on one end. Connect cable shield to the IF Motherboard ground plane. The Oscilloscope should display a level of 120 mV p-p at 446.1 kHz.
8. Deenergize the receiver and disconnect test equipment.

4.3.5.19.2 **BFO Synthesizer, A5A3, Fault Isolation**

BFO Synthesizer Fault Isolation includes Troubleshooting Tests to aid in isolating a fault to a defective stage or circuit. Supplementary Troubleshooting Data is provided in

paragraph 4.3.5.19.3 to aid in tracing the fault to a defective component or connection.

1. Set front panel BFO thumbwheel switches to "+0.0".

2. Programmable Circuits - Use this procedure when a 1 kHz signal is not seen entering the phase detector, pin 3 of U9.

   a. The frequencies in **Table 4-30** should be found at the corresponding IC pins. If a problem is detected, troubleshoot and/or replace the IC from which the signal originates.

Table 4-30. BFO Frequency Chart

IC	PIN	FREQ	IC	PIN	FREQ	IC	PIN	FREQ
U1	2	910 kHz	U2	2	91 kHz	U3	2	9 kHz
U1	3	2.275	U2	3	228 kHz	U3	3	23 kHz
U1	4	0	U2	4	455 kHz	U3	4	46 kHz
U1	6	455 kHz	U2	6	46 kHz	U3	6	5 kHz
U1	7	455 kHz	U2	7	46 kHz	U3	7	5 kHz
U1	11	1 kHz	U2	11	1 kHz	U3	11	1 kHz
U1	14	4.55 MHz	U2	14	4.55 MHz	U3	14	4.55 MHz
U4	2	1 kHz	U5	2	1 kHz	U6	10	27 kHz
U4	3	3 kHz	U5	4	1 kHz	U6	11	24 kHz
U4	4	5 kHz	U5	5	5 kHz	U6	12	12 kHz
U4	6	1 kHz	U5	6	5 kHz	U6	13	13 kHz
U4	7	1 kHz	U6	1	5 kHz	U7	1	455 kHz
U4	11	1 kHz	U6	2	46 kHz	U7	2	455 kHz
U4	14	4.55 MHz	U6	3	12 kHz	U7	4	910 kHz
U5	8	27 kHz	U6	4	228 kHz	U7	5	2.275 kHz
U5	9	9 kHz	U6	5	455 kHz	U7	6	455 kHz
U5	10	23 kHz	U6	6	24 kHz	U7	8	4.55 kHz
U5	12	46 kHz	U6	8	1 kHz	U7	9	4.55 kHz
U5	13	91 kHz	U6	9	1 kHz	U8	2	1 kHz

3. Phase Detector U9

   a. 1 kHz signal should be seen at pin 1 of U9. If not, troubleshoot Time Base circuits.

   b. A voltage level of roughly 1.25 Vdc should be seen at pin 10 of U9. If not, replace U9.

   c. Adjust capacitor C8 until a 2.7 Vdc level is seen at module pin 7.

4. Amplifier Q2 and Sine Wave to TTL Converter Q3 should be checked when the signal from the VCO through capacitor C10 is not amplified at the collector of Q3. Refer to the circuit description for these circuits, Section 3.

5. Output Divider U10 - Use **Table 4-31** below to check the operation of U10 with the BFO thumbwheel settings set to "+0.0".

Table 4-31. Output Divider U10 Frequency Chart

IC	PIN	FREQ
U10	1	4.55 MHz
U10	11	910 kHz
U10	12	455 kHz
U10	14	910 kHz

4.3.5.19.3 BFO Synthesizer Supplementary Troubleshooting Data

The following Supplementary Troubleshooting Data is used in conjunction with the Troubleshooting Test above as an aid in correcting BFO Synthesizer Faults.

1. Figure 6-19. BFO Synthesizer Schematic Diagram
2. Paragraph 3.4.20. BFO Synthesizer Circuit Description
3. Paragraph 4.3.7.2.6. BFO Synthesizer Alignment

4.3.5.20 Time Base Testing and Troubleshooting

Time Base Testing and Troubleshooting includes a checkout procedure and fault isolation information. A Frequency Counter and a wideband Oscilloscope (Table 4-1) are required to perform the tests outlined below.

4.3.5.20.1 Time Base Checkout Procedure

Perfom the following procedure in the sequence given. If any specified result is not obtained, refer to **paragraph 4.3.5.20.2** for Fault Isolation.

1. Deenergize the receiver.
2. Connect the Frequency Counter input to A5XA1 pin A9 using a short coaxial cable with clip leads on one end. Connect cable shield to Motherboard ground plane.

3. Energize the receiver. The Frequency Counter should read 1.000000 MHz ±3 Hz.

4. Move the Frequency Counter clip lead to A5XA1 pin A47. The Frequency Counter should read 10.000 kHz ±1 Hz.

5. Move the Frequency Counter clip lead to A5XA1 pin A53. The Frequency Counter should read 1.000 kHz ±1 Hz.

6. Move the Frequency Counter clip lead to test point A5A1A2 pin E6. The Frequency counter should read 40.000 kHz ±1 Hz.

7. Deenergize the receiver and disconnect test equipment.

4.3.5.20.2 Time Base, P/O A5A1, Fault Isolation

Time Base Fault Isolation includes Troubleshooting Tests to aid in isolating a fault to a defective stage or circuit. Supplementary Troubleshooting Data is provided in **paragraph 4.3.5.20.3** to aid in tracing the fault to a defective component or connection.

Using the internal frequency source, the frequencies in **Table 4-32** should be found at the corresponding IC pins. A Digital Counter is the recommended method to check the frequencies, however, an Oscilloscope may be used remembering the time for one input waveform is proportional to the time for one output waveform by the dividing ratio of the IC.

Table 4-32. Time Base Frequency Chart

IC	PIN	FREQUENCY	IC	PIN	FREQUENCY
U15	5	1 MHz	U18	12	10 kHz
U15	6	1 MHz	U19	5	250 kHz
U15	8	2 MHz	U19	12	50 kHz
U15	12	200 kHz	U20	5	5 kHz
U17	12	40 kHz	U20	12	1 kHz
U18	5	500 kHz	U23	8	1 MHz
U18	8	1 MHz	U23	11	1 MHz

4.3.5.20.3 Time Base Supplementary Troubleshooting Data

The following list of Supplementary Troubleshooting Data is used as an aid in correcting Time Base faults.

1. Figures 6-15. 1st and 3rd LO Synthesizer/Time Base Schematic Diagram

2. Paragraph 3.4.21. Time Base Circuits Description

3. Paragraph 4.3.7.2.5. 2 MHz Time Base Alignment

4.3.6 PARTS REPLACEMENT GUIDELINES

This paragraph provides techniques to assist the Technician in replacing components on PC boards.

WARNING

To prevent electrical shock or damage to the receiver, always disconnect the receiver from the ac power source before soldering or replacing components.

4.3.6.1 Soldering Techniques

When removing components from a printed circuit board for inspection or replacement, be especially careful not to damage the track. The soldering iron power should be no larger than 40 W, and a solder sipper or wicking procedure should be employed when removing solder. Non-corrosive soldering flux should be used when removing solder by wicking. In returning components to the board, make sure that holes are clear and that leads do not catch the edge of the track and lift it from the board. A good grade of rosin core 60/40 solder should be used. Heat no longer than is necessary to achieve a good joint. A heat sink should be used where possible.

4.3.6.2 Component Replacement

Specific guidelines for replacing the various kinds of components are as follows.

1. When soldering or unsoldering diodes or resistors, solder quickly to allow as little heat conduction as possible. When wiring permits, use a heat sink between the soldering iron and the part.

2. When soldering or unsoldering transistors, use a low wattage iron and a heat sink. Solder as quickly as possible. The use of a circular soldering tip to heat all three or four joints simultaneously is recommended.

3. When soldering or unsoldering glass or ceramic capacitors, use a heat sink between the capacitor and the iron. Excessive heat will crack the capacitor body.

4. When any electronic part is removed, note the position of the part and its leads, and replace it the same way.

4.3.6.3 Realignment

Replacement of semiconductors or tuned circuit components may affect the alignment of the PC board being repaired. Realignment may be necessary to return the PC board to normal operation.

4.3.7 ADJUSTMENT/ALIGNMENT PROCEDURES

4.3.7.1 General

The following Adjustment and Alignment Procedures should not be performed on a routine basis, but instead, should be used as aids in troubleshooting and post-repair testing. Before alignment is attempted, the technician should first perform the relevant procedures to determine which module needs alignment. These procedures may be used for testing or aligning new and repaired modules.

4.3.7.2 Synthesizer Alignment

4.3.7.2.1 lst LO Synthesizer Alignment

The only alignment points for the 1st LO Synthesizer are in the 1st LO VCO (A5A1A1) which is a very sensitive circuit; care must be taken to ensure proper operation. This procedure should be performed only when a definite alignment is needed. **Table-4-33** lists the components and their parameters used in this alignment procedure.

1. Mount the 1st and 3rd LO on an extender card.
2. Remove the VCO front plate.
3. Connect a Digital Voltmeter to module pin B1.
4. Beginning at Band 0, align the 8 Vco Bands indicated in **Table 4-33.** Alignment is accomplished by monitoring the voltage at pin B1 and adjusting the indicated components. Note that L2, L3 and L4 will cause interaction between the alignment of several bands.
5. Check the 1st LO frequency band (test point E3 in the VCO) while dialing the tuned frequency in 10 kHz steps starting with 00.00000 MHz.

Table 4-33. VCO Alignment Parameters

VCO Band	1st LO FREQ BAND (MHz)	VOLTAGE Pin B1 (Typical)	ALIGNMENT COMPONENT
0	42.91-46.90	-8.5 to 6.0	C6*, L1
1	46.91-50.90	-7.5 to 4.1	L2
2	50.91-54.90	-7.2 to 2.8	L3
3	54.91-54.90	-5.3 to 3.9	L2, L3
4	58.91-62.90	-6.6 to 2.7	L4
5	62.91-66.90	-6.0 to 2.2	L4, L2
6	66.91-70.90	-6.2 to 0.4	L3, L4
7	70.91-72.90	-5.7 to -3.0	L4, L3, L2
* Factory Select Value			

4.3.7.2.2 2nd LO Synthesizer Alignment (A5A2)

The 2nd LO Synthesizer procedure consists of a 32 MHz Loop Alignment, a Programmable Loop Alignment, and an Output Loop Alignment. Perform the procedure in the given sequence.

CAUTION

For optimum results, the 2nd LO Synthesizer Alignment should be performed in an ambient temperature of +25° C ±5° C.

1. Preliminary Setup

   a. Remove the top protective cover from the receiver.

   b. Mount the 2nd LO Synthesizer board (A5A2) on an extender card.

   c. Energize the receiver and allow 30 minutes warm-up time.

   d. Using a Digital Voltmeter, verify that +15 Vdc ±0.25 Vdc is present at pins B5, B41, and A59, and that +5 Vdc ±0.25 Vdc is present at pins A1, B1, and B45.

   e. Using a Frequency Counter, verify that the 1 MHz reference frequency at pin B49 is 1.000000 MHz and that the 10 kHz reference frequency at pin A57 is 10.000 kHz.

NOTE

If the two reference frequencies are not correct, perform the Time Base Adjustment Procedure before proceeding with the 2nd LO Synthesizer Alignment.

2. 32 MHz Loop Alignment

   a. Connect the Digital Voltmeter to test point E1.

   b. Adjust capacitor C51 until a Voltmeter reading of +3.0 Vdc is observed with the alignment tool withdrawn from the VCO shield.

3. Programmable Loop Alignment

   a. Connect the Digital Voltmeter to test point E3.

b. Tune the receiver to 00.00499 MHz.

c. Insert an alignment tool in the VCO shield opening and spread or squeeze the turns of L8 until a Voltmeter reading of +4.0 Vdc is observed with the alignment tool withdrawn from the VCO shield.

4. Output Loop Alignment

a. Connect the Digital Voltmeter to test point E2.

b. Tune receiver to 00.00499 MHz.

c. Adjust capacitor C61 until a Voltmeter reading of +3.0 Vdc is observed with the alignment tool withdrawn from the VCO shield.

d. Using the Frequency Counter, verify that a frequency of 32.205010 MHz ±3 Hz is present at output pin B15.

5. Final Adjustments

a. Deenergize the receiver.

b. Remove the 2nd LO Synthesizer board from the extender card and return it to the receiver.

c. Mount the top protective cover on the receiver (use only four fasteners to secure the top cover).

d. Energize the receiver and allow it to operate for a minimum of 30 minutes.

e. Tune the receiver to 00.00499 MHz.

f. With the receiver in operation, remove the bottom protective cover.

g. Using the Digital Voltmeter, check the Loop Test Point Voltages as indicated in **Table 4-34.**

Table 4-34. Loop Test Point Voltages

Parameter	Pin Number	Test Point Voltage
32 MHz Loop TP	A5XA2-B57	+3 Vdc ±0.1 Vdc
Programmable Loop TP	A5XA2-A51	+4 Vdc ±0.1 Vdc
Output Loop TP	A5XA2-A55	+3 Vdc ±0.1 Vdc

NOTE

Test Point Voltages may drift from initial settings. If any Test Point Voltage is not within tolerance, repeat the appropriate loop alignment procedure. Set the Test Point Voltage(s) high or low as required to compensate for any drift observed in Step g. Do not proceed to Step h until the voltages in **Table 4-34** are observed after the receiver has been in operation for 30 minutes with both covers in place.

h. Using the Frequency Counter, verify that a frequency of 32.205010 MHz ±3 Hz is present at pin A5XA2-B15.

i. Tune the receiver first to 00.00000 MHz and then to 00.00999 MHz. The appropriate Loop Test Point Voltages and the 2nd LO Output Frequency are given in **Table 4-35.**

Table 4-35. 2nd LO Synthesizer Tuning Parameters

Parameter	Pin Number	Receiver Tuned Frequency	
		00.00000 MHz	00.00999 MHz
32 MHz Loop TP	A5XA2-B57	+3 Vdc ±0.2 Vdc	+3 Vdc ±0.2 Vdc
Programmable Loop TP	A5XA2-A51	>1.5 Vdc	<7.0 Vdc
Output Loop TP	A5XA2-A55	+3 Vdc ±0.2 Vdc	+3 Vdc ±0.2 Vdc
2nd LO Frequency	A5XA2-B15	32.21000 MHz	32.20001 MHz

j. Mount the top protective cover on the receiver.

k. This completes the 2nd LO Synthesizer Alignment Procedure.

4.3.7.2.3 **2nd LO Filter Adjustment**

1. Deenergize the receiver.

2. Disconnect connector P4 from A2J1 of Input Converter (A3).

3. Connect the RF Voltmeter and 50 Ω adapter to P4.

4. Set Voltmeter to 0 dBm (0.3 mV) scale and energize the receiver.

5. Adjust A5C13 for maximum Voltmeter reading. A5C13 is located on the bottom side of the Synthesizer Motherboard (A5) near the front panel of the receiver.

4.3.7.2.4 3rd LO Synthesizer Alignment

1. Deenergize the receiver.
2. Mount the 1st and 3rd LO Synthesizer (A5A1A2) on extender cards and connect the Digital Voltmeter to Pin 8 of U22.
3. Energize the receiver. Adjust capacitor C33 until a reading of 3.0 Vdc is seen on the Voltmeter.
4. Deenergize the receiver and disconnect Digital Voltmeter.

4.3.7.2.5 2 MHz Time Base Adjustment

NOTE

Before performing the following adjustment, the receiver should have been in operation for at least one hour at normal operation temperature to allow the circuit to stabilize.

1. Deenergize the receiver.
2. Mount 1st and 3rd LO Synthesizer (A5A1A2) on extender cards.
3. Connect the Digital Counter to rear panel 1 MHz Ref connector J11.
4. Set the Clock switch S2 to INT position.
5. Energize the receiver. Allow at least a 5 minute warm-up to stabilize the circuits. (This assumes power was not off more than 5 minutes to make the cable connections.)
6. While observing the Counter display, adjust 2 MHz Crystal Oscillator (U14) for a reading of 1.000000 MHz ±3 Hz.
7. Deenergize the receiver and disconnect Digital Counter. Replace A5A1A2 board into the proper slots.

4.3.7.2.6 BFO Synthesizer Alignment

Two alignments are required for the BFO Synthesizer (A5A3). Capacitor C8 and resistor R1 are interdependent and must be aligned simultaneously.

1. Mount the BFO Synthesizer board on extender cards.
2. Adjust C8 until the closest reading to 3.0 Vdc is seen at module pin 7.

3. Adjust R1 until the voltage difference between gate to source of Q4 (Pins 3 and 2) is 0 Vdc. (The voltage from gate to ground and from source to ground will be approximately 1.2 Vdc.)

4. Adjust C8 again until the closer reading to 3.0 Vdc is seen at module pin 7.

4.3.7.3 Receiver Alignment

4.3.7.3.1 Input Converter Alignment

1. Deenergize the receiver and loosen the two (2) captivated screws holding the A3 module to the chassis. Pull the A3 module out and remove its cover. Connect test equipment as shown in **Figure 4-3.** Be careful that Input Converter does not short to the adjacent power supply circuitry.

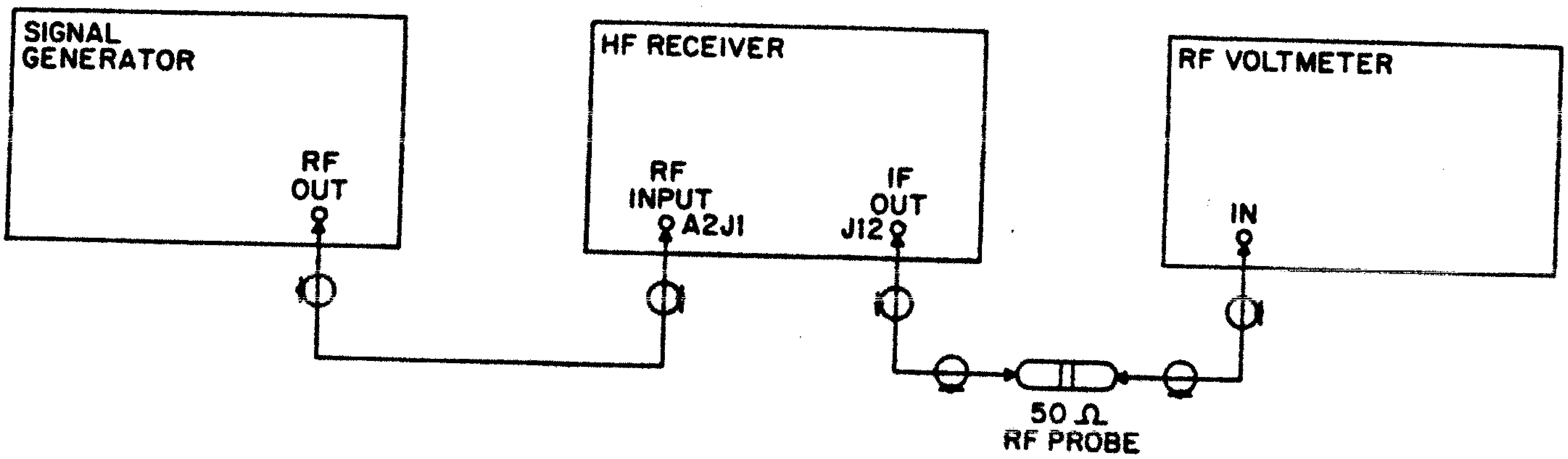

Figure 4-3. Input Converter Alignment Test Setup

2. Set receiver controls as follows:

a.	Meter	-	Signal Strength
b.	Gain Mode	-	Manual
c.	Detection Mode	-	AM
d.	RF Gain	-	Maximum Clockwise
e.	Phone Level	-	N/A
f.	IF Bandwidth	-	16 kHz
g.	BFO offset	-	N/A

3. Energize the receiver.

4. Set the Signal Generator to -97 dBm, unmodulated at 15.0050 MHz. Tune receiver to 15.00500 MHz.

5. While observing RF Voltmeter, adjust C3 of A3A1 and C1 of A3A2 for a maximum meter reading of approximately -15 dBm (40 mV).

6. Deenergize the receiver and disconnect test equipment.

7. Replace the cover on the Input Converter (A3). Install the Input Converter in chassis.

4.3.7.3.2 **10.7 MHz Filter Switch Adjustment**

1. Deenergize the receiver.

2. Connect the test equipment as shown in **Figure 4-4**. Set the Generator for 15.005 MHz, unmodulated, at -64 dBm.

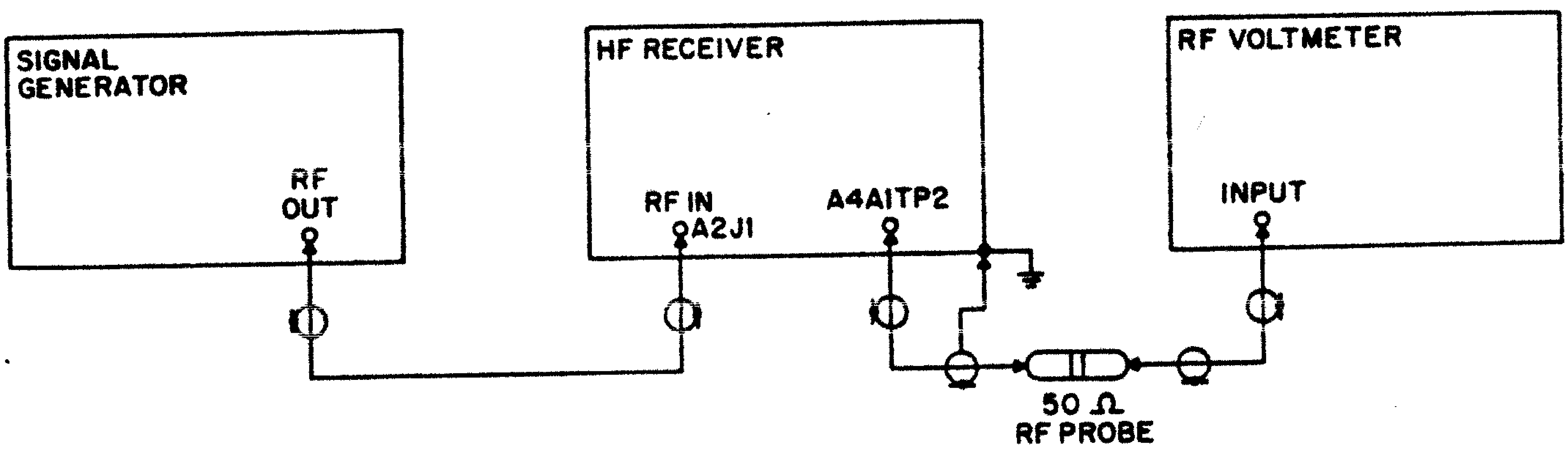

Figure 4-4. 10.7 MHz Filter Switch Adjustment, Test Setup

3. Remove A4A1 and A4A2 boards.

NOTE

A4A2 is removed to eliminate loading.

4. Place A4A1 on an extender card.

5. Energize the receiver and tune to 15.00500 MHz.

6. Depress the 3.2 kHz IF Bandwidth button and adjust A4A1R26 for a -36 dBm (3.5 mV) RF Voltmeter reading.

NOTE

If -36 dBm cannot be obtained, adjust for maximum dBm reading. Record this reading.

7. Depress the 6 kHz IF Bandwidth button and adjust A4A1R28 for the same dBm reading obtained in step 6.

8. Depress the 16 kHz IF Bandwidth button and adjust A4A1R30 for the same dBm reading obtained in step 6.

9. Deenergize the receiver and disconnect test equipment.

10. Install A4A2 and A4A1 into the proper slots.

4.3.7.3.3 455 kHz Amplifier/AM Detector Response Alignment

1. Deenergize the receiver.

2. Remove cards A4A3 and A4A10. Place A4A7 on an extender card.

3. Connect the test equipment as shown in **Figure 4-5**.

4. Set up the Sweep Generator as follows:

a.	Power	-	ON
b.	CW/Sweep	-	SYM
c.	Trig/Line/Free	-	Line
d.	Fast/Slow/Manual	-	Fast
e.	Crystal Cal	-	OFF
f.	Range	-	11
g.	Sym Sweep Width Vernier	-	.1/1
h.	1 kHz Mod	-	OFF
i.	Output Level	-	-60 dBm
j.	Frequency	-	455 kHz

5. Set up the Marker Generator for a 455 kHz output, unmodulated, at -80 dBm.

6. Set the receiver controls as follows:

a.	Meter	-	N/A
b.	Gain Mode	-	Manual

c. Detection Mode - N/A
d. RF Gain - Maximum Clockwise
e. Phone Level - N/A
f. IF Bandwidth - N/A
g. Receiver Frequency - N/A
h. BFO offset - N/A

7. Energize the receiver. Adjust Sweep Generator Frequency control to center the response pattern on the Oscilloscope screen.

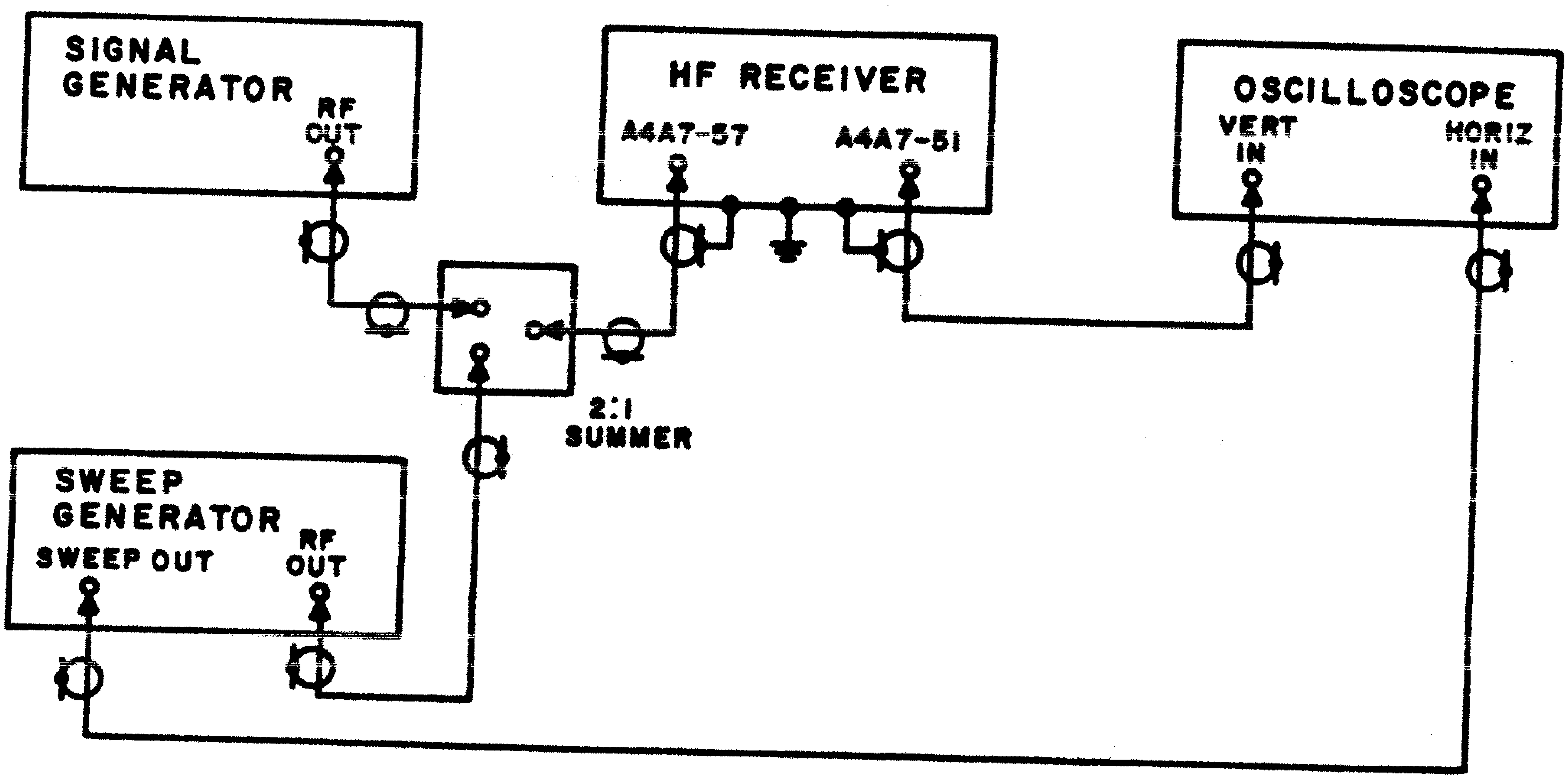

Figure 4-5. 455 kHz Amplifier/AM Detector Response Alignment, Test Setup

8. Adjust A4A7L2 and A4A7L3 for an Oscilloscope waveform which has maximum amplitude and is symmetrical about the marker. See **Figure 4-6** for a typical waveform.

9. Deenergize the receiver and disconnect test equipment.

10. Install A4A3 and A4A10 cards in the proper card slots.

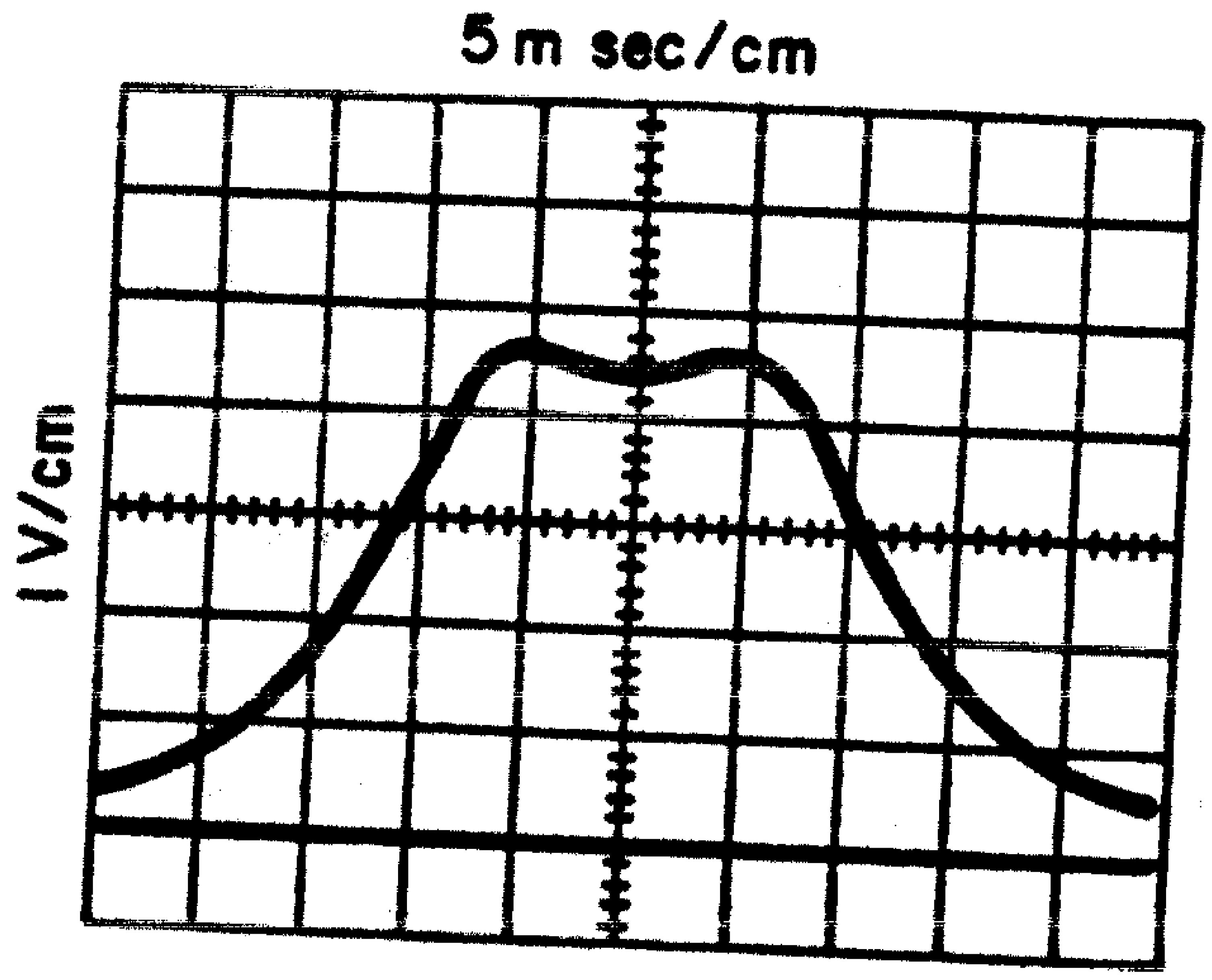

Figure 4-6. 455 kHz Amplifier/AM Detector Response Alignment, Typical Response

4.3.7.3.4 **455 kHz Amplifier/AM Detector Gain Adjustment**

1. Connect the test equipment as shown in **Figure 4-7.**

2. Set the receiver controls as follows:

a.	Meter	-	Signal Strength
b.	Gain Mode	-	Manual
c.	Detection Mode	-	AM
d.	RF Gain	-	Maximum Clockwise
e.	Phone Level	-	N/A
f.	IF Bandwidth	-	6 kHz
g.	BFO offset	-	N/A

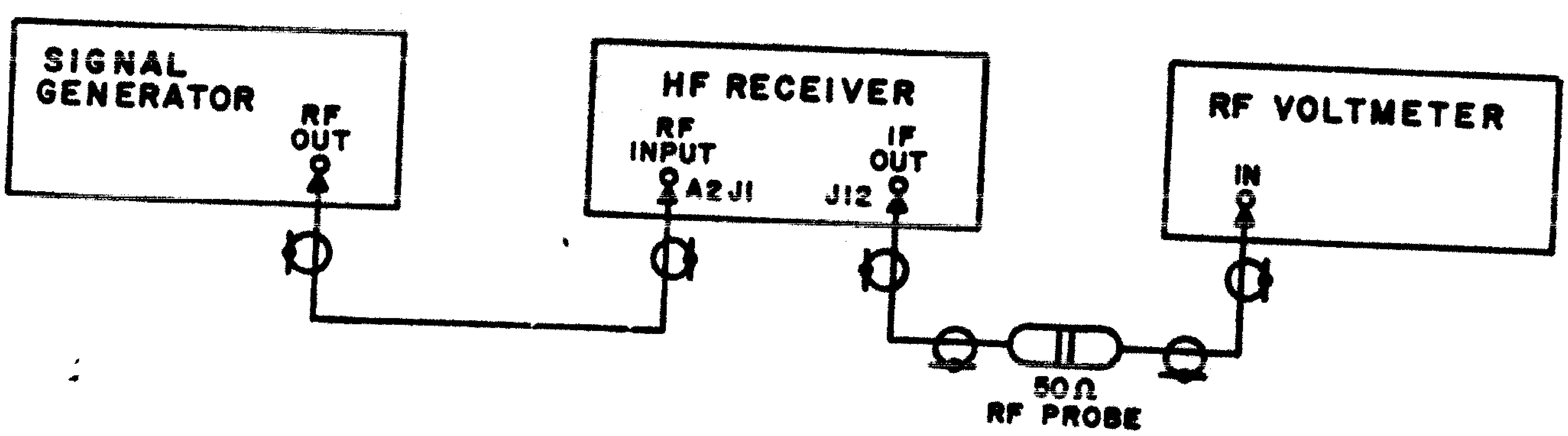

Figure 4-7. 455 kHz Amplifier/AM Detector Gain Adjustment, Test Setup

3. Energize the receiver.

4. Set the RF Voltmeter to the 100 mV scale.

5. Set the Signal Generator to 15.0050 MHz, unmodulated at -97 dBm (3 μV). Also tune receiver to 15.00500 MHz.

6. Adjust A4A7R7 for a 40 mV reading on the RF Voltmeter.

7. Deenergize the receiver and disconnect test equipment.

4.3.7.3.5 **USB Filter Switch and ISB/LSB Filter Switch Adjustment**

The purpose of this adjustment is to equalize the output levels of A4A4 and A4A5.

1. Deenergize the receiver.

2. Connect the RF output of the Signal Generator to RF Input connector A2J1.

3. Put A4A5 on an extender card and A4A4 on two extender cards.

4. Set the receiver controls as follows:

a.	Meter	-	Signal Strength
b.	Gain Mode	-	Manual
c.	Detection Mode	-	AM
d.	RF Gain	-	Maximum Clockwise
e.	Phone Level	-	Midway
f.	IF Bandwidth	-	16 kHz
g.	BFO offset	-	N/A

5. Energize the receiver.

6. Tune the receiver to 15.00500 MHz and set the Signal Generator to a 15.0050 MHz unmodulated signal.

7. Adjust the Signal Generator output level until the Signal Strength meter reads the SET level.

8. Change the Signal Generator frequency to 15.0054 MHz and receiver detection mode to USB.

9. Adjust potentiometer A4A4R23 until the meter reads the set level or until R23 is at its maximum setting, whichever occurs first. Record the meter level.

10. Change the Signal Generator frequency to 15.0046 MHz and receiver detection mode to LSB.

11. Adjust potentiometer A4A5R32 until the meter reads the level obtained in step 8. If the step 8 level cannot be obtained, set A4A5R32 at its maximum setting, record the meter reading, and perform steps 12 and 13.

12. Change the Signal Generator frequency to 15.0054 MHz and receiver detection mode to USB.

13. Adjust potentiometer A4A4R23 until the meter reads the level obtained in step 10.

14. Deenergize the receiver and disconnect test equipment.

4.3.7.3.6 **ISB Detector/Audio Adjustment** (Applies to WJ-8718/8718A/8718-9 Receivers)

1. Deenergize the receiver and connect the equipment as shown in **Figure 4-8.**

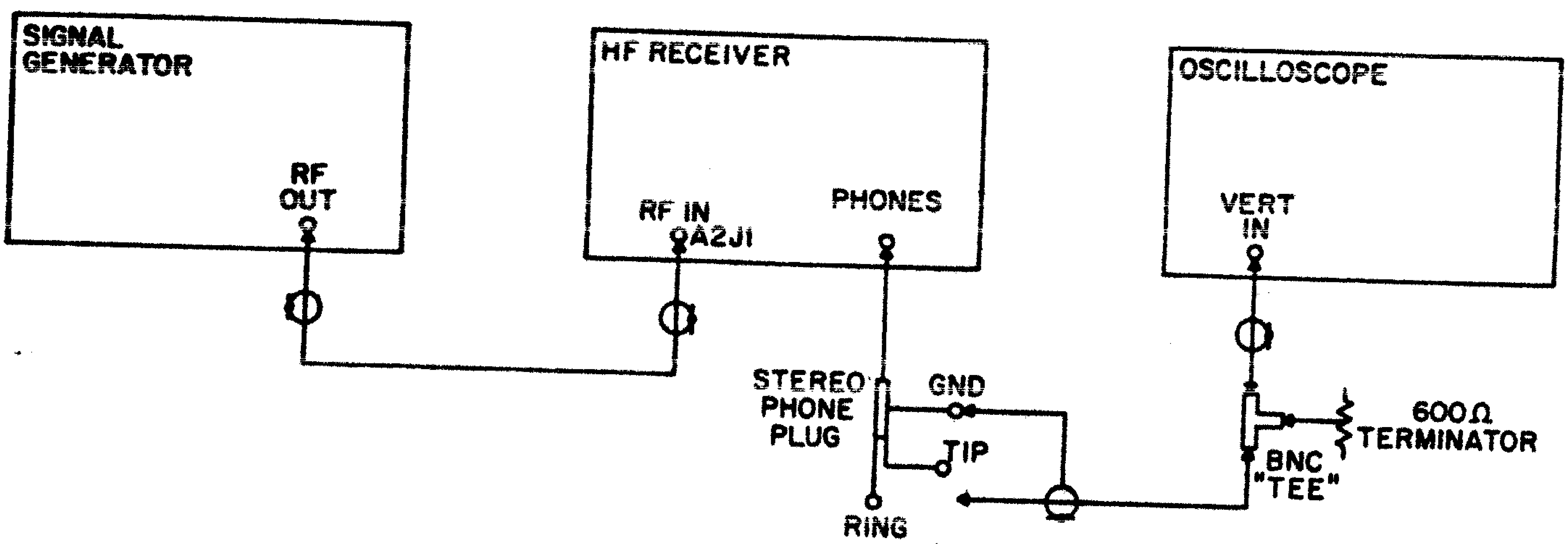

Figure 4-8. ISB Detector/Audio Adjustment, Test Setup

2. Set the receiver controls as follows:

a.	Meter	-	N/A
b.	Gain Mode	-	Manual
c.	Detection Mode	-	ISB
d.	RF Gain	-	Maximum Clockwise
e.	Phone Level	-	Maximum Clockwise (Initial Setting)
f.	IF Bandwidth	-	N/A

3. Energize the receiver. Connect oscilloscope to the "tip" on the phone plug. On WJ-8718A/8718-9 Receivers, ensure that USB and LSB Audio buttons are deenergized.

4. Set the Signal Generator to a -105 dBm unmodulated signal at 15.0054 MHz. Also tune the receiver to 15.00500 MHz.

5. With equipment connected properly, a 400 Hz audio output should be seen on the Oscilloscope.

6. Adjust the Phone Level gain control on the front panel for the maximum Oscilloscope waveform, without clipping or distortion present. Record this reading. This is the Upper Sideband signal.

7. Change the Signal Generator frequency to 15.0046 MHz.

8. Connect the Oscilloscope to the "ring" on the phone jack. This is the Lower Sideband signal.

9. Adjust A4A8R8 to obtain the same output obtained in step 5 above, or until output is at its maximum.

10. If the same level as in step 5 cannot be obtained, repeat steps 1 through 8, with the exception of increasing ISB IF gain via A4A5R32 slightly each time, so that step 5 (USB) and step 8 (LSB) waveforms are the same.

11. Deenergize the receiver and disconnect test equipment.

4.3.7.3.7 **FM Discriminator Alignment**

1. Deenergize the receiver.

2. Remove cards A4A7, A4A9, and A4A10.

3. Put A4A9 on an extender card.

4. Connect the test equipment as shown in **Figure 4-9.**

5. Set up the Sweep Generator as follows:

a.	Power	-	ON
b.	CW/Sweep	-	SYM
c.	Trig/Line/Free	-	Line
d.	Fast/Slow/Manual	-	Fast
e.	Crystal Cal	-	OFF
f.	Range	-	11
g.	Sym Sweep Width Vernier	-	.1/1
h.	1 kHz Mod	-	OFF
i.	Output Level	-	-10 dBm
j.	Frequency	-	455 kHz

6. Set up the Marker Generator for a 455 kHz output, unmodulated, at -25 dBm.

7. Set the receiver controls as follows:

a.	Meter	-	N/A
b.	Gain Mode	-	N/A
c.	Detection Mode	-	FM
d.	RF Gain	-	N/A
e.	Phone Level	-	N/A
f.	IF Bandwidth	-	N/A
g.	Receiver Frequency	-	N/A
h.	BFO offset	-	N/A

8. Energize the receiver. Adjust Sweep Generator Frequency control to center the response pattern on the Oscilloscope screen.

9. Adjust A4A9L1 and A4A9T1 for an Oscilloscope waveform which has maximum amplitude and is symmetrical and linear about the marker. See **Figure 4-10** for a typical waveform.

10. Deenergize the receiver.

11. Disconnect the test equipment and install A4A7, A4A9, and A4A10 boards into the proper slots.

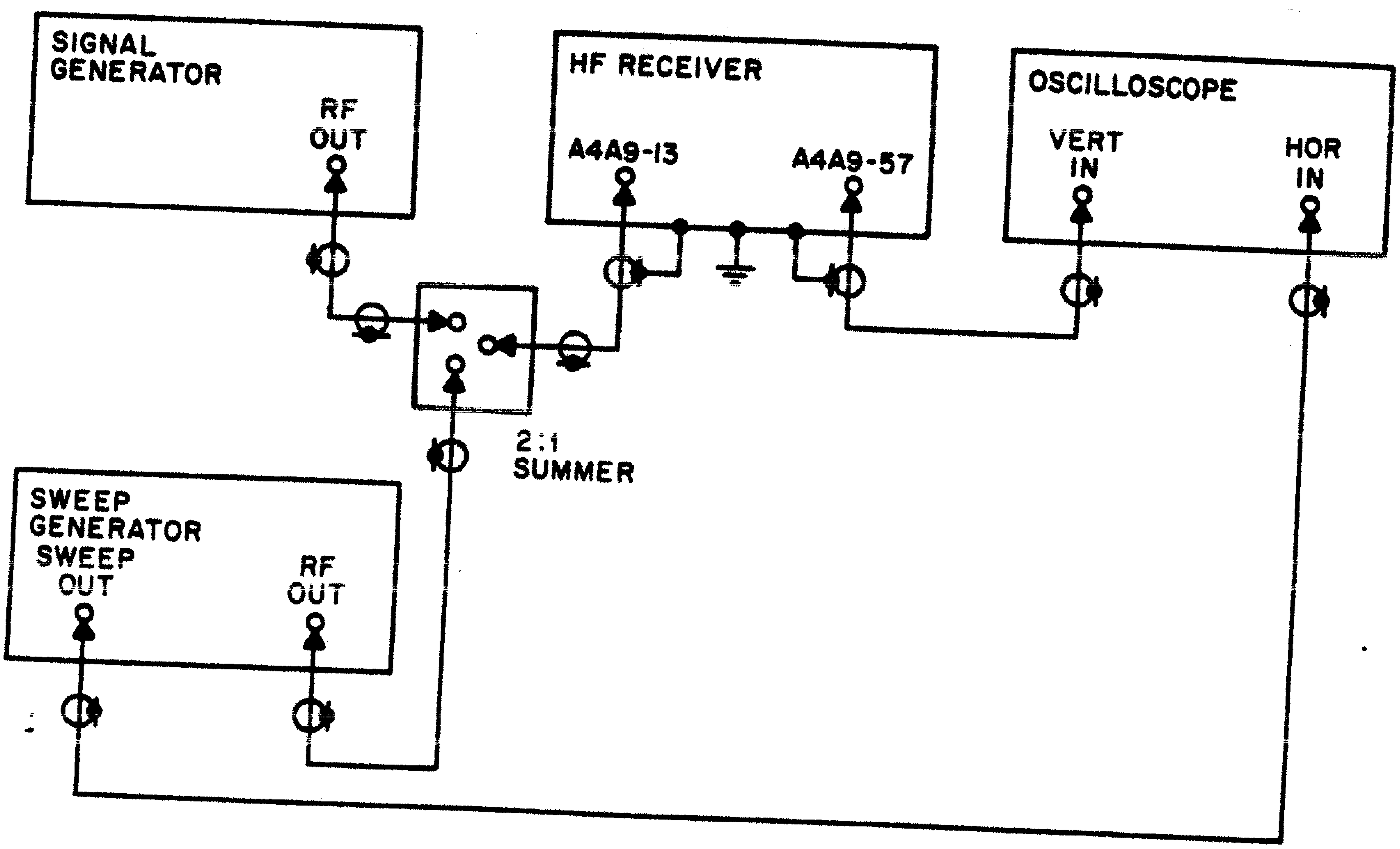

Figure 4-9. FM Discriminator Alignment, Test Setup

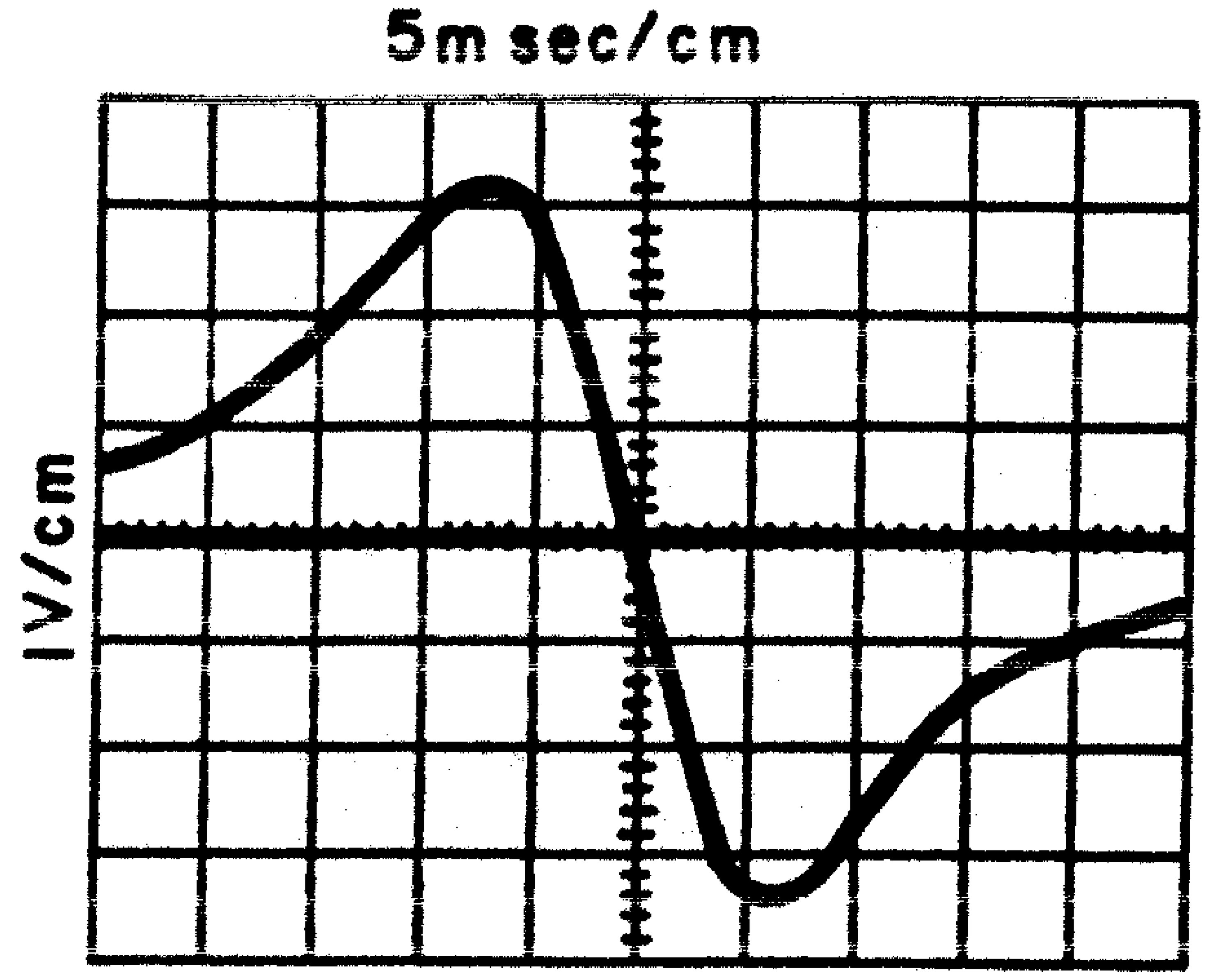

Figure 4-10. FM Discriminator Alignment, Typical Response

4.3.7.4 LED Intensity Adjustment

The intensity of the front panel Frequency Display can be varied by potentiometer R2, which is located inside the front panel on the left side of the Frequency Display LED's. Turning R2 clockwise increases the LED intensity.