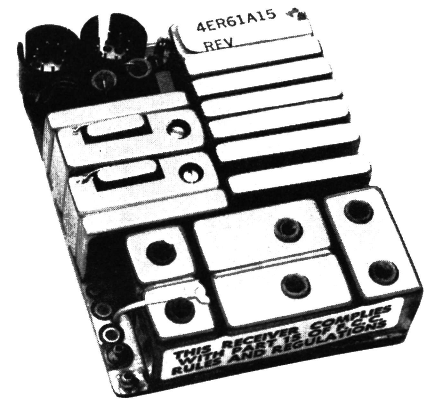
MOBILE RADIO

30-50 MHz RECEIVER
ER-61-A
FOR
PE MODELS AND Porta-Mobil II™

Maintenance Manual LBI4611E

DATAFILE FOLDER - DF-1115

ER-61-A



SPECIFICATIONS *

Type Number	ER-61-A
Audio Output (EIA)	500 milliwatts at less than 5% distortion
Channel Spacing	20 kHz
Sensitivity	
12 dB SINAD (EIA Method)	0.25 µV
20 dB Quieting Method	0.35 µV
Selectivity	
EIA Two-Signal	-60 dB
20 dB Quieting Method	-80 dB
Spurious Response	-70 dB
Image	-80 dB
Intermodulation (EIA)	-70 dB
Audio Response	Within +2 and -10 dB of a standard 6 dB per octave de-emphasis curve from 300 to 3000 Hz (1000 Hz reference)
Modulation Acceptance	±6.5 kHz
Squelch Sensitivity	
Critical Squelch	0.15 µV
Maximum Squelch	Greater than 20 dB Quieting

MAXIMUM FREQUENCY SPREAD (MHz)

FREQUENCY RANGE	Full Performance	1 dB Degradation in Sensitivity
30-36 MHz	0.36 MHz	0.45 MHz
36-42 MHz	0.43 MHz	0.54 MHz
42-50 MHz	0.51 MHz	0.645 MHz

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate **Specification Sheet** for the complete specifications.

TABLE OF CONTENTS

ILLUSTRATIONS

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

Receiver Models ER-61-A are single conversion, superheterodyne FM receivers for operation on the 30-50 MHz bands. The complete receiver mounts on a single printed wiring board, and utilizes both discrete components and Integrated Circuit modules. The application of each model receiver is shown in the following chart:

Model No.	Frequency Range	Number of Freqs.	Tone Option
4ER61A11	30-36 MHz	2	
4ER61A12	36-42 MHz	2	
4ER61A13	42-50 MHz	2	
4ER61A15	30-36 MHz	2	CG
4ER61A16	36-42 MHz	2	CG
4ER61A17	42-50 MHz	2	CG

References to symbol numbers mentioned in the following text are found on the Schematic Diagram, Outline Diagram and Parts List (see Table of Contents). The typical circuit diagrams used in the text are representative of the circuits used in the Integrated Circuit modules. A block diagram of the receiver is shown in Figure 1.

Supply voltage for the receiver includes a continuous regulated 5.4 Volts for the compensator module, a continuous 7.5 Volts for the squelch module, and a switched 7.5 Volts for the remaining receiver stages.

CIRCUIT ANALYSIS

OSCILLATOR MODULE

Oscillator Models 4EG28A17 and 18 (30-50 MHz) consist of a crystal-controlled Colpitts oscillator similar to the Oscillator module used in the transmitter (see Figure 2). The entire oscillator is contained in a metal can with the receiver operating frequency printed on the top. The crystal frequency ranges from 16.6 to 23.3 MHz. The crystal frequency is multiplied 3 times.

The oscillator frequency is temperature compensated to provide instant frequency compensation, with a frequency stability of ±.0002% from 0°C to +55°C and ±.0005% from -30°C to +60°C. The temperature compensation network is contained in Compensator Module A313.

In single frequency receivers, a jumper from H10 to H11 on System Board A705 connects the oscillator module to the continuous 5.4 Volt supply voltage. The oscillator output is applied to Compensator A313.

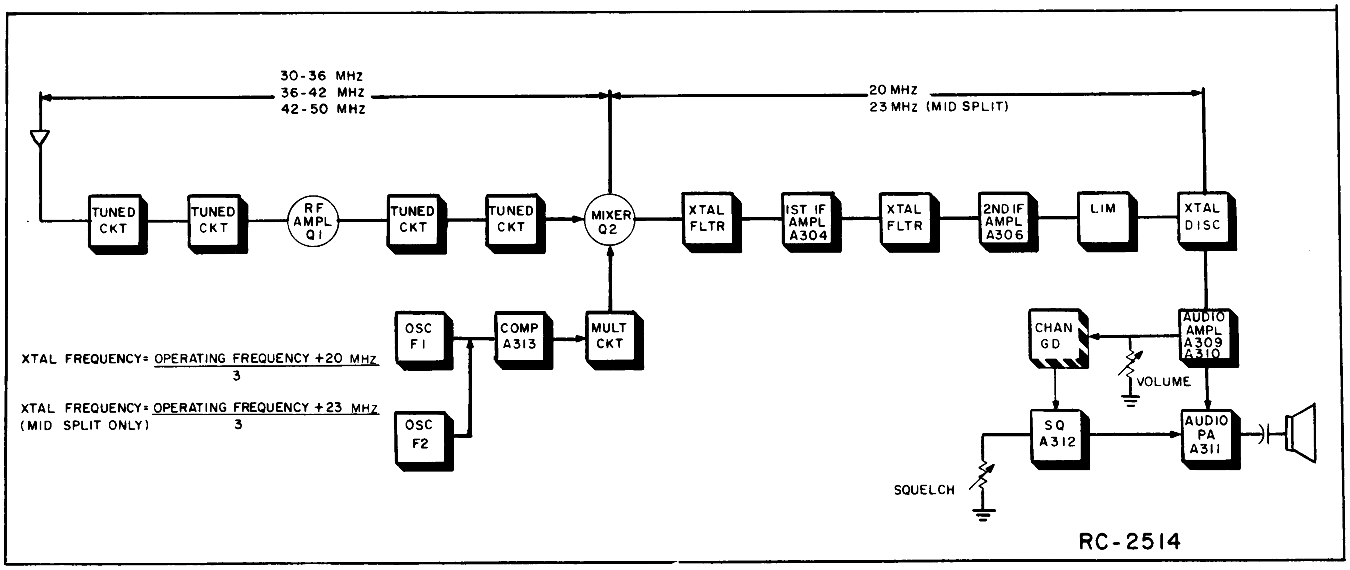


Figure 1 - Receiver Block Diagram

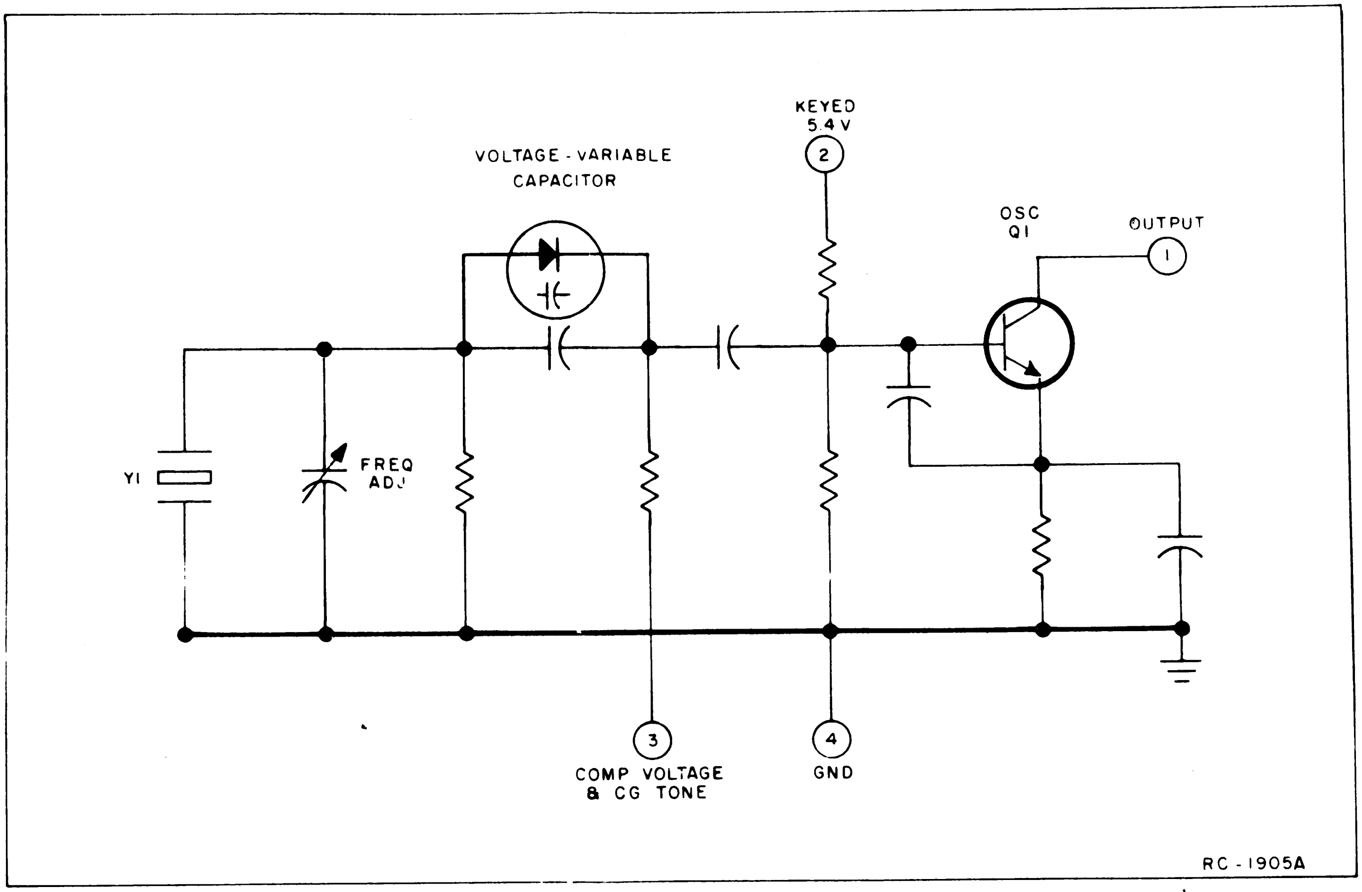


Figure 2 - Typical Oscillator Circuit

In two-frequency receivers, an additional oscillator module is mounted on the receiver board. The single-frequency supply jumper is removed, and the proper frequency is selected by connecting the 5.4 Volts to the selected oscillator module through frequency selector switch S1 on the control unit.

NOTE

All oscillator modules are individually compensated at the factory and cannot be repaired in the field. Any attempt to remove the oscillator cover will void the warranty.

COMPENSATOR A313

Compensator module A313 contains a buffer-amplifier stage, and the temperature compensation network for the oscillator (see Figure 3).

RF from the oscillator is coupled through a DC blocking capacitor to the base of Q1. The output of Q1 connects to multiplier coil L1 on the Multiplier assembly.

In the compensation Network, the regulated 5.4 volts at Pin 2 is applied to a thermistor-compensated voltage divider. The output at Pin 3 (2.35 volts measured with a VTVM) is applied to Pin 3 and to the varactor in the Oscillator module. At temperatures below -10°C, the compensated voltage increases to maintain the proper voltage on the oscillator voltage-variable capacitor.

SERVICE NOTE

An abnormally low VTVM reading (or no reading) at Pin 3 may indicate a short or leakage path in the oscillator. This can be checked by unsoldering Pin 2, raising it off of the printed board and taking anouther reading. If this reading is normal, the problem is in the Oscillator module. If the reading remains low (or zero), the problem is in the Compensator.

FRONT END

The receiver Front End consists of two slug tuned coils and a Dual-Gate Field Effect transistor (FET) RF amplifier stage. The RF signal from the antenna is coupled to a tap on L1/L2. RF from L1/L2 is coupled to L3/L4. A tap on L3/L4 is connected to gate 1 of FET Q1. The output of Q1 is developed across tuned circuit L5/L6 and C13/C14/C15 and coupled through C10/C17/C18 and L7/L8 to gate 1 of Mixer Q2.

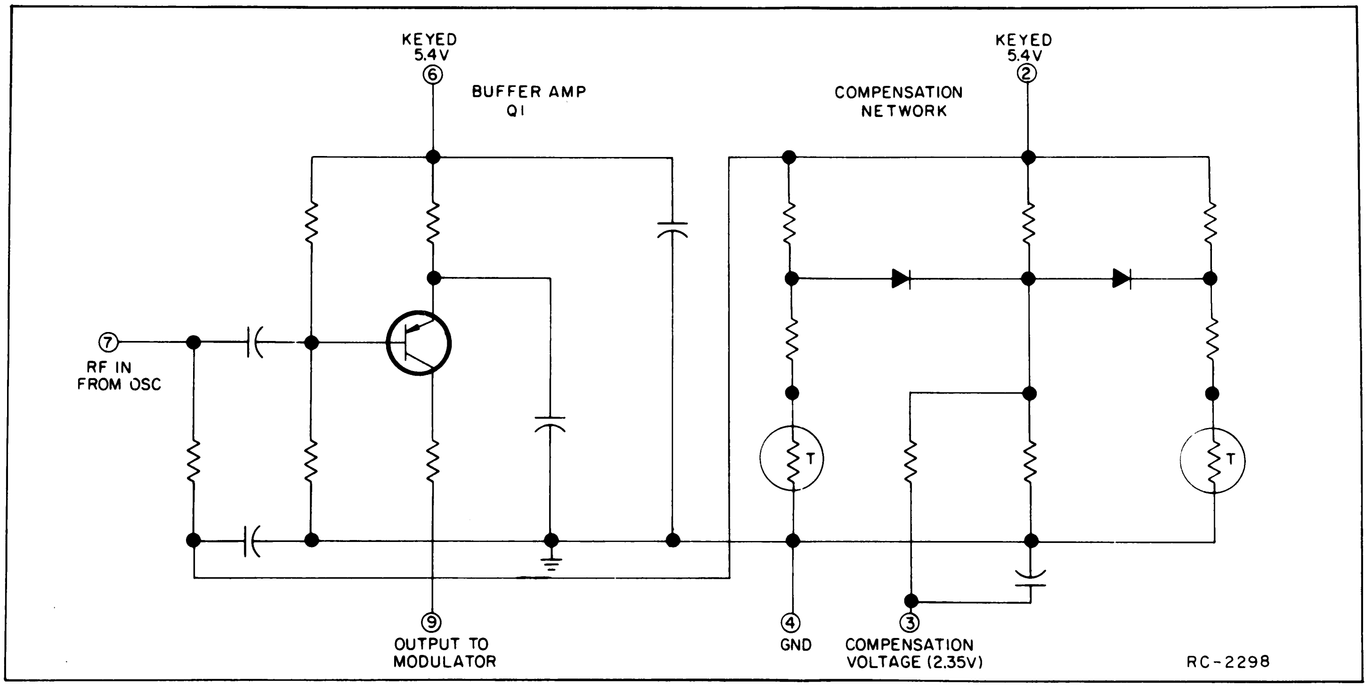


Figure 3 - Typical Compensator Circuit

MULTIPLIER & MIXER

The output of the Compensator module is applied to a tap on L9/L10 in the multiplier assembly. L9/L10 is tuned to three times the crystal frequency and is in the source circuit of FET Mixer Q2. High side injection is used.

The RF signal from RF amplifier Q1 is applied to gate 1 of Q2 and the high side injection frequency from the multiplier assembly is applied to the source. The resultant 20/23-MHz IF is coupled through the Mixer drain tank circuit L11, C25 and C22 to the input of Crystal Filter A320.

CRYSTAL FILTERS A320 & A321

Filter A320 follows the Multiplier-Mixer stage, and its output is applied to the 1st IF amplifier module, Filter A321 follows the IF Amplifier module. The two Crystal Filters provide the major selectivity for the receiver. A320 and A321 each provide a minimum of 40-45 dB stopband attenuation.

IF AMPS A304 & A306

An IF Amplifier module follows each of the crystal filters, and contain the resistor-matching networks for the filters. A typical IF amplifier circuit is shown in Figure 4.

Each of the IF Amplifier modules consists of three RC coupled amplifier stages that are DC series-connected for reduced current drain. The two IF modules provide a total gain of approximately 85 dB.

LIMITER A327 & DISCRIMINATOR A322

Limiter A327 consists of three RC coupled limiter stages that are a DC series connected for reduced current drain. The Limiter module also provides some gain. The output of the Limiter is applied to the discriminator. A typical Limiter circuit is shown in Figure 5.

The receiver uses a 20/23 MHz, fixed-tuned crystal discriminator (A322) to recover the audio from the IF signal. The Discriminator output is applied to the Audio Amplifier module.

AUDIO AMPLIFIER A309/A310

Audio and noise from the discriminator is applied to Audio Amplifier module A309 (A310 in Channel Guard applications). A typical audio amplifier circuit is shown in Figure 6.

Audio and noise is applied to the base of Q1. This stage operates as an emitter-follower for matching the impedance of the discriminator to the amplifier stage (Q2) and the VOLUME control. The output of Q1 is also applied to the input of the Squelch module.

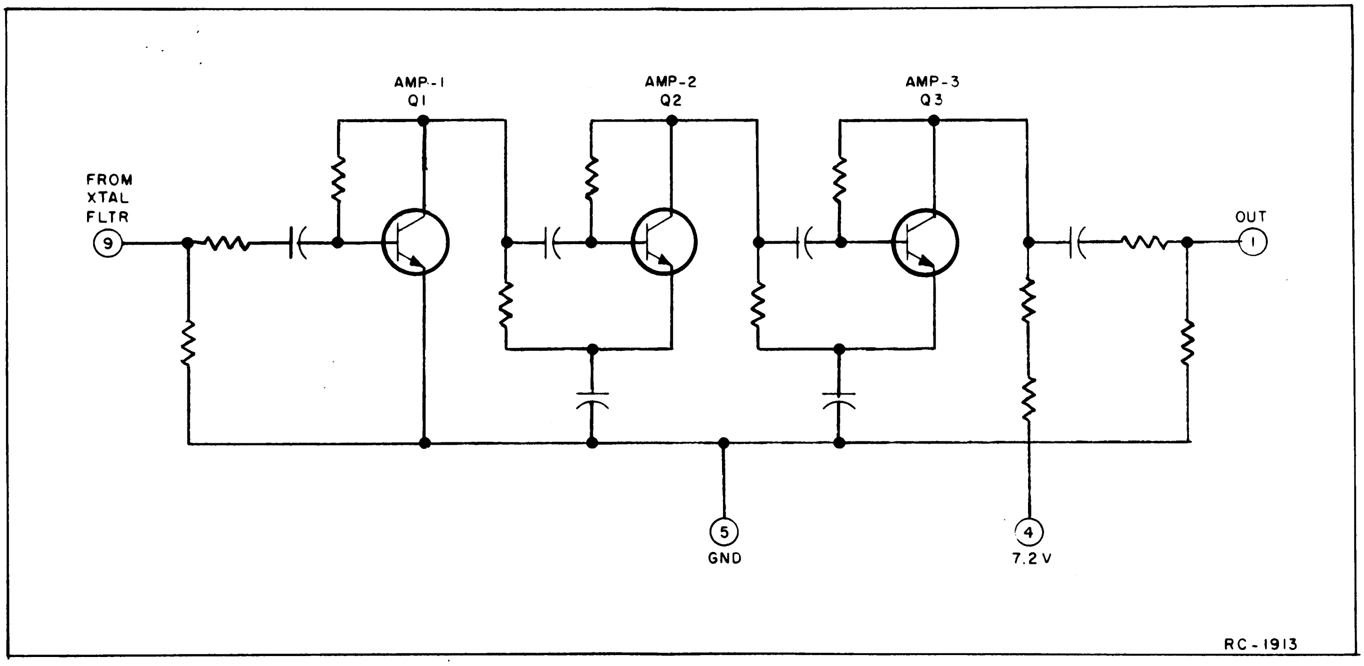


Figure 4 - Typical IF Amplifier Circuit

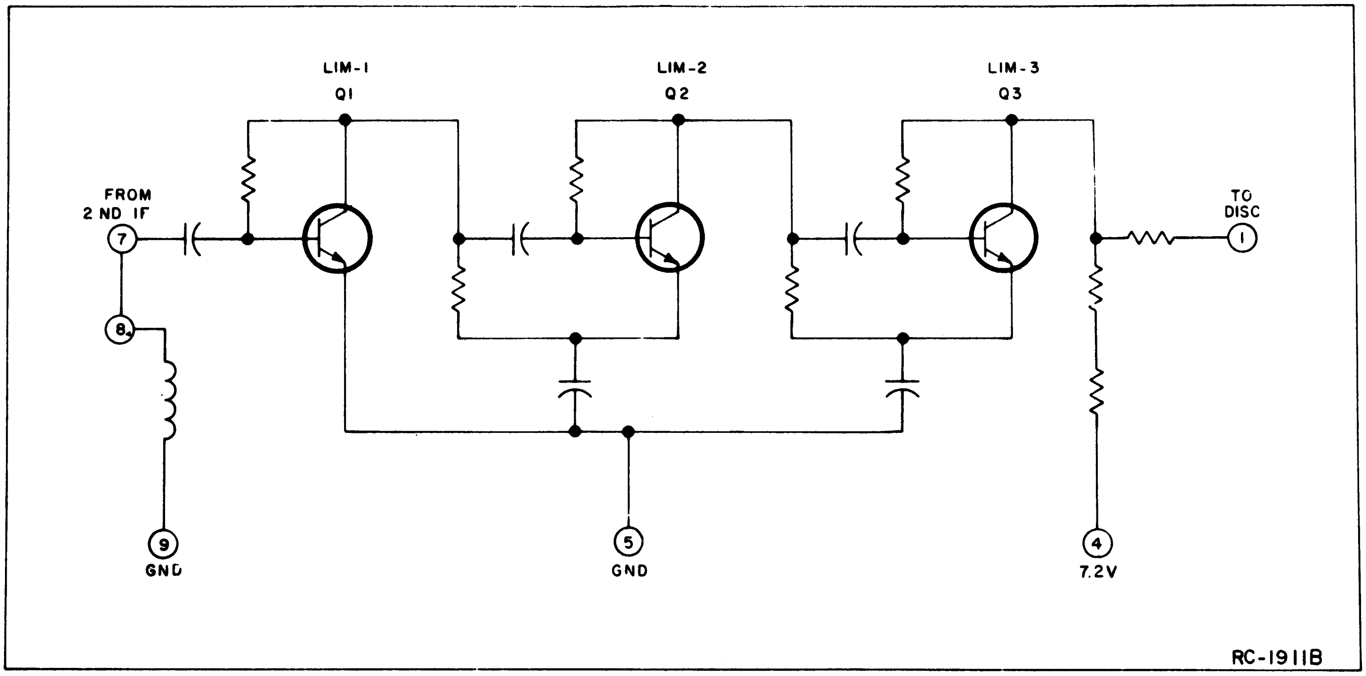


Figure 5 - Typical Limiter Circuit

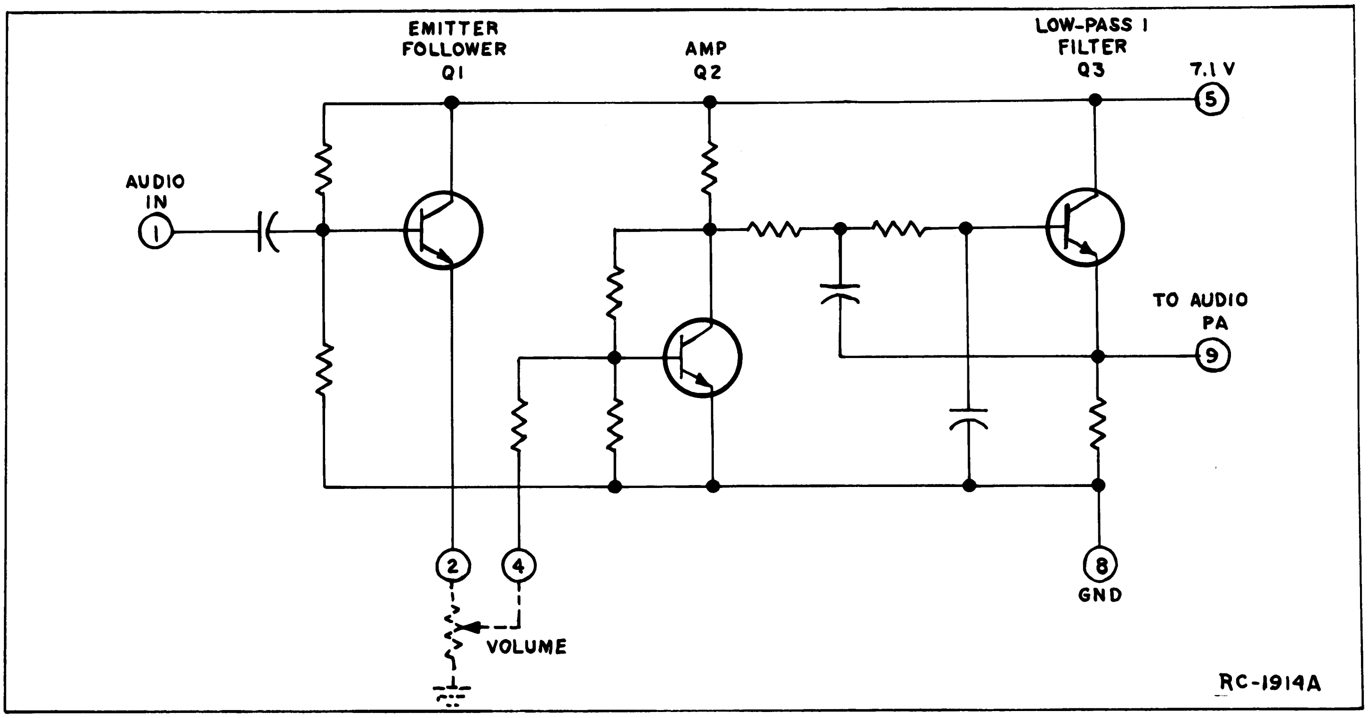


Figure 6 - Typical Audio Amplifier Circuit

Following amplifier Q2 is an active low-pass filter (Q3). Audio from the filter is connected from Pin 9 to the Audio PA module. In Audio Amplifier module A323, an active high-pass filter is added in series with the low-pass filter to provide the required Channel Guard tone frequency roll-off.

AUDIO PA A311

When the receiver is quieted by a signal, audio from the active filter is connected to Pin 1 of Audio PA module A311, and then to the base of amplifier Q1. Q1 feeds the audio signal to the base of Q2, which drives PA transistors Q4 and Q5. A typical audio PA circuit is shown in Figure 7.

PA transistors Q4 and Q5 operate as complementary emitter-followers, providing a 500 milliwatt output into an 8-ohm load. Audio from Pin 9 is coupled through capacitor C302 on the receiver board to the loudspeaker.

SQUELCH A312

Noise from Audio Amplifier A309/A310 operates the squelch circuit. A typical squelch circuit is shown in Figure 8.

When no carrier is present in the receiver, the noise output of active high-pass filter Q1 is coupled to the base of noise amplifier Q2 through SQUELCH control R708. R708 controls the gain of the noise amplifier.

The output of noise amplifier Q2 is detected by diodes CR1 and CR2, and the resultant positive voltage turns off the PNP squelch switch Q3. In standard radios, the emitter of Q3 is connected to +7 Volts by means of a jumper from H1 to H2. When noise turns off Q3, its collector drops to ground potential. As the collector of Q3 is connected to the base of amplifier Q1 in the Audio PA module, turning off Q3 also turns off Q1, keeping the audio PA turned off.

When the receiver is quieted by a signal, squelch switch Q3 turns on. This applies bias to the base of amplifier Q1 in the Audio PA module, turning the Audio PA circuit on so that sound is heard at the speaker.

In tone decoder applications, the 7-Volt jumper H1 to H2 is removed. The emitter of squelch switch Q3 is connected to 7.5 Volts by a DC switch to the decoder board.

An RF adaptor cable is available for connecting the receiver to a signal generator. Connecting the RF adaptor cable to J702 changes a set of contacts on the antenna and connects the receiver input to J702-1. Connection to chassis ground is made at J702-4.

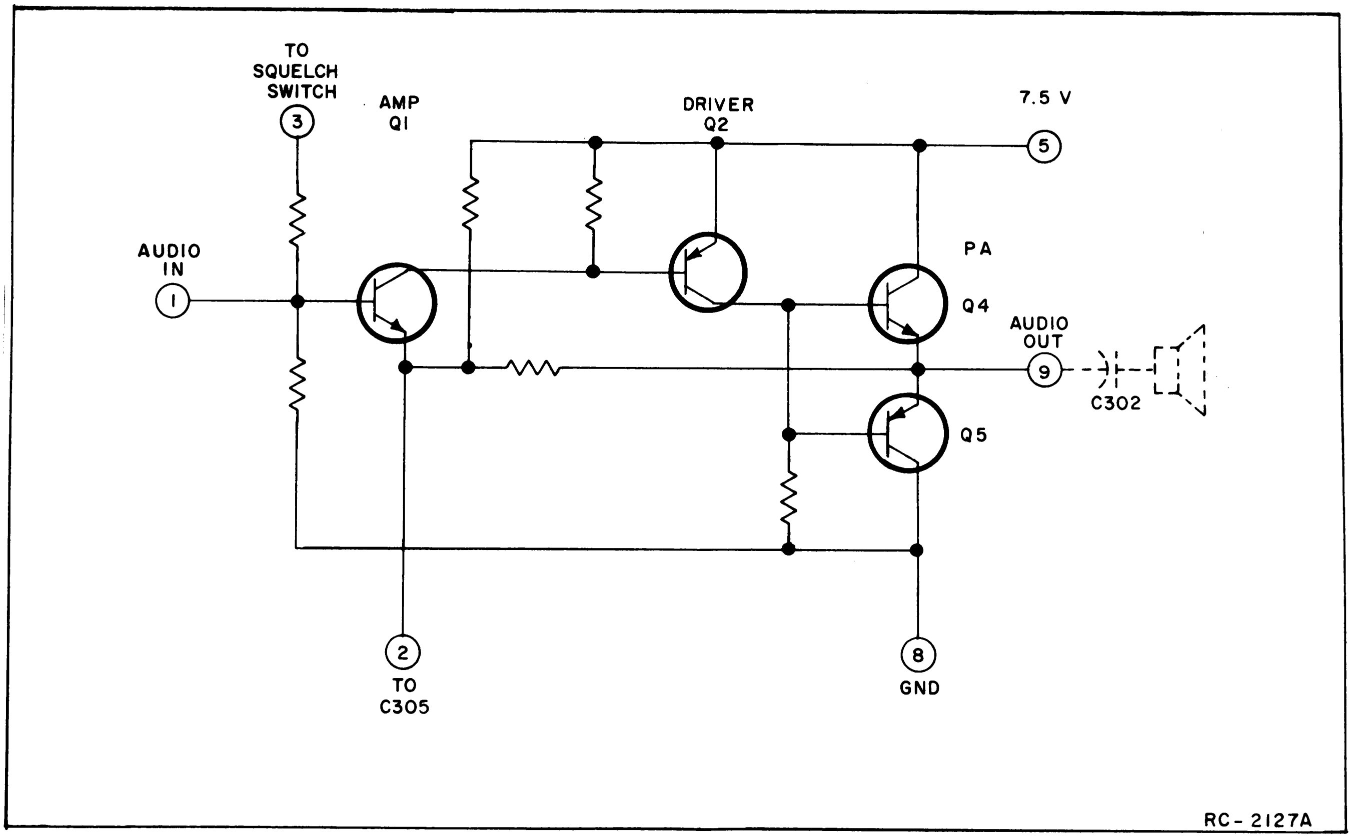


Figure 7 - Typical Audio PA Circuit

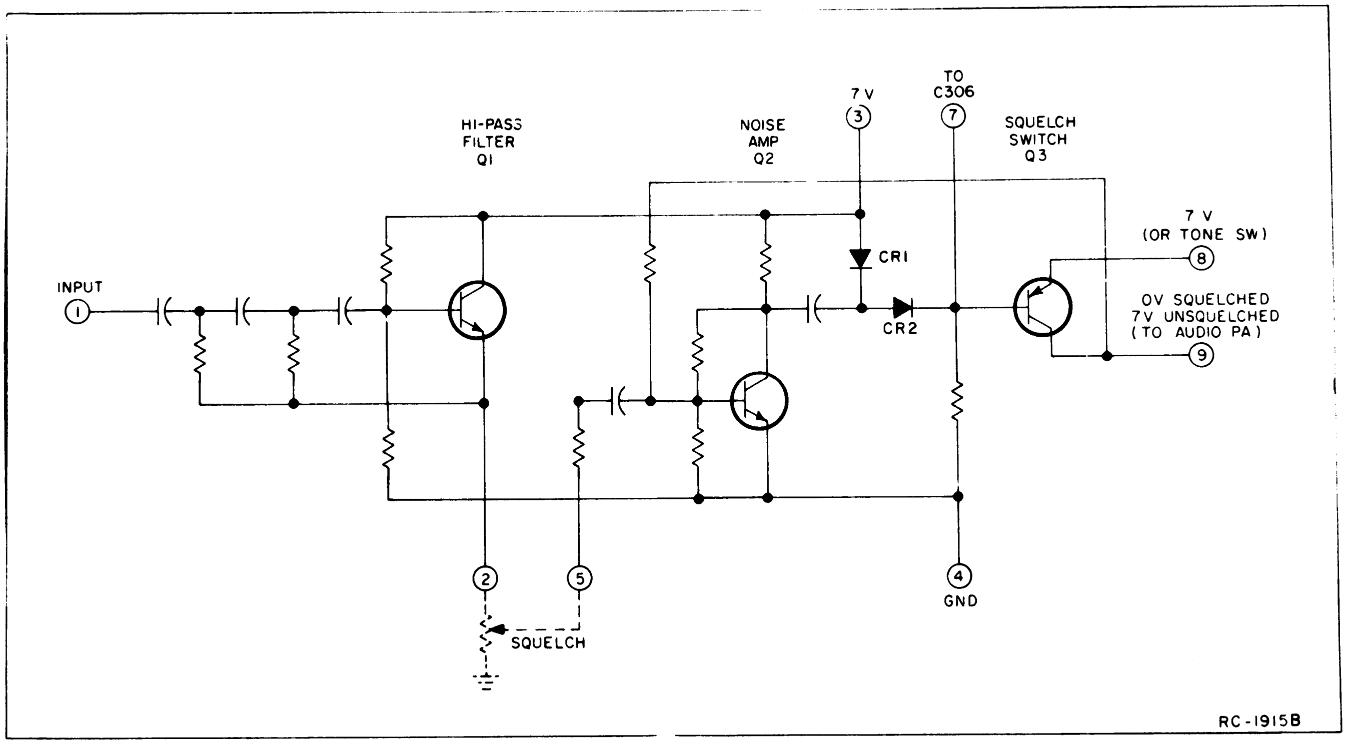
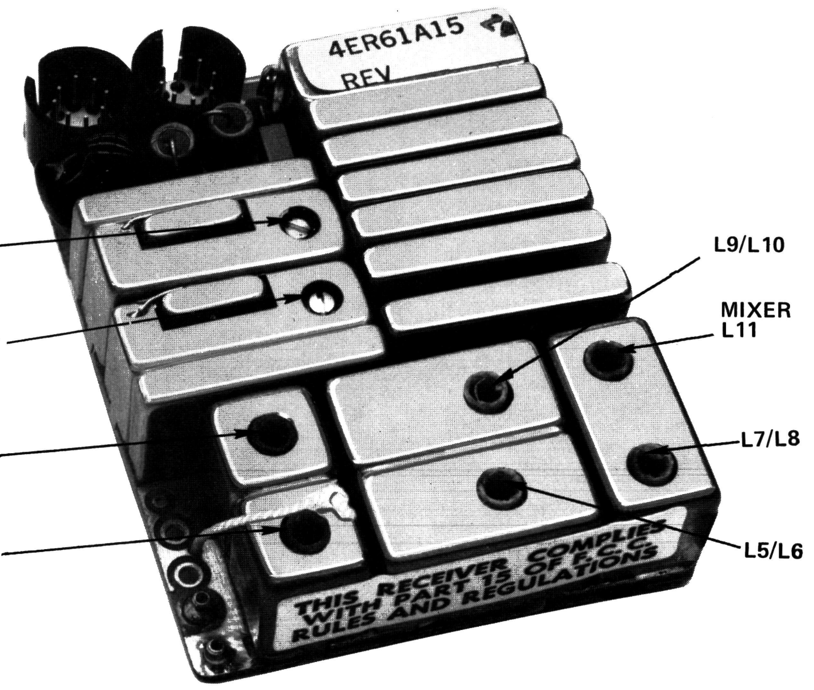


Figure 8 - Typical Squelch Circuit

SOLDER SIDE

COMPONENT SIDE



RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. A 20-MHz signal source (GE IF Generator Model 4EX9A10 or equivalent) and a 30-50 MHz source connected to Antenna Switch J702 by Receiver Test Cable 19C317633G1.
2. GE Test Set Model 4EX3A10 or 4EX8K11 or voltmeter with equivalent sensitivity.
3. GE Test Amplifier Model 4EX16A10 and RF probe 19C311370G1, or equivalent RF voltmeter.
4. Distortion Analyzer or AC-VTVM.
5. Tektronix Oscilloscope Model No. 515A or equivalent.

PRELIMINARY CHECKS AND ADJUSTMENTS

Set the slugs in L1 thru L8 to the bottom of the coil form for frequencies in the high end of the band. Set the slugs near the middle of the coil form for frequencies near the low end of the band. L11 should be set near the middle of the coil in all cases.

ALIGNMENT PROCEDURE

Step No.	Tuning Control	Procedure
1	MULT L9/L10	Connect RF Detector Probe to Pin 9 of A313. Tune L9/L10 for maximum meter reading on voltmeter.
2	L1 thru L8	Apply an on-frequency signal to J702 and adjust L1 thru L8 for best quieting sensitivity.
3	MULT L9/L10	Readjust L9/L10 for best quieting sensitivity. NOTE All circuits will tune with the slug in two positions. The correct position is the one closest to the board.
4	MIXER L11	Modulate the 20 KHz signal generator with the sawtooth output of the oscilloscope. Set the sweep rate for 2 ms/cm. Connect the output of the detector probe to the vertical input of the scope. Set the vertical sensitivity of the scope for highest sensitivity. With the probe connected to Pin 9 of A304, increase the input of the generator until the IF bank pass is displayed on the scope. Tune L11 for maximum Flatness of waveform. See Figure.
		FREQUENCY ADJUSTMENT
5		While applying an on-frequency signal to J702, loosely couple a 20-MHz signal to the Mixer. Adjust the Oscillator trimmer(s) for a zero beat frequency between the two signals. Alternate Method: Apply a strong 20 MHz signal to the Mixer. Measure the output of the Discriminator with a DC-VTVM at Pin 1 of A309/A310. Note the reading. Next, remove the 20-MHz signal and apply a strong on-frequency signal to J702. Then tune the oscillator trimmer(s) for the meter reading obtained at Pin 1 of A309/A310.

ALIGNMENT PROCEDURE
30—50 MHz RECEIVER
MODELS 4ER61A11, 12 & 13

TEST PROCEDURES

These Test Procedures are designed to help you to service a receiver that is operating --- but not properly. The problems encountered could be low power, poor sensitivity, distortion, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized.

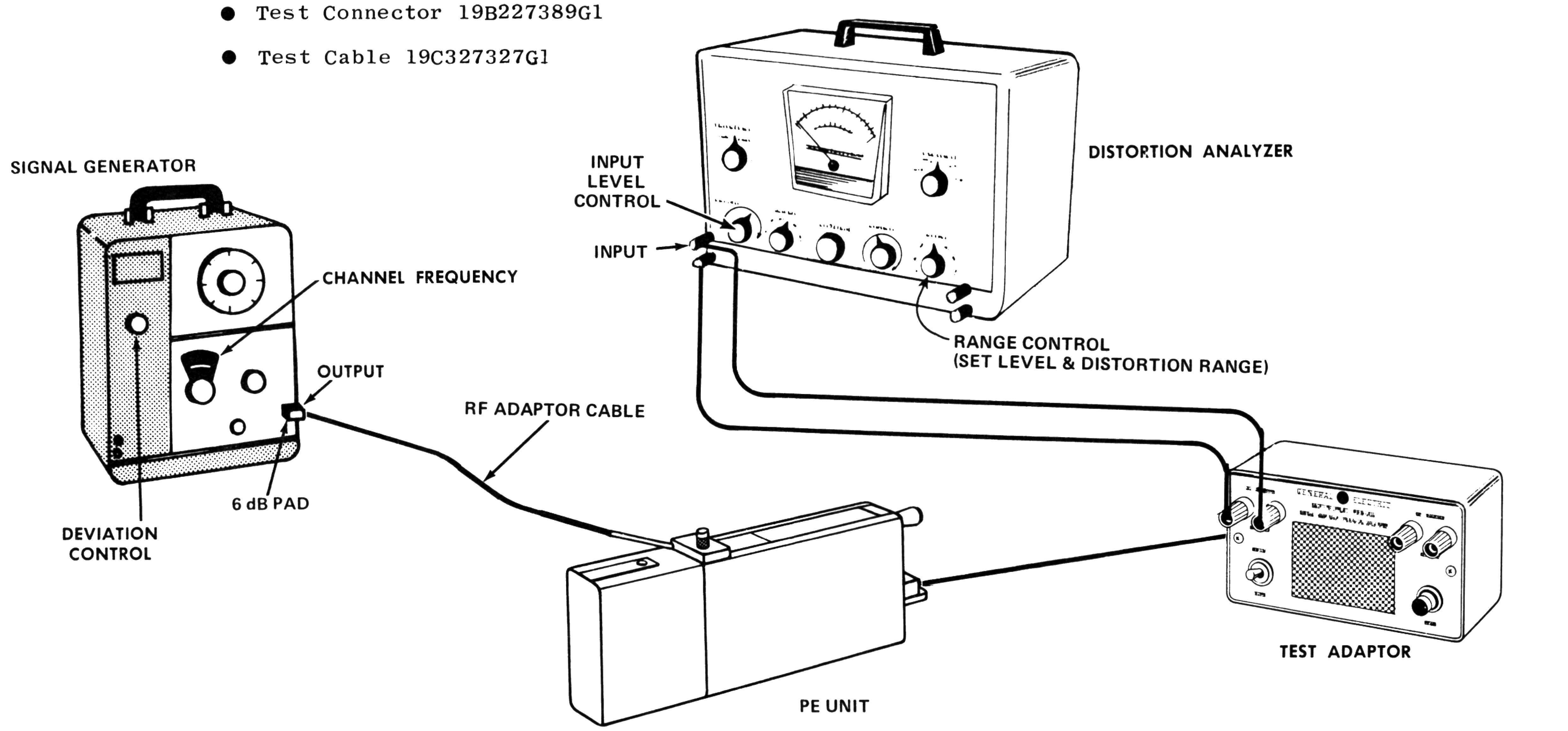
Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to: Heath IM-12
- Signal Generator similar to: Measurements M-800
- 6-dB attenuation pad
- Test Adaptor Model 4EX12A10
- RF Adaptor Cable 19C317633G1
- Test Connector 19B227389G1
- Test Cable 19C327327G1

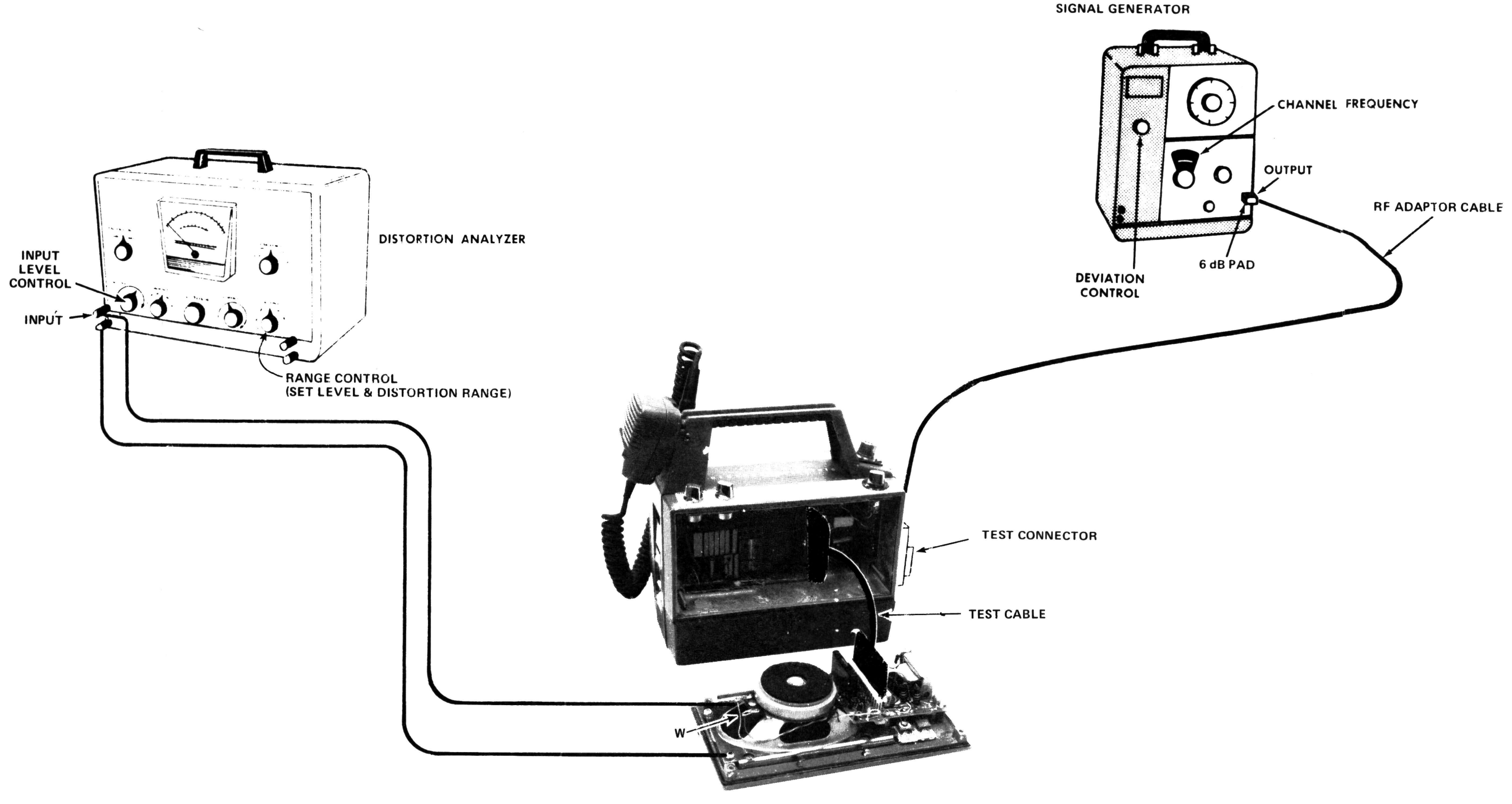
PRELIMINARY ADJUSTMENTS

1. Connect the test equipment to the receiver as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure.
3. Turn on all of the equipment and let it warm up for 20 minutes.



NOTE:

To keep from listening to 10 watts of audio, an 8 ohm resistor, rated at more than 10 watts, may be connected between the the white and blue leads on the speaker. When the resistor is used, the white lead is disconnected from the speaker terminal.



Porta-Mobile II™

STEP 1

AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power output as follows:

A. Connect a 1,000-microvolt test signal modulated by 1,000 hertz ±3.3 kHz deviation to the Antenna Switch J702.

B. Set the Volume Control for a 500 milliwatt output (2 volts RMS).

C. Make distortion measurements according to manufacturer's instructions. Reading should be less than 10% (5% is typical). If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than 0.5 watt, make the following checks:

D. Battery voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages.)

E. Audio Gain (Refer to Receiver Troubleshooting Procedure).

STEP 2

USABLE SENSITIVITY (12 dB SINAD)

TEST PROCEDURE

If STEP 1 checks out properly, measure the receiver sensitivity as follows:

A. Apply a 1000-microvolt, on-frequency signal modulated by 1000 Hz with 3.3-kHz deviation to J702.

B. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000-Hz distortion range position (1000-Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)

C. Place the RANGE switch to the SET LEVEL position (filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).

D. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range until a 12-dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

E. The 12-dB difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specification with an audio output of at least 250 milliwatts.

F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3

MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

TEST PROCEDURE

If STEPS 1 and 2 check out properly measure the bandwidth as follows:

A. Set the Signal Generator output for twice the microvolt reading obtained in the 12-dB SINAD measurement.

B. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000-Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

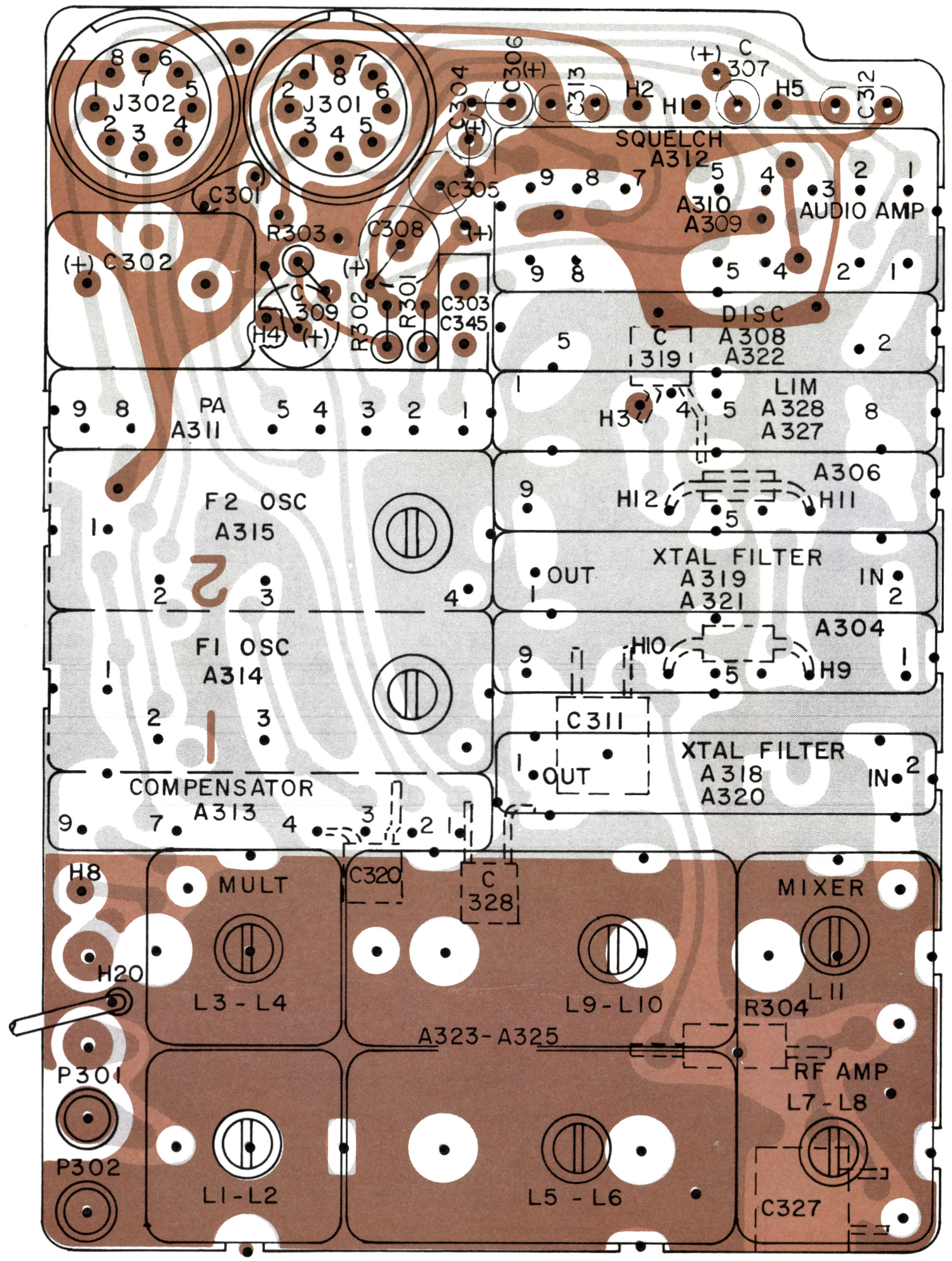
C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

D. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±7 kHz (but less than ±9 kHz).

SERVICE CHECK

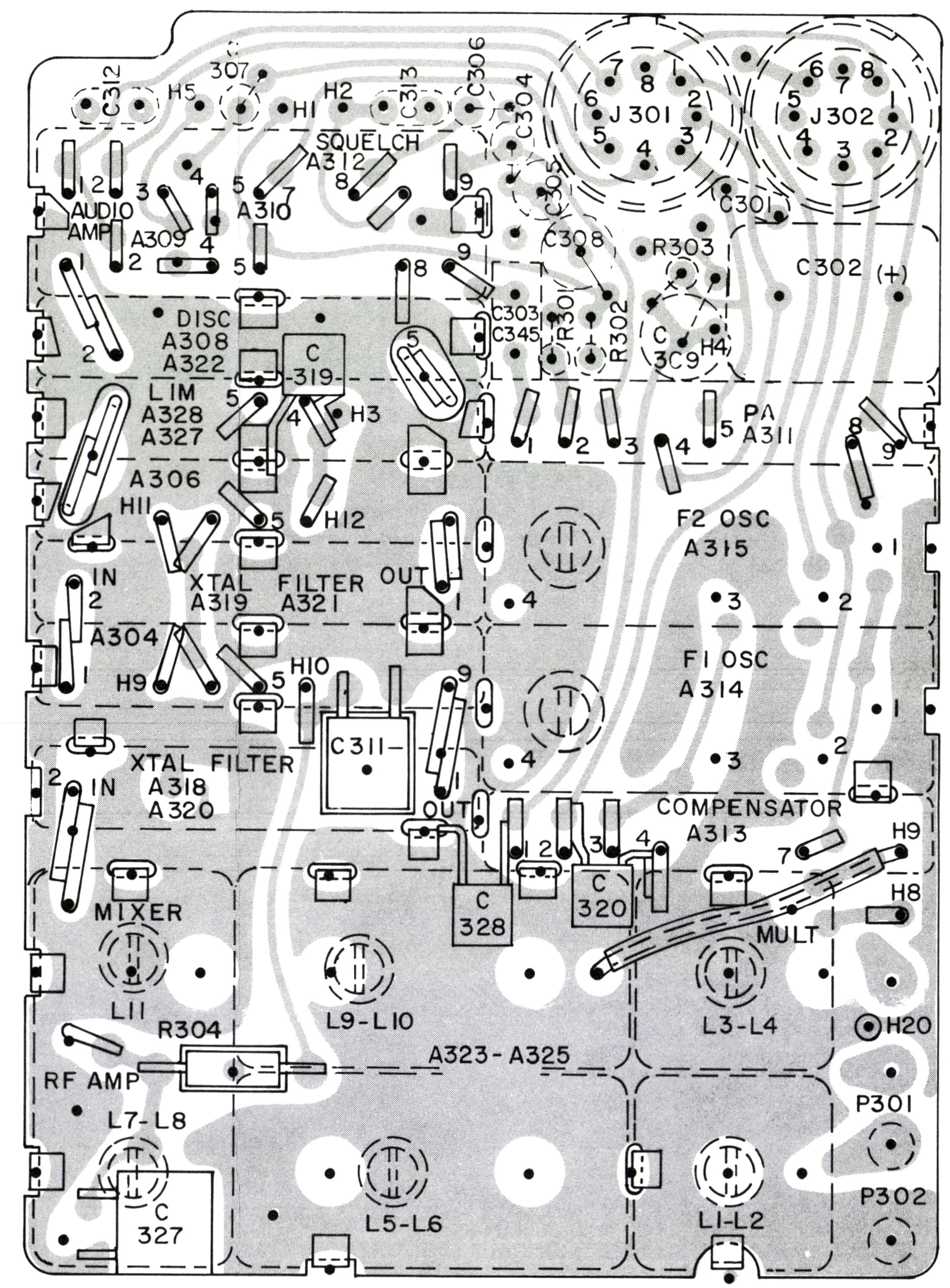
If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

COMPONENT SIDE



(19D417694, Rev. 5)
(19D416852, Sh. 2, Rev. 5)
(19D416852, Sh. 3, Rev. 6)

SOLDER SIDE



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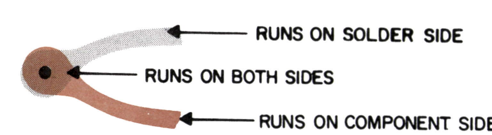
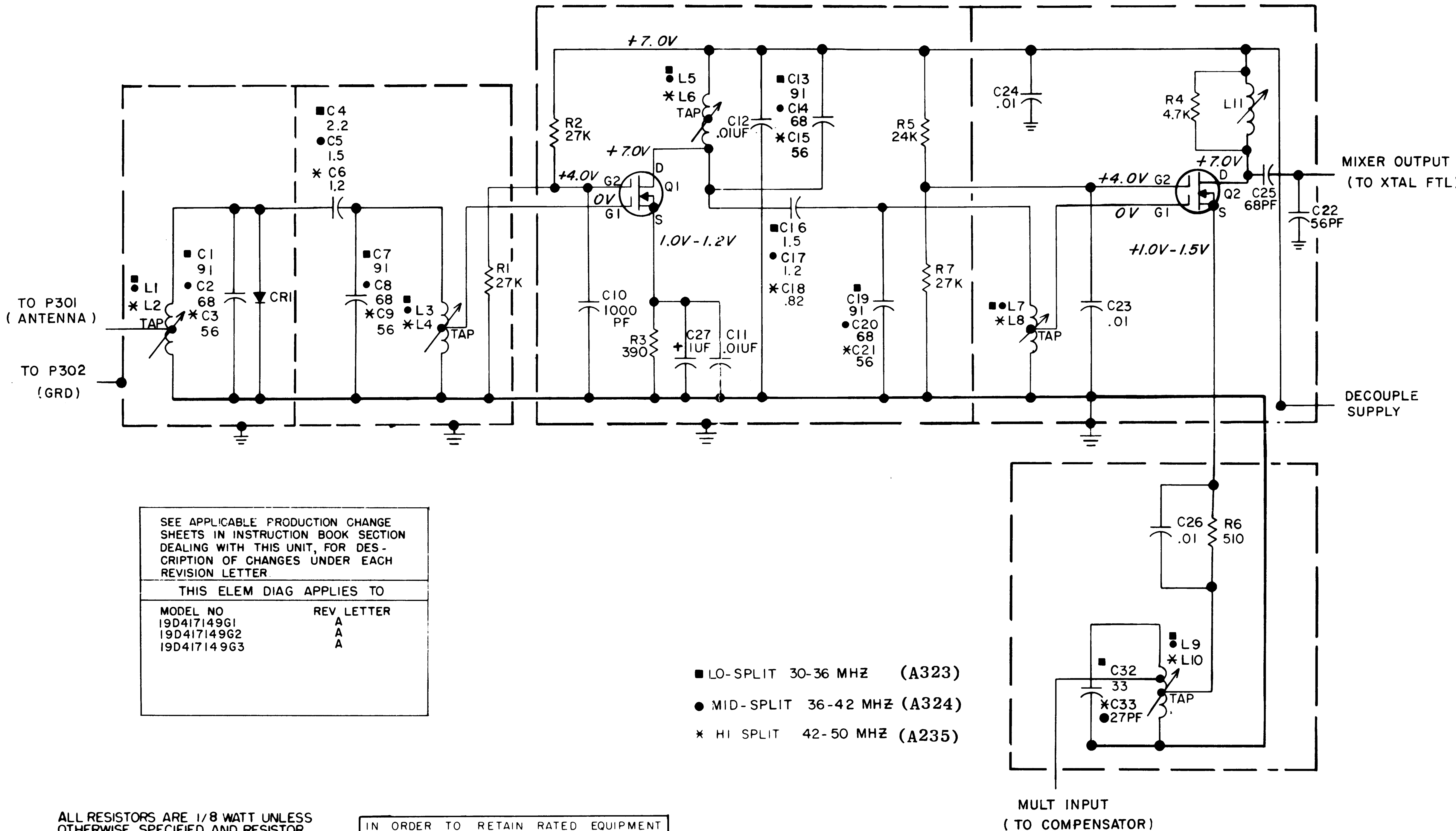
(19D416852, Sh. 2, Rev. 5)



OUTLINE DIAGRAM

30—50 MHz RECEIVER
MODELS 4ER61A11-13 & 15-17



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
19D417149G1	A
19D417149G2	A
19D417149G3	A

■ LO-SPLIT 30-36 MHZ (A323)

● MID-SPLIT 36-42 MHZ (A324)

✱ HI SPLIT 42-50 MHZ (A235)

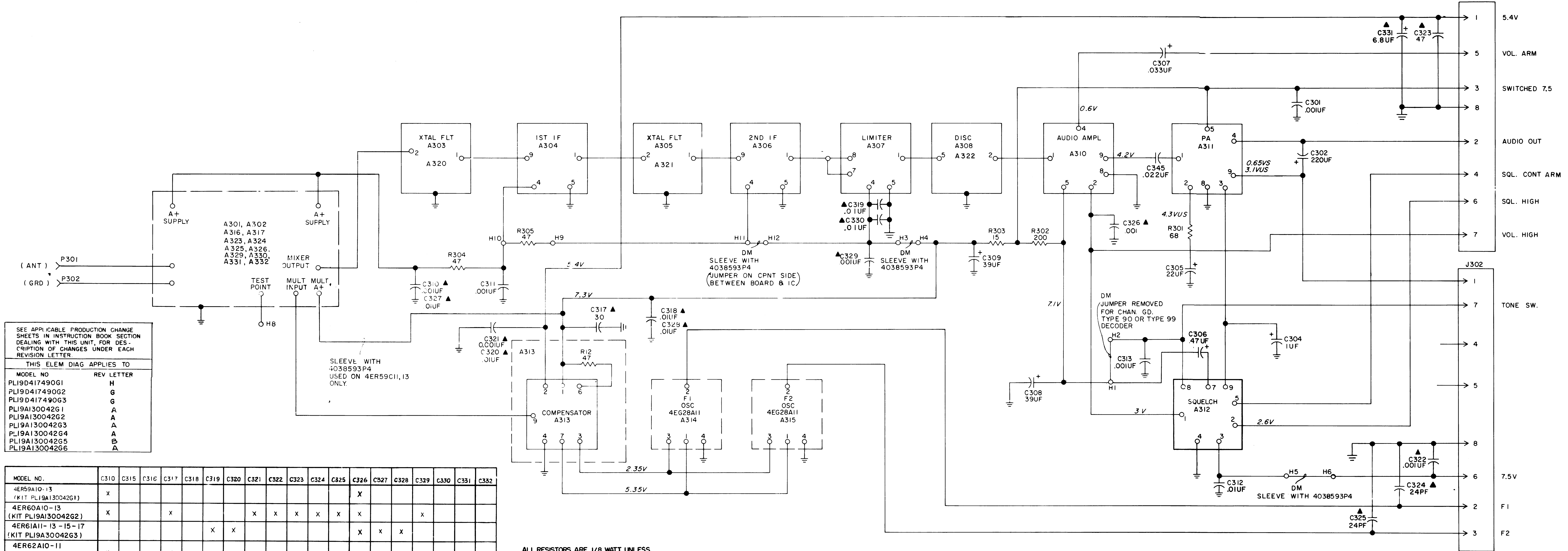
ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19C320885, Rev. 2)

SCHEMATIC DIAGRAM

30—50 MHz RECEIVER FRONT END



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19D417490G1	H
PL19D417490G2	G
PL19D417490G3	G
PL19A130042G1	A
PL19A130042G2	A
PL19A130042G3	A
PL19A130042G4	A
PL19A130042G5	B
PL19A130042G6	A

MODEL NO.	C310	C315	C316	C317	C318	C319	C320	C321	C322	C323	C324	C325	C326	C327	C328	C329	C330	C331	C332
4ER59A10-13 (KIT PL19A130042G1)	X												X						
4ER60A10-13 (KIT PL19A130042G2)	X			X				X	X	X	X	X	X			X			
4ER61A11-13-15-17 (KIT PL19A30042G3)						X	X						X	X	X				
4ER62A10-11 (KIT PL19A130042G4)	X			X	X		X						X						
4ER59C11,13 (KIT PL19A130042G5)	X					X		X					X		X		X	X	
4ER87A10-13 (KIT PL19A130042G6)						X	X						X	X	X				

ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

VOLTAGE READINGS

ALL READINGS TAKE WITH A DC-VTVM AND MEASURED TO GROUND. READINGS FOLLOWED BY "S" ARE WITH THE RECEIVER SQUELCHED. READINGS FOLLOWED BY "US" ARE WITH THE RECEIVER UNSQUELCHED.

▲ PART OF MODIFICATION KIT PL19A130042 SEE CHART BELOW FOR SELECTION OF PROPER PARTS FOR APPLICABLE MODEL NO.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19R622035, Rev. 16)

SCHEMATIC DIAGRAM

30—50 MHz RECEIVER BOARD
MODELS 4ER61A11, 12, 13

PARTS LIST

LBI-4595D

30-50 MHz RECEIVER
4ER61A11 30-36 MHz
4ER61A12 36-42 MHz
4ER61A13 42-50 MHz
4ER61A15 30-36 MHz CG
4ER61A16 36-42 MHz CG
4ER61A17 42-50 MHz CG

SYMBOL	GE PART NO.	DESCRIPTION
A323 thru A325		FRONT END A323 19D417149G1 30-36 MHz A324 19D417149G2 36-42 MHz A325 19D417149G3 42-50 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - -
C1	19A116114P2063	Ceramic: 91 pf ±5%, 100 VDCW; temp coef -80 PPM.
C2	19A116114P2059	Ceramic: 68 pf ±5%, 100 VDCW; temp coef -80 PPM.
C3	19A116114P2056	Ceramic: 56 pf ±5%, 100 VDCW; temp coef -80 PPM.
C4	5491601P126	Phenolic: 2.2 pf ±5%, 500 VDCW.
C5	5491601P123	Phenolic: 1.5 pf ±5%, 500 VDCW.
C6	5491601P122	Phenolic: 1.2 pf ±5%, 500 VDCW.
C7	19A116114P2063	Ceramic: 91 pf ±5%, 100 VDCW; temp coef -80 PPM.
C8	19A116114P2059	Ceramic: 68 pf ±5%, 100 VDCW; temp coef -80 PPM.
C9	19A116114P2056	Ceramic: 56 pf ±5%, 100 VDCW; temp coef -80 PPM.
C10	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
C11 and C12	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C13	19A116114P2063	Ceramic: 91 pf ±5%, 100 VDCW; temp coef -80 PPM.
C14	19A116114P2059	Ceramic: 68 pf ±5%, 100 VDCW; temp coef -80 PPM.
C15	19A116114P2056	Ceramic: 56 pf ±5%, 100 VDCW; temp coef -80 PPM.
C16	5491601P123	Phenolic: 1.5 pf ±5%, 500 VDCW.
C17	5491601P122	Phenolic: 1.2 pf ±5%, 500 VDCW.
C18	5491601P119	Phenolic: 0.82 pf ±5%, 500 VDCW.
C19	19A116114P2063	Ceramic: 91 pf ±5%, 100 VDCW; temp coef -80 PPM.
C20	19A116114P2059	Ceramic: 68 pf ±5%, 100 VDCW; temp coef -80 PPM.
C21 and C22	19A116114P2056	Ceramic: 56 pf ±5%, 100 VDCW; temp coef -80 PPM.
C23 and C24	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C25	19A116114P4059	Ceramic: 68 pf ±5%, 100 VDCW; temp coef -220 PPM.
C26	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C27	5491674P28	Tantalum: 1.0 µf ±20%, 25 VDCW; sim to Sprague Type 162D.
C32	19A116114P2047	Ceramic: 33 pf ±5%, 100 VDCW; temp coef -80 PPM.
C33	19A116114P2044	Ceramic: 27 pf ±5%, 100 VDCW; temp coef -80 PPM.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A115250P1	Silicon.
		- - - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19C320379G12	Coil. Includes:
	19B209436P1	Tuning slug.
L2	19C320379G13	Coil. Includes:
	19B209436P1	Tuning slug.
L3	19C320379G14	Coil. Includes:
	19B209436P1	Tuning slug.
L4	19C320379G15	Coil. Includes:
	19B209436P1	Tuning slug.
L5	19C320379G5	Coil. Includes:
	19B209436P1	Tuning slug.
L6	19C320379G6	Coil. Includes:
	19B209436P1	Tuning slug.
L7	19C320379G5	Coil. Includes:
	19B209436P1	Tuning slug.
L8	19C320379G6	Coil. Includes:
	19B209436P1	Tuning slug.
L9	19C320379G9	Coil. Includes:
	19B209436P1	Tuning slug.
L10	19C320379G10	Coil. Includes:
	19B209436P1	Tuning slug.
L11	19C320379G11	Coil. Includes:
	19B209436P1	Tuning slug.
		- - - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 and Q2	19A116818P2	N Channel, field effect.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R151P273J	Composition: 27K ohms ±5%, 1/8 w.
R2*	3R151P273J	Composition: 27K ohms ±5%, 1/8 w.
		Earlier than REV A:
	3R151P104J	Composition: 100K ohms ±5%, 1/8 w.
R3	3R151P391J	Composition: 390 ohms ±5%, 1/8 w.
R4	3R151P472J	Composition: 4.7K ohms ±5%, 1/8 w.
R5	3R151P243J	Composition: 24K ohms ±5%, 1/8 w.
R6	3R151P511J	Composition: 510 ohms ±5%, 1/8 w.
R7	3R151P273J	Composition: 27K ohms ±5%, 1/8 w.
		RECEIVER BOARD 19D417490G1 (30-36, 42-50 MHz) 19D417490G2 (Replaced by 19D417490G1) 19D417490G3 (36-42 MHz)
A303	19C304824G1	Bandpass Filter. (30-36, 42-50 MHz).
A304	19C311879G3	IF Amplifier.
A305	19C304824G1	Bandpass Filter. (30-36, 42-50 MHz).
A306	19C311879G4	IF Amplifier.
A307	19C311876G4	Receiver Limiter.
A308	19C304504G3	Discriminator. (30-36, 42-50 MHz).
A309*	19C311878G2	Audio Amplifier. Deleted in G1 by REV H, G3 by REV G.
A310	19C311995G2	Audio Amplifier, tone filter.
A311*	19C311877G4	Audio PA.
		In 19D417490G2 of REV F and earlier: In 19D417490G3 of REV E and earlier:
	19C311877G2	Audio PA.
A312	19C311880G4	Receiver Squelch.
A313*	19C320061G1	Oscillator Compensator.
		In REV B and earlier:
	19C311891G5	Oscillator Compensator.
		- - - - - - - - - - OSCILLATORS - - - - - - - -
A314 and A315		NOTE: When reordering, give GE Part Number and specify exact frequency needed.
	4EG28A17	Oscillator Module. 30-36 MHz. $Fx = \frac{Fo + 20}{3}$
	4EG28A18	Oscillator Module. 36-42 MHz. $Fx = \frac{Fo + 23}{3}$
	4EG28A17	Oscillator Module. 42-50 MHz. $Fx = \frac{Fo + 20}{3}$
A318 and A319	19C304824G1	Bandpass Filter. (30-36, 42-50 MHz).
A320 and A321	19C304824G3	Bandpass Filter. (36-42 MHz).
A322	19C304504G6	Discriminator. (36-42 MHz).
A327	19C311876G4	Limiter. (36-42 MHz).
A328	19C311876G4	Limiter. (30-36, 42-50 MHz).
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C301	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
C302	19A116178P7	Tantalum: 220 µf ±20%, 6 VDCW; sim to Components TSD5-6-227.
C303*	19A116089P1	Ceramic: 0.1 µf ±20%, 50 VDCW; sim to Erie 8523-006-X5R-104M. Deleted in G3 by REV G.
C304	5491674P28	Tantalum: 1.0 µf ±20%, 25 VDCW; sim to Sprague Type 162D.
C305	5491674P35	Tantalum: 22 µf ±20%, 4 VDCW; sim to Sprague Type 162D.
C306	5491674P27	Tantalum: 0.47 µf ±20%, 35 VDCW; sim to Sprague Type 162D.
C307	5491674P31	Tantalum: 0.033 µf ±20%, 35 VDCW; sim to Sprague Type 162D.
C308 and C309	5491674P30	Tantalum: 39 µf ±20%, 10 VDCW; sim to Sprague Type 162D.
C311	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
C312*	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
		In REV A and earlier:
	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
C313	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
C314*	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW. Deleted in 19D417490G2 by REV E. Deleted in 19D417490G3 by REV D.
C345*	19A116192P6	Ceramic: 0.022 µf ±20%, 50 VDCW; sim to Erie 8131-M050-W5R-223M. Added to 19D417490G2 by REV F. Added to 19D417490G3 by REV E.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J301 and J302	19A116122P1	Terminal, feed-thru: sim to Warren 1-B-2994-4.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P301 and P302	19A115834P4	Contact, electrical: sim to AMP 2-332070-9.
		- - - - - - - - - - - RESISTORS - - - - - - - - -
R301*	3R151P680J	Composition: 68 ohms ±5%, 1/8 w.
		In 19D417490G2 of REV A-D: In 19D417490G3 of REV A-G:
	3R151P101J	Composition: 100 ohms ±5%, 1/8 w.
		Earlier than REV A:
	3R151P470J	Composition: 47 ohms ±5%, 1/8 w.
R302	3R151P201J	Composition: 200 ohms ±5%, 1/8 w.
R303	3R151P150J	Composition: 15 ohms ±5%, 1/8 w.
R304 and R305	3R151P470J	Composition: 47 ohms ±5%, 1/8 w.
		RECEIVER KIT 19A130042G3
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C319 and C320	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C326*	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW. Added by REV A.
C327 and C328	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
		MISCELLANEOUS
	19B216316P1	Insulator. (Used with J301 and J302).
	4035306P11	Washer, fiber. (Used with Q1, Q2 on A323-A325).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Receiver Front End 19D417149G1, 2 & 3
To increase sensitivity.
Changed R2 and L5.

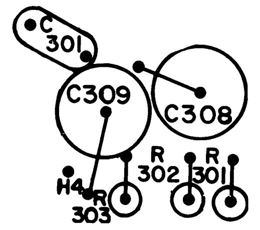
REV. A - Receiver Board 19D417490G2 & 3
To improve audio sensitivity.
Changed R301.

REV. B - To improve critical squelch.
Changed C312.

REV. C - To improve operation.
Changed A313.

REV. D - Receiver Board 19D417490G2
To make board compatible with other ranges.
Changed board layout.

Outline Diagram was:



REV. E - Receiver Board 19D417490G2

REV. D - Receiver Board 19D417490G3
To improve audio.
Deleted C314 and changed R301.

REV. F - Receiver Board 19D417490G2

REV. E - Receiver Board 19D417490G3
To improve frequency response.
Added C345.

REV. G - Receiver Board 19D417490G2

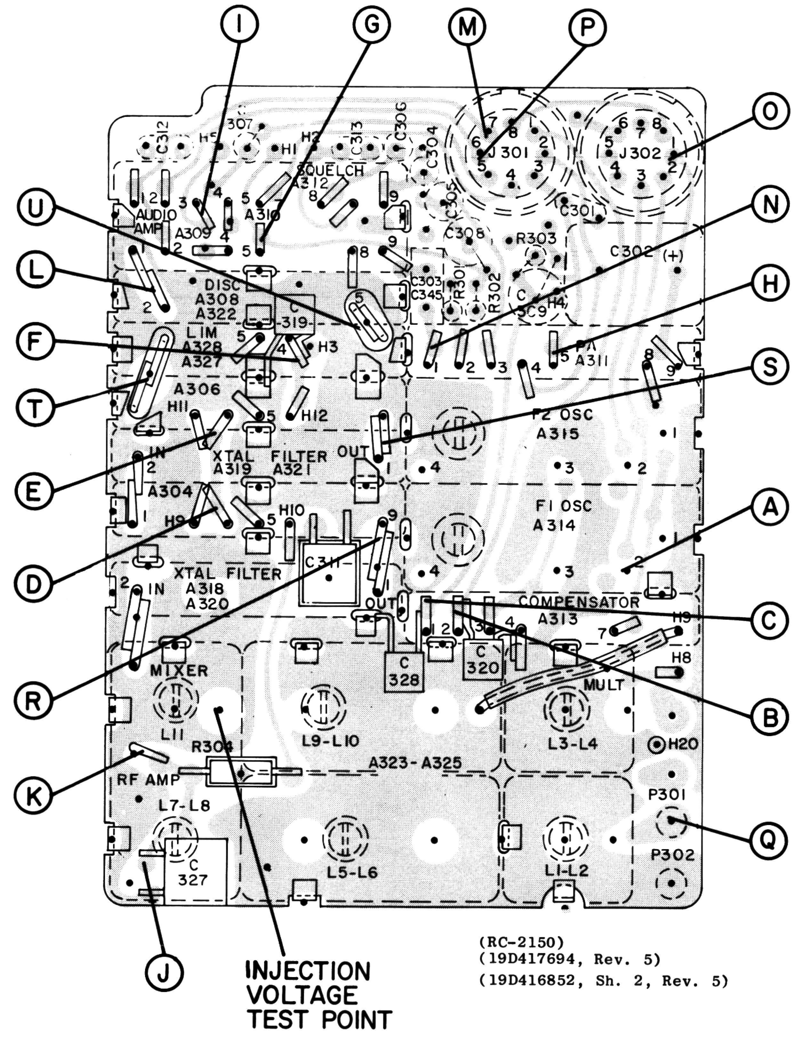
REV. F - Receiver Board 19D417490G3
To improve audio.
Changed A301.

REV. G - Receiver Board 19D417490G3
To eliminate non Channel Guard receiver boards. Deleted from schematic diagram callout ■ A309 and circle (•) in front of C345. Deleted callout ■ C303 and circle (•) for C345. Deleted NOTES:
■ Use for non channel guard receivers.
• Use for channel guard receivers.

REV. A - Receiver Kit 19A130043G3
To improve IF filtering.
Added C330.

REV. A-H - Receiver Board 19D417490G1
Present when board was incorporated.
Receiver Board 19D417490G1 replaced an identical board 19D417490G2.

SOLDER SIDE



(RC-2150)
(19D417694, Rev. 5)
(19D416852, Sh. 2, Rev. 5)

QUICK CHECKS

SYMPTOM	PROCEDURE
No Audio	1. Check audio waveform at the top of the Volume Control (see Step 2). 2. If audio is present, check voltage readings of Audio and Squelch modules (see Schematic Diagram). 3. If audio is not present, check gain and current readings of Front End and IF modules (see Steps 1 & 3).
Poor Sensitivity	1. Measure the RF injection voltage for a minimum level of 750 millivolts. If the reading is low, check the output of the Oscillator and Compensator modules with an RF voltmeter. 2. Measure the gain of the Mixer stage (see Step 3). If low, measure the gain of the RF amplifier and IF modules.
Improper Squelch Operation	1. Check the noise waveform at the input to the Squelch module and at Squelch Control high (see Step 2). 2. Measure the DC voltages for the Squelch module (squelched and unsquelched).

STEP 3 - RF GAIN CHECKS
(STEPS Q THRU U)

STEP 3 - RF GAIN CHECKS

EQUIPMENT REQUIRED:

1. RF probe and Test Amplifier Model 4EX16A10 connected to GE Test Set Model 4EX3A11, or an RF voltmeter.
2. A signal generator (M-800 or equivalent) connected to P301 (High) and P302 (Low).

PROCEDURE FOR MIXER & 1ST IF:

1. Switch the Test Set to the Test 1 position and the Test Amplifier to the X50 position.
2. Connect the RF probe across the input of the stage to be measured as shown on the diagram. Increase the signal generator output to obtain a reference reading on Test Set 4EX3A11. Note the Test Set reading and the dB reading on the generator (dB1).
3. Connect the RF probe to the output of the stage to be measured as shown on the diagram. Decrease the generator output until the Test Set reference reading in Step 2 is obtained. Note the dB reading on the generator (dB2).
4. Subtract the dB1 reading from the dB2 reading and check the results with the typical gains shown on the diagram.

$$\text{Example:}\quad \begin{array}{rl} 35\ \text{dB} & \text{(dB2)} \\ -15\ \text{dB} & \text{(dB1)} \\ \hline 20\ \text{dB} & \text{gain} \end{array}$$

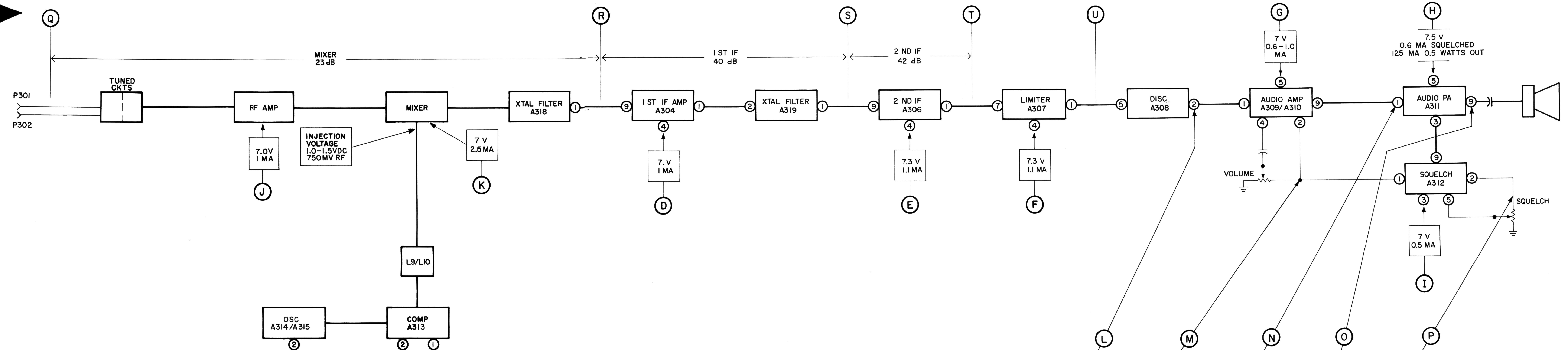
PROCEDURE FOR 2ND IF:

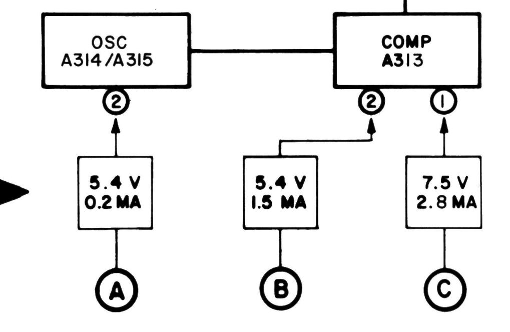
1. With no signal in, connect the RF probe to the output of the 2nd IF module. Increase the signal generator output until the Test Set reading increases by approximately 0.2 volt. Note Test Set and signal generator reading (dB2).
2. Connect the probe to the input of the 2nd IF module. Increase the signal generator until the Test Set reference reading is obtained, and note the dB reading (dB1).
3. Now subtract dB2 from dB1 to obtain the gain of the 2nd IF amplifier module.

LIMITER CHECK

The Limiter module limits on noise so that the gain of the circuit cannot be measured. The following procedure provides a check to determine if the module is limiting.

1. Switch the Test Amplifier to the X1 position and the Test Set to the Test 1 position. Then connect the RF probe to the output of the Limiter module and check for a reading of approximately 0.4 volt.
2. Increase the signal generator output. There should be no appreciable increase in the limiter output meter reading.





STEP 1 - MODULE CURRENT CHECKS
(STEPS A THRU K)

STEP 1 - MODULE CURRENT CHECKS

These current readings provide a method of checking the operation of each Integrated Circuit module using a milliammeter (Triplett 630 or equivalent).

1. Unsolder the + lead as shown in the Diagram of the module to be checked.
2. Connect the milliammeter in series with the + lead, and check for the indicated current drain and supply voltage. No current drain indicates that the module should be replaced.

CAUTION

When checking the current of Audio PA module A311, do not short Pin 4 to ground or to + (Pin 5). To do so will destroy the Audio PA module.

STEP 2 - AUDIO & SQUELCH WAVEFORMS
(STEPS L THRU P)

STEP 2 - AUDIO & SQUELCH WAVEFORMS

EQUIPMENT REQUIRED:

- Oscilloscope connected between the points shown and ground.
- Signal Generator (Measurements M-800 or equivalent).

PRELIMINARY STEPS:

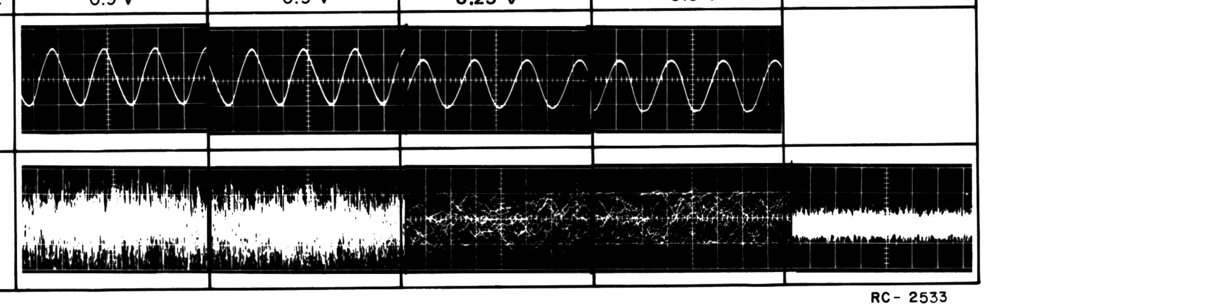
1. Apply a standard signal to P301. A standard signal is 1000 microvolts on the receiver frequency modulated by one kHz with 3.0-kHz deviation.
2. Set the Volume control for 0.5-watt output.

SCOPE SETTINGS

PEAK-TO-PEAK READINGS		L	M	N	O	P
	SIGNAL	0.35 V	0.35 V	0.25 V	5.6 V	
	NOISE	0.9 V	0.9 V	0.25 V	5.6 V	0.7 V

STANDARD SIGNAL

NOISE WAVEFORM



RC- 2533

TROUBLESHOOTING PROCEDURE

30—50 MHz RECEIVER MODELS 4ER61A11-13