GE Mobile Communications

138-150.8 MHz RECEIVER
ER-59-A FOR PE MODELS AND
Porta•Mobile II™

Maintenance Manual

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.

SPECIFICATIONS*

TYPE NUMBER	ER-59-A
AUDIO OUTPUT (EIA)	500 milliwatts at less than 5% distortion
CHANNEL SPACING	30 kHz
SENSITIVITY	
12-dB SINAD (EIA Method)	0.25 μV
20-dB Quieting Method	0.35 μV
SELECTIVITY	
EIA Two-Signal	-75 dB at ±30 kHz
20-dB Quieting Method	-110 dB at ± 30 kHz
SPURIOUS RESPONSE	-70 dB
INTERMODULATION (EIA)	-60 dB
AUDIO RESPONSE	+2 and -10 dB of a standard 6-dB per octave de-emphasis curve from 300 to 3000 Hz (1000-Hz reference)
MODULATION ACCEPTANCE	±7.0 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
138-145 MHz	0.55 MHz	1.1 MHz
145-150.8 MHz	0.58 MHz	1.16 MHz

ERICSSON

Ericsson GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

Printed in U.S.A.

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

DESCRIPTION

Receiver Models 4ER59A10 and 4ER59A12 are single conversion, superheterodyne FM receivers for operation on the 138-150.8 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.	Freq. Range	Number of Freq.	Tone Option
4ER59A10	138-150.8 MHz	2	
4ER59A12	138-150.8 MHz	2	Channel Guard

References to symbol numbers mentioned in the following test 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 Module 4EG28A15 consists 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 14.75 to 16.87 MHz, and the crystal frequency is multiplied 8 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 the system board

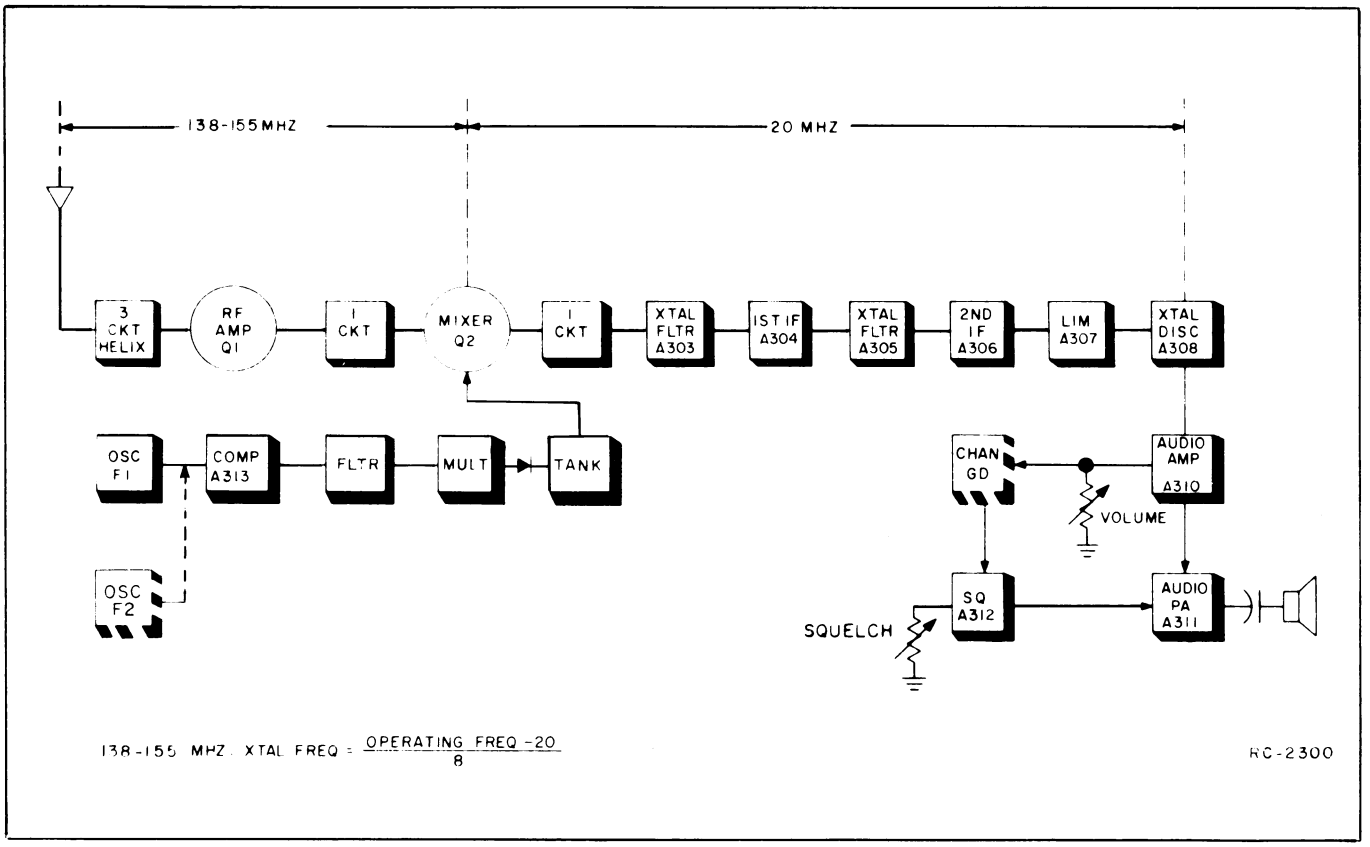


Figure 1 - Receiver Block Diagram

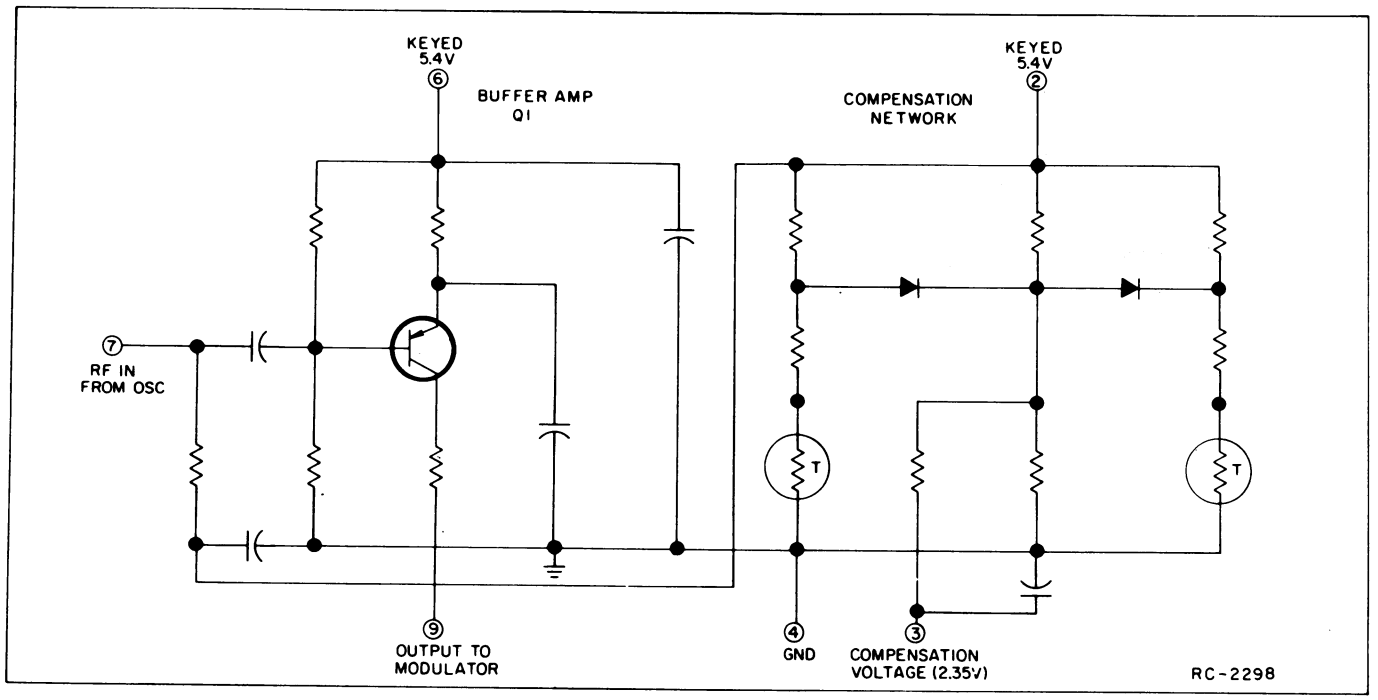


Figure 3 - Typical Compensator Circuit

FRONT END A301

The receiver Front End consists of three tuned helical resonators, an RF amplifier and Mixer stage as well as the Filter, Multiplier and Tank circuits. The RF signal from the antenna is coupled through RF cable W301 to a tap on L1. The tap is positioned to provide the proper impedance match to the antenna. RF energy is coupled to the third coil (L3) through openings in the sides of the cans. RF is then coupled from a tap on L3 through C1 to the base of RF amplifier Q1. The output of Q1 is developed across tuned circuit C2/L1 and is applied to the base of the mixer.

The output of the Compensator module is applied to L1 in Filter circuit A8. A8-L1 is tuned to four times the crystal frequency. The Filter output is applied to Multiplier A3. The multiplier coil (A3-L1) is also tuned to four times the crystal frequency and is metered at H8 (Mult Test Point). Following the multiplier is Tank circuit A9. The Tank circuit coil (A9-L1) is tuned to two times the multiplier output for a total multiplication of eight times. The output of the Tank circuit is direct-coupled to the emitter of the mixer transistor.

The RF signal from the RF amplifier is applied to the base of mixer Q2 and the low side injection voltage from the Tank circuit is applied to the emitter. The resultant 20 MHz IF frequency is coupled through the mixer collector tank (L2 & C6) to Crystal Filter A303. The collector tank also provides impedance matching to the crystal filter.

CRYSTAL FILTERS A303 & A305

Filter A303 follows the Multiplier-Mixer stage, and its output is applied to the 1st IF amplifier module. Filter A305 follows the IF Amplifier module. The two Crystal Filters provide the major selectivity for the receiver. A303 provides a minimum of 40 dB stop-band attenuation, while A305 provides a minimum of 20 dB stop-band 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 R-C coupled amplifier stages that are DC series-connected for reduced drain. The two IF modules provide a total gain of approximately 85 dB.

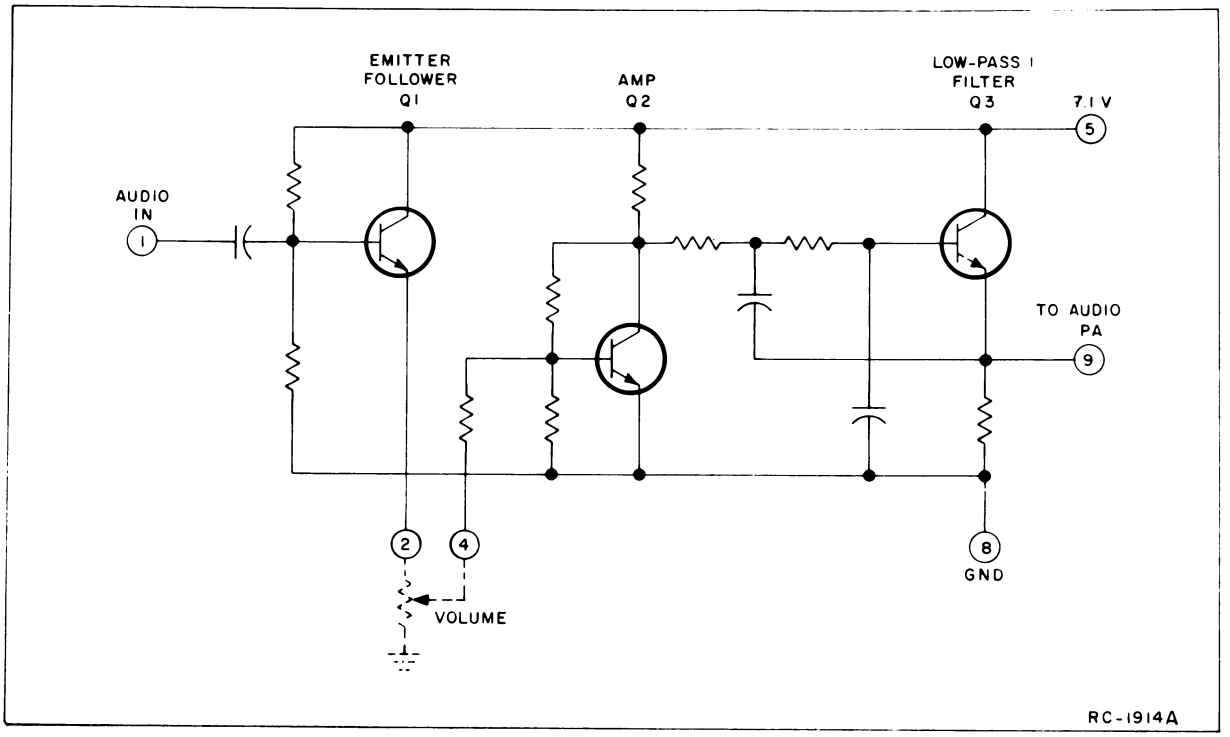


Figure 6 - Typical Audio Amplifier Circuit

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 connects from Pin 2 to the base of amplifier Q2 (Pin 4) through the VOLUME control. The output of Q1 is also applied to the input of the Squelch module.

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 A310, an active high-pass filter is added in series with the low-pass filter to provide the required 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 complimentary 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.

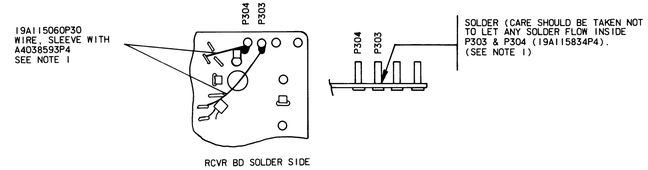
SQUELCH A312

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 or 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 +7 volts to the base of amplifier Q1 in the Audio PA module, turning the

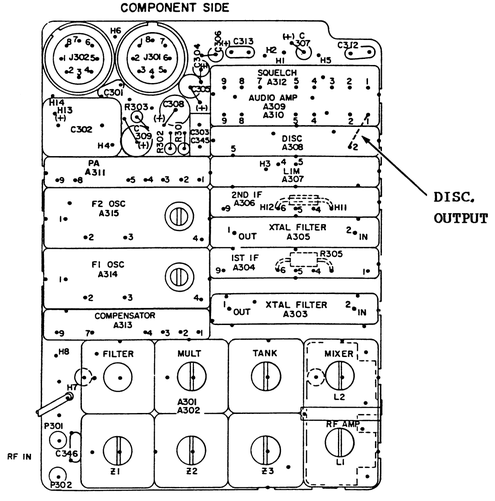


NOTE:

1. THESE ITEMS PART OF HARDWARE KIT 19A130460G2

   R9-3R151P103J, COMPOSTION, 1000 OHMS ±5%, 1/8 WATT.

RECEIVER MODIFICATION FOR PORTA ● MOBILE II APPLICATION



RC-7875

EQUIPMENT REQUIRED

1. A 20-MHz signal source (GE IF Generator Model 4EX9A10 or equivalent) and a 138-155 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. Distortion Analyzer or AC-VTVM.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. In multi-frequency receivers where the maximum frequency spacing is less than one MHz, align the receiver of the F1 channel. Where the frequency spacing is more than one MHz, align the receiver on the center frequency.
2. For frequencies in the low end of the band, set the slugs in Z1 thru Z3, RF AMP L1, and Tank L1 to the bottom of the coil form. Set Filter, Mult, and Mixer L2 slugs to the top of the coil form.

   For frequencies near the high end of the band, set the slugs in Z1 thru Z3, Filter, Mixer L2, and Tank to the top of the coil form, set RF AMP L1 and Mult to the bottom of the coil form.
3. Connect the negative lead of the DC Test Set to the Mult Test Point (H8), and the positive lead to ground. Connect the Distortion Analyzer or AC-VTVM across the speaker leads.

ALIGNMENT PROCEDURE

Step No.	Tuning Control	Procedure
1	Mult	Apply an on-frequency signal to J702 and tune Mult for best quieting sensitivity on AC-VTVM.
2	Filter	Adjust Filter for best quieting sensitivity on AC-VTVM.
3	Mult Tank	De-tune Mult. Next, increase the on-frequency input signal and tune Tank for best quieting sensitivity on AC-VTVM.
4	Filter Mult	Adjust Filter and Mult for peak reading on meter connected to H8.
5	Z1, Z2, Z3, RF AMP L1, Mixer L2.	Adjust Z1, Z2, Z3, RF AMP L1, and Mixer L2 for best quieting sensitivity on AC-VTVM.
		FREQUENCY ADJUSTMENT
6		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

138—150.8 MHz RECEIVER
MODELS 4ER59A10 & 12

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.

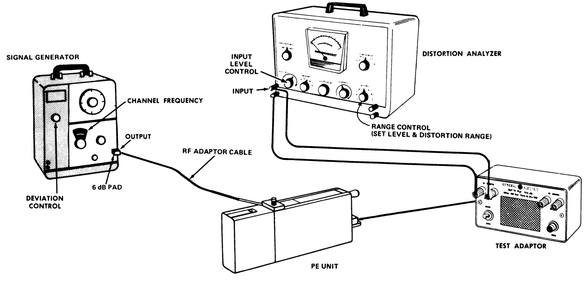
Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

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

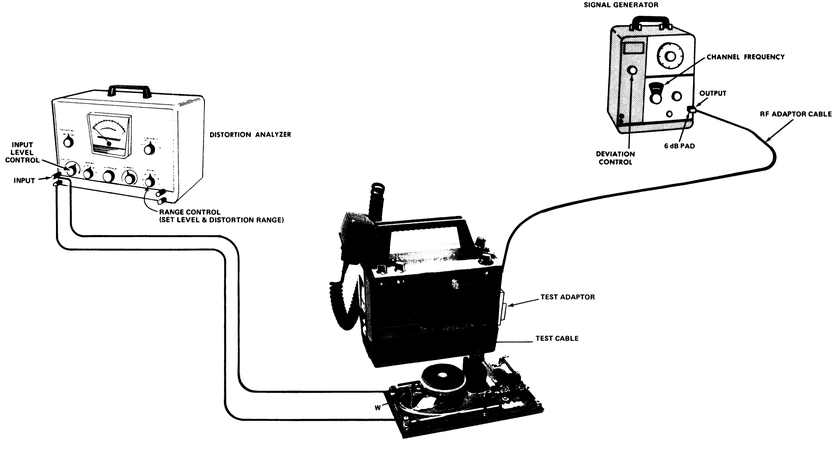
PRELIMINARY ADJUSTMENTS

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 white and blue leads on the speaker. When the resistor is used, the white lead is disconnected from the speaker terminal.



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).

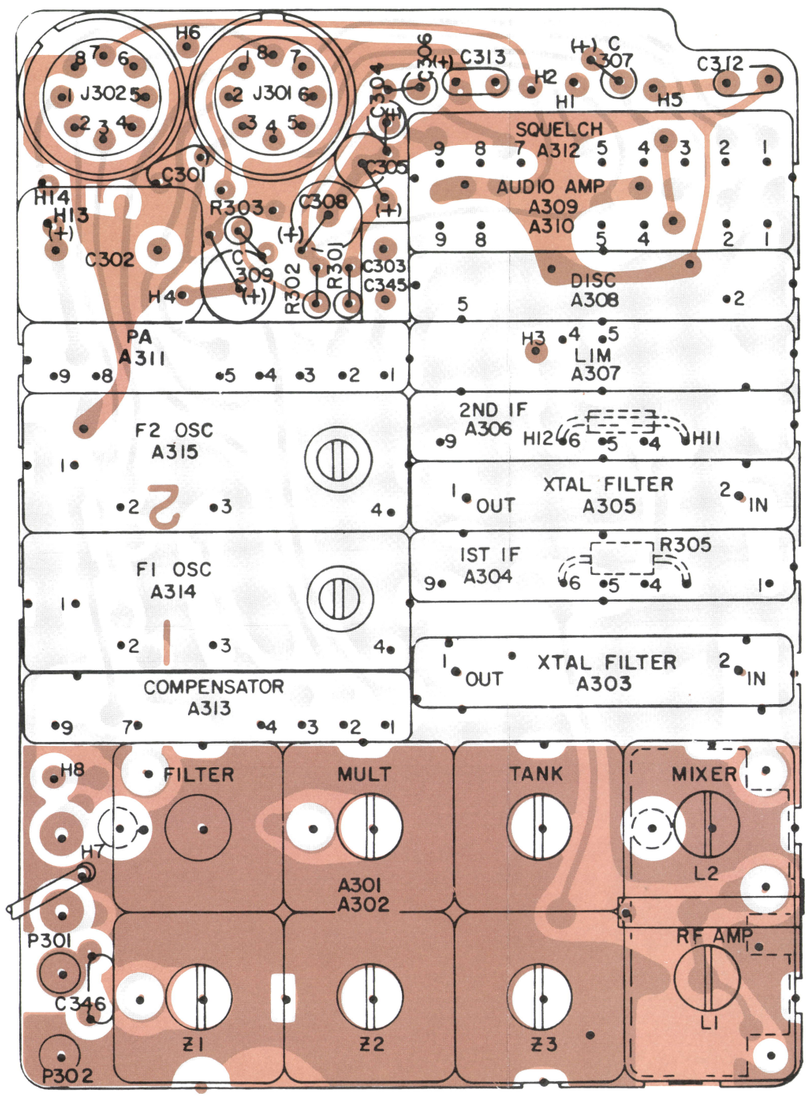
D. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±7 kHz (but less than ±9 kHz).

SERVICE CHECK

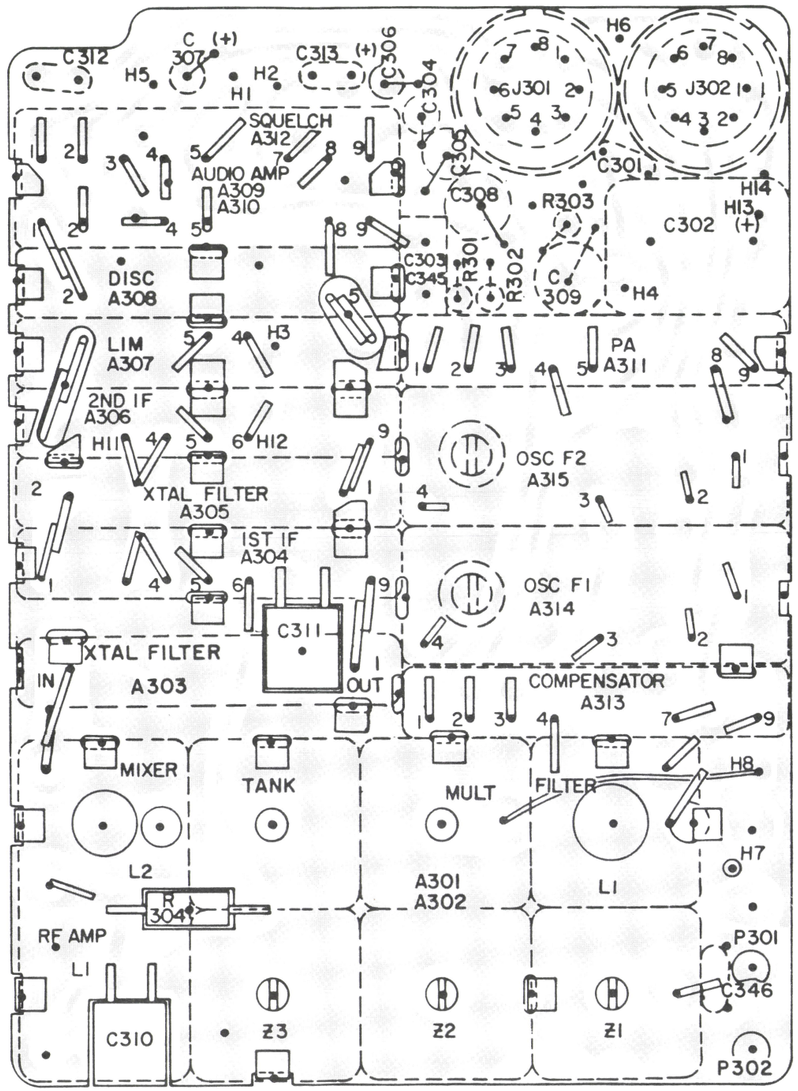
If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
J301	5.4V	AUDIO OUT	SWITCHED 7.5V	SQ ARM	VOL ARM	SQ HI	VOL HI	GND
J302		FREQ 1	FREQ 2			7.5V	TONE SWITCH	GND

COMPONENT SIDE



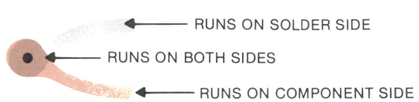
SOLDER SIDE



OUTLINE DIAGRAM

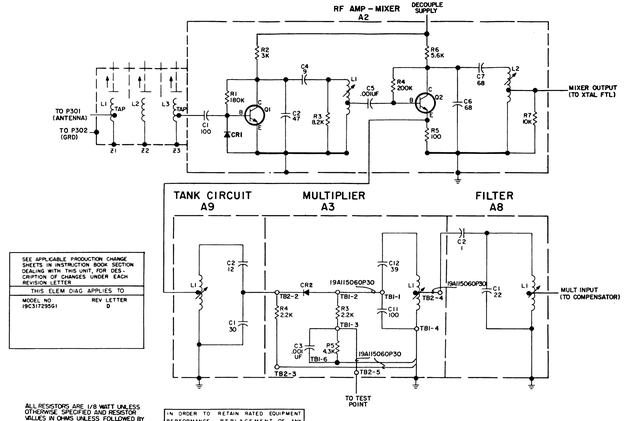
138—150.8 MHz RECEIVER
MODELS 4ER59A10 & 12

(19D416838, Sh. 1, Rev. 11)
(19D424862, Sh. 3, Rev. 5)
(19D424862, Sh. 2, Rev. 7)



(19D416838, Sh. 1, Rev. 11)
(19D424862, Sh. 2, Rev. 7)

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
19C317295G1	D

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.

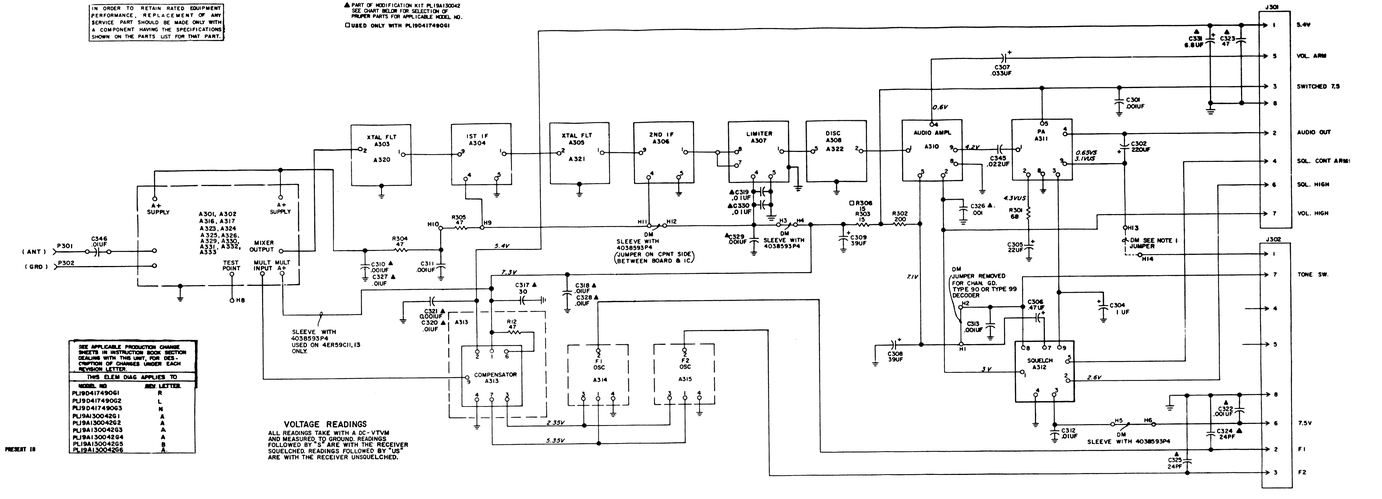
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19C320884, Sh. 1, Rev. 6)

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.

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

□ USED ONLY WITH PL19D417490G1



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	R
PL19D417490G2	L
PL19D417490G3	N
PL19A130042G1	A
PL19A130042G2	A
PL19A130042G3	A
PL19A130042G4	A
PL19A130042G5	B
PL19A130042G6	A

NOTE 1: BE ASURE OR SOLDER SIDE W13 TO W14. PRESENT IN P1 II APPLICATIONS ONLY.

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.

MODEL NO.	C310	C315	C316	C319	C318	C320	C321	C322	C323	C324	C325	C326	C327	C328	C329	C330	C331	C332
4E59A10-13 (KIT PL19A130042G1)	T											X						
4ER60A10-13 (KIT PL19A130042G2)	X			X				X	X	X	X	X	X			X		
4ER61A11-13-15-17 (KIT PL19A130042G3)					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				

(19A122035, Sh. 1, Rev. 26)

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.

SCHEMATIC DIAGRAM

138—150.8 MHz RECEIVER
MODELS 4ER59A10 & 12

PARTS LIST

138 - 150.8 MHz RECIVER FRONT END
4ER59A10, A12
19C312789G1
ISSUE 7

SYMBOL	GE PART NO.	DESCRIPTION
A2 *		**RF AMPLIFIER - MIXER 19C327300G2**
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A700230P64	Ceramic: 100 pF ±10%, 100 VDCW, temp coef +4200 PPM/°C.
C2	19A700227P53	Ceramic: 47 pF ±5%, 100 VDCW, temp coef -1500 PPM/°C.
C4	19A116114P2030	Ceramic: 9 pF ±5%, 100 VDCW; temp coef -80 PPM/°C.
C5	5495323P12	Ceramic: 0.001 uF +100% -20%, 75 VDCW.
C6 and C7	19A700223P59	Ceramic: 68 pF ±5%, 100 VDCW, temp coef -220 PPM/°C.
		- - - - - - - - - - DIODES - - - - - - - - - -
CR1	19A116052P1	Silicon, hot carrier: Fwd drop .350 volts max.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B216950G1	Coil.
L2	19B216948G1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 * and Q2	19A703654P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R151P184J	Composition: 180K ohms ±5%, 1/8 w.
R2	3R151P302J	Composition: 3K ohms ±5%, 1/8 w.
R3	3R151P822J	Composition: 8.2K ohms ±5%, 1/8 w.
R4	3R151P204J	Composition: 200K ohms ±5%, 1/8 w.
R5	3R151P101J	Composition: 100 ohms ±5%, 1/8 w.
R6	3R151P562J	Composition: 5.6K ohms ±5%, 1/8 w.
R7	3R151P103J	Composition: 10K ohms ±5%, 1/8 w.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	4034204P4	Tape, Insulating.
A3		**MULTIPLIER 19C311873G4**
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C3	5495323P12	Ceramic: 0.001 uF +100% -20%, 75 VDCW.
C11	19A700221P65	Ceramic: 100 pF ±5%, 100 VDCW, temp coef -80 PPM/°C.
C12	19A700221P50	Ceramic: 39 pF ±5%, 100 VDCW, temp coef -80 PPM/°C.
		- - - - - - - - - - DIODES - - - - - - - - - -
CR2 *	19A116809P1	Silicon; sim to HP Step Recovery 5082-0180.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B216296P1	Coil.
	19B200497P5	Tuning slug.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R3 and R4	3R151P222J	Composition: 2.2K ohms ±5%, 1/8 w.
R5	3R151P432J	Composition: 4.3K ohms ±5%, 1/8 w.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	4034204P4	Tape, Insulating.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
A8		**FILTER BOARD 19C320244G1**
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A700221P41	Ceramic: 22 pF ±5%, 100 VDCW, temp coef -80 PPM/°C.
C2	19A700219P1	Ceramic: 1 pF ±10%, 100 VDCW, temp coef 0 PPM/°C.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B216296P1	Coil.
	19B200497P5	Tuning slug.
A9		**TANK BOARD 19C320245G1**
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A700221P45	Ceramic: 30 pF ±5%, 100 VDCW, temp coef -80 PPM/°C.
C2	19A700221P30	Ceramic: 12 pF ±5%, 100 VDCW, temp coef -80 PPM/°C.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19A129340P1	Coil.
	19B200497P5	Tuning slug.
		ANTENNA FILTER
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B216441G13	Helical resonator. (Part of Z1).
L2	19B216441G14	Helical resonator. (Part of Z2).
L3	19B216441G15	Helical resonator. (Part of Z3).
	19C311727P1	Tuning slug. (Included with L1, L2 and L3).
		- - - - - - - - - - FILTER - - - - - - - - - -
Z1		Consists of L1 and 19D413132G16 Can.
Z2		Consists of L2 and 19D413132G3 Can.
Z3		Consists of L3 and 19D413132G17 Can.

PARTS LIST

138 - 150.8 MHz TWO FREQUENCY RECIVER
4ER59A10 Standard 4ER59A12 Channel Guard
19D417490G1 25 MHz IF
19D417490G3 23 MHz IF

ISSUE 7

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - ASSEMBLIES - - - - - - - - - -
A301 and A302	19C317295G1	Receiver Front End. (See Separate Parts List for Breakdown. Used in G1).
A303 *	19C304824G1	Crystal filter. (Used in G1).
A304	19D438001G3	IF Amplifier.
A305	19C304824G1	Crystal filter. (Used in G1).
A306	19D438001G4	IF Amplifier.
A307	19C311876G4	Limiter.
A308	19C304504G3	Discriminator. (Used in G1).
A310 *	19C330341G1	Audio Amplifier. (Includes Tone Filter).
A311 *	19C330710G1	Power Audio Amplifier.
A312 *	19C330342G1	Squelch Module.
A313 *	19C320061G1	Compensator.
A314 and A315	4E6Z8A15	Oscillator Module for PE Series. 138-155 MHz.
A314 and A315	4E6Z8A13	Oscillator Module for PORTA MOBILE II. 138-150.8 MHz.
		NOTE: When ordering Oscillator Modules, give GE Part Number and specify exact frequency needed. Fx = Fo - 20 (or 23) / 8
A320 and A321	19C304824G3	Band Pass Filter. (Used in G3).
A322	19C304504G6	Discriminator. (Used in G3).
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C301	5495323P12	Ceramic: 0.001 uF +100% -20%, 75 VDCW.
C302	19A116178P7	Tantalum: 220 uF ±20%, 6 VDCW.
C304	5491674P28	Tantalum: 1 uF ±20%, 25 VDCW; sim to Sprague Type 162D.
C305	5491674P35	Tantalum: 22 uF ±20%, 4 VDCW; sim to Sprague Type 162D.
C306	5491674P27	Tantalum: 0.47 uF ±20%, 35 VDCW; sim to Sprague Type 162D.
C307	5491674P31	Tantalum: 0.033 uF ±20%, 35 VDCW; sim to Sprague Type 162D.
C308 and C309	5491674P30	Tantalum: 39 uF ±20%, 10 VDCW; sim to Sprague Type 162D.
C310	5495323P12	Ceramic: 0.001 uF +100% -20%, 75 VDCW. (Used in G1).
C311	5495323P12	Ceramic: 0.001 uF +100% -20%, 75 VDCW.
C312 *	19A116192P1	Ceramic: 0.01 uF ±20%, 50 VDCW; sim to Erie 8121 Special.
C313	5495323P12	Ceramic: 0.001 uF +100% -20%, 75 VDCW.
C326 *	5495323P12	Ceramic: 0.001 uF +100% -20%, 75 VDCW. (Used in G1).
C345 *	19A116192P6	Ceramic: 0.022 uF ±20%, 50 VDCW; sim to Erie 8131-M050-W58-223M.
C346 *	19A116192P1	Ceramic: 0.01 uF ±20%, 50 VDCW; sim to Erie 8121 Special.
		- - - - - - - - - - JACKS - - - - - - - - - -
J301 and J302	19C331182P1	Terminal, feed-thru: sim to Warren 1-B-2994-4.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - PLUGS - - - - - - - - - -
P301 and P302	19A115834P4	Contact, electrical: sim to AMP 2-332070-9.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R301 *	3R151P680J	Composition: 68 ohms ±5%, 1/8 w.
R302	3R151P201J	Composition: 200 ohms ±5%, 1/8 w.
R303 *	3R151P150J	Composition: 15 ohms ±5%, 1/8 w. (Used in G3).
R304	19A134231P470J	Deposited carbon: 47 ohms ±5%, 1/8 w.
R305	3R151P470J	Composition: 47 ohms ±5%, 1/8 w.
R306 *	19A134564P1	Metal film: 15 ohms ±5%, 1/4 w. (Used in G1).
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A116279P1	Nylon Cord. (Wear Antenna).
	MP280006P1	Nameplate.
	19A701278P3	Insulator.
	19A121375P13	Insulator, plate. (Under R304).
	19A129811P1	Insulator. (Used with A310).

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.

4ER59A10 & 12

REV. A thru C - Incorporated into initial shipment.

REV. A - Receiver Board 19D417490G1
To improve audio sensitivity. Changed R301.

REV. A - Receiver Front End 19C317295G1
To improve spurious response. Deleted R2 and R6. Added R9, R10 and shield.

REV. B - To improve operation. Added CR1.

REV. C - To improve ease of assembly, troubleshooting and repair. Changed RF Amplifier/Mixer, A2.

REV. D - Receiver Board 19D417490G1
To improve producibility. Changed A303.

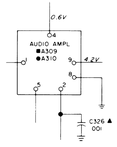
REV. E - To improve audio sensitivity and stability. Deleted C314 and changed R301.

REV. F - To improve frequency response. Added C345.

REV. G - To improve audio quality. Changed A313.

REV. H - To eliminate Non-Channel Guard receiver boards. Deleted callout of ■5309 and circle (●) in the circle (▲) for C345. Deleted callout of ■5303 and the circle (▲) for C345. Delete ■ symbol. ■Use for Non-Channel Guard receivers and ● use for Channel Guard receivers.

Schematic Diagram Was:



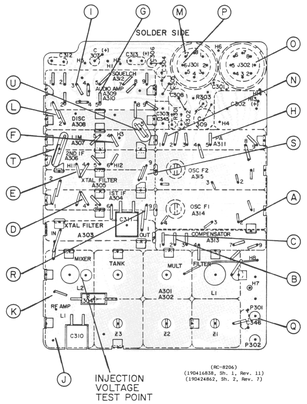
REV. A - Capacitor Kit 19A120047G1
To improve IF filtering. Added C326.

REV. J - Receiver Board 19D417490G1
Void - was not incorporated.

REV. K - To provide DC isolation of relay receiver contacts from antenna circuit. Added C346.

REV. D - Receiver Front End 19C317295G1
To replace a single source with a multi-source●.
Deleted CR1.
Added CR2 and R8.

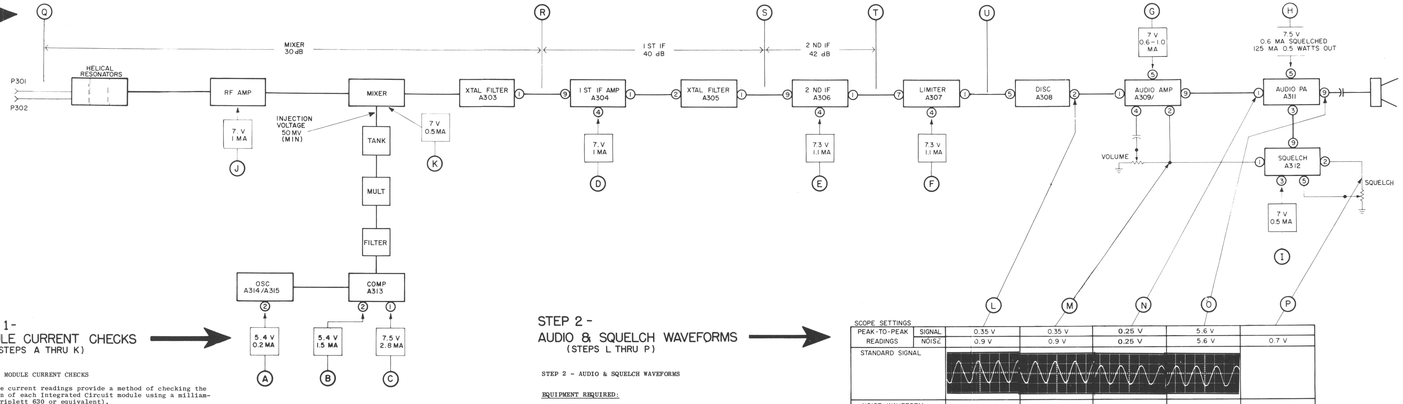
REV. E - Receiver Front End 19C317295G1
To replace obsolete transistors, changed Q1 and Q2 in the RF Amplifier - Mixer A2 from 19A116195P1 to 19A703654P2.



QUICK CHECKS

SYMPTON	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 injection voltage for a minimum level of 30 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 4EX3A10, 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 4EX3A10. 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.

Example: 35 dB (dB2)
−15 dB (dB1)
20 dB gain

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 tha 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 3.5-kHz deviation.
2. Set the Volume control for 0.5-watt output.

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

RC-2301

TROUBLESHOOTING PROCEDURE

138—150.8 MHz RECEIVER
MODELS 4ER59A10 & 12