MOBILE RADIO

MAINTENANCE MANUAL

MONITOR RECEIVERS TYPE ER-53-A

SPECIFICATIONS *

Frequency Range	406—420 & 450—470 MHz
Channel Spacing	25 kHz
Sensitivity	
12-dB SINAD	0.50 μV
20-dB Quieting	0.7 μV
Noise Squelch	0.3 μV
Selectivity (EIA Two-Signal Method)	-65 dB (adjacent channel, 25 kHz channels)
Spurious Response	-50 dB
Intermodulation (EIA)	-53 dB
First Oscillator Stability	±.0005% (-30°C to +70°C)
Modulation Acceptance	±9.5 kHz
Frequency Response	Within +2 dB and -8 dB of a 6 dB/octave de-emphasis curve from 300 to 3000 Hz (1000 Hz reference) per EIA standards.
Audio Output	1.5 watts at less than 10% distortion
Power Input	20 watts at 117 VAC ±10%, 50/60 Hz
Maximum Frequency Separation	0.4%

*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.

EQUIPMENT INDEX

EQUIPMENT	MODEL OR TYPE NUMBER
406—420 & 450—470 MHz Receivers	ER-53-A
Front Panel	19D402678-G1
Chassis	19C311011-G1
Top Cover	19A122162-G2
Standby Battery Supply	19B205435-G2
Channel Guard Decoder	4EK15A10

OPTIONAL EQUIPMENT

EQUIPMENT	PL OR MODEL NUMBER
Type 99 Tone Decoder Boards A1403 & A1404 (One thru four boards, Options 4203 thru 4206)	19D413100-G1
Type 90 Tone Decoder Board A1701 (One thru four boards, Options 4207 thru 4210)	19C303730-G1
Audible Alarm, Option 4211 Buzzer and Second Relay	19A122312-G1
Carrier Operated Relay, Option 7610	19C303533-G2
Indoor Antenna Option 4213 (Includes Connector M2R22-P2)	4EY19C10

COMBINATION NOMENCLATURE

1st Digit	2nd Digit	3rd Digit	4th Digit	5th Digit	6th Digit	7th Digit	8th & 9th Digits
N Monitor Rcvr	**S** Standard	**0** Standard	**5** 25 kHz Channels	**M** 117-VAC	**A** 1-Freq.	**S** Standard	**77** 406-420 MHz
	D Type 99 Decoder	**2** Two reeds Type 99		**N** 117-VAC and Stby Battery	**D** 2-Freq.	**U** Channel Guard (71.9-203.5 Hz)	**88** 450-470 MHz
	T Type 90 Decoder	**4** Four reeds Type 99					

Figure 1 - Combination Nomenclature Chart

DESCRIPTION

General Electric Monitor Receivers Type ER-53-A are attractively styled, high performance FM receivers designed for operation in the 406—420 and 450—470 megahertz range. The receivers are fully transistorized -- utilizing silicon transistors for added reliability. The compact design of the units permits them to be easily mounted on a desk, shelf or table with room left over for books, papers, etc.

Optional decoder boards are available for use with the receiver so that the unit will operate in a two-way radio system employing Channel Guard, Type 90 and Type 99 Encoders.

The receiver normally operates from a 117-volt AC, 50/60-Hz source. An optional chassis-mounted standby battery supply is available to power the receiver for up to seven hours in the event of power failure. The receiver may also be operated from an external 12-volt battery if desired.

Combination numbers for the receiver are shown in the Combination Nomenclature Chart (Figure 1.)

OPERATION

RECEIVER

Operating controls for the Monitor Receiver include the VOLUME and SQUELCH controls located on the front panel, and an OFF-ON switch located at the rear of the unit.

Turn the receiver on by sliding the OFF-ON switch to the ON position. The green power-on light will glow when the power is on. Then turn the SQUELCH control all the way to the right. If the receiver is equipped with Channel Guard, Type 90 or Type 99 Tone Decoders, disable the decoder circuitry by placing the RESET-MONITOR switch in the MONITOR position. Always return the MONITOR switch to the center position after making all adjustments.

Adjust the VOLUME control until the hissing sound is easily heard but not annoyingly loud. Next, turn the SQUELCH control slowly to the left until the hissing sound just fades out.

In two-frequency receivers, select the proper frequency (F1 or F2). The receiver is now ready to monitor two-way radios in the system.

CHANNEL GUARD

The operating control for the Channel Guard Decoder consists of a RESET-MONITOR switch located on the front panel. The decoder keeps all signals on the channel locked out of the Monitor Receiver except those that are continuously tone coded for positive identification by the decoder.

When a signal that is modulated by the proper tone code is received, the receiver audio circuits operate. Placing the RESET-MONITOR switch in the MONITOR position disables the Channel Guard Decoder, and permits all calls on the channel to be heard.

TYPE 90 & TYPE 99 TONE DECODERS

Operating controls for the Type 90 and Type 99 Tone Decoders include a RESET-MONITOR switch and an amber Call light located on the front panel.

When a properly tone-coded signal is received, the Call lamp lights and the message is heard in the speaker. After the message is completed, momentarily placing the RESET-MONITOR switch in the RESET position re-activates the decoder circuitry.

Placing the switch in the MONITOR position disables the decoder circuitry and permits all calls on the channel to be heard. Always return the RESET-MONITOR switch to the center position after monitoring the channel so that the receiver will operate normally.

CIRCUIT ANALYSIS

RECEIVER

The Monitor Receivers (Type ER-53-A) are double conversion, superheterodyne receivers designed to operate on fixed frequencies within the 406—470 megahertz band.

The frequency ranges and number of frequencies for the receivers are shown in the chart on the following page.

The audio PA stage is mounted on the main chassis, and the loud-speaker is mounted on the front panel. The unit is completely transistorized -- utilizing 18 silicon transistors. An additional transistor is added for two-frequency operation.

A centralized metering jack (J312) is provided for use with General Electric Test

Receiver Model No.	Receiver Board	Freq. Range	No. of Freq.
4ER53A10	19D413084-G3	406—420 MHz	One-Freq.
4ER53A11	19D413084-G1	450—470 MHz	One-Freq.
4ER53A12	19D413084-G4	406—420 MHz	Two-Freq.
4ER53A13	19D413084-G2	450—470 MHz	Two-Freq.

Set TM11 or TM12 (Model 4EX3A10) for aligning and servicing the receiver. The Test Set meters the limiter stages, oscillator, supply voltages, voice coil, PA and discriminator stages.

10-VOLT REGULATOR

The receiver operates on a regulated 10 volts provided by Q319 and Q320 in a series regulator circuit, except for the oscillator temperature compensating network which operates from a regulated 8-volts.

When the input voltage at J302 rises, the output voltage at the emitter of Q319 tries to rise. This increases the base-emitter bias on Q320, causing it to draw more collector current. This reduces the base bias on Q319 and less base current flows through Q319. With less base current flowing, the voltage drop across Q319 is larger which tends to keep the output voltage constant.

When the input voltage drops, Q320 conducts less, increasing the forward bias on Q319. The increased forward bias decreases the voltage drop across Q319, and tends to keep the output voltage constant. Regulation will stop if the input value drops below 11 volts.

R392 (10-volt REGULATOR adjustment) is set for a 10-volt reading at centralized metering jack J312 when aligning the receiver.

OSCILLATOR/MULTIPLIER

Q303 is a third mode oscillator that operates in the 43 to 45 megahertz region (406—420 MHz) and 47 to 51 megahertz region (450—470 MHz). The crystal is connected in the oscillator feedback path to permit oscillation only at the crystal frequency. L304, C311, C312 and C313 make up the mode selective resonant circuit. Adjustable coil L304 permits the oscillator frequency to be shifted slightly for setting the receiver on the system operating frequency. The collector tank of Q303 is tuned to three times the crystal frequency.

For two-frequency operation, a second oscillator/multiplier stage is added. Channels are selected by grounding the emitter of the desired oscillator by means of a two frequency switch on the control unit.

BUFFER AMPLIFIER AND MULTIPLIER

The oscillator output is coupled through L306 to the base of Buffer Amplifier Q305. The output of Q305 is coupled through tuned circuit L308 to the anode of multiplier diode CR302. The cathode of CR302 is connected to helical resonator L309/L327 which is tuned to 9 times the oscillator frequency.

1ST MIXER

RF signals from the antenna are fed to the base of 1st Mixer Q301 through two tuned pre-selector circuits. The oscillator injection frequency (operating frequency minus 19 MHz) is also applied to the base of the 1st Mixer. The 19 megahertz Hi IF Mixer output is fed through a tuned circuit to the base of Hi IF Amplifier Q302. Output from Q302 is fed through a Hi IF filter (consisting of three tuned circuits) to the base of 2nd Mixer Q308.

2ND OSCILLATOR AND MIXER

Q307 operates as a Pierce oscillator with a crystal frequency of 18.545 (or 19.455) megahertz.

Hi IF from the 1st mixer is applied to the base of 2nd mixer Q30. This Hi IF is mixed with the 2nd oscillator low side (or high side) injection frequency which produces the 455-kilohertz Lo IF. The main receiver selectivity is provided by the eight-coil Lo IF filter following the 2nd mixer.

LO IF AMPLIFIERS

Two RC-coupled Lo IF amplifiers (Q309 and Q310) are used to amplify the signal going to the limiter stages. The amplifier output is coupled to the 1st limiter through a 455-kHz tuned circuit (L324 and C389) which reduces the noise bandwidth of the IF amplifier.

LIMITERS

Following the Lo IF amplifiers are three RC-coupled limiter stages, Q311, Q312 and Q313, which operate as over-driven amplifiers. Zener diode CR305 provides additional limiting. The 1st and 2nd limiter stages are metered at the centralized metering jack (J312) through metering diodes CR303 and CR304.

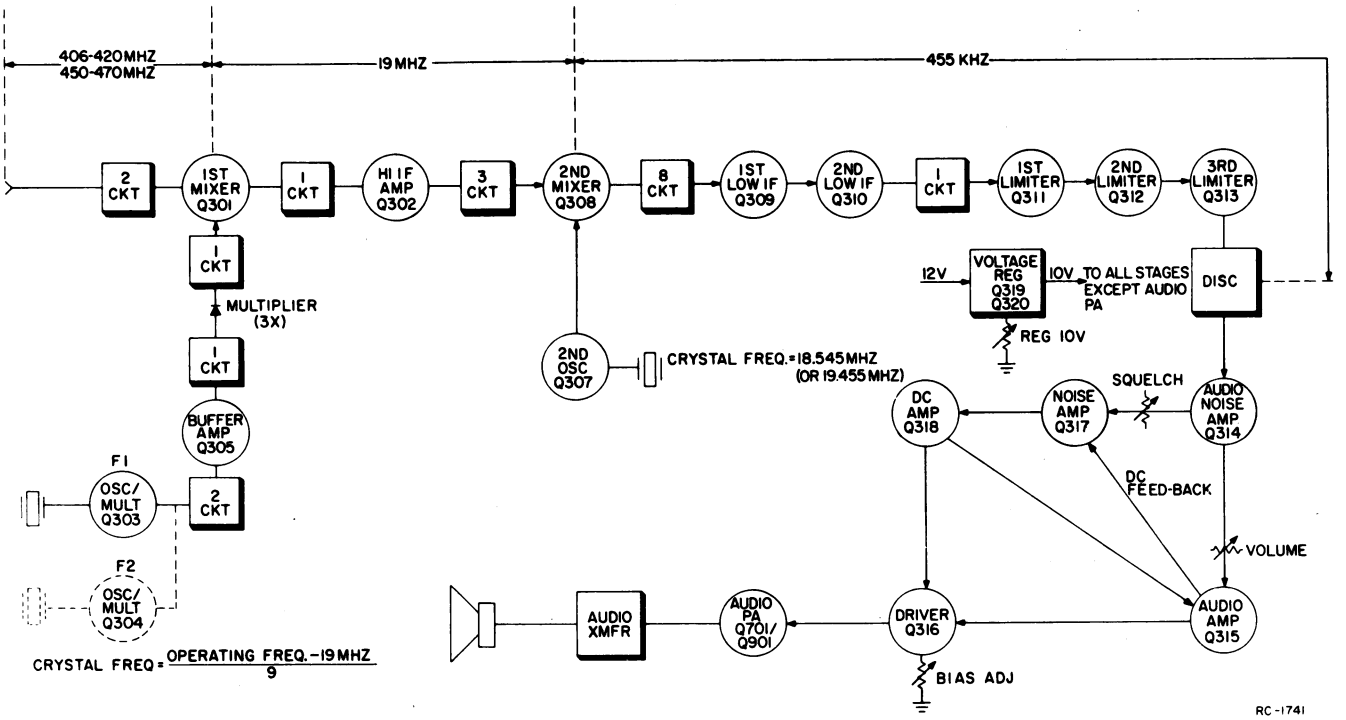


Figure 2 - Receiver Block Diagram

DISCRIMINATOR

The limiter output is applied to the Foster-Seely type discriminator, where the audio voltages are recovered from the 455-kHz Lo IF. A Lo IF filter, made up of C410, C411, C412, R369 and R372, removes any 455-kHz signal remaining in the discriminator output.

AUDIO AMPLIFIERS

When audio is present in the incoming signal, it is fed to the base of audio-noise amplifier Q314. Following Q314 is an audio de-emphasis network consisting of C417, C418, C419, R375, R376 and R377.

After the de-emphasis network, audio is fed to the base of audio amplifier Q315 through the volume control mounted on the front panel. The VOLUME control sets the amount of drive to the audio stages. An audio driver (Q316) and an audio output stage follow audio amplifier Q315. Audio Bias trimmer R396 sets the bias on Q316 and Q701, and is adjusted for a 250-millivolt reading at metering jack J312. The output of Q701 drives the loudspeaker.

SQUELCH

Noise from audio-noise amplifier Q314 is used to operate the squelch circuit. When no carrier is present in the receiver, this noise is coupled through a noise filter (which attenuates 300-3000 Hz audio frequencies) to the base of noise amplifier Q317. The noise filter consists of C414, C415, C416 and L323. The noise level fed to the noise amplifier is set by the SQUELCH control, located on the control unit. The output of noise amplifier Q317 is rectified by diodes CR308 and CR309, and filtered by C423 and C424 to produce a positive DC voltage. This DC voltage turns on the DC amplifier (A318), causing it to conduct. When conducting, the collector voltage of the DC amplifier drops to ground potential, which removes the bias on the audio stages and turns them off.

When audio amplifier Q315 is being turned off, its emitter potential decreases. This results in a positive DC feedback through R382 to the emitter of noise amplifier Q317 which causes an increase in the gain. As the gain of Q317 increases, the positive DC voltage to the DC amplifier increases, turning the audio stages off quickly.

When the receiver is quieted by a signal, less noise is present in the circuit and DC amplifier Q318 stays off. The audio stages are allowed to conduct and audio is heard from the speaker. With audio amplifier Q315 conducting, positive voltage appears across R382 which helps reduce the gain of noise amplifier Q317. The positive feedback causes a quick, positive switching action in the squelch circuit.

POWER SUPPLY

The Monitor Receiver has a self-contained power supply designed to operate from a 117-volt AC, 50/60 Hz source. The power supply consists of a full-wave rectifier (CR701 and CR702) for rectifying the AC voltage developed across the secondary of step-down transformer T701. The primary of T701 is protected by a 1/4-amp slow-blow fuse (F701).

The output of the rectifiers is filtered by C701, L701 and C702 to provide +12 volts DC for operating the receiver, audio PA stage and the tone options.

The power-on indicator light is operated by an unfiltered +12 volts.

OPTIONS

CHANNEL GUARD DECODER

The Channel Guard decoder is designed to eliminate all calls that are not tone coded for the Channel Guard frequency. Normally, all signals are locked out except those from transmitters that are continuously tone-coded for positive identification by the receiver. Placing the Monitor switch S704 in the MONITOR position, instantly disables the Channel Guard circuit and the receiver operates on noise squelch only.

TYPE 90 AND TYPE 99 DECODERS

A maximum of four tone decoder boards with single relays or two decoder boards with two relays can be used with the Monitor Receiver.

The basic decoder board is supplied with one output relay. When a signal modulated by a pulse tone (Type 90) or sequential tone (Type 99) is received from the receiver discriminator, the relay locks up and the Call light turns on, the the message is heard in the speaker. Placing the RESET-MONITOR switch (S703) in the RESET position unlocks the relay and cuts off the Call light. If desired, one set of relay contacts can be used to activate an external alarm. An optional second relay and buzzer is available for use with the tone decoders. A description of the option is contained in the following section.

AUDIBLE ALARM

An Audible Alarm, consisting of a buzzer and second relay, can be used with the Type 90 and Type 99 Decoders. The relay plugs into the socket provided on the decoder board, and the buzzer mounts on the under side of the chassis as shown on the chassis Outline Diagram.

When the Audible Alarm option is used, the output relay can be connected for timed operation (3 to 5 seconds). The second relay operates locked to the RESET switch. The buzzer operates from the timed relay.

STANDBY BATTERY SUPPLY

The Standby Battery Supply is available for providing up to seven hours of operation in the event of power failure. The Battery Supply mounts on the chassis of the Monitor Receiver, and consists of a voltage-regulated taper charging circuit, a change-over relay and two rechargeable nickel-cadmium batteries. A maximum of two Type 90 or Type 99 Tone Decoders can be mounted on the Monitor Receiver chassis when the Standby Battery Supply is used.

Turning OFF-ON switch S701 to the ON position applies 117 VAC to the primary of stepdown transformer T1, and +12 Volts to energize relay K. The AC voltage developed across the secondary of T1 is rectified by the full-wave rectifier CR1 and CR2 and filtered by R1, R2 and C1. R1 and R2 also serve as charging current limiting resistors when the two batteries, BT1 and BT2, are in a discharged condition.

Dropping resistor R4, provides the negative bias to turn on Q1. Zener diode VR1 provides a voltage reference for the regulator.

When the input voltage at H7 rises, the output voltage at the emitter of Q1 also tends to rise. This causes a change in the base-emitter bias on Q2 making it conduct more heavily. When Q2 conducts, there is less base bias on Q1, and less base current. With less base current, the voltage drop across Q1 is larger, and the output voltage remains constant.

When the input voltage starts to drop, the output voltage also tends to drop, causing Q2 to conduct less. This increases the forward bias of Q1 and reduces the voltage drop across the transistor so that the output voltage remains constant. R5, R6 and R7 form an adjustable voltage divider so that potentiometer R6 can be adjusted for a 16.65-Volt output. R3 provides bias current for VR1. The output is metered between H5 (+) and H4 (-) with the batteries disconnected.

If the batteries BT1 and BT2 are in a discharged condition, the charging current will be at a maximum since the regulator is supplying a constant voltage. The charging current will decrease as the batteries become fully charged until finally the batteries are receiving only a trickle charge.

In the event of a power failure, the relay is de-energized and the battery output is applied through K1-11 to operate the receiver. Diode CR2 prevents the pilot light (DS701) from lighting. Resistor R2 is switched in series with the emitter resistor of the audio PA stage (Q701), which reduces the audio output to approximately 150 milliwatts. When fully charged, the batteries will operate the receiver for approximately seven hours on a 10% receive, 90% squelched duty cycle.

CARRIER OPERATED RELAY

The Carrier Operated Relay assembly provides four form C contacts for controlling external circuits whenever a carrier is applied to the receiver.

When a carrier unsquelches the receiver, a positive voltage (approximately 2 volts) from the base of the receiver audio amplifier transistor turns on Q1 in the carrier operated relay circuit. Current flow in the collector circuit of Q1 forward biases Q2, causing it to conduct and energize relay K1. Voltage "spikes" produced across K1 (when K1 de-energizes) are absorbed by diode CR1 to prevent damage to transistors Q1 & Q2.

ADJUSTMENT

After the Monitor Receiver has been installed, the receiver should be set on the system operating frequency, and the antenna transformer matched to the antenna. Refer to the Front End Alignment on the RECEIVER ALIGNMENT PROCEDURE as listed in the Table of Contents.

No adjustments are required on the Channel Guard, Type 90 or Type 99 Decoders.

MAINTENANCE

TEST AND TROUBLESHOOTING PROCEDURES

Whenever difficult servicing problems occur, the test procedure for the receiver can be used by the serviceman to compare actual performance of the unit against the specifications met by the unit when shipped from the factory. The Test Procedure is described on the back of the Receiver Alignment Procedure.

In addition, a Receiver Troubleshooting Procedure is available. (Refer to the Table of Contents). For best results, the test procedure should be used in conjunction with the troubleshooting procedure.

Refer to the applicable Maintenance Manual for servicing the Channel Guard, Type 90 or Type 99 Decoders.

DISASSEMBLY

To gain access to the Monitor Receiver for servicing, loosen the two captive knurled screws in the back of the unit and lift off the top cover.

NOTE

If it should become necessary to replace the audio PA transistor (Q701), make sure that there is a thin layer of silicon grease on each side of the insulator before remounting the transistor.

FRONT END ALIGNMENT

These instructions are for tuning the oscillator and RF stages of the receiver and may be used when changing the receiver crystal or frequency. When necessary to realign the entire receiver, refer to the COMPLETE RECEIVER ALIGNMENT.

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A10, 4EX8K10,11 (or 20,000 ohms-per-volt Multimeter).

2. A 406-470 MHz Signal Source. Keep signal level below saturation.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug in the Test Set to the receiver centralized metering jack J312. Set Meter Polarity Switch on + and Meter Sensitivity Switch to 1. If using Multimeter, connect the negative lead to J312-13 (Ground).

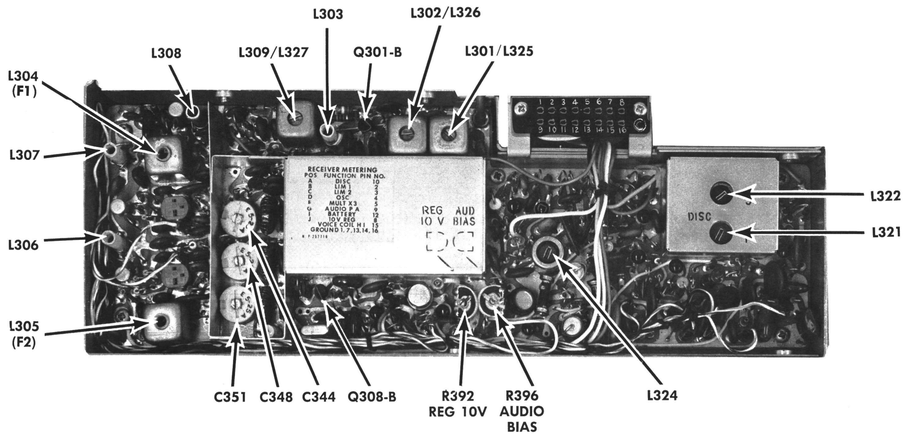
2. Switch Test Set to Position "I" (or measure at J302 with Multimeter). Reading should be at least 12 volts.

3. Switch to Position "J" (or measure across R392 with Multimeter) and adjust Voltage Regulation Potentiometer R392 for a reading of 10 volts.

4. Turn SQUELCH control fully clockwise and VOLUME control to minimum. Switch to Position "G" (or measure at J312-9 with Multimeter) and adjust PA Bias Potentiometer R396 for a reading of 0.25 volt.

ALIGNMENT PROCEDURE

STEP	METERING POSITION: GE TEST SET	METERING POSITION: Multimeter + at J312	TUNING CONTROL	METER READING	PROCEDURE
1.	D OSC	pin 4	L304 (& L305 for two-frequency), L306 and L307	See Procedure	Tune L304 (L305 for two-frequency) and L306 for maximum meter reading. Then tune L307 for minimum reading.
2.	C LIM-2	pin 3	L301/L325, L302/L326 and L309/L327	Maximum	Apply an on-frequency signal to P303 and tune L301/L325, L302/L326 & L309/L327 for maximum meter reading.
3.			L301/L325, L302/L326, L309/L327	See Procedure	While receiving a weak on-frequency signal at the Antenna, tune L301/L325, L302/L326 & L309/L327 for maximum quieting.
4.	A DISC	pin 10	L304 & L305 (two-frequency only)	Zero	Apply an on-frequency signal to P303 and tune L304 (and L305 for two-frequency) for zero discriminator reading. ——NOTE—— For proper frequency control of the receiver it is recommended that all frequency adjustments be made when the equipment is at a temperature of approximately 75°F. In no case should frequency adjustments be made when the equipment is outside the temperature range of 50° to 90°F.



COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A10, & 4EX8K10,11 (or 20,000 ohms-per-volt Multimeter).

2. A 455-kHz, 19.0 MHz and 406-470 MHz Signal Source. Couple the 455-kHz signal through a small capacitor (approximately 10 pF). Couple the 19 MHz signal through a .001 µF capacitor for Hi IF, and through a 100 pF capacitor for Low IF adjustment. Keep signal levels below saturation.

PRELIMINARY CHECKS AND ADJUSTMENTS

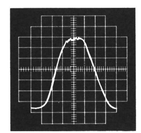
1. Plug in the Test Set to the receiver centralized metering jack J312. Set Meter Polarity Switch on + and Meter Sensitivity Switch to TEST 1. If using Multimeter, connect the negative lead to J312-13 (Ground).

2. Switch Test Set to Position "I" (or measure at J302 with Multimeter). Reading should be at least 12 volts.

3. Switch to Position "J" (or measure across R372 with Multimeter) and adjust Voltage Regulation Potentiometer R392 for a reading of 10 volts.

4. Turn SQUELCH control fully clockwise and VOLUME control to minimum. Switch to Position "G" (or measure at J312-9 with Multimeter) and adjust PA Bias Potentiometer R396 for a reading of 0.25 volt.

ALIGNMENT PROCEDURE

STEP	METERING POSITION: GE TEST SET	METERING POSITION: Multimeter + at J312	TUNING CONTROL	METER READING	PROCEDURE
			DISCRIMINATOR		
1.	C LIM-2	Pin 3		0.3 V (1.1 V with Multimeter	Apply a 455-kHz signal to the base of Q310 and adjust signal level for 0.3 volt meter reading (to saturate limiters).
2.	A DISC	Pin 10	L322	Zero	Apply a 455-kHz signal as above and adjust L322 (disc secondary) for zero meter reading.
3.	A DISC	Pin 10	L321 & L322	0.65 V (1.6 V with Multimeter)	Alternately apply a 445-kHz and 465-kHz signal while adjusting L321 and L322 for readings of at least 0.65 volt. Both readings should be within 10%.
4.	B LIM-1	Pin 2	L324	Maximum	Apply a 455-kHz signal as above, and tune L324 for maximum meter reading.
			IF ALIGNMENT		
5.	B LIM-1	Pin 2	L313 thru L320	Maximum	Apply a 455 kHz signal to collector of 2nd Mixer Q308. Adjust L313 thru L320 for maximum meter reading keeping signal below limiting.
6.	C LIM-2	Pin 3	C344, C348, C351 & L303	Maximum	Apply a 19 MHz signal to the base of 1st Mixer Q301. Adjust C344, C348, C351 & L303 for maximum meter reading, keeping signal below limiting.
			OSCILLATOR & MULTIPLIER ALIGNMENT		
7.	D OSC	Pin 4	L304 (and L305 for two-frequency) & L306	0.2 V to 0.6 V	Insert correct crystal and adjust L304 (L305 for two-frequency) and L306 for maximum meter reading.
8.	D OSC	Pin 4	L307	0.1 V to 0.4 V	Adjust L307 for minimum meter reading.
9.	E MULT	Pin 5	L308 & L307	-0.1 V to -0.6 V	Switch meter to negative and adjust L308 & L307 for maximum meter reading.
10.	E MULT	Pin 5	L309/L327	-0.1 V to -0.6 V	Adjust L309/L327 for dip (dip will be very small).
			FREQUENCY ADJUSTMENT		
11.	A DISC	Pin 2	L304 (and L305 for two-frequency)	Zero	Apply an on-frequency signal to P303 (Antenna Jack) and tune L304 (and L305 for two-frequency) for zero discriminator reading. ——NOTE—— For proper frequency control of the receiver it is recommended that all frequency adjustments be made when the equipment is at a temperature of approximately 75°F. In no case should frequency adjustments be made when the equipment is outside the temperature range of 50° to 90°F.
			RF ALIGNMENT		
12.	C LIM-2	Pin 3	L301/L325 and L302/L326	Maximum	With an on-frequency signal applied at P303, adjust L301/L325 and L302/L326 for maximum meter reading, keeping signal below limiting.
13.	C LIM-2	Pin 3	L309/L327	Maximum	Adjust L309/L327 for maximum meter reading with signal below limiting.
			FINAL IF & RF ALIGNMENT		
14.			L313 thru L320 & L324		Connect a D-C oscilloscope to pin 2 and pin 13 (Ground) of centralized metering Jack J312. Sweep RF signal generator connected to P303 with saw tooth generator (60 Hz or less) at ±30 kHz deviation. Connect a 455 kHz marker through 1 pf capacitor to collector of 2nd mixer. Adjust L313 thru L320 and L324 for a symetrical filter pattern as shown. This alignment should provide a minimum EIA modulation acceptance of ±9.5 kHz.  ——NOTE—— On some oscilloscopes, a 100K resistor across the probe will improve the wave shape.
15.			L301/L325, L302/L326, & L309/L327		Connect an audio voltmeter to audio output & adjust volume control for 1 volt RMS. Inject an on-frequency RF signal to P303 at a level to produce 10 dB quieting. Adjust L301/L325, L302/L326 & L309/L327 for maximum quieting.

* NOTE -- Low IF coils L313 through L320 and L324 have been set at the factory and will normally require no further adjustment. Do NOT realign the filter unless there is positive evidence of a defective filter. For location of IF coils, refer to the Receiver Service Sheet.

RECEIVER TEST PROCEDURES

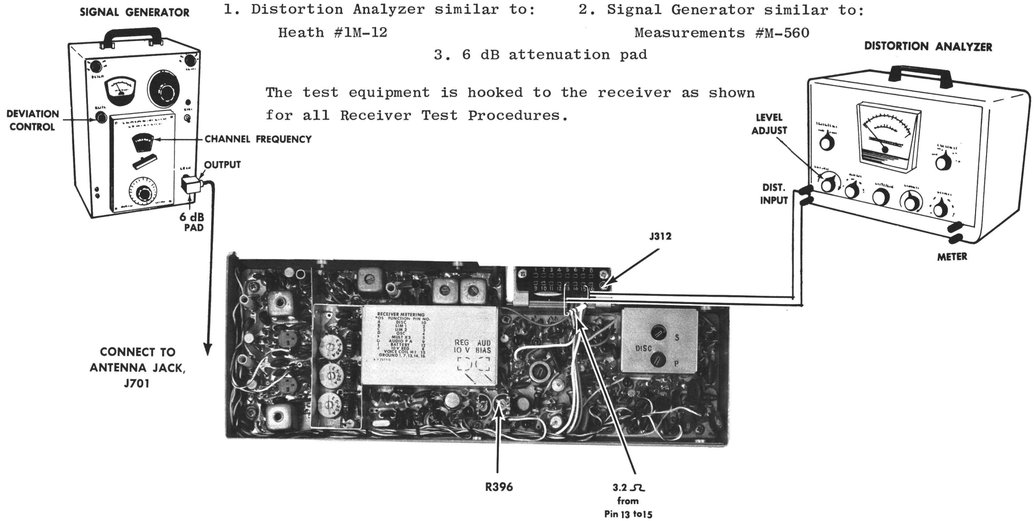
The Receiver Test Procedures are designed to help you to service a receiver that is operating -- but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the 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 Trouble-shooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

for test hookup shown:

1. Distortion Analyzer similar to: Heath #1M-12
2. Signal Generator similar to: Measurements #M-560
3. 6 dB attenuation pad

The test equipment is hooked to the receiver as shown for all Receiver Test Procedures.



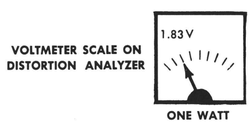
STEP 1

AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

1. Connect a 1,000-microvolt test signal modulated by 1,000 Hertz ±3.0 kHz deviation to the antenna jack.
2. Disconnect the Speaker Hi lead from the terminal board. Hook up a 3.2-ohm load resistor from Speaker Hi to ground as shown.
3. Connect Distortion Analyzer input across the 3.2-ohm resistor.
4. Set VOLUME Control for one-watt output (1.79 VRMS).



5. Make distortion measurements according to manufacturer's instructions. Reading should be less than 10% (5% is typical).

SERVICE CHECK

If the distortion is more than 10%, or maximum audio output is less than one watt, make the following checks:

1. Battery and regulator voltage--low voltage will cause distortion. (Refer to Receiver Service Sheet for voltages.)
2. Audio Bias Adjust (R396)--low current will cause distortion.
3. Audio Gain (Refer to Step 2A and 2B of Receiver Troubleshooting Procedure.
4. Discriminator Alignment (Refer to Receiver Alignment on reverse side of page).

STEP 2

USABLE SENSITIVITY (12 dB SINAD)

TEST PROCEDURE

Measure sensitivity of the receiver modulated at the standard test modulation as follows:

1. Be sure Test Step 1 checks out properly.
2. Reduce the Signal Generator output from setting in TEST STEP 1.
3. Adjust Distortion Analyzer LEVEL control for a +2 dB reading.
4. Set CONTROL for LEVEL to DISTORTION reading. Repeat Steps 1, 2, and 3 until difference in reading is 12 dB (+2 dB to -10 dB).
5. The 12-dB difference (Signal plus Noise And Distortion to noise plus distortion ratio) is the "usable" sensitivity level. Reading should be less than 0.55 microvolts with audio output at least 1/2 watt (1.25 volts RMS across the 3.2-ohm receiver load).

SERVICE CHECK

If the sensitivity level is more than 0.55 microvolts, make the following checks:

1. Alignment of RF stages (Refer to RF Alignment in Receiver Alignment on reverse side of page).
2. Gain measurements as shown on the Receiver Troubleshooting Procedure.

STEP 3

MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

TEST PROCEDURE

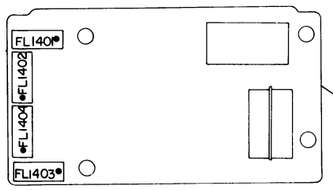
1. Be sure TEST STEPS 1 and 2 check out properly.
2. Set Signal Generator output for twice the microvolt reading obtained in TEST STEP 2 - 4.
3. Increase Signal Generator frequency deviation.
4. Adjust LEVEL Control for +2 dB.
5. Set CONTROL for LEVEL to DISTORTION reading. Repeat Steps 3, 4 and 5 until difference between readings becomes 12 dB from +2 dB to -10 dB.
6. Deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than 7.5 kHz (typical value is 9.5 kHz).

SERVICE CHECK

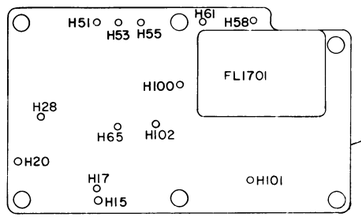
If the Modulation Acceptance Bandwidth test does not indicate the proper width, check the following:

1. Make gain measurements as shown on the Receiver Troubleshooting Procedure.
2. Voltage reading of 2nd Limiter (Q312) should read 0.13 volts RMS with a one-microvolt input signal on Test Set Meter or 0.3 volts with voltmeter. (Measure at J312-3).
3. DO NOT RE-ALIGN factory adjusted filters (L313 through L320), unless positive evidence of a defective filter is ascertained. (Refer to Filter Alignment on the Receiver Alignment Procedure).

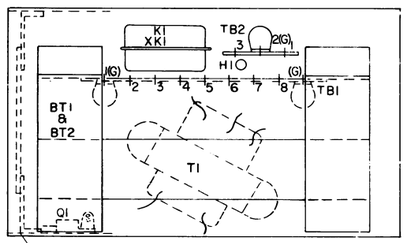
TYPE 99 TONE DECODER
19D413100

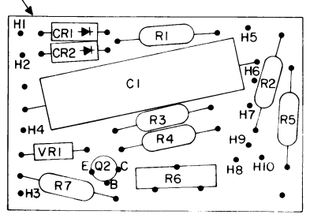


TYPE 90 TONE DECODER
19C303730

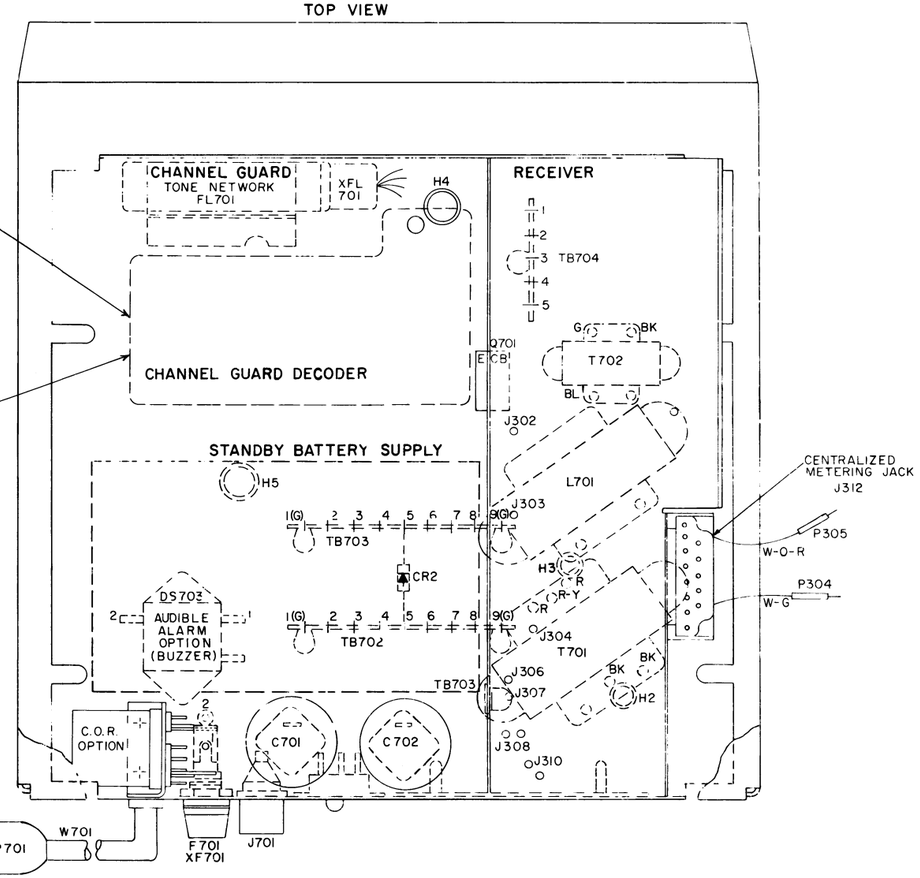


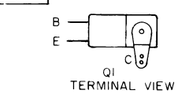
STANDBY BATTERY SUPPLY

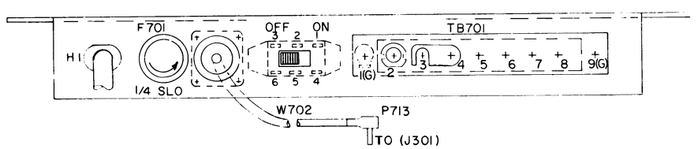




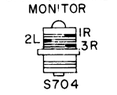
CHASSIS
TOP VIEW



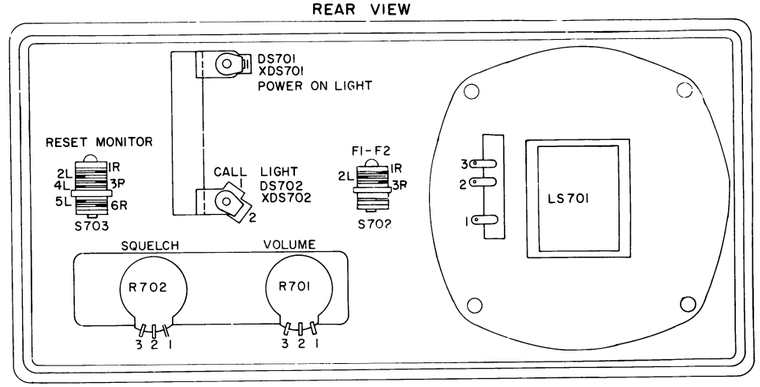




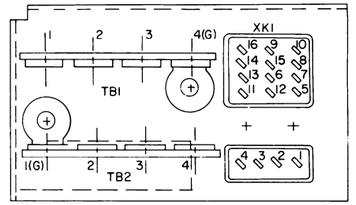
CHANNEL GUARD MONITOR



FRONT PANEL
REAR VIEW



CARRIER OPERATED RELAY (COR)
(TERMINAL VIEW)

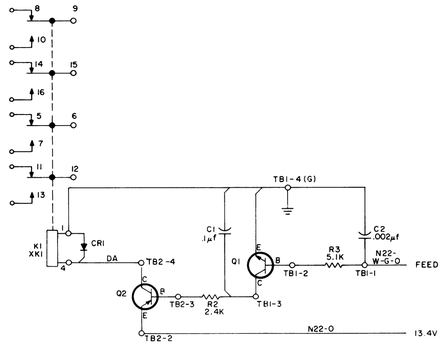


(19R620788, Rev. 8)

OUTLINE DIAGRAM

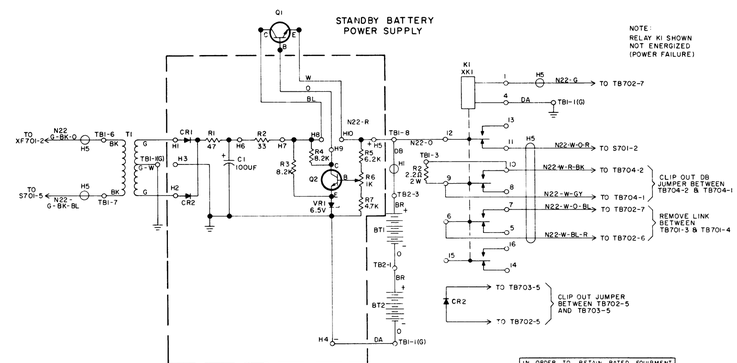
MONITOR RECEIVER CHASSIS
AND FRONT PANEL

CARRIER OPERATED RELAY



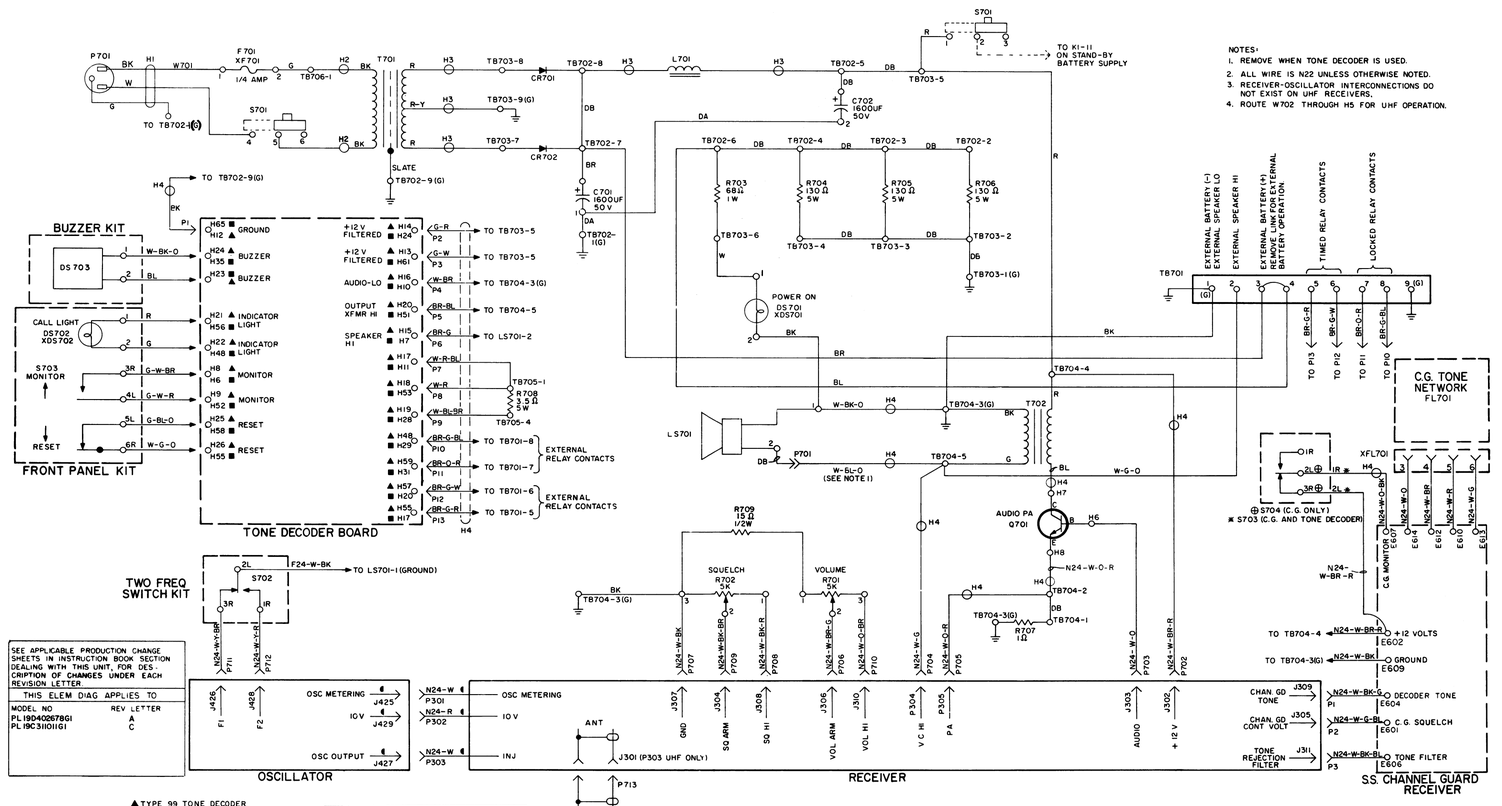
(19C311361, Rev. 4)

STANDBY BATTERY POWER SUPPLY



(19C317160, Rev. 3)

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.



▲ TYPE 99 TONE DECODER UNIVERSAL SEL CALL DECODER PL 19D413100

■ PULSE TONE DECODER PL 19C303730

◖ H8 & L8 ONLY

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.

(19D402696, Rev. 13)

SCHEMATIC DIAGRAM

MONITOR RECEIVER CHASSIS AND FRONT PANEL

PARTS LIST

LBI-3754G

MONITOR RECEIVER MAIN CHASSIS 19C311011G1
FRONT PANEL ASSEMBLY 19D402678G1

SYMBOL	GE PART NO.	DESCRIPTION
		MAIN CHASSIS ASSEMBLY 19C311011G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C701 and C702	7476442P20	Electrolytic: 1600 µf +250% -10%, 50 VDCW; sim to PR Mallory WP-068.
		- - - - - - - DIODES AND RECTIFIERS - - - - -
CR701 and CR702	4037822P1	Silicon.
		- - - - - - - - - - FUSES - - - - - - - - - -
F701	7487942P1	Slow blowing: 1/4 amp at 250 v; sim to Bussmann MDL-1/4.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L701	19A115671P1	Reactor: 0.21 h min, 7.5 ohms DC res max, 20 VDC operating.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P701		(Part of W701).
P702 and P703	4029840P2	Contact, electrical: sim to AMP 42827-2.
P704 and P705	7147199P2	Connector: female contact; sim to Winchester Electronics 21804.
P706 thru P710	4029840P2	Contact, electrical: sim to AMP 42827-2.
P713		(Part of W702).
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q701*	19A116118P1	Silicon, NPN.
		Earlier than REV B:
	19A115527P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R703	3R78P680K	Composition: 68 ohms ±10%, 1 w.
R704 thru R706	5493035P22	Wirewound: 130 ohms ±5%, 5 w; sim to Tru-Ohm Type X-60.
R707	19B209022P115	Wirewound: 1 ohm ±10%, 2 w; sim to IRC Type BWH.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S701	7145098P1	Slide: DPDT, 0.75 amp at 125 VAC or 0.5 amp at 125 VDC; sim to Stackpole 3S-150.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T701	19B209074P1	Power, step-down: single phase, Pri: 117 v, 50/60 Hertz, Sec 1: 850 ma at 13.8 VDC.
T702	19B209079P1	Audio freq: 0.3-3 KHz freq range, Pri: 55 ohms ±10% imp, 0.895 ohm ±10% DC res, Sec: 3.2 ohms imp, 0.168 ohm DC res.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB701	7117710P7	Phen: 7 terminals; sim to Cinch 1770.
TB702 and TB703	7775500P119	Phen: 9 terminals.
TB704	7775500P11	Phen: 5 terminals.

SYMBOL	GE PART NO.	DESCRIPTION
TB706	7775500P44	Phen: 2 terminals.
		- - - - - - - - - - CABLES - - - - - - - - - -
W701*	19A116740P2	Power: approx 8 feet long, 2 poles, 3 wire grounding; sim to Belden 17239.
		In REV B and earlier:
	4036441P1	Power: approx 6 feet long, with 2-contact plug (P701); sim to GE 2071-1.
W702		CABLE 19A122691G1
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J701	4029493P1	Receptacle, coaxial: sim to Amphenol 83-798 or Equiv. Military 50-239A.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P713	5496078P6	Right angle: coaxial; sim to FXR 27-6.
		- - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B209044P11	RF: approx 15 inches long; sim to Amphenol 21-598.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XF701	19B209005P1	Fuseholder, post type, phen: 15 amps at 250 v; sim to Littelfuse 342012.
		FRONT PANEL ASSEMBLY 19D402678G1
		- - - - - - - - INDICATING DEVICES - - - - - - - -
DS701	19C307037P19	Lamp, incandescent: 14 v; sim to GE 756.
		- - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS701	19B209101P1	Permanent magnet, 5-inch: 2-1/4 w operating, paper dust cap; sim to Cletron X10271.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P701	4036634P1	Contact, electrical; sim to AMP 42428-2.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R701	5496870P11	Variable, carbon film: 5000 ohms ±20%, 0.25 w; sim to Mallory LC(5K).
R702	5496870P15	Variable, carbon film: 5000 ohms ±20%, 0.5 w; sim to Mallory LC(5K).
R709	3R77P150K	Composition: 15 ohms ±10%, 1/2 w.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XDS701	19B209342P1	Lampholder: sim to Leecraft 7-04-1.
		FRONT PANEL KIT 19A122311G1
		- - - - - - - - INDICATING DEVICES - - - - - - - -
DS702	19C307037P19	Lamp, incandescent: 14 v; sim to GE 756.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S703	19B209139P5	Lever: 3 amps at 120 VAC, Position up: 1 form B contact, momentary, Position down: 1 form A, 1 form B contacts, locking; sim to Switchcraft 28000 (Pt. 205-1007).
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XDS702	19B209342P1	Lampholder: sim to Leecraft 7-04.
		EXTERNAL ALARM KIT 19A122312G1
		- - - - - - - - INDICATING DEVICES - - - - - - - -
DS703	19B200788P3	Buzzer: 12 VDC or 12-16 VAC nominal, 200 ma DC operating; sim to Line Electric BD-1. (Used with second relay, GE Dwg 19C300957P2).

SYMBOL	GE PART NO.	DESCRIPTION
		2 FREQUENCY SWITCH KIT 19A122310G1
		- - - - - - - - - - PLUGS - - - - - - - - - -
P711 and P712	4029840P2	Contact, electrical: sim to AMP 42827-2.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S702	19B209139P4	Lever: 3 amps at 120 VAC, Position down: 1 form C contact, locking; sim to Switchcraft 28203L.
		HARDWARE KIT (CHANNEL GUARD) 19A122322G1
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S704	19A122310G2	Channel Guard Monitor. Includes:
	19B209139P4	Lever: 3 amps at 120 VAC, Position down: 1 form C contact, locking; sim to Switchcraft 28203L.
		CABLE ASSEMBLY 19B205451G1 (TYPE 99 TONE DECODER) 19B205451G2 (TYPE 90 TONE DECODER)
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 thru P13	4036634P1	Contact, electrical: sim to AMP 42428-2.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R708	5493035P10	Wirewound: 3.5 ohms ±5%, 5 w; sim to Tru-Ohm Type X-60.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB705	7775500P8	Phen: 4 terminals.
		CABLE ASSEMBLY 19B205450G1 (CHANNEL GUARD) 19B205450G2 (CHANNEL GUARD AND TONE DECODER)
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 thru P3	4029840P2	Contact, electrical: sim to AMP 42827-2.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XFL701	7768887P17	Tube, phen: 7 pins; sim to Elco 04-710-02.
		BATTERY KIT 19A122315G2 (Used with 19B205435G2).
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR2	4037822P1	Silicon.
		STAND-BY POWER SUPPLY 19B205435G2 (Used with 19A122315G2)
		- - - - - - - - - - BATTERIES - - - - - - - - - -
BT1 and BT2	19B201887P2	Storage, nickel-cadmium: 6 v min; sim to GE 41B001AAQ1.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	5491595P14	Armature: 1.5 w operating, 520 ohms ±15% coil res, 4 form C contacts; sim to Allied Control T154-X-131.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A116118P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2	19B209022P123	Wirewound: 2.2 ohms ±10%, 2 w; sim to IRC Type BWH.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T1	19B209017P1	Power: single phase, Pri: 117 v, 50/60 Hz, Sec 1: 25/25 v.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500P119	Phen: 9 terminals.
TB2	7775500P7	Phen: 3 terminals.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK1	5491595P5	Relay: 16 contacts; sim to Allied Control 30034-2.
		STAND-BY POWER SUPPLY BOARD 19B216567G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A115680P12	Electrolytic: 100 µf +150% -10%, 30 VDCW; sim to Mallory Type TT.
		- - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1 and CR2	4037822P1	Silicon.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q2	19A115362P1	Silicon, NPN; sim to Type 2N2925.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P470J	Composition: 47 ohms ±5%, 1/2 w.
R2	3R77P330J	Composition: 33 ohms ±5%, 1/2 w.
R3 and R4	3R77P822J	Composition: 8200 ohms ±5%, 1/2 w.
R5	3R77P622J	Composition: 6200 ohms ±5%, 1/2 w.
R6	19B209358P103	Variable, carbon film: approx 25 to 1000 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R7	3R77P472J	Composition: 4700 ohms ±5%, 1/2 w.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	4036887P6	Silicon, Zener.
		CARRIER OPERATED RELAY 19C303533G2
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C2	7774750P6	Ceramic disc: .002 µf +100% -0%, 500 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	5494922P1	Silicon; sim to Type 1N456.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	5491595P14	Armature: 1.5 w max operating, 520 ohms ±15% coil res, 4 form C contacts rated at 0.5 amp at 12 VDC; sim to Allied Control T154-X-131.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q2	19A115706P1	Silicon, PNP.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2	3R77P242J	Composition: 2400 ohms ±5%, 1/2 w.
R3	3R77P512J	Composition: 5100 ohms ±5%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1 and TB2	7775500P6	Phen: 4 terminals.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK1	5491595P5	Relay: 16 contacts; sim to Allied Control 30034-2.
		IMPROVED INTERMODULATION 19A127250G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2351	5491271P103	Variable, sub-miniature: approx 1.7-8.3 pf, 750 v peak; sim to EF Johnson 189.
		- - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A122161G2	Top cover.
	19A116768P8	Bushing, strain relief: cable; sim to Heyco SR-59-4. (Used with W701 in 19C311011G1).
	19B205512G1	Casting. (Used in 19D402678G1).
	19C303769P1	Grille. (Used in 19D402678G1).
	8529P16D	Button plug: approx 15/32 inch dia. (Used in 19D402678G1).
	19A122240P1	Support. (Used with XDS701 in 19D402678G1).
	4037559P9	Bumper, rubber. (Used in 19D402678G1).
	19C307038P6	Nut, push-on. (Holds jewel in 19D402678G1).
	19B204949P3	Jewel: amber. (Used in 19D402678G1).
	19A122210P1	Lens, green. (Used with XDS702 in 19D402678G1).
	4034668P1	(Not Used).
	19A115679P1	Knob, push-on: black. (Used with R702, 703 in 19D402678G1).
	NP248990	Nameplate. (Used in 19D402678G1).
	4036634P1	Contact, electrical. (Used in 19A122311G1).
	5491595P9	Retainer, spring. (Used with K1 in 19B205435G2).

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 description of parts affected by these revisions.

REV. A - (19C311011-G1 only)
To change antenna connector from phono to UHF Type.
Changed W702.

REV. A - (19D402670-G1 only)
To make minimum volume level consistent with requirements of tone decoders and to change the ground circuit for indicator lamp DS701.
Changed R709 and XDS701.

REV. B - (19C311011-G1 only)
To incorporate a different audio transistor. Changed Q701.

REV. C - To incorporate a 3-wire power cable. Changed W701.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

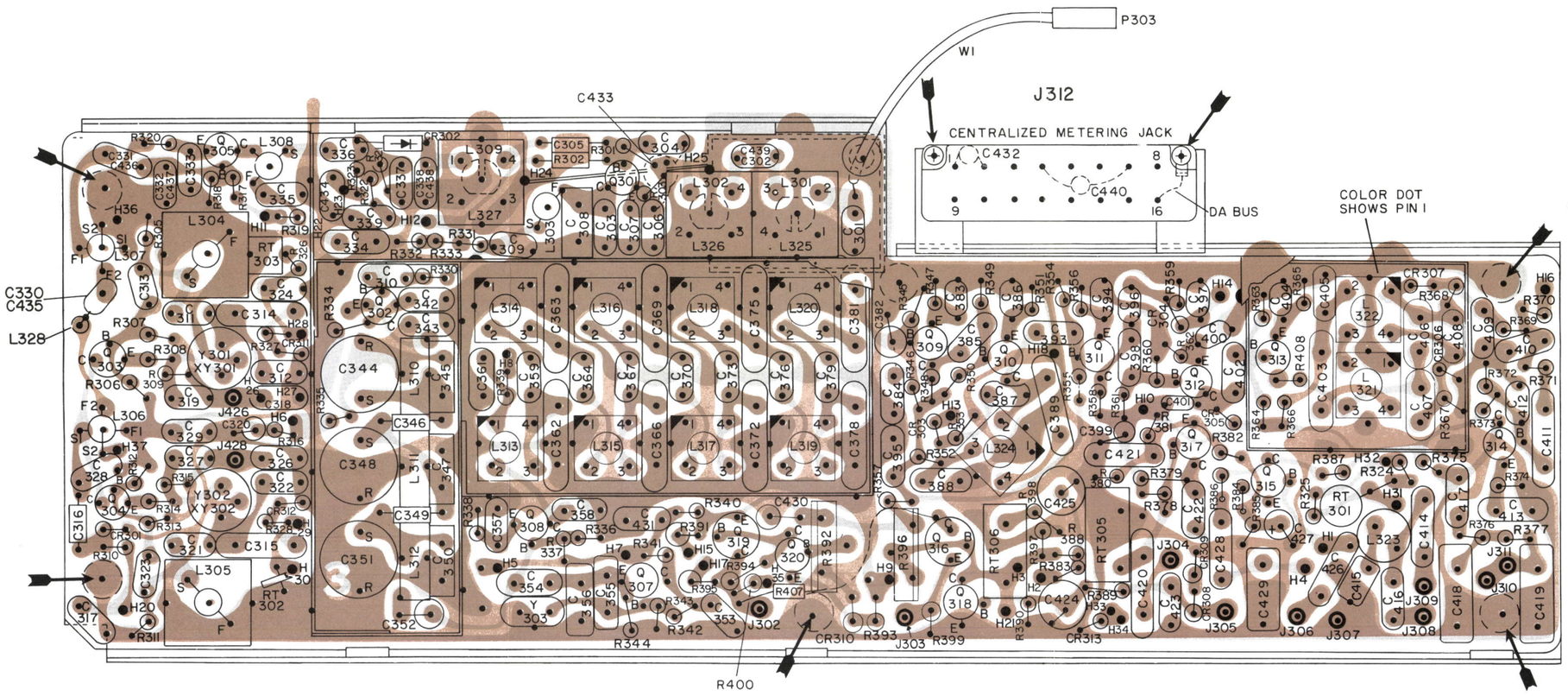
LBI-3962D

406-470 MHz RECEIVER
MODEL 4ER53A10 19D413084G3 406-420 MHz 1 FREQ
MODEL 4ER53A11 19D413084G1 450-470 MHz 1 FREQ
MODEL 4ER53A12 19D413084G4 406-420 MHz 2 FREQ
MODEL 4ER53A13 19D413084G2 450-470 MHz 2 FREQ

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C301	19A116656P5J0	Ceramic disc: 5 pf ±5%, 500 VDCW, temp coef 0 PPM.
C302*	19A116656P7J0	Ceramic disc: 7 pf ±5%, 500 VDCW, temp coef 0 PPM.
		Earlier than REV A:
	5496219P39	Ceramic disc: 8 pf ±5%, 500 VDCW, temp coef 0 PPM.
C303	19A116656P13J3	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -330 PPM.
C304	19A116656P33J1	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -150 PPM.
C305	5491601P124	Phenolic: 1.8 pf ±5%, 500 VDCW.
C306	19A116656P5J0	Ceramic disc: 5 pf ±5%, 500 VDCW, temp coef 0 PPM.
C307	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C308	7489162P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C309	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C310	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C311	5496219P644	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -470 PPM.
C312	5496219P745	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -750 PPM.
C313	5496219P35	Ceramic disc: 4 pf ±5%, 500 VDCW, temp coef 0 PPM.
C314	5496219P767	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -750 PPM.
C315	19A116656P150J7	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -750 PPM.
C316	5491601P126	Phenolic: 2.2 pf ±5%, 500 VDCW.
C317 and C318	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C319	19A116656P3G8	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C320	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C321	5496219P644	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -470 PPM.
C322	5496219P745	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -750 PPM.
C323	5496219P35	Ceramic disc: 4 pf ±5%, 500 VDCW, temp coef 0 PPM.
C324	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C326	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C327	5496219P34	Ceramic disc: 3 pf ±5%, 500 VDCW, temp coef 0 PPM.
C328	19A116656P6G8	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C329	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C330	19A116656P6G8	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C331	19A116656P10G8	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C332	19A116656P39J8	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C333 and C334	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C335	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C336	19A116656P13J4	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -470 PPM.
C337	19A116656P33J4	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -470 PPM.
C338	19A116656P5J3	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -330 PPM.
C339	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C342 and C343	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague Type 19C180.
C344	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie Style 557-36.
C345	5496219P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C346	5491601P105	Phenolic: 0.22 pf ±5%, 500 VDCW.
C347	19A116656P43J8	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C348	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie Style 557-36.
C349	5491601P105	Phenolic: 0.22 pf ±5%, 500 VDCW.
C350	5496219P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C351	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie Style 557-36.
C352	7491930P4	Polyester: .0068 µf ±20%, 100 VDCW; sim to GE Type 61F.
C353	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C354	19A116656P15J0	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef 0 PPM.
C355	5490008P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C356	5490008P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C357	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C358	5490008P11	Silver mica: 22 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C359	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
C361	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C362 and C363	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C364	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
C366	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C367	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
C369	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C370	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
C372	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C373	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
C375	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C376	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
C378	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C379	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
C381	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C382	7491930P3	Polyester: .0047 µf ±20%, 100 VDCW; sim to GE Type 61F.
C383*	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
		In Models 4ER53A10, 12 of REV B and earlier: In Models 4ER53A11, 13 of REV A and earlier:
	5492638P101	Ceramic disc: 0.1 µf +80 -20%, 3 VDCW; sim to Sprague Type 54C23.
C384	5496219P817	Ceramic disc: 47 pf ±10%, 500 VDCW, temp coef -1500 PPM.
C385	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C386*	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
		In Models 4ER53A10, 12 of REV B and earlier: In Models 4ER53A11, 13 of REV A and earlier:
	5492638P101	Ceramic disc: 0.1 µf +80 -20%, 3 VDCW; sim to Sprague Type 54C23.
C387	5496203P117	Ceramic disc: 47 pf ±10%, 500 VDCW, temp coef -3300 PPM.
C388	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C389	5496219P367	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -150 PPM.
C393	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C394*	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
		In Models 4ER53A10, 12 of REV B and earlier: In Models 4ER53A11, 13 of REV A and earlier:
	5492638P101	Ceramic disc: 0.1 µf +80 -20%, 3 VDCW; sim to Sprague Type 54C23.
C395	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C396 and C397	7491393P1	Ceramic disc: .001 µf +100% -0%, 500 VDCW; sim to Sprague 1219C4.
C398	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C399	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C400	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C401	5494481P106	Ceramic disc: 330 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C402	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C403	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C404	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C405	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C406 and C407	5490008P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C408	5496219P656	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -470 PPM.
C409 and C410	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C411	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C412*	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		In Models 4ER53A10, 12 of REV A and earlier: In Models 4ER53A11, 13 earlier than REV A:
	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C413	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C414	5494481P116	Ceramic disc: 3000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C415	19A116080P201	Polyester: 0.01 µf ±5%, 50 VDCW.
C416	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

(Cont'd on page 16)



TO REMOVE RECEIVER BOARD FROM SHIELD REMOVE SCREWS SHOWN BY ARROWS. ALSO DISCONNECT GREEN AND BLACK SLEEVED INLINE CONNECTORS BEHIND J312.

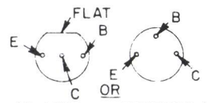
RESISTANCE READINGS

RESISTANCE READINGS ARE TYPICAL READINGS MEASURED TO J312-13 (GROUND), AND WITH ALL POWER REMOVED FROM THE CHASSIS.

MEASURED FROM	NEGATIVE (-) PROBE TO GRD	POSITIVE (+) PROBE TO GRD
* J302	5.5K	4K
J305	11K	1.8K
J312-2	1 MEG OHM	60K
J312-3	1 MEG OHM	60K
J312-4	2 MEG OHMS	6.8K
J312-9	1Ω (HI) 8Ω (LO)	1Ω (HI) 8Ω (LO)
J312-10	150K	150K

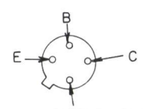
* MEASURED WITH POWER SUPPLY LEAD P712 (+ 12V) DISCONNECTED.

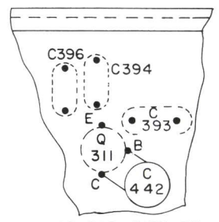
LEAD IDENTIFICATION
FOR Q301, Q302, Q307-Q320



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION
FOR Q303, Q304 & Q305



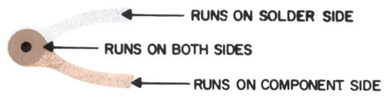


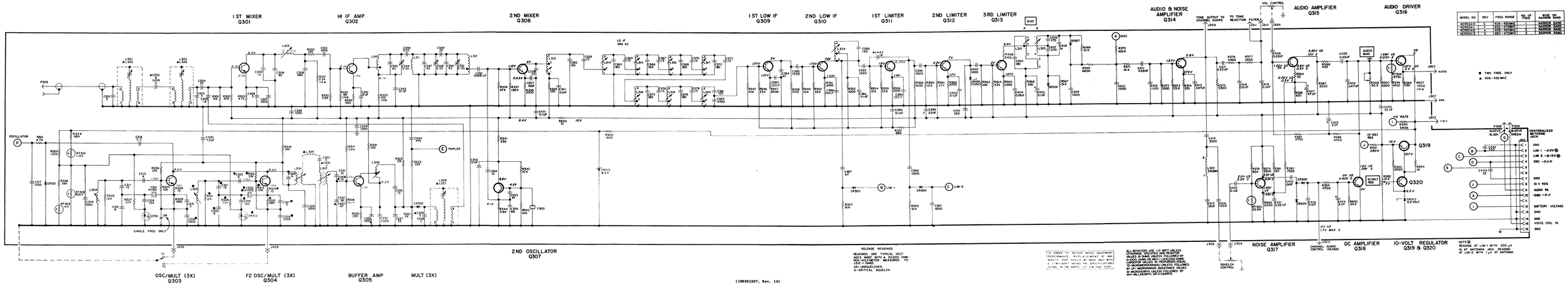
SOLDER SIDE OF PRINTED BOARD (406-420 MHZ ONLY)

(19D413238, Rev. 5)
(19C311414, Sh. 1, Rev. 3)
(19C311414, Sh. 2, Rev. 3)

OUTLINE DIAGRAM

406—470 MHz RECEIVER
TYPE ER-53-A





MODEL NO.	REV	FREQ RANGE	NO. OF FREQ	NARROW BAND OR Conv.
*ER53A10	G	406 - 420MC	1	NARROW BAND
*ER53A11	F	450 - 470MC	1	NARROW BAND
*ER53A12	G	406 - 470MC	1	NARROW BAND
*ER53A13	G	406 - 470MC	1	NARROW BAND

■ TWO FREQ ONLY
▲ 406-420 MHZ

VOLTAGE READINGS
READINGS ARE TYPICAL VOLTAGES MADE WITH A 20,000 OHM/VOLT METER MEASURED TO (SD-V) GND.
US- UNSQUELCHED
S-CRITICAL SQUELCH

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY COMPONENT MARKED WITH A ★ SYMBOL MUST BE STRICTLY ADHERED TO AS SHOWN IN THE PARTS LIST FOR THAT POINT.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED. RESISTANCE VALUES IN OHMS WITH K=1000 AND M=1000000 OHMS. CAPACITOR VALUES ARE MICROFARADS UNLESS OTHERWISE INDICATED. INDUCTANCE VALUES ARE IN MICROHENRYS. VALUES FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS

NOTE ● READING AT LIM-1 WITH 200 μV IN AT ANTENNA JACK. READING AT LIM-2 WITH 1 μV AT ANTENNA

(198621207, Rev. 14)

SCHEMATIC DIAGRAM

406—470 MHz RECEIVER
TYPE ER-53-A

(Cont'd from page 13) (LBI-3962)

SYMBOL	GE PART NO.	DESCRIPTION
C417	19A116080P9	Polyester: 0.22 pf ±20%, 50 VDCW.
C418	19A116080P8	Polyester: 0.15 pf ±20%, 50 VDCW.
C419	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C420	7491827P5	Ceramic disc: .1 pf +80% -20%, 50 VDCW; sim to Sprague Type 3NC17X.
C421	19A116080P9	Polyester: 0.22 pf ±20%, 50 VDCW.
C422	19A116080P1	Polyester: 0.01 pf ±20%, 50 VDCW.
C423	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C424	549567VP12	Electrolytic: 2 pf +75% -10%, 25 VDCW; sim to Sprague Type 30D.
C425	549567U93	Electrolytic: 5 pf +75% -10%, 6 VDCW; sim to Sprague Type 30D.
C426	19A116080P9	Polyester: 0.22 pf ±20%, 50 VDCW.
C427	540626792	Tantalum: 47 pf ±20%, 6 VDCW; sim to Sprague Type 150D.
C428	19A116080P9	Polyester: 0.22 pf ±20%, 50 VDCW.
C429	19A116080P5	Polyester: 0.047 pf ±20%, 50 VDCW.
C430	549626792T10	Tantalum: 22 pf ±20%, 15 VDCW; sim to Sprague Type 150D.
C431	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C432	5494481P6	Ceramic disc: 330 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C433	5496218P24	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C434	5494481P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C435*	19A116656P4GS	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
		In Models 4ES53A10, 13 of KEY A:
	5494481P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		In Models 4ES53A10, 12 earlier than KEY A:
	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C436	19A116656P1S28	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C437	7489162P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C438	19A116656P3GS	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C439	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C440	7489162P111	Silver mica: 22 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C442	5496218P45	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef 0 PPM.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR301	7777146P3	Germanium.
CR302	19A121975P1	Silicon.
CR303 and CR304	4038056P1	Germanium.
CR305	4036887P3	Silicon, Zener.
CR306 and CR307	19A115250P1	Silicon.
CR308 and CR309	4038056P1	Germanium.
CR310	4036887P6	Silicon, Zener.
CR311 and CR312	19A116034P1	Silicon.
CR313	4036887P40	Silicon, Zener.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J302 thru J311	4033513P4	Contact, electrical: sim to Bead Chain L93-3.

SYMBOL	GE PART NO.	DESCRIPTION
J312	19B209589G2	Connector: 18 contacts.
J426	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J428	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L301 and L302	19D413078G1	Helical resonator.
L303 thru L305	19B209917G1	Coil. Includes tuning slug 19B200497P2.
L306 thru L307	19B209916G1	Coil. Includes tuning slug 19B200497P2.
L308	19B203239G2	Coil. Includes tuning slug 19B200497P2.
L309	19D413078G2	Helical resonator.
L310	19B209918G1	Coil. Includes tuning slug 549266O9S.
L311	19B209919G2	Coil. Includes tuning slug 549266O9S.
L312	19B209919G1	Coil. Includes tuning slug 549266O9S.
L313 thru L320	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX13670.
L321	19A115711P6	Transformer, freq: 455 KHz; sim to TOKO PEFCH-14733-CK12.
L322	19A115711P7	Transformer, freq: 455 KHz; sim to TOKO PEFCH-14736-BN12.
L323	5491736P2	Choke: 240 mh ±10% at (1 KHz, 0.5 v), 270 ohms DC res max; sim to Aladdin 33-161.
L324	19A115711P2	Transformer, freq: 455 KHz; sim to Automatic Mfg EX13671.
L325 and L326	19D413078G3	Helical resonator.
L327	19D413078G4	Helical resonator.
L328*	748807P93	Choke, RF: 0.33 µh ±20%, 0.07 ohms DC res max; sim to Jeffers 4411-3R. Added by KEY A.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P303		(Part of W1).
P304 and P305	7147199P1	Connector: male contact; sim to Winchester Electronics 21803.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q301	19A115991P1	Silicon, NPN.
Q302	19A115925P1	Silicon, NPN.
Q303*	19A115440P1	Silicon, NPN.
		In 4ES53A10, 12 of KEY F and earlier: In 4ES53A11, 13 of KEY E and earlier:
	19A115925P1	Silicon, NPN.
Q304*	19A115440P1	Silicon, NPN.
		In 4ES53A12 of KEY G and earlier: In 4ES53A13 of KEY F and earlier:
	19A115925P1	Silicon, NPN.
Q305	19A115925P1	Silicon, NPN.
Q307	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q308	19A115245P1	Silicon, NPN.
Q309 thru Q315	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q316	19A115300P2	Silicon, NPN; sim to Type 2N3053.
Q317	19A115392P1	Silicon, NPN; sim to Type 2N2925.
Q318	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q319	19A115300P4	Silicon, NPN; sim to Type 2N3053.
Q330	19A115889P1	Silicon, NPN; sim to Type 2N2712.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R301	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R302	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R303	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R305	3R77P123K	Composition: 12,000 ohms ±10%, 1/2 w.
R306*	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
		In Models 4ES53A10, 12 of KEY C and earlier: In Models 4ES53A11, 13 of KEY B and earlier:
	3R152P183K	Composition: 18,000 ohms ±10%, 1/4 w.
R307	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R308	3R77P150K	Composition: 15 ohms ±10%, 1/2 w.
R309	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R310	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R311	3R77P123K	Composition: 12,000 ohms ±10%, 1/2 w.
R312*	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
		In Model 4ES53A10 of KEY C and earlier: In Model 4ES53A13 of KEY B and earlier:
	3R152P183K	Composition: 18,000 ohms ±10%, 1/4 w.
R313	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R314	3R77P150K	Composition: 15 ohms ±10%, 1/2 w.
R315	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R316	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R317*	3R77P24J	Composition: 24,000 ohms ±5%, 1/2 w.
		In Model 4ES53A10, 12 of KEY D and earlier: In Model 4ES53A13 of KEY C and earlier:
	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R318*	3R77P822K	Composition: 8200 ohms ±10%, 1/2 w.
		In Models 4ES53A10, 12 of KEY D and earlier: In Models 4ES53A11, 13 of KEY C and earlier:
	3R152P392K	Composition: 3900 ohms ±10%, 1/4 w.
R319	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R320	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
R321	3R77P302J	Composition: 3000 ohms ±5%, 1/2 w.
R322	3R77P123J	Composition: 12,000 ohms ±5%, 1/2 w.
R323	3R77P222K	Composition: 22,000 ohms ±10%, 1/2 w.
R324	3R77P683J	Composition: 68,000 ohms ±5%, 1/2 w.
R325	3R77P104J	Composition: 0.10 megohm ±5%, 1/2 w.
R326	3R77P093J	Composition: 39,000 ohms ±5%, 1/2 w.
R327 and R328	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R329	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R331	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R332	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R333	3R152P183K	Composition: 18,000 ohms ±10%, 1/4 w.
R334	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R335	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R336	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R337	3R77P154K	Composition: 0.15 megohm ±10%, 1/2 w.
R338	3R77P203J	Composition: 2000 ohms ±5%, 1/2 w.
R339	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R340	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
R341	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R342 and R343	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R344	3R77P392K	Composition: 3900 ohms ±10%, 1/2 w.
R345	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R346	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R347	3R77P203J	Composition: 2000 ohms ±5%, 1/2 w.
R348	3R77P512J	Composition: 5100 ohms ±5%, 1/2 w.
R349	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R350	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R351	3R77P202J	Composition: 2000 ohms ±5%, 1/2 w.
R352	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R353	3R77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R354	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R355	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R356	3R77P202J	Composition: 2000 ohms ±5%, 1/2 w.
R357	3R152P681K	Composition: 680 ohms ±10%, 1/4 w.
R358	3R77P512J	Composition: 5100 ohms ±5%, 1/2 w.
R359	3R77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R360	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R361	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R362	3R77P202J	Composition: 2000 ohms ±5%, 1/2 w.
R363	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R364	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R365	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
R366	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R367 and R368	3R77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R369	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R370	3R77P104K	Composition: 0.10 megohm ±10%, 1/2 w.
R371	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R372	3R77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R373	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R374	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
R375	3R77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R376	3R77P332J	Composition: 3300 ohms ±5%, 1/2 w.
R377	3R77P152J	Composition: 1500 ohms ±5%, 1/2 w.
R378	3R77P823J	Composition: 82,000 ohms ±5%, 1/2 w.
R379	3R77P332J	Composition: 3300 ohms ±5%, 1/2 w.
R380	3R77P222J	Composition: 2200 ohms ±5%, 1/2 w.
R381	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R382	3R77P75J	Composition: 7500 ohms ±5%, 1/2 w.
R383	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R384	3R77P300J	Composition: 30 ohms ±5%, 1/2 w.
R385	3R77P621J	Composition: 620 ohms ±5%, 1/2 w.
R386	3R77P431J	Composition: 430 ohms ±5%, 1/2 w.
R387	3R77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R388 and R389	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R390	3R77P243J	Composition: 24,000 ohms ±5%, 1/2 w.
R391	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
R392*	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
		In 4ES53A10, 12 of KEY E and earlier: In 4ES53A11, 13 of KEY D and earlier:
	19B204808G2	Variable, sub-miniature trimmer: 10,000 ohms ±20%, 0.1 w; sim to Centralab Series 4.
R393	3R77P302J	Composition: 3000 ohms ±5%, 1/2 w.
R394	3R77P103J	Composition: 1000 ohms ±5%, 1/2 w.
R395	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R396*	19B209358P108	Variable, carbon film: approx 100 to 50,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
		In 4ES53A10, 12 of KEY E and earlier: In 4ES53A11, 13 of KEY D and earlier:
	19B204808G1	Variable, sub-miniature trimmer: 50,000 ohms ±20%, 0.1 w; sim to Centralab Series 4.
R397	3R77P623J	Composition: 6200 ohms ±5%, 1/2 w.
R398	3R77P473J	Composition: 4700 ohms ±5%, 1/2 w.
R399	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R400	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R407	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R408*	3R77P511K	Composition: 510 ohms ±10%, 1/2 w. Added to 4ES53A10, 12 by KEY F. Added to 4ES53A11, 13 by KEY E.
		- - - - - - - - - - TRANSITORS - - - - - - - - -
RT301	5490828P43	Thermistor: 0.11 megohm ±5%, color code yellow, green; sim to Global Type 055MB.
RT302	19C900048P10	Disc: 0.4 megohm ±10%; sim to GE 26D.
RT303	19C300048P11	Disc: 14,000 ohms ±5%; sim to GE 4D.
RT305	5490828P20	Thermistor: 22,800 ohms ±5%, color code black, orange; sim to Global Type 723B-1.
RT306	5490828P28	Thermistor: 8750 ohms ±5%, color code black, yellow; sim to Global Type 723F-2.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1		CABLE ASSEMBLY 19B216076G2
		- - - - - - - - - - PLUGS - - - - - - - - - -
P303	5496078P2	Jack: coaxial; sim to FXR 27-2.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	R330P1503F22	Eyelet, brass.
	19B209044P13	Cable, RF: approx 2 inches long.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY301 and XY302	5490277P1	Transistor: 4 contacts; sim to Elco 3303.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering, give GE Part Number and specify exact frequency needed.
		Crystal Frequency = (OF-19) ± 9.
Y301 and Y302	19B206890P2	Quartz: freq range 43-55 MHz, temp range -30°C to +85°C.
Y303	19B206357P2	Quartz: freq 18.545 MHz, temp range -30°C to +85°C.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B210058P1	Shield.
	19C311737G1	Shield. (Used with L313-L320).
	19B204612G1	Shield. (Used with L321 and L323).
	19B204442P1	Cover. (Used with L321 and L322).
	4036555P1	Insulator, disc. (Used with Q316 and Q319).
	19B204491P1	Cover. (Used with L313-L320).
	19A121088P1	Can. (Used with L304 and L305).
	19A127060P1	Can. (Used with L301 and L302).
	19A127484G1	Can. (Used with L304).
	4035306P40	Washer, fiber. (Used with Y303).

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 - Models 4ES53A10 & 12
Incorporated in initial shipments.

REV. A - Models 4ES53A11, 13
REV. B - Models 4ES53A10, 12
To remove the Low IF frequency from the squelch circuit and lower the maximum squelch opening level. Changed C412.

REV. B - Models 4ES53A11, 13
REV. C - Models 4ES53A10, 12
To replace capacitors no longer available. Changed C383, C386, and C394.

REV. C - Models 4ES53A11, 13
REV. D - Models 4ES53A10, 12
To provide adequate 1st oscillator injection voltage. Changed R306 and R312.

REV. D - Models 4ES53A11, 13
REV. E - Models 4ES53A10, 12
To improve multiplier reading on Position E of test set and set bias voltage for Q305. Changed R317 and R318. Changed C435 on 19D413084 -G3 & 4 only.

REV. E - Models 4ES43A11, A12
REV. F - Models 4ES53A10, A12
To incorporate new coils. Changed L313 thru L322, L324, R392, and R396. Added R408

REV. F - Models 4ES53A11, A12
REV. G - Models 4ES53A10, A12
To improve operation of Oscillator/Multiplier Q303 under temperature extremes. Changed Transistor Q303.

REV. H - Models 4ES53A12
REV. G - Model 4ES53A12
To incorporate a new transistor. Changed transistor Q304.

TROUBLESHOOTING PROCEDURE

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	Check your connections and continuity of supply leads, and check fuse in power supply. If fuse is blown, check receiver for short circuits.
NO REGULATED 10 VOLTS	Check the 12-volt supply. Then check regulator Q319 and regulator circuit. Resistance reading of 10-volt supply from the emitter of Q319 to ground should be 2K ohms.
LOW 2ND LIM READING	Check supply voltages and then check oscillator reading at J312-4 as shown in STEP 2A. Make SIMPLIFIED VTVM GAIN CHECKS from 2nd Mixer through 2nd Limiter stages as shown in STEP 2A.
LOW OSCILLATOR READING	Check alignment of Oscillator (Refer to Front End Alignment Procedure). Check voltage and resistance reading of Oscillator Q303. Check crystal Y301 (substitution method).
LOW RECEIVER SENSITIVITY	Check Front End Alignment (Refer to Receiver Alignment Procedure). Check antenna connections. Check voltage and resistance readings of RF Amp and 1st and 2nd Mixers. Make SIMPLIFIED GAIN CHECKS (STEP 2A).
LOW AUDIO	Check Audio PA (Q701) output current at J312-9. If reading is low-- a. Check BIAS ADJ for 0.25 VDC at J312-9 (STEP 2A). b. Check Q701. Make SIMPLIFIED GAIN and WAVEFORM CHECKS (STEPS 2A and 2B) of Audio and Squelch stages. Check unsquelched voltage readings in Audio section (Refer to Receiver Service Sheet). Check voltage and resistance readings on Channel Guard receiver.
IMPROPER SQUELCH OPERATION	Make GAIN and WAVEFORM CHECKS (STEPS 2A and 2B) of Audio and Squelch stages. Check voltage and resistance readings of Squelch circuit (Refer to Receiver Service Sheet).
DISCRIMINATOR IDLING TOO FAR OFF ZERO	See if discriminator zero is in the center of IF bandpass.

STEP 3- GAIN-PER-STAGE READINGS-

EQUIPMENT REQUIRED:

1. RF VOLTMETER (SIMILIAR TO BOONTON MODEL 91-CA OR MILLIVAC TYPE MV-18 C.
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION) CORRECT FREQUENCY CAN BE DETERMINED BY ZEROING THE DISCRIMINATOR.

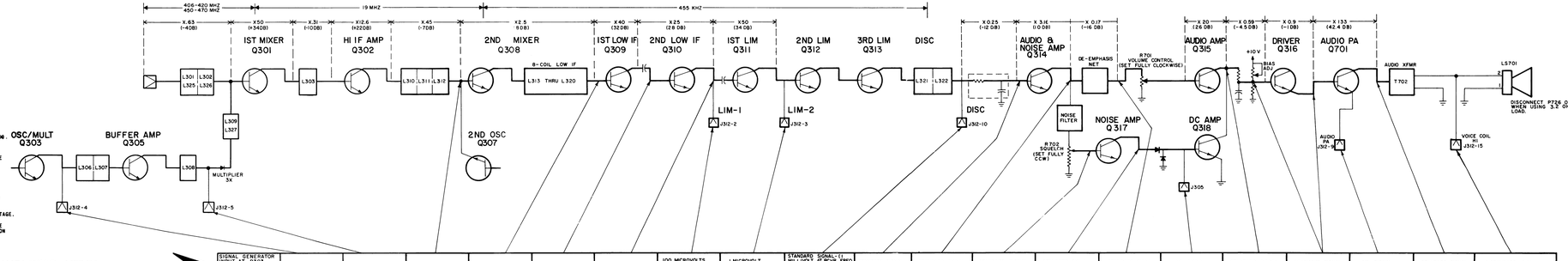
PROCEDURE

1. APPLY PROBE TO INPUT OF STAGE (FOR EXAMPLE, BASE OF RF AMP). PEAK RESONANT CIRCUIT OF STAGE BEING MEASURED AND TAKE VOLTAGE READING (E_1).
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (1ST MIXER W. REPEAK FIRST RESONANT CIRCUIT THEN PEAK CIRCUIT BEING MEASURED AND TAKE READING (E_2).
3. CONVERT READINGS (BY SUBTRACTING E_1 FROM E_2 ON THE DB SCALE OF RF VOLTMETER, OR) BY MEANS OF THE FOLLOWING FORMULA.

   AMP FACTOR $\frac{E_2}{E_1}$

4. CHECK RESULTS WITH TYPICAL GAINS SHOWN ON DIAGRAM BELOW.
5. USE PROCEDURE LISTED ABOVE TO FIND GAIN OF EACH STAGE.

NOTE: REMOVE CRYSTAL OR SHORT OUT OSC. BASE BEFORE MEASURING MIXER STAGES TO ELIMINATE INJECTION VOLTAGE.



STEP 2A- SIMPLIFIED VTVM GAIN CHECKS

EQUIPMENT REQUIRED:

1. VTVM-AC&DC
2. SIGNAL GENERATOR (MEASUREMENTS M560 EQUIV.)

PRELIMINARY STEPS:

1. SET VOLUME CONTROL FULLY CLOCKWISE.
2. SET SQUELCH CONTROL FULLY COUNTERCLOCKWISE.
3. RECEIVER SHOULD BE PROPERLY ALIGNED.

SIGNAL GENERATOR INPUT. ADJUST TO MAINTAIN SYSTEM AT DISCRIMINATOR ZERO			UNMODULATED	UNMODULATED	UNMODULATED	UNMODULATED	100 MICROVOLTS UNMODULATED	1 MICROVOLT UNMODULATED	STANDARD SIGNAL (1 MILLIVOLT AT RECVR FREQ MODULATED BY 1KHZ WITH 3.3KHZ DEVIATION)	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	NO SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	NO SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL
PROCEDURE			INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING DECREASES BY 5%	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING DECREASES BY 5%	INCREASE SIGNAL GENERATOR OUTPUT FROM 5000 UNTIL VTVM READING DECREASES BY 5%	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING DECREASES BY 5%													AFTER CHECKING WAVEFORMS ADJUST VOLUME CONTROL FOR RATED 1 WATT OUTPUT ACROSS 3.2 Ω LOAD.
READING	0.34 VDC EX-3-A 0.12 VDC MULTMTR 0.25 VDC	-1.14 VDC EX-3-A -0.52 VDC MULTMTR -0.85 VDC	GENERATOR OUTPUT SHOULD BE APPROX 10 MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 500 MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 600 MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 10 MICROVOLTS	1.75 VDC EX-3-A 0.34 VDC MULTMTR 0.75 VDC	1.25 VDC EX-3-A 0.26 VDC MULTMTR 0.55 VDC	0.50 VAC	0.1 VAC	0.70 VAC	0.06 VAC	1 VAC	.085 VAC	0.8 VDC	1.2 VAC	0.7 VAC	0.25 VDC	13 VAC	1.8 VAC

STEP 2B-AUDIO & SQUELCH WAVEFORMS

EQUIPMENT REQUIRED:

1. OSCILLOSCOPE
2. SIGNAL GENERATOR (MEASUREMENTS M560 OR EQUIVALENT)

SCOPE SETTING												
HORIZONTAL	0.5 MS/DIV (APPROX 200 HZ)	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	2 MS/DIV (500 HZ)	0.5 MS/DIV		0.5 MS/DIV	0.5 MS/DIV		0.5 MS/DIV	0.5 MS/DIV
VERTICAL	1 VOLT/DIV	100 MILLIVOLTS/DIV	1 VOLT/DIV	100 MILLIVOLTS/DIV	1 VOLT/DIV	100 MILLIVOLTS/DIV		1 VOLT/DIV	1 VOLT/DIV		10 VOLTS/DIV	1 VOLT/DIV
PEAK-TO-PEAK VOLTAGE	1.6 V P-P	0.3 V P-P	2.1 V P-P	0.4 V P-P	2.5 V P-P	0.24 V P-P		3.1 V P-P	1.8 V P-P		28 V P-P	6 V P-P
NOISE WAVE FORM												
STANDARD SIGNAL (1 MILLIVOLT AT RECEIVER FREQ MODULATED BY 1 KHZ WITH 3.3 KHZ DEVIATION)												

(RC-1877)

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service Parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MAINTENANCE MANUAL

LBI-4039

DF-1093

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

PRINTED IN U.S.A.