MOBILE RADIO

450-470 MHz

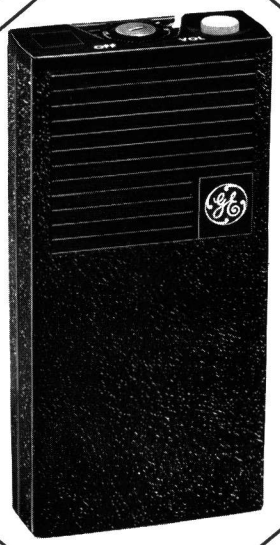
personal pager

PVO

DF-1103

LBI - 4550B

MAINTENANCE MANUAL



GENERAL ELECTRIC

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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-69-A
Frequency Range	450-470 MHz
Modulation Acceptance	±7 kHz
Channel Spacing	25 kHz
Selectivity	
EIA Method	-50 dB at ±25 kHz
20 dB Quieting	-50 dB at ±25 kHz
Chassis Sensitivity	
12 dB SINAD (EIA Method)	0.50 μV
20 dB Quieting Method	0.75 μV
Paging	0.25 μV
Spurious Response	-40 dB
Frequency Stability	.0005% (-10°C to +50°C)
Battery Drain (at 3.75 Volts)	
Squelched	15.0 milliamperes
Unsquelched	95 milliamperes
Audio Power Output	150 milliwatts
Alert Tone Output	200 milliwatts
Audio Distortion	Less than 10% at rated power output
Frequency Response	+2 dB and -10 dB of a standard 6 dB per octave de-emphasis curve from 300 to 3000 Hz (1000 Hz reference)

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

COMBINATION NOMENCLATURE

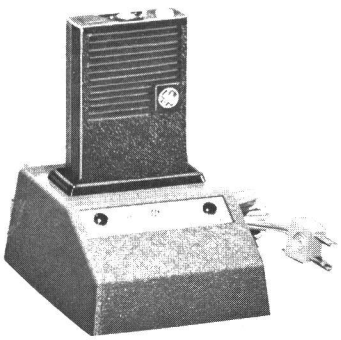
1st & 2nd Digits	3rd Digit	4th Digit	5th Digit	6th Digit	7th Digit	8th & 9th Digits
PRODUCT LINE	RF POWER	Channel Spacing	MODE OF OPERATION	ALERT TONES	Options	Frequency Range
PV Personal Pager	**0** Receive Only	**5** 25 kHz	**A** Individual Call Tone & Voice (Automatic Reset)	**W** Fixed Output	**L** Type 99 Decoder	**88** 450 - 470 MHz
			B Individual Call Tone & Voice (Push-To-Reset)	**V** Adjustable Output	**S** Noise Squelch	
			C Individual Call Tone & Voice (Push-To-Listen)	**U** Noise Squelch		
			D Individual Call Tone Only (Push-To-Silence)			
			E (Noise Squelch)			
			F Group Call Tone & Voice (Push-To-Reset)			
			G Group Call Tone & Voice (Push-To-Listen)			
			H Group Call Tone Only (Push-To-Silence)			

ACCESSORIES

DESK CHARGER
MODEL 4EP67A11 (Option 5406)

INDOOR ANTENNA
(Option 5406)

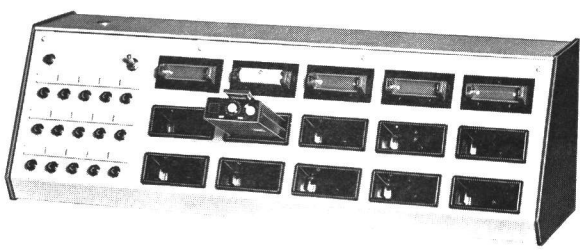
DESK CHARGER
MODEL 4EP67A10 (Option 5405)



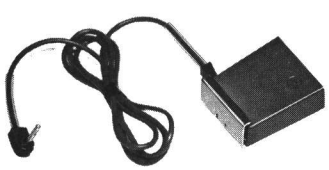
MOBILE CHARGER
MODEL 4EP75A10 (Option 5413)

5-WATT SPEAKER
MODEL 4EZ18A13 (Option 5422)

MULTI-CHARGERS
MODELS 4EP74A10-13 (Options 5407-5410)



LAPEL SPEAKER
& CORD SET
(Option 5420)



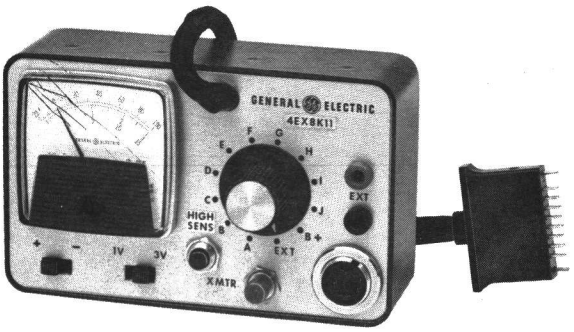
EARPHONE
(Option 5421)

LEATHER
CASE
(Option 5415)

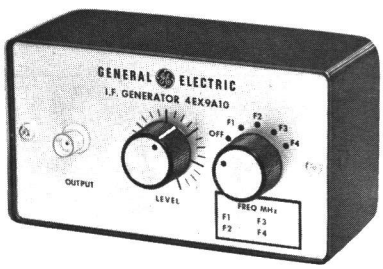
TEST EQUIPMENT

TEST SET
MODEL 4EX3A11 (TM-11, 12, 13, 16 & 17)

TEST KIT
MODEL 4EX8K11



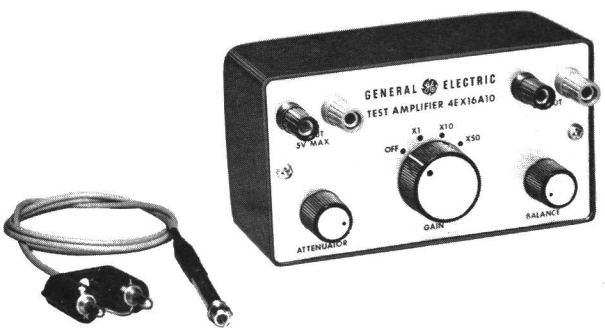
IF GENERATOR
MODEL 4EX9A10 (Option 4381)



For setting the receiver on frequency and for troubleshooting

TEST FIXTURE
MODEL 4EX17A10 (Option 5425)

TEST AMPLIFIER
MODEL 4EX16A10 &
RF PROBE 19C311370-G1 (Option 4382)



For receiver front end and IF gain measurements

VOLTAGE CALIBRATOR
MODEL 4EX10A10 (Option 4383)

For setting voltages on Personal Pager Battery Chargers

DESCRIPTION

General Electric Personal Paging receivers are extremely compact, high performance FM receivers for tone and voice paging in the 450-470 MHz range. The Personal Pagers are available for three differenct types of operation. The three types are:

- Voice and Type 99 tone signaling
- Type 99 tone signaling only
- Voice only (noise squelch)

The receiver is housed in a ruggedly-constructed, weatherproof and dustproof Lexan® case with a self-contained speaker, antenna and battery. All operating controls are conveniently mounted on the top of the case. An accessory jack on the top of the radio is provided for an external speaker or earphone. Directions for opening the accessory jack cover are contained in Figure 1.

Power for the Personal Pager is normally supplied by a single rechargeable nickel-cadmium battery that fits in a separate battery compartment in the bottom section of the case. The battery can be recharged either in or out of the receiver, depending on the battery charger used.

If desired, the Pager can also be operated by either a mercury battery or alkaline battery. However, these batteries are not rechargeable.

The Spring on the Pager may be used to clip the radio to a pocket or belt. The Pager may also be carried on a belt in an optional leather case.

OPERATION

The Personal Pager is shipped from the factory equipped for one of five different modes of operation. The operating mode of the receiver can be determined by noting the 5th digit of the combination number printed on the nameplate on the bottom of the case. The operating modes and controls for the different paging combinations are shown in the following chart.

5th Digit of Combination Number	Mode of Operation	Controls
A	Individual Call Tone and Voice (With Automatic Reset)	Push-to-Reset and OFF - VOLUME
B	Individual Call Tone and Voice Push-to-Reset	Push-to-Reset and OFF - VOLUME
C	Individual Call Tone and Voice Push-to-Listen	Push-to-Listen and OFF - VOLUME
D	Individual Call Tone Only Push-to-Silence	Push-to-Silence and OFF - VOLUME
E	Voice Only	Squelch and OFF - VOLUME
F	Group Call Tone and Voice Push-to-Reset	Push-to-Reset and OFF - VOLUME
G	Group Call Tone and Voice Push-to-Listen	Push-to-Reset and OFF - VOLUME
H	Group Call Tone Only Push-to-Silence	Push-to-Silence and OFF - VOLUME

TONE & VOICE RECEIVERS

PUSH-TO-RESET

Turn the receiver on by turning the OFF-VOLUME Control halfway to the right (see Figure 1). A short burst of tone and a continuous hissing sound should be heard from the speaker. Next, press down and release the Push-to-Reset button to cut off the hissing sound. The Personal Pager is now ready to receive messages.

Before a message is received, a short burst of tone will be heard, followed by the voice message. As soon as the message is completed, press the Push-to-Reset button to reset the receiver.

NOTE

In receivers equipped with the automatic reset option, the receiver will reset itself automatically within 36 seconds. However, the Push-to-Reset button may be pressed as soon as the message is completed to reset the receiver.

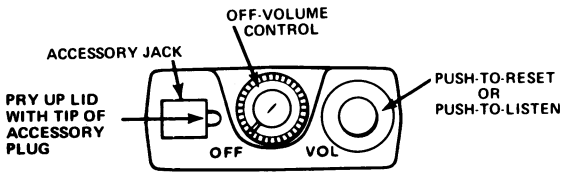


Figure 1 - Tone & Voice Receiver

PUSH-TO-LISTEN

Turn the receiver on by turning the OFF-VOLUME control halfway to the right (see Figure 1). A short burst of tone should be heard from the speaker.

Before a message is received, an alerting tone will be heard. As soon as the tone is heard, hold down the Push-to-Listen button to hear the voice message. Release the button as soon as the message is complete.

TONE ONLY RECEIVER

Turn the receiver on by turning the OFF-VOLUME Control halfway to the right (see Figure 2). A short burst of tone will be heard. The receiver is now ready to receive an alert tone--no voice message will be received. The tone may be silenced by pressing the Push-to-Silence button at any time before the tone ends.

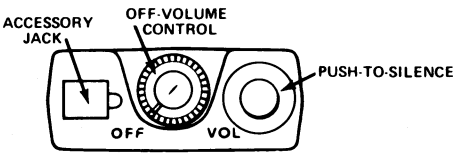


Figure 2 - Tone Only Receiver

VOICE ONLY RECEIVER

Turn the receiver on by turning the OFF-VOLUME Control halfway to the right (see Figure 3). Next, turn the SQUELCH control to the right until a continouous hissing noise is heard. Then slowly turn the SQUELCH control to the left until the hissing sound just fades out. The radio is now ready to receive voice messages.

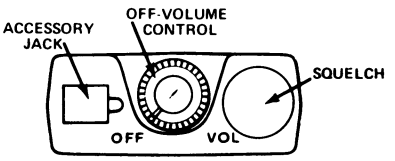


Figure 3 - Voice Only Receiver

BATTERY INFORMATION

The Personal Pager is shipped from the factory ready for immediate operation upon installation of the battery. Tne part number as well as battery life for each of the batteries is shown in the following chart.

Battery Type	GE Part Number	Equivalent	Pager Battery Life
Rechargeable	19A116252P1		12 hrs.
Mercury	19A116387P2 (package of 12)	Mallory TR133 Eveready T133	90 hrs.
Alkaline	19A116448P2 (Package of 6)	Mallory PX21	50 hrs.

The rechargeable battery is shipped from the factory in a fully-charged condition--ready for immediate use. If the radio has been stored for over 30 days, the battery should be fully recharged before using. When it is necessary to store the unit for over 30 days, it is recommended that the battery be kept on charge in one of the Personal Pager chargers.

BATTERY INSTALLATION OR REPLACEMENT

To replace the battery:

1. Turn the radio OFF.
2. Turn the captive screw to the left as far as it will go (see Figure 4).
3. Place a fingernail in the slot shown and pull down in the direction of the arrow. This will flip open the hinged battery compartment cover.
4. Replace the battery with the (+) end pointing toward the battery compartment opening (away from spring).

WARNING

Do not incinerate either the Mercury or the rechargeable battery. To do so may cause a battery to explode.

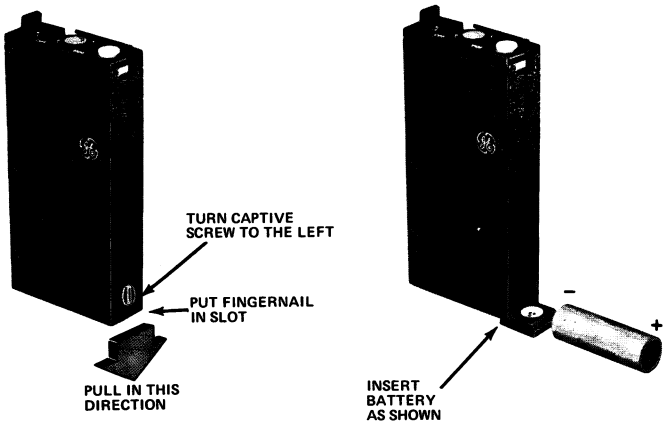


Figure 4 - Battery Replacement

NOTE

There is no way to dispose of mercury batteries without possible pollution except by returning them to the manufacturer for recycling.

Mallory Battery Company will buy all used mercury batteries at the current price of 60 cents per pound (price subject to change).

Batteries are to be shipped prepaid, enclosing a packing slip indicating who is to receive payment for the batteries, to:

Mallory Battery Company
Plant #2
Lexington, N.C. 27292

BATTERY CHARGERS

Three different type chargers are available for recharging the nickel-cadmium batteries used in the Personal Pager. The chargers include a desk charger, a multi-unit charger and a mobile charger. All of the chargers will fully recharge the battery in 14 hours.

A fully charged battery will operate the Pager for approximately 12 hours. In addition, an eight-hour charge will provide a sufficient charge to operate the Pager for one day (8 hours).

NOTE

Due to the temperature characteristics of nickel-cadmium batteries, the batteries will not accept a full charge at temperature extremes. For maximum capacity, recharge the battery at a room temperature of from 65° to 85° Fahrenheit whenever possible.

The chargers are designed to prevent the battery from being overcharged. Whenever the battery is charged to approximately 70% of capacity, the charging circuit applies a trickle charge for the remainder of the charging cycle. The battery may be safely left on trickle charge for as long as desired.

Refer to the applicable Maintenance Manual for complete instructions.

WARNING

Do not attempt to recharge Mercury batteries. To do so may cause the batteries to explode.

DESK CHARGER

Two desk chargers are available for recharging the nickel-cadmium battery from a 120-Volt, 50/60 Hz source. Charger Model 4EP67A10 will recharge one battery in the radio, and charger Model 4EP67A11 will recharge one radio and one battery.

To use the desk charger, turn the Pager OFF. Then place the radio into the charging insert, or the battery into the battery charging clip. The red charge light(s) will glow brightly at the beginning of the charge cycle and will gradually become dimmer until it goes out, indicating that the charger is on trickle charge. The charge will fully recharge the battery in an additional 6 hours.

Charger Model 4EP67A11 is also equipped with an antenna jack for connecting the Pager to an external antenna. Placing the Pager into the charging insert with the speaker facing the front of the charger automatically connects the Pager to the external antenna. The Pager may be turned ON to monitor the channel and receive messages while in the charger. The battery can be charged up to approximately 50% of capacity with the Pager turned ON.

An optional indoor antenna is available for use with the 4EP67A11.

MULTI-CHARGER

Four multichargers are available for recharging up to 15 radios, 15 batteries, or a combination of radios and batteries.

To use the multicharger, plug the power cable into a 120-Volt, 50/60 Hz source. Then turn the OFF-ON switch to the ON position. Next, place the radios into the battery charging clips. The green charge light will glow brightly at the start of the charging cycle, and will gradually become dimmer until it goes out, indicating that the charger is on trickle charge. The charger will fully recharge the batteries in an additional 6 hours.

MOBILE CHARGER

The mobile charger recharges one radio from the vehicle battery, and is shipped with an external antenna. To use the charger, turn the Pager OFF and make sure that the charger is ON. Due to the low battery drain, it is not necessary to turn the charger off unless the charger will not be used for long periods of time. Next, press open the belt clip on the Pager and place the radio into the charging insert with the speaker towards the front of the insert. Press the Pager into the Charger until the belt clip catches into the retaining slot.

The radio can be turned ON and used to monitor the channel and receive messages while in the charger. The battery can be charged up to approximately 50% of capacity with the Pager turned on.

An optional 5-Watt speaker is available for use with the mobile charger. The charger ON-OFF switch also turns the 5-Watt speaker on and off.

INITIAL ADJUSTMENT

The initial adjustment for the Personal Pager includes zeroing the receiver to the system operating frequency and tuning the antenna circuit and front end coils. Refer to the FRONT END ALIGNMENT in the ALIGNMENT PROCEDURE as listed in the Table of Contents.

MAINTENANCE

SERVICING THE RECEIVER

If the radio should begin to operate improperly, the first thing to suspect is a discharged battery. If a freshly recharged battery or a new mercury or alkaline battery fails to restore the radio to its normal operating condition, refer to the Troubleshooting Procedure for help in isolating and correcting the problem.

A complete procedure is provided in this manual for disassembling the radio for servicing. Refer to the DISASSEMBLY PROCEDURE as listed in the Table of Contents.

TEST AND TROUBLESHOOTING PROCEDURES

Whenever difficult servicing problems occur, the Test Procedure for the receiver can be used by the serviceman to compare the actual performance of the unit to the specifications met by the Pager when shipped from the factory.

In addition, a Troubleshooting Procedure is available for the receiver, tone and Squelch boards. For best results, the Test Procedure should be used in conjunction with the Troubleshooting Procedure when servicing the radio (see Table of Contents).

RECEIVER MODIFICATIONS

The Personal Pager can be easily modified in the field for the following modes of operation:

- Setting the alerting tone output level by means of the VOLUME control in all receivers with Tone.
- Changing from Push-to-Reset to Push-to-Listen in Tone and Voice receivers.
- Changing from Push-to-Listen to Push-to-Reset in Tone and Voice receivers.
- Changing from Tone and Voice to Tone Only.

Instructions for these changes are contained on the applicable Schematic Diagram as listed in the Table of Contents.

CIRCUIT ANALYSIS

General Electric Personal Paging receivers Type ER-69-A are double-conversion, superheterodyne receivers for tone and voice paging in the 450-470 MHz range. The circuit boards used in the different receiver applications are shown in the following chart.

APPLICATION	RECEIVER BOARD
TONE AND VOICE	19D417348G1
TONE ONLY	19D417348G1
VOICE ONLY	19D417353G1

References to symbol numbers mentioned in the following text are found in the Outline Diagram, Schematic Diagram and Parts List (see Table of Contents).

RECEIVER BOARD

ANTENNA & RF AMP

RF from the belt-clip antenna is coupled through the antenna circuit to the base of RF Amplifier Q301. The antenna circuit consists of L301 and capacitors C302 and C303. The circuit is tuned by C303.

The output of Q301 is coupled through C306 to helical resonators L3 and L1. The output of L1 is applied to the base of first mixer A303-Q1.

1ST OSCILLATOR & MIXER

1st Oscillator A301-Q1 is a third mode oscillator that operates in the 47 to 50 MHz range. The crystal is connect in the oscillator feedback path to permit oscillator at the crystal frequency only. A301-L1, C1 and C2 make up the mode-selective resonant circuit. Tuneable coil L1 permits the oscillator frequency to be shifted slightly for setting the receiver on the system operating frequency.

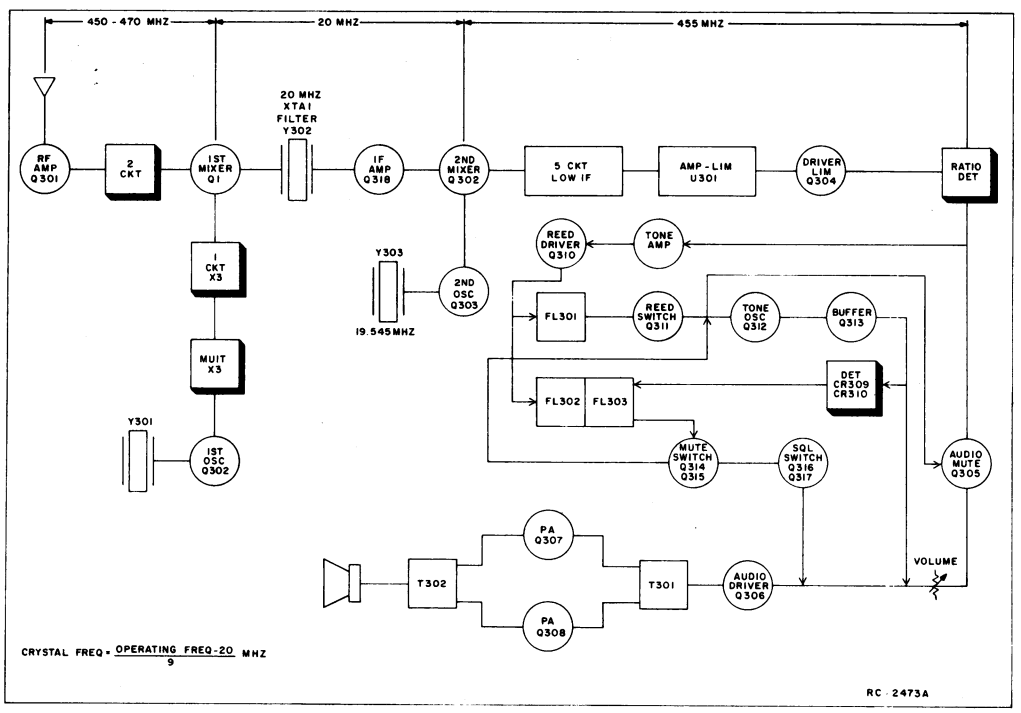


Figure 5 - Tone and Voice Receiver Block Diagram

The oscillator output is transformer-coupled through A302-L1 and C2 to the base of Multiplier A302-Q1. A302-L1 is tuned to three times the crystal frequency. A302 helical resonator is tuned to nine times the crystal frequency. The oscillator stage is metered at TP1.

RF from the helical resonators L3 and L1, is applied to the base of 1st Mixer A303-Q1. The injection frequency from the oscillator and multiplier is applied to the emitter of the 1st Mixer A303-Q1. The 20-megahertz high IF output is coupled through high IF crystal filter Y302, providing High-IF selectivity, to the base of the High-IF Amplifier Q318.

2ND OSCILLATOR & MIXER

Q303 operates as a Colpitts oscillator with a crystal frequency of 19.545 megahertz. The High-IF signal from the 1st Mixer and the low side injection frequency from the 2nd oscillator is applied to the base of 2nd mixer Q302 producing the 455-kilohertz Low-IF output. The 2nd Mixer Stage is metered at TP4.

Following the 2nd Mixer is a five coil Low-IF filter (L304 through L308) that provides the main receiver selectivity.

AMP-LIMITER & DRIVE-LIMITER

The Low IF filter output is applied to Pin 10 of the integrated circuit Amplifier-Limiter (U301). The IC amplifies the Low IF signal and provides some limiting at high signal levels.

The IC output at Pin 5 is coupled through C324 to the base of Driver-Limiter transistor Q304. The output of Q304 is applied directly to the ratio detector.

RATIO DETECTOR

A ratio detector is used to demodulate the 455 kHz IF signal. This type of detector provides a high degree of AM rejection. The recovered audio, tone and noise is obtained from the tertiary winding of L309. The ratio detector is metered at TP2.

AUDIO STAGES

Tone and Voice Receiver

The ratio detector output is applied to both the base of Audio Mute transistor Q305 and to the Decoder input. Applying the proper sequential tones to the receiver activates the Decoder circuitry and the audio stages causing a 2800 Hz tone to be heard at the speaker.

After the alerting tone is completed, the output of Q305 is coupled through VOLUME control R388 to the base of Audio Amp Q306.

The output of Q306 is transformer-coupled through T301 to provide phase inversion for the push-pull audio PA stage.

Q307 and Q308 operate as a class B, push-pull audio PA. The PA output is coupled through audio transformer T302 to the loudspeaker. C343, R341 and R342 provide a negative feedback loop from the output of T302 to the base of Q306 for added stability of the PA stage.

Voice Only Receiver

The ratio detector output is applied to both the base of Audio Mute transistor Q305 and to the Squelch input. Q305 operates as an emitter-follower in Voice Only receivers.

Applying a carrier to the receiver unsquelches the unit and activates the audio stage. The output of Q305 is coupled through VOLUME control R388 to the base of Audio Amp Q306.

The output of Q306 is transformer-coupled through T301 to provide phase inversion for the push-pull audio PA stage.

Q307 and Q308 operate as a class B, push-pull audio PA. The PA output is coupled through audio transformer T302 to the loudspeaker.

C343, R341 and R342 provide a negative feedback loop from the output of T302 to the base of Q306 for added stability of the audio PA.

Tone Only Receiver

In tone only receivers, the audio stages consist of Audio amp Q306 and Audio PA Q307-Q308. The output of the Audio Mute Q305 is not coupled to the Volume Control R388. The ratio detector output is applied to the Decoder Circuit.

Applying the proper sequential tone to the receiver activates the Decoder circuitry and Audio Amp Q306.

A 2800 Hz alerting tone from the decoder is applied to the base of Q306. The output of Q306 is transformer-coupled through T301 to provide phase inversion for the push-pull audio PA stage.

Q307 and Q308 operate as a class B, push-pull audio PA. The PA output is coupled through audio transformer T302 to the loudspeaker.

SQUELCH CIRCUIT

The Squelch Circuit, in voice only receivers, consists of 1st Noise Amp Q309, Active Filter Q310, 2nd Noise Amp Q311 and Squelch Switch Q312.

Noise from the ratio detector operates the squelch circuit. With no carrier applied to the receiver, noise is coupled through SQUELCH control R390 to the base of 1st Noise Amp Q309. R390 determines the gain of the Noise Amplifier by varying the noise amplitude to the base of Q309.

The output of Q309 is applied to an active, high-pass filter that attenuates frequencies below 3 kHz. The filter consists of C347, C348, C349, R349, R350 and Q310.

Following the high-pass filter is 2nd Noise Amp Q311. The output of Q311 is rectified by CR305 and CR306, and filtered by R357 and C353 to produce a positive DC voltage. The positive voltage is applied to the base of PNP Squelch Switch Q312, turning it off.

The collector of Q312 is tied to the base of Audio Driver Q306. Turning off Q312 changes the bias voltage to the Audio Driver transistor Q306, turning it off.

When the receiver is quieted by a carrier, the receiver noise is reduced. This removes the positive voltage on the base of Squelch Switch Q312 turning it on. Turning on Q312 applies the bias voltage to Q306, allowing it to conduct so that sound is heard from the speaker. Capacitor C354 in the collector of Q312 slows down the switching action of the transistor to provide a more positive switching action. Resistor R354 connects from the collector of Q312 to the base of Q311 providing a hysteresis loop in the squelch circuit. When a weak signal opens the squelch, the signal level may be reduced by approximately 3 dB without the squelch closing.

TYPE 99 DECODER

Type 99 Decoder Circuit is a two or three reed sequential tone decoder for operation with any two-tone sequential encoder in individual call applications. The two or three reeds plug into pins mounted on the receiver board, and are available for operation on tone frequencies in the 517.5 to 997.5 Hertz range.

The decoder circuit is used in tone and voice and tone only receivers. Timing waveforms for the decoder are shown in Figure 6. It is recommended that these waveforms be studied in conjunction with circuit analysis for a better understanding of the decoder operation.

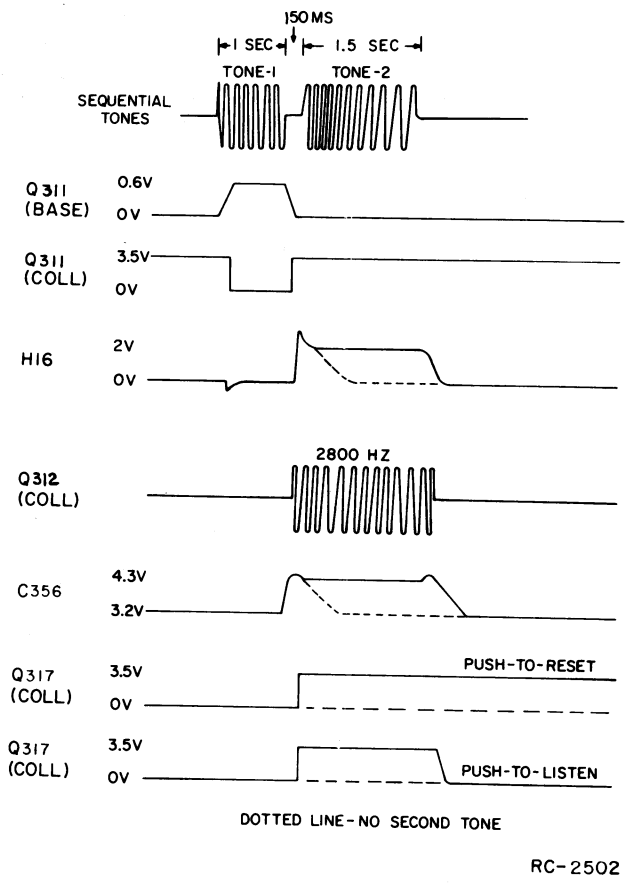


Figure 6 – Decoder Timing Waveforms

TONE AMP & REED DRIVER

The ratio detector output is amplified by Tone Amp Q309 and then applied to the base of Reed Driver Q310. Capacitor C344 provides 455 kHz and high frequency roll-off. The square-wave output of Q310 drives the reeds.

REED SWITCH

The reeds are selected to respond to one combination of sequential tones. When the first tone of a two-tone sequential call is received, the contacts of FL301 close. This applies the battery voltage to the base of Reed Switch Q311, turning it on.

When turned on, the collector potential of Q311 drops to ground for the duration of the tone discharging C349 (see Figure 6). As soon as the first tone stops, Q311 turns off and C349 starts charging through R353.

The charging current also flows through R354 and R355 developing a positive potential of approximately +2 Volts at H22.

The +2 Volts at H22 is applied to the base of Auto Mute transistor Q305 on the receiver board, turning the transistor off. Q305 remains off while the sequential tones are being applied so that only the alerting tone will be heard from the speaker.

TONE ALERT OSCILLATOR & BUFFER

The voltage developed across divider network R354 and R355 turns on Tone Alert Oscillator Q312.

Q312 operates as a 2800 Hertz oscillator with a "twin-T" feedback loop consisting of C351, C352, R356, C353, R357 and R358.

Buffer Q313 follows the oscillator. The Buffer tone output is applied to a voltage doubler (CR309 and CR310) where the rectified output charges C356.

The buffer tone output is also applied to the base of Audio Driver Q306. The Audio Amp is turned off until the second sequential tone activates the decoder logic circuitry.

If the second tone is not applied to the decoder, the voltage at H22 drops to ground and C356 stops charging (see Figure 6).

MUTE & SQUELCH SWITCHES

The Mute and Squelch switches are activated by the second sequential tone. When the second tone is received, the contacts of FL302 or FL303 close. This applies a positive trigger pulse from the charge in C356 to the emitter of Q314 and to the base of Q315.

FL303 is paralleled with FL302 for Group Call applications. See DATAFILE BULLETIN DF-5000-3A.

Mute Switch

Mute Switch transistors Q314 and Q315 are normally off. Applying the trigger pulse to the emitter of Q314 turns it on, which turns on Q315. The emitter of Q315 connects to the cathode of CR308 in the base circuit of Tone Alert Oscillator Q312. Turning on Q315 applies the bias voltage to the base of Q312 keeping the oscillator running and charging C350. The bias voltage is also applied to the base of Audio Mute transistor Q305, keeping the transistor turned off. The positive voltage is applied to the base of Q305 and Q312 for the duration of the sequential tone.

Squelch Switch

In the Squelch Switch transistor Q316 is normally on and Q317 is normally off (reset). The collector of Q317 is connected to the base of Audio Driver Q306. When Q317 is turned off, its collector is at ground potential, keeping Q306 turned off.

Applying the trigger pulse turns off Q316 and turns on Q317. Turning on Q317 applies the bias voltage to the audio driver transistor, turning it on so that sound can be heard from the speaker.

In Pagers connected for Push-to-Reset, turning the radio on causes Q317 to conduct. This causes a short burst of tone and then noise to be heard from the speaker. Q317 will conduct until the Push-to-Reset button is pressed, grounding the base of Q316 and turning it on. Turning on Q316 turns off Q317 resetting the Squelch Switch. A simplified Push-to-Reset Circuit is shown in Figure 7.

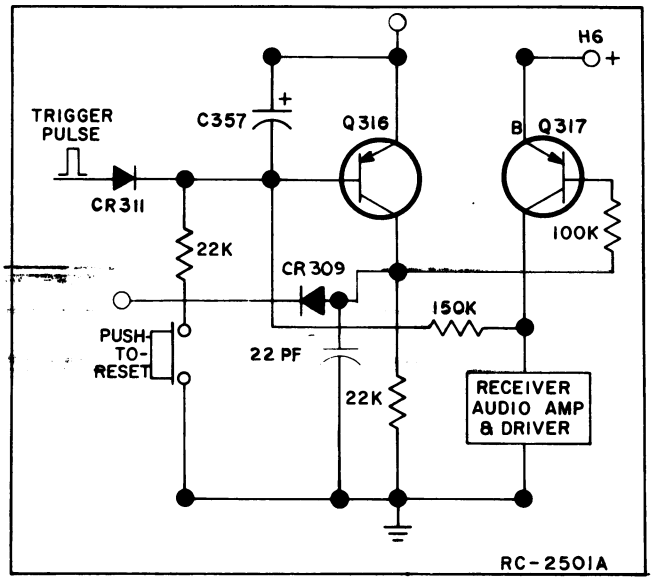


Figure 7 - Push-To-Reset Circuit

In Pagers with the automatic reset option, transistors Q319 and Q320 operate as a momentary switch for automatically resetting the Squelch Switch (Q316 and Q317).

The emitter of Q320 is connected to the collector circuit of Q317 while the collector of Q319 is connected to the base of Q316. When the proper tones turn on Q317 the battery voltage is applied to the emitter circuit of Q320 and capacitor C365.

In approximately 30 seconds, the charge on C365 is sufficient to momentarily turn on

Q320, which momentarily turns on Q319. When turned on, the collector of Q319 drops to ground, applying a momentary ground to the base of Q316, turning it on. Turning on Q316 turns off Q317 resetting the Squelch Switch.

Pressing the Push-To-Reset button turns Q316 on and Q317 off. The Squelch Switch will remain in this state until the radio is turned off and on again, or until the circuit is triggered by the proper sequential tones.

In pagers connected for Push-To-Listen, turning the radio on causes Q317 to conduct until C357 charges up, allowing a short burst of tone to be heard from the speaker. When C357 charges, Q316 turns on and Q317 turns off. A simplified Push-To-Listen circuit is shown in Figure 8.

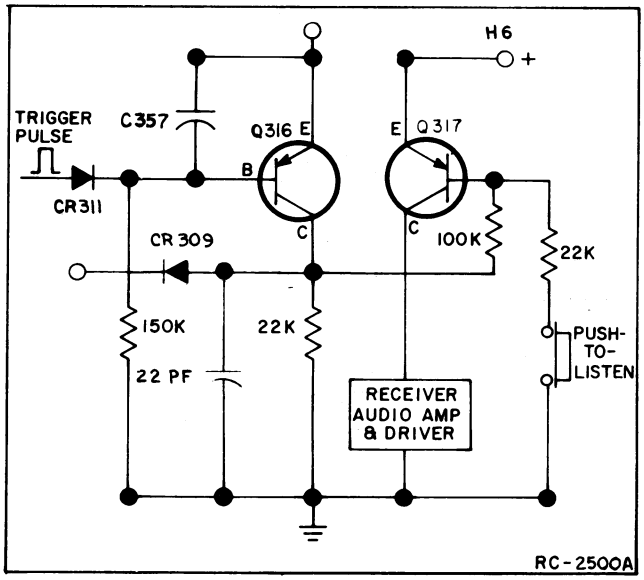


Figure 8 - Push-To-Listen Circuit

When the circuit is triggered, C316 is turned off and Q317 is turned on until C357 charges up, allowing the alerting tone to be heard. When charged, Q316 turns on and Q317 turns off. Pressing the Push-To-Listen button turns on Q317. The transistor will remain on as long as the button is held down.

Determination of Tone Frequencies

Tables I and II enable the technician to determine the tone frequencies without opening the radio to examine the reeds.

For example, assume the paging number to be 123. The first digit of the paging number is a 1. Look in Table I, and read down the column labeled "100's Digit" to a 1. Read horizontally across to the column labeled "10's Digit". The tone group is B. The second digit of the paging number is a 2. The tone number is B2. Look in Table II and down the column labeled "Tone Designator" to find B2. Read horizontally across to the column labeled "Tone Frequency". The first tone frequency is 787.5 Hz.

To determine the second tone frequency look in Table I and as before, find the first digit of the paging number 1. Read horizontally across to the column labeled "1's Digit".

The second tone group is A. The third digit of the paging number is a 3 and the Tone Designator is A3. In Table II read down the column labeled "Tone Designator" and find A3. Read horizontally across the column labeled "Tone Frequency". Tne second tone frequency is 802.5 Hz.

For different paging numbers, locate the first digit in the "100's Digit" column and determine the tone frequencies as described in the example. For a complete description of tone applications see DATAFILE BULLETIN DF-5000-3A

Table I - Tone Groups

100's Digit	10's Digit	1's Digit
	For 1st Tone	For 2nd Tone
0	A	A
1	B	A
2	B	B
3	A	B
4	C	C
5	C	A
6	C	B
7	A	C
8	B	C
9	Not Used	

Table II - Tone Generator Frequencies

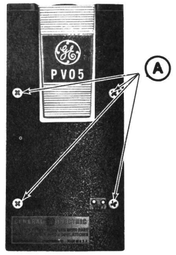
Tone Group	Tone Designator	Tone Frequency
A	A0	682.5 Hz
	A1	592.5 Hz
	A2	757.5 Hz
	A3	802.5 Hz
	A4	847.5 Hz
	A5	892.5 Hz
	A6	937.5 Hz
	A7	547.5 Hz
	A8	727.5 Hz
	A9	637.5 Hz
B	B0	652.5 Hz
	B1	607.5 Hz
	B2	787.5 Hz
	B3	832.5 Hz
	B4	877.5 Hz
	B5	922.5 Hz
	B6	967.5 Hz
	B7	517.5 Hz
	B8	562.5 Hz
	B9	697.5 Hz
C	C0	667.5 Hz
	C1	712.5 Hz
	C2	772.5 Hz
	C3	817.5 Hz
	C4	862.5 Hz
	C5	907.5 Hz
	C6	952.5 Hz
	C7	532.5 Hz
	C8	577.5 Hz
	C9	622.5 Hz
Diagonal Tone		742.5 Hz

DISASSEMBLY PROCEDURE

Equipment required:

- Small Phillips-head screwdriver for loosening the front cover retaining screws.
- Small metal pick or scribe for prying up the tone or squelch board.
- Sharp knife for removing the speaker.

To gain access to the receiver:



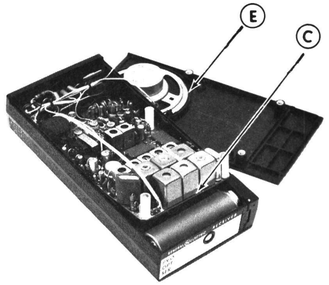
1. Turn the radio OFF.
2. Loosen the four captive screws (A) .
3. Turn the radio on its back and carefully lift up the front cover by the end nearest the battery compartment (B) . Then, carefully lift off the cover.
4. If the GE Test Fixture is not used, place a block under the front cover to prevent any wires from pulling loose.

NOTE

When replacing the front cover, place the edge of the front cover into the groove at the top of the case and close the cover. In Pagers with Type 99 Tone Decoder board, it may be necessary to gently push the reeds aside with a screwdriver so that the reeds will clear the receiver shielding.

To remove the receiver board:

1. Remove the front cover as directed above.
2. Lift up the receiver chassis by the end nearest the battery compartment (C) and lift out the receiver.



To replace the speaker:

1. Cut around the outside edge of the speaker to separate the weatherproof seal, and pry up the speaker at (E) .
2. Unsolder the two speaker leads and lift the speaker out of its mounting hole.
3. Remove any of the old sealant remaining in the speaker mounting hole.
4. Run a bead of RTV 102 (GE Part No. 19A115153-P3) around the edge of the speaker mounting hole, and insert the new speaker with the terminals located as shown (E) .

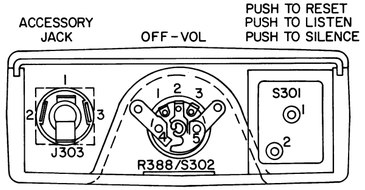
REPLACEMENT PROCEDURE

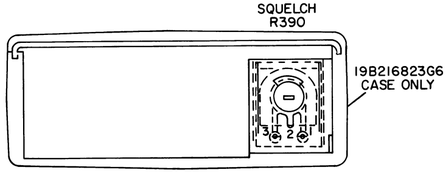
Equipment Required:

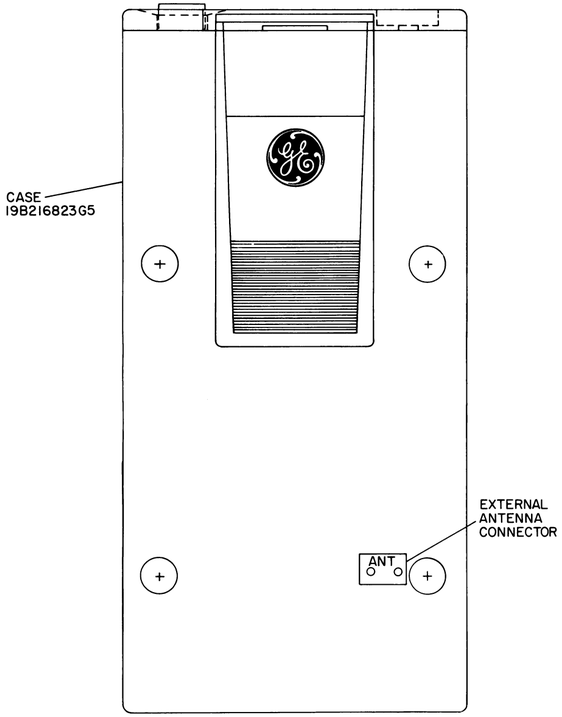
- A pencil-type, 40-to 60-watt soldering iron with the following tips:
  - A medium chisel tip for unsoldering individual component lead.
  - A large chisel tip for simultaneously unsoldering all leads of a module or component.
  - A small pencil tip for soldering in the new components.
- A round, wooden toothpick for cleaning solder out of mounting holes.

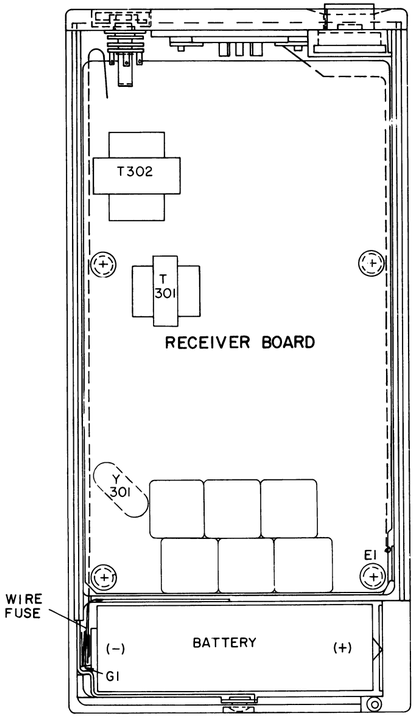
Procedure:

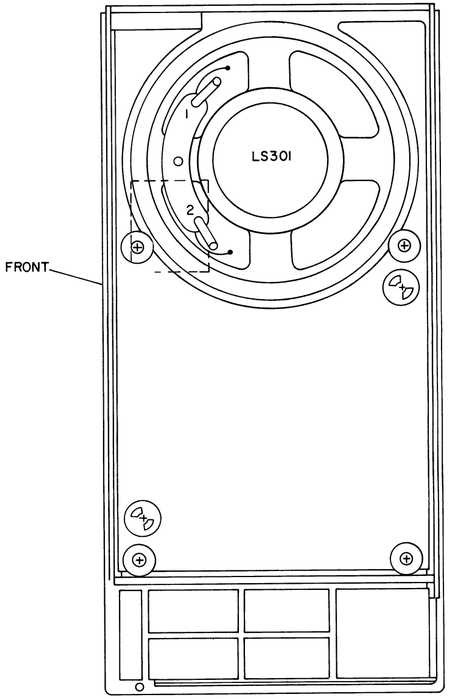
1. Clip out and remove the defective component (when possible) so that the leads can be removed individually.
2. Collect a puddle of melted solder on the flat side of the chisel tip.
3. Hold the melted solder against the bottom of the printed circuit board to melt the solder holding the component or module leads.
4. Carefully remove the lead(s), and clean out the mounting hole(s).
5. Solder in the new component on the bottom side of the board using the small pencil tip on the soldering iron.











MODULE LAYOUT DIAGRAM

PERSONAL PAGER TYPE ER-69-A

(19D417673, Rev. 0)

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED:

1. GE Test Set Models 4EX3A10 (TM11 or TM12) or 4EX8K11, or 20,000 ohms-per-Volt multimeter.
2. A 455 kHz signal source (IF Generator Model 4EX7A10 or equivalent), and a 450-470 MHz signal source (M800 Signal Generator or equivalent.
3. Test Amplifier Model 4EX16A10 and RF Probe 19C311370G1. Connect the Test Amplifier to the GE Test Set.
4. Test Fixture Model 4EX17A10.

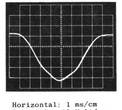
PRELIMINARY CHECKS & ADJUSTMENTS

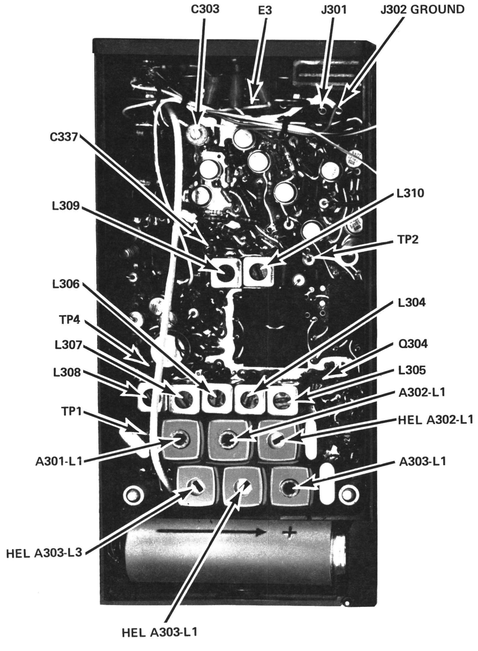
1. If Test Fixture Model 4EX17A10 or an external 3.7-Volt supply is not used, install a freshly-charged nickel-cadmium battery or a new mercury or alkaline battery.
2. In voice only receivers, turn the receiver ON and set the SQUELCH control fully counterclockwise and the VOLUME control to minimum.

   In tone and voice receivers, turn the receiver on and set the VOLUME control to minimum. For Push-To-Reset combinations, press the Push-To-Reset button.

   In tone only receivers, connect a 0.1 µfd capacitor between H26 and emitter of Q305. This will allow normal receiver noise to be heard in the speaker. Refer to the receiver Outline Diagram for hole locations.
3. Disconnect the lead of C301 from E2 (see Figure 9). The recommended signal generator setup is shown in Figure 10.

ALIGNMENT PROCEDURE

STEP	METERING POINT	TUNING CONTROL	PROCEDURE
			RATIO DETECTOR
1.	Positive End of C337	L309	Connect a 455 kHz signal between the case of Q302 and ground. Maintaining the generator level below limiting, adjust L309 for maximum output at C337.
2.	TP2	L310	Adjust L310 for Zero output at TP2.
3.	Positive end of C337 and TP2	L309 & L310	Repeat Steps 1 and 2 until the maximum output at the positive end of C337 coincides with a zero reading at TP2. Disconnect the 455 kHz generator.
			1st OSCILLATOR
4.	TP1	A301-L1 & A302-L1	Adjust A301-L1 for a maximum meter reading at TP1. Tune A302-L1 for a very small dip at TP1.
			HI & LO IF FILTER
			The IF Circuits have been aligned at the factory and will normally require no further adjustment. Should alignment become necessary, use the procedure outlined in Steps 5 and 6.
5		See Procedure	Connect the scope, signal generator and detector as shown in Figures 10 and 11. Apply an on-frequency signal using the lowest possible input level to avoid limiting. Modulate the generator with 20 Hz at 10 to 16 kHz deviation. NOTE An on-frequency signal is easily determined by zero beating the channel signal with the 455 kHz marker generator signal. Loosely couple the 455 kHz generator to the case of Q302 and adjust the RF level of the RF signal generator to 20 dB quieting level.
6.	TP4  Horizontal: 1 ms/cm Vertical: .01 Volt/cm	L308, L307, L306, L305, L304, and A303-L1	Tune L308, L307, L306, L305 and L304 for minimum ripple. This should be near maximum amplitude. Tune A303-L1 for maximum amplitude and best shape on scope as shown on scope wave form, keeping the signal below saturation.
			FRONT END
7.		A302-L1, helicals L3, L1, of A303 and C303	Apply an on-frequency signal as above and tune the helical of A302, helicals L3 and L1 of A303 and C303 for maximum quieting. NOTE Do NOT tune Mixer Coil of A303
			1st OSCILLATOR
8.		A301-L1	Apply an on-frequency signal as above. Loosely couple 455 kHz to the receiver and adjust A301-L1 for zero beat to the speaker.
			ANTENNA CIRCUIT
9.	TP3 or TP4	C303	Apply radiated, on-frequency signal to the receiver antenna and adjust C303 for best quieting.



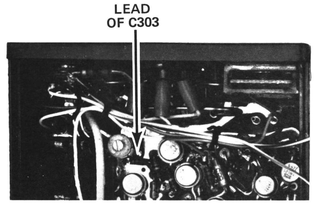


Figure 8 - Signal Generator Connections

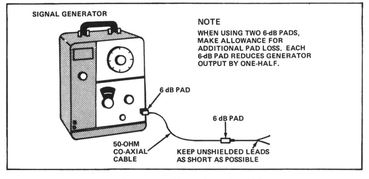


Figure 9 - Signal Generator Setup

NOTE 1: Appendix A of DATAFILE Bulletin 1000-6 contains instructions for building a sweep modulator.

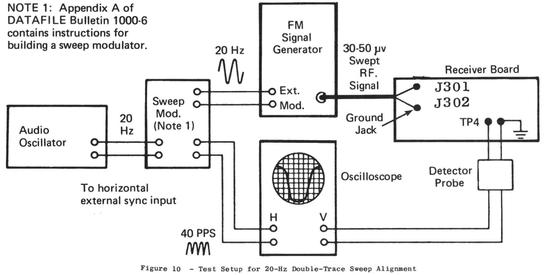


Figure 10 - Test Setup for 20-Hz Double-Trace Sweep Alignment

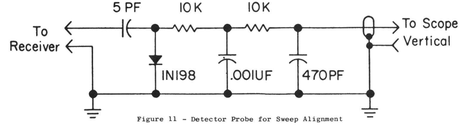


Figure 11 - Detector Probe for Sweep Alignment

FRONT END ALIGNMENT

EQUIPMENT REQUIRED

1. A 450-470 MHz signal source (M800 Signal generator or equivalent).
2. GE Test Set Models 4EX3A11, 4EX8K11, or a 20,000 ohm-per-Volt meter. Test Fixture Model 4EX17A10 is also recommended.

PRELIMINARY CHECKS & ADJUSTMENTS

1. If Test Fixture Model 4EX17A10 or an external 3.7-Volt supply is not used, install a freshly-charged nickel-cadmium battery or a new mercury or alkaline battery.
2. In voice only receivers, turn the receiver ON, and set the SQUELCH control fully counterclockwise and the VOLUME control to minimum.

   In tone and voice receivers, turn the receiver ON and set the VOLUME control to minimum. For Push-To-Reset combinations, press the Push-To-Reset button.

   In tone only receivers, connnect a 0.1 µfd capacitor between H26 and emitter of Q305. This will allow normal receiver noise to be heard in the speaker. Refer to the receiver Outline Diagram for hole locations.
3. If Test Fixture Model 4EX17A10 is used, connect the signal generator to the Text Fixture antenna connector. If the Test Fixture is not used, connect the signal generator high to J301 and the signal generator low to ground jack J302. The recommended signal generator set-up is shown in Figure 10.

ALIGNMENT PROCEDURE

STEP	METERING POINT	TUNING CONTROL	PROCEDURE
			FRONT END
1.		H302-L1, helicals L3, L1 and C303	Apply an on-frequency signal as above and tune the helical of A302, helicals L3 and L1 of A303, and C303 for maximum quieting. NOTE Do NOT tune Mixer Coil A303
			1st OSCILLATOR
2.		A301-L1	Apply an on-frequency signal as above. Loosely couple 455 kHz to the receiver and adjust A301-L1 for zero beat to the speaker.
			ANTENNA CIRCUIT
3.	TP3 or TP4	C303	Apply radiated, on-frequency to the receiver antenna and adjust C303 for best quieting.

ALIGNMENT PROCEDURE

450—470 MHz PERSONAL PAGER
TYPE ER-69-A

TEST PROCEDURES

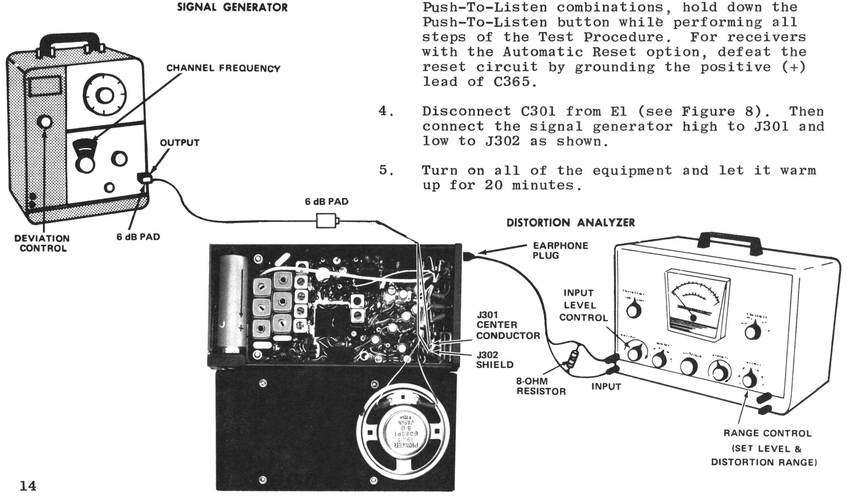
These Test Procedures are designed for checking receiver specifications, and for helping service a receiver that is operating--but not properly. The problems encountered could be low power, poor sensitivity, distortion, ratio detector not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pinpointed, 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 turned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to: Heath IM-12
- Signal Generator similar to: Measurements M-800
- 6-dB attenuation pad, and 8-ohm resistor

PRELIMINARY ADJUSTMENTS

1. If Test Fixture Model 4EX17A10 is not used, connect an external 3.75-Volt supply to the receiver or install a freshly-charged or new battery.
2. If the Test Fixture is not used, connect the test equipment to the receiver as shown for all steps of the Test Procedure.
3. In Voice Only receivers, turn the receiver ON and set the SQUELCH control fully clockwise for all steps of the Test Procedure. In Tone and Voice receivers with Push-To-Reset, do not press in the Push-To-Reset button. For Push-To-Listen combinations, hold down the Push-To-Listen button while performing all steps of the Test Procedure. For receivers with the Automatic Reset option, defeat the reset circuit by grounding the positive (+) lead of C365.
4. Disconnect C301 from E1 (see Figure 8). Then connect the signal generator high to J301 and low to J302 as shown.
5. Turn on all of the equipment and let it warm up for 20 minutes.



STEP 1
AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Apply a 1000 microvolt, on-frequency test signal modulated by 1,000 hertz with ±3.3 kHz deviation to the receiver.

B. Connect an 8-ohm load resistor across the Distortion Analyzer input as shown.

C. Connect a standard earphone plug to the receiver accessory jack, and connect the receiver output across the 8-ohm resistor as shown.

D. Adjust the VOLUME control for 150-milliwatts output (1.1 volts RMS using the Distortion Analyzer as a VTVM).

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

SERVICE CHECK

If the distortion is more than 10%, or maximum audio output is less than 150 milliwatts, make the following checks:

F. Battery or external supply voltage -- low voltage will cause distortion.

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

H. Ratio Detector Alignment (Refer to Receiver Alignment Procedure on reverse side of page).

J. Audio output set too high -- output voltage over 1.1 volt, Re-check Step D.

STEP 2
USABLE SENSITIVITY (12-dB SINAD)

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 a 3.3-kHz deviation to the receiver.

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 or equal to rated 12 dB SINAD specification with an audio output of at least 75 milliwatts (.77 volt RMS across the 8-ohm receiver load using the Distortion Analyzer as a VTVM).

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, make the following checks:

G. 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)

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.

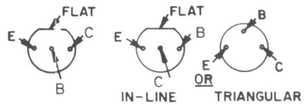
C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

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.

SERVICE CHECK

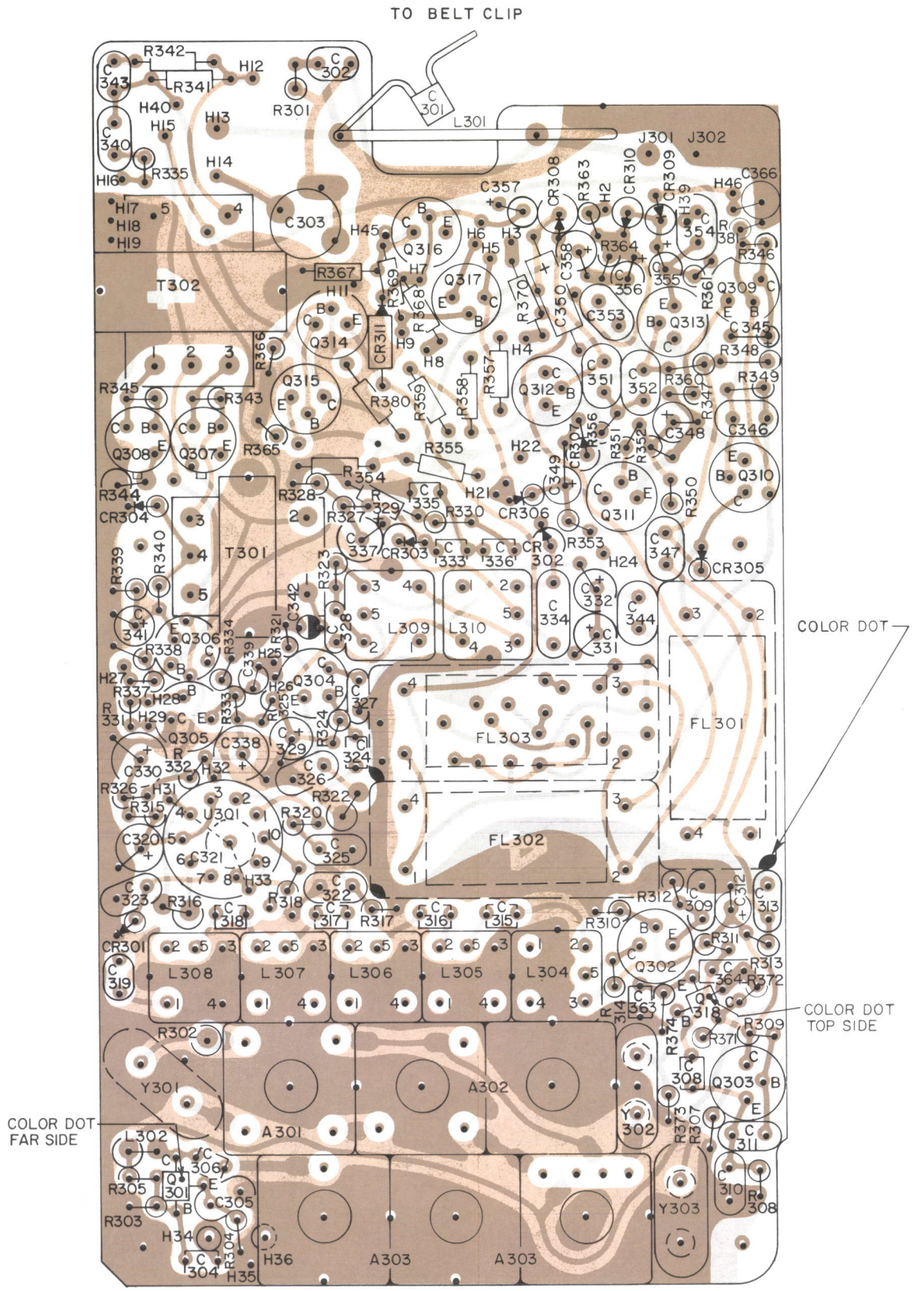
If the Modulation Acceptance Bandwidth test does not indicate the proper width, re-align the Low IF stages (Refer to the Receiver-Alignment Procedure).

LEAD IDENTIFICATION FOR



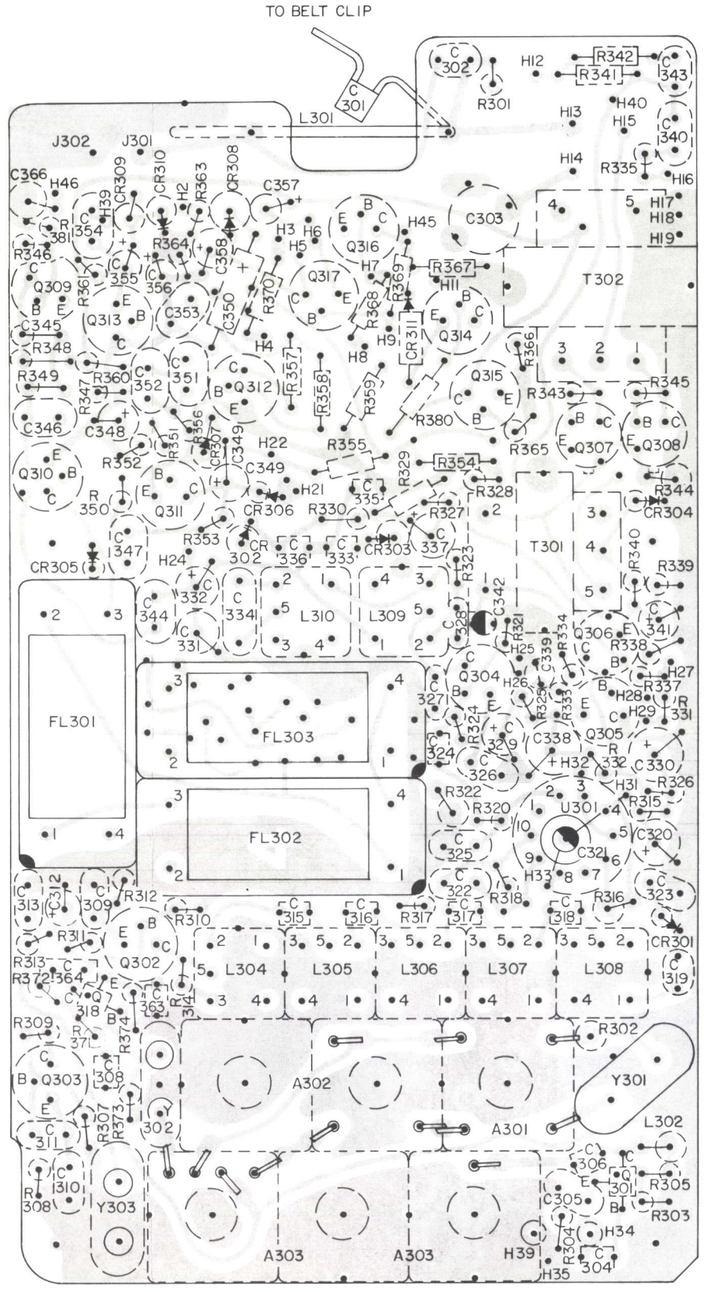
FOR Q302-Q304 VIEW FROM LEAD END

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



COMPONENT SIDE

(19D417563, Rev. 8)
(19D417347, Sh. 2, Rev. 4)
(19D417347, Sh. 3, Rev. 4)

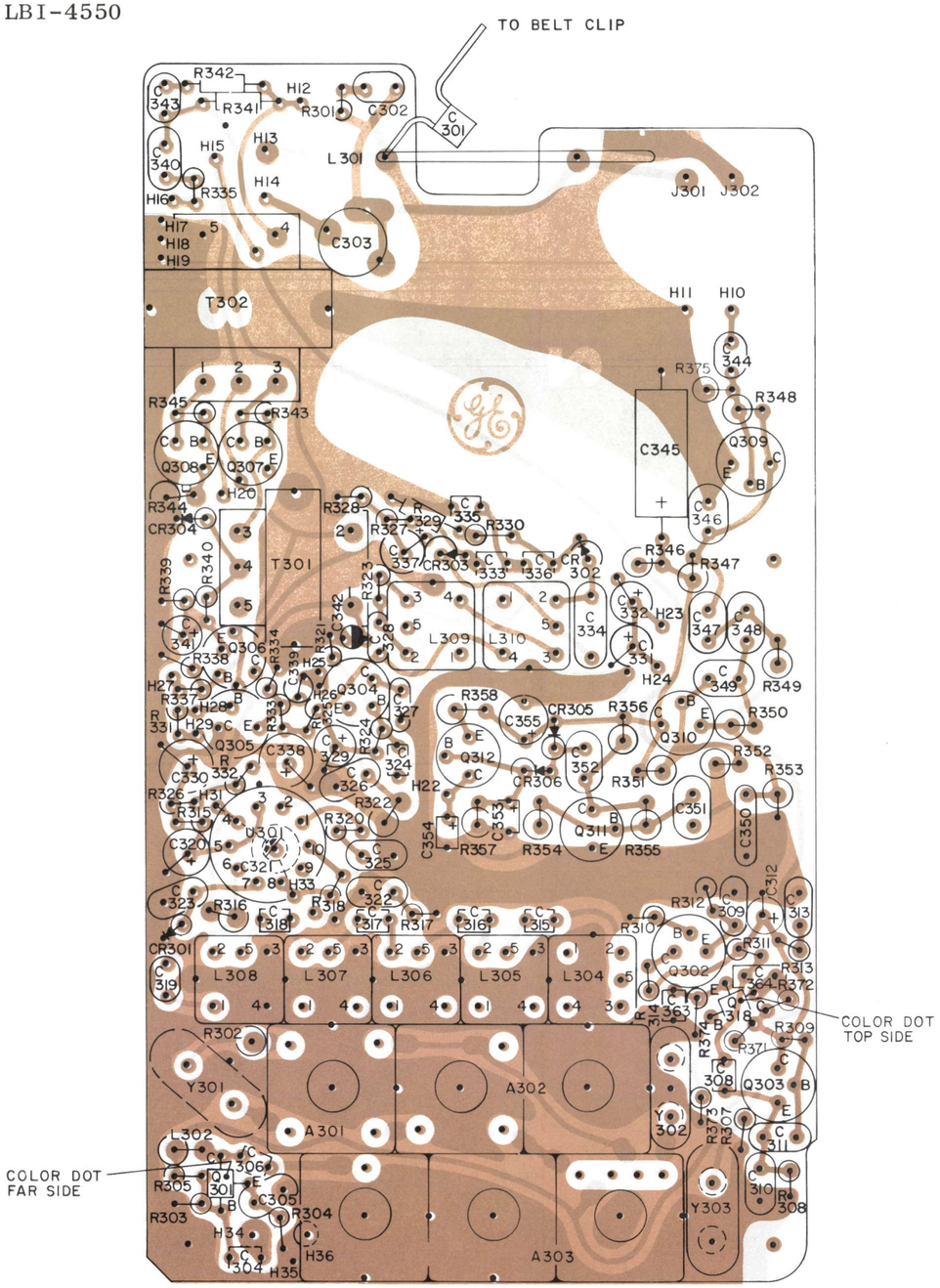


SOLDER SIDE

(19D417563, Rev. 8)
(19D417347, Sh. 2, Rev. 4)

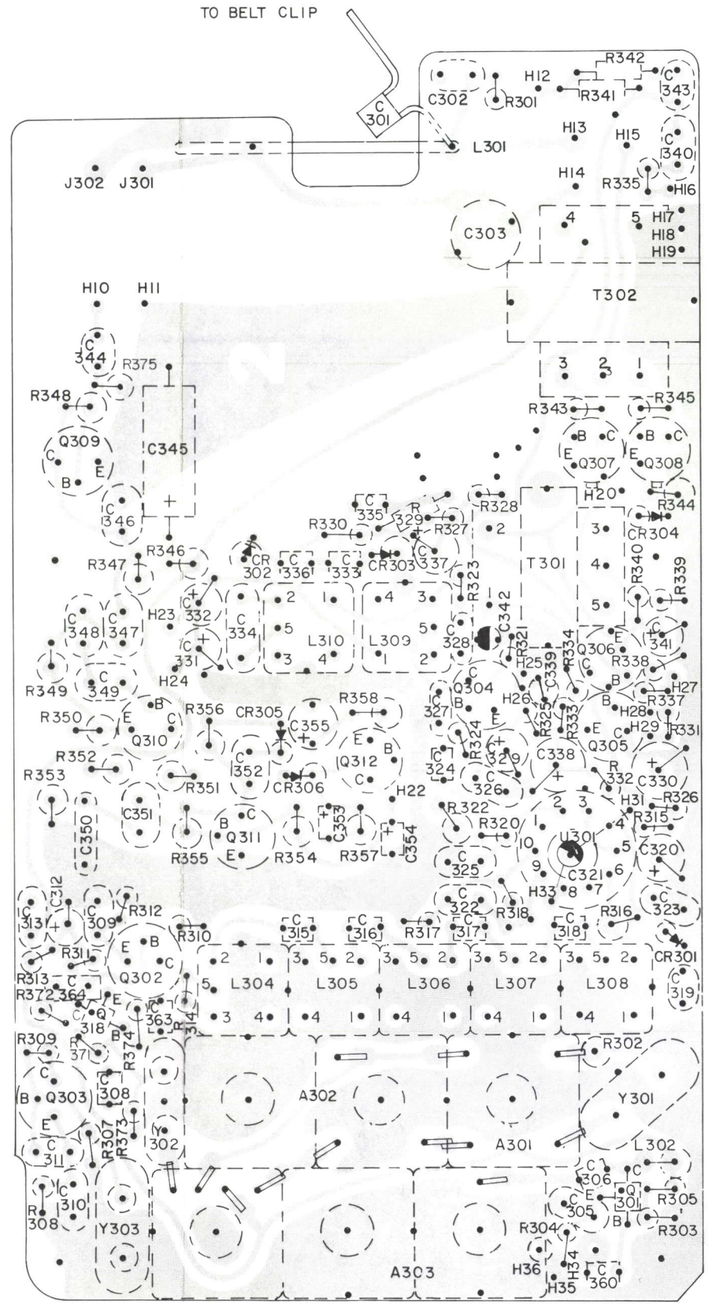
OUTLINE DIAGRAM

450—470 MHz PERSONAL PAGER
4ER69A10 TONE & VOICE RECEIVER



(19D417629, Rev. 6)
(19D417352, Sh. 2, Rev. 2)
(19D417352, Sh. 3, Rev. 3)

COMPONENT SIDE



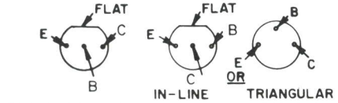
(19D417629, Rev. 6)
(19D417352, Sh. 2, Rev. 2)

SOLDER SIDE

OUTLINE DIAGRAM

450—470 MHz PERSONAL PAGER
4ER69A11 NOISE SQUELCH RECEIVER

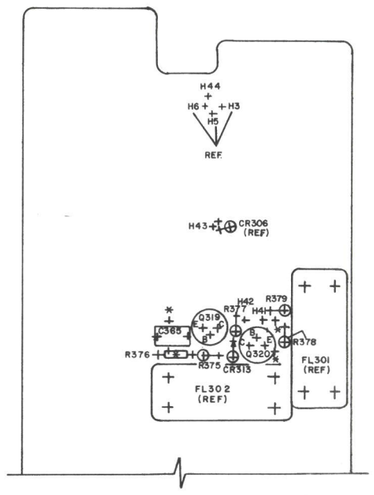
LEAD IDENTIFICATION FOR



FOR Q302-Q304

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

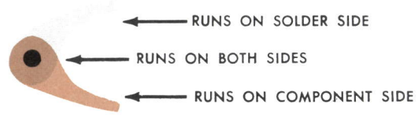
This instruction covers addition of components from kit PL19A129973G1 to component board 19D417348G1 & G2. To make automatic reset for tone voice systems.

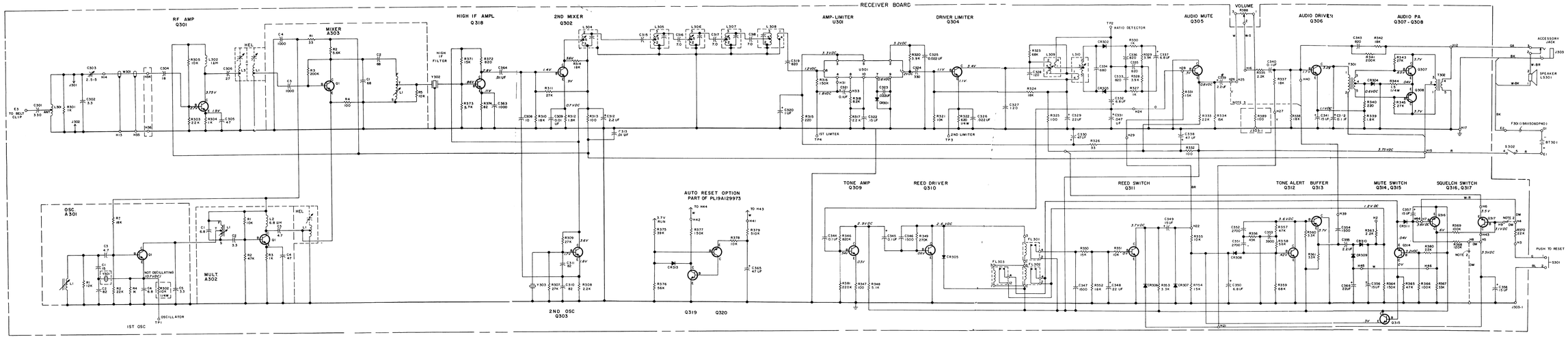


Connect H41 to H43 & H42 to H44 with Pt 3 white wire on solder side. Asm. Pt. 2 between board and Q319 & Q320.

Remove 4 pins marked with (*).

(19A129974, Sh. 1, Rev. 2)





NOTES:
1. ALL WIRES SFT28 UNLESS OTHERWISE SPECIFIED
2. THE SQUELCH SWITCH IS SHOWN CONNECTED FOR PUSH TO RESET OPERATION (JUMPER FROM H7 TO H8 AND FROM H9 TO H10). FOR PUSH TO TALK OPERATION (NO JUMPER FROM H7 TO H8 AND FROM H9 TO H10).
3. FOR VOLUME CONTROL OF ALERT TONE, MOVE VIOLET WIRE FROM H40 TO H.
4. VOLTAGE MEASUREMENTS TAKEN AT NO SIGNAL CONDITION WITH AUDIO ON AT MINIMUM VOLUME.
5. COMPONENT MARKED WITH # TO BE REMOVED FOR TONE ONLY.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION FOR CHANGES TO THIS DIAGRAM AND DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM. DIAG. APPLIES TO:	
MODEL NO	REV LETTER
4 ER69A10	F
PL19B268250 5	A

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

ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED. RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K FOR KILOHMS OR M FOR MEGOHMS. CAPACITOR VALUES ARE MICROFARADS (MFD) UNLESS FOLLOWED BY UUF (MICROMICROFARADS). INDUCTANCE VALUES ARE MICROHENRYS UNLESS OTHERWISE SPECIFIED BY MH (MILLIHENRYS) OR H (HENRYS).

(19B622007, Rev. 10)

SCHEMATIC DIAGRAM

450—470 MHz PERSONAL PAGER
4ER69A10 TONE & VOICE RECEIVER

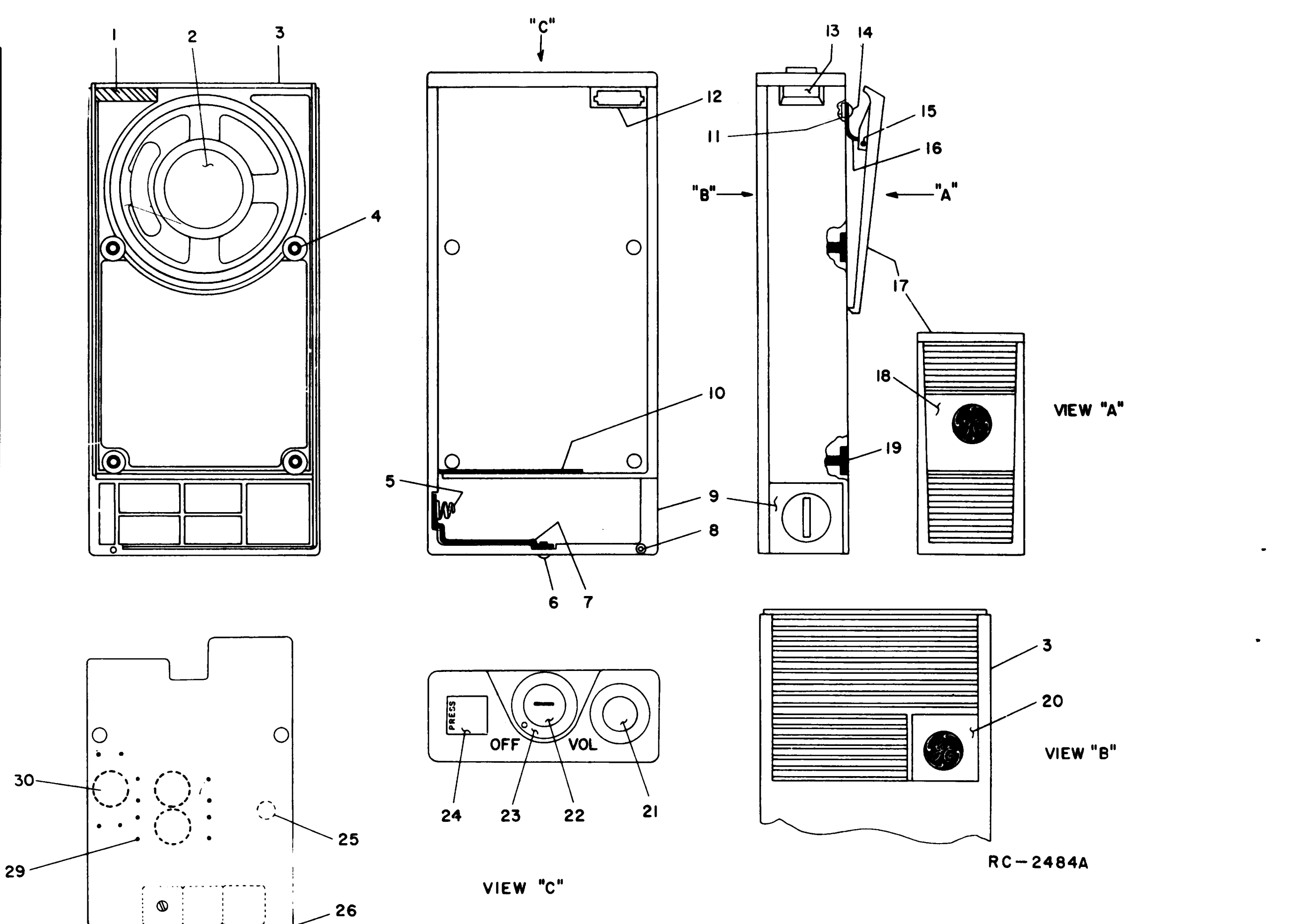
PARTS LIST

LBI-4565B

450-470 MHz PERSONAL PAGER
4ER69A10 TONE AND VOICE

SYMBOL	GE PART NO.	DESCRIPTION
		RECEIVER BOARD 19D417348G1
A301		OSCILLATOR BOARD 19C320739G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116114P3036	Ceramic: 15 pf ±5%, 100 VDCW; temp coef -150 PPM.
C2	19A116288P11	Ceramic: 82 pf ±5%, 100 VDCW; sim to Erie 8121-100-COG-820J.
C3	19A116114P16	Ceramic: 4.7 pf ±5%, 100 VDCW; temp coef 0 PPM.
C4	19A116114P3022	Ceramic: 6.8 pf ±5%, 100 VDCW; temp coef -150 PPM.
C5	19A116114P12	Ceramic: 3.3 pf ±5%, 100 VDCW; temp coef 0 PPM.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B219288G1	Coil. Includes:
	19B209436P1	Tuning slug.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A116159P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R151P123J	Composition: 12,000 ohms ±5%, 1/8 w.
R2	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w.
R3	3R151P183J	Composition: 18,000 ohms ±5%, 1/8 w.
R4*	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
		In REV B and earlier:
	3R151P621J	Composition: 620 ohms ±5%, 1/8 w.
A302		MULTIPLIER BOARD 19B226100G1
A1		COMPONENT BOARD 19D417361G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116114P3022	Ceramic: 6.8 pf ±5%, 100 VDCW; temp coef -150 PPM.
C2	19A116114P12	Ceramic: 3.3 pf ±5%, 100 VDCW; temp coef 0 PPM.
C3 and C4	19A116114P3053	Ceramic: 47 pf ±5%, 100 VDCW; temp coef -150 PPM.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B216591G2	Coil. Includes powdered iron tuning slug 19B209436P1. NOTE: L1 may require brass tuning slug (Modification Kit 19A127807G1) for 165-174 MHz operation.
L2	19B209420P123	Coil, RF: 6.80 µh ±10%, 1.80 ohms DC res max; sim to Jeffers 4446-2.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A116159P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w.
R2	3R151P473J	Composition: 47,000 ohms ±5%, 1/8 w.
R3	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B216439G3	Helical resonator. Including tuning slug 19C311750P1.
		- - - - - - - - - - NETWORKS - - - - - - - - - -
Z1		Includes L1 and 19D413132G30 can.
A303		MIXER BOARD 19B226099G1
A1		COMPONENT BOARD 19C320724G1
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 and C2	19A116114P4059	Ceramic: 68 pf ±5%, 100 VDCW; temp coef -220 PPM.
C3 and C4	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B216948G1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A116159P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R151P330J	Composition: 33 ohms ±5%, 1/8 w.
R2	3R151P562J	Composition: 5600 ohms ±5%, 1/8 w.
R3	3R151P204J	Composition: 0.20 megohm ±5%, 1/8 w.
R4	3R151P101J	Composition: 100 ohms ±5%, 1/8 w.
R5	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B216439G1	Helical resonator. Including tuning slug 19C311750P1.
L3	19B216439G7	Helical resonator. Including tuning slug 19C311750P1.
		- - - - - - - - - - NETWORKS - - - - - - - - - -
Z1		Includes L1 and 19D413132G3 can.
Z3		Includes L3 and 19D413132G32 can.
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C301	19A116192P7	Ceramic: 330 pf ±20%, 50 VDCW; sim to Erie 8101-050-W5R.
C302	19A116221P8	Ceramic: 3.3 pf ±5%, 75 VDCW; temp coef 0 ±30 PPM.
C303	19A116149P4	Variable: 2 to 5 pf, 63 VDCW, temp coef -33 PPM.
C304	19A116114P37	Ceramic: 18 pf ±10%, 100 VDCW; temp coef 0 PPM.
C305	19A116221P10	Ceramic: 47 pf ±5%, 75 VDCW; temp coef ±40% -150 PPM.
C306	19A116114P2043	Ceramic: 27 pf ±10%, 100 VDCW; temp coef -80 PPM.
C308	19A116114P1031	Ceramic: 10 pf ±10%, 100 VDCW; temp coef -30 PPM.
C309	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C310 and C311	19A116288P11	Ceramic: 82 pf ±5%, 100 VDCW; sim to Erie 8121-M100-COG-820J.
C312*	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
		In REV D and earlier:
	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C313*	19A116244P5	Ceramic: 0.1 µf ±20%, 50 VDCW.
		In REV C and earlier:
	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C315 thru C318	19A116114P24	Ceramic: 7 pf ±5%, 100 VDCW; temp coef 0 PPM.
C319	19A116192P9	Ceramic: 820 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C320	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C321	19C307102P16	Tantalum: 0.1 µf +40% -20%, 20 VDCW.
C322	19A116244P4	Ceramic: 0.15 µf ±20%, 50 VDCW.
C323	19A116244P2	Ceramic: 0.022 µf ±20%, 50 VDCW.
C324	19A116192P7	Ceramic: 330 pf ±20%, 50 VDCW; sim to Erie 8101-050-W5R.
C325 and C326	19A116244P2	Ceramic: 0.022 µf ±20%, 50 VDCW.
C327 and C328	19A116288P9	Ceramic: 120 pf ±5%, 100 VDCW; sim to Erie 8121-A100-U2J-121J.
C329	5491674P35	Tantalum: 22 µf +20%, 4 VDCW; sim to Sprague Type 162D.
C330	5491674P42	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 162D.
C331*	19A116244P2	Ceramic: 0.022 µf ±20%, 50 VDCW.
		In REV H and earlier:
	5496267P23	Tantalum: 0.047 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C332	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C333	19A116192P9	Ceramic: 820 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C334	19A116288P10	Ceramic: 680 pf ±5%, 50 VDCW; sim to Erie 8131-M050-S2H-681J.
C335 and C336	19A116192P9	Ceramic: 920 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C337	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C338	5491674P42	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 162D.
C339*	5491674P44	Tantalum: 2.2 µf ±20%, 15 VDCW; sim to Sprague Type 162D.
		In REV A and earlier:
	19C307102P16	Tantalum: 0.1 µf +40% -20%, 20 VDCW.
C340	19A116244P5	Ceramic: 0.1 µf ±20%, 50 VDCW.
C341	5491674P34	Tantalum: 15 µf ±20%, 6 VDCW; sim to Sprague Type 162D.
C342	19C307102P16	Tantalum: 0.1 µf +40% -20%, 20 VDCW.
C343	19A116192P9	Ceramic: 920 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C344	19A116244P5	Ceramic: 0.1 µf ±20%, 50 VDCW.
C345	5491674P43	Tantalum: 0.1 µf ±20%, 35 VDCW; sim to Sprague Type 162D.
C346 and C347	19A116192P10	Ceramic: 1500 pf ±20%, 50 VDCW; sim to Erie 8121-050-W5R.
C348	5491674P35	Tantalum: 22 µf ±20%, 4 VDCW; sim to Sprague Type 162D.
C349	5491674P34	Tantalum: 15 µf ±20%, 6 VDCW; sim to Sprague Type 162D.
C350	5491674P33	Tantalum: 6.8 µf ±20%, 4 VDCW; sim to Sprague Type 162D.
C351 and C352	19A116192P4	Ceramic: 2700 µf ±20%, 50 VDCW; sim to Erie 8121-050-W5R.
C353	19A116192P5	Ceramic: 3900 pf ±20%, 50 VDCW; sim to Erie 8121-050-W5R.
C354	19A116192P10	Ceramic: 1500 pf ±20%, 50 VDCW; sim to Erie 8121-050-W5R.
C355	5491674P44	Tantalum: 2.2 µf ±20%, 15 VDCW; sim to Sprague Type 162D.
C356	5491674P34	Tantalum: 15 µf ±20%, 6 VDCW; sim to Sprague Type 162D.
C357 and C358	5491674P34	Tantalum: 15 µf ±20%, 6 VDCW; sim to Sprague Type 162D.
C363	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
C364*	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
		In REV D and earlier:
	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
C366*	5491674P35	Tantalum: 22 µf ±20%, 4 VDCW; sim to Sprague Type 162D. Added by REV A.
C367* and C368*	5491674P42	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 162D. Added by REV H.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR301	19A115250P1	Silicon.
CR302* and CR303*	19A115250P1	Silicon.
		In REV H and earlier:
	4033292P1	Germanium.
CR304	19A115775P1	Silicon.
CR305 and CR306	19A115250P1	Silicon.
CR307 thru CR310	4038056P1	Germanium.
CR311	19A115250P1	Silicon.
CR312*	19A115250P1	Silicon. Deleted by REV A.
		- - - - - - - - - - - FILTERS - - - - - - - - -
FL301 thru FL303	19C300580	Tone Detector. (Check group numbers for desired frequency).
	G1	517.5 Hz
	G2	532.5 Hz
	G3	547.5 Hz
	G4	562.5 Hz
	G5	577.5 Hz
	G6	592.5 Hz
	G7	607.5 Hz
	G8	622.5 Hz
	G9	637.5 Hz
	G10	652.5 Hz
	G11	667.5 Hz
	G12	682.5 Hz
	G13	697.5 Hz
	G14	712.5 Hz
	G15	727.5 Hz
	G16	742.5 Hz
	G17	757.5 Hz
	G18	772.5 Hz
	G19	787.5 Hz
	G20	802.5 Hz
	G21	817.5 Hz
	G22	832.5 Hz
	G23	847.5 Hz
	G24	862.5 Hz
	G25	877.5 Hz
	G26	892.5 Hz
	G27	907.5 Hz
	G28	922.5 Hz
	G29	937.5 Hz
	G30	952.5 Hz
	G31	967.5 Hz
	G32	982.5 Hz
	G33	997.5 Hz
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J301 and J302	19A116366P2	Contact, electrical: sim to Cambion 3233-1.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L301	19A129897G1	Coil.
L302	19B209420P1	Coil, RF: 0.10 µh ±5%, 0.08 ohms DC res max; sim to Jeffers 4416-1.
L304 thru L307	19A116309P1	IF Transformer: sim to TOKO Inc. LMC-4916G02.
L308	19A116309P2	IF Transformer: sim to TOKO Inc. LMC-5133N2.
L309	19A116308P1	IF Transformer.
L310	19A116308P2	IF Transformer: sim to TOKO Inc. LSN 4816VE2.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q301	19A116159P1	Silicon, NPN.
Q302 and Q304	19A115910P1	Silicon, NPN; sim to Type 2N3906.
Q305	19A129187P1	Silicon, PNP.
Q306	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q307* and Q308*	19A115720P1	Silicon, NPN; sim to Type 2N2222.
		In REV B and earlier:
	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q309 thru Q312	19A129184P1	Silicon, NPN.
Q313 and Q314	19A129187P1	Silicon, PNP.
Q315	19A129184P1	Silicon, NPN.
Q316 and Q317	19A129187P1	Silicon, PNP.
Q318	19A116159P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R301	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
R302	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R303	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w.
R304	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
R305	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w.
R307	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R308	3R151P222J	Composition: 2200 ohms ±5%, 1/8 w.
R309	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R310	3R151P183J	Composition: 18,000 ohms ±5%, 1/8 w.
R311	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R312	3R151P182J	Composition: 1800 ohms ±5%, 1/8 w.
R313	3R151P101K	Composition: 100 ohms ±10%, 1/8 w.
R314	3R151P183J	Composition: 18,000 ohms ±5%, 1/8 w.
R315	3R151P221K	Composition: 220 ohms ±10%, 1/8 w.
R316	3R152P154K	Composition: 0.15 megohm ±10%, 1/4 w.
R317	3R151P222K	Composition: 2200 ohms ±10%, 1/8 w.
R318	3R151P822K	Composition: 8200 ohms ±10%, 1/8 w.
R320	3R151P392K	Composition: 3900 ohms ±10%, 1/8 w.
R321	3R151P103K	Composition: 10,000 ohms ±10%, 1/8 w.
R322	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R323	3R151P683K	Composition: 68,000 ohms ±10%, 1/8 w.
R324	3R151P183K	Composition: 18,000 ohms ±10%, 1/8 w.
R325	3R151P101K	Composition: 100 ohms ±10%, 1/8 w.
R326	3R151P330K	Composition: 33 ohms ±10%, 1/8 w.
R327	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
R328 and R329	3R151P392J	Composition: 3900 ohms ±5%, 1/8 w.
R330	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
R331	3R151P153J	Composition: 15,000 ohms ±5%, 1/8 w.
R332	3R151P101J	Composition: 100 ohms ±5%, 1/8 w.
R333	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w.
R334*	3R151P153J	Composition: 15,000 ohms ±5%, 1/8 w.
		In REV A and earlier:
	3R151P123J	Composition: 12,000 ohms ±5%, 1/8 w.
R335	3R151P222J	Composition: 2200 ohms ±5%, 1/8 w.
R337 and R338	3R151P183K	Composition: 18,000 ohms ±10%, 1/8 w.
R339	3R151P182J	Composition: 1800 ohms ±5%, 1/8 w.
R340	3R151P221J	Composition: 220 ohms ±5%, 1/8 w.
R341	3R151P204J	Composition: 0.20 megohm ±5%, 1/8 w.
R342	3R151P183K	Composition: 18,000 ohms ±10%, 1/8 w.
R343	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R344	19A116216P1R5K	Deposited carbon: 1.5 ohms ±10%, 1/4 w.
R345	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R346	3R151P824K	Composition: 0.82 megohm ±10%, 1/4 w.
R347	3R151P101J	Composition: 100 ohms ±5%, 1/8 w.
R348	3R151P512J	Composition: 5100 ohms ±5%, 1/8 w.
R349	3R151P274J	Composition: 0.27 megohm ±5%, 1/8 w.
R350*	3R151P682J	Composition: 6800 ohms ±5%, 1/8 w.
		In REV F and earlier:
	3R151P153J	Composition: 15,000 ohms ±5%, 1/8 w.
R351	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w.
R352*	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w.
		In REV F and earlier:
	3R151P183J	Composition: 18,000 ohms ±5%, 1/8 w.
R353	3R151P332J	Composition: 3300 ohms ±5%, 1/8 w.
R354*	3R151P153J	Composition: 15,000 ohms ±5%, 1/8 w.
		Earlier than REV A:
	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w.
R355	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w.
R356	3R151P272J	Composition: 4700 ohms ±5%, 1/8 w.
R357	3R151P473J	Composition: 47,000 ohms ±5%, 1/8 w.
R358	3R151P563J	Composition: 56,000 ohms ±5%, 1/8 w.
R359	3R151P683J	Composition: 68,000 ohms ±5%, 1/8 w.
R360 and R361	3R151P332J	Composition: 3300 ohms ±5%, 1/8 w.
R362*	3R151P101J	Composition: 100 ohms ±5%, 1/8 w. Deleted by REV A.
R363	3R151P222J	Composition: 2200 ohms ±5%, 1/8 w.
R364	3R151P154J	Composition: 0.15 megohm ±5%, 1/8 w.
R365	3R151P473J	Composition: 47,000 ohms ±5%, 1/8 w.
R366	3R151P104J	Composition: 0.10 megohm ±5%, 1/8 w.
R367*	3R151P333J	Composition: 33,000 ohms ±5%, 1/8 w.
		In REV B and earlier:
	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w.
R368	3R151P154J	Composition: 0.15 megohm ±5%, 1/8 w.
R369	3R151P104J	Composition: 0.10 megohm ±5%, 1/8 w.
R370	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w.
R371	3R151P153J	Composition: 15,000 ohms ±5%, 1/8 w.
R372	3R151P821J	Composition: 820 ohms ±5%, 1/8 w.
R373	3R151P472J	Composition: 4700 ohms ±5%, 1/8 w.
R374	3R151P820J	Composition: 82 ohms ±5%, 1/8 w.
R380*	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w. Added by REV A.
R381*	3R151P224J	Composition: 0.22 megohm ±5%, 1/8 w. Added by REV D.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T301	19A116213P1	Audio freq: 400-3000 Hz, Pri: 260 ohms DC res, Sec: 120 ohms DC res.
T302	19A116709P1	Audio freq: 400-3000 Hz, Pri: 9 ohms DC res, Sec: 0.67 ohms DC res.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
U301*	19A116208P2	Monolithic, linear.
		In REV E and earlier:
	19A116208P1	Monolithic, linear.
		- - - - - - - - - - - CABLES - - - - - - - - -
W301	19A127715G2	Cable: approx 5 inches long.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering Y301 give GE Part Number and specify exact frequency needed. Crystal Freq= (Operating Freq -20.0)/9
Y301	19B206890P6	Quartz: frequency range 42-55 MHz, temp range -30°C to +85°C.
Y302	19B219824G2	Crystal, freq: Resonator A: 19,996.300±0.300 KHz, Resonator B: 19,996.300±0.300 KHz.
Y303	19B206357G7	Quartz: frequency range 12-20 MHz, temp range -30°C to +85°C.
		AUTOMATIC-RESET MODIFICATION 19A129973G1
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C365	19C307102P5	Tantalum: 47 µf ±20%, 6 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - -
CR313	19A115250P1	Silicon.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q319	19A129184P1	Silicon, NPN.
Q320	19A129187P1	Silicon, PNP.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R375	3R151P393J	Composition: 39,000 ohms ±5%, 1/8 w.
R376	3R151P563J	Composition: 56,000 ohms ±5%, 1/8 w.
R377	3R151P154J	Composition: 0.15 megohm ±5%, 1/8 w.
R378	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w.
R379	3R151P514J	Composition: 0.51 megohm ±5%, 1/8 w.
		- - - - - - - - - - BATTERIES - - - - - - - - -
BT301	19A116252P1	Nickel-Cadmium: Rechargeable, 3.75 v, 150 MAH; sim to GE 41B902CD10.
		CASE ASSEMBLY 19B216823G5
		- - - - - - - - - - FUSES - - - - - - - - - -
F301	19A127884G1	Fuse Kit.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J303*	19A116134P3	Jack, telephone: sim to NTT310-2.
		Earlier than REV A:
	19A116134P2	Jack, telephone: sim to NTT310.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R388		(Part of S302).
R389	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S301	19A127540G1	Contact.
S302	19A116437P1	Resistor/switch: includes Resistor, 10,000 ohms ±20%, 0.05 w; Switch, rotary, SPST, 0.1 amp at 12 v; sim to Tsubame (TBM) Type RV16 Model 161-S2. (Includes R388).
		COVER ASSEMBLY 19B216822G2
		- - - - - - - - - **LOUDSPEAKERS** - - - - - - - -
LS301	19A116090P1	Permanent magnet: 2.00 inch, 8 ohms ±10% voice coil imp, 450 Hz ±112 Hz resonant; freq range 400 to 3000 Hz.
		- - - - - - - - - **MISCELLANEOUS** - - - - - - - -
	19A127884G1	Fuse Kit.
	4033530P2	Alignment Tool. (Metal tip).
	4038831P1	Alignment Tool. (Screw driver tip).
	4038831P4	Alignment Tool. (Fork tip).
	19A127841P1	Crystal Protecting Pad.
	NP258023C	Model Identification Label. (PV05).
	19A127640P1	Selective Calling Label.
		MECHANICAL PARTS (SEE RC-2484)
1	4032591P64	Tape, pressure sensitive.
2	19A115186P5	Tape, insulated.
3	19D413296P1	Cover. (Does not include LS301, items 1, 4, and 20. If complete assembly is desired order 19B216822G1).
4	19B201806P1	Insert, screw thread: sim to Phelps Mfg Div Heli-Coil Corp 70015-04.
5	19B216401P5	Battery spring.
6	N324P9005E	Rivet, tubular. (Charging contact).
7	19C317186P1	Contact. (Secures battery spring).
8	19A127707P1	Pin. (Secures battery cap).
9	19B216749G1	Battery cap.
10	19A115941P1	Tape, pressure sensitive: sim to Permacel EE3990. (Connects fuse to ground clip).
11	19A116131P4	Flatwasher.
12	19C317384P1	Holder. (Used with Push to Reset/Push to Listen Switch and Squelch button).
13	19A127576P1	Cover. (Used with call number).
14	19B200525P128	Rivet, tubular.
15	N510P814C	Pin.
16	19B216804G1	Spring.
17	19D413318P1	Spring clip.
18	NP258023C	Nameplate, etched aluminum.
19	19A127538P1	Screw. (Secures cover).
20	NP258024	Nameplate, etched aluminum.
21	19A127539P1	Button. (Used with S301).
22	19C317433P1	Insert. (Secures Knob, item 23).
23	19C317182P1	Knob. (ON/OFF- VOLUME).
24	19C317348P1	Cover. (Used with External Speaker).
25	4035306P11	Washer, fiber. (Used with Q305, Q309-Q317).
26	19A127536P1	Stud. (External Antenna connection).
27	19A127708P1	Gasket. (Used with External Antenna connection).
28	19A116477P1	Screw, machine: Brass, No. 1-64 x 5/32.
29	4036040P1	Contact, electrical. (Used with FL301-FL303).
30	19A127841P2	Tape, pressure sensitive. (Used with FL301-FL303).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



RC-2484A

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 - 4ER69A10
To improve operation of tone reeds.
Changed R354. Deleted CR312 and R362.
Added R380 and C366.

REV. B - To improve audio frequency response.
Changed R334 and C339.

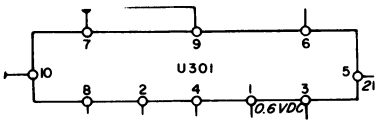
REV. C - To improve operation.
Changed Q307 and Q308.
Changed R4 on oscillator module A301.

REV. D - To improve RF sensitivity.
Changed C313 and added R381.

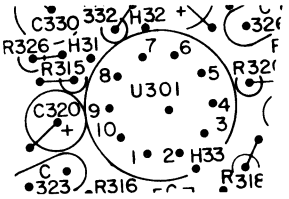
REV. E - To improve operation.
Changed C312 and C364.

REV. F - To incorporate a new IC.
Changed U301.

Schematic Diagram was:



Outline Diagram was:



REV. G - To improve paging at low battery voltage.
Changed R350 and R352.

REV. H - To improve operation. Added C367 and C368.

REV. J - To improve frequency response.
Changed C331, CR302 and CR303.

NOTES:
1. ALL WIRES SFT28 UNLESS OTHEWISE SPECIFIED.
2. ALL VOLTAGE READINGS TAKEN WITH NO SIGNAL INPUT AND VOLUME CONTROL SET FOR MINIMUM. SQUELCH SWITCH READINGS WITH ▲ AT CRITICAL SQUELCH AND WITH ● WITH SQUELCH JUST OPEN.

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
4ER69A11	

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.

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.

(19B623010, Rev. 3)

SCHEMATIC DIAGRAM

450—470 MHz PERSONAL PAGER
4ER69A11 NOISE SQUELCH RECEIVER

Issue 2

PARTS LIST

LBI-4552B

450-470 MHz PERSONAL PAGER
4ER69A11 NOISE SQUELCH

SYMBOL	GE PART NO.	DESCRIPTION
		RECEIVER BOARD 19D417353G1
A301		OSCILLATOR BOARD 19C320739G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116114P3036	Ceramic: 15 pf ±5%, 100 VDCW; temp coef -150 PPM.
C2	19A116288P11	Ceramic: 82 pf ±5%, 100 VDCW; sim to Erie 8121-100-COG-820J.
C3	19A116114P16	Ceramic: 4.7 pf ±5%, 100 VDCW; temp coef 0 PPM.
C4	19A116114P3022	Ceramic: 6.8 pf ±5%, 100 VDCW; temp coef -150 PPM.
C5	19A116114P12	Ceramic: 3.3 pf ±5%, 100 VDCW; temp coef 0 PPM.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B219288G1	Coil. Includes:
	19B209436P1	Tuning slug.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A116159P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R151P123J	Composition: 12,000 ohms ±5%, 1/8 w.
R2	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w.
R3	3R151P183J	Composition: 18,000 ohms ±5%, 1/8 w.
R4*	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
		In REV A and earlier:
	3R151P621J	Composition: 620 ohms ±5%, 1/8 w.
A302		MULTIPLIER BOARD 19B226100G1
A1		COMPONENT BOARD 19D417361G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116114P3022	Ceramic: 6.8 pf ±5%, 100 VDCW; temp coef -150 PPM.
C2	19A116114P12	Ceramic: 3.3 pf ±5%, 100 VDCW; temp coef 0 PPM.
C3 and C4	19A116114P3053	Ceramic: 47 pf ±5%, 100 VDCW; temp coef -150 PPM.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B216591G2	Coil. Includes powdered iron tuning slug 19B209436P1. NOTE: L1 may require brass tuning slug (Modification Kit 19A127807G1) for 165-174 MHz operation.
L2	19B209420P123	Coil, RF: 6.80 µh ±10%, 1.80 ohms DC res max, sim to Jeffers 4446-2.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A116159P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w.
R2	3R151P473J	Composition: 47,000 ohms ±5%, 1/8 w.
R3	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B216439G3	Helical resonator. Including tuning slug 19C311750P1.
		- - - - - - - - - - NETWORKS - - - - - - - - - -
Z1		Includes L1 and 19D413132G30 can.
A303		MIXER BOARD 19B226099G1
A1		COMPONENT BOARD 19C320724G1
		- - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	19A116114P4059	Ceramic: 68 pf ±5%, 100 VDCW; temp coef -220 PPM.
C3 and C4	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B216948G1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A116159P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R151P330J	Composition: 33 ohms ±5%, 1/8 w.
R2	3R151P562J	Composition: 5600 ohms ±5%, 1/8 w.
R3	3R151P204J	Composition: 0.20 megohm ±5%, 1/8 w.
R4	3R151P101J	Composition: 100 ohms ±5%, 1/8 w.
R5	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B216439G1	Helical resonator. Including tuning slug 19C311750P1.
L3	19B216439G7	Helical resonator. Including tuning slug 19C311750P1.
		- - - - - - - - - - NETWORKS - - - - - - - - - -
Z1		Includes L1 and 19D413132G3 can.
Z3		Includes L3 and 19D413132G32 can.
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C301	19A116192P7	Ceramic: 330 pf ±20%, 50 VDCW; sim to Erie 8101-050-W5R.
C302	19A116221P8	Ceramic: 3.3 pf ±5%, 75 VDCW; temp coef 0 ±30 PPM.
C303	19A116149P4	Variable: 2 to 5 pf, 63 VDCW, temp coef -33 PPM.
C304	19A116114P37	Ceramic: 18 pf ±10%, 100 VDCW; temp coef 0 PPM.
C305	19A116221P10	Ceramic: 47 pf ±5%, 75 VDCW; temp coef ±40 -150 PPM.
C306	19A116114P2043	Ceramic: 27 pf ±10%, 100 VDCW; temp coef -80 PPM.
C308	19A116114P1031	Ceramic: 10 pf ±10%, 100 VDCW; temp coef -30 PPM.
C309	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C310 and C311	19A116288P11	Ceramic: 82 pf ±5%, 100 VDCW; sim to Erie 8121-M100-COG-820J.
C312*	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
		In REV C and earlier:
	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.

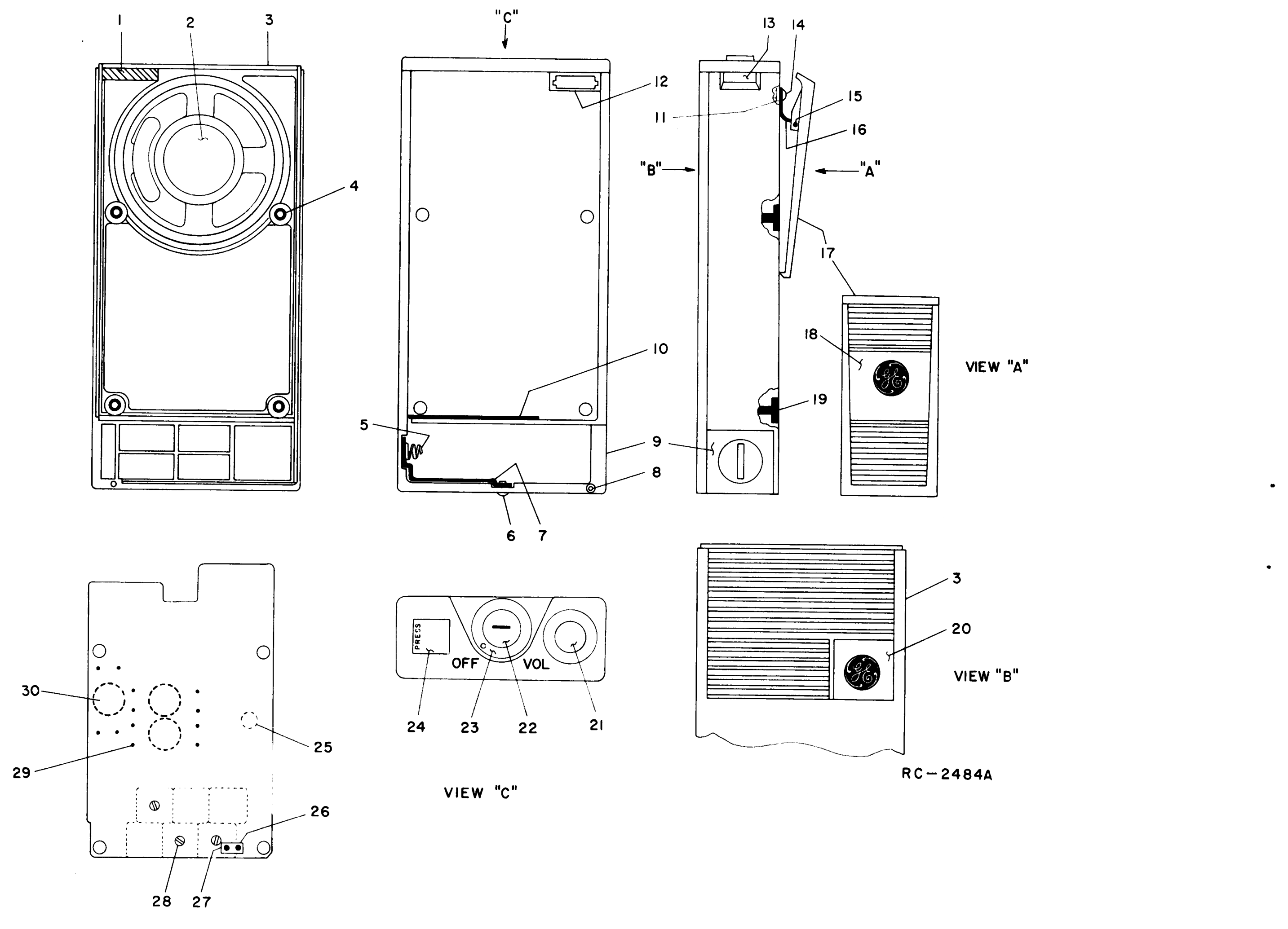
SYMBOL	GE PART NO.	DESCRIPTION
C313*	19A116244P5	Ceramic: 0.1 µf ±20%, 50 VDCW.
		In REV B and earlier:
	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C315 thru C318	19A116114P24	Ceramic: 7 pf ±5%, 100 VDCW; temp coef 0 PPM.
C319	19A116192P9	Ceramic: 820 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C320	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C321	19C307102P16	Tantalum: 0.1 µf +40% -20%, 20 VDCW.
C322	19A116244P4	Ceramic: 0.15 µf ±20%, 50 VDCW.
C323	19A116244P2	Ceramic: 0.022 µf ±20%, 50 VDCW.
C324	19A116192P7	Ceramic: 330 pf ±20%, 50 VDCW; sim to Erie 8101-050-W5R.
C325 and C326	19A116244P2	Ceramic: 0.022 µf ±20%, 50 VDCW.
C327 and C328	19A116288P9	Ceramic: 120 pf ±5%, 100 VDCW; sim to Erie 8121-A100-U2J-121J.
C329	5491674P35	Tantalum: 22 µf ±20%, 4 VDCW; sim to Sprague Type 162D.
C330	5491674P42	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 162D.
C331*	19A116244P2	Ceramic: 0.022 µf ±20%, 50 VDCW.
		In REV E and earlier:
	5496267P23	Tantalum: 0.047 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C332	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C333	19A116192P9	Ceramic: 820 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C334	19A116288P10	Ceramic: 680 pf ±5%, 50 VDCW; sim to Erie 8131-M050-S2H-681J.
C335 and C336	19A116192P9	Ceramic: 920 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C337	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C338	5491674P42	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 162D.
C339*	5491674P44	Tantalum: 2.2 µf ±20%, 15 VDCW; sim to Sprague Type 162D.
		Earlier than REV A:
	19C307102P16	Tantalum: 0.1 µf +40% -20%, 20 VDCW.
C340	19A116244P5	Ceramic: 0.1 µf ±20%, 50 VDCW.
C341	5491674P34	Tantalum: 15 µf ±20%, 6 VDCW; sim to Sprague Type 162D.
C342	19C307102P16	Tantalum: 0.1 µf +40% -20%, 20 VDCW.
C343 and C344	19A116192P9	Ceramic: 920 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C345	5491674P42	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 162D.
C346	19A116192P5	Ceramic: 3900 pf ±20%, 50 VDCW; sim to Erie 8121-050-W5R.
C347 thru C349	19A116192P10	Ceramic: 1500 pf ±20%, 50 VDCW; sim to Erie 8121-050-W5R.
C350	5495323P14	Ceramic: .005 µf +100% -20%, 75 VDCW.
C351 and C352	19A116192P4	Ceramic: 2700 pf ±20%, 50 VDCW; sim to Erie 8121-050-W5R.
C353	5491674P24	Tantalum: .47 µf +50% -20%, 10 VDCW; sim to Sprague Type 162D.
C354	19C307102P12	Tantalum: 2.2 µf ±20%, 10 VDCW.
C355	19C307102P15	Tantalum: 22 µf ±20%, 6 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C363	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
C364*	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR301	19A115250P1	Silicon.
CR302* and CR303*	19A115250P1	Silicon.
		In REV E and earlier:
	4033292P1	Germanium.
CR304	19A115775P1	Silicon.
CR305 and CR306	19A115250P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J301 and J302	19A116366P2	Contact, electrical: sim to Cambion 3233-1.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L301	19A129897G1	Coil.
L302	19B209420P1	Coil, RF: 0.10 µh ±5%, 0.08 ohms DC res max; sim to Jeffers 4416-1.
L304 thru L307	19A116309P1	IF Transformer: sim to TOKO Inc. LMC-4916G02.
L308	19A116309P2	IF Transformer: sim to TOKO Inc. LMC-5133N2.
L309	19A116308P1	IF Transformer.
L310	19A116308P2	IF Transformer: sim to TOKO Inc. LSN 4816VE2.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q301	19A116159P1	Silicon, NPN.
Q302 and Q304	19A115910P1	Silicon, NPN; sim to Type 2N3906.
Q305	19A129187P1	Silicon, PNP.
Q306	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q307* and Q308*	19A11720P1	Silicon, NPN; sim to Type 2N2222.
		In REV A and earlier:
	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q309	19A129184P1	Silicon, NPN.
Q310 and Q311	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q312	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q318	19A116159P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R301	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
R302	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R303	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w.
R304	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
R305	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w.
R307	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R308	3R151P222J	Composition: 2200 ohms ±5%, 1/8 w.
R309	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R310	3R151P183J	Composition: 18,000 ohms ±5%, 1/8 w.
R311	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R312	3R151P182J	Composition: 1800 ohms ±5%, 1/8 w.
R313	3R151P101K	Composition: 100 ohms ±10%, 1/8 w.
R314	3R151P183J	Composition: 18,000 ohms ±5%, 1/8 w.

SYMBOL	GE PART NO.	DESCRIPTION
R315	3R151P221K	Composition: 220 ohms ±10%, 1/8 w.
R316	3R152P154K	Composition: 0.15 megohm ±10%, 1/4 w.
R317	3R151P222K	Composition: 2200 ohms ±10%, 1/8 w.
R318	3R151P822K	Composition: 8200 ohms ±10%, 1/8 w.
R320	3R151P392K	Composition: 3900 ohms ±10%, 1/8 w.
R321	3R151P103K	Composition: 10,000 ohms ±10%, 1/8 w.
R322	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R323	3R151P683K	Composition: 68,000 ohms ±10%, 1/8 w.
R324	3R151P183K	Composition: 18,000 ohms ±10%, 1/8 w.
R325	3R151P101K	Composition: 100 ohms ±10%, 1/8 w.
R326	3R151P330K	Composition: 33 ohms ±10%, 1/8 w.
R327	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
R328 and R329	3R151P392J	Composition: 3900 ohms ±5%, 1/8 w.
R330	3R151P102J	Composition: 1000 ohms ±5%, 1/8 w.
R331	3R151P153J	Composition: 15,000 ohms ±5%, 1/8 w.
R332	3R151P101J	Composition: 100 ohms ±5%, 1/8 w.
R333	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w.
R334*	3R151P153J	Composition: 15,000 ohms ±5%, 1/8 w.
		Earlier than REV A:
	3R151P123J	Composition: 12,000 ohms ±5%, 1/8 w.
R335	3R151P222J	Composition: 2200 ohms ±5%, 1/8 w.
R337 and R338	3R151P183K	Composition: 18,000 ohms ±10%, 1/8 w.
R339	3R151P182J	Composition: 1800 ohms ±5%, 1/8 w.
R340	3R151P221J	Composition: 220 ohms ±5%, 1/8 w.
R341	3R151P204J	Composition: 0.20 megohm ±5%, 1/8 w.
R342	3R151P183K	Composition: 18,000 ohms ±10%, 1/8 w.
R343	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R344	19A116216P1R5K	Deposited carbon: 1.5 ohms ±10%, 1/4 w.
R345	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R346	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R347	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R348	3R152P824K	Composition: 0.82 megohm ±10%, 1/4 w.
R349	3R152P153K	Composition: 15,000 ohms ±10%, 1/4 w.
R350	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R351	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R352	3R152P823K	Composition: 82,000 ohms ±10%, 1/4 w.
R353	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R354	3R152P684J	Composition: 0.68 megohm ±5%, 1/4 w.
R355	3R152P154J	Composition: 0.15 megohm ±5%, 1/4 w.
R356	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R357	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R358	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R371	3R151P153J	Composition: 15,000 ohms ±5%, 1/8 w.
R372	3R151P821J	Composition: 820 ohms ±5%, 1/8 w.
R373	3R151P472J	Composition: 4700 ohms ±5%, 1/8 w.
R374	3R151P820J	Composition: 82 ohms ±5%, 1/8 w.
R375*	3R152P224J	Composition: 0.22 megohm ±5%, 1/4 w. Added by REV D.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T301	19A116213P1	Audio freq: 400-3000 Hz, Pri: 260 ohms DC res, Sec: 120 ohms DC res.

SYMBOL	GE PART NO.	DESCRIPTION
T302	19A116709P1	Audio freq: 400-3000 Hz, Pri: 9 ohms DC res, Sec: 0.67 ohms DC res.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
U301*	19A116208P2	Monolithic, linear.
		In REV D and earlier:
	19A116208P1	Monolithic, linear.
		- - - - - - - - - - - CABLES - - - - - - - - -
W301	19A127715G2	Cable: approx 5 inches long.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering Y301 give GE Part Number and specify exact frequency needed. Crystal Freq= Operating Freq -20.0 / 9
Y301	19B206890P6	Quartz: frequency range 42-55 MHz, temp range -30°C to +85°C.
Y302	19B219824G2	Crystal, freq: Resonator A: 19,996.300±0.300 KHz, Resonator B: 19,996.300±0.300 KHz.
Y303	19B206357G7	Quartz: frequency range 12-20 MHz, temp range -30°C to +85°C.
		- - - - - - - - - - BATTERIES - - - - - - - - - -
BT301	19A116252P1	Nickel-Cadmium: Rechargeable, 3.75 v, 150 MAH; sim to GE 41B902CD10.
		CASE ASSEMBLY 19B216823G6
		- - - - - - - - - - FUSES - - - - - - - - -
F301	19A127884G1	Fuse Kit.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J303*	19A116134P3	Jack, telephone: sim to NTT310-2.
		Earlier than REV A:
	19A116134P2	Jack, telephone: sim to NTT310.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R388		(Part of S302).
R389	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R390	19B216998G1	Variable, carbon film: 22,000 ohms ±20%, 0.05 w; sim to Amperex 2322-410-050-08.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S302	19A116437P1	Resistor/switch: includes Resistor, 10,000 ohms ±20%, 0.05 w; Switch, rotary, SPST, 0.1 amp at 12 v; sim to Tsubame (TBM) Type RV16 Model 161-S2. (Includes R388).
		COVER ASSEMBLY 19B216822G2
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS301	19A116090P1	Permanent magnet: 2.00 inch, 8 ohms ±10% voice coil imp, 450 Hz ±112 Hz resonant; freq range 400 to 3000 Hz.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	19A127884G1	Fuse Kit.
	4033530P2	Alignment Tool. (Metal tip).
	4038831P1	Alignment Tool. (Screw driver tip).
	4038831P4	Alignment Tool. (Fork tip).
	19A127841P1	Crystal Protecting Pad.
	NP258023C	Model Identification Label. (PV05).

SYMBOL	GE PART NO.	DESCRIPTION
		MECHANICAL PARTS (SEE RC-2484)
1	4032591P64	Tape, pressure sensitive.
2	19A115186P5	Tape, insulated.
3	19D413296P1	Cover. (Does not include LS301, items 1, 4, and 20. If complete assembly is desired order 19B216822G1).
4	19B201806P1	Insert, screw thread: sim to Phelps Mfg Div Heli-Coil Corp 70015-04.
5	19B216401P5	Battery spring.
6	N324P9005E	Rivet, tubular. (Charging contact).
7	19C317186P1	Contact. (Secures battery spring).
8	19A127707P1	Pin. (Secures battery cap).
9	19B216749G1	Battery cap.
10	19A115941P1	Tape, pressure sensitive: sim to Permacel EE3990. (Connects fuse to ground clip).
11	19A116131P4	Flatwasher.
12	19C317384P1	Holder. (Used with Push to Reset/Push to Listen Switch and Squelch button).
13	19A127576P1	Cover. (Used with call number).
14	19B200525P128	Rivet, tubular.
15	N510P814C	Pin.
16	19B216804G1	Spring.
17	19D413318P1	Spring clip.
18	NP258023C	Nameplate, etched aluminum.
19	19A127538P1	Screw. (Secures cover).
20	NP258024	Nameplate, etched aluminum.
21	19B216996G1	Knob. (Used with Squelch pot).
22	19C317433P1	Insert. (Secures Knob, item 23).
23	19C317182P1	Knob. (ON/OFF- VOLUME).
24	19C317348P1	Cover. (Used with External Speaker).
25	4035306P43	Washer, fiber: .120 dia. (Used with Q305, Q309).
26	19A127536P1	Stud. (External Antenna connection).
27	19A127708P1	Gasket. (Used with External Antenna connection).
28	19A116477P1	Screw, machine: Brass, No. 1-64 x 5/32.



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 - 4ER69A11
To improve audio frequency response.
Changed R334 and C339.

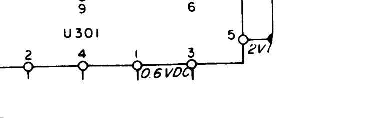
REV. B - To improve operation.
Changed Q307 and Q308.
Changed R4 on oscillator module A301.

REV. C - To improve RF sensitivity.
Changed C313 and added R381.

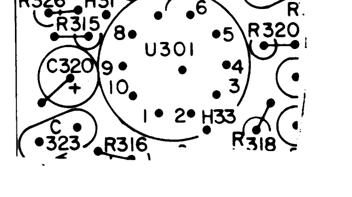
REV. D - To improve operation.
Changed C312 and C364.
Added R375.

REV. E - To incorporate a new IC.
Changed U301.

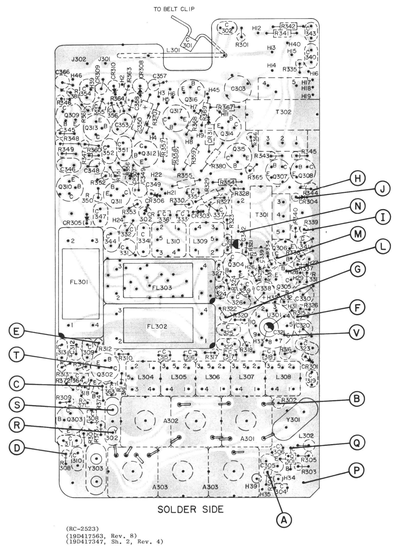
Schematic Diagram was:



Outline Diagram was:



REV. F - To improve frequency response.
Changed C331, CR302 and CR303.



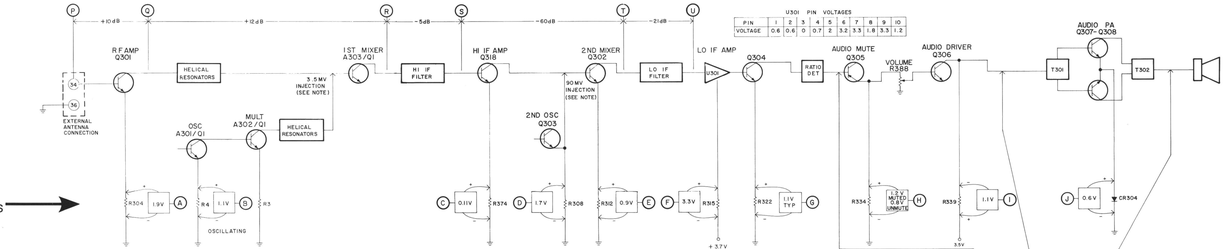
(RC-2523)
(190417343, Rev. 8)
(190417347, Sh. 2, Rev. 4)

QUICKCHECKS

Before starting the procedure, check for battery voltage on the receiver chassis (H15 to ground). Also check the wire fuse.

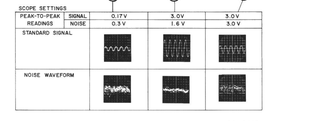
Symptom	Procedure
No Audio	1. Check earphone jack contacts. 2. Check for +3.7 Volts at H8 on the receiver board after the receiver is unsquelched by a signal or tones. 3. Check DC voltages at (H) and (J) .
Poor sensitivity	1. Check the coax connections to the RF Amp. 2. Check DC voltage at (A) . 3. Check to see if the receiver board ground tab is making contact with the ground shield on the battery compartment. 4. Check RF gains (P) thru (V) .
Receiving noise but no signal.	1. Check DC voltages (B) and (D) . 2. Check DC voltages (C) and (E) .
Low noise and no signal	Check DC voltage at (F) .

STEP 1- DC VOLTAGE CHECKS
(STEPS A THRU K)



The DC voltage checks provide an easy method of checking the operation of the receiver stages with GE Test Set Model 4EX3A10 (or equivalent), and with no signal applied to the receiver.

STEP 2- AUDIO & NOISE WAVEFORMS
(STEPS L THRU O)



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 the external antenna pins. A standard signal is 1000 microvolts on the receiver frequency modulated by one kHz with 3.3 kHz deviation.
2. Set the Volume control for 150 milliwatts output (1.1 volts).

STEP 3- RF GAIN CHECKS
(STEPS P THRU T)

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 the external antenna pins (H20 and H10). Disconnect the internal antenna by removing the center conductor of the coaxial cable from H20.

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 dB 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 MIXER

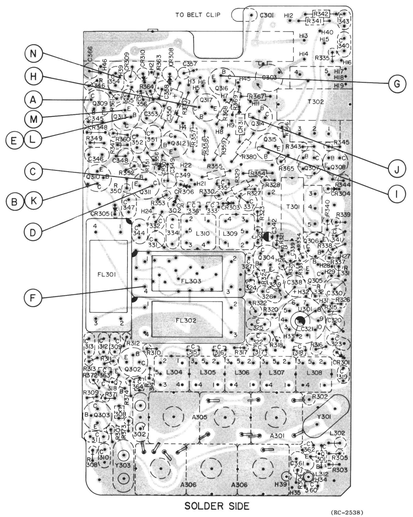
1. With no signal in, connect the RF probe to the output (collector) of Q302 and set the Test Amp to the X10 position.
2. Apply a 700 microvolt signal to the receiver and check for a Test Set reading of 2 volts.

PROCEDURE FOR LO IF AMP

1. With no signal in, measure the voltage at TP4 (Pin 8 of 1C301) with GE Test Set Model 4EX3A10.
2. Next, apply a 700 microvolt signal to the receiver and check for a 0.2 volt increase in the reading at TP4.

QUICKCHECK

Symptom	Procedure
Alert tone runs continuously (Pages on 2nd tone only).	Check for open or defective C350, or open CR308.



(RC-2538)
(19D417564, Rev. 5)
(19D417247, Sh. 2, Rev. 4)

TROUBLESHOOTING PROCEDURE

450—470 MHz PERSONAL PAGER
TYPE 99 DECODER CIRCUIT

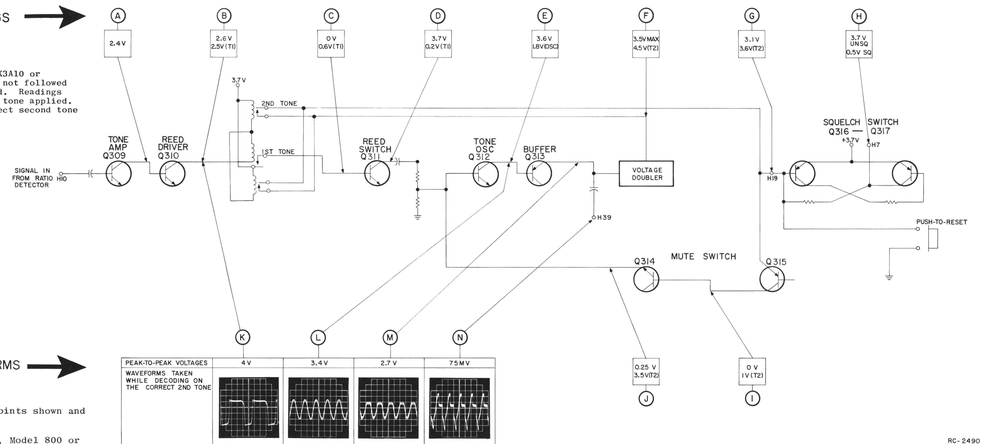
STEP 3- DECODER STAGE CHECKS

The following stage checks provide a method of checking the operation of the decoder stages for quickly isolating a service problem. Begin the checks with the receiver in the RESET or quitet condition.

To Check:	Procedure
Reed drive	Check DC reading (B) and waveform (K) with 1st tone applied.
Reed Switch and 1st Reed	Check DC reading at (D) with and without 1st tone applied.
Tone Oscillator	Waveforms (L) , (M) and (N) should appear momentarily when the 1st tone is removed.
Voltage doubler	Check the DC reading at (F) . Next, jumper 3.75 Volts to H16 to cause the tone oscillator to run continuously. Check the voltage at (F) .
Squelch Switch	With 3.75 Volts jumpered to H16 and to H19, the tone alert should be heard at the speaker. Reading at (H) should be 3.75 Volts.
2nd Reed	Remove the 3.75 Volts jumpered to H19. Apply a standard signal modulated by the 2nd tone to the receiver. The tone alert should be heard at the speaker.
Mute Switch	Apply the standard signal modulated by the second tone to the receiver. Next, disconnect the 3.75-Volt jumper from H16. The tone alert should be heard until the 2nd tone is removed.

STEP 1-TYPICAL DC READINGS
(STEPS A THRU J)

All readings are made with GE Test Set Model 4EX3A10 or equivalent 20,000 ohm-per-volt meter. Readings not followed by any symbol are taken with either tone applied. Readings followed by T1 are taken with the correct first tone applied. Readings followed by T2 are taken with the correct second tone applied.



STEP 2- TONE WAVEFORMS
(STEPS K THRU N)

- Oscilloscope connected between the points shown and ground.
- Signal Generator (Measurements M-560, Model 800 or equivalent).
- Type 99 Encoder with the correct 1st and 2nd tones.

PRELIMINARY STEP:

Apply a 1000 microvolt signal on the receiver frequency that is modulated by the correct 2nd tone with 3.3 kHz deviation.

RC-2490

QUICKCHECKS

Symptom	Procedure
Receiver won't unsquelch	1. Check C346, C350, CR305 and CR306 on Squelch Board. 2. Check C351 on receiver board.
Receiver won't squelch	1. Check CR305, CR306 and shorted Q312. 2. Make Audio Gain checks.
Erratic critical squelch	1. Check C353 and R390.
Squelches on voice peaks.	1. Check the receiver frequency. 2. Check C347, C348 and C349.

STEP 3- AUDIO GAIN CHECKS

EQUIPMENT REQUIRED:

- Audio generator with 7 kHz output.
- Signal generator (M-560 or equivalent).
- Oscilloscope (5 MV to 1.2 Volts).

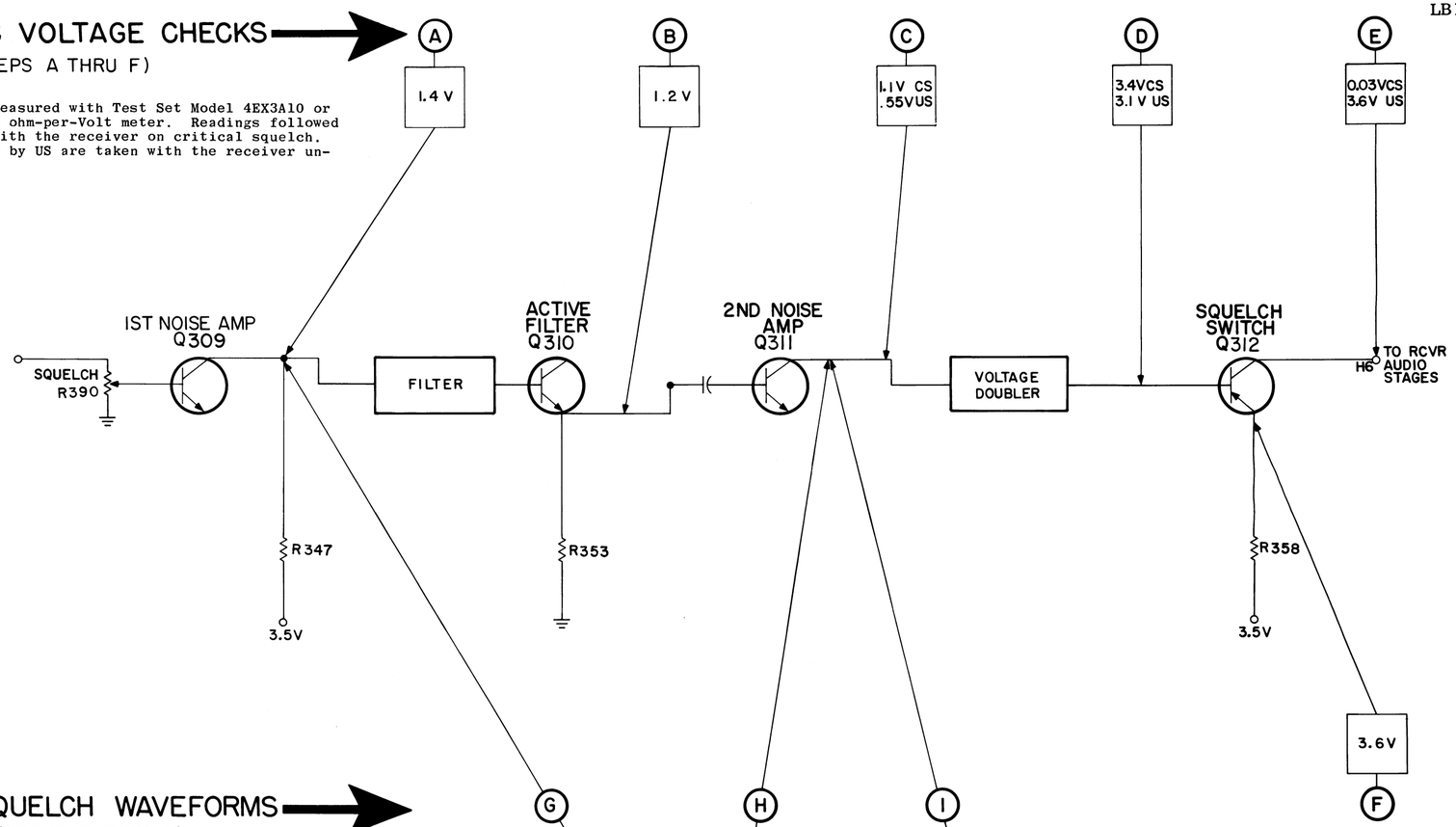
PROCEDURE

1. Apply a 1000 microvolt, 7 kHz signal modulated by 3.3 kHz deviation to the external antenna connector.
2. Turn SQUELCH control R390 fully clockwise.
3. Scope reading at the base of 1st Noise Amp Q309 should be approximately 45 millivolts.
4. Turn R390 counterclockwise until the reading at the base of Q309 drops to 5 millivolts.
5. Check for a 140 millivolts peak-to-peak reading at the collector of Q309.
6. Check for a 100 millivolts peak-to-peak reading at the emitter of Active Filter Q310.
7. Check for a 1.2 Volts peak-to-peak reading at the collector of 2nd Noise Amp Q311. The waveform should be clipped on the negative side.

STEP 1- DC VOLTAGE CHECKS

(STEPS A THRU F)

DC readings are measured with Test Set Model 4EX3A10 or equivalent 20,000 ohm-per-Volt meter. Readings followed by CS are taken with the receiver on critical squelch. Readings followed by US are taken with the receiver unsquelched.



STEP 2- SQUELCH WAVEFORMS

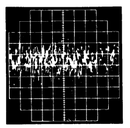
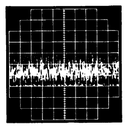
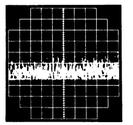
(STEPS G THRU I)

EQUIPMENT REQUIRED:

- Oscilloscope connected between the points shown and ground.
- Signal Generator (Measurements M560 or equivalent) connected to external antenna connectors.

PRELIMINARY STEPS:

1. Set R390 for critical squelch.
2. When a signal is required, apply an on-frequency signal with no modulation.

G	H	I
0.6 V P-P	3V P-P	2.5 V P-P
NO SIGNAL IN		SIGNAL INCREASED UNTIL SQUELCH JUST OPENS
		

RC-2492

TROUBLESHOOTING PROCEDURE

450—470 MHz PERSONAL PAGER
NOISE SQUELCH CIRCUIT ER-69-A

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 Sales Office of the General Electric Company.

MAINTENANCE MANUAL

LBI-4550

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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