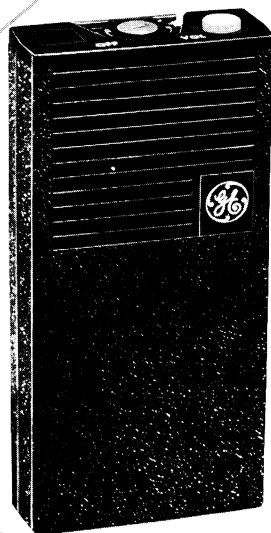


 **MOBILE RADIO**

**150.8-174 MHz
personal pager
LBI-4200 B**

DF-1099

**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-54-A
Frequency Range	150.8 - 174 MHz
Modulation Acceptance	± 7 KHz
Channel Spacing	30 KHz
Selectivity	
EIA Method	-60 dB (adjacent Channel, 30 KHz Channels)
20 dB Quieting Method	-70 dB at ± 30 KHz
Chassis Sensitivity	
12 dB SINAD (EIA Method)	0.25 μ V
20 dB Quieting Method	0.35 μ V
Paging	0.15 μ V
Radiated Sensitivity	
12 dB SINAD	20 μ V/Meter
20 dB Quieting	30 μ V/Meter
Paging	10 μ V/Meter
Critical Squelch	0.15 μ V
Spurious Response	-60 dB
Frequency Stability	0.001% (-10° C to +50° C)
Battery Drain (at 3.7 volts)	
Squelched	10 milliamperes
Unsquelched	90 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.

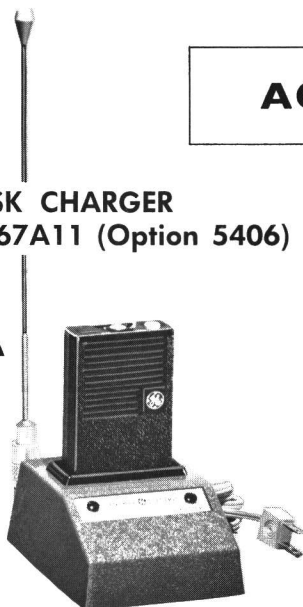
COMBINATION NOMENCLATURE

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 TONE	OPTIONS	FREQUENCY RANGE
PC Personal Pager	O Receive Only	6 30 kHz	A Tone & Voice (Automatic Reset)	W Fixed Output	L Type 99 Decoder	66 150.8-174 MHz
			B Tone & Voice (Push-To- Reset)	V Adjustable Output	S Noise Squelch	
			C Tone & Voice (Push-To- Listen)	U Noise Squelch		
			D Tone Only (Push-To- Silence)			
			E (Noise Squelch)			

ACCESSORIES

LBI-4200

DESK CHARGER
MODEL 4EP67A11 (Option 5406)



INDOOR ANTENNA
(Option 5406)

DESK CHARGER
MODEL 4EP67A10 (Option 5405)



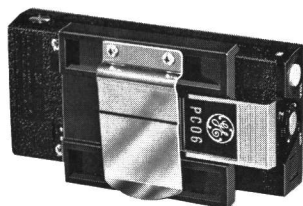
MOBILE CHARGER
MODEL 4EP75A10 (Option 5413)



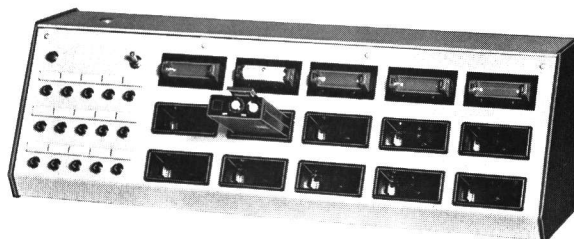
5-WATT SPEAKER
MODEL 4EZ18A13 (Option 5422)



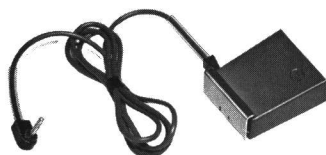
BELT-MOUNTING CLIP
(Option 5417)



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



LAPEL SPEAKER
& CORD SET
(Option 5420)



EARPHONE
(Option 5421)

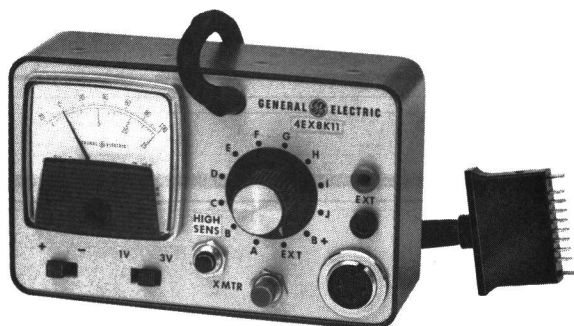


LEATHER
CASE
(Option 5415)



TEST EQUIPMENT

**TEST KIT
MODEL 4EX8K11**



**TEST SET
MODEL 4EX3A10 (TM-11 & TM-12)**

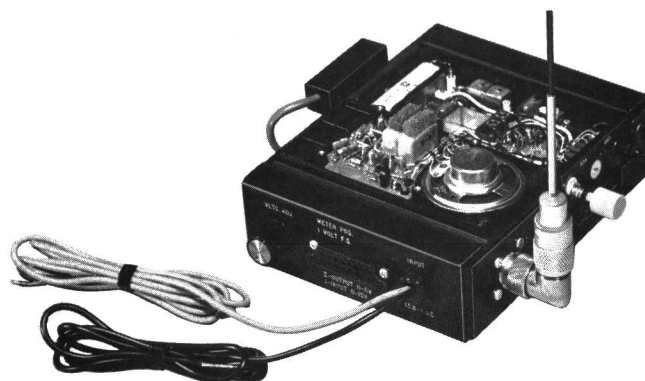


**IF GENERATOR
MODEL 4EX9A10 (Option 4381)**



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 Type ER-54-A are extremely compact, high performance FM receivers for tone and voice paging in the 150.8 - 174 MHz range. The Personal Pagers are available for three different 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.

A belt-mounting clip supplied with the Pager permits the radio to be attached to a belt in a horizontal position. 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	Tone and Voice (With Automatic Reset)	Push-to-Reset and OFF - VOLUME
B	Tone and Voice	Push to Reset and OFF - VOLUME
C	Tone and Voice	Push to Listen and OFF - VOLUME
D	Tone only	Push to Silence and OFF - VOLUME
E	Voice only	Squelch 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 30 seconds. However, the Push-to-Reset button may be pressed as soon as the message is completed to reset the receiver.

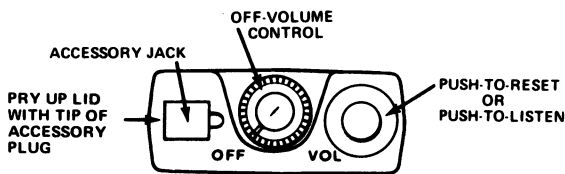


Figure 1 - Tone & Voice Receiver

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 RECEIVERS

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 a short alerting 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.

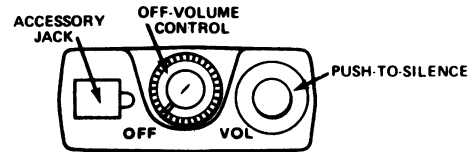


Figure 2 - Tone Only Receiver

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 continuous 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.

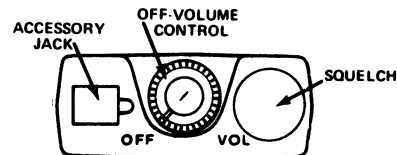


Figure 3 - Voice Only Receiver

BATTERY INFORMATION

The Personal Pager is shipped from the factory ready for immediate operation upon installation of the battery. The 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	19A116252-P1		14 hrs.
Mercury	19A116387-P2 (package of 12)	Mallory TR133 Eveready E133	105 hrs.
Alkaline	19A116448-P2 (package of 6)	Mallory MN1306	50 hrs.

The rechargeable battery is shipped from the factory in a fully-charged condition---ready for immediate use. If the

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 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.

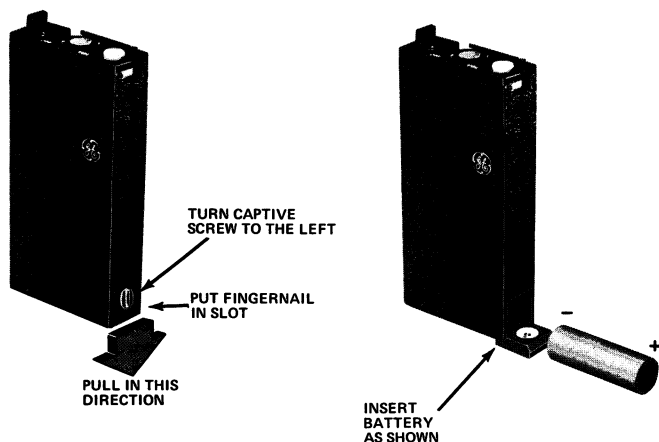


Figure 4 - Battery Replacement

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 14 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 safely be left on trickle charge for as long as desired.

Refer to the applicable Maintenance Manual for complete instructions.

WARNING

Do not attempt to recharge the 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 117-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 117-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.

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-54-A are double-conversion, superheterodyne receivers for tone and voice paging in the 150.8 to 174 MHz range. The circuit boards used in the different receiver applications are shown in the following chart.

APPLI- CATION	RECEIVER BOARD	TYPE 99 DECODER BOARD	SQUELCH BOARD
Tone & Voice	19D413303 G1	19C317029- G1	
Tone Only	19D413303- G2	19C317029- G1	
Voice Only	19D413303- G1		19C317187- G1

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

The antenna circuit consists of ferrite rod L317 and capacitors C363 and C364. The circuit is tuned by C364. An RF signal from the antenna is coupled by RF cable W301 to a 50-ohm matching network (L318 and L319) that provides the proper impedance match to RF Amplifier Q310.

The output of Q310 is coupled through helical resonators L301 and L302 to the base of the 1st Mixer.

1ST OSCILLATOR & MIXER

1st Oscillator Q302 is a third mode oscillator that operates in the 46 to 54 MHz range. The crystal is connected in the oscillator feedback path to permit oscillation at the crystal frequency only. L304, C304 and C305 make up the mode-selective resonant circuit. Tuneable coil L304 permits the oscillator frequency to be shifted slightly

for setting the receiver on the system operating frequency.

The oscillator output is transformer-coupled through L305 and C302 to the base of the 1st mixer. L305 is tuned to three times the crystal frequency. The oscillator stage is metered at TP1.

RF from the helical resonators and the low-side injection frequency from the 1st Oscillator are applied to the base of 1st Mixer Q301. The 12.4-megahertz high IF output is coupled through a three-coil toroidal filter (L306 and C311, L307 and C314, L308 and C317) which provides the High-IF selectivity.

2ND OSCILLATOR & MIXER

Q303 operates as a Colpitts oscillator with a crystal frequency of 11.945 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 Q304 producing the 455-kilohertz Low IF output. The 2nd Mixer stage is metered at TP4.

Following the 2nd Mixer is a six coil Low IF filter (L309 through L314) that provides the main receiver selectivity.

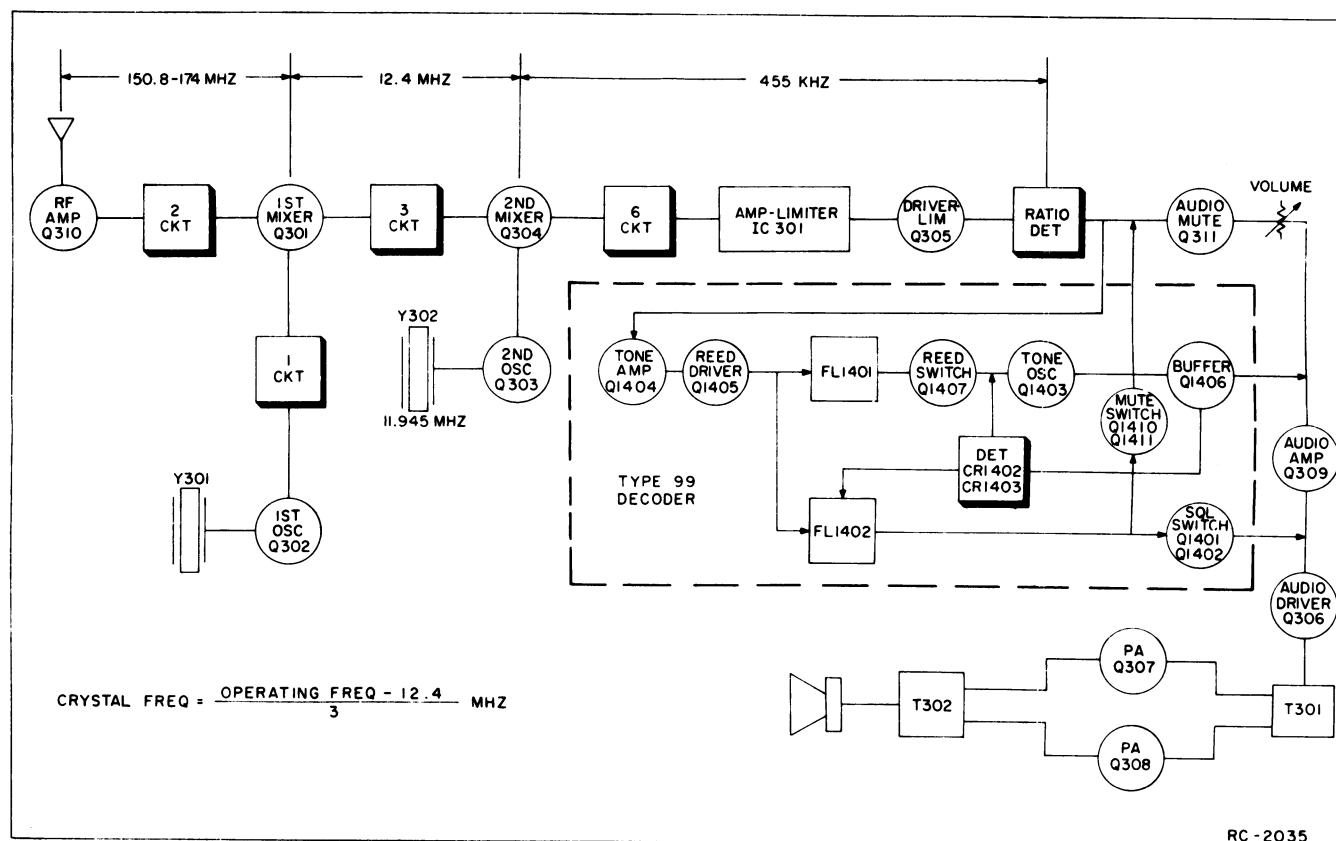


Figure 5 - Tone and Voice Receiver Block Diagram

irns on Tone Alert

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nd R1410, and R1412

allows the oscillation to be applied to the input of the CR1403) where the output is taken from the output of the CR1403.

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a collector of
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the base of Audio
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pulse turns off
Q1402/Q1413. Turn-
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In Pagers connected for Push-to-Reset, turning the radio on causes Q1402/Q1413 to conduct. This causes a short burst of tone and then noise to be heard from the speaker. Q1402/Q1413 will conduct until the Push-to-Reset button is pressed, grounding the base of Q1401/Q1412 and turning it on. Turning on Q1401/Q1412 turns off Q1402/Q1413, resetting the Squelch Switch. A simplified Push-to-Reset circuit is shown in Figure 7.

In Pagers with the automatic reset option, transistors Q1408/Q1419, Q1409/Q1420 and associated circuitry are mounted on the Decoder Board. The two transistors operate as a momentary switch for automatically resetting the Squelch Switch (Q1401 and Q1402).

The emitter of Q1408/Q1419 is connected to the collector circuit of Q1402/Q1413 and the collector of Q1409/Q1420 is connected to the base circuit of Q1401/Q1412. When the proper tones turn on Q1402/Q1413, the battery voltage is applied to the emitter circuit of Q1408/Q1419 and capacitor C1417.

In approximately 30 seconds, the charge on C1417 is sufficient to momentarily turn on Q1408/Q1419, which momentarily turns on Q1409/Q1420. When turned on, the collector of Q1409/Q1420 drops to ground, applying a momentary ground to the base of Q1401/Q1412, turning it on. Turning on Q1401/Q1412 turns off Q1402/Q1413, resetting the Squelch Switch.

Pressing the Push-To-Reset button turns Q1401/Q1412 on and Q1402/Q1413 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 Q1402/Q1413 to

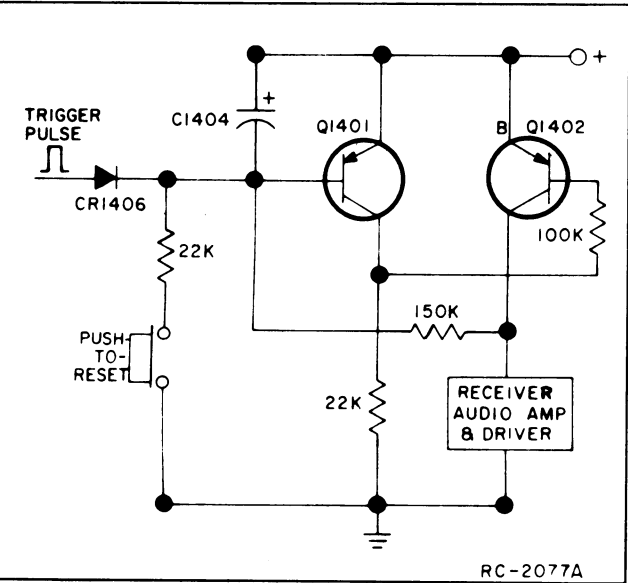


Figure 7 - Push-To-Reset Circuit

conduct until C1404 charges up, allowing a short burst of tone to be heard from the speaker. When C1404 charges, Q1401 turns on and Q1402 turns off. A simplified Push-to-Listen circuit is shown in Figure 8.

When the circuit is triggered, Q1401/Q1412 is turned off and Q1402/Q1413 is turned on until C1404 charges up, allowing the alerting tone to be heard. When C1404 charges Q1401/Q1412 turns on and Q1402/Q1413 turns off. Pressing the Push-To-Listen button turns on Q1402/Q1413. The transistor will remain on as long as the button is held down.

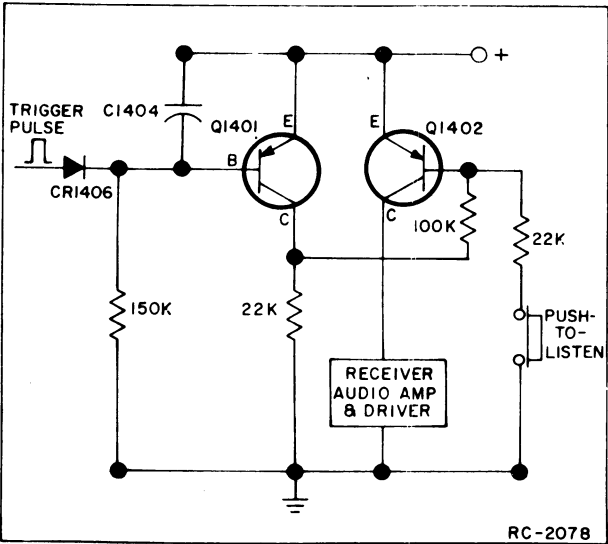


Figure 8 - Push-To-Listen Circuit

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 to the column labeled "Tone Frequency". The second tone frequency is 802.5 Hz.

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For different paging numbers, locate the first digit in the "100's Digit" column and determine the tone frequencies as described in the example.

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

SQUELCH BOARD

Squelch Board A302 is used in voice only receivers. The Squelch Board consists of 1st Noise Amp Q654, Active Filter Q651, 2nd Noise Amp Q652 and Squelch Switch Q653.

Noise from the ratio detector operates the squelch circuit. With no carrier applied to the receiver, noise is coupled through SQUELCH control R655 to the base of 1st Noise Amp Q654. R655 determines the gain of the Noise Amplifier by varying the bias to the base of Q654.

The output of Q654 is applied to an active, high-pass filter that attenuates frequencies below 3 kHz. The filter consists of C651, C652, C653, R651, R652 and Q651.

Following the high-pass filter is 2nd Noise Amp Q652. The output of Q652 is rectified by CR651 and CR652, and filtered by R659 and C656 to produce a positive DC voltage. The positive voltage is applied to the base of PNP Squelch Switch Q653, turning it off.

The collector of Q653 is tied to the collector of Audio Amp Q304 and the base of Audio Driver Q306 on the receiver board. Turning off Q653 removes the supply voltage to the audio transistors, turning them off.

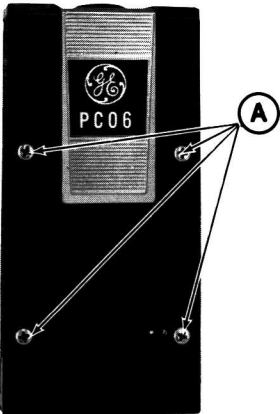
When the receiver is quieted by a carrier, the receiver noise is reduced. This removes the positive voltage on the base of Squelch Switch Q653, turning it on. Turning on Q653 applies the battery voltage to Q309 and Q306, allowing the audio stages to conduct so that sound is heard from the speaker. Capacitor C657 in the collector of Q653 slows down the switching action of the transistor to provide a more positive switching action. Resistor R662 connects from the collector of Q653 to the base of Q652, 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.

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.

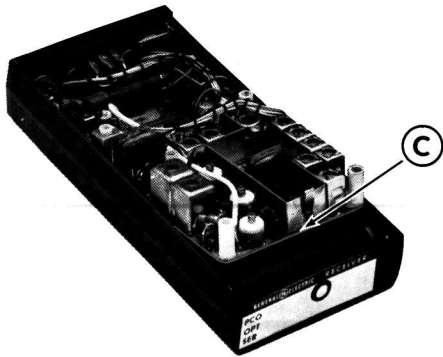


NOTE

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.

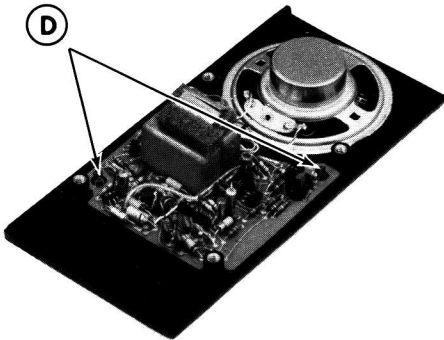
To remove the receiver board:

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.



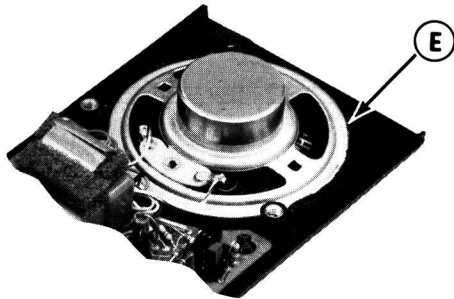
To remove the tone or squelch board:

1. Carefully pry up one side of the board until it slips over the plastic retaining clip (D).
2. Then pry up the other side of the board until it slips over the retaining clip.



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

The Personal Pager uses a special type of epoxy-coated printed circuit board. When replacing a component or module, care is required to avoid pulling the plated-through holes out of the board. Replace the components as follows:

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.

IMPORTANT! If the plated-through hole is accidentally pulled out of the printed circuit board, replace the component as follows:

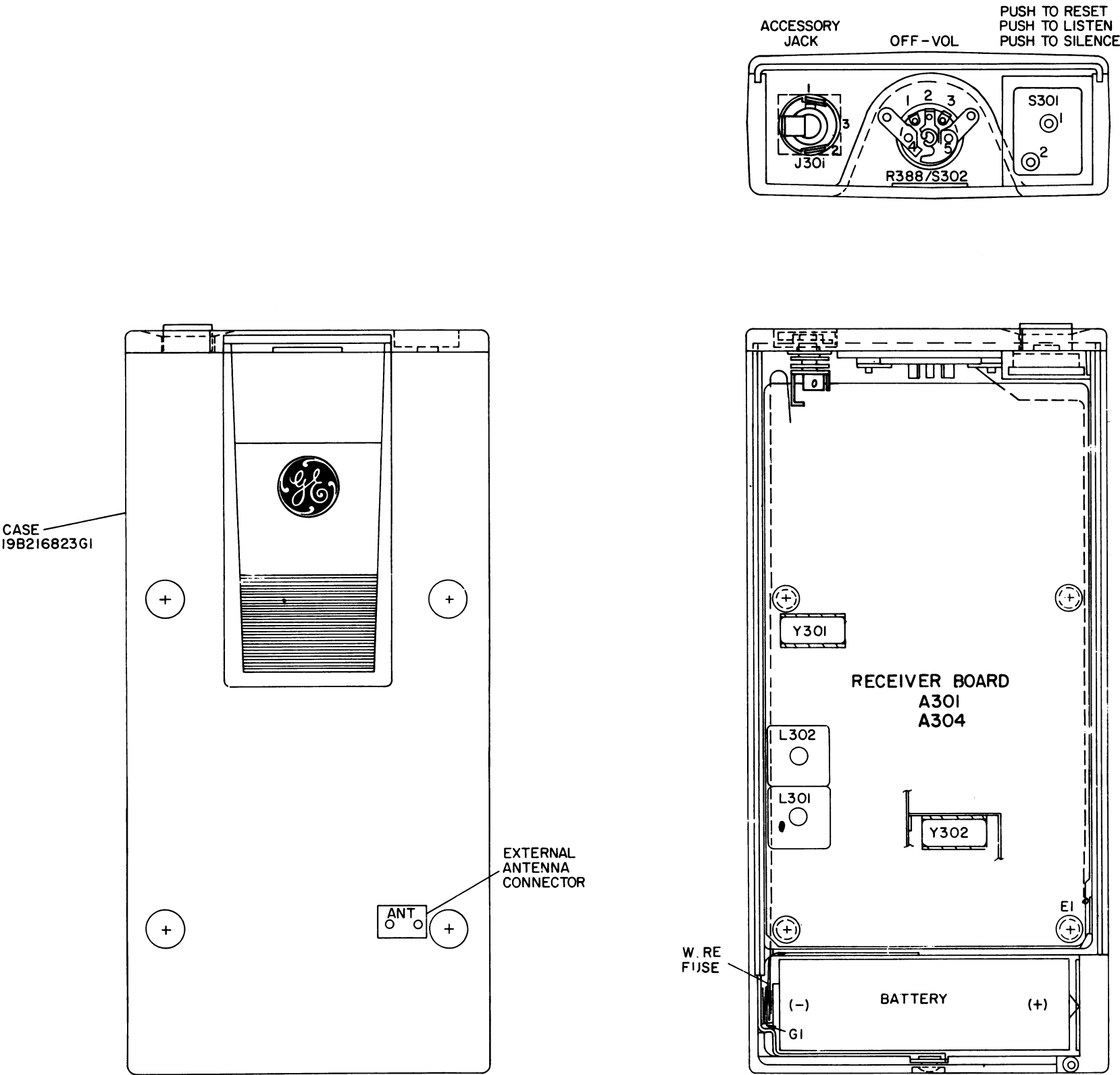
1. Carefully scrape off the epoxy coating to expose the copper run. This step must be done to both the top and bottom of the board if the hole connected two runs.
2. Coat the copper run(s) with solder (top and bottom if required).
3. Insert the component into the hole and solder the component to the coated area (top and bottom if required).

DISASSEMBLY PROCEDURE

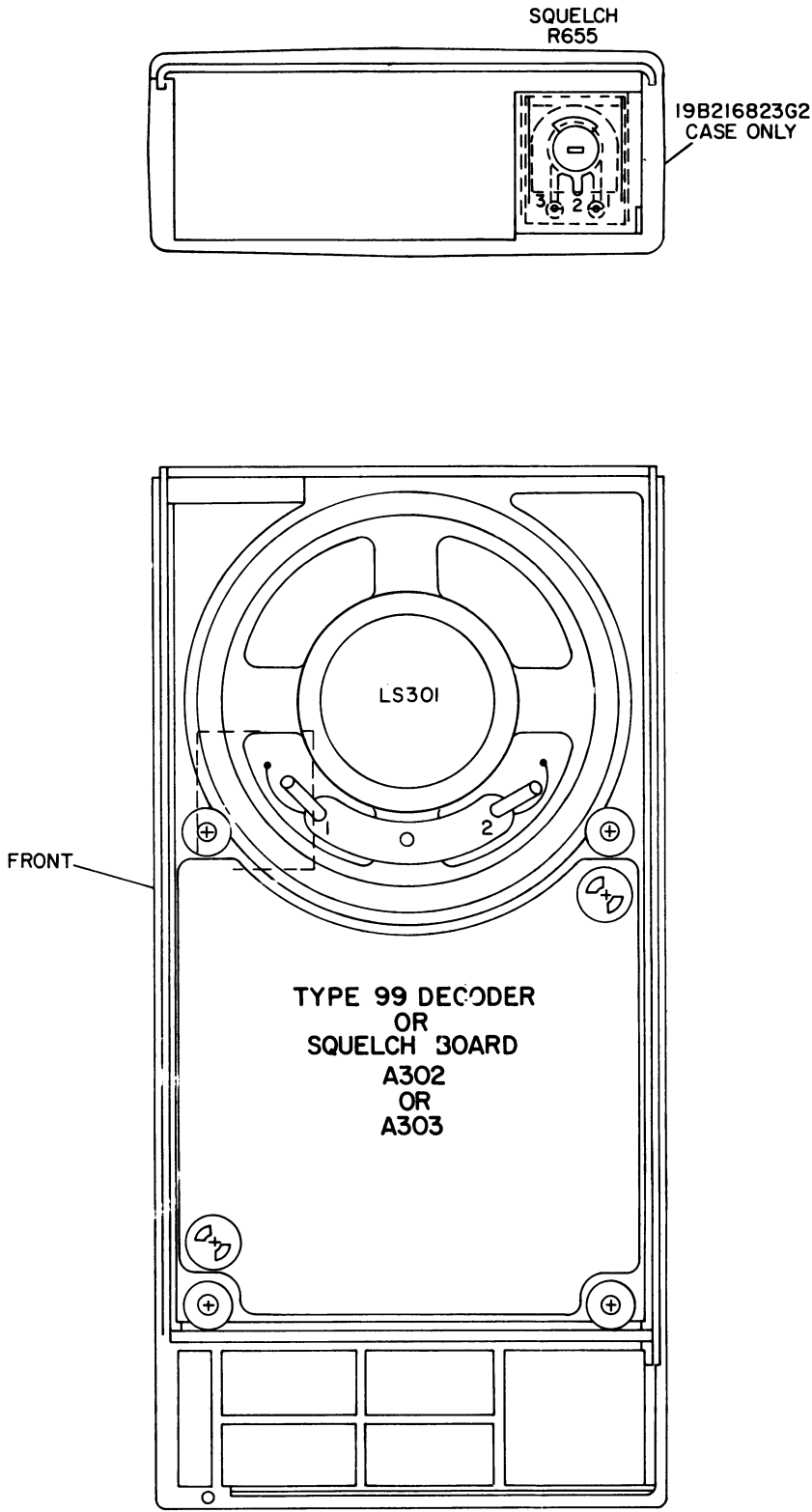
PERSONAL PAGER
TYPE ER-54-A

MODULE LAYOUT DIAGRAM

PERSONAL PAGER
TYPE ER-54-A



(19D413968, Rev. 3)



COMPLETE RECEIVER ALIGNMENT

- EQUIPMENT REQUIRED:
- GE Test Set Models 4EX3A10 (TM11 or TM12) or 4EX8K11, or 20,000 ohms-per-volt multimeter.
 - A 455 kHz signal source (IF Generator Model 4EX7A10 or equivalent), and a 150.8 - 174 MHz signal source (M800 Signal Generator or equivalent).
 - Test Amplifier Model 4EX16A10 and RF Probe 19C311370-G1. Connect the Test Amplifier to the GE Test Set.
 - Test Fixture Model 4EX17A10.
- PRELIMINARY CHECKS & ADJUSTMENTS
- 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.
 - 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 jumper between H21 (near C336) and H33 (near Q310). Connect another jumper between H8 (near R339) and the 3.7-volt supply. This will allow normal receiver noise to be heard in the speaker. Refer to the receiver Outline Diagram for hole locations.
 - If C311, C314 or C317 have been de-tuned, set the capacitors to mid-capacity. Otherwise, do **not** pre-set these capacitors.
 - Disconnect the center conductor of the antenna cable at H20. The recommended signal generator setup is shown in Figure 9.

STEP	METERING POINT	TUNING CONTROL	PROCEDURE
RATIO DETECTOR			
1.	TP3 & TP2	L316	Loosely couple the 455 kHz signal to C335 and adjust the generator output for maximum meter reading at TP3. Then adjust L316 for zero meter reading at TP2.
2.	Junction of R323 & R349	L315	Set the generator output for a level below limiting at the junction of R323 and R349 (approximately 1.3 VDC). Then adjust L315 for maximum meter reading.
3.	TP3 & TP2	L316	Set the generator output for maximum meter reading at TP3. Then adjust L316 for zero meter reading at TP2.
4.	Junction of R323 & R349, and TP2	L315 and L316	Repeat STEPS 2 and 3 until the maximum output at the junction of R323 and R349 coincides with a zero reading at TP2.
1ST OSCILLATOR			
5.	TP1	L304 & L305	Adjust L304 for maximum meter reading. Then adjust L305 for a very small dip at TP1.
HI & LO IF FILTER			
6.		See Procedure	The IF circuits have been aligned at the factory and will normally require no further adjustment. Should adjustment become necessary, use the procedure outlined in Steps 6 and 7. Connect the scope, signal generator and detector as shown in Figures 11 and 12. 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 insulated body of C326 and adjust RF level of signal generator to 20 dB quieting level.
7.	TP4	L314, L313, L312, L311, L310, L309, C317, C314 and C311	With the signal applied, adjust L314, L313, L312, L311, L310, and L309 for minimum ripple. This should be near maximum amplitude. Then adjust C317, C314 and C311 for maximum amplitude on scope as shown on the scope waveform, keeping signal below saturation.
FRONT END			
8.		C364, L301, L302 and L305	Apply an on-frequency signal as above and tune C364, L301, L302 and L305 for maximum quieting.
1ST OSCILLATOR			
9.		L304	Apply an on-frequency signal as above. Loosely couple 455 kHz to the receiver and adjust L304 for zero beat at the speaker.
RATIO DETECTOR			
10.		L315	With no RF signal applied to the radio, adjust L315 for maximum noise at the output of the receiver. Do not readjust L316 for zero after adjusting L315.
ANTENNA CIRCUIT			
11.		C364	Re-connect center conductor of antenna cable at H20. Then apply a radiated, on-frequency signal to the receiver antenna and adjust C364 for best quieting (maximum reading).

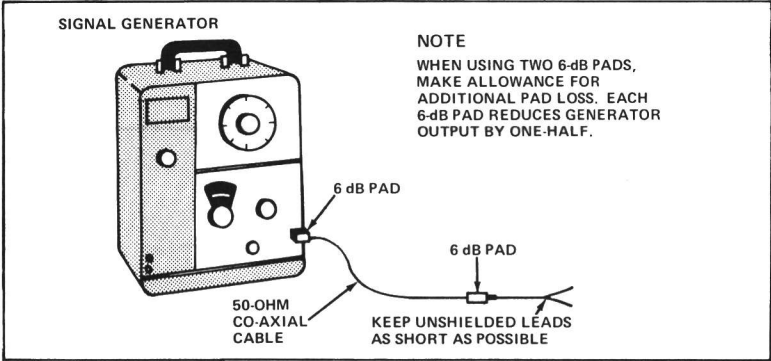
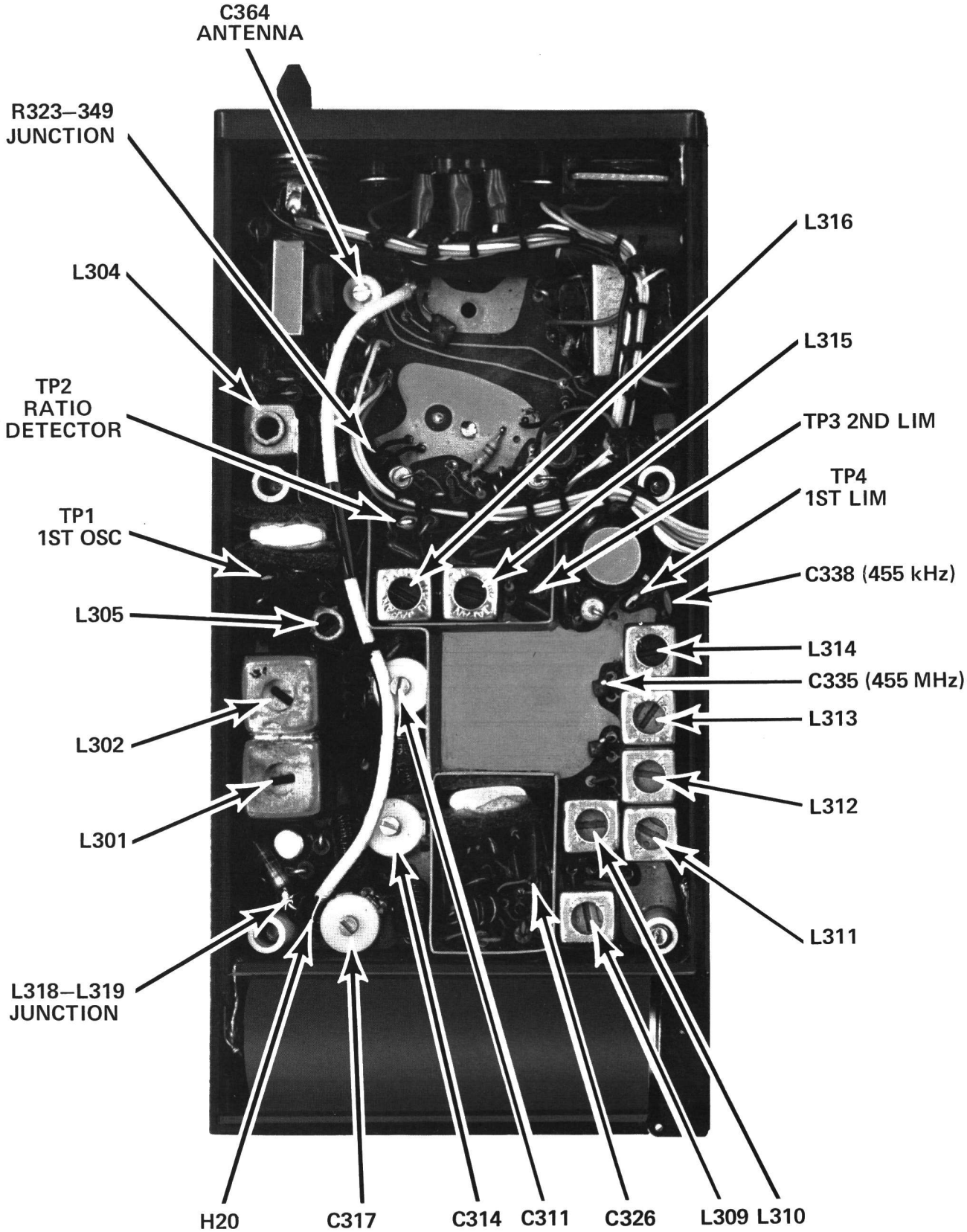


Figure 9 - Signal Generator Setup

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

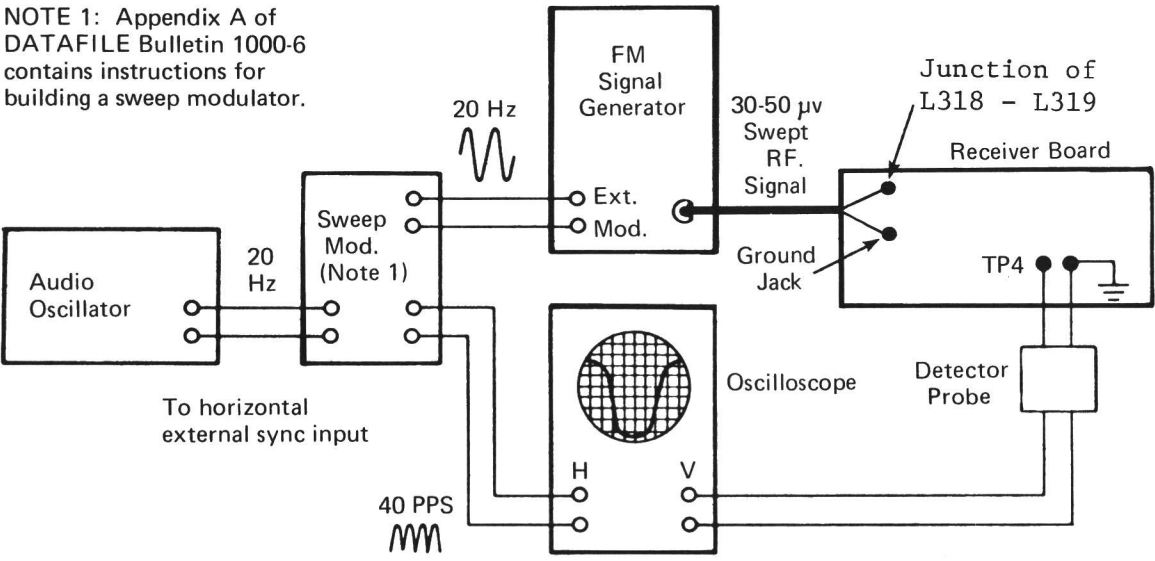


Figure 10 - Test Setup for 20-Hz Double-Trace Sweep Alignment

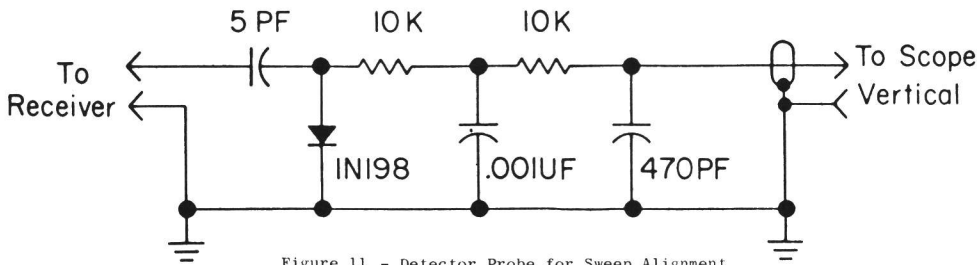


Figure 11 - Detector Probe for Sweep Alignment

FRONT END ALIGNMENT

- EQUIPMENT REQUIRED
- A 150.8-174 MHz signal source (M800 Signal generator or equivalent).
 - GE Test Set Models 4EX3A10, 4EX8K11, or a 20,000 ohm-per-volt meter. Test Fixture Model 4EX17A10 is also recommended.
- PRELIMINARY CHECKS & ADJUSTMENTS
- 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.
 - 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 jumper between H21 (near C336) and H33 (near Q310). Connect another jumper between H8 (near R339 and the 3.7-volt supply. This will allow normal receiver noise to be heard in the speaker. Refer to the receiver Outline Diagram for hole locations.
 - If Test Fixture Model 4EX17A10 is used, connect the signal generator to the Test Fixture antenna connector. If the Test Fixture is not used, connect the signal generator high to the junction of L317-C364 and the ground jacks on the printed wireboard. The recommended signal generator set-up is shown in Figure 9.

STEP	METERING POINT	TUNING CONTROL	PROCEDURE
FRONT END			
1		C364, L301, L302 and L305	Apply an on-frequency signal as above and tune C364, L301, L302 and L305 for maximum quieting.
1ST OSCILLATOR			
2		L304	Apply an on-frequency signal as above. Loosely couple 455 kHz to the receiver and adjust L304 for zero beat at the speaker.
ANTENNA CIRCUIT			
3	TP3 or TP4	C364	Apply a radiated, on-frequency signal to the receiver antenna and adjust C364 for best quieting.

ALIGNMENT PROCEDURE

150.8—174 MHz PERSONAL PAGER
TYPE ER-54-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.

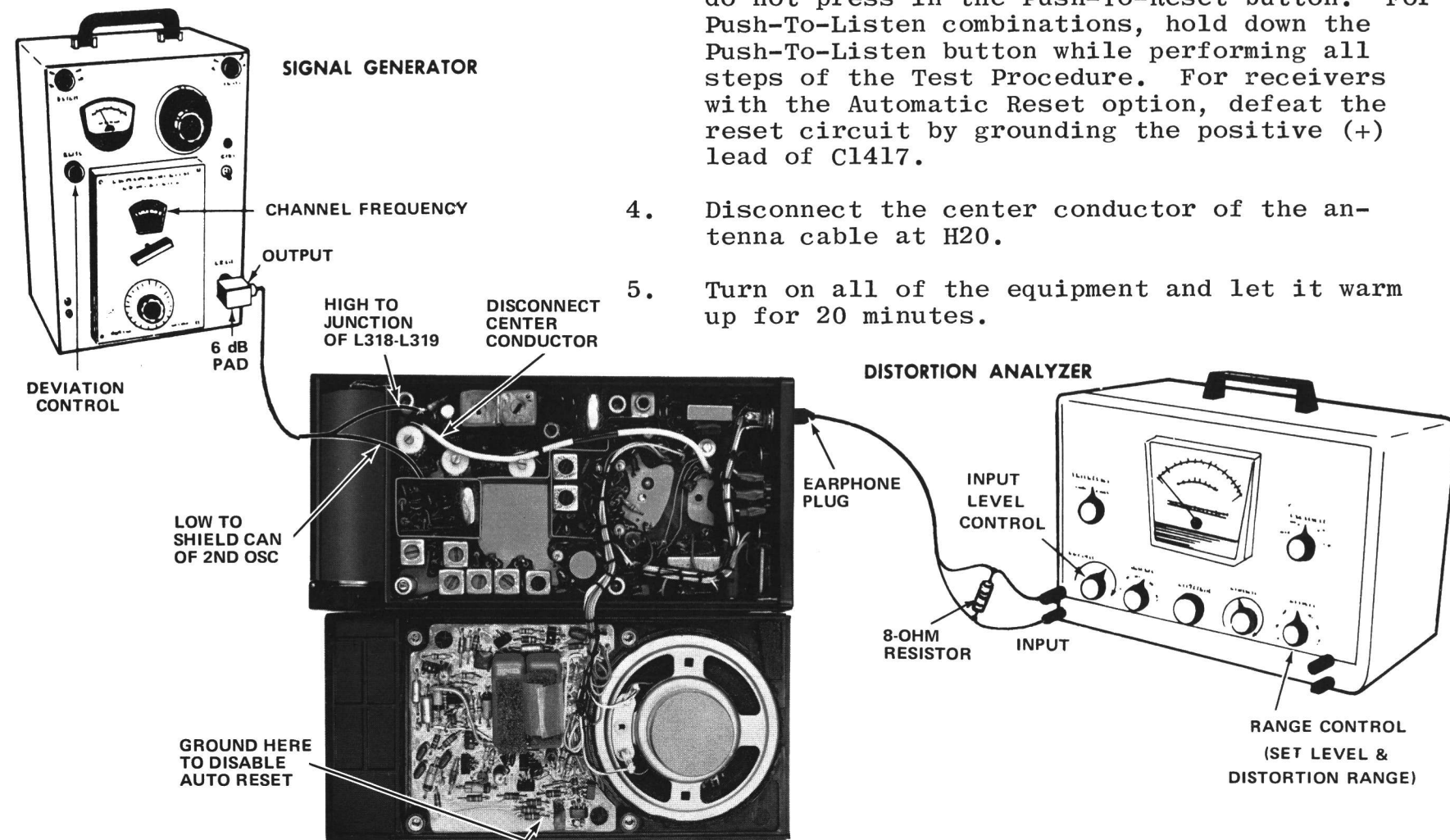
Once the defective stage is pinpointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to: Heath IM-12
- Signal Generator similar to: Measurements M-560
- 6-dB attenuation pad, and 8-ohm resistor

PRELIMINARY ADJUSTMENTS

1. If Test Fixture Model 4EX17A10 is not used, connect an external 3.7-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 C1417.
4. Disconnect the center conductor of the antenna cable at H20.
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 junction of L318-L319.
- 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 3.3-kHz deviation to the junction of L318-L319.
- 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 (.55 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)

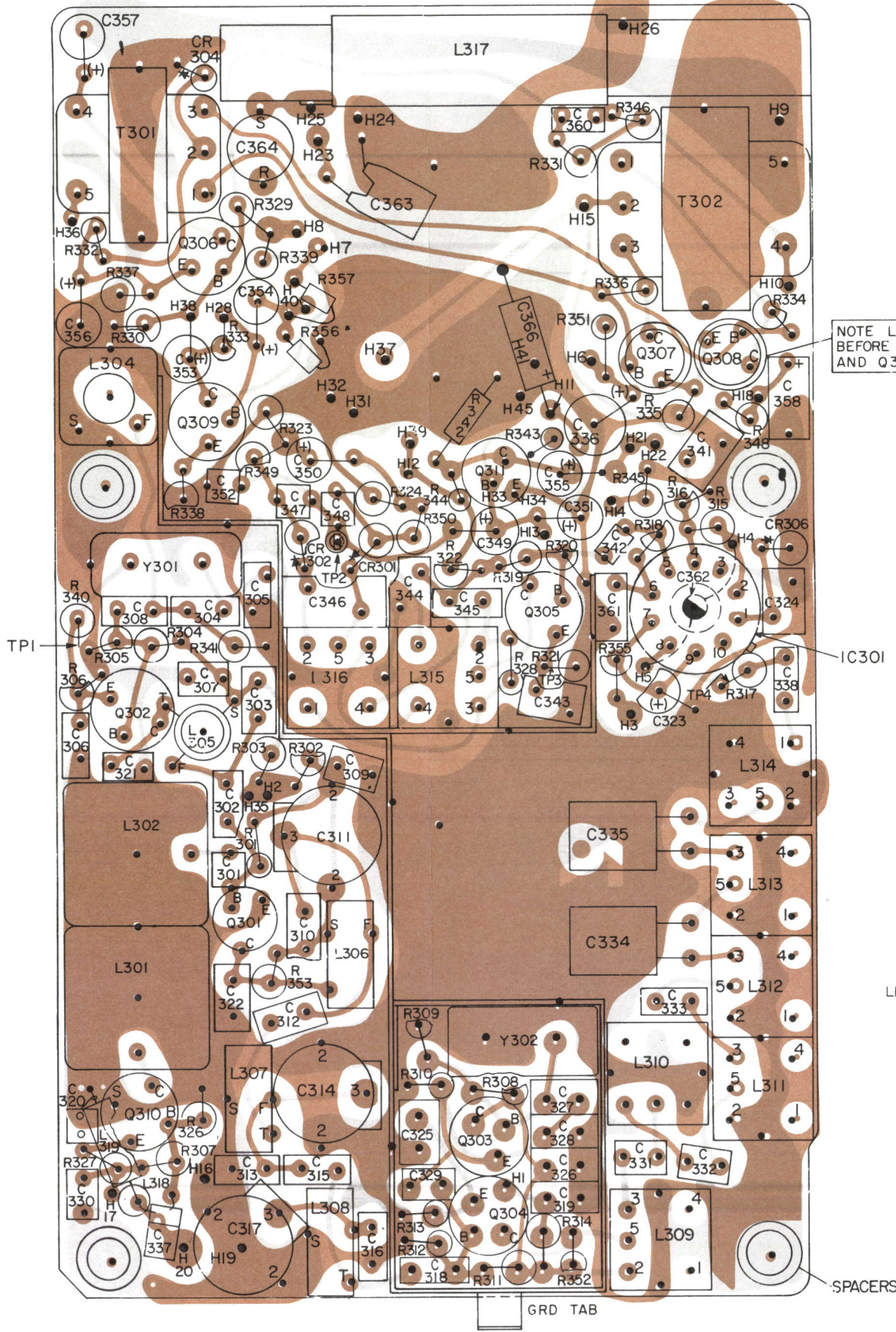
If STEPS 1 and 2 check out properly, measure the bandwidth as follows:

- 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

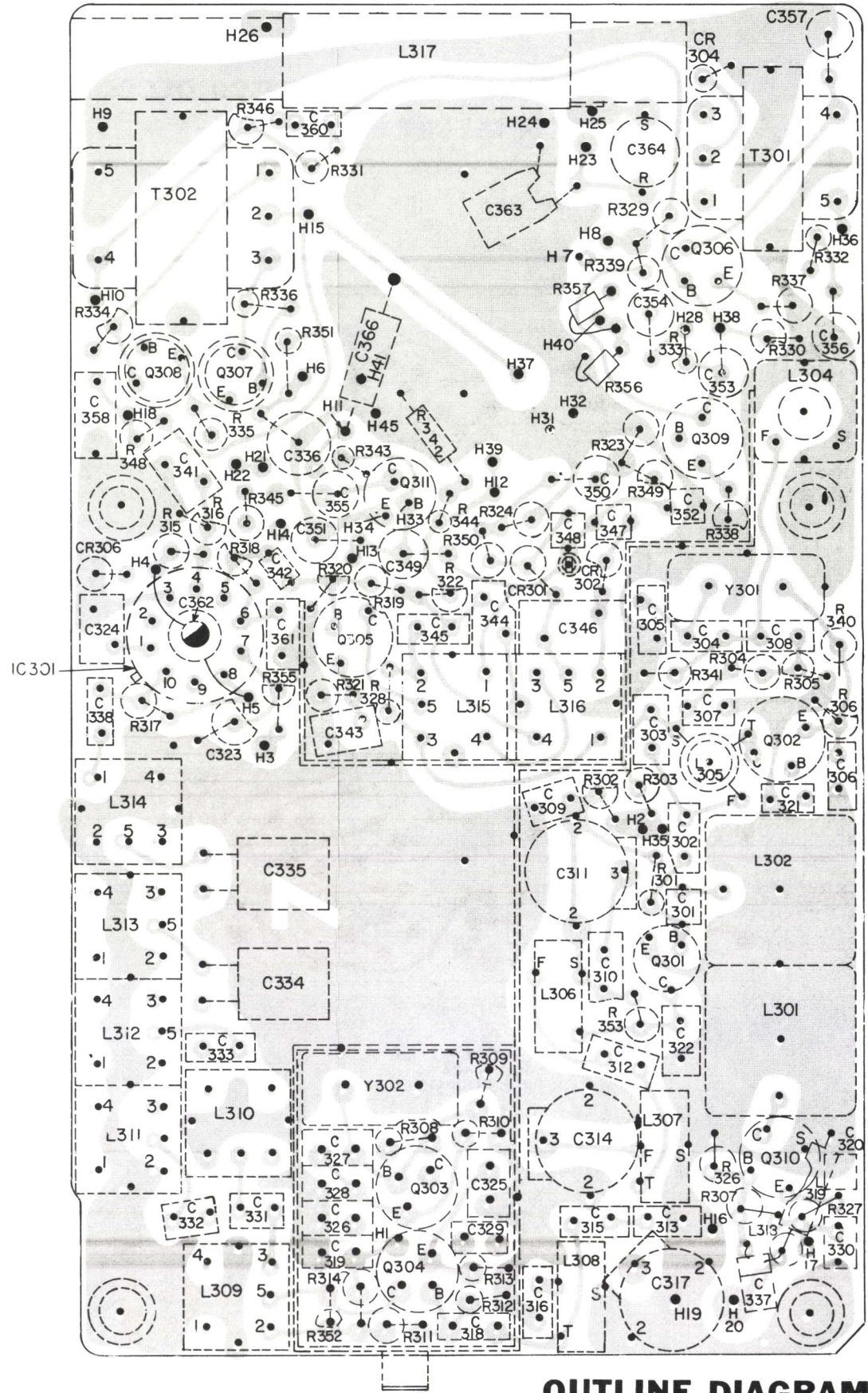
If the Modulation Acceptance Bandwidth test does not indicate the proper width, re-align the Low IF stages (Refer to the Receiver-Alignment Procedure).

COMPONENT SIDE



SOLDER SIDE

LB1-4200



OUTLINE DIAGRAM

RECEIVER BOARD
TYPE ER-54-A

TYPE 99 DECODER BOARD 19C317029G1

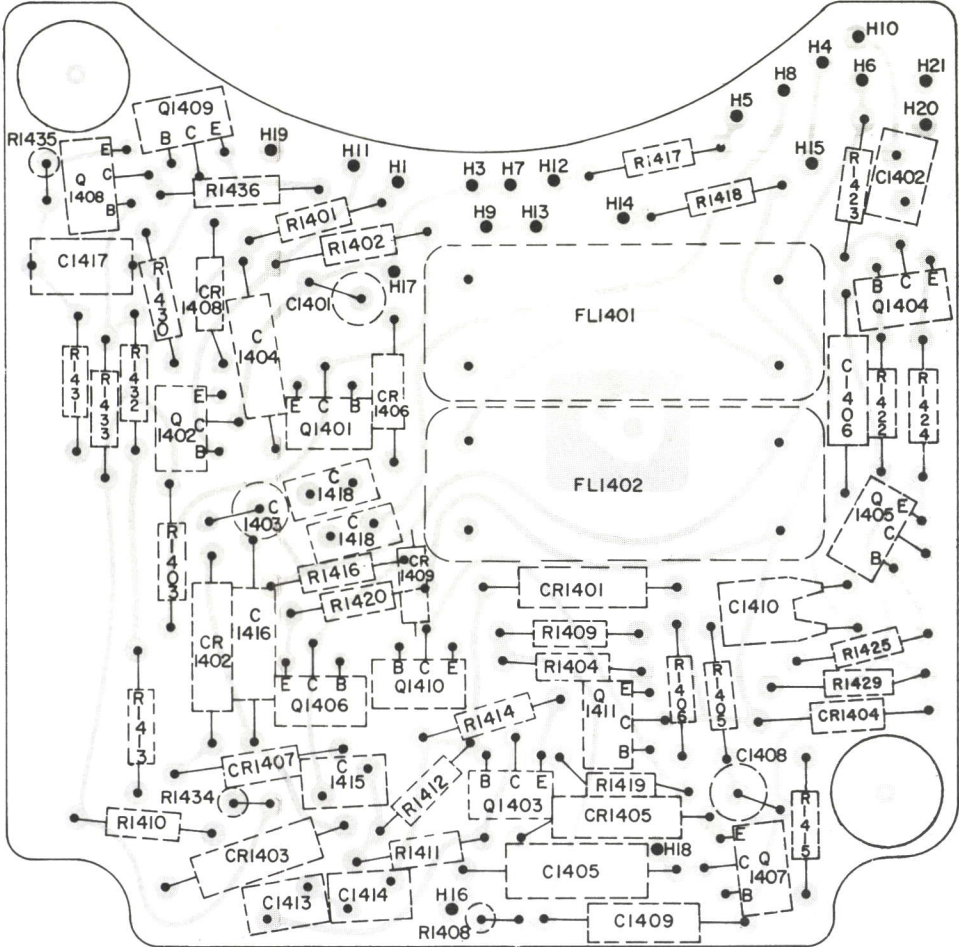
(19C317813, Rev. 2)
(19C317174, Sh. 1, Rev. 6)
(19C317174, Sh. 2, Rev. 6)

COMPONENT SIDE



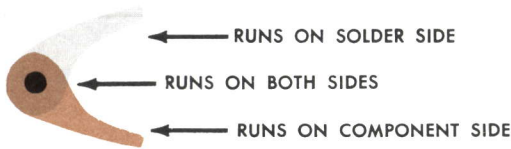
COMPONENTS SHOWN
DOTTED IN ARE PART
OF AUTO RESET KIT
19A127807G1

SOLDER SIDE



TRANSISTOR LEAD
IDENTIFICATION
FOR Q1401-Q1411

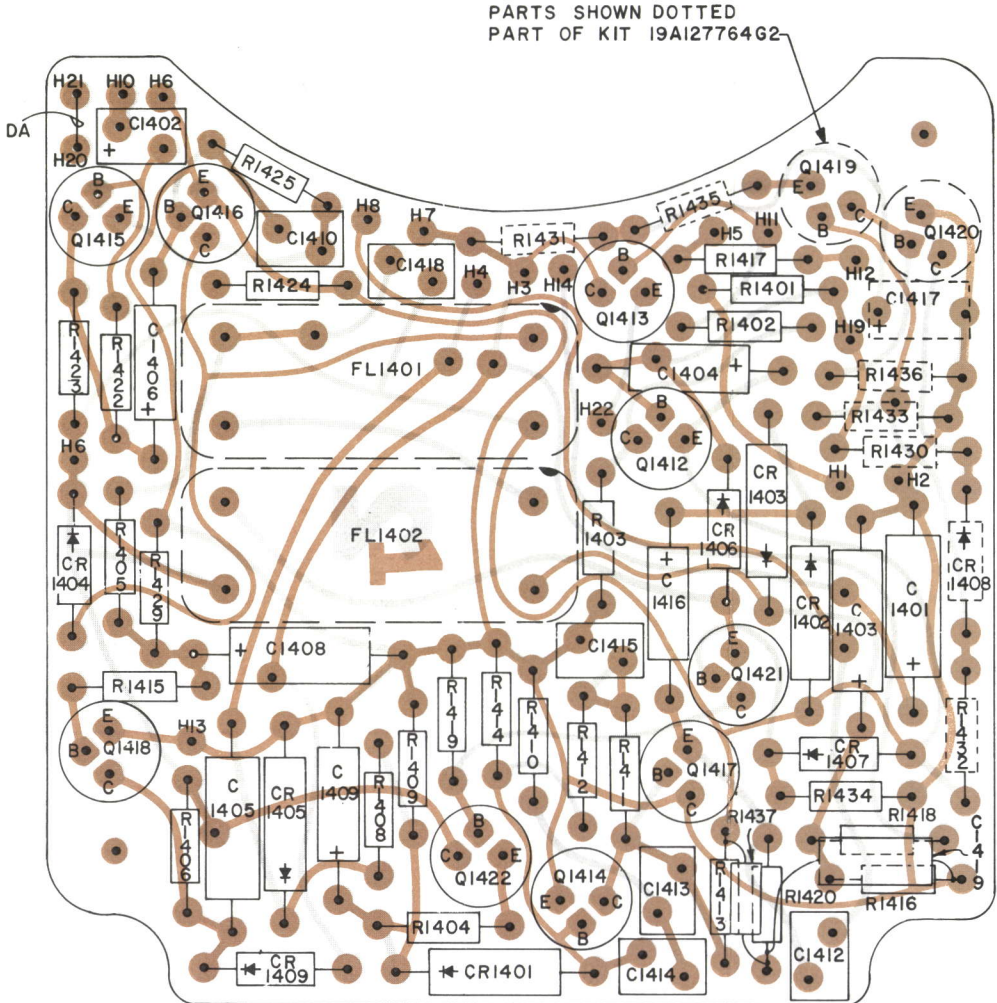
NOTE:
INSTALL REEDS WITH COLOR
DOTS AS SHOWN.



TYPE 99 DECODER BOARD 19C317029G2

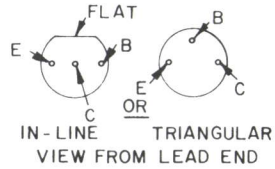
(19C320385, Rev. 3)
(19C320384, Sh. 1, Rev. 1)
(19C320384, Sh. 2, Rev. 2)

COMPONENT SIDE



PARTS SHOWN DOTTED
PART OF KIT 19A127764G2

LEAD IDENTIFICATION
FOR Q1412-Q1418, Q1421 & Q1422

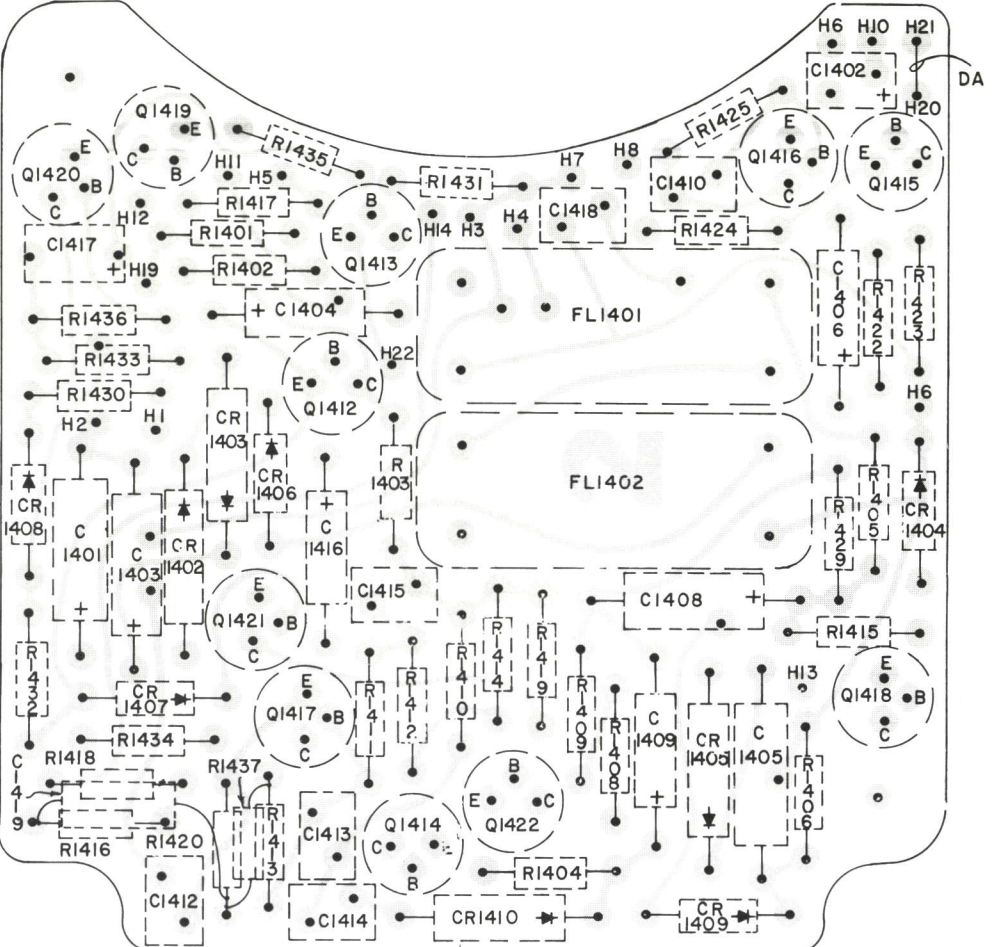


LEAD IDENTIFICATION
FOR Q1419 & Q1420



NOTE:
INSTALL REEDS WITH COLOR
DOTS AS SHOWN.

SOLDER SIDE



OUTLINE DIAGRAM

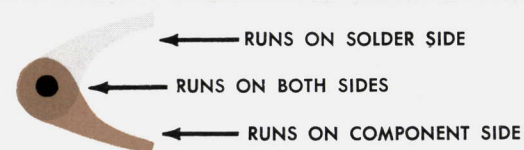
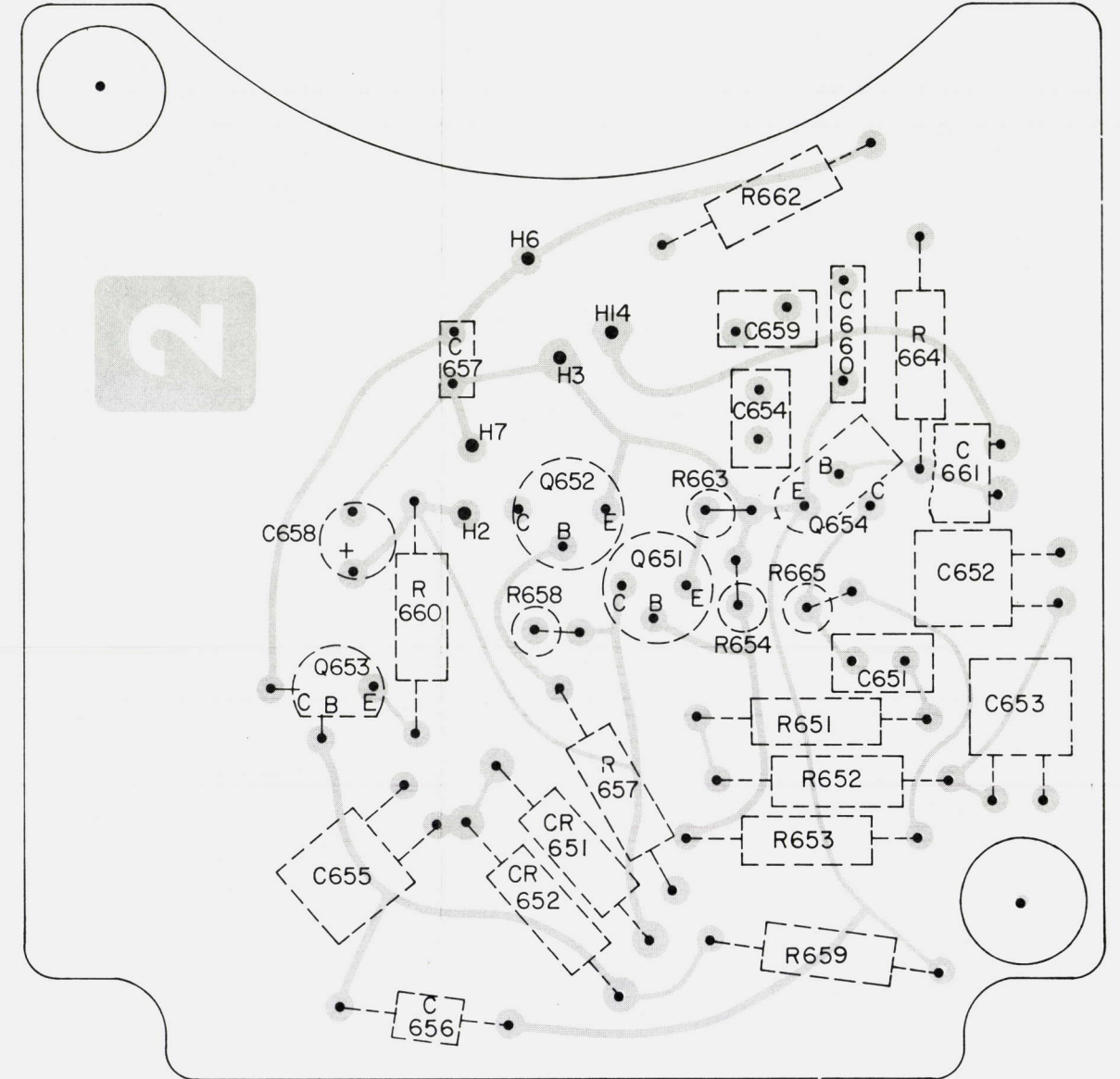
TYPE 99 DECODER
BOARD A303/A307

(19C317815, Rev. 1)
(19C317173, Sh. 1, Rev. 2)
(19C317173, Sh. 2, Rev. 2)

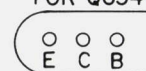
COMPONENT SIDE



SOLDER SIDE

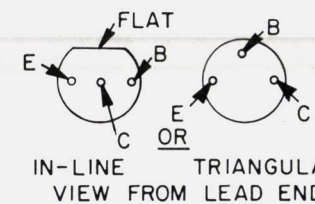


TRANSISTOR LEAD IDENTIFICATION FOR Q654



NOTE LEAD ARRANGEMENT BEFORE REPLACING Q654

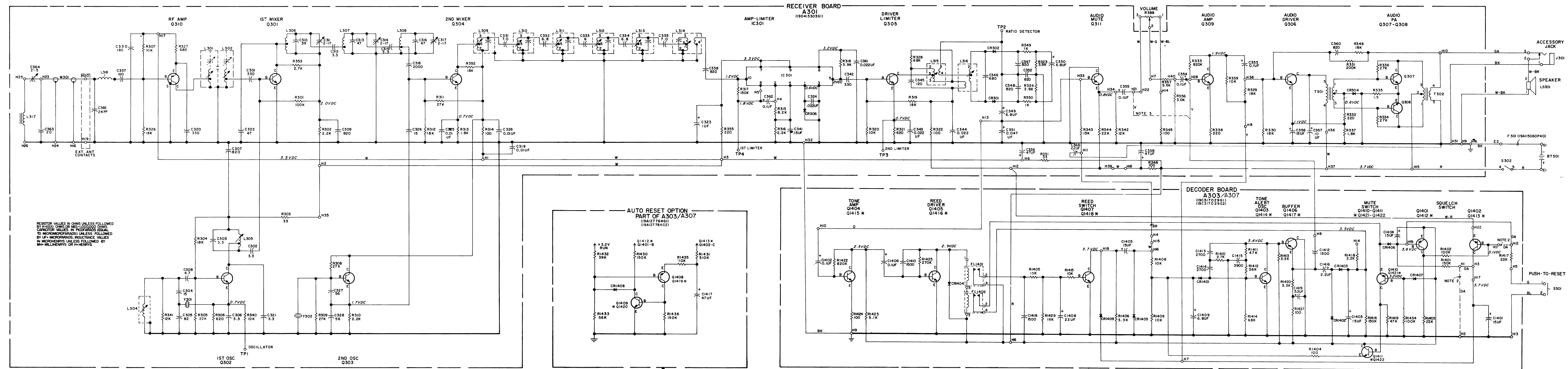
LEAD IDENTIFICATION FOR Q651-Q654



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

OUTLINE DIAGRAM

NOISE SQUELCH
BOARD A302



- 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 | | |
|---------------------------|---------------|---|
| DRAWING NO. | REV LETTER | |
| A301 | PL19D413303G1 | H |
| A303 | PL19C317029G1 | B |
| A307 | PL19B16823G1 | A |
| A307 | PL19C317029G2 | D |

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.

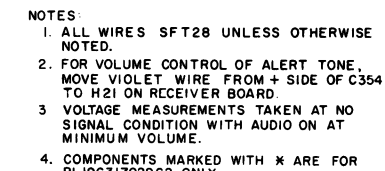
SCHEMATIC DIAGRAM

VOICE AND TONE RECEIVER

TYPE ER-54-A

150.8 - 174 MHz PERSONAL PAGE
TYPE ER-54-A

SYMBOL	GE PART NO.	DESCRIPTION
A301 and A304		RECEIVER BOARD A301 19D41330G1 TONE AND VOICE A304 19D41330G2 TONE
C301	19A116192P7	----- CAPACITORS ----- Ceramic: 330 pf ±20%, 50 VDCW; sim to Erie 8101-050-W5R-681K.
C302	19A116221P8	Ceramic: 3.3 pf ±5%, 75 VDCW; temp coef 0 ±30 PPM.
C303*	19A116221P8	Ceramic: 3.3 pf ±5%, 75 VDCW; temp coef 0 ±30 PPM. Earlier than REV A:
19A116221P9		Ceramic: 6.8 pf ±5%, 75 VDCW; temp coef -150 ±40 PPM.
C304	19A116114P2036	Ceramic: 15 pf ±5%, 100 VDCW; temp coef -80 PPM.
C305	19A116288P11	Ceramic: 82 pf ±5%, 100 VDCW; sim to Erie 8121-100-COG-8205.
C306	19A116221P8	Ceramic: 3.3 pf ±5%, 75 VDCW; temp coef 0 ±30 PPM.
C307	19A116192P9	Ceramic: 820 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R-821K.
C308	19A116114P16	Ceramic: 4.7 pf ±5%, 100 VDCW; temp coef 0 PPM.
C309	19A116192P9	Ceramic: 820 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R-821K.
C310	19A116221P7	Ceramic: 39 pf ±5%, 75 VDCW; temp coef -150 ±40 PPM.
C311	19A116163P3	Variable: approx 3 to 17 pf, 50 VDCW; sim to Amperex HT10KA/218.
C312	19A116114P12	Ceramic: 4 pf ±5%, 100 VDCW; temp coef 0 PPM.
C313	19A116221P10	Ceramic: 47 pf ±5%, 75 VDCW; temp coef -150 ±40 PPM.
C314	19A116163P3	Variable: approx 3 to 17 pf, 50 VDCW; sim to Amperex HT10KA/218.
C315	19A116114P12	Ceramic: 3.3 pf ±5%, 100 VDCW; temp coef 0 PPM.
C316	19A116221P10	Ceramic: 47 pf ±5%, 75 VDCW; temp coef -150 ±40 PPM.
C317	19A116163P3	Variable: approx 3 to 17 pf, 50 VDCW; sim to Amperex HT10KA/218.
C318	5495323P13	Ceramic: .002 pf +100% -20%, 75 VDCW.
C319*	19A116192P1	Ceramic: 0.01 pf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL. In REV E and earlier: Ceramic: .01 pf +100% -20%, 75 VDCW.
C320	19A116192P7	Tantalum: 330 pf ±20%, 50 VDCW; sim to Erie 8101-050-W5R-681K.
C321	19A116221P8	Ceramic: 3.3 pf ±5%, 75 VDCW; temp coef 0 ±30 PPM.
C322	19A116221P10	Ceramic: 47 pf ±5%, 75 VDCW; temp coef -150 ±40 PPM.
C323	5496267P17	Tantalum: 1.0 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
C324	19A116244P2	Ceramic: 0.022 pf ±20%, 50 VDCW.
C325* and C326*	19A116192P1	Ceramic: 0.01 pf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL. In REV E and earlier: Ceramic: .01 pf +100 -20%, 75 VDCW.
C327 and C328	19A116288P8	Ceramic: 56 pf ±5%, 100 VDCW; sim to Erie 8121-100-P2G-560J.
C331	19A116114P24	Ceramic: 7 pf ±5%, 100 VDCW; temp coef 0 PPM.
C332	19A116114P22	Ceramic: 6.8 pf ±5%, 100 VDCW; temp coef 0 PPM.
C333	19A116114P20	Ceramic: 6 pf ±5%, 100 VDCW; temp coef 0 PPM.
C334	19A116114P22	Ceramic: 6.8 pf ±5%, 100 VDCW; temp coef 0 PPM.
C335	19A116114P24	Ceramic: 7 pf ±5%, 100 VDCW; temp coef 0 PPM.
C336	5491674P42	Tantalum: 47 pf ±20%, 6 VDCW; sim to Sprague Type 162D.
C337*	19A116114P10073	Ceramic: 180 pf ±10%, 100 VDCW; temp coef 0 PPM.
C338	19A116114P39	Ceramic: 20 pf ±5%, 100 VDCW; temp coef 0 PPM.
C339	19A116192P9	Ceramic: 820 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C341	19A116244P4	Ceramic: 0.15 pf ±20%, 50 VDCW.
C342	19A116192P7	Ceramic: 330 pf ±20%, 50 VDCW; sim to Erie 8101-050-W5R.
C343 and C344	19A116244P2	Ceramic: 0.022 pf ±20%, 50 VDCW.
C345	19A116288P9	Ceramic: 120 pf ±5%, 100 VDCW; sim to Erie 8121-100-U22.
C346	19A116288P10	Ceramic: 680 pf ±5%, 100 VDCW; sim to Erie 8131-050-S2H.
C347 and C348	19A116192P9	Ceramic: 820 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C349 and C350	5496267P1	Tantalum: 6.8 pf ±20%, 6 VDCW; sim to Sprague Type 150D.
C351	5496267P23	Tantalum: 0.047 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
C352	19A116192P9	Ceramic: 820 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C353 thru C355	5496267P24	Tantalum: 0.1 pf ±20%, 35 VDCW; sim to Spague Type 150D.
C356	5491674P34	Tantalum: 15 pf ±20%, 6 VDCW; sim to Sprague Type 162D.
C357*	5496267P24	Tantalum: 0.1 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
C358	5496267P23	Tantalum: 0.047 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
C359	19C307102P5	Tantalum: 47 pf ±20%, 6 VDCW; sim to Components Inc 8476R.
C360	19A116192P9	Ceramic: 820 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C361	19A116244P2	Ceramic: 0.022 pf ±20%, 50 VDCW.
C362	19C307102P16	Tantalum: 0.1 pf +40 -20%, 20 VDCW; sim to Components Inc Y104R.
C363	19A116114P39	Ceramic: 20 pf ±5%, 100 VDCW; temp coef 0 PPM.
C364	19A116149P4	Variable: 2 to 5 pf, 63 VDCW; temp coef -33 PPM.
C365*	19A116114P2042	Ceramic: 24 pf ±5%, 100 VDCW; temp coef -80 PPM. Added by REV D.
C366*	5491674P44	Tantalum: 2.2 pf ±20%, 15 VDCW; sim to Sprague Type 162D. Added by REV H.
C367	19A116244P2	Ceramic: 0.022 pf ±20%, 50 VDCW.
C368	4033292P1	Germanium: sim to Hughes 1N198.
C369	19A115775P1	In REV F and earlier: Silicon.
C370	19A115250P1	Silicon.
C371	19A115250P1	Silicon.
IC301	19A116208P1	Monolithic, linear.
L306	19B216590G1	Coil.
L307 and L308	19B216590G2	Coil.
L309 thru L313	19A116309P1	IF Transformer.
L314	19A116309P2	IF Transformer.
L315	19A116308P1	IF Transformer.
L316	19A116308P2	IF Transformer.
L317	19B21682G1	Antenna.
L318	19B208420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K.
L319*	19B208420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K. Deleted by REV D.
Q301 and Q302	19A115991P1	Silicon, NPN.
Q303 and Q304	19A115245P1	Silicon, NPN.
Q305	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q306	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q307 and Q308	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q309	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q310	19A116313P1	Germanium, PNP.
Q311*	19A129187P1	Silicon, PNP. In REV E and earlier: Silicon, PNP; sim to 2N4290.
R301	3R151P104J	Composition: 0.10 megohm ±5%, 1/8 w.
R302	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R303	3R152P330K	Composition: 33 ohms ±10%, 1/4 w.
R304	3R152P183J	Composition: 18,000 ohms ±5%, 1/4 w.
R305*	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R306	3R152P123J	Composition: 12,000 ohms ±5%, 1/4 w.
R307	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R308 and R309	3R151P273J	Composition: 27,000 ohms ±5%, 1/8 w.
R310	3R151P222J	Composition: 2200 ohms ±5%, 1/8 w.
R311*	3R151P273J	Composition: 27,000 ±5%, 1/8 w.
R312	3R151P183J	Composition: 18,000 ohms ±5%, 1/8 w.
R313	3R151P182J	Composition: 1800 ohms ±5%, 1/8 w.
R314*	3R151P101K	Composition: 100 ohms ±10%, 1/8 w. In REV E and earlier: Composition: 100 ohms ±10%, 1/4 w.
R319	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R319	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R319	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
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R319	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R319	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R319	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R3		

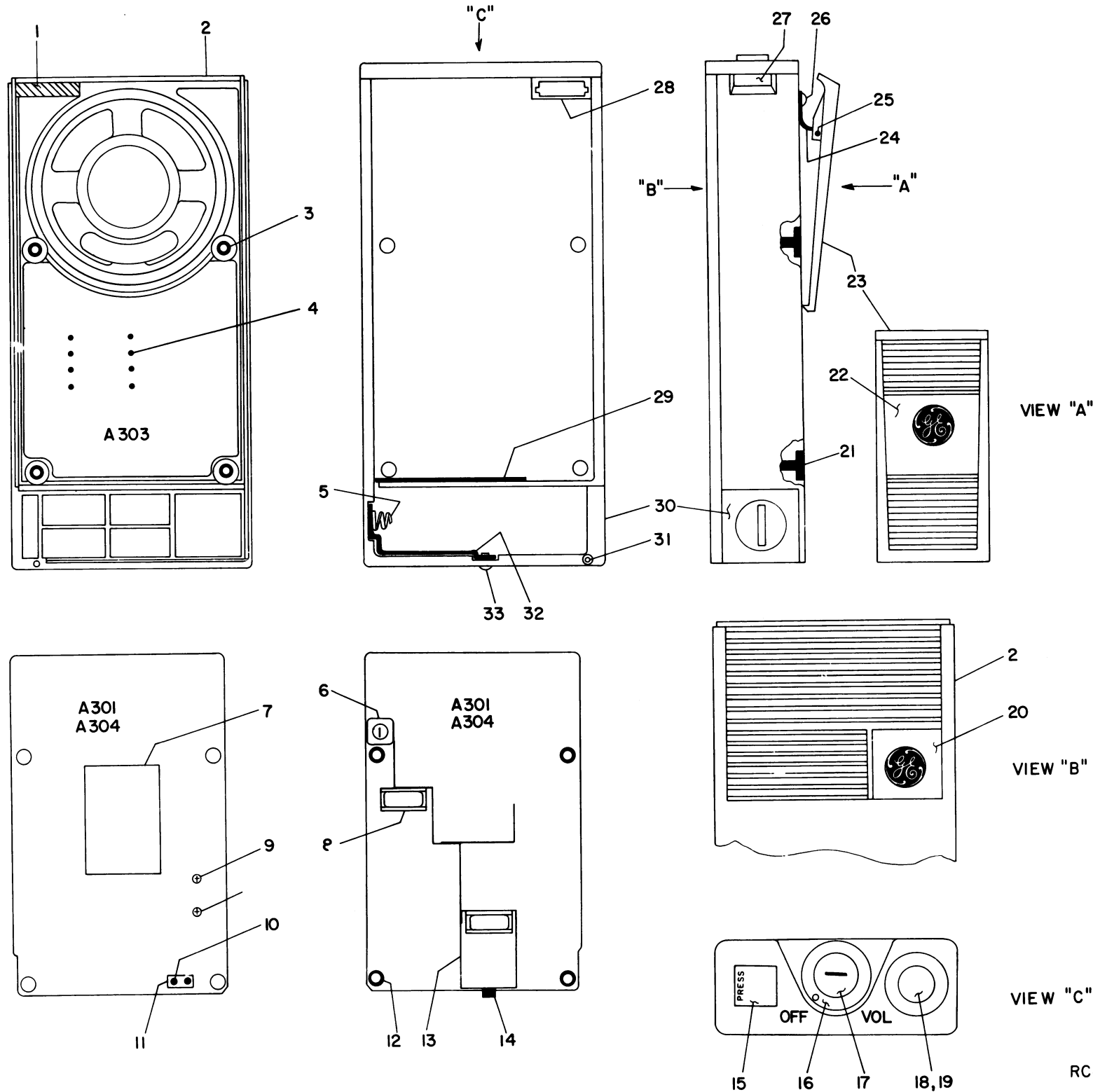


SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.		
THIS ELEM DIAG APPLIES TO		
	DRAWING NO.	REV LETTER
A304	PL19D41330362	G
A303	PL19C31702961	A
	PL19B21682361	B
A307	PL19C31702962	D

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

**ONE ONLY RECEIVER
TYPE ER-54-A**

SYMBOL	GE PART NO.	DESCRIPTION
9	19A127110P1	Screw. No. 1-64 x .156. (Secures coil forms for L301 and L302).
10	19A127536P1	Stud. (External Antenna connection).
11	19A127708P1	Gasket. (Used with External Antenna connection).
12	19A127537P1	Spacer.
13	19C317345G1	Shield.
14	19A127706P1	Grounding tab.
15	19C317348P1	Cover. (Used with External Speaker).
16	19C317182P1	Knob. (ON/OFF- VOLUME).
17	19C317433P1	Insert. (Secures Knob, item 16).
18	19A127539P1	Button. (Push to Reset-Push to Listen).
19	19B216996G1	Knob. (Used with Squelch pot).
20	NP258024	Nameplate, etched aluminum.
21	19A127538P1	Screw. (Secures cover).
22	NP258023B	Nameplate, etched aluminum.
23	19D413318P1	Spring clip.
24	19B216804G1	Spring.
25	N510P814C	Pin.
26	19B200525P128	Rivet, tubular.
27	19A127576P1	Cover. (Used with call number).
28	19C317384P1	Holder. (Used with Push to Reset/Push to Listen Switch and Squelch button).
29	19A115941P1	Tape, pressure sensitive: sim to Permacel EE3990. (Connects fuse to ground clip- NOT USED).
30	19B216749G1	Battery cap.
31	19A127707P1	Pin. (Secures battery cap).
32	19C317186P1	Contact. (Secures battery spring).
33	N3249005E	Rivet, tubular. (Charging contact).



RC-2083

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision letter", which is stamped on the unit includes all previous revisions. Refer to the Parts List for description of parts affected by these revisions.

Receiver Board A301, A304 - 19D413303G1, G2

REV. A - To improve tuning range. Changed C303.

REV. B - To stabilize the audio at maximum volume control setting. Added R356 and R357.

REV. C - To stabilize the audio at minimum volume control setting. Changed C357.

REV. D - To increase first oscillator and multiplier output. Changed R305.

REV. E - Noise Squelch receivers only. To prevent oscillation with mercury battery. Moved Red wire from R348 to H12.

REV. E - Tone Squelch receivers only. To prevent oscillation with mercury battery. Added White and Red wire from H12 to the emitter of Q1402 on Tone Board 19C317028G1.

REV. A - Tone Board A303/A307, 19C317029G1&G2 To prevent oscillation with mercury battery. Added White and Red wire from emitter of Q1402 to H12 on Receiver Board 19D413303G1,2.

REV. F - Receiver Board A301/A304, 19D413303G1, G2

To incorporate new transistors and capacitors. Changed Q311, C319, C325, C329, R311 and R314. Added notch in shield 19C317345G1 for cable to pass.

REV. A - Noise Squelch Board A302, 19C317187G1 To insure squelch action. Changed Q651 and Q652.

REV. B - Tone Board A303/A307, 19C317029G1&G2 To improve frequency response. Changed R1405 and R1429.

REV. C - Tone Board A307, 19C317029G2

To improve operation. Added R1437 and C1419.

REV. D - To increase tone alert above the "Dial Comm" disconnect frequency. Changed R1410.

REV. G - Receiver Board A301/A304, 19D413303G1 & G2

To improve frequency response. Changed CR304.

REV. H - Receiver Board A301, 19D413303G1

To improve operation. Added C366.

QUICKCHECKS

Symptom	Procedure
Receiver won't unsquelch	1. Check C659, C660, CR651 and CR652 on Squelch Board. 2. Check C351 on receiver board
Receiver won't squelch	1. Check CR651, CR652 and shorted Q653. 2. Make Audio Gain Checks.
Erratic critical squelch	1. Check C656 and R388.
Squelches on voice peaks.	1. Check the receiver frequency. 2. Check C651, C652 and C653.

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).

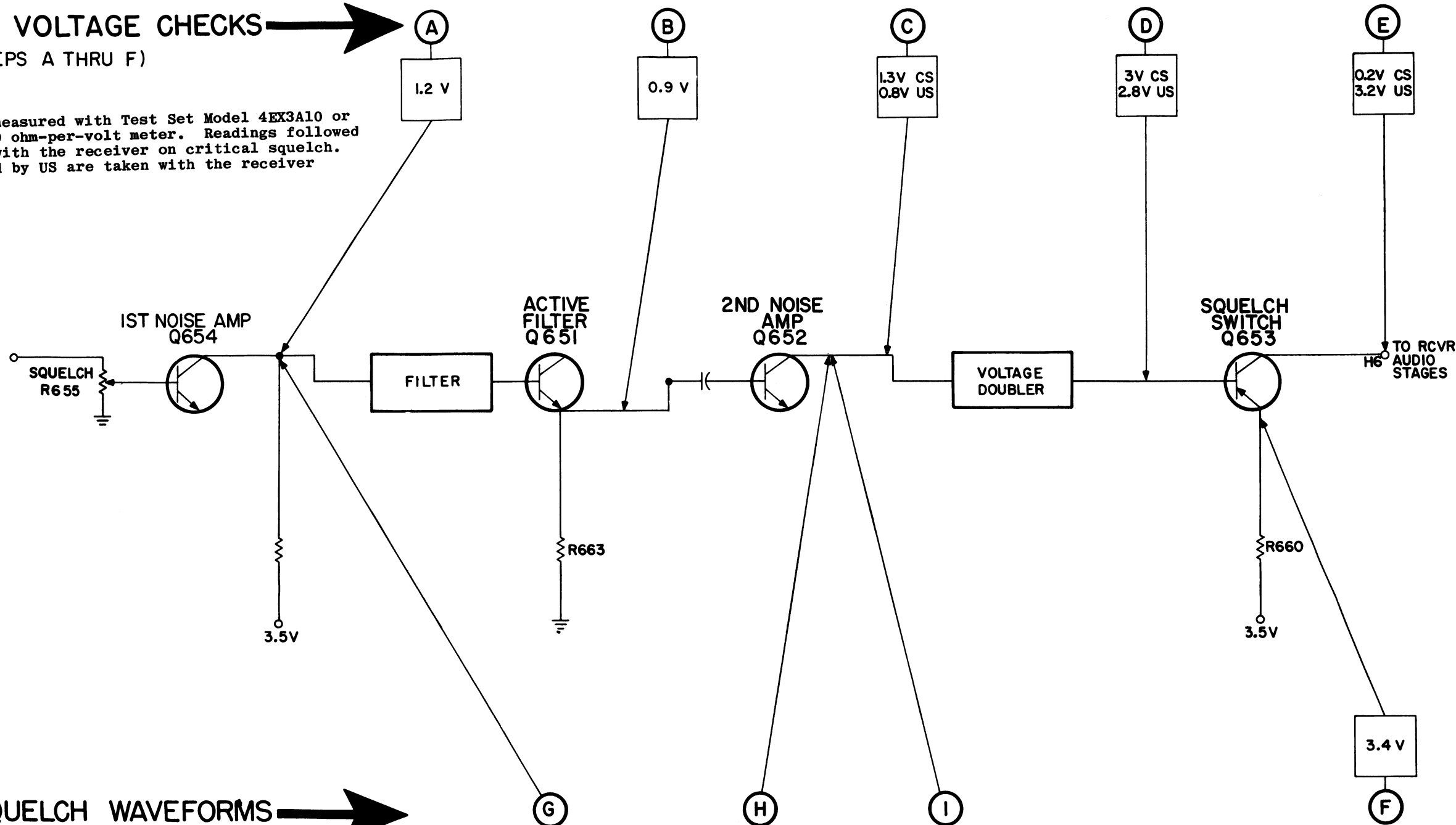
PROCEDURE

1. Apply a 1000 microvolt, 7 kHz signal modulated by 3.3 kHz deviation to the external antenna connector.
2. Turn SQUELCH control R655 fully clockwise.
3. Scope reading at the base of 1st Noise Amp Q654 should be approximately 45 millivolts.
4. Turn R655 counterclockwise until the reading at the base of Q654 drops to 5 millivolts.
5. Check for a 140 millivolts peak-to-peak reading at the collector of Q654.
6. Check for a 100 millivolts peak-to-peak reading at the emitter of Active Filter Q651.
7. Check for a 1.2 volts peak-to-peak reading at the collector of 2nd Noise Amp Q652. 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

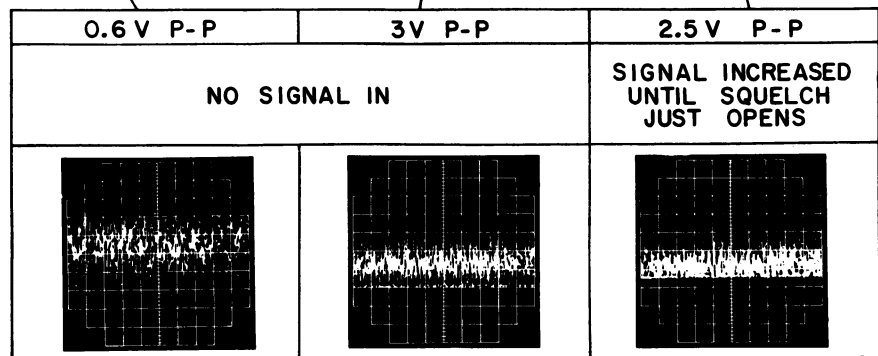
(STEPS G THRU I)

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 R655 for critical squelch.
2. When a signal is required, apply an on-frequency signal with no modulation.



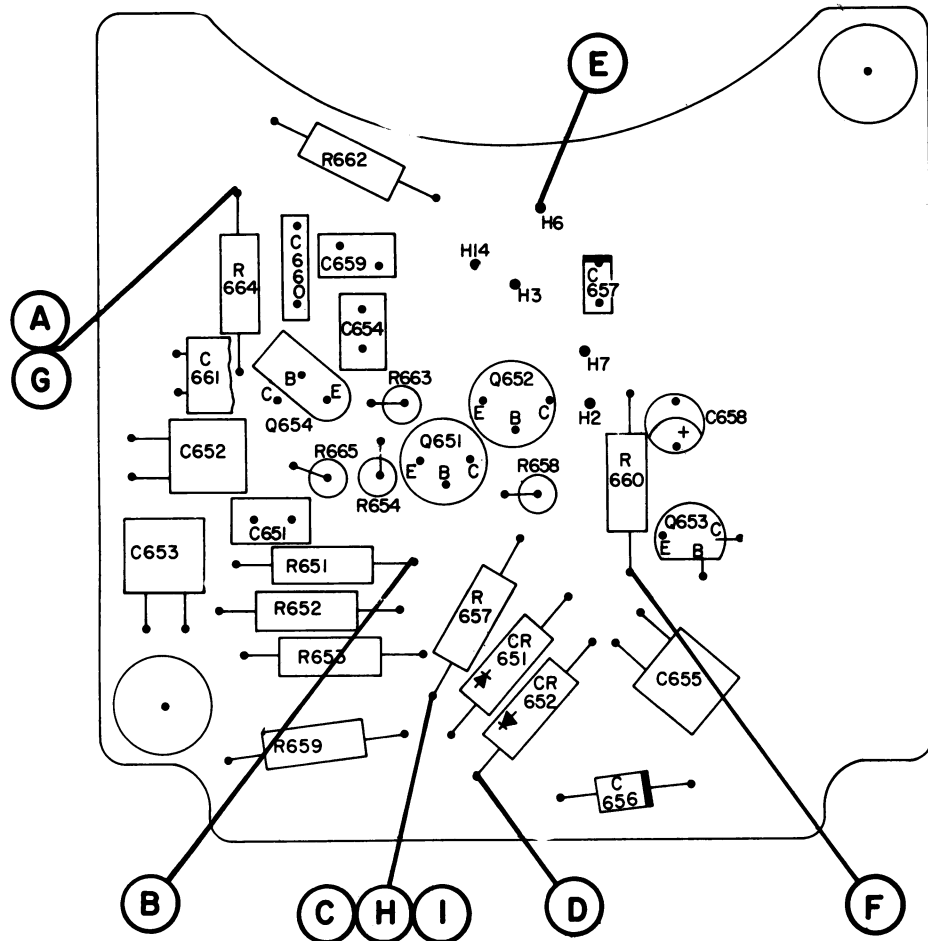
RC-2105

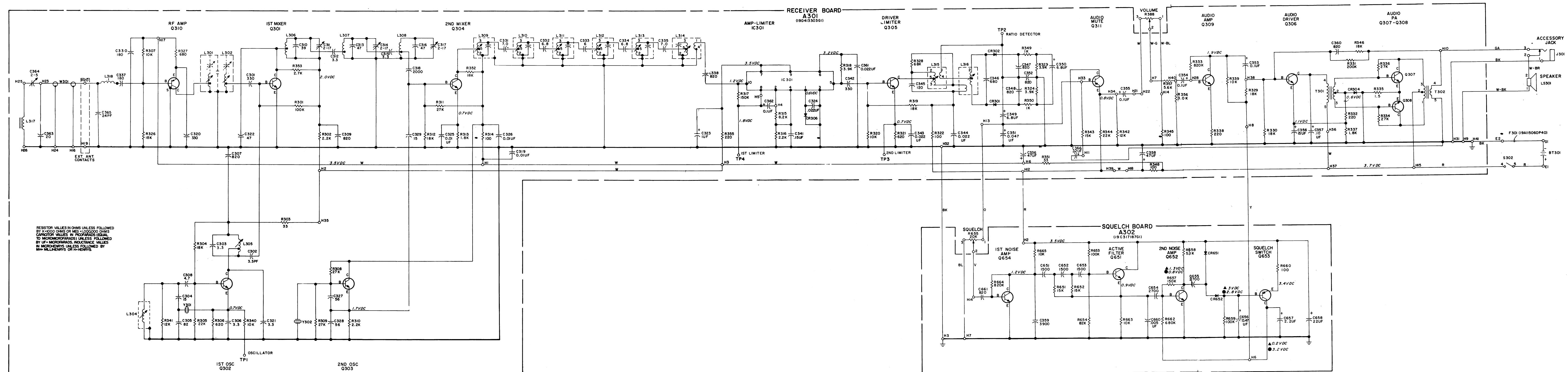
TROUBLESHOOTING PROCEDURE

NOISE SQUELCH
PERSONAL PAGER ER-54-A

(RC-2112)
(19C317815, Rev. 1)

(DF-1099)





NOISE SQUELCH

NOTES:

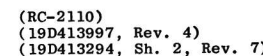
1. ALL WIRES SFT28 UNLESS OTHERWISE NOTED.
2. ALL VOLTAGE READINGS TAKEN WITH NO SIGNAL INPUT AND VOLUME CONTROL SET FOR MINIMUM. SQUELCH BOARD READINGS WITH ● AT CRITICAL SQUELCH AND WITH ● WITH SQUELCH JUST OPEN.

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		
	DRAWING NO.	REV LETTER
A301	PL19D413303GI	H
A302	PL19C371876GI	A
	PL19216823G2	A

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

SCHEMATIC DIAGRAM

**VOICE ONLY RECEIVER
TYPE ER-54-A**



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 +3.5 volts at H8 on the receiver board after the receiver is unswitched by a signal or tones. 3. Check DC voltages at (H) and (D).
Poor sensitivity	1. Check the coax connections to the antenna. 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 (U).
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 (B)

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-560 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.

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.

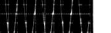
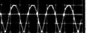
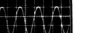
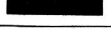
Example:

35 dB (dB2)
-15 dB (dB1)
20 dB gain

1. With no signal in, connect the RF probe to the output (collector) of Q304, and set the Test Amp to the X10 position.
2. Apply a 200 microvolt signal to the receiver and check for a Test Set reading of 2 volts.

1. With no signal in, measure the voltage at TP4 (Pin 8 of IC301) with GE Test Set Model 4EX3A10.
2. Next, apply a 200 microvolt signal to the receiver and check for a 0.2 volt increase in the reading at TP4.



SCOPE SETTINGS					
PEAK-TO-PEAK READINGS	SIGNAL NOISE	0.17 V	0.68V	3.0 V	3.0 V
		0.3 V	1.6 V	3.0 V	3.0 V
STANDARD SIGNAL					
NOISE WAVEFORM					

EQUIPMENT REQUIRED:

- Oscilloscope connected between the points shown and ground.
- Signal Generator (Measurements M-560 or equivalent).

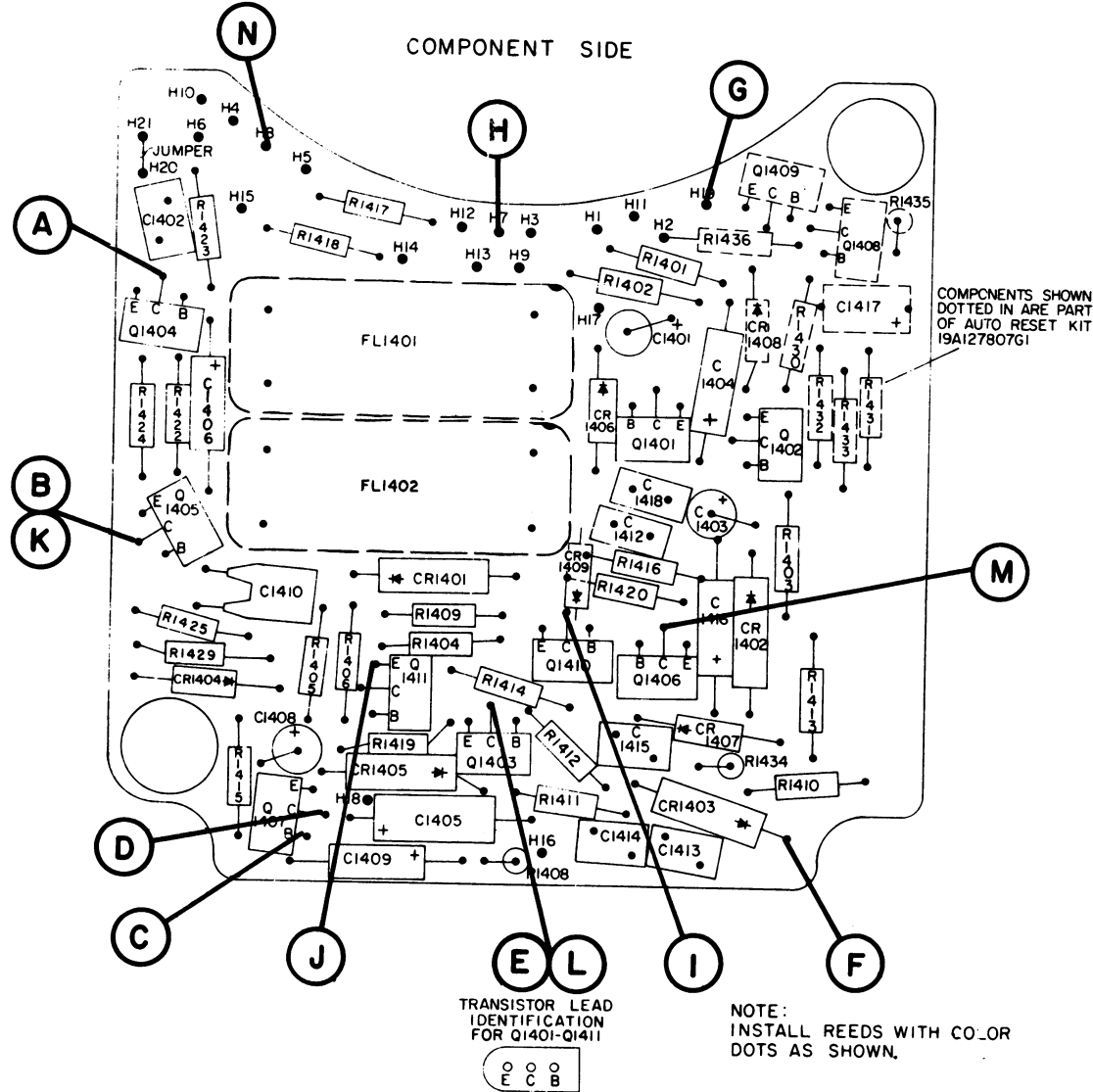
1. Apply a standard signal to the external antenna pins. A standard signal is 1000 microvolts on the receiver frequency modulated by one kHz with 3.3 kHz deviation.
2. Set the Volume control for 150 milliwatts output (1.1 volts).

PERSONAL PAGER RECEIVER
TYPE ER-54-A

QUICKCHECK

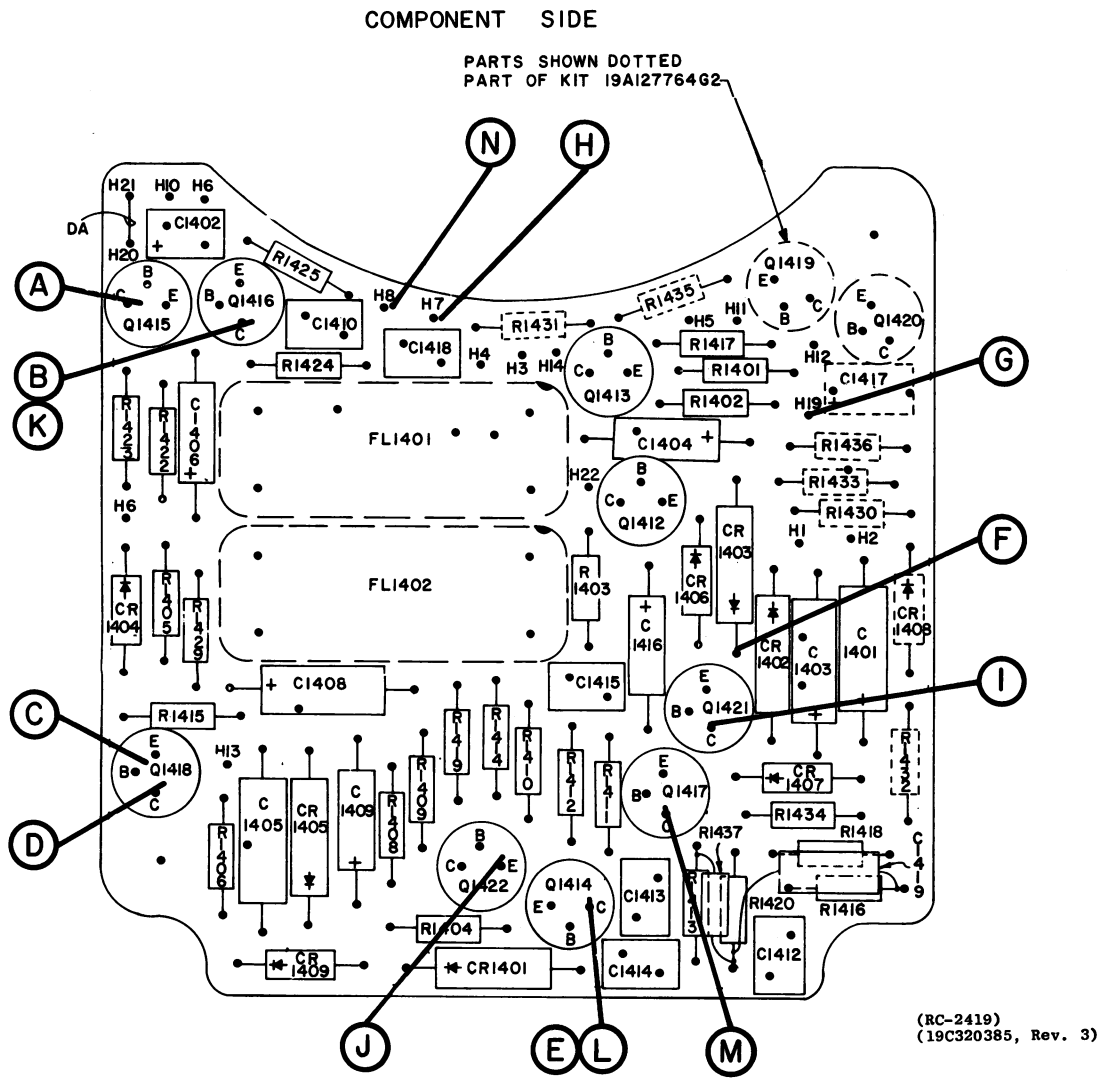
TYPE 99 DECODER BOARD 19C317029G1

Symptom	Procedure
Alert tone runs continuously (pages on 2nd tone only).	Check for open or defective C1409, or open CR1401.

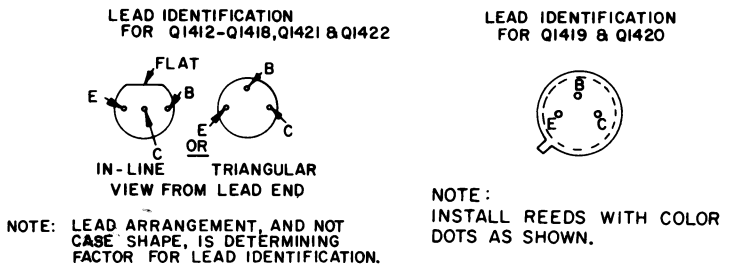


(RC-2111)
(19C317013, Rev. 2)

TYPE 99 DECODER BOARD 19C317029G2



(RC-2419)
(19C320385, Rev. 3)



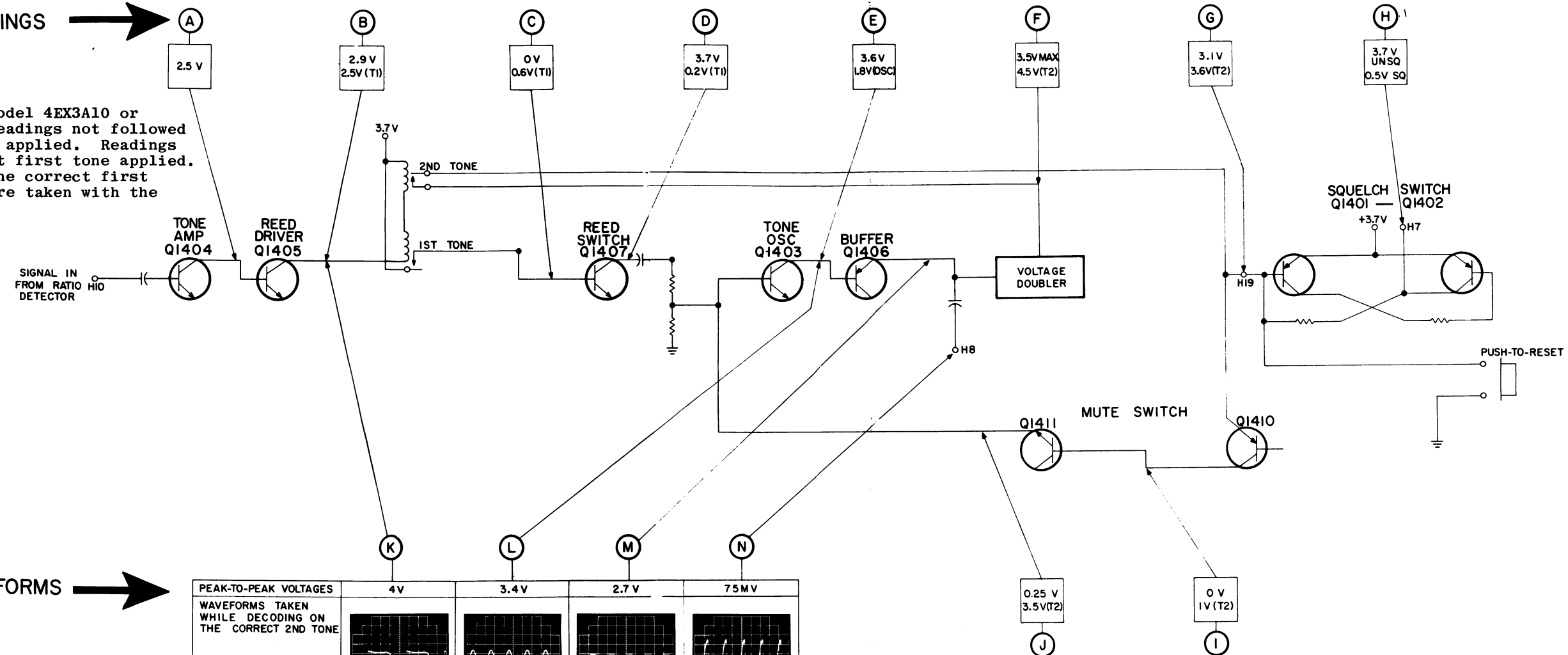
STEP 3-DECODER STAGE CHECKS

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 quiet 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 3.7 volts to H16 and to H19, the tone alert should be heard at the speaker. Reading at (H) should be 3.5 volts.
Squelch Switch	With 3.7 volts jumpered to H16 and to H19, the tone alert should be heard at the speaker. Reading at (H) should be 3.5 volts.
2nd Reed	Remove the 3.7 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 3.7-volt jumper from H16. The tone alert should be heard until the 2nd tone is removed.

STEP I-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.

TROUBLESHOOTING PROCEDURE

PERSONAL PAGER
TYPE 99 DECODER

For different paging numbers, locate the first digit in the "100's Digit" column and determine the tone frequencies as described in the example.

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

SQUELCH BOARD

Squelch Board A302 is used in voice only receivers. The Squelch Board consists of 1st Noise Amp Q654, Active Filter Q651, 2nd Noise Amp Q652 and Squelch Switch Q653.

Noise from the ratio detector operates the squelch circuit. With no carrier applied to the receiver, noise is coupled through SQUELCH control R655 to the base of 1st Noise Amp Q654. R655 determines the gain of the Noise Amplifier by varying the bias to the base of Q654.

The output of Q654 is applied to an active, high-pass filter that attenuates frequencies below 3 kHz. The filter consists of C651, C652, C653, R651, R652 and Q651.

Following the high-pass filter is 2nd Noise Amp Q652. The output of Q652 is rectified by CR651 and CR652, and filtered by R659 and C656 to produce a positive DC voltage. The positive voltage is applied to the base of PNP Squelch Switch Q653, turning it off.

The collector of Q653 is tied to the collector of Audio Amp Q304 and the base of Audio Driver Q306 on the receiver board. Turning off Q653 removes the supply voltage to the audio transistors, turning them 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 Q653, turning it on. Turning on Q653 applies the battery voltage to Q309 and Q306, allowing the audio stages to conduct so that sound is heard from the speaker. Capacitor C657 in the collector of Q653 slows down the switching action of the transistor to provide a more positive switching action. Resistor R662 connects from the collector of Q653 to the base of Q652, 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.