MOBILE RADIO

MASTR® Progress Line

25—50 MHz RECEIVER MODELS 4ER39C50-67

Maintenance Manual LBI4123H

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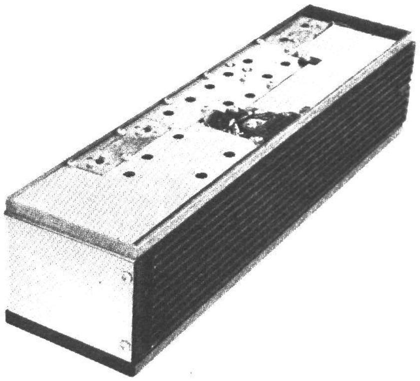

SPECIFICATIONS *

FCC Filing Designation	**ER-39-C**
Frequency Range	25—50 MHz
Audio Output	5 watts at less than 5% distortion
Sensitivity	
12-dB SINAD (EIA Method)	0.25 μV
20-dB Quieting Method	0.35 μV
Selectivity	
EIA Two-Signal Method	-85 dB (adjacent channel, 20 kHz channels)
20-dB Quieting Method	-100 dB at ±15 kHz
Spurious Response	-100 dB
First Oscillator Stability	±.0005% (-30°C to +60°C)
Modulation Acceptance	±7 kHz (narrow-band)
Squelch Sensitivity	
Critical Squelch	0.15 μV
Maximum Squelch	Greater than 20 dB quieting (less than 1.5 μV)
Intermodulation (EIA)	-75 dB
Maximum Frequency Separation	0.4%
Frequency Response	+1 and -8 dB of a standard 6-dB per octave de-emphasis curve from 300 to 3000 Hz (1000-Hz reference)

4ER39C50-67

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

GENERAL ELECTRIC

TABLE OF CONTENTS

ILLUSTRATIONS

WARNING

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

GENERAL ELECTRIC COMPANY• MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

GENERAL ELECTRIC*
U.S.A.

Printed in U.S.A.

DESCRIPTION

General Electric MASTR Progress Line Receiver Type ER-39-C is a double conversion, superheterodyne FM receiver designed for operation on the 25-50 megahertz band.

The receiver is of single-unit construction and is completely housed in a copper-plated aliminum casting for maximum shielding and rigidity. The top compartment of the casting contains the RF, oscillator, converter, and 1st IF amplifier stages. The bottom portion of the casting contains the IF-audio and squelch board, and the optional Channel Guard Board.

CIRCUIT ANALYSIS

The MASTR Progress Line Receiver is completely transistorized, using silicon transistors throughout for added reliability. Input leads to the receiver are individually filtered by the 20-pin feed-through by-pass connector J443. A regulated +10 volts is used for all receiver stages except the audio PA stage which operates from the 12-volt system supply.

Centralized metering jack J442 is provided for use with General Electric Test Set Model 4EX3A10 or 4EX8K11 for ease of alignment and servicing. The Test Set meters the oscillator, multiplier, and limiter stages as well as the discriminator and regulated 10 volts.

RF AMPLIFIER (A341)

RF Amplifier A341 consists of two high-Q helical resonators and an RF amplifier stage (Q2). The RF signal from the antenna is coupled by RF cable W442/W443 to a tap on L341/L343/L345. The tap is

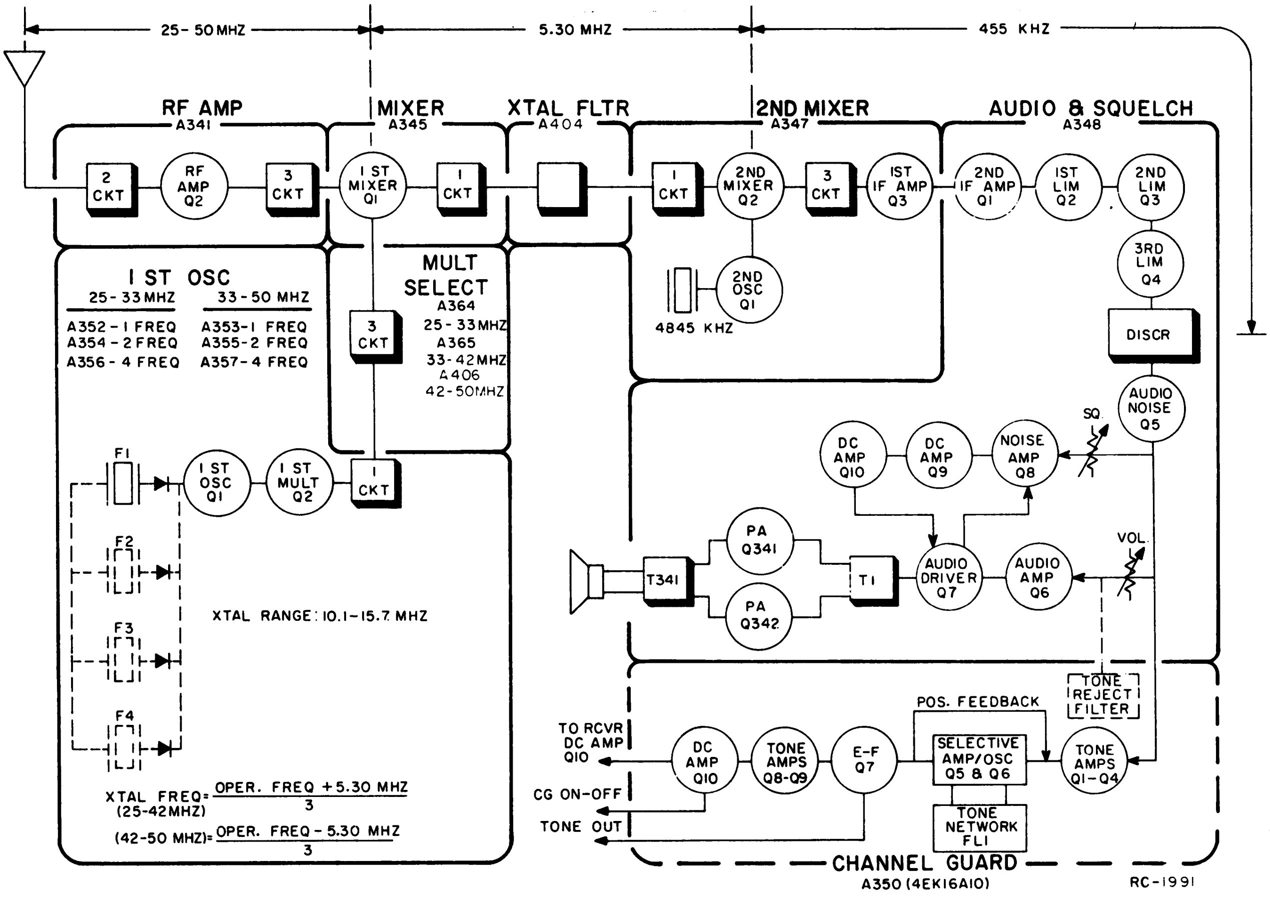


Figure 1 - Receiver Block Diagram

positioned to insure the proper impedance match to the antenna. RF energy is coupled through the two coils by an opening in the shield wall to the RF Amplifier. The coils are tuned to the incoming frequency by air trimmer capacitors C341 and C342.

The RF amplifier uses a Field-Effect Transistor (FET) as the active device. The FET may be considered a semiconductor current path (or channel) whose resistance is varied by a voltage applied between the "gate" and "source" terminals. Lead identification for the FET is shown in Figure 2. The FET has voltage-controlled characteristics, and may be compared to a vacuum tube in operation (see Figure 2).

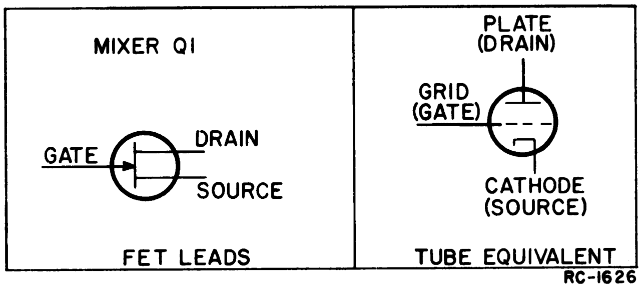


Figure 2 - FET Nomenclature

RF from the antenna is applied to the "source" terminal of FET Q1. Q1 operates as a grounded-gate amplifier. This method of operation provides a low impedance input to the amplifier. The amplified output is taken from the "drain" terminal and coupled through three tuned circuits to the 1st mixer.

1ST OSCILLATOR AND MULTIPLIER (A352-A357)

The receiver 1st oscillator operates in a transistorized Colpitts oscillator circuit. The oscillator crystal operates in a fundamental mode at a frequency of approximately 10 to 15 megahertz. The crystal is cut to provide temperature compensation at the high end of the temperature range and is thermistor compensated at low temperatures. This provides ±.0005% frequency stability as soon as the receiver is energized—without the warm-up time required by crystal ovens or warmers.

In single frequency receivers, bias for the oscillator transistor is obtained by a jumper from H1 to H2 on the oscillator board.

In multi-frequency receivers, a diode is connected in series with the crystal, and up to three addition crystal circuits can be added. The 10-volt jumper is removed and the proper frequency is selected by switching the desired crystal circuit to +10 volts by means of a frequency selector switch on the control unit.

Switching the +10 volts to the crystal circuit forward biases the diode and reduces its impedance. This applies the crystal frequency to the base of oscillator transistor Q1. Feedback for the oscillator is developed across C21/C22. The output is coupled to the base of 1st multiplier Q2.

The output of the 1st multiplier is transformer-coupled (T3/T4) to multiplier-selectivity assembly A364/A365. The 1st multiplier tank is tuned to three times the crystal frequency and is metered at centralized metering jack J442-4 through metering network CR1, R1, C7 and C8.

MULTIPLIER SELECTIVITY (A364/A365/A404)

Following the 1st multiplier tank (T3/T4) are three additional L-C tuned circuits (L1, -L2 and -L3). Capacitor C34/C35/C36 couples the multiplier selectivity output to the first mixer.

1ST MIXER (A345) AND CRYSTAL FILTER (A404)

The 1st mixer uses a Field-Effect Transistor (FET) as the active device (Figure 2). The FET has several advantages over a conventional transistor, including a high input impedance, high power gain, and an output that is relatively free of harmonics (low in intermodulation products).

In 1st mixer A345, RF from the 1st RF amplifier and injection voltage from the multiplier-selectivity assembly are applied to the gate of Q1. The mixer output is taken from the drain with the output tuned to the 5.3-MHz high IF frequency.

A highly selective crystal filter (A404) following the 1st mixer provides the major selectivity for the receiver. The output of the filter is fed through impedance matching transformer A347-T1 to the base of the 2nd mixer.

2ND OSCILLATOR, 2ND MIXER AND 1ST LO IF AMPLIFIER (A347)

A347-Q2 operates in a Colpitts oscillator circuit, with feedback supplied through C4. The oscillator low-side injection voltage (4845 kHz) is applied to the base of the 2nd mixer.

The high IF signal from the filter and the injection voltage from the 2nd oscillator is applied to the base of 2nd mixer Q2. The 455-kHz mixer output is applied to three tuned low IF circuits, L1, L2 and L3. These tuned circuits are required for shaping the nose of the IF waveform, and for rejecting any undesired output frequencies from the 2nd mixer.

The low IF signal is applied to the base of 1st low IF amplifier A347-Q3. The output of A347-Q3 is R-C coupled to the base of the 2nd low IF amplifier.

2ND LO IF AMPLIFIER AND LIMITERS (A348)

Additional amplification of the low IF signal going to the limiter stages is provided by 2nd low IF amplifier A348-Q1. This stage is metered at J442-2 through a metering network consisting of C19, CR3 and R25.

Following the 2nd low IF amplifier are three R-C coupled limiter stages (A348-Q2, -Q3 and -Q4). The 1st limiter is metered at J442-3 through metering network C20, CR4 and R26.

DISCRIMINATOR (A348)

The limiter output is applied to a Foster-Seely type discriminator, where diodes CR1 and CR2 rectify the 455-kHz signal to recover the audio. The discriminator is metered at J442-10 through metering network C16 and R23.

AUDIO - NOISE AMPLIFIER (A348)

The discriminator output is coupled through a low-pass filter (C16, C18, R21 and R22) to the base of audio-noise amplifier Q5. The filter removes any 455-kHz signal remaining in the discriminator output. Q5 operates as a emitter-follower to match the discriminator impedance to the VOLUME control, SQUELCH control, and Channel Guard input. The stage also provides power gain.

AUDIO AMPLIFIERS (A348)

Any audio present in the incoming signal is coupled from the emitter of Q5 through the VOLUME control and a de-emphasis network to the base of audio amplifier Q6. The de-emphasis network consists of C22, C23, R30 and R31.

Audio driver Q7 follows the audio amplifier. The audio output of Q7 is coupled through transformer T1 to provide phase inversion for the push-pull audio PA stage.

Q341 and Q342 operate as a push-pull, class AB audio PA stage. The PA output is coupled through audio transformer T341 to the loudspeaker. The yellow and white tertiary windings of T341 supply balanced feedback to the collector of Q7. The feedback winding minimizes distortion and prevents the pick-up of external electrical noise.

The PA stage provides a 5-watt output at less than 5% distortion into a 3.5-ohm load at the receiver output terminals (3.2-ohms at the Control Unit). Base bias for the PA stage and the elimination of cross-over distortion is controlled by bias adjust potentiometer R43. The potentiometer is set at the factory as shown in STEP 1 of the receiver Test Procedure.

NOTE

Do not adjust bias adjust potentiometer R43 unless PA transistors Q341 and Q342 have been replaced.

Audio high and low are also present at centralized metering jack J442, and can be used as shown in STEP 1 of the Test Procedure.

SQUELCH (A348)

Noise from the audio-noise amplifier operates the squelch circuit. With no carrier present in the receiver, this noise is coupled to the base of noise amplifier Q8 through a high-pass filter which attenuates frequencies below 3 kHz. The filter consists of C30, C31 and R45, as well as C34 and L3 in the collector circuit of Q8. The gain of Q8 is determined by the Squelch control, which varies the bias on the base of Q8. Thermistor RT2 keeps the critical squelch constant over wide variations in temperature.

The output of noise amplifier Q8 is rectified by diodes CR5 and CR6, and filtered by C36 and C37 to produce a negative DC voltage. This DC voltage is applied to the base of DC amplifier Q9, turning it off. When turned off, the collector voltage of Q9 rises to approximately 8 volts, turning on DC amplifier Q10. When conducting, the collector voltage of Q10 drops to almost ground potential, which removes the base bias to audio amplifier Q6 and audio driver Q7, turning them off.

When the receiver is quieted by a signal (unsquelches), the noise in the receiver is reduced, turning DC amplifier Q9 on and DC amplifier Q10 off. This allows the audio stages to conduct so that sound is heard in the speaker. A network composed of C38, CR7 and R62 slows down the switching action of Q10, preventing an obnoxious "thump" from being heard in the speaker.

Resistor R53 connects from the emitter of audio driver Q7 to the emitter of noise amplifier Q8, providing a hysteresis loop in the squelch circuit. When a weak signal opens the squelch, the signal level may be reduced by 4 to 6 dB without the squelch closing. This limits squelch "flutter" or "picket-fence" operation.

With audio driver Q7 conducting, a positive voltage through R53 helps to reduce the gain of noise amplifier Q8. This positive feedback provides a quick, positive switching action in the squelch circuit. When the receiver squelches, audio driver Q7 turns off and its emitter potential drops to zero. This reduces the DC feedback through R53 to the emitter of noise amplifier Q8. Reducing the feedback causes Q8 to conduct harder, turning the audio stages off quickly.

Keying the transmitter removes the +10 volts from J19. This turns off DC amplifier Q9 and turns on Q10, muting the receiver.

CHANNEL GUARD

Channel Guard Board Model 4EK16A10 is a fully transistorized encoder-decoder for use with MASTR Professional Series mobile and station combinations. The tone frequencies are controlled by plug-in tone networks that are made with precision components for excellent stability and reliability. The tone frequencies range from 71.9 to 203.5 Hz.

Encoder (A350)

Keying the transmitter removes the receiver mute +10 volts, and forward biases feedback control diode CR5, causing it to conduct. When conducting, the diode shunts R39, R35 and C19). This provides the necessary gain to the base of Q5 to permit oscillation.

The encoder tone is provided by selective amp-oscillator transistors **Q5** and **Q6** which oscillate at a frequency determined by the tone network. Negative feedback applied through the tone network to the base of Q5 prevents any gain in the stage except at the desired encode frequency.

Starting network R45, C21, C22 and CR6 provide an extremely fast starting time for the encoder tone. Keying the transmitter removes the receiver mute +10 volts, causing a pulse to be applied to the base of Q6 to quickly start the oscillator. Thermistor-resistor combination R32 and RT1 provides temperature compensation for the oscillator output. Limiter diodes CR3 and CR4 keep the tone amplitude constant.

Emitter-follower Q7 follows the oscillator circuit. The encoder tone is taken from the emitter of Q7 and applied to the transmitter.

Decoder (A350)

The decoder function is designed to eliminate all calls that are not tone coded for the Channel Guard Frequency. As long as the CHANNEL GUARD-OFF switch on the control unit is left in the CHANNEL GUARD position, all signals are locked out except those from transmitters that are continuously tone coded for positive identification by the receiver.

Placing the CHANNEL GUARD-OFF switch in the OFF position instantly disables the Channel Guard operation so that all calls on the channel can be heard. When the hookswitch option is used, lifting the microphone from its hanger disables the Channel Guard Circuit.

Audio, tone and noise are taken from the emitter of the receiver audio-noise amplifier Q348-Q5 and is fed through A350-J1 to four tone amplifier and bandpass filter circuits. The filters remove the audio and high-frequency noise from the signal, and the tone amplifiers provide sufficient gain to insure clipping by limiter diodes CR1 and CR2. The clipping action eliminates variation in the squelch performance due to changes in tone deviation. The signal is then applied to selective amplifiers Q5 and Q6 which amplify only the tone determined by the tone network.

The output of the selective amplifier is applied through emitter-follower Q7 to the high gain, broad-band tone amplifiers Q8 and Q9. The output of Q9 is rectified by detector diodes CR7 and CR8, and the resulting negative DC voltage controls the squelch gate. Q8 is normally biased for low gain. When the tone is detected by CR7 and CR8, feedback is provided through R54 to quickly change the bias on Q8 for full gain. This ensures a more positive "unsquelching" action.

Squelch gate diode CR9 is normally forward biased by a positive DC voltage (approximately 1.5 volts) fed through R58. The forward bias causes CR9 to conduct, feeding a DC voltage to the base of DC amplifier A348-Q10 in the receiver. This removes the bias on the receiver audio stages and holds them off.

When the proper tone is applied to the decoder, the negative DC voltage from the detector diodes back-biases squelch gate diode CR9 and cuts off the positive bias to the receiver DC amplifier A348-Q10. However, the receiver noise squelch circuit continues to operate until a carrier quiets the receiver.

Placing the CHANNEL GUARD - OFF switch in the OFF position (or removing the microphone from its hookswitch) removes the ground to the base of the decoder DC switch (Q10), causing it to conduct. This back-biases squelch control diode CR9 and cuts off the positive bias to the receiver DC amplifier (A348-Q10). The receiver noise squelch circuit continues to operate until a carrier quiets the receiver.

A tone rejection filter connected in parallel with A348-J12 (in the receiver) bypasses any incoming tone to ground. This attenuates the tone level reaching the receiver audio circuits. The filter is composed of C26, C27, C28, C29, L1 and R59.

An optional tone reject filter (A402) that is identical to the filter described above is available for use in two-way radios with transmitter Channel Guard only.

MAINTENANCE

DISASSEMBLY

To service the receiver from the top--

1. Pull locking handle down and pull radio about one inch out of mounting frame.
2. Pry up cover at rear of receiver.
3. Slide cover back and lift off.

To service the receiver from the bottom--

1. Pull locking handle down. Pull radio out of mounting frame.
2. Remove screws in bottom cover. Pry up cover at back of receiver.
3. Slide cover back and lift off.

To remove the receiver from the system frame--

1. Loosen the two Phillips-head retaining screws in from casting (see Figure 3), and pull casting away from system frame.
2. Remove the four screws in the back cover.
3. Remove the two screws holding the receiver at each end of the system frame.
4. Disconnect the antenna jack and the 20-pin connector from the front of the receiver, and slide the unit out of the system frame.

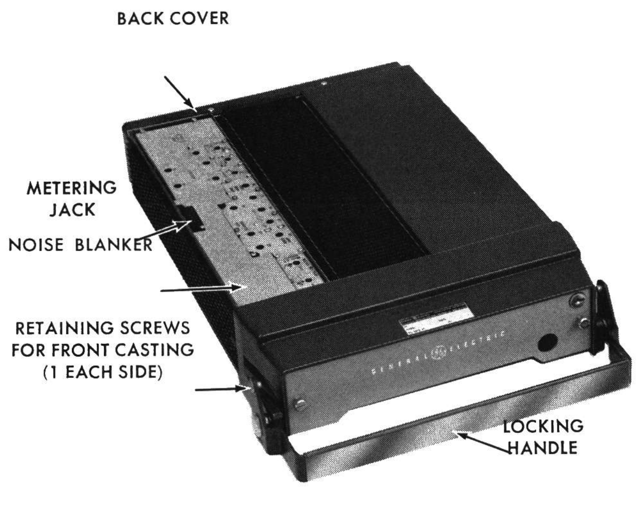


Figure 3 - Removing Top Cover

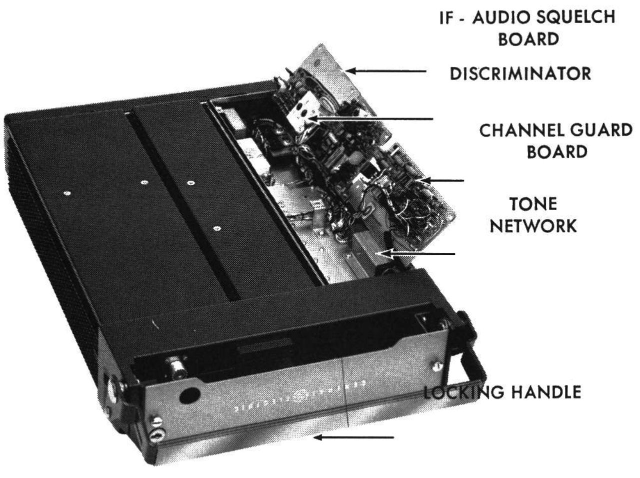


Figure 4 - Removing Bottom Cover

FRONT END ALIGNMENT

EQUIPMENT REQUIRED

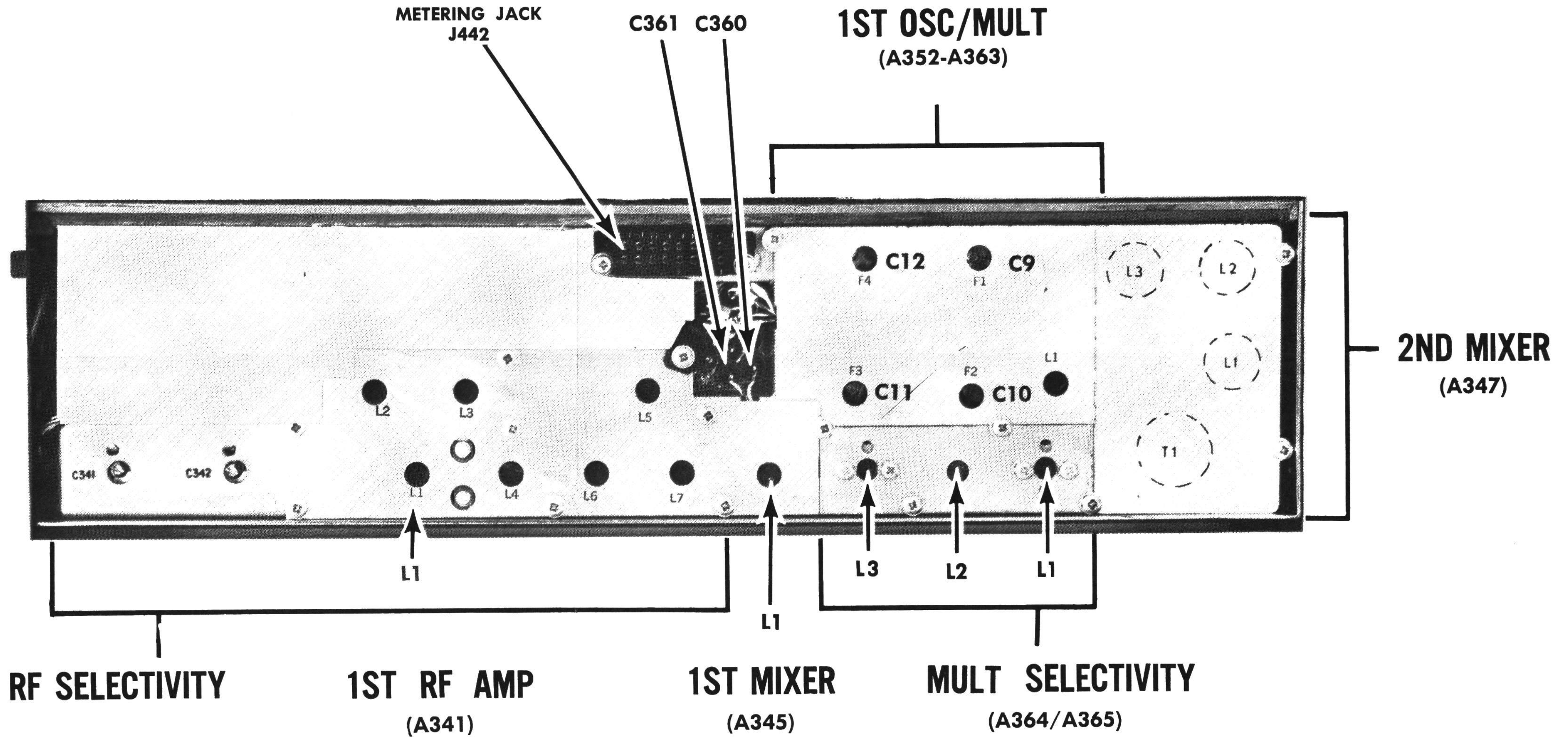
1. GE Test Set Models 4EX3A10, 4EX8K10, 11 (or 20,000 ohms-per-volt Multimeter with a 1-volt scale).
2. A 455 kHz and 25-50 MHz signal source. Connect a one-inch piece of insulated wire no larger than .065-inch diameter to generator output probe.

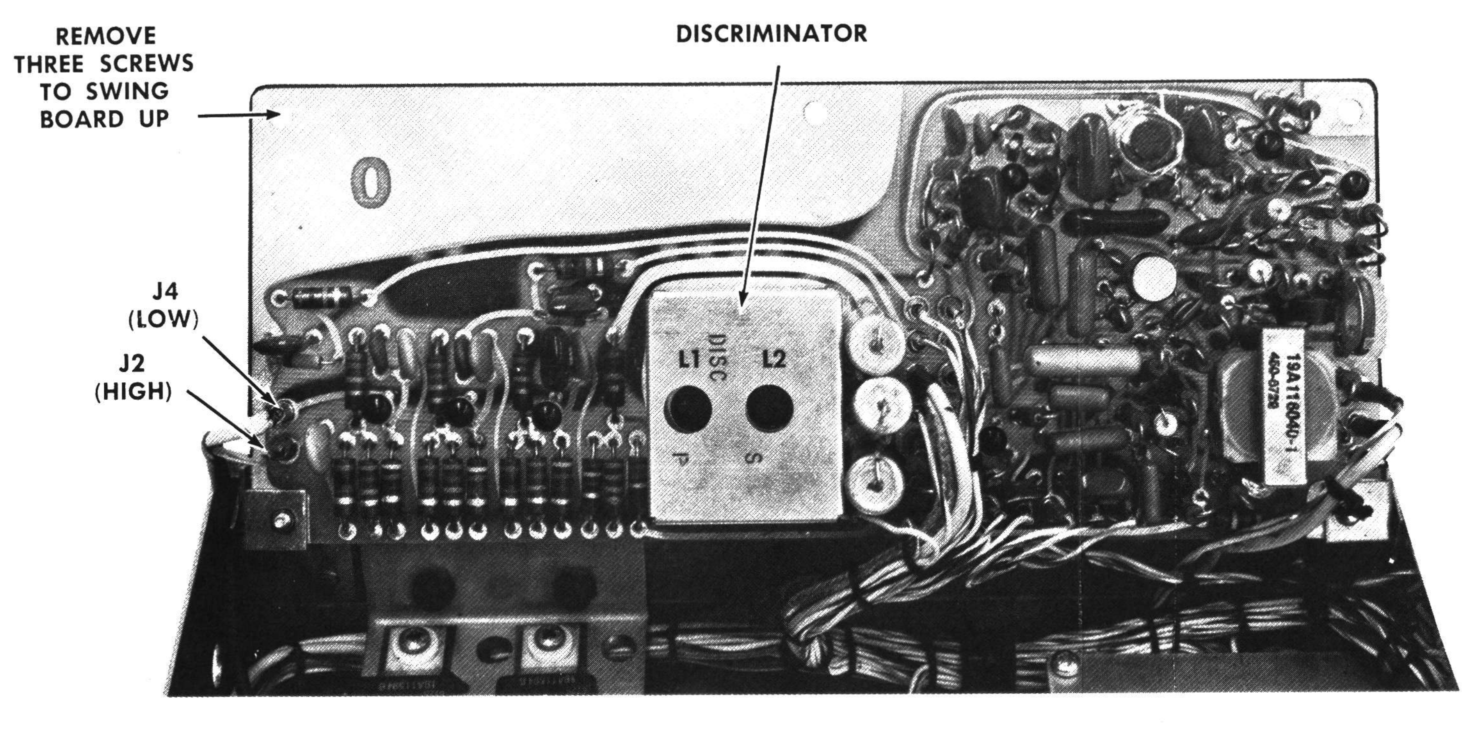
PRILIMINARY CHECKS AND ADJUSTMENTS

1. Connect Test Set to Receiver Centralized Metering Jack J442 and set meter sensitivity switch to the TEST 1 position (or 1-volt position on 4EX8K10, 11).
2. With Test Set in Position J, check for regulated +10 volts. If using Multimeter, measure from C360 to C361.
3. If using Multimeter, connect the positive lead to J442-16 (Ground).
4. Disable Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION		TUNING CONTROL	METER READING	PROCEDURE
	GE Test Set	Multimeter - at J442			
OSCILLATOR/MULTIPLIER					
1.	D (MULT-1)	Pin 4	L4 (on 1st OSC/MULT) and L1, L2 (on MULT SELECTIVITY)	See Procedure	Tune L4 on 1st OSC/MULT and L1 on MULT SELECTIVITY for maximum meter reading. Then tune L2 for minimum meter reading. Change voltage scale if necessary. Repeat this step.
RF AMPLIFIER & SELECTIVITY					
2.	A (DISC)	Pin 10		Zero	Apply an on-frequency signal adjacent to L7. Adjust the signal generator for discriminator zero.
3.	B (2nd IF Amp)	Pin 2	L1 (1st RF Amp), L6, L7, C341 and C342 (RF SELECTIVITY)	Maximum	Apply an on-frequency signal to the antenna jack, keeping below saturation. Tune L1, L6, L7, C341, and C342 for maximum meter reading.
4.	"	"	L4 (1st OSC/MULT) L1, L2 and L3 (MULT SELECTIVITY)	Maximum	Apply an on-frequency signal as above, keeping below saturation. Tune L4 on 1st OSC/MULT and L1, L2 and L3 on MULT SELECTIVITY for maximum meter reading.
FREQUENCY ADJUSTMENT					
5.	A (DISC)	Pin 10	C9 on 1st OSC (C10, C11 or C12 for multi-frequency)	Zero	Apply an on-frequency signal to the antenna jack. Tune C9 for zero discriminator reading. In multi-frequency units, tune C10, C11 or C12 as required. —— NOTE —— For proper frequency control of the receiver, it is recommended that all frequency adjustments be made when the equipment is at a temperature of approximately 75°F. In no case should frequency adjustments be made when the equipment is outside the temperature range of 50° to 90° F.




IF-AUDIO & SQUELCH

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

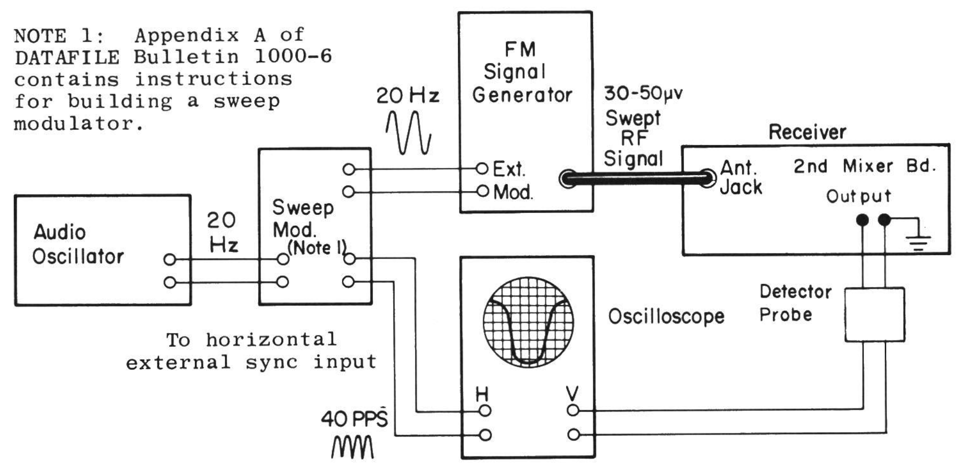


Figure 5 - Test Setup for 20-Hz Double-Trace Sweep Alignment

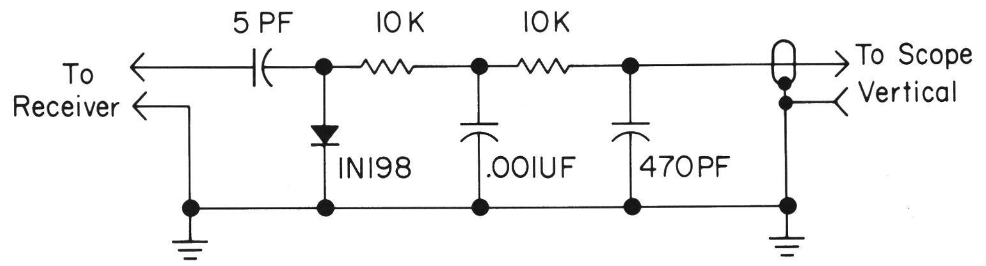


Figure 6 - Detector Probe for Sweep Alignment

COMPLETE RECEIVER ALIGNMENT

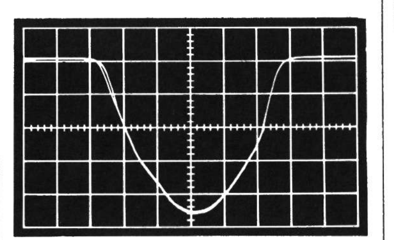
EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A10, 4EX8K10, 11 (or 20,000 ohms-per-volt Multimeter with a 1-volt scale).
2. A 455-kHz signal source (GE Test Set Model 4EX7A10) and 25-50 MHz signal source. Connect a one-inch piece of insulated wire no larger than .065-inch diameter to generator output prove.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect Test Set to Receiver Centralized Metering Jack J442, and set meter sensitivity switch to the TEST 1 position (or 1-volt position on 4EX8K10, 11).
2. For large changes in frequency or a badly misaligned receiver, set crystal trimmer C9 to mid-capacity. In multi-frequency receivers, set C10, C11 or C12 to mid-capacity as required. Where the maximum frequency spacing is less than 100 kHz, align the unit on channel F1. If the frequency spacing is greater than 100 kHz, align the receiver on the center frequency.
3. With Test Set in Position J, check for regulated +10 volts. If using Multimeter, measure from C360 to C361.
4. If using Multimeter, connect the positive lead to J442-16 (Ground).
5. Disable the Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION		TUNING CONTROL	METER READING	PROCEDURE
	GE Test Set	Multimeter - at J442			
DISCRIMINATOR & OSCILLATOR					
1.	A (DISC)	Pin 10	L1 and L2 (on IF-AUDIO SQUELCH board)	Zero	Remove three screws and swing open the IF-AUDIO & SQUELCH board. Adjust L1 (disc primary) 1/2 turn counterclockwise from the bottom of coil. Next, apply a 455-kHz signal to J2 and J4 and adjust L2 (disc secondary) for zero meter reading.
2.	A (DISC)	Pin 10		See Procedure	Alternately apply a 450-kHz and 460-kHz signal and check for readings of at least 0.3 volt, but not more than 0.5 volt on GE Test Set. Both readings must be within .05 volt. Do not attempt to balance readings any closer than .05 volt.
3.	D (MULT-1)	Pin 4	L4 (on 1st OSC/MULT) and L1, L2 & L3 (on MULT SELECTIVITY)	See Procedure	Tune L4 on 1st OSC/MULT and L1 on MULT SELECTIVITY for maximum meter reading. Tune L2 for minimum meter reading. Change voltage scale if necessary. Then tune L3 for maximum meter reading. Repeat step 3.
RF AMPLIFIER & SELECTIVITY					
4.	A (DISC)	Pin 10		Zero	Apply an on-frequency signal adjacent to L7. Adjust the signal generator for discriminator zero.
5.	B (2nd IF AMP)	Pin 2	L7 and L6 (RF SELECTIVITY)	Maximum	Apply an on-frequency signal and tune for maximum meter reading as shown below, keeping signal below saturation. Apply Signal Generator Probe to: — Tune: L6 — L7 L1 — L6
6.	"	"	C341, C342 and L1 (1st RF Amp)	Maximum	Apply an on-frequency signal to the antenna jack. Tune C341, C342, and L1 for maximum meter reading, keeping signal below saturation.
7.	"	"	L1 (1st RF Amp) L6, L7, C341, and C342 (RF SELECTIVITY)	Maximum	Apply an on-frequency signal as above, keeping below saturation. Tune L1, L6, L7, C341 and C342 for maximum meter reading.
8.	"	"	L3 (MULT SELECTIVITY)	Maximum	Apply on-frequency signal as above, keeping below saturation. Tune L2 & L3 (on MULT SELECTIVITY) for maximum meter reading.
2ND MIXER & LO IF					
The 1st and 2nd mixer, and low IF circuits have been aligned at the factory and will normally require no further adjustment. If adjustment is necessary, use the procedure outlined in STEPS 9, 10, and 11. L1 (on 1st mixer) provides impedance matching for the crystal filter input and should only be tuned when observing IF trace on oscilloscope. —— NOTE —— Refer to DATAFILE BULLETIN 1000-6 (IF Alignment of Two-Way Radio FM Receivers) for helpful suggestions on how to determine when IF Alignment is required.					
9.	B (2nd IF AMP)	Pin 2	A 347-L3, L2, L1, T1 (2nd Mixer)	Maximum	Apply on-frequency, unmodulated signal and tune A347-L3, L2, L1, and T1 for maximum meter reading, keeping signal below saturation.
10.			A347-L3, L2, L1, T1 (2nd Mixer) and L1 (1st Mixer) 		Connect scope, signal generator, and detector as shown in Figure 4. Set signal generator level for 30-50 µv and modulate with 10 kHz at 20 Hz. With detector at the collector of A347-Q3 (2nd mixer board output), tune L3, L2, L1, T1 (2nd Mixer) and L1 (1st Mixer) for double trace as shown on scope pattern.
11.	A (DISC)	Pin 10		See Procedure	Check to see that discriminator idling voltage is within ±.05 volt of zero with no signal applied. Check to see that modulation acceptance bandwidth is between ±7 and 9 kHz.
FREQUENCY ADJUSTMENT					
12.	A (DISC)	Pin 10	C9 on 1st OSC (C10, C11 or C12 for multi-frequency)	Zero	Apply an on-frequency signal to the antenna jack. Tune C9 for zero discriminator reading. In multi-frequency units, tune C10, C11 or C12 as required. —— NOTE —— For proper frequency control of the receiver, it is recommended that all frequency adjustments be made when the equipment is at a temperature of approximately 75°F. In no case should frequency adjustments be made when the equipment is outside the temperature range of 50° to 90°F.

ALIGNMENT PROCEDURE

25—50 MHz MASTR RECEIVER
MODELS 4ER39C50-67

Issue 1

TEST PROCEDURES

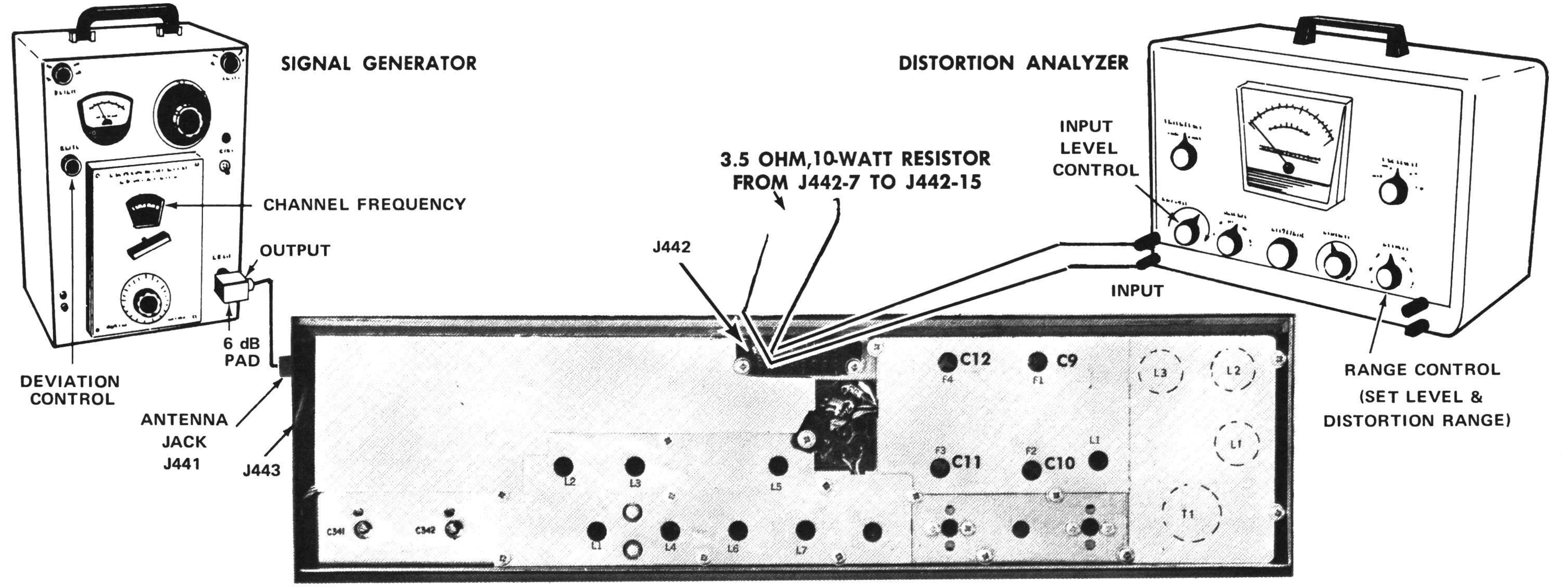
These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the 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

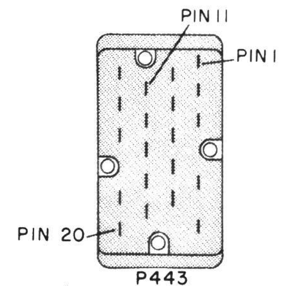
- Distortion Analyzer similar to: Heath IM-12
- Signal Generator similar to: Measurements M-560
- 6-dB attenuation pad, and 3.5-ohm, 10-watt resistor

PRELIMINARY ADJUSTMENTS

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

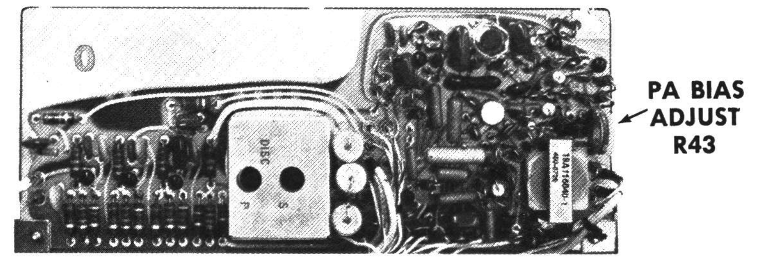


COMPONENT TOP VIEW

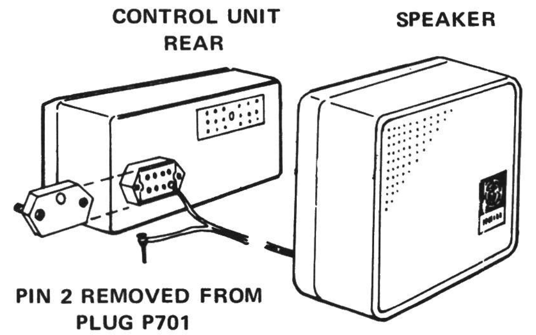


P443
(CONNECTS TO J443)

REMOVE THREE SCREWS AND SWING BOARD OPEN



IF-AUDIO & SQUELCH BOARD (COMPONENT VIEW)



PIN 2 REMOVED FROM PLUG P701

STEP 1
AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Apply a 1,000-microvolt, on-frequency test signal modulated by 1,000 hertz with ±3.0 kHz deviation to antenna jack J441.

B. With Five-Watt Speaker:

Disconnect speaker lead pin from J701-2 (on rear of Control Unit).

Connect a 3.5-ohm load resistor from J442-15 to J442-7. Connect the Distortion Analyzer input across the resistor as shown.

OR

With Handset:

Lift the handset off of the hookswitch. Connect the Distortion Analyzer input from J442-15 to J442-7.

C. Adjust the VOLUME control for five-watt output (4.18 VRMS using the Distortion Analyzer as a VTVM).

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

SERVICE CHECK

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

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

F. P.A. Bias Adjust (R43) -- Turn the SQUELCH control fully counterclockwise. Then connect a milliammeter in series with the +12 volt lead at P443-11. With no signal in, adjust R43 for a reading of approximately 20 milliamps. This adjustment should not be necessary unless an output transistor has been replaced.

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

H. Discriminator Alignment (Refer to Receiver Alignment on reverse side of page).

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 3.0-kHz deviation to J441.

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 0.25 microvolts with an audio output of at least 2.5 watts (2.9 volts RMS across the 3.5-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 0.25 microvolts, 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 (but less than ±9 kHz).

SERVICE CHECK

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

STEP 1 - QUICK CHECKS

TEST SET CHECKS

These checks are typical voltage readings measured with GE Test Set Model 4EX3A10 in the Test 1 position, or Model 4EX8K10 or 11 in the 1-volt position.

Metering Position	Reading With No Signal In	Reading with 1 Microvolt Unmodulated
A (Disc Idling)	Less then ±.05 VDC	
B (2nd IF)	.03 VDC	0.2 VDC
C (1st Lim)	0.5 VDC	0.8 VDC
D (Mult-1)	0.6 VDC	
J (Reg. +10 volts)	+10 VDC	

SYMPTOM CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	• Check power connections and continuity of supply leads, and check fuse in power supply. If fuse is blown, check receiver for short circuits.
NO REGULATED 10-VOLTS	• Check the 12-volt supply. Then check regulator circuit. (See Troubleshooting Procedure for Power Supply).
LOW 1ST LIM READING	• Check supply voltages and then check oscillator reading at J442-4 & 5 as shown in STEP 2A. • Make SIMPLIFIED VTVM GAIN CHECKS from 2nd Mixer through 1st Limiter stages as shown in STEP 2A.
LOW OSCILLATOR/MULTIPLIER READINGS	• Check alignment of Oscillator, (Refer to Front End Alignment Procedure). • Check voltage readings of 1st Oscillator/Multiplier Q1/Q2. • Check crystal Y1.
LOW RECEIVER SENSITIVITY	• Check Front End Alignment. (Refer to Receiver Alignment Procedure). • Check antenna connections, cable and relay. • Check 1st and 2nd Oscillator injection voltage. • Check voltage readings of 1st Mixer, HI IF Amp and 2nd Mixer. • Make SIMPLIFIED GAIN CHECKS (STEP 2A).
LOW AUDIO	• Check Audio PA (Q341 & Q342) voltage readings on schematic diagram. • Make simplified gain and waveform checks of audio and squelch stages. (Steps 2A and 2B). • Make unsquelched voltage readings in Audio section. (Refer to Receiver Schematic Diagram). • Check voltage readings on Channel Guard board.
HIGH DISTORTION AT LOW AUDIO LEVELS (50 MW)	• Set PA bias adjust R43 as specified under Service Checks in STEP 1 of TEST PROCEDURES.
IMPROPER SQUELCH OPERATION	• Check voltage readings of Squelch circuit. (Refer to Receiver Schematic Diagram). • Make gain and waveform checks of audio and squelch stages. (Steps 2A and 2B).
DISTORTION IDLING TOO FAR OFF ZERO	• See if discriminator zero is in center of IF bandpass.

STEP 3-VOLTAGE RATIO READINGS →

EQUIPMENT REQUIRED:

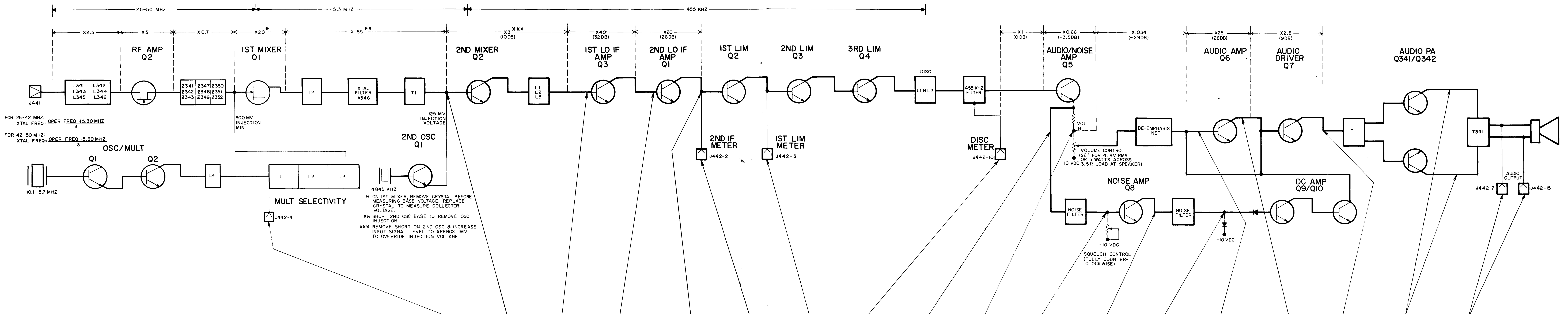
1. RF Voltmeter (similar to Boonton Model 91-CA or Millivac Type MV-18 C.
2. Signal on receiver frequency (below saturation). Correct frequency can be determined by zeroing the discriminator. Use 1,000 hertz signal with 3.3 kHz deviation.

PROCEDURE:

1. Apply probe to input of stage (for example, base of RF amp). Peak resonant circuit of stage being measured and take voltage reading (E_1).
2. Move probe to input of following stage (1st mixer*). Repeak first resonant circuit then peak circuit being measured and take reading (E_2).
3. Convert readings by means of the following formula.

$$\text{Voltage Ratio} = \frac{E_2}{E_1}$$

4. Check results with typical voltage ratios shown on diagram.



STEP 2A-SIMPLIFIED VTVM GAIN CHECKS →

EQUIPMENT REQUIRED:

1. VTVM - AC & DC
2. Signal generator (Measurements M560 to equivalent).

PRELIMINARY STEPS:

1. Set VOLUME control for 4.18 volts across 3.5-ohm load. If this cannot be obtained, set to approx. 70% of max. rotation.
2. Set SQUELCH control fully counterclockwise.
3. Receiver should be properly aligned.
4. Connect VTVM between system negative and points indicated by arrow.

SIGNAL GENERATOR INPUT AT J441 MAINTAIN SETTING AT DISCRIMINATOR ZERO		UNMODULATED	UNMODULATED	UNMODULATED	UNMODULATED	1 MICROVOLT UNMODULATED	NO SIGNAL INPUT	STANDARD SIGNAL-(1 MILLIVOLT AT RCVR FREQ, MODULATED BY 1KHZ WITH 3.3KHZ DEVIATION)	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL
PROCEDURE		INCREASE GENERA- OUTPUT UNTIL VTVM READING ON 1.5 V SCALE DECREASES BY **50 MV**	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING DECREASES BY **5 %**	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING DECREASES BY **5 %**	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING DECREASES BY **5 %**													CONNECT VTVM OR SCOPE ACROSS 3.5Ω LOAD BETWEEN J442-7 AND J442-15 WITH SPEAKER DISCONNECTED.
READING	2.4 VDC	GENERATOR OUTPUT SHOULD BE APPROX **20** MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX **600** MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX **5** MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX **0.3** MICROVOLTS	-0.6 VDC	- 2 VDC	0.8 VAC	0.75 VAC	0.55 VAC	0.15 VAC	2.3 VAC	0.05 VAC		0.5 VAC	1.4 VAC	10 VAC	4.18 VAC

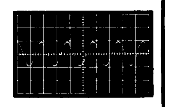
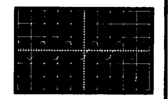
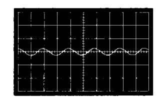
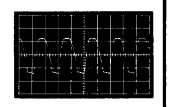
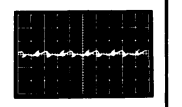
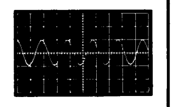
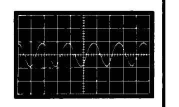
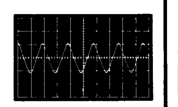
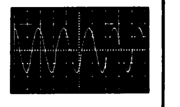
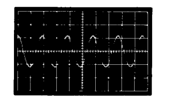
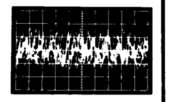
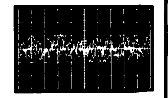
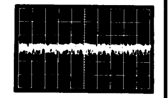
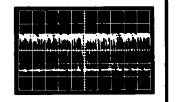
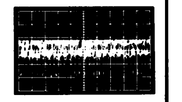
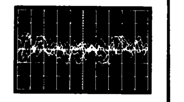
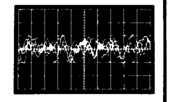
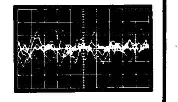
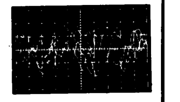
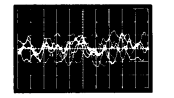
STEP 2B-AUDIO & SQUELCH WAVEFORMS →

EQUIPMENT REQUIRED:

1. Oscilloscope.
2. Signal generator (measurements M560 to equivalent).

PRELIMINARY STEPS:

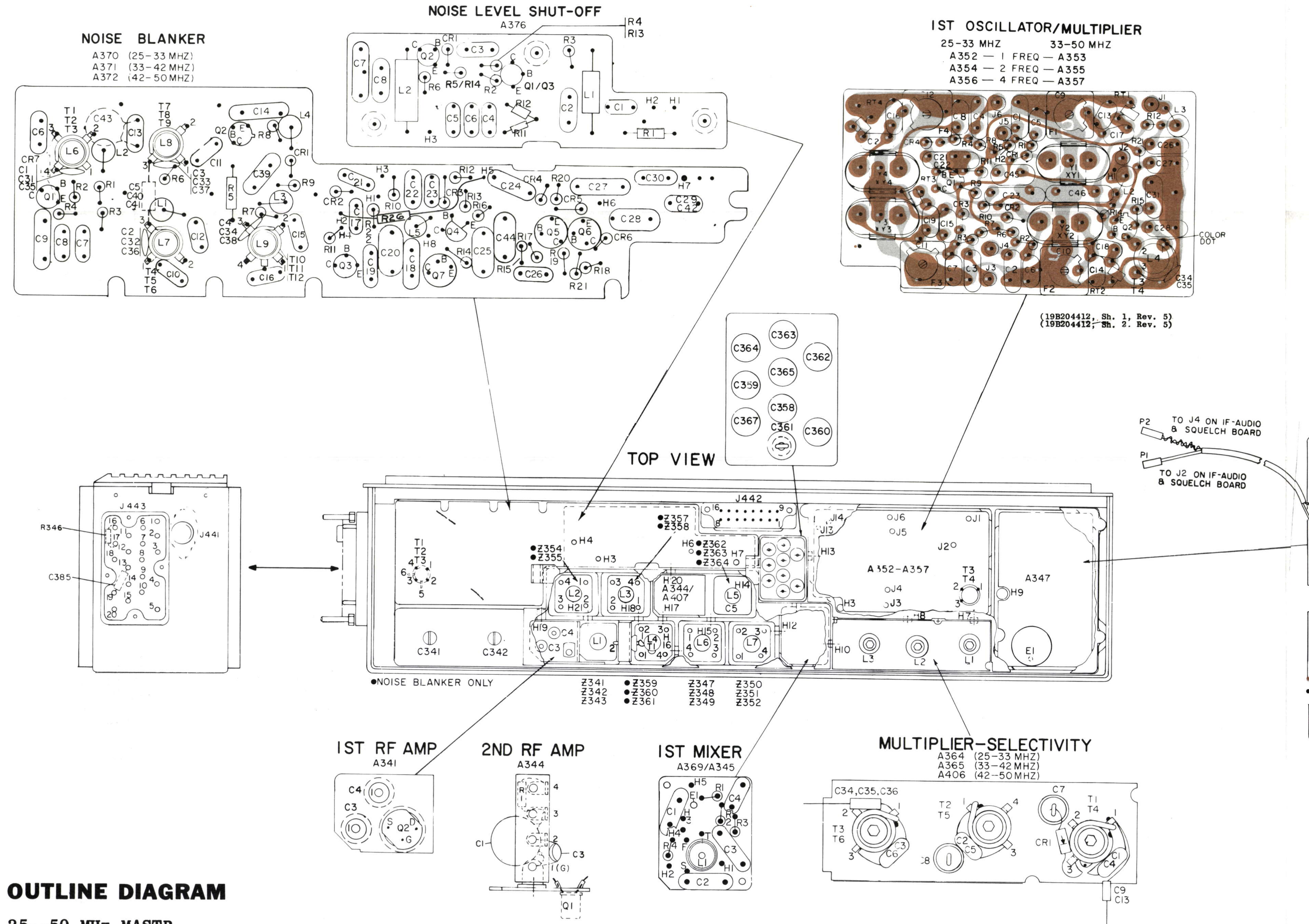
1. Set VOLUME control for 4.18 volts across 3.5-ohm load. If this cannot be obtained, set to approx. 70% of max. rotation.
2. Set SQUELCH control fully counterclockwise.
3. Receiver should be properly aligned.
4. Connect oscilloscope between system negative and points indicated by arrow.

SCOPE SETTING	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV
	1 VOLT/DIV	1 VOLT/DIV	1 VOLT/DIV	2 VOLTS/DIV	0.5 VOLTS/DIV	50 MILLIVOLTS/DIV	1 VOLT/DIV	2 VOLTS/DIV	10 VOLTS/DIV	5 VOLTS/DIV
	2 V P-P	1.4 V P-P	1 V P-P (NOISE)	5.7 V P-P (NOISE)	3 V P-P (NOISE)	0.1 V P-P	1.9 V P-P	4 V P-P	30 V P-P	12 V P-P
STANDARD SIGNAL (1 MILLIVOLT AT RECEIVER FREQ MODULATED BY 1KHZ WITH 3.3 KHZ DEVIATION)										
NOISE WAVE FORM (NO SIGNAL INPUT)										

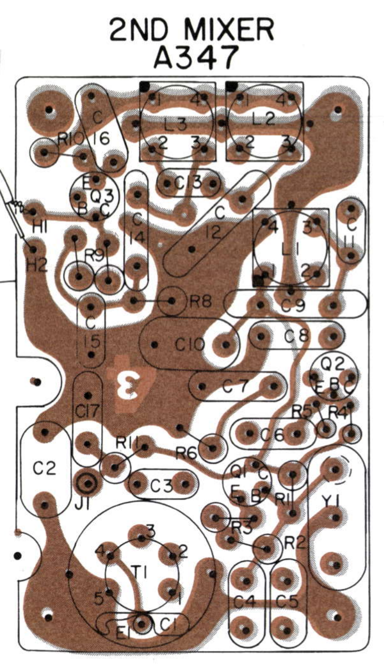
(RC-1992)

TROUBLESHOOTING PROCEDURE

25—50 MHz MASTR RECEIVER
MODELS 4ER39C50-67



(19B204412, Sh. 1, Rev. 5)
(19B204412, Sh. 2, Rev. 5)



(19B216045, Sh. 1, Rev. 4)
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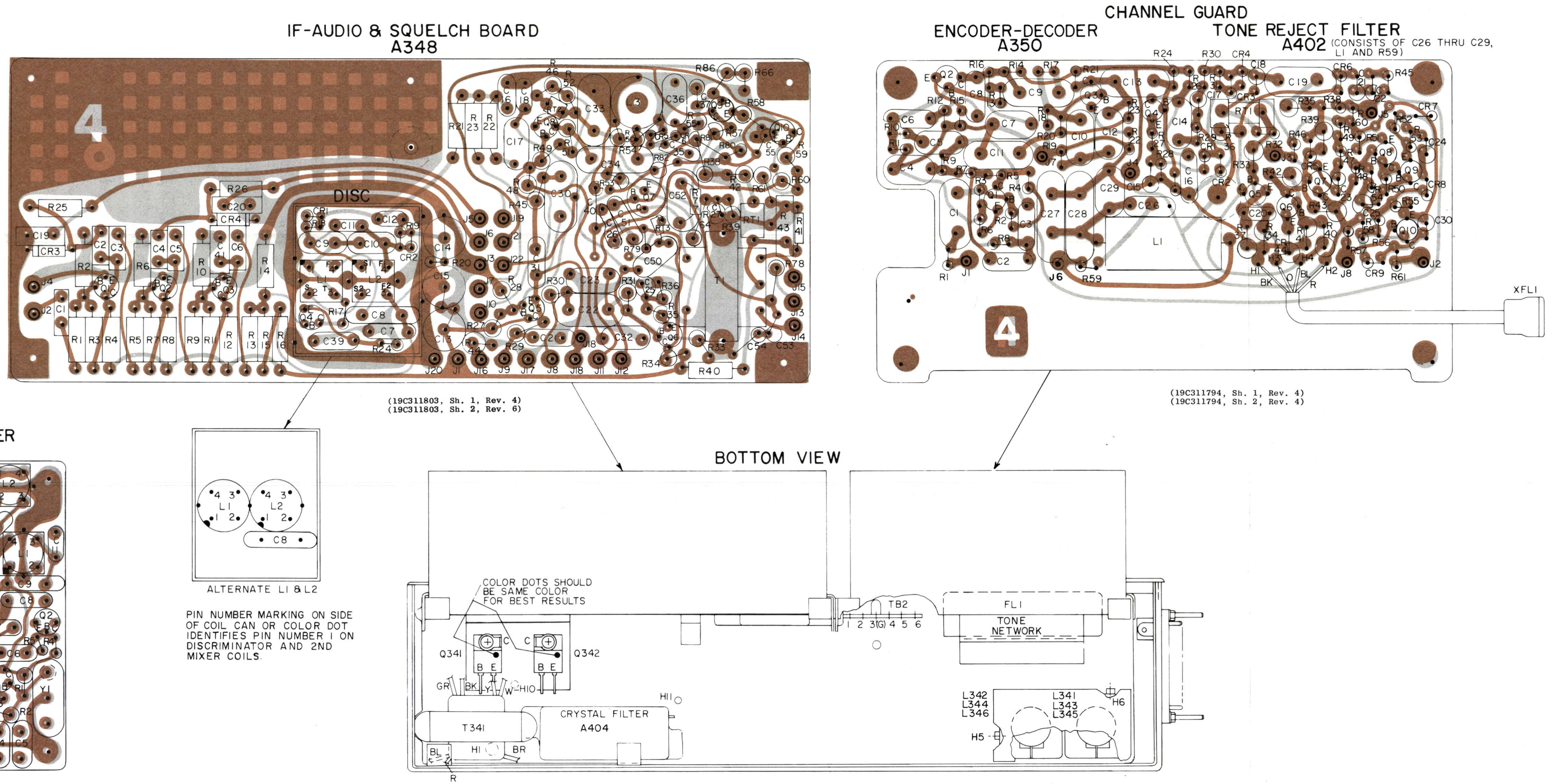
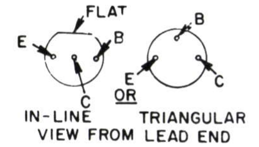


(19C311803, Sh. 1, Rev. 4)
(19C311803, Sh. 2, Rev. 6)

(19C311794, Sh. 1, Rev. 4)
(19C311794, Sh. 2, Rev. 4)

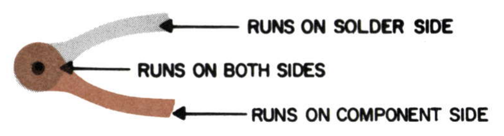
PIN NUMBER MARKING ON SIDE OF COIL CAN OR COLOR DOT IDENTIFIES PIN NUMBER 1 ON DISCRIMINATOR AND 2ND MIXER COILS.



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

TRANSISTOR LEAD IDENTIFICATION

(19R621253, Rev. 26)



OUTLINE DIAGRAM

25—50 MHz MASTR
RECEIVER MODELS 4ER39C50-67

PARTS LIST

LBI-4127G

25-50 MHz RECEIVER
MODELS 4ER39C50 - 4ER39C67

SYMBOL	GE PART NO.	DESCRIPTION
A341		RF AMPLIFIER ASSEMBLY 19B204772G3
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C3 and C4	5493392P7	Ceramic, feed-thru: 1000 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C9 and C10	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	7491382P101	Coil, RF: 100 μh ±10%, 4 ohms DC res max; sim to Delevan 3500 Series.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q2*	19A116960P1	N Type, field effect; sim to Type 2N4416.
		In 19E500873G1 of REV G and earlier: In 19E500873G2 of REV H and earlier: In 19E500873G3 of REV G and earlier:
	19A115953P1	N Channel; sim to T1S34.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R10	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R11 and R12	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XQ2	5490277P5	Transistor, phen: 3 contacts rated at 1 amp at 400 VRMS; sim to Alcon 1213LL2.
A345		FIRST MIXER ASSEMBLY 19B216867G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496218P258	Ceramic disc: 62 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2 and C3	5494481P127	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C5	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B216880G1	Coil.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R2	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R3 and R4	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1*	19A116960P1	N Type, field effect; sim to Type 2N4416.
		In 19E500873G1 of REV G and earlier: In 19E500873G2 of REV H and earlier: In 19E500873G3 of REV G and earlier:
	19A115953P1	N Channel; sim to T1S34.
A347		SECOND MIXER 19B216119G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2	19A116080P7	Polyester: 0.1 μf ±20%, 50 VDCW.
C3	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW.
C4 and C5	5490008P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C6	5490008P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C7 and C8	19A116080P5	Polyester: 0.047 μf ±20%, 50 VDCW.
C9	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C10	19A116080P7	Polyester: 0.1 μf ±20%, 50 VDCW.
C11	5496219P40	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C12	5496219P369	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C13	5496219P40	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C14	19A116656P220J2	Ceramic disc: 220 pf ±5%, 500 VDCW, temp coef -220 PPM.
C15	7491395P109	Ceramic disc: 1000 pf ±10%, 500 VDCW; sim to RMC Type JL.
C16	19A116080P5	Polyester: 0.047 μf ±20%, 50 VDCW.
C17	19A116080P1	Polyester: 0.01 μf ±20%, 50 VDCW.
		- - - - - - - JACKS AND RECEPTACLES - - - - -
J1	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19C311181G3	Coil. Includes tuning slug 4038368P1.
L2 and L3	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12670.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	4029840P2	Contact, electrical: sim to Amp 42827-2.
P2	4029840P1	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115889P1	Silicon, NPN.
Q2	19A115245P1	Silicon, NPN.
Q3	19A115123P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R3	3R77P512J	Composition: 5100 ohms ±5%, 1/2 w.
R4	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R5	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R6	3R77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R7	3R77P123K	Composition: 12,000 ohms ±10%, 1/2 w.
R8	3R77P622J	Composition: 6200 ohms ±5%, 1/2 w.
R9	3R77P302J	Composition: 3000 ohms ±5%, 1/2 w.
R10	3R77P202J	Composition: 2000 ohms ±5%, 1/2 w.
R11	3R77P201J	Composition: 200 ohms ±5%, 1/2 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1		COIL ASSEMBLY 19B216120G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19C301540P261	Ceramic disc: 82 pf ±5%, 200 VDCW, temp coef -80 PPM.
	5491798P3	Tuning slug.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	19A110192P3	Quartz: freq 4845 KHz ±100 Hz at 25°C, temp range -30°C to +75°C.
A348		IF AUDIO AND SQUELCH 19D413129G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	5496219P717	Ceramic disc: 47 pf ±10%, 500 VDCW, temp coef -750 PPM.
C3	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	5496219P717	Ceramic disc: 47 pf ±10%, 500 VDCW, temp coef -750 PPM.
C5 and C6	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C7	19A116080P5	Polyester: 0.047 μf ±20%, 50 VDCW.
C8	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C9 and C10	5490008P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C11	5496219P656	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -470 PPM.
C12	5494481P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C13	19A115680P107	Electrolytic: 100 μf +150% -10%, 15 VDCW; sim to Mallory Type TT.
C14 and C15	19A115680P104	Electrolytic: 50 μf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C16	5494481P112	Ceramic disc: 1000 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.
C17	19A116080P7	Polyester: 0.1 μf ±20%, 50 VDCW.
C18	5494481P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C19 and C20	19A116080P5	Polyester: 0.047 μf ±20%, 50 VDCW.
C21	19A116080P3	Polyester: 0.022 μf ±20%, 50 VDCW.
C22	19A116080P108	Polyester: 0.15 μf ±10%, 50 VDCW.
C23	19A116080P107	Polyester: 0.1 μf ±10%, 50 VDCW.
C25	5496267P6	Tantalum: 33 μf ±20%, 10 VDCW; sim to Sprague Type 150D.
C26*	19A116080P110	Polyester: 0.33 μf ±10%, 50 VDCW.
		In REV E-M:
	19A116080P109	Polyester: 0.22 μf ±10%, 50 VDCW.
		In REV D and earlier:
	5496267P28	Tantalum: 0.47 μf ±20%, 35 VDCW; sim to Sprague Type 150D.
C27	5496267P2	Tantalum: 47 μf ±20%, 6 VDCW; sim to Sprague Type 150D.
C30	19A116080P8	Polyester: 0.15 μf ±20%, 50 VDCW.
C31	19A116080P102	Polyester: 0.015 μf ±20%, 50 VDCW.
C32	19A116080P7	Polyester: 0.1 μf ±20%, 50 VDCW.
C33	19A116080P9	Polyester: 0.22 μf ±20%, 50 VDCW.
C34	4029003P207	Silver mica: 1830 pf ±2%, 500 VDCW; sim to Electro Motive Type DM-20.
C35	19A116080P5	Polyester: 0.047 μf ±20%, 50 VDCW.
C36	19A116080P9	Polyester: 0.22 μf ±20%, 50 VDCW.
C37	5496267P28	Tantalum: 0.47 μf ±20%, 35 VDCW; sim to Sprague Type 150D.
C39	19A116080P1	Polyester: 0.01 μf ±20%, 50 VDCW.
C40*	5496267P29	Tantalum: 0.68 μf ±20%, 35 VDCW; sim to Sprague Type 150D.
		In REV K and earlier:
	5496267P28	Tantalum: 0.47 μf ±20%, 35 VDCW; sim to Sprague Type 150D.
C41	5490008P129	Silver mica: 120 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C50	19A116080P7	Polyester: 0.1 μf ±20%, 50 VDCW.
C51	19A116655P22	Ceramic disc: 2700 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C52	19A116080P109	Polyester: 0.22 μf ±10%, 50 VDCW.
C53 and C54	5496267P213	Tantalum: 2.2 μf ±10%, 20 VDCW; sim to Sprague Type 150D.
C55	5496267P14	Tantalum: 15 μf ±20%, 20 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115250P1	Silicon.
CR3* and CR4*	19A115250P1	Silicon.
		In REV F and earlier:
	4038056P1	Germanium.
CR5 and CR6	19A115250P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J18	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J18A	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J19 thru J22	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19A115711P6	Transformer, freq: 455 KHz; sim to TOKO PEFCN-14833-CX12.
L2	19A115711P7	Transformer, freq: 455 KHz; sim to TOKO PEFCN-14834-BNL2.
L3	19A127134G1	Choke. Includes tuning slug 7486872P7.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q4	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q5	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q6	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q7	19A115300P4	Silicon, NPN; sim to Type 2N3053.
Q8	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q9	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q10*	19A116774P1	Silicon, NPN; sim to Type 2N5210.
		In REV G and earlier:
	19A115123P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R2	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R3	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R4	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R5	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R6	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R7	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R8	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R9	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R10	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R11	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R12	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R13	3R77P272K	Composition: 2700 ohms ±10%, 1/2 w.
R14	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R15	3R77P333J	Composition: 33,000 ohms ±5%, 1/2 w.
R16	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R17	3R152P471J	Composition: 470 ohms ±5%, 1/4 w.
R18 and R19	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R20	3R152P472K	Composition: 4700 ohms ±10%, 1/4 w.
R21 and R22	3R77P362J	Composition: 3600 ohms ±5%, 1/2 w.
R23	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R24	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R25 and R26	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R27 and R28	3R77P753J	Composition: 75,000 ohms ±5%, 1/2 w.
R29	3R77P182J	Composition: 1800 ohms ±5%, 1/2 w.
R30*	3R77P821J	Composition: 820 ohms ±5%, 1/2 w.
		In REV C and earlier:
	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
R31	3R77P821J	Composition: 820 ohms ±5%, 1/2 w.
R33	3R77P912J	Composition: 9100 ohms ±5%, 1/2 w.
R34	3R77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R35	3R77P330K	Composition: 33 ohms ±10%, 1/2 w.
R36	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R38	3R77P752J	Composition: 7500 ohms ±5%, 1/2 w.
R39	3R77P820J	Composition: 82 ohms ±5%, 1/2 w.
R40*	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
		In REV H and earlier:
	3R77P241J	Composition: 240 ohms ±5%, 1/2 w.
R41	3R152P240J	Composition: 24 ohms ±5%, 1/4 w.
R42	3R77P200J	Composition: 20 ohms ±5%, 1/2 w.
R43	19B209358P101	Variable, carbon film: approx 25 to 250 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R44	19B209022P101	Wirewound: 0.27 ohms ±10%, 2 w; sim to IRC Type BWH.
R45	3R77P123J	Composition: 12,000 ohms ±5%, 1/2 w.
R46	3R77P913J	Composition: 91,000 ohms ±5%, 1/2 w.
R48	19A116278P249	Metal film: 3160 ohms ±2%, 1/2 w.
R49	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R50	3R77P222J	Composition: 2200 ohms ±5%, 1/2 w.
R51	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R52	3R77P682J	Composition: 6800 ohms ±5%, 1/2 w.
R53*	3R77P223J	Composition: 22,000 ohms ±5%, 1/2 w.
		In REV E and earlier:
	3R77P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R54	3R77P822J	Composition: 8200 ohms ±5%, 1/2 w.
R55	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R56	3R77P224J	Composition: 0.22 megohm ±5%, 1/2 w.
R57	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R58	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R59	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R60 and R61	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R64	3R77P120J	Composition: 12 ohms ±5%, 1/2 w.
R66	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R77	3R152P153K	Composition: 15,000 ohms ±10%, 1/4 w.
R78*	3R77P200J	Composition: 20 ohms ±5%, 1/2 w.
		In REV C and earlier:
	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R79	3R152P393J	Composition: 39,000 ohms ±5%, 1/4 w.
R80*	3R152P272J	Composition: 2700 ohms ±5%, 1/4 w.
		In REV L and earlier:
	3R152P432J	Composition: 4300 ohms ±5%, 1/4 w.
R81	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R82	3R77P273J	Composition: 27,000 ohms ±5%, 1/2 w.
R85*	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w. Added by REV K. Deleted by REV L.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT1	5490828P41	Thermistor: 30 ohms ±10%, color code black/white; sim to Globar Type B1211H-4.
RT2 and RT3	5490828P9	Thermistor: 10,000 ohms ±10%, color code yellow; sim to Globar Type 551H8.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1	19A116040P1	Audio freq: 300-4000 Hz, Pri: 19.3 ohms ±10% DC res, Sec: 23.5 ohms ±10% DC res.
A350		ENCODER/DECODER 4EK16A10 19C311797G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116080P9	Polyester: 0.22 μf ±20%, 50 VDCW.
C2 and C3	19A116080P205	Polyester: 0.047 μf ±5%, 50 VDCW.
C4	19A116080P207	Polyester: 0.1 μf ±5%, 50 VDCW.
C5	19A116080P7	Polyester: 0.1 μf ±20%, 50 VDCW.
C6	19A116080P205	Polyester: 0.047 μf ±5%, 50 VDCW.
C7	19A116080P207	Polyester: 0.1 μf ±5%, 50 VDCW.
C8	19A116080P205	Polyester: 0.047 μf ±5%, 50 VDCW.
C9	19A116080P9	Polyester: 0.22 μf ±20%, 50 VDCW.
C10	19A116080P207	Polyester: 0.1 μf ±5%, 50 VDCW.
C11	19A116080P109	Polyester: 0.22 μf ±10%, 50 VDCW.
C12	19A116080P207	Polyester: 0.1 μf ±5%, 50 VDCW.
C13	19A116080P9	Polyester: 0.22 μf ±20%, 50 VDCW.
C14	19A116080P7	Polyester: 0.1 μf ±20%, 50 VDCW.
C15	5496267P1	Tantalum: 6.8 μf ±20%, 6 VDCW; sim to Sprague Type 150D.
C16	19A116080P5	Polyester: 0.047 μf ±20%, 50 VDCW.
C17	5496267P417	Tantalum: 1.0 μf ±5%, 35 VDCW; sim to Sprague Type 150D.
C18	5496267P1	Tantalum: 6.8 μf ±20%, 6 VDCW; sim to Sprague Type 150D.
C19	19A116080P109	Polyester: 0.047 μf ±10%, 50 VDCW.
C20	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C21	5496267P9	Tantalum: 3.3 μf ±20%, 15 VDCW; sim to Sprague Type 150D.
C22	5496267P17	Tantalum: 1.0 μf ±20%, 35 VDCW; sim to Sprague Type 150D.
C23	5496267P13	Tantalum: 2.2 μf ±20%, 20 VDCW; sim to Sprague Type 150D.
C24	5496267P1	Tantalum: 6.8 μf ±20%, 6 VDCW; sim to Sprague Type 150D.
C25	5496267P18	Tantalum: 6.8 μf ±20%, 35 VDCW; sim to Sprague Type 150D.
C26	19A116080P206	Polyester: 0.068 μf ±5%, 50 VDCW.
C27 and C28	19A116080P210	Polyester: 0.33 μf ±10%, 50 VDCW.
C29*	19A116080P205	Polyester: 0.047 μf ±5%, 50 VDCW.
		In REV B and earlier:
	19B209243P107	Polyester: 0.1 μf ±10%, 50 VDCW.
C30	5496267P17	Tantalum: 1.0 μf ±20%, 35 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115250P1	Silicon.
CR3 and CR4	5494922P1	Silicon.
CR5	19A115250P1	Silicon.
CR6	4036887P3	Silicon, Zener.
CR7 thru CR9	19A115250P1	Silicon.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL1		TONE FREQUENCY NETWORK 19B205280
	19B205280G1 19B205280G2 19B205280G3 19B205280G4 19B205280G5 19B205280G6 19B205280G7 19B205280G8 19B205280G9 19B205280G10 19B205280G11 19B205280G12 19B205280G13 19B205280G14 19B205280G15 19B205280G16 19B205280G17 19B205280G18 19B205280G19 19B205280G20 19B205280G21 19B205280G22 19B205280G23 19B205280G24 19B205280G25 19B205280G26	71.9 Hz 77.0 Hz 82.5 Hz 88.5 Hz 94.8 Hz 100.0 Hz 103.5 Hz 107.2 Hz 110.9 Hz 114.8 Hz 118.8 Hz 123.0 Hz 127.3 Hz 131.8 Hz 136.5 Hz 141.3 Hz 146.2 Hz 151.4 Hz 156.7 Hz 162.2 Hz 167.9 Hz 173.8 Hz 179.9 Hz 186.2 Hz 192.8 Hz 203.5 Hz
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J8	4033513P4	Contact, electrical sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19A115690P1	Coil, RF: 880 mh ±5%, sim to Artted AC5672.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q2	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q3 and Q4	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q5 thru Q8	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q9 and Q10	19A115123P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R2	3R77P683J	Composition: 68,000 ohms ±5%, 1/2 w.
R3	3R77P822J	Composition: 8200 ohms ±5%, 1/2 w.
R4	3R77P152J	Composition: 1500 ohms ±5%, 1/2 w.
R5	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R6	3R77P201J	Composition: 200 ohms ±5%, 1/2 w.
R7	19A116278P305	Metal film: 11,000 ohms ±2%, 1/2 w.
R8*	3R77P562J	Composition: 5600 ohms ±5%, 1/2 w.
		Earlier than REV A:
	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R9	19A116278P305	Metal film: 11,000 ohms ±2%, 1/2 w.
R10	3R77P512J	Composition: 5100 ohms ±5%, 1/2 w.
R11	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R12	3R77P822J	Composition: 8200 ohms ±5%, 1/2 w.
R13	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R14	3R77P133J	Composition: 13,000 ohms ±5%, 1/2 w.
R15	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
R16	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R17	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R18	3R77P622J	Composition: 6200 ohms ±5%, 1/2 w.
R19	3R77P123J	Composition: 12,000 ohms ±5%, 1/2 w.
R20	3R77P223J	Composition: 22,000 ohms ±5%, 1/2 w.
R21	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R22	3R77P301J	Composition: 300 ohms ±5%, 1/2 w.
R23	3R77P223J	Composition: 22,000 ohms ±5%, 1/2 w.
R24	3R77P433J	Composition: 43,000 ohms ±5%, 1/2 w.
R25	3R77P133J	Composition: 13,000 ohms ±5%, 1/2 w.
R26	3R77P123J	Composition: 12,000 ohms ±5%, 1/2 w.
R27	3R77P151J	Composition: 150 ohms ±5%, 1/2 w.
R28	3R77P562J	Composition: 5600 ohms ±5%, 1/2 w.
R29	3R77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R30	3R77P334J	Composition: 0.33 megohm ±5%, 1/2 w.
R31	3R77P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R32	3R77P822J	Composition: 8200 ohms ±5%, 1/2 w.
R33	19A116278P342	Metal film: 26,700 ohms ±2%, 1/2 w.
R34	19A116278P233	Metal film: 2150 ohms ±2%, 1/2 w.
R35	19A116278P365	Metal film: 46,400 ohms ±2%, 1/2 w.
R36	19A116278P301	Metal film: 10,000 ohms ±2%, 1/2 w.
R37	19A116278P65	Metal film: 46.4 ohms ±2%, 1/2 w.
R38	3R77P204J	Composition: 0.20 megohm ±5%, 1/2 w.
R39	19A116278P385	Metal film: 75,000 ohms ±2%, 1/2 w.
R40	19A116278P329	Metal film: 19,000 ohms ±2%, 1/2 w.
R41	19A116278P285	Metal film: 7500 ohms ±2%, 1/2 w.
R42	19A116278P412	Metal film: 130,000 ohms ±2%, 1/2 w.
R43	19A116278P269	Metal film: 5110 ohms ±2%, 1/2 w.
R44	19A116278P117	Metal film: 147 ohms ±2%, 1/2 w.
R45 and R46	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
		NOTE The value of Resistor R47 must be obtained from the component, then find corresponding value in parts list for the correct part number.
R47A	3R77P822J	Composition: 8200 ohms ±5%, 1/2 w.
R47B	3R77P912J	Composition: 9100 ohms ±5%, 1/2 w.
R47C	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R47D	3R77P113J	Composition: 11,000 ohms ±5%, 1/2 w.
R47E	3R77P123J	Composition: 12,000 ohms ±5%, 1/2 w.
R47F	3R77P133J	Composition: 13,000 ohms ±5%, 1/2 w.
R47G	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R47H	3R77P752J	Composition: 7500 ohms ±5%, 1/2 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

(DF-1095)

MODEL NO.	FREQ. RANGE	NO. FREQ.	CHAN. GUARD
4ER39C50	25-33 MHZ	1	
4ER39C51	33-42 MHZ	1	
4ER39C52	42-50 MHZ	1	
4ER39C53	25-33 MHZ	2	
4ER39C54	33-42 MHZ	2	
4ER39C55	42-50 MHZ	2	
4ER39C56	25-33 MHZ	4	
4ER39C57	33-42 MHZ	4	
4ER39C58	42-50 MHZ	4	
4ER39C59	25-33 MHZ	1	X
4ER39C60	33-42 MHZ	1	X
4ER39C61	42-50 MHZ	1	X
4ER39C62	25-33 MHZ	2	X
4ER39C63	33-42 MHZ	2	X
4ER39C64	42-50 MHZ	2	X
4ER39C65	25-33 MHZ	4	X
4ER39C66	33-42 MHZ	4	X
4ER39C67	42-50 MHZ	4	X

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (J442-8) WITH TEST SET MODEL 4EX3A10 OR A 20,000 OHM-PER-VOLT METER.

S= NO SIGNAL IN WITH SQUELCH CONTROL FULLY COUNTERCLOCKWISE (MAXIMUM SQUELCH).

US= SQUELCH CONTROL FULLY CLOCKWISE WITH A ONE MILLIVOLT MODULATED SQUELCH (UNSQUELCHED) AND 5WATT AUDIO OUTPUT.

REV. LTR BLOCK

		REV.
A352	PL19B204419G13	C
A353	PL19B204419G16	C
A354	PL19B204419G14	A
A355	PL19B204419G17	A
A356	PL19B204419G15	A
A357	PL19B204419G18	A

(19D402991, Rev. 0)

(19R621227, Rev. 36)

SCHEMATIC DIAGRAM

25—50 MHz RECEIVER
MODELS 4ER39C50-67

REV. LTR. BLOCK		
		REV.
	PL19E500873G1	H
	PL19E500873G2	J
	PL19E500873G3	J
A347	PL19B216119G1	A
A348	PL19D413129G1	R
A350	4EK16A10	[illegible]
A402	PL19C311797G2	[illegible]

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

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

- ● LOW SPLIT 25-33 MHZ
- ▲ MID SPLIT 33-42 MHZ
- ◓ HIGH SPLIT 42-50 MHZ
- ■ VALUE OF R47 IS DETERMINED BY TEST (SEE TEST SPEC. 19A127182).
- ◒ THESE ARE ONLY PARTS PRESENT ON A402
- * C342 1.80-8.3 IN HIGH SPLIT ONLY

(DF-1095)

(19R621227, Rev. 36)

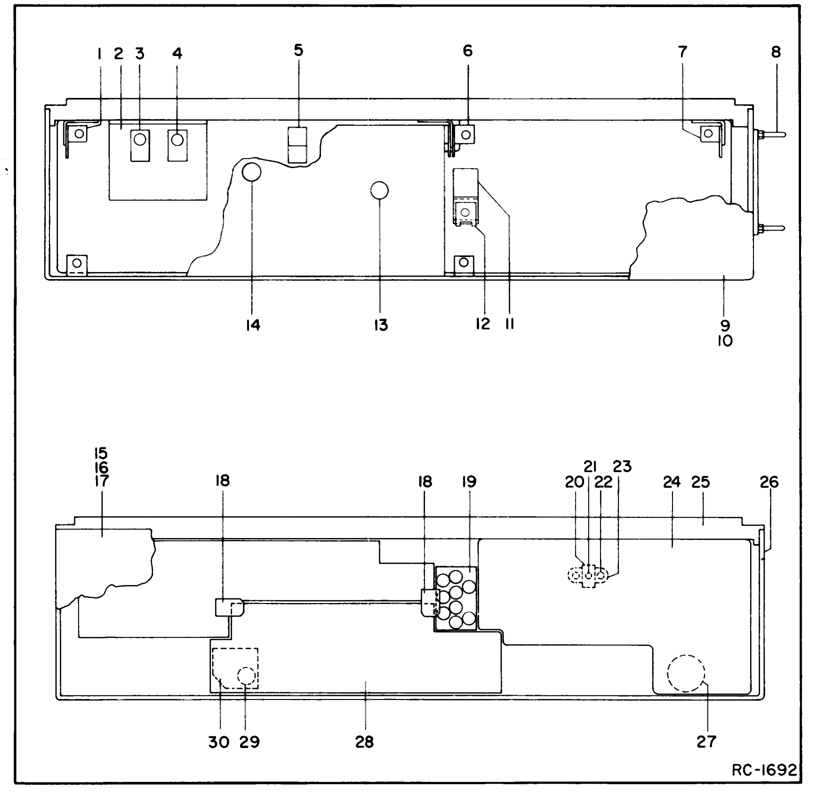
SCHEMATIC DIAGRAM

25—50 MHz RECEIVER
MODELS 4ER39C50-67

Issue 9

(Cont'd from Page 11) (LBI-4127)

SYMBOL	GE PART NO.	DESCRIPTION
R48	3R77P563J	Composition: 56,000 ohms ±5%, 1/2 w.
R49	3R77P224J	Composition: 0.22 megohm ±5%, 1/2 w.
R50	3R77P242J	Composition: 2400 ohms ±5%, 1/2 w.
R51	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R52	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
R53	3R77P201J	Composition: 200 ohms ±5%, 1/2 w.
R54	3R77P333J	Composition: 33,000 ohms ±5%, 1/2 w.
R55	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R56	3R77P363J	Composition: 36,000 ohms ±5%, 1/2 w.
R57	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R58	3R77P913J	Composition: 91,000 ohms ±5%, 1/2 w.
R59*	3R77P182J	Composition: 1800 ohms ±5%, 1/2 w.
		In REV C and earlier:
	3R152P432J	Composition: 4300 ohms ±5%, 1/4 w.
R60	3R77P432J	Composition: 4300 ohms ±5%, 1/2 w.
R61	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.
		- - - - - - - - - - THERMISTORS - - - - - - - - -
RT1	5490828P22	Thermistor: 50,000 ohms ±10%, color code yellow; sim to Globar Type 763H.
		- - - - - - - - - - - - SOCKETS - - - - - - - - -
XFL1	19A121920G3	Reed, mica-filled phen: 7 pins rated at 1 amp at 500 VRMS with 4-1/2 inches of cable.
A352 thru A357		FIRST OSCILLATOR ASSEMBLY A352 19B204419G13 A353 19B204419G16 A354 19B204419G14 A355 19B204419G17 A356 19B204419G15 A357 19B204419G18
		- - - - - - - - - - CAPACITORS - - - - - - - -
C1 thru C4	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C5 thru C8	5496219P751	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C9 thru C12	5491271P106	Variable, subminiature: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C13 thru C16	5496219P40	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C17 thru C20	19C300685P93	Ceramic disc: 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C21	5496219P771	Ceramic disc: 220 pf ±5%, 500 VDCW, temp coef -750 PPM.
C22	5496219P773	Ceramic disc: 270 pf ±5%, 500 VDCW, temp coef -750 PPM.
C23	5494481P114	Ceramic disc: 2000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C26 thru C28	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C31	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C45	5490008P35	Silver mica: 220 pf ±5%, 500 VDCW.
C46	5496219P563	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -330 PPM.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 thru CR4	19A115603P1	Silicon.
		- - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J6	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - - INDUCTORS - - - - - - - - -
L2 and L3	7488079P16	Choke, RF: 10 µh ±10% ind at 640 ma, 0.6 ohm DC res; sim to Jeffers 4421-7K.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 and Q2	19A115330P1	Silicon, NPN.
		- - - - - - - - - - - RESISTORS - - - - - - - -
R1 thru R4	3R152P562J	Composition: 5600 ohms ±5%, 1/4 w.
R5 thru R8	3R152P104K	Composition: 0.1 megohm ±10%, 1/4 w.
R9	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R10	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R11 and R12	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R14	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R15	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R19	3R152P360J	Composition: 36 ohms ±5%, 1/4 w.
R21	3R152P750J	Composition: 75 ohms ±5%, 1/4 w.
		- - - - - - - - - - THERMISTORS - - - - - - - -
RT1 thru RT4	19B209284P5	Disc: 43 ohms res nominal at 25°C, color code green.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T3 and T4		COIL ASSEMBLY T3 19B205416G1 T4 19B205416G2
		- - - - - - - - - - CAPACITORS - - - - - - - -
C34	5496218P253	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C35	5496218P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L4	19A121464P2	Coil.
		- - - - - - - - - - MISCELLANEOUS - - - - - - -
	5491798P5	Tuning slug.
		- - - - - - - - - - - SOCKETS - - - - - - - -
XY1 thru XY4		Refer to Mechanical Parts (RC-1692).
		- - - - - - - - - - - CRYSTALS - - - - - - - - -
		NOTE: When reordering give GE Part No. and specify exact freq needed.
		25-42 MHz crystal freq = (OF +5.30 MHz) ÷ 3.
		42-50 MHz crystal freq = (OF -5.30 MHz) ÷ 3.
Y1 thru Y4	19B206576P1	Quartz: freq range 10086.666 to 12766.666 KHz, temp range -30°C to +85°C. (25-33 MHz).
Y1 thru Y4	19B206576P2	Quartz: freq range 12766.667 to 15766.666 KHz, temp range -30°C to +85°C. (33-42 MHz).
Y1 thru Y4	19B206576P3	Quartz: freq range 12233.333 to 16233.333 KHz, temp range -30°C to +85°C. (42-54 MHz).
A364, A365 and A406		MULTIPLIER SELECTIVITY ASSEMBLY A364 19B205326G6 A365 19B205326G7 A406 19B205326G8
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 and C2	5496218P252	Ceramic disc: 36 µf ±5%, 500 VDCW, temp coef -80 PPM.
C3	5496218P251	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM.
C4 and C5	5496218P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C6	5496218P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C7 and C8	5493392P107	Ceramic, stand-off: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type SS5D.
C9	5491601P123	Phenolic: 1.5 pf ±5%, 500 VDCW.
C10	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW.
C11	5491601P118	Phenolic: 0.75 pf ±5%, 500 VDCW.
C13	5491601P137	Phenolic: 0.91 pf ±5%, 500 VDCW.
C14	5491601P114	Phenolic: 0.51 pf ±5%, 500 VDCW.
C15	5491601P115	Phenolic: 0.56 pf ±5%, 500 VDCW.
C34 and C35	5491601P127	Phenolic: 2.4 pf ±5%, 500 VDCW.
C36	5491601P126	Phenolic: 2.2 pf ±5%, 500 VDCW.
		- - - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1	4038056P1	Germanium.
		- - - - - - - - - - - INDUCTORS - - - - - - - - -
L1		(Part of T1 and T4).
L2		(Part of T2 and T5).
L3		(Part of T3 and T6).
		- - - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P473K	Composition: 47,000 ohms ±10%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T1	19B205325G2	Coil, includes tuning slug 5491798P4.
T2 and T3	19B205325G1	Coil, includes tuning slug 5491798P4.
T4	19B205325G2	Coil, includes tuning slug 5491798P4.
T5 and T6	19B205325G1	Coil, includes tuning slug 5491798P4.
A402		TONE REJECT FILTER 19C311797G2
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C26	19A116080P206	Polyester: 0.068 µf ±5%, 50 VDCW.
C27 and C28	19A116080P210	Polyester: 0.33 µf ±5%, 50 VDCW.
C29*	19A116080P205	Polyester: 0.047 µf ±5%, 50 VDCW.
		Earlier than REV A:
	19B209243P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J6 and J7	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19A115690P1	Coil, RF: 880 mh ±5%, sim to Artted AC5672.
		- - - - - - - - - - - RESISTORS - - - - - - - - -
R59*	3R77P182J	Composition: 1800 ohms ±5%, 1/2 w.
		In REV A and earlier:
	3R152P432J	Composition: 4300 ohms ±5%, 1/4 w.
A404		CRYSTAL FILTER 19B204616G10
		- - - - - - - - - - - FILTERS - - - - - - - - -
FL5	19B206692G1	Bandpass.
		- - - - - - - - - - - RESISTORS - - - - - - - -
R8	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R14*	3R152P752K	Composition: 7500 ohms ±10%, 1/4 w. Deleted by REV F in 19E500873G1 and G3, by REV G in G2.
A406		(See A364 and A365)
		CHASSIS AND RF ASSEMBLY 19E500873G1 thru G3
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C349	5491601P120	Phenolic: 1.0 pf ±5%, 500 VDCW.
C350	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW.
C351	5491601P114	Phenolic: 0.51 pf ±5%, 500 VDCW.
C358 thru C363	5493392P7	Ceramic feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C385	7774750P4	Ceramic disc: .001 µf +100% -0%, 500 VDCW.
C387 and C388	5494481P12	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1*	19A116062P2	Thyrector. Deleted by REV E in 19E500873G1 and G3, by REV F in G2.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J442	19B205689G2	Connector: 18 contacts.
J443	19C303426G1	Connector: 20 pin contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L341 thru L345		COIL ASSEMBLY L341 19B204820G5 L342 19B204820G6 L343 19B204820G1 L344 19B204820G2 L345 19B204820G3
		- - - - - - - - - - CAPACITORS - - - - - - - -
C341 and C342	19B209159P3	Variable, subminiature: approx 1.70-6.9 pf, 750 v peak; sim to EF Johnson 189.
		- - - - - - - - INDICATING DEVICES - - - - - -
DS301	19B209067P1	Lamp, glow: 0.3 ma; sim to GE NE-2T.
L346		COIL ASSEMBLY 19B204820G4
		- - - - - - - - - - CAPACITORS - - - - - - - -
C342*	19B209159P4	Variable, subminiature: approx 1.80-8.3 pf, 650 v peak; sim to EF Johnson 189.
		In REV H and earlier:
	19B209159P3	Variable, subminiature: approx 1.70-6.9 pf, 750 v peak; sim to EF Johnson 189.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P301 thru P311	4029840P2	Contact, electrical; sim to Amp 42827-2.
P312	4029840P3	Contact, electrical; sim to Amp 42101-2.
P313	4029840P2	Contact, electrical; sim to Amp 42827-2.
P315 thru P317	4029840P2	Contact, electrical; sim to Amp 42827-2.
P319 and P320	4029840P2	Contact, electrical; sim to Amp 42827-2.
P322	4029840P2	Contact, electrical; sim to Amp 42827-2.
P323	4029840P1	Contact, electrical; sim to Amp 41854.
P324	4029840P2	Contact, electrical; sim to Amp 42827-2.
P325 and P326	4029840P2	Contact, electrical; sim to Amp 42827-2.
P327	4029840P1	Contact, electrical; sim to Amp 41854.
		- - - - - - - - - - TRANSISTORS - - - - - - -
Q341* and Q342*	19A116741P1	Silicon, NPN.
		In 19E500873G1 and G3 of REV F and earlier: In 19E500873G2 of REV G and earlier:
	19A116203P2	Silicon, NPN.
		- - - - - - - - - - - RESISTORS - - - - - - - -
R343 and R344	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R345	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
R346	3R78P390K	Composition: 39 ohms ±10%, 1 w.
		- - - - - - - - - - - TRANSFORMERS - - - - - - - -
T341	19A116041P2	Audio: 300 to 4000 Hz, Pri: 1.00 ohms ±15% DC res, Sec 1: 1.23 ohms ±10% DC res, Sec 2: 10.5 ohms ±15% DC res.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7487424P26	Miniature, phen: 6 terminals.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W442	19B205634G6	Coaxial: approx 5 inches long.
W443	19B205634G3	Coaxial: approx 5 inches long.
		- - - - - - - - TUNED CIRCUITS - - - - - - - -
Z341 thru A343		COIL ASSEMBLY Z341 19B204786G4 Z342 19B204786G5 Z343 19B204786G6
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496218P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2	5496218P250	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C3	5496218P245	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
C4	5494481P14	Ceramic disc: 2000 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	5491798P1	Tuning slug. (Used in Z341).
	5491798P4	Tuning slug. (Used in Z342).
	5491798P5	Tuning slug. (Used in Z343).
Z347 thru Z349		COIL ASSEMBLY Z347 19B204767G1 Z348 19B204767G2 Z349 19B204767G3
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496218P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2	5496218P250	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C3	5496218P245	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	5491798P1	Tuning slug. (Used in Z347).
	5491798P4	Tuning slug. (Used in Z348).
	5491798P5	Tuning slug. (Used in Z349).
Z350, Z351* Z352 Z353*		COIL ASSEMBLY Z350 19B204784G8 Z351* 19B204784G9 (Deleted by REV E). Z352 19B204784G10 Z353* 19B204784G11 (Added by REV E).
		- - - - - - - - - - - CAPACITORS - - - - - - - - -
C7 and C8	5496218P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C9	5496218P244	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C12	5496218P241	Ceramic disc: 10 pf ±5%, 500 VDCW, temp coef -80 PPM.
C13	5496218P237	Ceramic disc: 6.0 pf ±5%, 500 VDCW, temp coef -80 PPM.
C14	5496218P236	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C15 and C16	5496218P242	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef -80 PPM.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	5491798P1	Tuning slug. (Used in Z350).
	5491798P4	Tuning slug. (Used in Z351 and Z353).
	5491798P5	Tuning slug. (Used in Z352).
		HARNESS ASSEMBLY 19E500873G14 (Include C385, C387, C388, J442, J443, P301-P304, P307-P313, P315-P317, P319, P320, P322-P327, R345, R346, T341, TB1).
		CHANNEL GUARD MODIFICATION KIT 19A127178G1 (Used with A350)
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	19B216176G1	Harness (Encoder/Decoder). Includes:
P314	4029840P2	Contact, electrical; sim to Amp 42827-2.
P318	4029840P2	Contact, electrical; sim to Amp 42827-2.
P321	4029840P2	Contact, electrical; sim to Amp 42827-2.
P328 thru P335	4029840P2	Contact, electrical; sim to Amp 42827-2.
		CHANNEL GUARD MODIFICATION KIT 19A127178G2 (Used with A402)
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	19B216177G1	Harness (Tone Reject Filter). Includes:
P321	4029840P2	Contact, electrical; sim to Amp 42827-2.
P330	4029840P2	Contact, electrical; sim to Amp 42827-2.
P332	4029840P2	Contact, electrical; sim to Amp 42827-2.
		MECHANICAL PARTS (SEE RC-1692)
1	19B204583G3	Hinge.
2	19B216727P1	Support. (Used with Q341 and Q342).
3	19A116023P2	Plate, insulated. (Used with Q341 and Q342).
4	19A116022P1	Insulator. (Used with Q341 and Q342).
5	4029851P6	Clip, loop.
6	19B204583G1	Hinge.
7	19B204583G2	Hinge.
8	19A121676P1	Guide pin.
9	19C303396G4	Bottom cover. (Station)
10	19C303385G1	Bottom cover. (Mobile)
11	19A121297P1	Angle.
12	7160861P4	Nut, sheet spring; sim to Tinnerman C6452-8Z-67. (Used to secure cover).
13	4036555P1	Insulator, washer: nylon. (Used with Q7 on A348).
14	4035267P2	Button, plug. (Used with A348, A350 and A402).
15	19C303495G3	Top cover. (Station, except Repeaters and VM).
16	19C303676G2	Top cover. (Station, Repeaters and VM only).
17	19C303385P2	Top cover. (Mobile)
18	4029851P3	Clip, loop.
19	19A121383P1	Support.
20	4033089P1	Clip. (Part of XY1-XY4).
21	19B200525P9	Rivet. (Part of XY1-XY4).
22	19A115793P1	Contact. (Part of XY1-XY4).
23	4039307P1	Crystal socket. (Part of XY1-XY4).
24	19C303547P1	Cover.
25	19C317344P3	Heat sink.
26	19C303389G1	Chassis.
27	4034252P5	Can (Used with T1 on A347).
28	19B204672P1	Cover.
29	7162414P1	Retainer, transistor. (Used with Q1 on A341).
30	19B204917P1	Support.



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 - 2nd Mixer A347 (19B216119G1)
Channel Guard Encoder/Decoder Model 4EK16A10
1st Osc/Mult A354-A357

REV. C - 1st Osc/Mult A352 & A353
IF-Audio & Squelch A348 (19D413129G1)

REV. D - Chassis & RF Assembly (19E500873G1 thru G3)
These revisions incorporated into initial shipment.

REV. D - IF Audio & Squelch Board A348 (19D413129G1)
To improve receiver frequency response. Changed R30 and R78.

REV. B - Channel Guard Encoder/Decoder Model 4EK16A10
To increase stop-band attenuation. Changed R8.

REV. C - Channel Guard Encoder/Decoder Model 4EK16A10
REV. A - Tone Reject Filter 19C311797G2
To optimize the frequency response. Changed C29.

REV. D - Channel Guard Encoder/Decoder Model 4EK16A10
REV. B - Tone Reject Filter 19C311797G2
To prevent excessive roll-off at 300 Hertz. Changed R59.

REV. E - Chassis & RF Assembly (19E500873G2)
To improve sensitivity. Changed Z351 to Z353.

IF Audio & Squelch Board A348 (19D413129G1)
REV. E - To compensate for vendor change. Changed C26.

REV. F - To improve squelch action. Changed R53.

REV. G - To incorporate silicon diodes. Changed CR3 and CR4.

REV. E - Chassis & RF Assembly (19E500873G1 & G3
To remove unnecessary protection. Deleted CR1.

REV. F - Chassis & RF Assembly (19E500873G2)
To remove unnecessary protection. Deleted CR1.

REV. G - To improve match. Deleted R14.

REV. F - Chassis & RF Assembly (19E500873G1 & G2)
To improve match. Deleted R14.

REV. H - IF Audio & Squelch Board A348 (19D413129G1)
To insure squelch action at -30°C. Changed Q10.

REV. J - To increase PA bias current. Changed R40.

REV. K - To improve stability to Audio output. Added R85.

REV. L - To improve frequency response. Deleted R85 and changed C40.

REV. G - Chassis & RF Assembly (19E500873G1 & G3
REV. H - Chassis & RF Assembly (19E500873G2)
To incorporate new transistors. Changed Q341 and Q342.

REV. M - IF Audio & squelch Board A348 (19D413129G1)
To improve audio quality. Changed R80.

REV. N - To improve frequency response. Changed C26.

REV. P - To improve stability. Changed Q5.

REV. H - Chassis & RF Assembly (19E501873G1 & G3)
REV. J - Chassis & RF Assembly (19E500873G2)
To incorporate new transistor. Changed Q2 in 1st RF Amp A341 and Q1 in 1st Mixer (A345).

REV. J - Chassis & RF Assembly (19E500873G3)
To improve tuning range of 1st RF stage. Changed C342.

REV. R - IF Audio and Squelch Board A348 (19D413129G1)
To minimize squelch popping. Delete R56. Added R86.
R56 was: 3R77P224J, Composition: 0.22 megohm ±5%, 1/2 W.
R86 is : C3R77P204J, Composition: 20,000 ohms ±5%, 1/2 W.