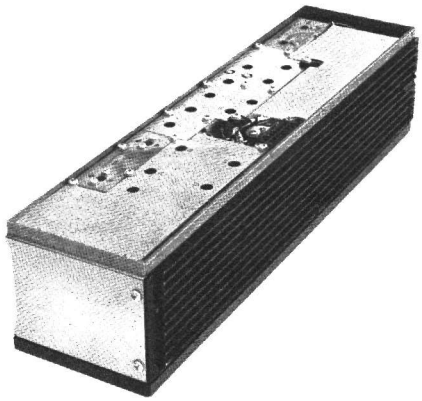
MOBILE RADIO

MASTR® Progress Line

66-88 MHZ RECEIVER MODELS 4ER40C10-21



SPECIFICATIONS *

FCC Filing Designation	**ER-40-C**
Frequency Range	66-88 MHz
Audio Output	5 watts at less than 5% distortion
Sensitivity	
12-dB SINAD (DIA Method)	0.25 µV
20-dB Quieting Method)	0.4 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
Frequency Stability	±.0005%
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)	-60 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)

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

ER-40-C

GENERAL ELECTRIC

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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.

DESCRIPTION

General Electric MASTR Progress Line Receiver Type ER-40-C is a double-conversion, superheterodyne FM receiver designed for operation on the 66-88 megahertz band.

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

CIRCUIT ANALYSIS

The MASTR Progress Line Receiver is completely transistorized, using silicon transistors 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 Models 4EX3A10 or 4EX8K10, 11 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 (A343)

RF Amplifier (A343) consists of two high-Q helical resonators and an RF amplifier stage (Q1). The RF signal from the antenna is coupled by RF cable W441 to a tap on L347/L349. The tap is positioned to insure the proper impedance match to the antenna. RF energy is coupled through the

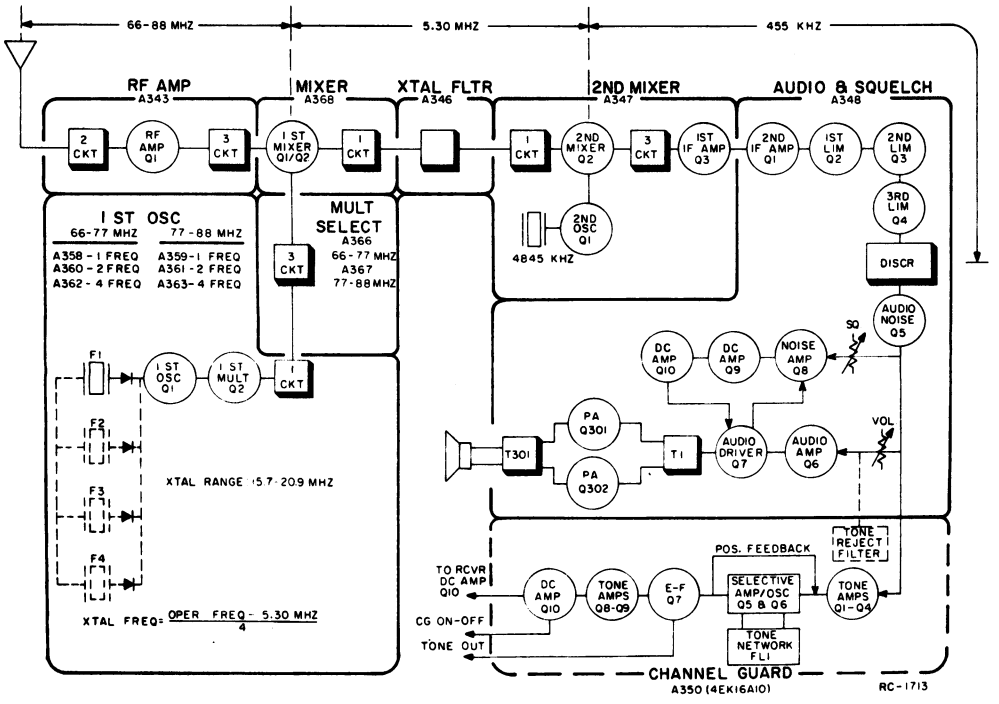


Figure 1 - Receiver Block Diagram

two coils by an opening in the shield wall to the base of RF Amplifier Q1. The coils are tuned to the incoming frequency by air trimmer capacitors C343 and C344. The output of Q1 is coupled through three tuned circuits to the base of the first mixer.

1ST OSCILLATOR AND MULTIPLIER (A358-A363)

The receiver 1st oscillator operates in a transistorized Colpitts oscillator circuit. The oscillator crystal operates in a fundamental mode at a frequency of approximately 15 to 20 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 additional 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 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.

The output of the 1st multiplier (quadrupler Q2) is transformer-coupled (T5/T6) to multiplier selectivity assembly A366/Q367. The 1st multiplier tank is tuned to four times the crystal frequency.

The stage is metered at centralized metering jack J442-4 through metering network CR1, R1, C12 and C13.

MULTIPLIER SELECTIVITY ASSEMBLY (A366/A367)

Following the 1st multiplier tank (T5/T6) are three additional tuned circuits (A366/A367-L1, -L2 and -L3). Capacitor C10/C11 couples the multiplier selectivity output to the base of the first mixer.

1ST MIXER (A368) AND CRYSTAL FILTER (A346)

The RF signal from the RF Amplifier and the injection voltage from the 1st multiplier are applied to the base of 1st mixer A368-Q1. The mixer collector tank (L1 and C3) is tuned to 5.3 megahertz and provides impedance matching to the high IF filter.

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 445-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, tuning off DC amplifier Q9 and tuning on Q10 to mute the receiver.

CHANNEL GUARD

Channel Guard Board Model 4EK16A10 is a fully transistorized encoder-decoder for use in the 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 A348-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 assures 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 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 2), 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.

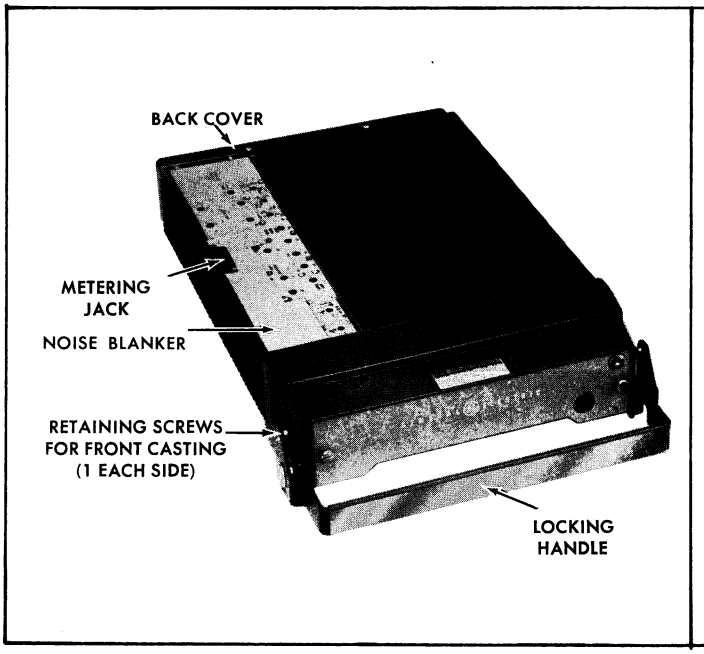


Figure 2 - Removing Top Cover

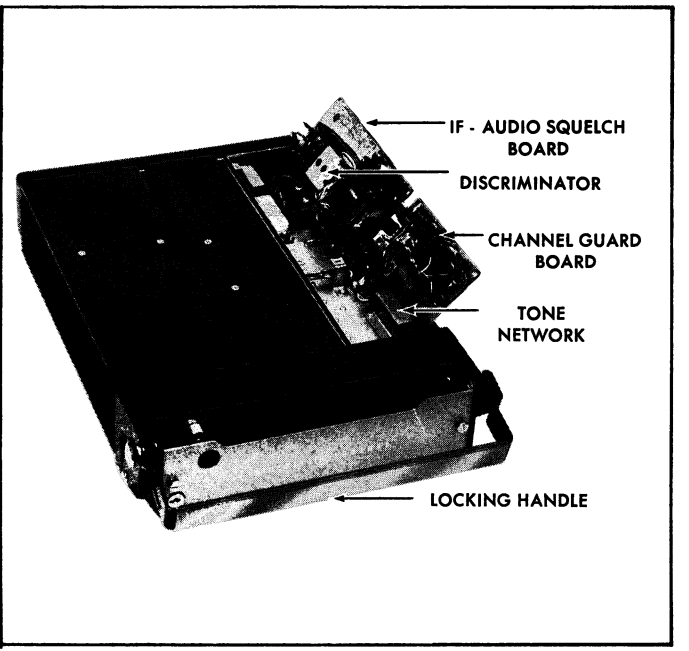


Figure 3 - Removing Bottom Cover

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.

FRONT END ALIGNMENT

EQUIPMENT REQUIRED

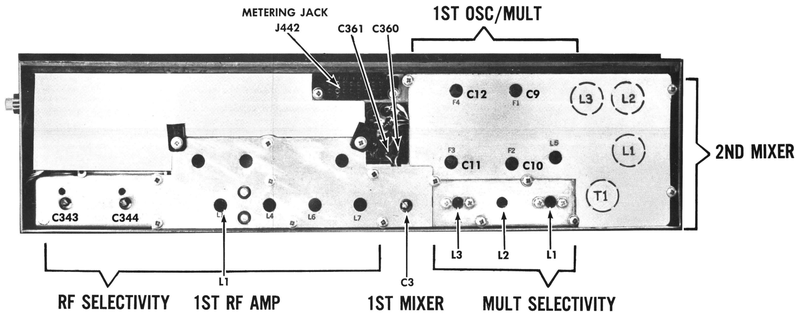
1. GE Test Set Models 4EX3A10, 4EX8K10, 11 (or 20,000 ohms-per-volt Multimeter with a 1-volt scale).
2. A 455 kHz and 66-88 MHz signal source. Connect a one-inch piece of insulated wire no larger than .065-inch diameter to generator output probe.

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. 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 GE Test Set	METERING POSITION Multimeter - at J442	TUNING CONTROL	METER READING	PROCEDURE
			OSCILLATOR/MULTIPLIER		
1.	D (MULT-1)	Pin 4	L6 (on 1st OSC/MULT) and L1, L2 & L3 (on MULT SELECTIVITY)	See Procedure	Tune L6 on 1st OSC/MULT and L1 on MULT SELECTIVITY for maximum meter reading. Then tune L2 for minimum meter reading and L3 for maximum meter reading. Change voltage scale if necessary.
			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), L4, L6, L7, C343 and C344 (RF SELECTIVITY)	Maximum	Apply an on-frequency signal to the antenna jack, keeping below saturation. Tune L1,L4, L6, L7, C343, and C344 for maximum meter reading.
4.	"	"	L6 (1st OSC/MULT) and L1, L2, & L3 (MULT SELECTIVITY)	Maximum	Apply an on-frequency signal to above, keeping below saturation Tune L6 on 1st OSC/MULT and L1, L2, & 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.

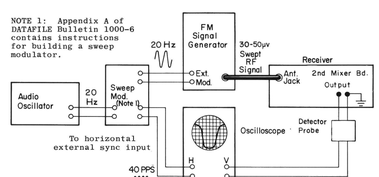


Figure 4 - Test Setup for 20-Hz Double-Trace Sweep Alignment

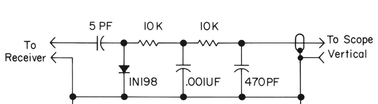


Figure 5 - Detector Probe for Sweep Alignment

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 66-88 MHz signal source. Connect a one-inch piece of insulated wire no larger than .065-inch diameter to generator output probe.

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. 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 150 kHz, align the unit on channel F1. If the frequency spacing is greater than 150 kHz, align the receiver with a center frequency crystal.
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 GE Test Set	METERING POSITION Multimeter - at J442	TUNING CONTROL	METER READING	PROCEDURE
			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 disc closer than readings obtained if within .05 volt limit.
3.	D (MULT-1)	Pin 4	L6 (on 1st OSC/MULT) and L1, L2 & L3 (on MULT SELECTIVITY)	See Procedure	Tune L6 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, L6 and L4 (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 L4 L6 L1 L4
6.	"	"	C343, C344 and L1 (1st RF Amp)	Maximum	Apply an on-frequency signal to the antenna jack. Tune C343, C344 and L1 for maximum meter reading, keeping signal below saturation.
7.	"	"	L1 (1st RF Amp), L4, L6, L7, C343 and C344 (RF SELECTIVITY)	Maximum	Apply an on-frequency signal as above, keeping below saturation. Tune L1, L4, L6, L7, C341 and C342 for maximum meter reading.
8.	"	"	L2 & L3 (MULT SELECTIVITY)	Maximum	Apply on-frequency signal as above, keeping below saturation. Tune L2 and L3 (on MULT SELECTIVITY) for maximum meter reading.
			2ND MIXER		
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. C3 (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 RM 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)		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 C3 (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 27 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 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.

TEST PROCEDURES

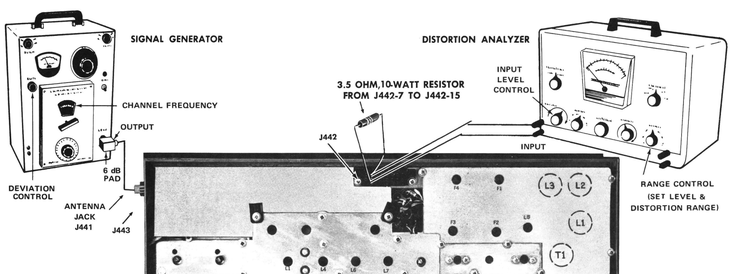
These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect 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.

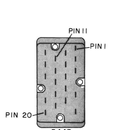
TEST EQUIPMENT REQUIRED

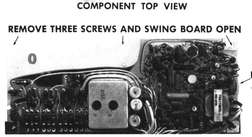
- Distortion Analyzer similar to: Heath IM-12
- Signal Generator similar to: Measurements M-560
- 6-dB attenuation pad, and 3.5-ohm, 10-watt resistor

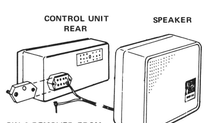
PRELIMINARY ADJUSTMENTS

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.









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 ±3.3 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 3.3-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 rated 12-dB SINAD specification 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 rated 12 dB SINAD, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3
MODULATION ACCEPTANCE BANDWITH (IF BANDWITH)

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 Micro-volt Unmodulated
A (Disc Idling)	Less than ±.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 (15 volts full scale)	

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 as shown in STEP 2. Make SIMPLIFIED VTVM GAIN CHECKS from 2nd Mixer through 1st Limiter stages as shown in STEP 2A.
LOW OSCILLATOR READING	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 Alignment Procedure). Check antenna connections, cable and relay. Check voltage readings of RF Amp and 1st and 2nd Mixers. Make SIMPLIFIED GAIN CHECKS (STEP 2A).
LOW AUDIO	Check Audio PA voltage readings (Q341/Q342). (Refer to Schematic Diagram). Make simplified gain and waveform checks of Audio and Squelch stages (Steps 2A and 2B). Check unsquelched voltage readings in Audio section (Refer to Schematic Diagram). Check voltage readings on Channel Guard decoder.
IMPROPER SQUELCH OPERATION	Check voltage and resistance readings of Squelch circuit (Refer to Schematic Diagram). Make gain and waveform checks (Steps 2A and 2B).
DISCRIMINATOR IDLING TOO FAR OFF ZERO	See if discriminator zero is on 455 kHz. Check alignment of IF coils (Refer to Alignment Procedure).
HIGH DISTORTION AT LOW AUDIO LEVELS	Check PA Bias Adjust R43 (Refer to STEP 1 of Test Procedure).

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 3.0 KHZ DEVIATION.

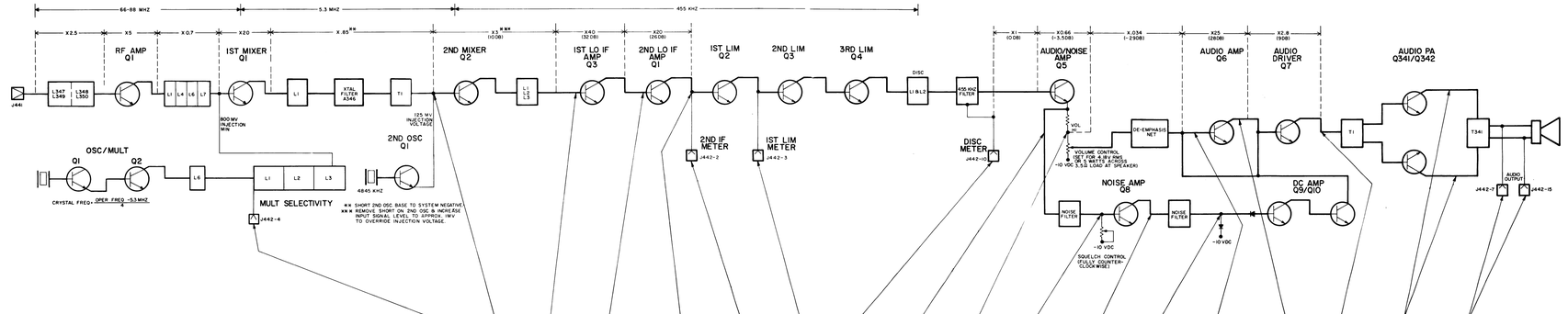
PROCEDURE:

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.

* NOTE: ON 1ST MIXER, REMOVE CRYSTAL BEFORE MEASURING BASE VOLTAGE. REPLACE CRYSTAL TO MEASURE COLLECTOR VOLTAGE.



STEP 2A-SIMPLIFIED VTVM GAIN CHECKS

EQUIPMENT REQUIRED:

1. Oscilloscope.
2. Signal generator (Measurements M560 or 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.

SIGNAL GENERATOR INPUT AT J446, MAINTAIN SETTING AT DISCRIMINATOR TEAD		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 GENERATOR OUTPUT UNTIL VTVM READING ON 2.7 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:

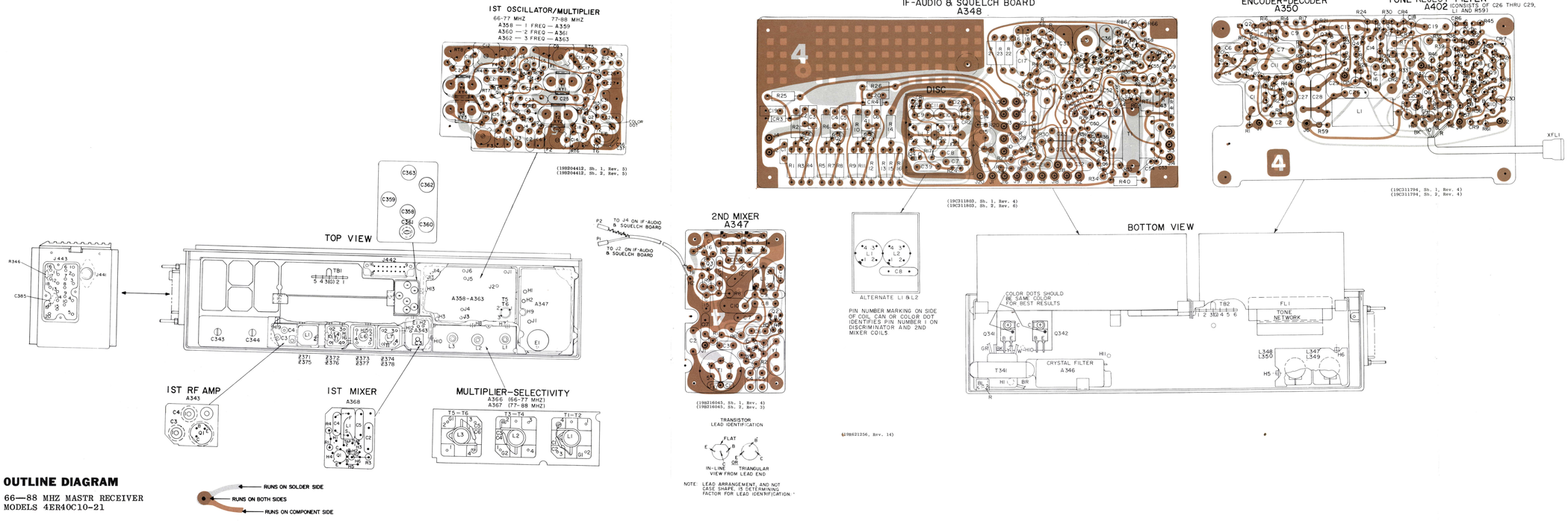
1. Oscilloscope.
2. Signal generator (measurements M560 to equivalent).

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 1 VOLT/DIV 2 V P-P	0.5 MS/DIV 1 VOLT/DIV 1.4 V P-P	0.5 MS/DIV 1 VOLT/DIV 1 V P-P (NOISE)	0.5 MS/DIV 2 VOLTS/DIV 5.7 V P-P NOISE)	0.5 MS/DIV 0.5 VOLTS/DIV 3 V P-P (NOISE)	0.5 MS/DIV 50 MILLIVOLTS/DIV 0.1 V P-P	0.5 MS/DIV 1 VOLT/DIV .9 V P-P	0.5 MS/DIV 2 VOLTS/DIV 4 V P-P	0.5 MS/DIV 10 VOLTS/DIV 30 V P-P	0.5 MS/DIV 5 VOLTS/DIV 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-1718L



OUTLINE DIAGRAM

66—88 MHZ MASTR RECEIVER
MODELS 4ER40C10-21

PARTS LIST

LBI3950F

66-88 MHz RECEIVER
MODELS 4ER60C10 - 4ER60C21

SYMBOL	GE PART NO.	DESCRIPTION
A343		RF AMPLIFIER ASSEMBLY 19B204773G3
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C3 and C4	549339P7	Ceramic, feed-thru: 1000 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C5	5494481P12	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Disc.
C6	748439P4	Silver mica: 500 pf ±10%, 500 VDCW; sim to Underwood Type J-1-MF.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1	403864P1	Germanium.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1	402930P1	Terminal, feed-thru: sim to Sealectro FT-3M-27.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A116859P1	Silicon, NPN; sim to Type 2N5032.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R5	3R152P273K	Composition: 27K ohms ±10%, 1/4 w.
R6	3R152P103K	Composition: 10K ohms ±10%, 1/4 w.
R7	3R152P102K	Composition: 1K ohms ±10%, 1/4 w.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XQ1	549027P5	Transistor, phen: 3 contacts; sim to Alcon 1213LS2.
A346		CRYSTAL FILTER 19B206401G3
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL5	19B206692G1	Bandpass.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R7	3R152P562K	Composition: 5.6K ohms ±10%, 1/4 w.
R8	3R152P103K	Composition: 10K ohms ±10%, 1/4 w.
A347		SECOND MIXER 19B216139G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1		(Part of T1).
C2	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C3	5494481P112	Ceramic disc: 1000 pf ±10%, 500 VDCW; sim to RMC Type JF Disc&p.
C4 and C5	5490008P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C6	549000 8P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C7 and C8	19A116080P5	Polyester: 0.047 pf ±20%, 50 VDCW.
C9	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C10	9A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C11	5496219P40	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C12	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C13	5496219P40	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C14	19A116656P20J2	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 pf ±20%, 50 VDCW.
C17	19A116080P1	Polyester: 0.01 pf ±20%, 50 VDCW.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1	403351P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19C311181G3	Coil. Includes:
	403836P1	Tuning slug.
L2 and L3	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12670.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	402984G2P2	Contact, electrical: sim to AMP 42827-2.
P2	402984G9P1	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115888P1	Silicon, NPN.
Q2	19A115245P1	Silicon, NPN.
Q3	19A115123P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R3	3R77P913J	Composition: 5.1K ohms ±5%, 1/2 w.
R4	3R152P333K	Composition: 33K ohms ±10%, 1/4 w.
R5	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R6	3R77P333K	Composition: 3.3K ohms ±10%, 1/2 w.
R7	3R77P123K	Composition: 12K ohms ±10%, 1/2 w.
R8	3R77P62J	Composition: 6.2K ohms ±5%, 1/2 w.
R9	3R77P03J	Composition: 3K ohms ±5%, 1/2 w.
R10	3R77P02J	Composition: 2K ohms ±5%, 1/2 w.
R11	3R77P201J	Composition: 200 ohms ±5%, 1/2 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1		COIL ASSEMBLY 19B216139G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19C301540P261	Ceramic disc: 82 pf ±5%, 200 VDCW, temp coef -80 PPM.
	549179P3	Tuning slug.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	19A110192P3	Quartz: freq 4845 KHz ±300 Hz at 25°C, temp range -30°C to +75°C.
A348		IF AUDIO AND SQUELCH 19B411139G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Disc&p.
C2	5496219P717	Ceramic disc: 47 pf ±10%, 300 VDCW, temp coef -750 PPM.
C3	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Disc&p.
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 Disc&p.
C7	19A116656P18GJ1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C8	19A116656P18GJ1	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 IM-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 Disc&p.
C13	19A115680P107	Electrolytic: 100 pf +150%-10%, 15 VDCW; sim to Mallory Type TT.
C14 and C15	19A115680P104	Electrolytic: 50 pf +150%-10%, 25 VDCW; sim to Mallory Type TT.
C16	5494481P112	Ceramic disc: 1000 pf ±10%, 500 VDCW; sim to RMC Type JF Disc&p.
C17	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C18	5494481P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Disc&p.
C19 and C20	19A116080P5	Polyester: 0.047 pf ±20%, 50 VDCW.
C21*	19A116080P3	Polyester: 0.022 pf ±20%, 50 VDCW.
	19B209243P1	Earlier than REV A: Polyester: 0.01 pf ±20%, 50 VDCW.
C22	19A116080P108	Polyester: 0.15 pf ±10%, 50 VDCW.
C23	19A116080P107	Polyester: 0.1 pf ±10%, 50 VDCW.
C24*	19B209243P106	Polyester: .068 pf ±10%, 50 VDCW. Deleted by REV A.
C25	5496267P6	Tantalum: 33 pf ±20%, 10 VDCW; sim to Sprague Type 150D.
C26*	19A116080P110	Polyester: 0.33 pf ±10%, 50 VDCW.
	19A116080P109	In REV F-M: Polyester: 0.22 pf ±10%, 50 VDCW.
	5496267P28	In REV A-D: Tantalum: 0.47 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
		Earlier than REV A:
	19B209243P14	Polyester: 0.33 pf ±20%, 250 VDCW.
C27*	5496267P2	Tantalum: 47 pf ±20%, 6 VDCW; sim to Sprague Type 150D.
	5496267P6	In REV B and earlier: Tantalum: 33 pf ±20%, 10 VDCW; sim to Sprague Type 150D.
C28*	5496267P229	Tantalum: 0.68 pf ±10%, 35 VDCW; sim to Sprague Type 150D. Deleted by REV A.
C29*	5496267P17	Tantalum: 1.0 pf ±20%, 35 VDCW; sim to Sprague Type 150D. Deleted by REV A.
C30	19A116080P8	Polyester: 0.15 pf ±20%, 50 VDCW.
C31	19A116080P102	Polyester: 0.015 pf ±20%, 50 VDCW.
C32	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C33	19A116080P9	Polyester: 0.22 pf ±20%, 50 VDCW.
C34	402900 3P207	Silver mica: 1830 pf ±2%, 500 VDCW; sim to Electro Motive Type IM-20.
C35	19A116080P5	Polyester: 0.047 pf ±20%, 50 VDCW.
C36*	19A116080P9	Polyester: 0.22 pf ±20%, 50 VDCW.
		In REV B and earlier:
	19B209243P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C37*	5496267P28	Tantalum: 0.47 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
		Earlier than REV A:
	5496267P17	Tantalum: 1.0 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
C38*	5496267P10	Tantalum: 22 pf ±20%, 15 VDCW; sim to Sprague Type 150D. Deleted by REV C.
	5496267P14	Earlier than REV A: Tantalum: 15 pf ±20%, 20 VDCW; sim to Sprague Type 150D.
C39	19A116080P1	Polyester: 0.01 pf ±20%, 50 VDCW.
C40*	5496267P28	Tantalum: 0.68 pf ±20%, 35 VDCW; sim to Sprague Type 150D. Deleted by REV L.
	19B209243P117	Earlier than REV A: Polyester: 0.22 pf ±10%, 50 VDCW.
C41	5490008P129	Silver mica: 120 pf ±10%, 500 VDCW; sim to Electro Motive Type IM-15.
C42*	19B209243P4	Polyester: 0.033 pf ±20%, 50 VDCW. Deleted by REV A.
C43*	5496267P213	Tantalum: 2.2 pf ±10%, 20 VDCW; sim to Sprague Type 150D. Deleted by REV A.
C49*	5496267P9	Tantalum: 3.3 pf ±20%, 15 VDCW; sim to Sprague Type 150D. Added by REV A. Deleted by REV C.
C50*	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW. Added by REV A.
C51*	19A116655P22	Ceramic disc: 2700 pf ±10%, 1000 VDCW; sim to RMC Type JF Disc&p. Added by REV A.
C52*	19A116080P109	Polyester: 0.22 pf ±10%, 50 VDCW. Added by REV A.
C53* and C54*	5496267P213	Tantalum: 2.2 pf ±10%, 20 VDCW; sim to Sprague Type 150D. Added by REV A.
C55*	5496267P14	Tantalum: 15 pf ±20%, 20 VDCW; sim to Sprague Type 150D. Added by REV A.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 and CR2	19A115250P1	Silicon.
CR3* and CR4*	19A115250P1	Silicon.
		In REV F-M:
	19A115250P1	Silicon.
		In REV F and earlier:
	403805G1	Germanium.
CR5 thru CR8	19A115250P1	Silicon.
CR9*	19A115250P1	Silicon. Deleted by REV C.
CR9*	19A115250P1	Silicon. Added by REV A. Deleted by REV C.
J1 thru J22	403351P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19A115711P6	Transformer, freq: 455 KHz; sim to TOKO PEFCH-14723-CX13.
L2	19A115711P7	Transformer, freq: 455 KHz; sim to TOKO PEFCH-14734-HKL2.
L3	19A123134G1	Choke. Includes tuning slug 746687P7.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q4	19A115123P1	Silicon, NPN.
Q5	19A115888P1	Silicon, NPN.
Q6	19A115123P1	Silicon, NPN.
Q7	19A115300P4	Silicon, NPN.
Q8	19A115123P1	Silicon, NPN.
Q9	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q10*	19A116774P1	Silicon, NPN; sim to Type 2N5210.
		In REV N and earlier:
	19A115123P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P102K	Composition: 1K ohms ±10%, 1/2 w.
R2	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R3	3R77P823K	Composition: 82K ohms ±10%, 1/2 w.
R4	3R77P472K	Composition: 4.7K ohms ±10%, 1/2 w.
R5	3R77P103K	Composition: 1K ohms ±10%, 1/2 w.
R6	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R7	3R77P823K	Composition: 82K ohms ±10%, 1/2 w.
R8	3R77P472K	Composition: 4.7K ohms ±10%, 1/2 w.
R9	3R77P102K	Composition: 1K ohms ±10%, 1/2 w.
R10	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R11	3R77P823K	Composition: 82K ohms ±10%, 1/2 w.
R12	3R77P472K	Composition: 4.7K ohms ±10%, 1/2 w.
R13	3R77P273K	Composition: 27K ohms ±10%, 1/2 w.
R14	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R15	3R77P333J	Composition: 33K 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: 51K ohms ±5%, 1/4 w.
R20	3R152P472K	Composition: 4.7K ohms ±10%, 1/4 w.
R21 and R22	3R77P562J	Composition: 5.6K ohms ±5%, 1/2 w.
R23	3R77P104K	Composition: 100K ohms ±10%, 1/2 w.
R24	3R152P103J	Composition: 1K ohms ±5%, 1/4 w.
R25 and R26	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R27 and R28	3R77P753J	Composition: 75K ohms ±5%, 1/2 w.
R29	3R77P182J	Composition: 1.8K ohms ±5%, 1/2 w.
R30*	3R77P821J	Composition: 820 ohms ±5%, 1/2 w.
		In REV C and earlier:
	3R77P102J	Composition: 1K ohms ±5%, 1/2 w.
R31	3R77P821J	Composition: 820 ohms ±5%, 1/2 w.
R32*	3R77P752J	Composition: 7.5K ohms ±5%, 1/2 w. Deleted by REV A.
R33*	3R77P913J	Composition: 9.1K ohms ±5%, 1/2 w.
	3R77P303J	Earlier than REV A: Composition: 30K ohms ±5%, 1/2 w.
R34	3R77P332K	Composition: 3.3K ohms ±10%, 1/2 w.
R35	3R77P330K	Composition: 33 ohms ±10%, 1/2 w.
R36	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R37*	3R77P822J	Composition: 8.2K ohms ±5%, 1/2 w. Deleted by REV A.
R38*	3R77P752J	Composition: 7.5K ohms ±5%, 1/2 w.
	3R77P622J	Earlier than REV A: Composition: 6.2K ohms ±5%, 1/2 w.
R39*	3R77P820J	Composition: 82 ohms ±5%, 1/2 w.
		Earlier than REV A:
	3R77P131J	Composition: 130 ohms ±5%, 1/2 w.
R40*	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
		In REV N and earlier:
	3R77P241J	Composition: 240 ohms ±5%, 1/2 w.
R41*	3R152P240J	Composition: 24 ohms ±5%, 1/4 w.
		Earlier than REV A:
	3R77P300J	Composition: 30 ohms ±5%, 1/2 w.
R42*	3R77P200J	Composition: 20 ohms ±5%, 1/2 w.
		Earlier than REV A:
	3R77P100J	Composition: 10 ohms ±5%, 1/2 w. Added by REV A.
R43	19B209358P101	Variable, carbon film: approx 25 to 250 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R44	19B209022P101	Wirewound: .27 ohms ±10%, 2 w; sim to IRC Type BWH.
R45	3R77P123J	Composition: 12K ohms ±5%, 1/2 w.
R46	3R77P913J	Composition: 91K ohms ±5%, 1/2 w.
R48*	19A116278P249	Metal film: 3.16K ohms ±2%, 1/2 w.
		In REV A:
	3R77P903J	Composition: 3K ohms ±5%, 1/2 w.
		Earlier than REV A:
	3R77P333J	Composition: 3.3K ohms ±5%, 1/2 w.
R49	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R50	3R77P223J	Composition: 22K ohms ±5%, 1/2 w.
R51	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R52	3R77P683J	Composition: 6.8K ohms ±5%, 1/2 w.
R53*	3R77P223J	Composition: 22K ohms ±5%, 1/2 w.
		In REV E:
	3R77P203J	Composition: 20K ohms ±5%, 1/2 w.
		In REV D and earlier:
	3R77P303J	Composition: 30K ohms ±5%, 1/2 w.
		In REV B:
	3R77P473J	Composition: 47K ohms ±5%, 1/2 w.
		Earlier than REV A:
	3R77P303J	Composition: 30K ohms ±5%, 1/2 w.
R54	3R77P822J	Composition: 8.2K ohms ±5%, 1/2 w.
R55	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R56	3R77P224J	Composition: 220K ohms ±5%, 1/2 w.
R57	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R58	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R59	3R77P393K	Composition: 39K ohms ±10%, 1/2 w.
R60 and R61	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R62*	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
		Earlier than REV A: Deleted by REV C.
	3R77P223K	Composition: 22K ohms ±10%, 1/2 w.
R63*	3R77P433J	Composition: 4.3K ohms ±5%, 1/2 w. Deleted by REV A.
R64*	3R77P120J	Composition: 12 ohms ±5%, 1/2 w.
		In REV B and earlier:
	3R77P180J	Composition: 18 ohms ±5%, 1/2 w.
R65*	3R77P154K	Composition: 150K ohms ±10%, 1/2 w. Deleted by REV A.
R66	3R77P473K	Composition: 47K ohms ±10%, 1/2 w.
R75*	3R77P473J	Composition: 47K ohms ±5%, 1/2 w. Added by REV A. Deleted by REV C.
R76*	3R152P912J	Composition: 9.1K ohms ±5%, 1/4 w. Added by REV A. Deleted by REV C.
R77*	3R152P153J	Composition: 15K ohms ±5%, 1/4 w.
		In REV B and earlier:
	3R152P563J	Composition: 5.6K ohms ±5%, 1/4 w. Added by REV A.
R78*	3R77P200J	Composition: 20 ohms ±5%, 1/2 w.
		In REV C and earlier:
	3R77P100J	Composition: 10 ohms ±5%, 1/2 w. Added by REV A.
R79*	3R152P393J	Composition: 39K ohms ±5%, 1/4 w. Added by REV A.
R80*	3R152P272J	Composition: 2.7K ohms ±5%, 1/4 w.
	3R152P432J	In REV D-L: Composition: 4.3K ohms ±5%, 1/4 w. Added by REV C.
R81*	3R152P472J	Composition: 4.7K ohms ±5%, 1/4 w. Added by REV C.
R82*	3R152P273J	Composition: 27K ohms ±5%, 1/4 w. Added by REV C.
R85*	3R152P102J	Composition: 1K ohms ±5%, 1/4 w. Added by REV E. Deleted by REV L.
R86*	3R77P204J	Composition: 200K ohms ±5%, 1/2 w. Added by REV B.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT1	5490828M41	Thermistor: 30 ohms ±10%, color code black, white; sim to Global Type BI31B-4.
RT2	5490828P9	Thermistor: 10,000 ohms ±10%, color code yellow; sim to Global Type 5S1BB.
RT3*	5490828P9	Thermistor: 10,000 ohms ±10%, color code yellow; sim to Global Type 5S1BB. Added by REV A.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1	19A116040P1	Audio freq: 300 to 4000 Hz, Pri: 19.2 ohms ±15% DC res; Sec: 24 ohms ±10% DC res.
A350		ENCODER/DECODER 4EK16A10 19C311797G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116080P9	Polyester: 0.22 pf ±20%, 50 VDCW.
C2 and C3	19A116080P205	Polyester: 0.047 pf ±5%, 50 VDCW.
C4	19A116080P207	Polyester: 0.1 pf ±5%, 50 VDCW.
C5	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C6	19A116080P205	Polyester: 0.047 pf ±5%, 50 VDCW.
C7	19A116080P207	Polyester: 0.1 pf ±5%, 50 VDCW.
C8	19A116080P205	Polyester: 0.047 pf ±5%, 50 VDCW.
C9	19A116080P9	Polyester: 0.22 pf ±20%, 50 VDCW.
C10	19A116080P207	Polyester: 0.1 pf ±5%, 50 VDCW.
C11	19A116080P109	Polyester: 0.22 pf ±10%, 50 VDCW.
C12	19A116080P207	Polyester: 0.1 pf ±5%, 50 VDCW.
C13	19A116080P9	Polyester: 0.22 pf ±20%, 50 VDCW.
C14	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C15	5496267P1	Tantalum: 6.8 pf ±20%, 6 VDCW; sim to Sprague Type 150D.
C16	19A116080P5	Polyester: 0.047 pf ±20%, 50 VDCW.
C17	5496267P417	Tantalum: 1.0 pf ±5%, 35 VDCW; sim to Sprague Type 150D.
C18	5496267P1	Tantalum: 6.8 pf ±20%, 6 VDCW; sim to Sprague Type 150D.
C19	19A116080P109	Polyester: 0.22 pf ±10%, 50 VDCW.
C20	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Disc&p.
C21	5496267P9	Tantalum: 3.3 pf ±20%, 15 VDCW; sim to Sprague Type 150D.
C22	5496267P17	Tantalum: 1.0 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
C23	5496267P13	Tantalum: 2.2 pf ±20%, 20 VDCW; sim to Sprague Type 150D.
C24	5496267P1	Tantalum: 6.8 pf ±20%, 6 VDCW; sim to Sprague Type 150D.
C25	5496267P18	Tantalum: 6.8 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
C26	19A116080P206	Polyester: 0.068 pf ±5%, 50 VDCW.
C27 and C28	19A116080P210	Polyester: 0.33 pf ±5%, 50 VDCW.
C29	19A116080P205	Polyester: 0.047 pf ±5%, 50 VDCW.
C30	5496267P17	Tantalum: 1.0 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 and CR2	19A115250P1	Silicon.
CR3 and CR4	5494922P1	Silicon.
CR5 and CR6	5494481P112	Silicon, Zener.
CR7 thru CR9	19A115250P1	Silicon.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL1		TONE FREQUENCY NETWORK 19B205280
	G1	71.9 Hz
	G2	77.0 Hz
	G3	82.5 Hz
	G4	88.5 Hz
	G5	94.8 Hz
	G6	100.0 Hz
	G7	103.5 Hz
	G8	107.2 Hz
	G9	110.9 Hz
	G10	114.8 Hz
	G11	118.8 Hz
	G12	123.0 Hz
	G13	127.3 Hz
	G14	131.8 Hz
	G15	136.5 Hz
	G16	141.3 Hz
	G17	146.2 Hz
	G18	151.4 Hz
	G19	156.7 Hz
	G20	162.2 Hz
	G21	167.9 Hz
	G22	173.8 Hz
	G23	179.9 Hz
	G24	186.2 Hz
	G25	192.8 Hz
	G26	203.5 Hz
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J8	403351P4	Contact, electrical sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19A115690P1	Coil, RF: 880 kH ±5%, sim to Arttel AC5672.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115123P1	Silicon, NPN.
Q2	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q3 and Q4	19A115123P1	Silicon, NPN.
Q5 thru Q8	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q9 and Q10	19A115123P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P682K	Composition: 6.8K ohms ±10%, 1/2 w.
R2	3R77P683J	Composition: 68K ohms ±5%, 1/2 w.
R3	3R77P823J	Composition: 8.2K ohms ±5%, 1/2 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

MODEL NO.	FREQ. RANGE	NO. FREQ	CHAN GUARD
4ER40C10	66-77 MHZ	1	
4ER40C11	77-82 MHZ	1	
4ER40C12	66-77 MHZ	2	
4ER40C13	77-82 MHZ	2	
4ER40C14	66-77 MHZ	4	
4ER40C15	77-82 MHZ	4	
4ER40K16	66-77 MHZ	1	X
4ER40C17	77-82MHZ	1	X
4ER40C18	66-77 MHZ	2	X
4ER40C19	77-82 MHZ	2	X
4ER40C20	66-77 MHZ	4	X
4ER40C21	77-82 MHZ	4	X

REV. LTR BLOCK		
		REV.
	PL19E500873G7	E
	PL19L500873G8	F
A347	PL19B216119G1	A
A348	PL19D416319G1	N
A350	4ER16A10	D
A402	PL19C317797G2	B

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

ALL RESISTORS ARE 1/4 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.

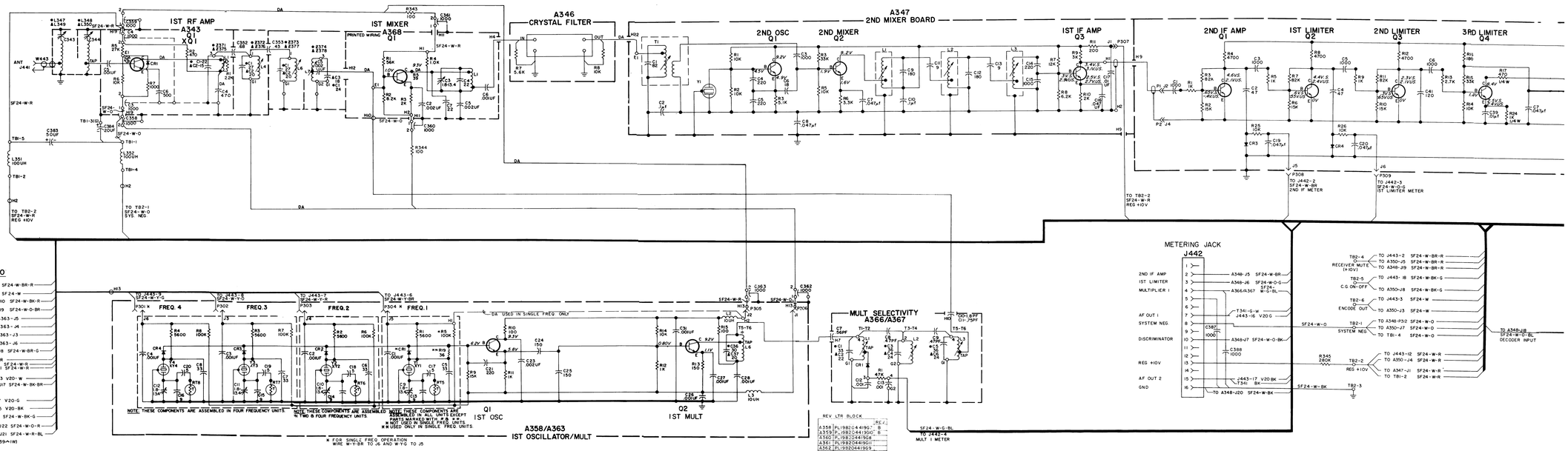
VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED WITH A HEATHKIT IM-102-B WITH TEST SET MODEL IM-143A OR A 20,000 OHMS-PER-VOLT METER.

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

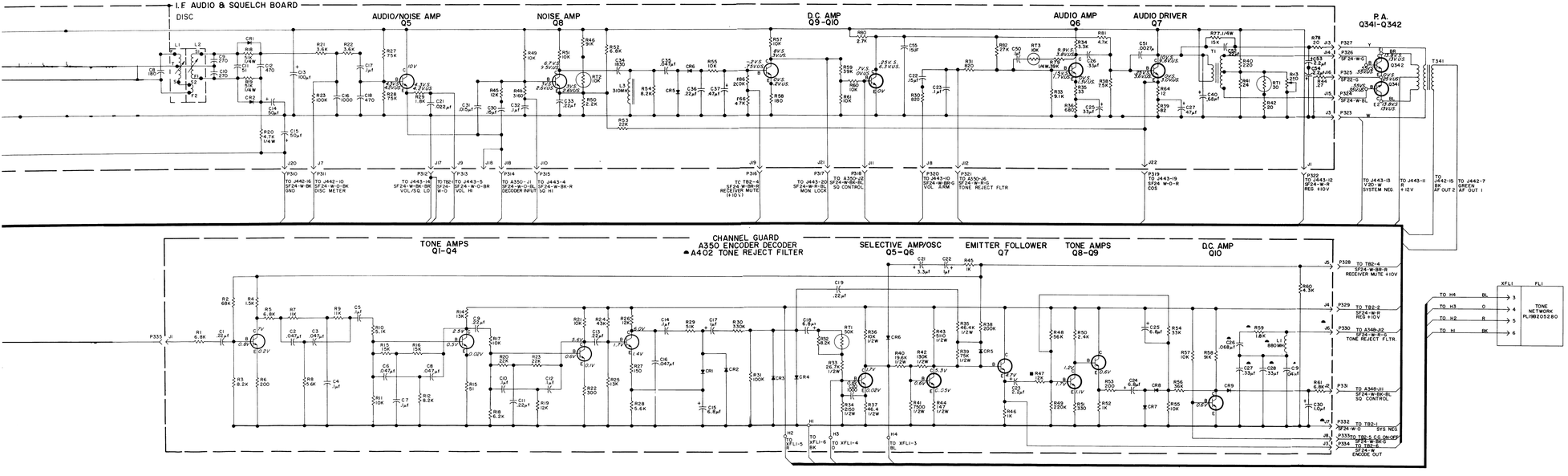
US+ SQUELCH CONTROL FULLY CLOCKWISE WITH A ONE MILLIVOLT MODULATED SIGNAL (UNSQUELCHED) AND 5 WATT AUDIO OUTPUT.

● LOW SPLIT 66-77 MHZ
▲ HIGH SPLIT 77-88MHZ
■ VALUE OF R47 IS DETERMINED BY TEST (SEE TEST SPEC 19A07821.
★ THESE ARE ONLY PARTS PRESENT ON A402.



SCHEMATIC DIAGRAM

66—88 MHZ MASTR RECEIVER
MODELS 4ER40C10-21



SCHEMATIC DIAGRAM

66—88 MHz MASTR RECEIVER
MODELS 4ER40C10-21

SYMBOL	GE PART NO.	DESCRIPTION
R4	3R77F152J	Composition: 1.5K ohms ±5%, 1/2 w.
R5	3R77P682K	Composition: 6.8K ohms ±10%, 1/2 w.
R6	3R77P200J	Composition: 200 ohms ±5%, 1/2 w.
R7	19A116278P305	Metal film: 11K ohms ±2%, 1/2 w.
R8*	3R77F562J	Composition: 5.6K ohms ±5%, 1/2 w.
		In REV A:
	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
		Earlier than REV A:
	3R152P512J	Composition: 5.1K ohms ±5%, 1/4 w.
R9	19A116278P305	Metal film: 11K ohms ±2%, 1/2 w.
R10	3R77P513J	Composition: 51K ohms ±5%, 1/2 w.
R11	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R12	3R77P82J	Composition: 82K ohms ±5%, 1/2 w.
R13	3R77F153J	Composition: 15K ohms ±5%, 1/2 w.
R14	3R77P133J	Composition: 13K ohms ±5%, 1/2 w.
R15	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
R16	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R17	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R18	3R77P62J	Composition: 62K ohms ±5%, 1/2 w.
R19	3R77P123J	Composition: 12K ohms ±5%, 1/2 w.
R20	3R77P223J	Composition: 22K ohms ±5%, 1/2 w.
R21	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R22	3R77P301J	Composition: 300 ohms ±5%, 1/2 w.
R23	3R77P223J	Composition: 22K ohms ±5%, 1/2 w.
R24	3R77P43J	Composition: 43K ohms ±5%, 1/2 w.
R25	3R77P133J	Composition: 13K ohms ±5%, 1/2 w.
R26	3R77P123J	Composition: 12K ohms ±5%, 1/2 w.
R27	3R77P151J	Composition: 150 ohms ±5%, 1/2 w.
R28	3R77P56J	Composition: 5.6K ohms ±5%, 1/2 w.
R29	3R77P13J	Composition: 51K ohms ±5%, 1/2 w.
R30	3R77P334J	Composition: 330K ohms ±5%, 1/2 w.
R31	3R77P104J	Composition: 100K ohms ±5%, 1/2 w.
R32	3R77P82J	Composition: 8.2K ohms ±5%, 1/2 w.
R33	19A116278P242	Metal film: 26.70K ohms ±2%, 1/2 w.
R34	19A116278P233	Metal film: 2.15K ohms ±2%, 1/2 w.
R35	19A116278P965	Metal film: 46.40K ohms ±2%, 1/2 w.
R36	19A116278P301	Metal film: 10K ohms ±2%, 1/2 w.
R37	19A116278P95	Metal film: 46.4 ohms ±2%, 1/2 w.
R38	3R77P204J	Composition: 200K ohms ±5%, 1/2 w.
R39	19A116278P385	Metal film: 75K ohms ±2%, 1/2 w.
R40	19A116278P39	Metal film: 19.60K ohms ±2%, 1/2 w.
R41	19A116278P385	Metal film: 7.5K ohms ±2%, 1/2 w.
R42	19A116278P413	Metal film: 130K ohms ±2%, 1/2 w.
R43	19A116278P309	Metal film: 5.11K ohms ±2%, 1/2 w.
R44	19A116278P117	Metal film: 147 ohms ±2%, 1/2 w.
R45 and R46	3R77P103J	Composition: 1K ohms ±5%, 1/4 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	3R77P82J	Composition: 8.2K ohms ±5%, 1/2 w.
R47B	3R77P91J	Composition: 9.1L ohms ±5%, 1/2 w.
R47C	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R47D	3R77P113J	Composition: 11K ohms ±5%, 1/2 w.
R47E	3R77P123J	Composition: 12K ohms ±5%, 1/2 w.
R47F	3R77P133J	Composition: 13K ohms ±5%, 1/2 w.
R47G	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R47H	3R77P73J	Composition: 7.5K ohms ±5%, 1/2 w.
R48	3R77P563J	Composition: 56K ohms ±5%, 1/2 w.
R49	3R77P224J	Composition: 220K ohms ±5%, 1/2 w.
R50	3R77P242J	Composition: 2.4K ohms ±5%, 1/2 w.
R51	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R52	3R77P102J	Composition: 1K ohms ±5%, 1/2 w.
R53	3R77P301J	Composition: 300 ohms ±5%, 1/2 w.
R54	3R77P332J	Composition: 33K ohms ±5%, 1/2 w.
R55	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R56	3R77P363J	Composition: 36K ohms ±5%, 1/2 w.
R57	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R58	3R77P913J	Composition: 91K ohms ±5%, 1/2 w.
R59	3R77P182J	Composition: 1.8K ohms ±5%, 1/2 w.
R60	3R77P432J	Composition: 4.3K ohms ±5%, 1/2 w.
R61	3R77P682K	Composition: 6.8K ohms ±10%, 1/2 w.
RT1	5490828P22	Thermistor: 50K ohms ±10%, color code yellow; sim to Carborundum Type 703H-54.
XPL1	19A121920G3	Socket
		Reed, mica-filled phen: 7 pins rated at 1 amp at 500 VRMS with 4-1/2 inches of cable.
A358 thru A363		FIRST OSCILLATOR ASSEMBLY A358 19B204419G7 (4E840C10, 16) A359 19B204419G10 (4E840C11, 17) A360 19B204419G8 (4E840C12, 18) A361 19B204419G11 (4E840C13, 19) A362 19B204419G9 (4E840C14, 20) A363 19B204419G12 (4E840C15, 21)
C1 thru C4	5494481P112	Ceramic disc: 1000 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.
C5 thru C6	5496219P751	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C8	5491797P106	Variable, subminiature: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C9 thru C12	5496219P40	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C13 thru C16		
C17 thru C20	19C306485P63	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.
C23	5494481P114	Ceramic disc: 2000 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.
C24	5490068P51	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C25	5496219P467	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -220 PPM.
C26 thru C28	5494481P112	Ceramic disc: 1000 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.
C31	5494481P112	Ceramic disc: 1000 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.
CR1 thru CR4	19A115603P1	Silicon.

SYMBOL	GE PART NO.	DESCRIPTION
J1 thru J6	4033513P4	JACKS AND RECEPTACLES Contact, electrical; sim to Bead Chain L93-3.
L2 and L3	7488079P16	INDUCTORS Choke, RF: 10 µh ±10%, 0.6 ohm DC res; sim to Jeffers 4421-7K.
Q1 and Q2	19A115330P1	TRANSISTORS Silicon, NPN.
R1 thru R4	3R152P563J	RESISTORS Composition: 0.6K ohms ±5%, 1/4 w.
R5 thru R8	3R152P104K	Composition: 100K ohms ±10%, 1/4 w.
R9	3R152P153J	Composition: 15K ohms ±5%, 1/4 w.
R10	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R11 thru R12	3R152P103J	Composition: 1K ohms ±5%, 1/4 w.
R13	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
R14	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R15	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R19	3R152P360J	Composition: 36 ohms ±5%, 1/4 w.
RT5 thru RT8	192D9284P7	THERMISTORS Disc: 62 ohms res nominal at 25°C, color code violet.
T5 and T6		TRANSFORMERS COIL ASSEMBLY T5 19B204548G1 T6 19B204548G2
C36	5496218P250	CAPACITORS Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C37	5496218P246	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef -80 PPM.
L6	19A121481P1	INDUCTORS Coil. Includes:
	5491798P5	Tuning slug.
XY1 thru XY4		SOCKETS Refer to Mechanical Parts (RC1692).
		CRYSTALS NOTE: When reordering, give GE Part number and specify exact frequency needed.
		66-88 MHz crystal freq = (QF ÷ 3.90 MHz)
Y1 thru Y4	19B206576P6	Quartz: freq range 15175.000 to 17925.000 KHz, temp range -30°C to +85°C. (66-77 MHz)
Y1 thru Y4	19B206576P7	Quartz: freq range 17925.001 to 20685.000 KHz, temp range -30°C to +85°C. (77-88 MHz)
A366 and A367		MULTIPLIER SELECTIVITY ASSEMBLY A366 19B204827G1 (4E840C10,12,14,16,18,20) A367 19B204827G2 (4E840C11,13,15,17,19,21)
C8 and C9	5491601P13	CAPACITORS Phenolic: 0.47 pf ±10%, 500 VDCW; sim to Quality Components Type MC.

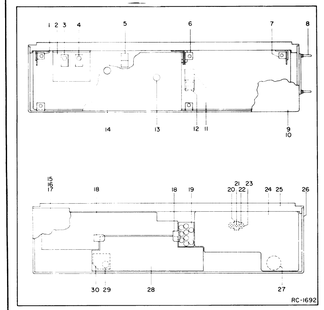
SYMBOL	GE PART NO.	DESCRIPTION
R1	3R152P473K	RESISTORS Composition: 47,000 ohms ±10%, 1/4 w.
T1 and T2		TRANSFORMERS COIL ASSEMBLY T1 19B204822G1 T2 19B204822G2
C1	5496218P251	CAPACITORS Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2	5496218P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C7	5491601P15	Tubular: 0.56 pf ±10%, 500 VDCW; sim to Quality Components Type MC.
C12	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
CR1	7777164P3	DIODES AND RECTIFIERS Germanium; sim to Type 1N90.
T3 and T4	5491798P5	Tuning slug.
J6 and J7	4033513P4	JACKS AND RECEPTACLES Contact, electrical: sim to Bead Chain L93-3.
L1	19A115690P1	INDUCTORS Coil, RF: 880 ah ±5%, sim to Arrtel AC5672.
R59	3R77P183J	RESISTORS Composition: 1.8K ohms ±5%, 1/2 w. In REV A and earlier:
	3R152P432J	Composition: 4.3K ohms ±5%, 1/4 w.
T5 and T6	5491798P5	TRANSFORMERS COIL ASSEMBLY T5 19B204548G1 T6 19B204548G2
C352	5491601P117	CAPACITORS Phenolic: 0.68 pf ±5%, 500 VDCW; sim to Quality Components Type MC.
C353	5491601P113	Phenolic: 0.43 pf ±5%, 500 VDCW; sim to Quality Components Type MC.
C358 thru C363	5493392P7	Ceramic, feed-thru: 1000 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C383	19A115680P4	Electrolytic: 50 µf +150%-10%, 25 VDCW; sim to Mallory Type TT.
C384	19A115680P5	Electrolytic: 20 µf +150%-10%, 25 VDCW; sim to Mallory Type TT.
C385	777475094	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.
CR1*	19A116062P2	DIODES AND RECTIFIERS Selenium. Added by REV A. Deleted by REV D.
J441	19B205889G2	JACKS AND RECEPTACLES (Part of 9443).
J442	19C303429G1	Connector: 18 contacts.
J443	19C303429G1	Connector: 20 pin contacts.
L347 thru L350		INDUCTORS COIL ASSEMBLY L347 and L348 19B204821G1 L349 and L350 19B204821G2
C343 and C344	19B209159P1	CAPACITORS Variable, subminiature: approx 1.40-3.25 pf, 750 v peak; sim to EF Johnson 189.
L1	19A121082G1	Toroidal coil.

SYMBOL	GE PART NO.	DESCRIPTION
Q1	19A115342P1	TRANSISTORS Silicon, NPN.
R1	3R152P563J	RESISTORS Composition: 56K ohms ±5%, 1/4 w.
R2	3R152P822J	Composition: 8.2K ohms ±5%, 1/4 w.
R3	3R152P203J	Composition: 2K ohms ±5%, 1/4 w.
R4	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
A402		TONE REJECT FILTER 19C311793G2
C26	19A116080P206	CAPACITORS 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.
J6 and J7	4033513P4	JACKS AND RECEPTACLES Contact, electrical: sim to Bead Chain L93-3.
L1	19A115690P1	INDUCTORS Coil, RF: 880 ah ±5%, sim to Arrtel AC5672.
R59	3R77P183J	RESISTORS Composition: 1.8K ohms ±5%, 1/2 w. In REV A and earlier:
	3R152P432J	Composition: 4.3K ohms ±5%, 1/4 w.
T5 and T6	5491798P5	TRANSFORMERS COIL ASSEMBLY T5 19B204548G1 T6 19B204548G2
C352	5491601P117	CAPACITORS Phenolic: 0.68 pf ±5%, 500 VDCW; sim to Quality Components Type MC.
C353	5491601P113	Phenolic: 0.43 pf ±5%, 500 VDCW; sim to Quality Components Type MC.
C358 thru C363	5493392P7	Ceramic, feed-thru: 1000 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C383	19A115680P4	Electrolytic: 50 µf +150%-10%, 25 VDCW; sim to Mallory Type TT.
C384	19A115680P5	Electrolytic: 20 µf +150%-10%, 25 VDCW; sim to Mallory Type TT.
C385	777475094	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.
CR1*	19A116062P2	DIODES AND RECTIFIERS Selenium. Added by REV A. Deleted by REV D.
J441	19B205889G2	JACKS AND RECEPTACLES (Part of 9443).
J442	19C303429G1	Connector: 18 contacts.
J443	19C303429G1	Connector: 20 pin contacts.
L347 thru L350		INDUCTORS COIL ASSEMBLY L347 and L348 19B204821G1 L349 and L350 19B204821G2
C343 and C344	19B209159P1	CAPACITORS Variable, subminiature: approx 1.40-3.25 pf, 750 v peak; sim to EF Johnson 189.

SYMBOL	GE PART NO.	DESCRIPTION
L351 and L352	7488079P72	Choke, RF: 100 µh ±10%, 2.6 ohms DC res; sim to Jeffers 4424-9K.
P301 thru P311	4029846P2	PLUGS Contact, electrical; sim to Amp 42827-2.
P312	4029846P3	Contact, electrical: sim to Amp P-53007.
P313 thru P320	4029846P22	Contact, electrical: sim to Amp 42827-2.
P321	4029846P21	Contact, electrical: sim to AMP 41854.
P322	4029846P2	Contact, electrical: sim to Amp 42827-2.
P323	4029846P1	Contact, electrical; sim to Amp 41854.
P324 thru P329	4029846P2	Contact, electrical; sim to Amp 42827-2.
P327	4029846P1	Contact, electrical; sim to Amp 41854.
Q341* and Q342*	19A116741P5	TRANSISTORS Silicon, NPN.
	19A116303P2	In REV B-D: Silicon, NPN.
	19A115948P1	In REV A and earlier: Silicon, NPN.
R343 thru R344	3R152P101K	RESISTORS Composition: 100 ohms ±10%, 1/4 w.
R345	19A116278P444	Metal film: 200K ohms ±2%, 1/2 w.
R346*	3R78P390E	Composition: 39 ohms ±10%, 1 w. Added by REV B.
T341	19A116041P2	TRANSFORMERS Audio: 300 to 4000 Hz, PV1: 1,000 ohm ±15% DC res, Sec 1: 28 ohm ±10% DC res, Sec 2: 10.5 ohms ±15% DC res.
TB1	7487424P7	TERMINAL BOARDS Miniature, phen: 4 terminals.
TB2	7487424P26	Miniature, phen: 6 terminals.
W443	19B205634G3	CABLES Coaxial: approx 5 inches long. Includes (J441).
2371		TUNED CIRCUITS COIL ASSEMBLY 19B204843G1
C1	5496218P247	CAPACITORS Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C3	5491601P17	Phenolic: 0.68 pf ±10%, 500 VDCW; sim to Quality Components Type MC.
C4	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
R1	3R152P222K	RESISTORS Composition: 2.2K ohms ±10%, 1/4 w.
R2	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
	5491798P5	Tuning slug.
2372 and 2373		COIL ASSEMBLY 19B204833G1
C1	5496218P249	CAPACITORS Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
	5491798P5	Tuning slug.

SYMBOL	GE PART NO.	DESCRIPTION
2374		COIL ASSEMBLY 19B204833G3
C1	5496218P248	CAPACITORS Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C3	5494481P14	Ceramic disc: 2000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
	5491798P5	Tuning slug.
2375		COIL ASSEMBLY 19B204843G2
C2	5496218P244	CAPACITORS Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C3	5491601P17	Phenolic: 0.68 pf ±10%, 500 VDCW; sim to Quality Components Type MC.
C4	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
R1	3R152P222K	RESISTORS Composition: 2.2K ohms ±10%, 1/4 w.
R2	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
	5491798P5	Tuning slug.
2376 and 2377		COIL ASSEMBLY 19B204833G3
C2	5496218P246	CAPACITORS Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef -80 PPM.
	5491798P5	Tuning slug.
2378		COIL ASSEMBLY 19B204833G2
C3	5496218P245	CAPACITORS Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
C5	5494481P14	Ceramic disc: 2000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
	5491798P5	Tuning slug.
1	19B204583G3	MECHANICAL PARTS (SEE RC1692)
2	19B216727P1	Hinge.
3	19A116023P2	Support. (Used with Q341 and Q342).
4	19A115222P3	Plate, insulated. (Used with Q341 and Q342).
5	4029851P6	Insulator, bushing. (Used with Q341 and Q342).
6	19B204583G1	Clip, loop: sim to Weckesser 5/16-4-128.
7	19B204583G2	Hinge.
8	19A116769P1	Hinge.
9	19C303489G4	Guide pin.
10	19C303489G1	Bottom cover. (Station)
11	19A115297P1	Bottom cover. (Mobile)
12	7160861P4	Angle.
13	4036555P1	Nut, sheet spring: sim to Tinnerman C6452-8Z-67. (Used to secure cover).
14	4035267P2	Insulator disc. (Used with Q7 on A348).
15	19C303459G3	Button, plug. (Used with A348, A350 and A4023).
16	19C303670G2	Top cover. (Station, except Repeaters and WB).
17	19C303835G2	Top cover. (Station, Repeaters and WW only).
		Top cover. (Mobile)

SYMBOL	GE PART NO.	DESCRIPTION
18	4029851P3	Clip, loop: sim to Weckesser 1/8-4-128.
19	19A121383P1	Support.
20	4033049P1	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	19C311734P3	Heat sink.
26	19C303389G1	Chassis.
27	4034252P5	Can. (Used with T1 on A347).
28	19B204672P1	Cover.
29	7162418P1	Retainer, transistor. (Used with Q1 on A343).
30	19B204732P1	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 number of the assembly. The revision stamped on the assembly includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - 2nd Mixer A347 (19B216119-G1)

Incorporated in initial shipments.

REV. A - Channel Guard Encoder/Decoder A350 (Model 4EK16A10)

To obtain correct output level. Changed R8.

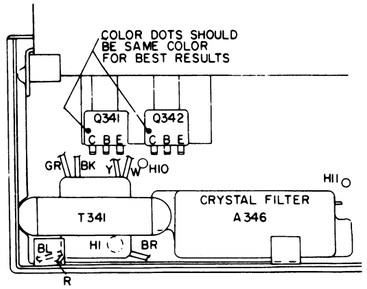
REV. A - Chassis and RF Assembly (19E500873-G7 & G8)

To protect the receiver against positive voltage transients. Added thyrector CR1 between J443-11 and -13.

REV. B - Chassis and RF Assembly (19E500873-G7 & G8)

To incorporate new PA transistors. Changed Q341 & Q342 and added R346.

Outline Diagram Was:

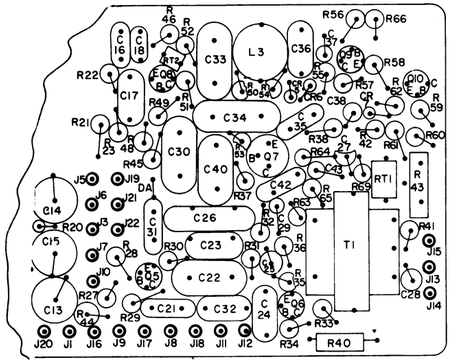


REV. A - IF Audio & Squelch Board A348 (19D413129-G1)

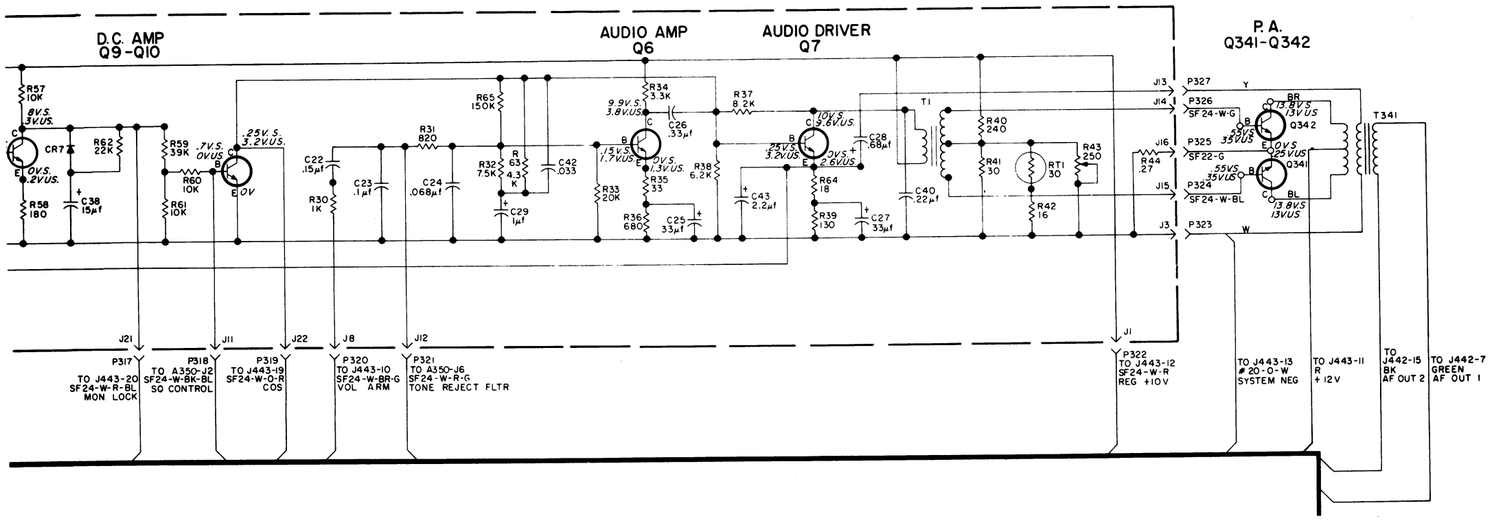
To make IF Audio & Squelch Board compatible with new PA transistors and to improve squelch operation. Added C49-C54, CR8, R75-R79, and RT3. Deleted C24, C28, C29, C42, C43, R32, R37, R63 and R65. Changed C21, C26, C37, C38, C40, R33, R38, R39, R41, R42, R48, R53 and R62.

Outline Diagram Was:

IF-AUDIO & SQUELCH BOARD
A348



Schematic Diagram Was:



PRODUCTION CHANGES

66—88 MHz MASTR RECEIVER
MODELS 4ER40C10-21

REV. B - Channel Guard Encoder/Decoder A350 (Model 4EK16A10)
To increase stop-band attenuation. Changed R8.

REV. C - Channel Guard Encoder/Decoder A350 (Model 4EK16A10)
REV. A - Tone Reject Filter A402 (19C311797-G2)
To optimize frequency response. Changed C29.

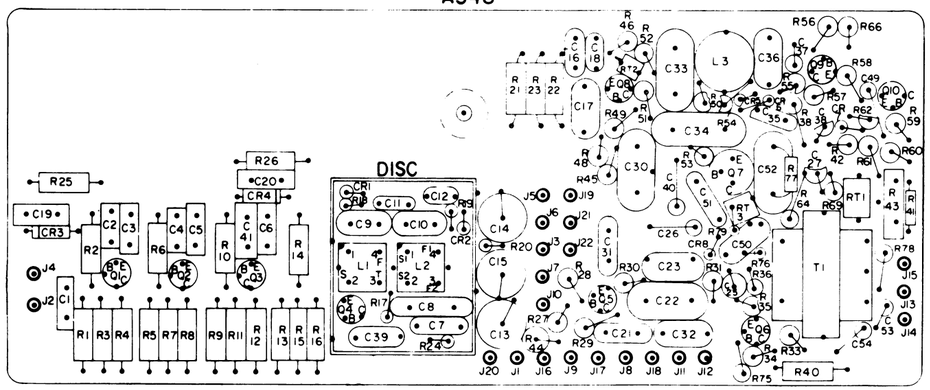
REV. C - Chassis and RF assembly (19E500873-G7 & G8)
To eliminate squelch opening thump in receivers with Channel Guard. Removed White-Orange wire between J443-13 and TB2-1. Added a White-Orange wire between P312 (or J17 on IF Audio and Squelch board) and TB2-1.

REV. B - IF Audio & Squelch Board A348 (19D413129-G1)
To control more closely the squelch control rotation. Changed R48.

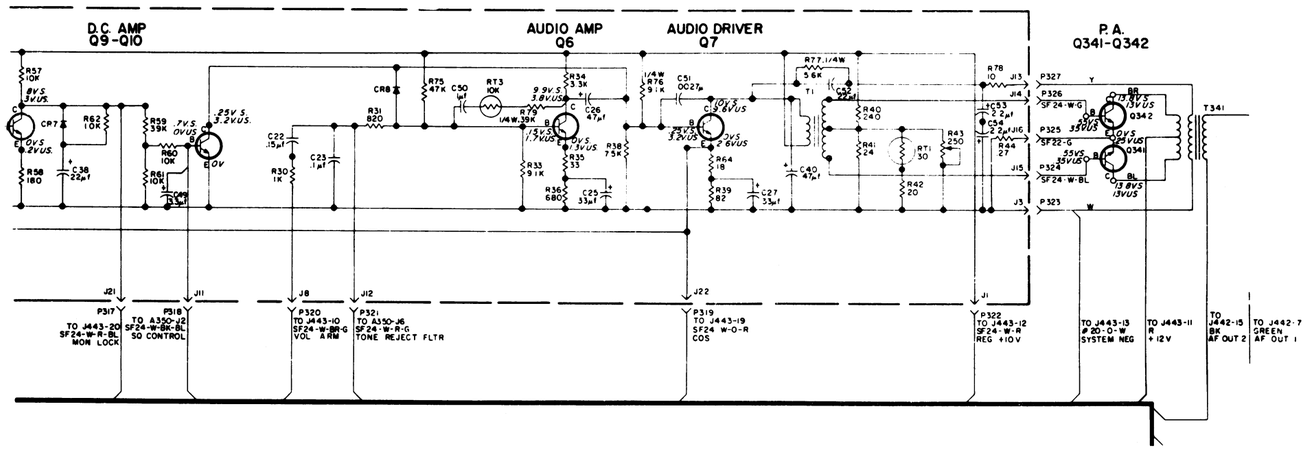
REV. C - IF Audio & Squelch Board A348 (19D413129-G1)
To eliminate barely audible squelch switching transients and to reduce receiver squelch tail. Deleted C38, C49, CR7, CR8, R62, R75, and R76. Added C55, R80, R81, and R82. Changed C27, C36, R53, R64, and R77.

OUTLINE DIAGRAM WAS:

IF-AUDIO & SQUELCH BOARD
A348



SCHEMATIC DIAGRAM WAS:



REV. D - IF Audio & Squelch Board A348 (19D413129-G1)
To improve receiver frequency response. Changed R30 and R78.

REV. D - Channel Guard Encoder/Decoder A350 (Model 4EK16A10)

REV. B - Tone Reject Filter A402 (19C311797-G2)
To prevent excessive roll-off at 300 Hertz. Changed R59.

REV. E - IF Audio & Squelch Board A348 (19D413129-G1)
To improve design. Changed C26

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

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

REV. H - To improve Squelch at -30°C with PSLM. Changed Q10.

REV. J - To provide sufficient PA bias current. Changed R40.

REV. K - To improve stability of audio output. Added R85.

REV. D - Chassis and RF Assembly (19E500873-G7 & -G8)
To eliminate unnecessary component: Deleted CR1.

REV. E - To improve procurement. Changed Q341 and Q342.

REV. F - To improve 12 dB SINAD sensitivity. Changed Q1.

IF Audio & Squelch Board A348 (19D413129-G1)

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

REV. M - To improve audio quality. Changed R80.

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

REV. P - To improve stability. Changed Q5.

REV. R -To improve squelch operation. Deleted R56 and added R86.