MOBILE RADIO

MASTR Progress Line

406-470 MC DUAL FRONT END MODELS 19D402799-G1 THRU G8 (WITH SEARCH-LOCK MONITOR)

Maintenance Manual LBI-3795A
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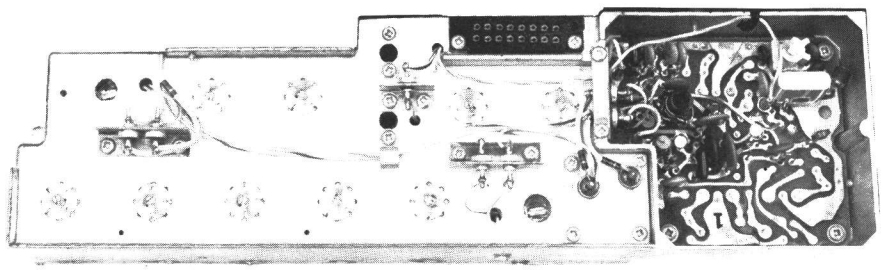
DF-849



SPECIFICATIONS *

DUAL FRONT END

FREQUENCY RANGE	406-470 MC	
SENSITIVITY		
Standard DFE	With One Antenna	With Two Antennas
12-db SINAD	0.55 microvolt	0.5 microvolt
20-db Quieting	0.8 microvolt	0.7 microvolt
With UHS		
12-db SINAD	0.4 microvolt	0.35 microvolt
20-db Quieting	0.55 microvolt	0.45 microvolt
INTERMODULATION (EIA)	-60 db	
INPUT POWER	.010 Amps at 10 volts	
FREQUENCY STABILITY	.0005% (-30°C to +60°C)	
TRANSISTORS	4 (5 in UHS model)	
DIMENSIONS (HxWxD)	2-1/4" x 11-3/4" x 4-3/8"	

SEARCH-LOCK MONITOR

SEARCH RATE (Receiver squelched)	Samples each channel approximately 10 times per second.
INPUT POWER	.005 Amps at 10 volts
TRANSISTORS	3
TEMPERATURE RANGE	-30°C to +60°C (-22°F to +140°F)
DIMENSIONS (HxWxD)	2" x 2-3/4" x 3/4"

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

406-470 MC DUAL FRONT END

GENERAL ELECTRIC

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ILLUSTRATIONS

DESCRIPTION

DUAL FRONT END

General Electric Dual Front End Model 19D402799-G1 through -G8 was designed for operation in the 406-470 megacycle band. The Dual Front End (DFE) is used with MASTR Progress Line Receivers to monitor two frequencies when the channel spacing is greater than 0.4% (±0.2%). The DFE is available in two versions: a standard model and an ultra-high sensitivity (UHS) model.

The DFE is of single-unit construction, completely housed in an aluminum casting for maximum shielding and rigidity. The unit consists of an RF amplifier, mixer, oscillator and two multiplier stages. The output feeds directly into the receiver 1st mixer stage as shown in Figure 1. The chassis is mounted in a housing on the rear of the mobile frame, adding approximately three inches to the overall length of the mobile unit.

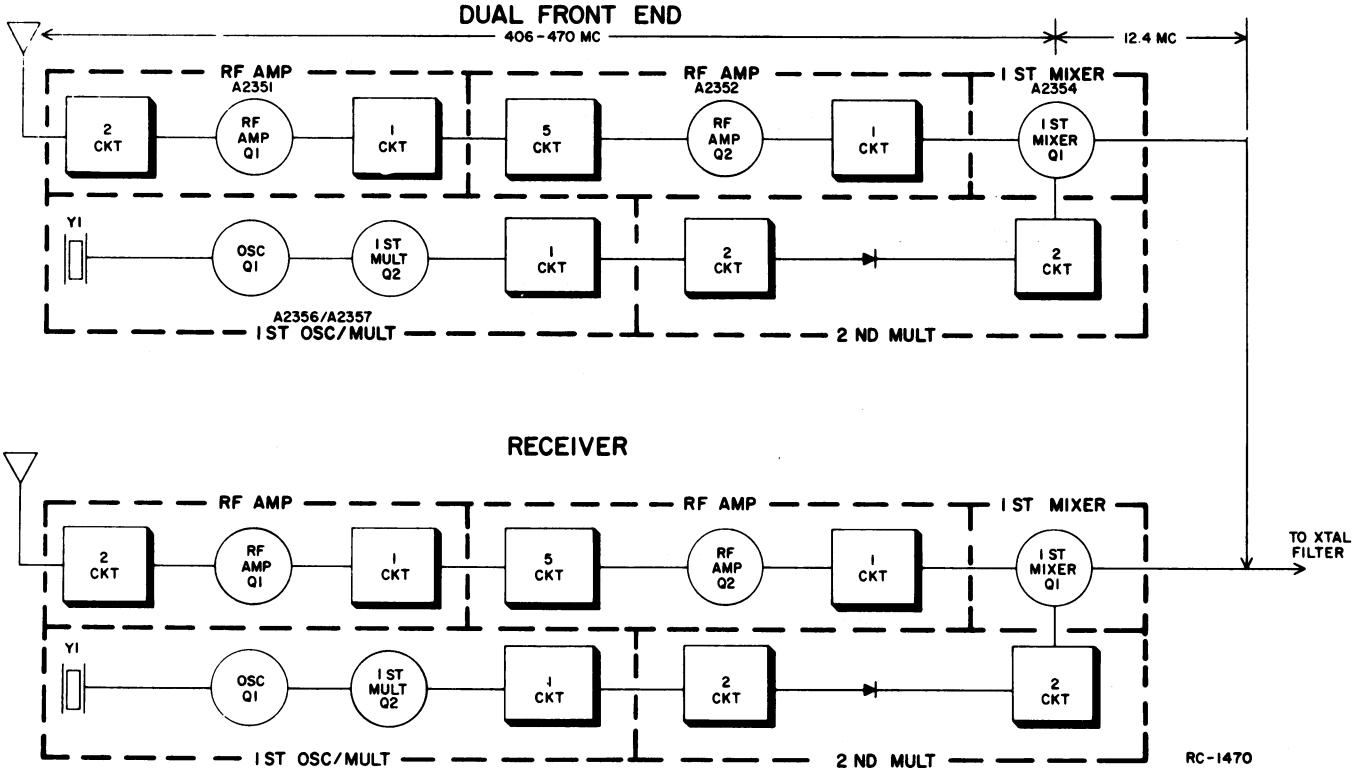


Figure 1 - Dual Front End Block Diagram

SEARCH-LOCK MONITOR

Mobile combinations with Dual Front End are also equipped with Search-Lock Monitor (SLM) to provide two-frequency monitoring. A three-position Search-Lock Monitor Switch (S705) is mounted on the mobile control unit. The switch has F1, F1-F2 and F2 positions. When the

switch is in the F1-F2 position, no voltage is fed from S705 to either receiver crystal-switching diode or the Dual Front End switching diode, and the Search-Lock Monitor operates. The Search-Lock Monitor then provides two-channel monitoring by alternately switching +10 volts between the receiver crystal-switching diode and Dual Front End switching diode at a rate of approximately 20 times per second. When a signal is received on either channel, the SLM "locks" on that frequency for the duration of the signal (see Figure 2).

Turning the switch to the F1 or F2 position applies +10 volts to the selected crystal-switching diode and overrides the SLM. Switching to the F1 or F2 position also connects the crystal-switching diode of the transmitter oscillator to ground, so that the receiver or Dual Front End will operate on the frequency determined by the selected transmitter and receiver/Dual Front End oscillator. With the switch in the F1-F2 position, the transmitter will operate on the F1 frequency only.

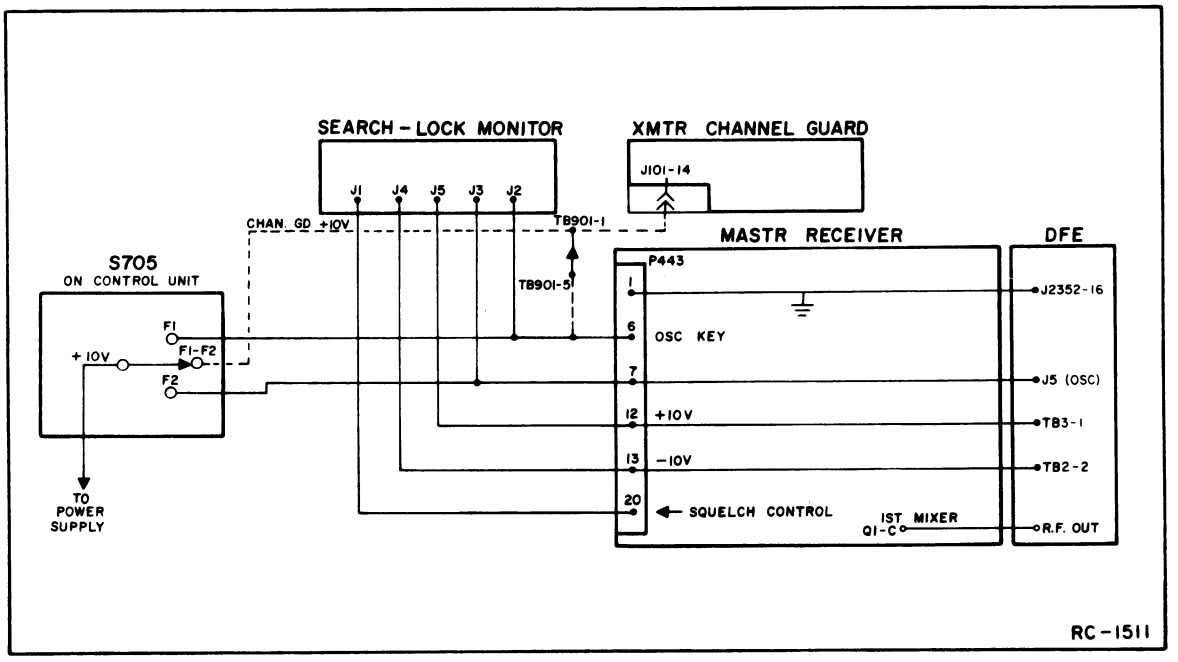


Figure 2 - Search-Lock Monitor Switching Diagram

In combinations equipped with Channel Guard, the receiver Channel Guard operates only in the F1 position. The transmitter Channel Guard operates in the F1 and F1-F2 positions.

The Search-Lock Monitor board is mounted on the rear of the mobile system frame between the Dual Front End and the receiver.

ANTENNA SYSTEMS

The Dual Front End and the receiver may use a common antenna or separate antennas. If the two frequencies are in either the 406-420 or 450-470 megacycle range, one antenna will work satisfactorily. However, two antennas must be used to obtain maximum receiver sensitivity. The frequency range and antenna system used with each model DFE is shown in the following chart.

DUAL FRONT END		FREQUENCY RANGE	ANTENNA SYSTEM
STANDARD	WITH UHS		
19D402799-G1	19D402799-G3	406-420 MC	Two Antennas
19D402799-G2	19D402799-G4	450-470 MC	Two Antennas
19D402799-G5	19D402799-G7	406-420 MC	One Antenna
19D402799-G6	19D402799-G8	450-470 MC	One Antenna

Single Antenna System (Figure 3)

In the single antenna system, the antenna connects to jack J901 on the front of the mobile unit. From J901, the antenna connects to the common terminal of antenna relay K901. The transmitter connects to the normally open contact terminal of the antenna relay. The normally closed contact terminal of K904 is connected to the common terminal of the antenna "T" connector. One cable from the "T" connector goes to J1 on the Dual Front End and the other cable goes to J441 on the receiver.

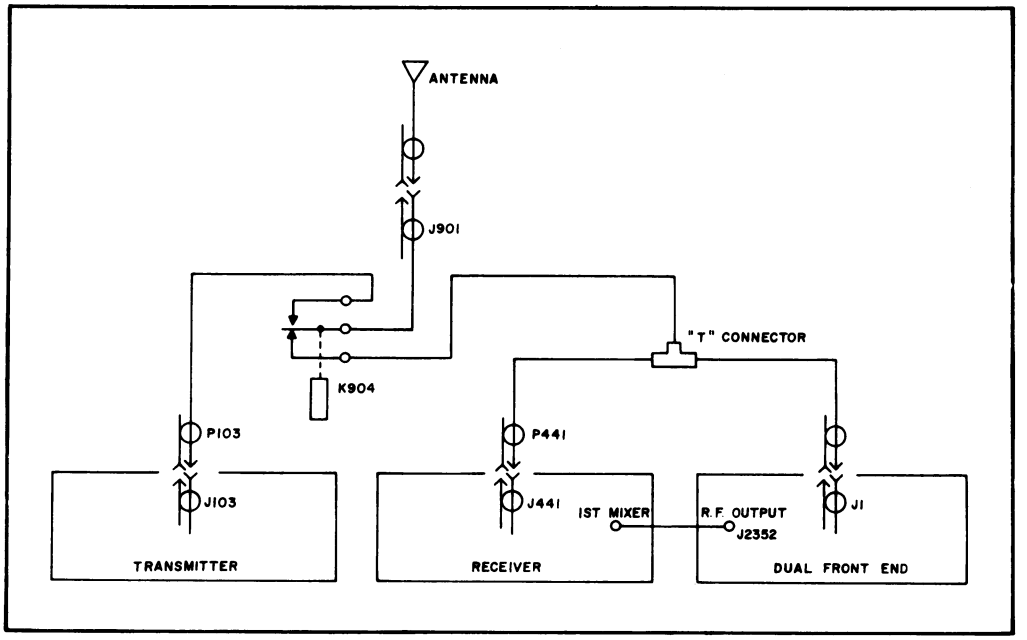
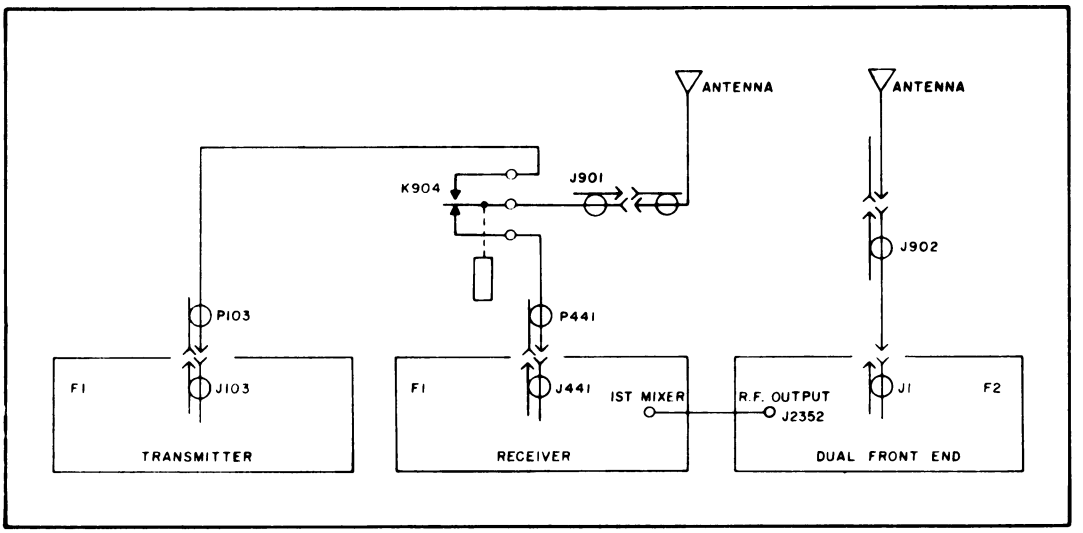


Figure 3 - Single Antenna Block Diagram

Dual Antenna System (Figure 4)

When two antennas are used, one antenna is connected through antenna jack J902 on the front of the mobile unit to jack J1 on the DFE. The second antenna is connected through J901 to the common terminal of antenna relay K904. The normally closed relay contact is connected to receiver antenna jack J441, and the normally open contact is connected to the transmitter.



RC-1510

Figure 4 - Dual Antenna Block Diagram

CIRCUIT ANALYSIS

DUAL FRONT END (19D402799-G1 through -G8)

The MASTR Progress Line Dual Front End is completely transistorized, using four silicon transistors (five in UHS models). A regulated 10 volts is used for all stages of the Dual Front End.

Centralized metering jack J2352 is provided for use with the General Electric Test Set Model 4EX3A10 for ease of alignment and servicing. The Test Set meters the oscillator, multipliers, and the regulated 10 volts.

RF Amplifier (A2351)

RF Amplifier A2351 is used only in the ultra-high sensitivity (UHS) Dual Front End, and consists of two tuned helical resonators and a transistorized amplifier stage.

The RF signal from the antenna is coupled through RF cable W2352 (for dual antennas) or W2354 (for single antennas) to a tap on L2351/ L2354. The tap is positioned to provide the proper impedance match to the antenna. RF energy is coupled to the second coil through an opening in the shield wall, and then to the base of RF Amplifier Q1. Diode CR1 protects Q1 from damage by high signal levels. The output of Q1 is developed across tuned circuit C3 and L1, and is coupled through five helical resonators to RF Amplifier A2352-Q2.

RF Amplifier (A2352)

RF Amplifier A2352 is used in both the standard and ultra-high sensitivity dual front end, and consists of five helical resonators and a transistorized RF amplifier stage. In standard models, the RF signal from the antenna is fed by RF cable W2351 (for dual antennas) or W2355 (for single antennas) to a tap on L2355/L2360. RF energy is then coupled through the five coils by openings in the shield walls to the base of RF Amplifier Q2. The output of Q2 is loop-coupled to the base of 1st Mixer A2354-Q1.

1st Oscillator and Multiplier (A2356-A2357)

The receiver 1st oscillator operates in a transistorized Colpitts oscillator circuit. The oscillator crystal operates in a fundamental mode at a frequency of approximately 16 to 19 megacycles. 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 having to wait for crystal ovens to warm up.

Regulated 10 volts is supplied to the crystal circuit to forward bias diode CR1. Forward biasing the diode reduces its impedance, so that the crystal frequency is applied to the base of oscillator transistor Q1. Feedback for the oscillator is developed across C47. The oscillator output is fed through C45 to the base of the 1st multiplier Q2.

The output of the 1st Multiplier (quadrupler Q2) is coupled through three tuned circuits (T7/T8, T2351/T2353 and T2352/T2354) to the 2nd Multiplier assembly. The 1st multiplier stage is metered at centralized metering jack J2352-4 through metering network CR6, R17 and R18.

2nd Multiplier Assembly

The 1st multiplier output is applied to the anode of multiplier diode CR2351. Following the multiplier diode are two helical resonator circuits that are tuned six times the 1st multiplier frequency for a total multiplication of 24 times the crystal frequency. The 2nd multiplier output is fed to the emitter of 1st Mixer A2354-Q1.

1st Mixer (A2354)

The RF signal from the RF amplifier is applied to the base of 1st mixer A2353-Q1 and the injection voltage from the 2nd multiplier is applied to the emitter of the 1st mixer. The 12.4 MC hi-IF mixer output is connected to the collector of the receiver 1st mixer stage through J2357.

The four leads from receiver plug P443 supplies the regulated 10 volts for the Dual Front End circuit, crystal switching, system negative, and ground connections.

SEARCH-LOCK MONITOR (19A121599-G1)

The SLM circuit consists of a pulse generator (Q1) and a bi-stable multivibrator circuit (Q2 and Q3). The pulse generator operates at a nominal frequency of 20 pulses per second.

When the receiver is squelched, 9 volts from the collector of the receiver DC amp (Q8) is fed through J1 and R2 on the SLM board to the base of pulse generator Q1. This voltage causes Q1 to operate, sending a series of pulses to the base of switching transistors Q2 and Q3. These pulses activate the switching circuit which alternately applies +10 volts to each receiver oscillator-switching diode at a rate of approximately 10 times per second.

When a signal is received, the receiver squelch opens; and the voltage at the base of Q1 drops almost to zero. This disables the pulse generator and switching circuit, and the +10 volt input from J5 is applied through R11 and Q2 or Q3 to the receiver oscillator. For example, if the first call is received on F1, the +10 volt is applied to the F1 receiver oscillator through R11 and Q2, locking the receiver on F1. Subsequent signals at F2 will not be heard while the F1 signal is being received.

When the signal at F1 stops, the receiver squelches and 9 volts is fed to the base of pulse generator Q1. Then Q2 and Q3 begin to switch back and forth until another signal is received.

Back bias is prevented from reaching the collectors of Q2 and Q3 by CR1 and CR2. CR4 biases Q3 off while Q2 is conducting, thereby preventing Q3 from conducting while Q2 is operating. The pulse generator circuit consists of R1, R2, R3, R13, R14, R15, RT1, C1 and Q1.

MAINTENANCE

DISASSEMBLY

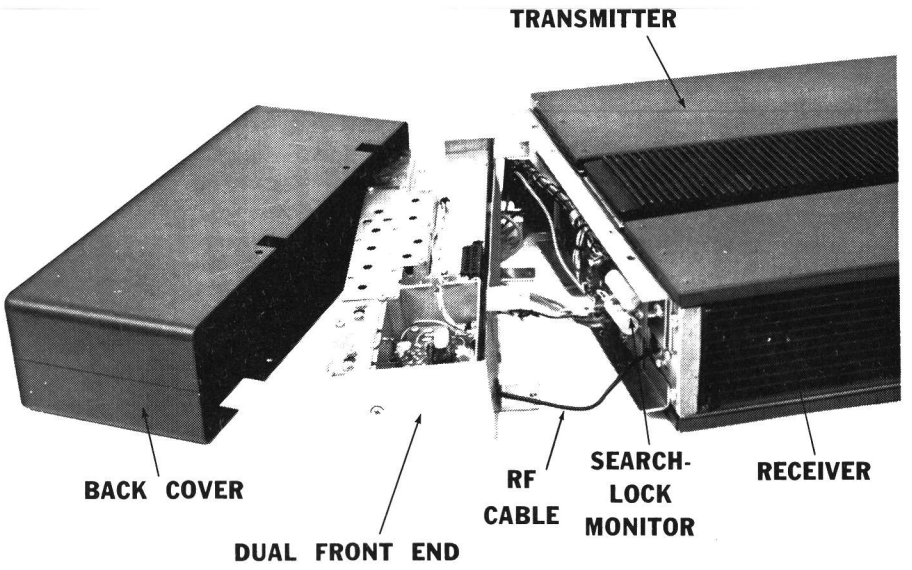


Figure 5 - Dual Front End Disassembly

Removing Dual Front End and/or Search-Lock Monitor:

Dual Front End

1. Pull locking handle down and pull radio out of mounting frame.

2. Remove the four screws holding back cover to system frame. Slide cover back and lift off (see Figure 5).

3. Remove four screws from angle brackets holding Dual Front End to the system frame.

4. Carefully swing Dual Front End chassis out for servicing.

Search-Lock Monitor

1. Same as Steps 1 through 4 above.

2. Remove three screws holding circuit board to system frame at rear of receiver).

TEST PROCEDURES

Dual Front End

SYMPTOM	CHECK THE FOLLOWING:
No Signal	1. Connections to P443. 2. Cable from J2357 to receiver mixer board. 3. Antenna terminal connections. 4. Search-Lock Monitor switching circuit. 5. Check 10-volt supply with G-E test meter at pin 13 on DFE centralized metering jack J2352.
Low Sensitivity	1. DFE alignment. 2. Cable and relay connections. 3. RF Amplifier voltages (A2351-Q1 or A2352-Q2). 4. 1st Oscillator voltages (A2356/A2357-Q1).
Low Oscillator Reading	1. Oscillator alignment 2. Voltage readings at 1st Oscillator Q1. 3. Crystal Y1.

Search-Lock Monitor

1. Turn the SLM switch to the F1-F2 (Search-Lock) position and make sure that the receiver is squelched.

2. Connect positive probe of oscilloscope to junction of R1 and CR1 (for F1) or R22 and CR2 (for F2) on the receiver oscillator board. Connect negative probe to J442-8 (negative). If SLM is operating, the signal should vary from zero to a positive voltage approximately 10 times per second.

3. Next, unsquelch the receiver. The Search-Lock circuit will lock on one of the channels. The oscilloscope reading should be less than one volt on OFF channel (not conducting) and 6.6 volts on ON channel (conducting).

4. Switch to the F1 position. Reading at junction of R1 and CR1 should be approximately 6.6 volts. Then switch to the F2 position. Reading at junction of R2 and CR2 should be approximately 6.6 volts.

DUAL FRONT END ALIGNMENT

Refer to Receiver MAINTENANCE MANUAL for Receiver Mixer and IF Alignment Procedure.

EQUIPMENT REQUIRED

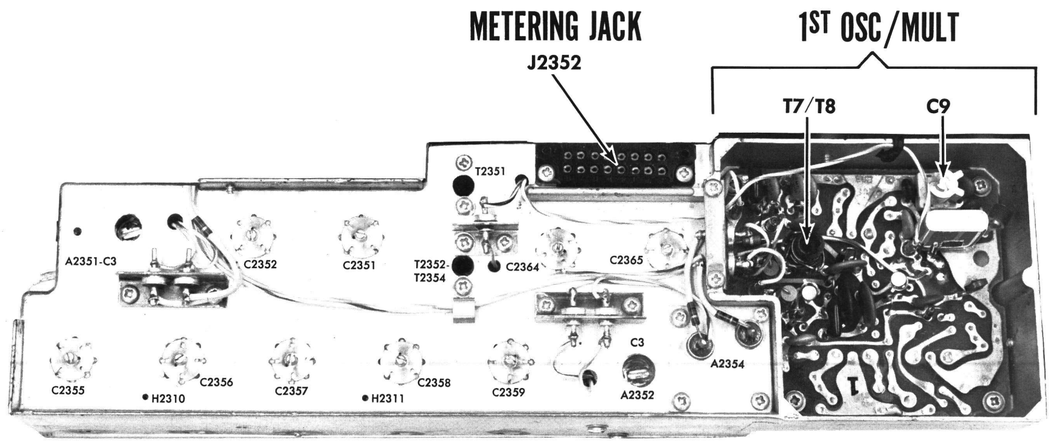
1. G-E Test Set Model 4EX3A10 (or a 20,000 ohm-per-volt multimeter).
2. Signal Generator (406-470 MC range). Connect a one-inch piece of insulated wire no larger than .065-inch diameter to generator output probe.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. With Test Set in position J, check for regulated +10 volts. If using multimeter, measure at metering jack J2352-13 and -16.
2. If using Multimeter for alignment, connect positive lead to J2352-16 (ground).
3. Set frequency selector switch on control unit to F2 position.

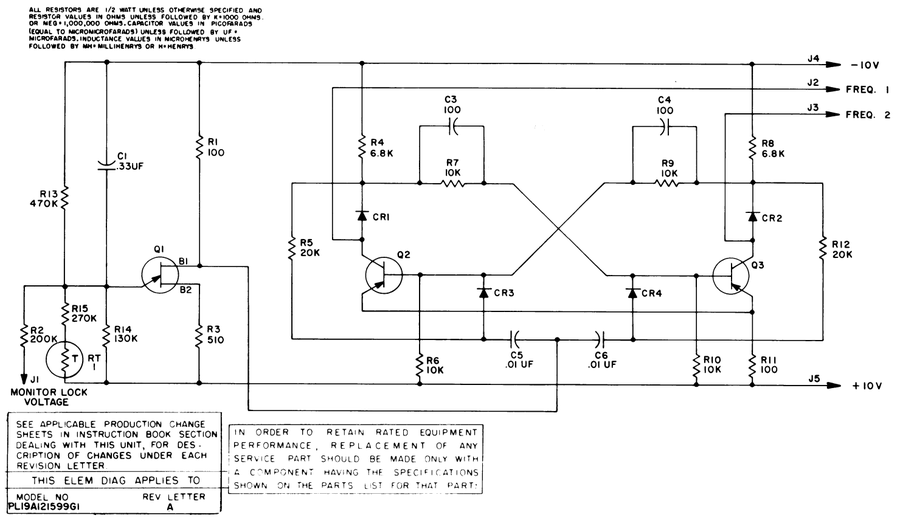
NOTE

If Receiver and Dual Front End operating frequencies are less than 2 MC apart, connect the signal generator directly into the Dual Front End antenna connector J1, not into the "T" connector.



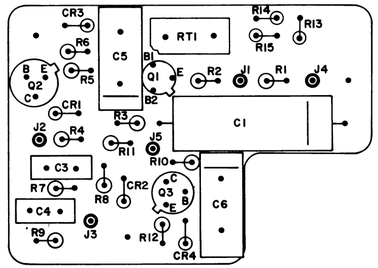
STEP	METERING POSITION G-E Test Set	METERING POSITION Multimeter Minus at J2352	TUNING CONTROL	METER READING	PROCEDURE
			OSCILLATOR AND MULTIPLIERS		
1			C9 (on 1st OSC/MULT)	See Procedure	Set C9 to approximately mid-frequency range.
2	D (MULT-1)	Pin 4	T7/T8 (on 1st OSC/MULT)	Maximum	Tune T7/T8 for maximum meter reading.
3	D (MULT-1)	Pin 4	T2351/T2353	Minimum	Tune T2351/T2353 for minimum meter reading.
4	E (MULT-2)	Pin 5	T7/T8 (on 1st OSC/MULT), T2351/T2353 and T2352/T2354	Maximum	Tune T7/T8, T2351/T2353 and T2352/T2354 for maximum meter reading. If two peaks occur, use the peak that occurs with the slug nearest the top of the coil form.
5	E (MULT-2)	Pin 5	C2364	Minimum	Tune C2364 for a small dip in meter reading.
6	A (DISC)	Pin 10		Zero	Insert signal generator probe into H2311. Adjust signal generator for zero meter reading.
7	B	Pin 2	T2352/T2354, C2364 and C2365	Maximum	Tune T2352/T2354, C2364 and C2365 for maximum meter reading.
			RF CIRCUITS		
8	B	Pin 2	A2352-C3, C2359, C2358, C2356, C2357 and C2358	Maximum	Apply an on-frequency signal into holes as shown below. Insert probe into hole only deep enough to obtain a reading. Insert Probe In: / Tune: 1. H2311 / A2352-C3, C2359 and C2358 2. H2310 / C2356, C2357 and C2358
9	B	Pin 2	C2355, C2356, C2357, C2358 C2359 and A2352-C3	See Procedure	For standard models, apply an on-frequency signal to the antenna jack (J1) and tune C2355 for maximum meter reading. Then retune C2356 thru C2359 and A2352-C3 for best sensitivity.
10	B	Pin 2	C2351, C2352, A2351-C3, C2355 thru C2359 and A2352-C3	See Procedure	For models with UHS, apply an on-frequency signal to the antenna jack (J1) and tune C2351, C2352 and A2351-C3 for maximum meter reading. Then retune C2351, C2352, A2351-C3, C2355 thru C2359, and A2352-C3 for best sensitivity.
			FREQUENCY ADJUSTMENT		
11	A (DISC)	Pin 10	C9 (on 1st OSC/MULT)	Zero	Apply a 10 μv or greater on-frequency signal to the antenna jack, and adjust C9 for zero discriminator reading.

SCHEMATIC DIAGRAM



(19B204847, Rev. 3)

OUTLINE DIAGRAM



CONNECTIONS		
FROM		TO
WIRE COLOR	SEARCH LOCK MONITOR BD.	MOBILE
G-BK-R	J1	P443-20
W-Y-BR	J2	P443-6
W-Y-R	J3	P443-7
W-O	J4	P443-13
W-R	J5	P443-12

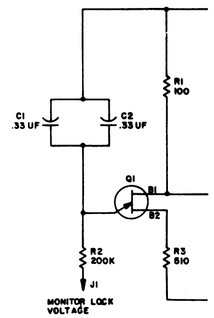
(19C303818, Rev. 1)

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 - To increase search rate.
Deleted C2, added R13, R14, R15 and RT1.

Elementary Diagram Was:



PARTS LIST

LBI-3799A

SEARCH LOCK MONITOR KIT
19A121599G1 (Mobile)

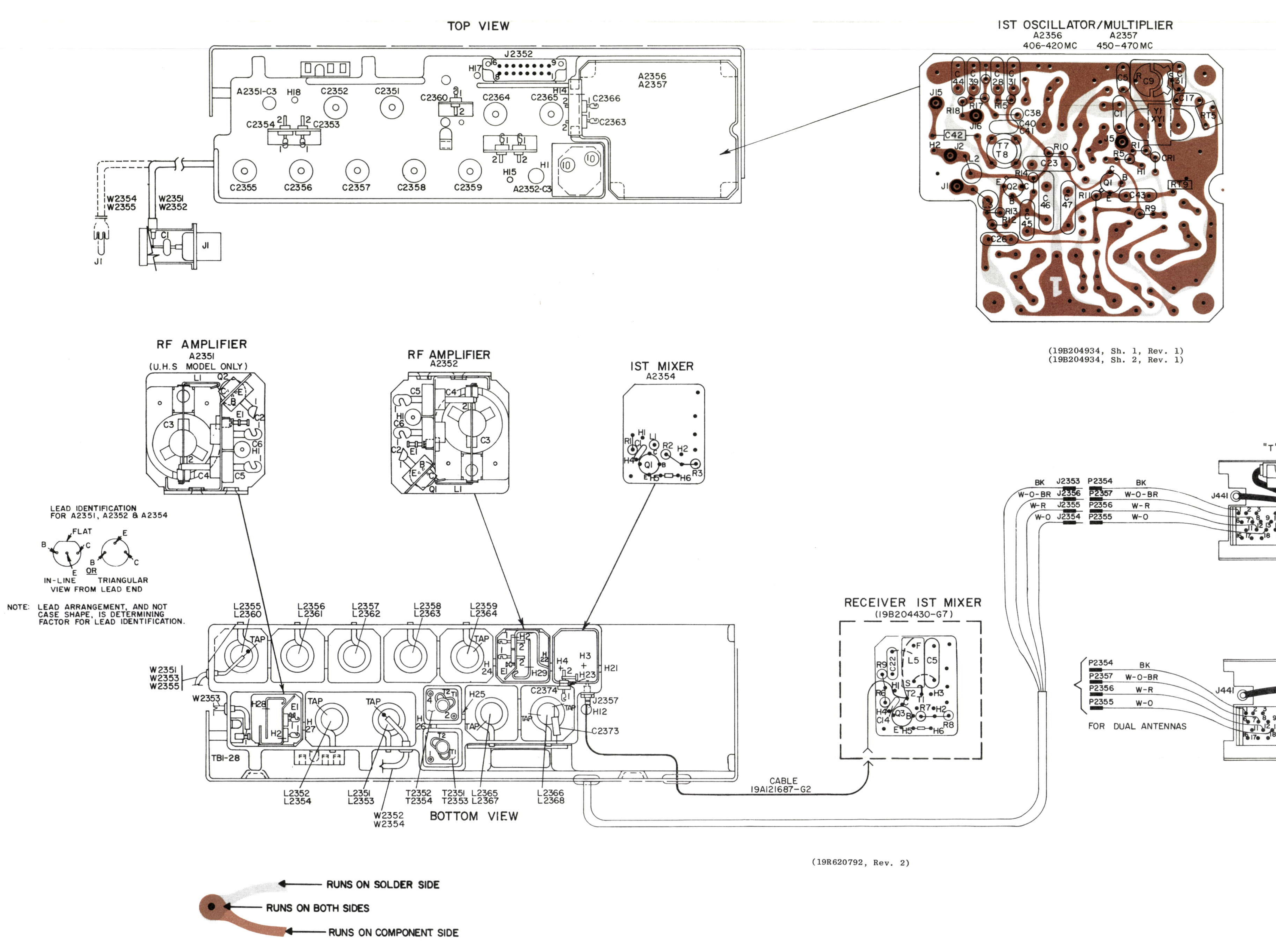
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR5	5494922P1	Silicon; sim to Type 1N456.
		COMPONENT BOARD ASSEMBLY 19B204748G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	7491930P11	Polyester: 0.33 µf ±20%, 100 VDCW; sim to GE Type 61F.
C2*	7491930P11	Polyester: 0.33 µf ±20%, 100 VDCW; sim to GE Type 61F. Deleted by REV A.
C3 and C4	5490008P127	Silver mica: 100 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C5 and C6	19A115028P107	Polyester: 0.01 µf ±20%, 200 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 thru CR4	5494922P1	Silicon; sim to Type 1N456.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J5	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115364P1	Silicon, unijunction; sim to Type 2N2646.
Q2 and Q3	19A115706P1	Silicon, PNP; sim to Type 2N3638.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R2	3R152P204J	Composition: 0.2 megohm ±5%, 1/4 w.
R3	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
R4	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R5	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R6 and R7	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R8	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R9 and R10	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R11	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R12	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R13*	3R152P474J	Composition: 0.47 megohm ±5%, 1/4 w. Added by REV A.
R14*	3R152P134J	Composition: 0.13 megohm ±5%, 1/4 w. Added by REV A.
R15*	3R152P274J	Composition: 0.27 megohm ±5%, 1/4 w. Added by REV A.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT1*	5490828P37	Rod, thermal; 0.12 megohm ±10%; sim to Globar Type 783F. Added by REV A.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A121592G1	Mobile support assembly.
	7140624P3	Spacer. (Located between board and support).
	19A121603G1	Cable Assembly, 24 inches long.

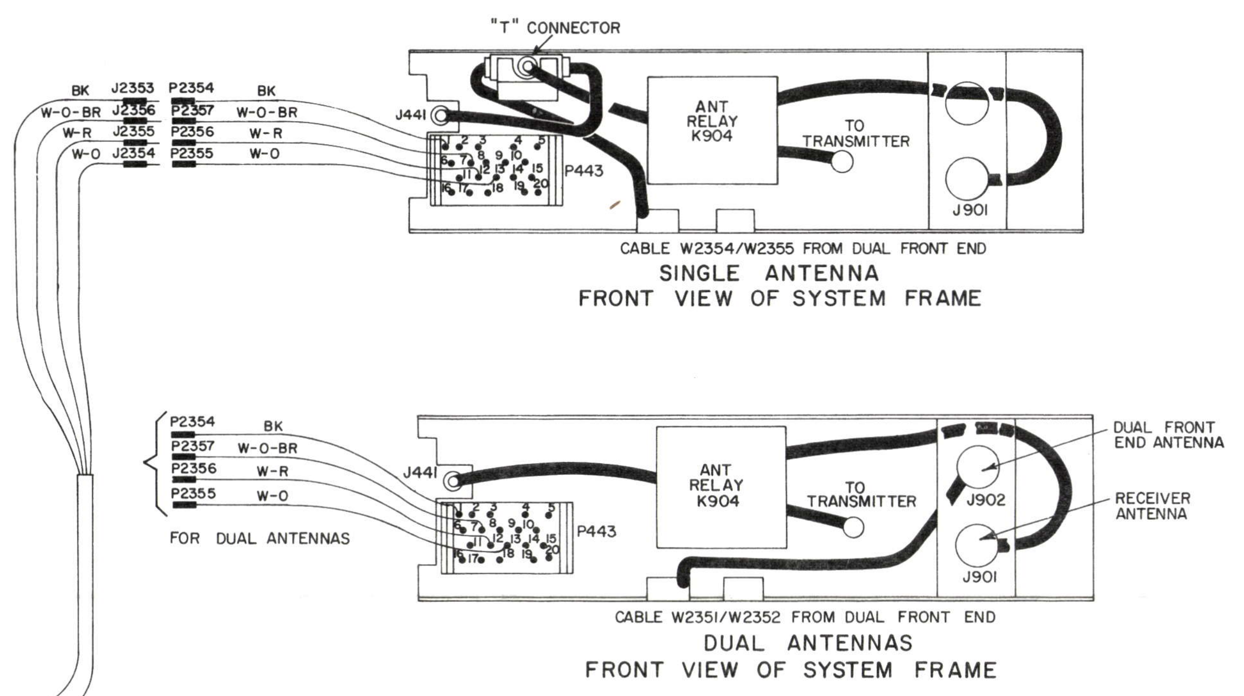
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

OUTLINE & SCHEMATIC DIAGRAM

SEARCH-LOCK MONITOR
PL-19A121599-G1

OUTLINE DIAGRAM





RESISTANCE READINGS

TRANSISTOR	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
RF AMPS Q1 & Q2	200Ω	400Ω	600Ω	350Ω	190Ω	225Ω
1ST MIXER Q1	3.9K	10K	1.6K	1.6K	500Ω	600Ω
1ST OSC MULT Q1	470Ω	1K	10.5K	5.50	110Ω	110Ω
1ST OSC MULT Q2	2800	140Ω	100Ω	100Ω	70Ω	150Ω

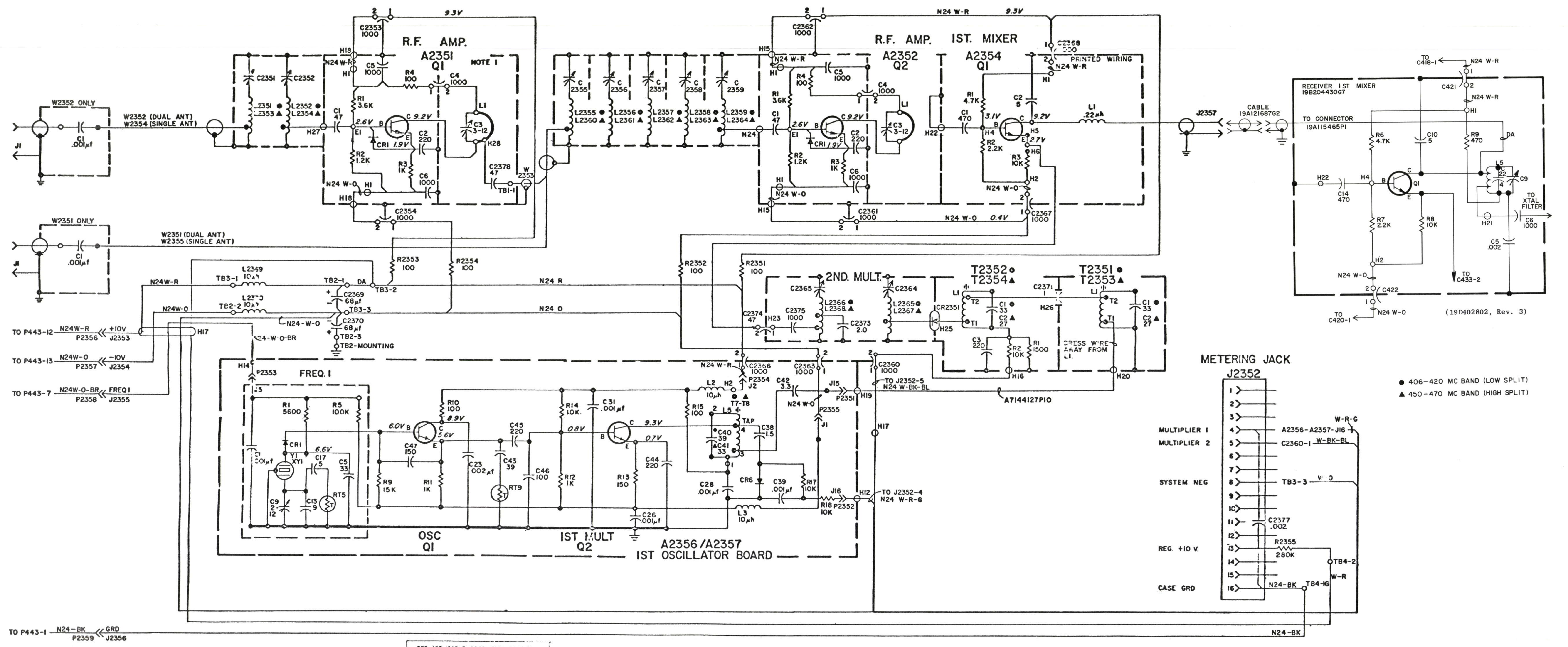
ALL READINGS ARE TYPICAL READINGS MEASURED WITH A 20,000 OHM-PER-VOLT METER, WITH CONTROL CABLE DISCONNECTED FROM J443 ON RECEIVER. READINGS ARE MADE WITH A SHORTING JUMPER CONNECTED FROM C2366-1. (+10V) TO C2363-1 (-10V), AND ARE MEASURED FROM TRANSISTOR PINS TO C2366-1. +OR- SIGNS SHOW METER LEAD TO C2361-1.

CAUTION

ALWAYS REMOVE THE SHORTING JUMPER AFTER MAKING RESISTANCE READINGS. APPLYING POWER WITH THE SHORTING JUMPER CONNECTED MAY DAMAGE THE UNIT.

FOR READINGS OF:	USE SCALE:
1-100Ω	X1
100-1KΩ	X10
1K-50KΩ	X1,000

SCHEMATIC DIAGRAM



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19D402799G1-8	A

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.

VOLTAGE READINGS

ALL READINGS ARE TYPICAL VOLTAGES MADE WITH A 20,000 OHM-PER-VOLT METER, MEASURED TO J2352-8 (NEG).

OUTLINE & SCHEMATIC DIAGRAM

DUAL FRONT END, 406-470 MC
19D402799-G1 thru G8

PARTS LIST

LBI-3794A

406-470 MHz DUAL FRONT END
19D402779G1 thru G8

SYMBOL	GE PART NO.	DESCRIPTION
		19D402779G1 406-420 MHz DUAL ANT 19D402779G2 420-470 MHz DUAL ANT 19D402779G3 406-420 MHz PRE AMP, DUAL ANT 19D402779G4 420-470 MHz PRE AMP, DUAL ANT 19D402779G5 406-420 MHz SINGLE ANT 19D402779G6 420-470 MHz SINGLE ANT 19D402779G7 406-420 MHz PRE AMP, SINGLE ANT 19D402779G8 420-470 MHz PRE AMP, SINGLE ANT
A2351		RF AMPLIFIER ASSEMBLY A2351 19C303671G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496218P755	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -750 PPM.
C2	5493392P105	Ceramic, stand off: 220 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type SSBA.
C3	748438P2	Variable, ceramic: approx 3-12 pf, 500 VDCW, temp coef 0 PPM; sim to Eric Style 503.
C4	5493392P7	Ceramic, feed thru: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type FASC.
C5 and C6	5493392P107	Ceramic, stand-off: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type SSBA.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	4038642P1	Germanium.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1	4034512P3	Terminal, feed-thru: sim to Sealectro RFT-MB-10-TUR.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19A121716P1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1*	19A116032P1	Silicon, NPN.
		Earlier than REV A:
	19A115441P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P953J	Composition: 3600 ohms ±5%, 1/4 w.
R2	3R152P123J	Composition: 1200 ohms ±5%, 1/4 w.
R3	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R4	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
A2352		RF AMPLIFIER ASSEMBLY A2352 19C303671G2
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496218P755	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -750 PPM.
C2	5493392P105	Ceramic, stand off: 220 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type SSBA.
C3	748438P2	Variable, ceramic: approx 3-12 pf, 500 VDCW, temp coef 0 PPM; sim to Eric Style 503.
C4	5493392P7	Ceramic, feed thru: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type FASC.
C5 and C6	5493392P107	Ceramic, stand-off: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type SSBA.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	4038642P1	Germanium.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1	4034512P3	Terminal, feed-thru: sim to Sealectro RFT-MB-10-TUR.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19A121716P1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q2*	19A116032P1	Silicon, NPN.
		Earlier than REV A:
	19A115440P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P562J	Composition: 3600 ohms ±5%, 1/4 w.
R2	3R152P123J	Composition: 1200 ohms ±5%, 1/4 w.
R3	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R4	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
A2354		FIRST MIXER ASSEMBLY 19B205642G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496218P755	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C2	5496218P236	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	748807P2	Choke, RF: 0.22 uh ±20%, .04 ohm DC res max; sim to Jeffers 4411-2K.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1*	19A116032P1	Silicon, NPN.
		Earlier than REV A:
	19A115440P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R2	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R3	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
A2356 and A2357		FIRST OSCILLATOR ASSEMBLY A2356 19B204419G19 405-420 MHz A2357 19B204419G22 450-470 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496481P112	Ceramic disc: .001 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.
C5	5496219P751	Ceramic disc: 33 pf ±5%,500 VDCW, temp coef -750 PPM.
C9	5491271P106	Variable: approx 2.1 to 12.7 pf, 750 v peak; sim to RF Johnson 189.
C13	5496219P40	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C17	19C300685P93	Ceramic disc: 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C33	5496481P114	Ceramic disc: .002 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C36	5496481P112	Ceramic disc: .001 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.
C38	5496481P112	Ceramic disc: .001 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.
C51	5496481P112	Ceramic disc: .001 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.
C59	5496481P112	Ceramic disc: .001 pf ±10%, 500 VDCW; sim to RMC Type JF Discap.

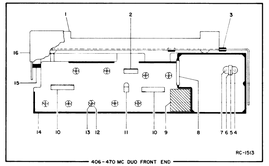
SYMBOL	GE PART NO.	DESCRIPTION
C62	5491601P130	Phenolic: 3.3 pf ±5%, 500 VDCW; sim to Quality Components Type MC.
C63	5496219P5	When reordering give GE Part No. and specify exact freq needed.
C64	5490008P135	Crystal freq = (OF -12.4 MHz) ‡ 24).
C65	5490008P93	Silver mica: 220 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C66	5496219P563	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C67	5496219P767	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -330 PPM.
CR6	19A115230P1	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -750 PPM.
		Silicon.
J1 thru J5	4033513P4	- - - - - - - - - - DIODES AND RECTIFIERS - - - - - - - - - -
J15 and J16	4033513P4	- - - - - - - - - - JACKS AND RECEPTACLES - - - - - - - - - -
L5 and L3	7488079P16	Contact, electrical: sim to Bead Chain 183-3.
Q1 and Q2	19A115330P1	Contact, electrical: sim to Bead Chain 183-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
		Choke, RF: 10 uh ±5%, 0.6 ohm DC res max; sim to Jeffers 4421-2K.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
		Silicon, NPN.
R1	3R152P563J	- - - - - - - - - - RESISTORS - - - - - - - - - -
R9	3R152P153J	Composition: 5600 ohms ±5%, 1/4 w.
R10	3R152P101K	Composition: 19,000 ohms ±5%, 1/4 w.
R11 and R12	3R152P103J	Composition: 100 hms ±10%, 1/4 w.
R13	3R152P151J	Composition: 1000 ohms ±5%, 1/4 w.
R14	3R152P103J	Composition: 150 ohms ±5%, 1/4 w.
R15	3R152P101K	Composition: 10,000 ohms ±5%, 1/4 w.
R17 and R18	3R152P103K	Composition: 100 ohms ±10%, 1/4 w.
R20	3R152P270K	Composition: 10,000 ohms ±10%, 1/4 w.
		Composition: 27 ohms ±5%, 1/4 w.
R75	19B209284P7	- - - - - - - - - - THERMISTORS - - - - - - - - - -
R79	19B209284P6	Disc: 62 ohms, color code violet.
		Disc: 945 ohms, color code gray.
T7 and T8		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
		COIL ASSEMBLY T7 19B204890G1 (A2356) T8 19B204890G2 (A2357)
C40	5496218P253	- - - - - - - - - - CAPACITORS - - - - - - - - - -
C41	5496218P251	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM. (Used in A2356)
		Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM. (Used in A2357)
L5	19A121728P1	- - - - - - - - - - INDUCTORS - - - - - - - - - -
		Coil.
	5491798P7	- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
		Tuning slug.
XT1		- - - - - - - - - - SOCKETS - - - - - - - - - -
		Refer to Mechanical Parts (RC-1513).

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		When reordering give GE Part No. and specify exact freq needed.
		Crystal freq = (OF -12.4 MHz) ‡ 24).
Y1	19B206576P6	Quartz: freq range 16401.11 to 16983.333 KHz temp range -30°C to +85°C.
Y1	19B206576P7	Quartz: freq range 18233.333 to 19066.66 KHz temp range -30°C to +85°C.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2353 and C2354	5493392P7	Ceramic, feed thru: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type FASC.
C2360 thru C2363	5493392P7	Ceramic, feed thru: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type FASC.
C2366 thru C2368	5493392P7	Ceramic, feed thru: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type FASC.
C2369 and C2370	5496267P11	Tantalum: 68 pf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2371	5491601P130	- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
C2375	5494481P12	Phenolic: 1.0 pf ±5%, 500 VDCW; sim to Quality Components Type MC.
C2377	7774750P6	Ceramic disc: .001 pf +100% -0%, 500 VDCW.
C2378	5496218P755	Ceramic disc: .002 pf +100% -0%, 500 VDCW.
		Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -750 PPM.
CR2351	19A121975P1	- - - - - - - - - - DIODES AND RECTIFIERS - - - - - - - - - -
J2352	19B205689G2	Silicon, capacitive.
J2353 thru J2356	7147199P1	- - - - - - - - - - JACKS AND RECEPTACLES - - - - - - - - - -
J2357	19A115465P1	Connector: 16 contacts.
L2359 and L2370	7488079P18	Connector: male contact; sim to Winchester Electronics 21G0.
P2351 thru P2355	4029860P2	Connector: receptacle, coaxial; sim to Micon Electronics Type 1104.
R2351 and R2352	3R152P101K	- - - - - - - - - - INDUCTORS - - - - - - - - - -
R2353 and R2354	3R152P101K	Choke, RF: 15 uh ±10%, 1.2 ohm DC res max; sim to Jeffers 4421-9K.
R2355	19A116278P444	- - - - - - - - - - PLUGS - - - - - - - - - -
T2351		Contact, electrical: sim to Amp 42827-2.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
		Composition: 100 ohms ±10%, 1/4 w.
		Composition: 100 ohms ±10%, 1/4 w.
		Metal film: 0.28 megohm ±2%, 1/2 w.
C1	5496218P251	- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
		COIL ASSEMBLY 19B204946G1
TB1	7487424P2	- - - - - - - - - - CAPACITORS - - - - - - - - - -
TB2 and TB3	7487424P24	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM.
TB4	7487424P23	- - - - - - - - - - INDUCTORS - - - - - - - - - -
		Coil.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	5491798P7	Tuning slug.

SYMBOL	GE PART NO.	DESCRIPTION
T2353		COIL ASSEMBLY 19B204944G1
C1	5496218P251	- - - - - - - - - - CAPACITORS - - - - - - - - - -
C3	5494481P3	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM.
C4	5491601P130	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		Phenolic: 1.0 pf ±5%, 500 VDCW.
CR1	19A121975P1	- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
L1	19A121715P1	Silicon, capacitive.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
R1	3R152P153J	Coil.
R2	3R152P103E	- - - - - - - - - - RESISTORS - - - - - - - - - -
		Composition: 1500 ohms ±5%, 1/4 w.
		Composition: 10,000 ohms ±20%, 1/4 w.
	5491798P7	- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
T2353		Tuning slug.
		COIL ASSEMBLY 19B204944G2
C2	5496218P249	- - - - - - - - - - CAPACITORS - - - - - - - - - -
C3	5494481P3	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C4	5491601P130	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
CR1	19A121975P1	Phenolic: 1.0 pf ±5%, 500 VDCW.
L1	19A121715P1	- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
R1	3R152P153J	Silicon, capacitive.
R2	3R152P103E	- - - - - - - - - - INDUCTORS - - - - - - - - - -
	5491798P7	Coil.
TB1	7487424P2	- - - - - - - - - - RESISTORS - - - - - - - - - -
TB2 and TB3	7487424P24	Composition: 1500 ohms ±5%, 1/4 w.
TB4	7487424P23	Composition: 10,000 ohms ±10%, 1/4 w.
W2351 and W2352		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
C1	19B209141P1	Tuning slug.
		- - - - - - - - - - BOARDS - - - - - - - - - -
		Minature, phen: 2 terminals.
		Minature, phen: 3 terminals.
		- - - - - - - - - - CABLES - - - - - - - - - -
		CABLE ASSEMBLY 19B204930G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
		Ceramic disc: .001 pf ±10%, 500 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
J1	2B22P3	- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
		Receptacle: coaxial, Signal Corps SO-239 or sim to Amphenol 83-1R.
	19B204938P3	Cap.
	19A121439P1	Cap.
	19B203107P206	Screw, tap.
W2353	19B209044P13	RF: approx 4 inches; sim to Amphenol 421-105.
W2354	19A122553G1	Cable, RF: approx 27 inches.
W2355	19A122563G2	Cable, RF: approx 31 inches.
		RF CIRCUIT ASSEMBLY 19C311190G2 (406-420 MHz WITH PRE AMP) 19C311190G3 (450-470 MHz WITH PRE AMP) 19C311190G1 (406-420 MHz) 19C311190G4 (450-470 MHz)
C5	5494481P14	- - - - - - - - - - CAPACITORS - - - - - - - - - -
C6	5494481P12	Ceramic disc: .002 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C9	5491271P104	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C10	5496218P236	Variable, air: approx 1.7-8.3 pf, 750 v peak; sim to RF Johnson 189.
C14	5494481P8	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C22	5496218P235	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
L5	19A121048P5	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
Q3	19A115440P1	- - - - - - - - - - INDUCTORS - - - - - - - - - -
R6	3R152P473J	Toroidal coil.
R7	3R152P223J	- - - - - - - - - - TRANSISTORS - - - - - - - - - -
R8	3R152P103J	Silicon, NPN.
R9	3R152P471K	- - - - - - - - - - RESISTORS - - - - - - - - - -
		Refer to Mechanical Parts (RC-1513).
		Refer to Mechanical Parts (RC-1513).
		Refer to Mechanical Parts (RC-1513).
		Refer to Mechanical Parts (RC-1513).
		Phenolic: 2 pf ±10%, 500 VDCW; sim to Quality Components Type MC.
		Ceramic feed-thru: 47 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type FASC.
L2351	19B204939G7	- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2352	19B204939G9	Coil.
L2353	19B204939G8	Coil.
L2354	19B204939G10	Coil.
L2355	19B204939G11	Coil.
L2356 thru L2358	19B204939P1	Coil.
L2359	19B204939G5	Coil.
L2360	19B204939G13	Coil.
L2361 thru L2363	19B204939P2	Coil.
L2364	19B204939G6	Coil.
L2365	19B204939G3	Coil.
L2366	19B204939G1	Coil.
L2367	19B204939G4	Coil.
L2368	19B204939G2	Coil.
		ASSOCIATED EQUIPMENT
		MODIFICATION KITS 19A122564G1-SINGLE ANTENNA 19A122564G2-DUAL ANTENNA 19A122564G3-SINGLE ANTENNA W PRE AMP
CR1	19A115346P1	- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
R5	3R152P104E	Silicon.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
		Composition: 0.1 megohm ±10%, 1/4 w.
	19A115324P1	- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
		Connector, "T" coaxial: sim to Component Mfg. Service A1173. (Mounts on frame-Used with single antenna).

SYMBOL	GE PART NO.	DESCRIPTION
	19A115465P1	Receptacle, coaxial: 500 v, sim to Micon Electronics Type 1104. (Mounts on First Mixer).
		- - - - - - - - - - CABLES - - - - - - - - - -
	19B204924G1	Cable: approx 15 inches, includes P2356 thru P2358 (7147199P2).
	19A121687G2	Cable, RF: approx 11 inches.
	19A122563G3	Cable, RF: approx 2 inches. (Used with Single Antenna without Pre Amp).
	19A122563G4	Cable, RF: approx 8 1/2 inches. (Used with Single Antenna with Pre Amp).
		FIRST MIXER 19B204483G7
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C5	5494481P14	Ceramic disc: .002 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C6	5494481P12	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C9	5491271P104	Variable, air: approx 1.7-8.3 pf, 750 v peak; sim to RF Johnson 189.
C10	5496218P236	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C14	5494481P8	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C22	5496218P235	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
L5	19A121048P5	- - - - - - - - - - INDUCTORS - - - - - - - - - -
Q3	19A115440P1	Toroidal coil.
R6	3R152P473J	- - - - - - - - - - TRANSISTORS - - - - - - - - - -
R7	3R152P223J	Silicon, NPN.
R8	3R152P103J	- - - - - - - - - - RESISTORS - - - - - - - - - -
R9	3R152P471K	Composition: 4700 ohms ±5%, 1/4 w.
		Composition: 2200 ohms ±5%, 1/4 w.
		Composition: 10,000 ohms ±5%, 1/4 w.
		Composition: 470 ohms ±5%, 1/4 w.
		FRONT PLATE ASSEMBLY 19B205189G5 THUMB MOUNT SINGLE ANTENNA 19B205189G2 THUMB MOUNT DUAL ANTENNA
	19A121759P1	Thumbscrew, 1/4-20 X 1 inch.
	4036436P2	Nut, push on; sim to Fastex 8063-21-00.
		FRONT PLATE ASSEMBLY 19B204446G2 FRONT MOUNT SINGLE ANTENNA 19B204446G4 FRONT MOUNT DUAL ANTENNA
	19A121759P1	Thumbscrew, 1/4-20 X 1 inch.
	4036436P2	Nut, push on; sim to Fastex 8063-21-00.
		MECHANICAL PARTS (SEE RC-1513)
1	19C303648P1	Support.
2	19A121674P1	Support (Mounts C2360).
3	5490407P2	Grommet, rubber.
4	4039307P1	Socket (XT1).
5	19B200525P9	Rivet (XT1).
6	4033698P1	Clip, spring tension (XT1).
7	19A115793P1	Contact (XT1).
8	19A121723P1	Support (Mounts C2353 and C2366).
9	19A121722P1	Plate (A2354).
10	19A121724P1	Support (Mounts C2361 and C2362).
11	716545L9	Clip, cable.
12	7117825P1	Washer, spring tension.
13	4039765Q5	Screw.
14	19C311155P1	Casting, RF.
15	7142162P109	Spacer.
16	19A121515G1	Rear Cap.



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 - Dual Front End 19D402779G1-G8

To replace a transistor no longer available. Changed Q1 on A2351 and Q2 on A2352.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

ORDERING SERVICE PARTS

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

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

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

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

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

MAINTENANCE MANUAL

LBI-3795

DF-8401

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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