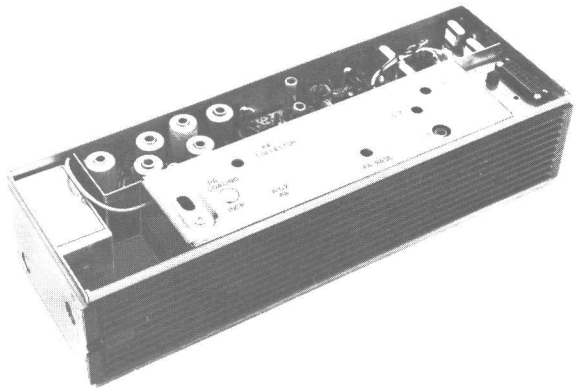
MOBILE RADIO

MASTR *Imperial*

25-50 MHz, 60-WATT TRANSMITTER MODELS 4KT23A10



SPECIFICATIONS *

FCC Filing Designation	**KT-23-A**
Frequency Range	25-50 MHz
Power Output	60 Watts (Adjustable from 20 to 60 Watts)
Crystal Multiplication Factor	12
Frequency Stability	±0.0005% (-30°C to +60°C)
Spurious and Harmonic Radiation	At least 80 dB below full rated power output
Modulation	Adjustable from 0 to ±5 kHz swing with instantaneous modulation limiting.
Modulation Sensitivity	50 - 100 Millivolts
Audio Frequency Characteristics	Within +1 dB to -3 dB of a 6-dB/ octave pre-emphasis from 300 to 3000 Hz per EIA standards. Post limiter filter per FCC and EIA.
Distortion	Less than 3%
Deviation Symmetry	0.5 kHz maximum
Maximum Frequency Spacing	±0.4%
Duty Cycle	EIA 20% Intermittent

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

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ILLUSTRATIONS

WARNING

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

DESCRIPTION

Transmitter Type KT-23-A is a crystal controlled, phase modulated transmitter designed for one-, two- or four-frequency operation in the 25—50 megahertz band. The transmitter consists of the following assemblies:

- Transistorized Exciter Board Audio, modulator, amplifier and multiplier stages.
- Transistorized PA Assembly Multiplier, amplifiers, driver, power amplifier and filter.
- Optional Channel Guard Board Encoder and tone network.

CIRCUIT ANALYSIS

The Transmitter provides a maximum power output of 60 Watts. The crystals range from approximately 2.14 to 4.17 megahertz, and the crystal frequency is multiplied 12 times.

A centralized metering jack (J102) is provided for use with GE Test Set Models 4EX3A10 (Rev. A or later) or 4EX8K11. The test set meters the amplifiers, multipliers and PA stage, and PA supply voltages. The metering jack also provides access to receiver audio, microphone and push-to-talk leads.

All input leads to the transmitter are individually filtered by the 20-pin feed-through by-pass connector J101. Supply voltage, metering and control functions for the exciter board are connected from the PA assembly to jacks J1 through J18 on the exciter board.

EXCITER

OSCILLATOR

The transmitter uses a transistorized Colpitts oscillator (Q4). The oscillator provides a frequency stability of ±0.0005% without crystal ovens or warmers. Feedback for the oscillator is developed across C24.

In single-frequency transmitters, a jumper connects the F1 crystal keying lead to ground and the crystal frequency is applied to the base of oscillator Q4. The oscillator frequency is adjusted by trimmer C5. The oscillator output is applied to the anode of phase modulator CV1.

In multi-frequency transmitters, the single oscillator transistor is used, and up to three crystal circuits that are identical to the F1 crystal circuit are added. The keying jumper is removed, and the proper crystal frequency is selected by switching the crystal keying lead to ground by means of a frequency selector switch on the Control Unit. This forward biases the diode in the crystal circuit, reducing its impedance, so that the selected crystal frequency is applied to the base of oscillator Q4.

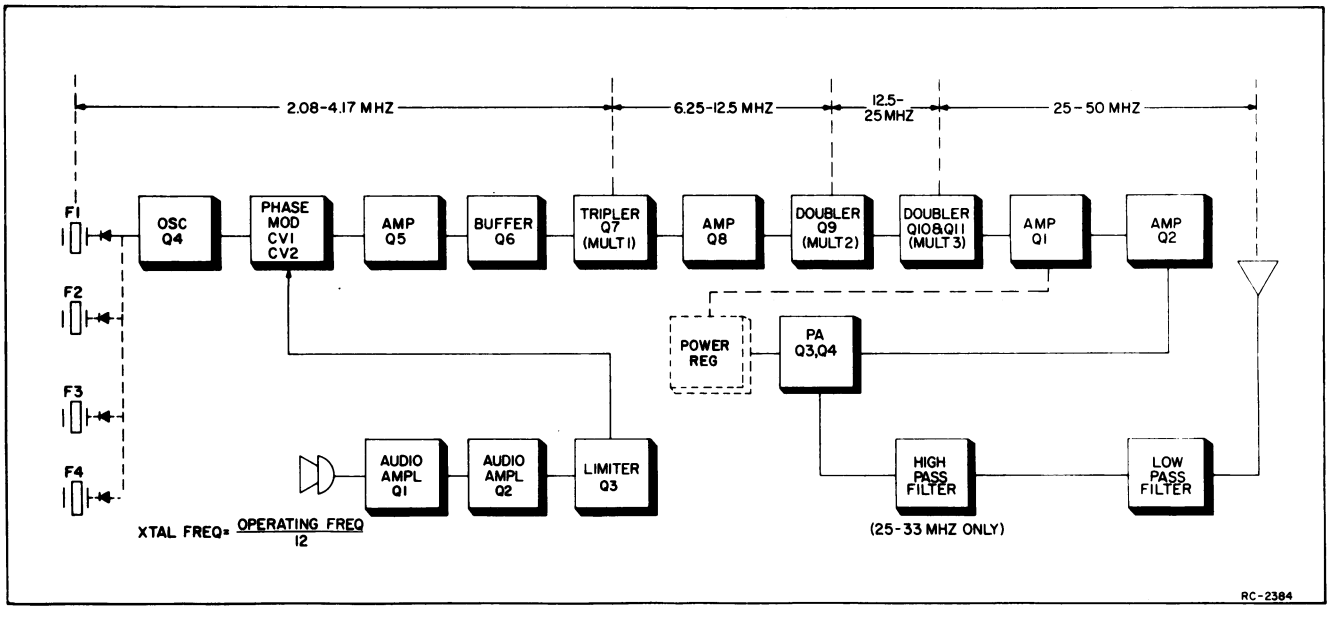


Figure 1 - Transmitter Block Diagram

AUDIO AMPLIFIERS AND LIMITERS

The audio section of the transmitter consists of DC-coupled feed-back amplifiers Q1, Q2 and Q3. Q3 also acts as a limiter at high audio input levels. Audio from the microphone is coupled through an input network (C2 and R1) to the audio stages. The input network, in conjunction with the feedback circuit, provides the audio gain and a 6-dB/octave pre-emphasis.

The output of limiter Q3 is connected through modulation adjust potentiometer R8 to a de-emphasis network for 6-dB/octave de-emphasis and post limiter roll-off. The network consists of C12, C13, R12 and R13. Modulation adjust R8 determines the maximum signal level applied to the modulator circuit, and is normally set for ±4.5 kHz (narrow band).

PHASE MODULATOR

The phase modulator uses varactors CV1 and CV2 (voltage-variable capacitors) in two cascaded R-L-C networks (R31-L2 and R32-L3). An audio signal applied to the modulator through L2 and L3 varies the capacitance of CV1 and CV2, resulting in a phase modulated output. The modulator output is applied to the base of emitter-follower Q5.

In Channel Guard applications, tone from the encoder-decoder board (on the receiver) is coupled to the modulator circuit through Channel Guard Mod Adjust potentiometer R35. This control is normally set for ±0.75 kHz deviation as described in the transmitter Modulation Adjustment Procedure.

NOTE

If Channel Guard decode only is desired, disconnect the CHAN GD TONE HI lead from J8 of the transmitter exciter board.

EMITTER-FOLLOWER AND BUFFER-AMPLIFIER

Emitter-follower Q5 and buffer-amplifier Q6 isolates the modulator from the loading effects of the tripler stage, and provides some amplification. The output of Q6 is direct-coupled to the base of the tripler.

AMPLIFIER AND MULTIPLIERS

Q7 operates as a tripler (MULT-1) with collector tank T1 tuned to three times the crystal frequency. This stage is metered at Centralized Metering Jack J102 through R52. Following the tripler is amplifier Q8. This stage is metered at J102 through R62. The output of Q8 is capacitive-coupled from T2 to T3, and applied to the base of Q9.

Q9 operates as a doubler (MULT-2) the output of Q9 is capacitive-coupled from T4 to T5 to the base of Q10 and Q11, with both coils tuned to six times the crystal frequency. The stage is metered at J102 through R72.

Q10 and Q11 operate as a Class C, push-pull doubler (MULT-3) with collector tank T6 tuned to 12 times the crystal frequency. The doubler is metered at J102 through R82.

PA ASSEMBLY

WARNING

The stud mounted RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

AMPLIFIERS AND PA

The exciter output is capacity-coupled to two common-emitter, series-tuned RF amplifier stages, A102-Q1 and Q2. Q1 base voltage is metered at J102-4 through metering network CR1, R1, R2 and C2.

Collector current for Q2 is metered across metering resistor R101 at J102-14 (AMP-2 Ic). The reading is taken on the 1-Volt scale (the actual current reading is 10 amperes full scale) with the GE Test Set in Position F. The amplifier output is coupled through a series-tuned circuit to base-balancing inductors L10-L15, and then to the bases of the power amplifiers.

Q3 and Q4 operate as parallel-connected, common-emitter power amplifiers to provide variable RF power output of 20-60 Watts from 25 to 50 MHz. Collector current for the PA transistors is metered across metering resistor R102 at J102-1 (PA Ic). The reading is taken on the 1-Volt scale (the actual current reading is 10 amperes full scale) with the GE Test Set in Position G, and with the HIGH SENSITIVITY button pressed.

Meter shunt R101 also serves as a voltage and current sensing element in conjunction with the Power Regulator to provide protection for the PA transistors by reducing the supply voltage of the pre-driver amplifier Q1 when the collector current or the supply voltage of the PA amplifiers (Q3, Q4) rises. Reducing the supply voltage of Q1 causes the RF drive to the PA transistors (Q3, Q4) to be reduced thus limiting the DC input power and holding the RF output power approximately constant.

The adjustable RF power output feature is accomplished by controlling the supply voltage of the pre-driver amplifier Q1. Potentiometer R13 on the Power Regulator board controls the RF power output by varying the supply voltage to the pre-driver amplifier Q1.

The Power Amplifier output is coupled through a series-tuned circuit to the high-pass filter, FL102, the low-pass filter FL101, then through the antenna relay K901 to the antenna.

CHANNEL GUARD ENCODER OPTION

Channel Guard Encoder Model 4EH18A10 is a fully transistorized encoder for use with MASTR Imperial combinations in encode only applications, or where different encode and decode tones are desired. 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.

The encoder board and tone network mount on the underside on the transmitter chassis. Power, ground and tone output connections are made to transmitter exciter board A101 by means of a cable (19B216186G1).

The encoder tone is provided by selective oscillators Q1 and Q2, which oscillate continuously at a frequency determined by the tone network (FL1). Negative feedback, applied through the tone network to the base of Q1, prevents any gain in the stage except at the desired encode frequency. The oscillator output is applied to the base of emitter-follower Q3.

Thermistor-resistor combination R1 and RT1 provides temperature compensation for the oscillator output. Limiter diodes CR1 and CR2 keep the tone amplitude constant.

The output of emitter-follower Q5 is applied to the phase modulator on the transmitter exciter board through Channel Guard MOD ADJUST R35. Instructions for setting R35 are contained in the Modulation Adjustment section of the Transmitter Alignment Procedure.

CARRIER CONTROL TIMER

The Carrier Control Timer option shuts off the transmitter on each transmission after a one-minute timing cycle, and alerts the operator that the transmitter is off by means of an alarm tone in the speaker. The transmitter can be turned on again by releasing and rekeying the push-to-talk switch on the microphone.

The timing cycle (transmitter keyed time) is normally set at the factory for a duration of one minute. An optional potentiometer is available that permits the timing cycle to be adjusted from 15 seconds to 5 minutes. Complete instructions for the Carrier Control Timer are contained in Maintenance Manual LBI-4138.

MAINTENANCE

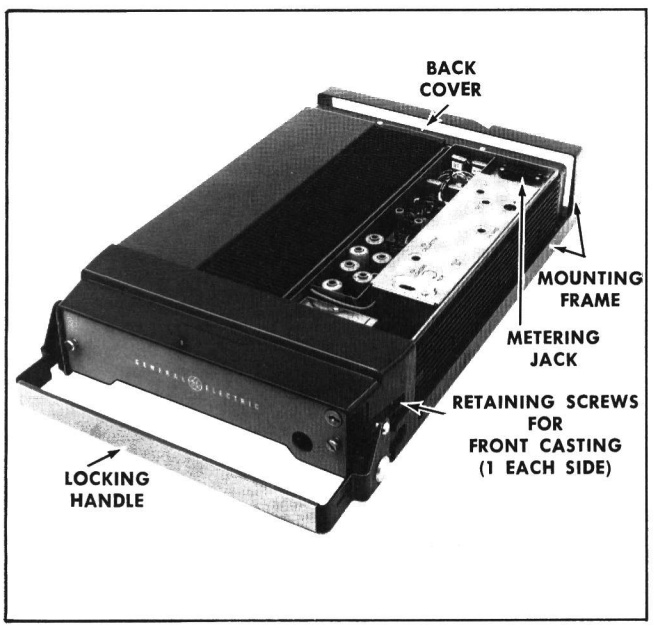


Figure 2 - Top Cover Removed

Figure 3 - Bottom Cover Removed

DISASSEMBLY

To service the transmitter from the top (Figure 2):

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

To service the transmitter from the bottom (Figure 3):

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

To remove transmitter from system frame:

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

PA TRANSISTOR REPLACEMENT

WARNING

The stud mounted RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

To replace the PA transistors (Q1 through Q4):

1. Unsolder one lead at a time with a 50-Watt soldering iron. Use a scribe to hold the lead away from the printed circuit board until the solder cools.
2. Turn the transmitter over.
3. Hold the body of the transistor to prevent it from turning. Remove the transistor hold-down nut and spring washer through the hole in the heatsink with an 11/32-inch nut-driver. Lift out the transistor, and remove the old solder from the printed circuit board.
4. Trim the new transistor leads (if required) to approximately 3/8-inch lengths. Cut the collector lead at a 45° angle for future identification (see Figure 4). The letter "C" on the top of the transistor indicates the collector.
5. Apply a coating of silicone grease around the transistor mounting surface, and place the transistor in the mounting hole. Align the leads as shown in the Outline Diagram. Then hold the body of

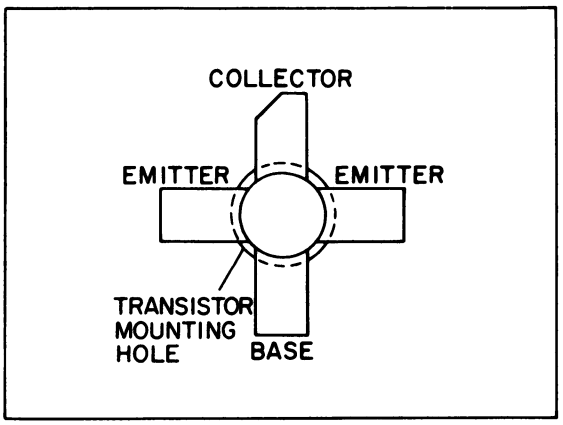


Figure 4 - Lead Identification

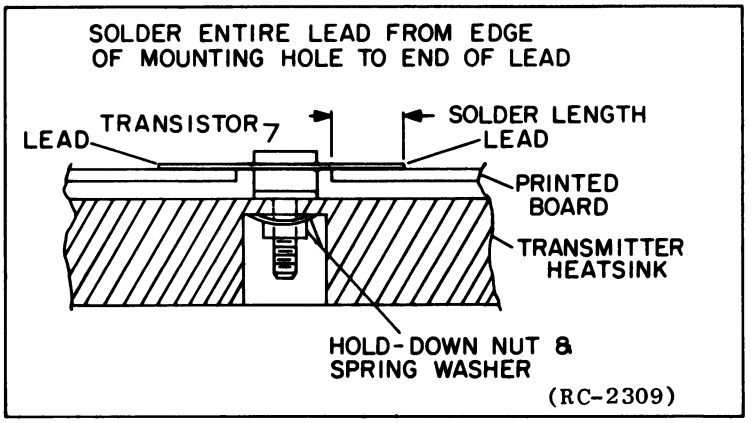


Figure 5 - Lead Forming

the transistor and replace the hold-down nut and spring washer, using moderate torque (8 to 10 inch-pounds maximum in 25-50 MHz transmitters, and 6.5 inch-pounds for 150.8 to 470 MHz transmitters).

6. Make sure that the transistor leads are formed as shown in Figure 5 so that the leads can be soldered to the printed circuit pattern, starting from the inner edge of the mounting hole.

7. Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hole and solder the remaining length of transistor lead to the board.

CAUTION

Failure to solder the transistor leads as directed may result in the generation of RF loops that could damage the transistor.

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R8) was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause overmodulation are clipped by the modulation limiter. The limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing overmodulation while preserving intelligibility.

TEST EQUIPMENT

1. An audio oscillator (GE Model 4EX6A10)
2. A frequency modulation monitor
3. An output meter of a VTVM
4. GE Test Set Models 4EX3A10 or 4EX8K10,11

PROCEDURE

1. Connect the audio oscillator and the meter across audio input terminals J5 (Green-Hi) and J6 (Black-Lo) on GE Test Set or across J5 (Mike High) and J6 (Mike Low) on the Exciter Board.
2. Apply a 0.75-volt signal at 1000 Hz to Test Set or across J5 and J6 on Exciter Board.
3. For transmitters without Channel Guard, set the MOD ADJUST (R8) for a 4.5-kilohertz swing with the deviation polarity which gives the highest reading as indicated on the frequency modulation monitor.
4. For transmitters with Channel Guard, set the Channel Guard MOD ADJUST (R35) for 0.75 kHz tone deviation. Remove the tone to the transmitter by unplugging leads to J7 and J8 on Exciter Board, or by switching to a non-Channel Guard frequency in multifrequency units. Apply a 0.75-Volt signal at 1000 Hz and set MOD ADJUST (R8) for a 3.75 kHz deviation (4.5 kHz minus 0.75 kHz tone deviation).
5. For multi-frequency transmitters, set the deviation as described in Steps 3 and 4 on the channel producing the largest amount of deviation.

PA POWER INPUT

For FCC purposes, the PA power input can be determined by measuring the PA supply voltage and PA current, and using the following formula:

P_i = PA voltage x PA current

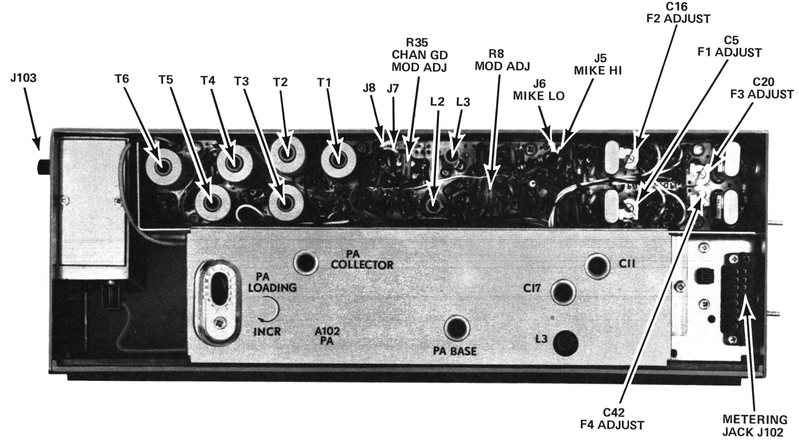
where

P_i is the power input in watts,

PA voltage is measured with the GE Test Set in Position G on the 15 volt scale, and polarity switch in the (-) position.

PA current is measured with the Test Set in Position G in the Test 1 position, and with the HIGH SENSITIVITY button pressed (10 amperes full scale).

Example: P_i = 12.5 volts x 7 amperes = 87.5 watts



TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Model 4EX3A10 (Revision A or later), or Model 4EX8K11.
2. A 50-ohm wattmeter connected to J103.
3. A frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal(s) in crystal socket (crystal frequency = operating frequency ÷ 12).
2. For a large change in frequency or a badly mis-aligned transmitter, set crystal trimmer C5 to mid-capacity. In multi-frequency transmitters, set all trimmers to mid-capacity and set the channel selector switch to the F1 position.
3. For a large change in frequency or a badly mis-aligned transmitter, turn the slugs in exciter coils L2, L3, T1 thru T6 and L3 on PA board A102 (if present) so that the top of the slug is approximately even with the bottom of the coil winding or until the slugs hit the board (whichever comes first). Turn mica compression capacitors C11, C17, PA BASE, PA COLLECTOR, and PA LOADING (on PA board) all the way to the right (clockwise). Then set each capacitor 1-1/2 turns counterclockwise.
4. Connect the GE Test Set to receiver metering jack J442 and check for +10 Volts at Position J. If reading is not 10 Volts, refer to the Power Regulator Outline Diagram and set R28 for +10 Volts.
5. Set the Power Regulator Power Adjust pot (R13) fully clockwise.
6. Connect GE Test Set to metering jack J102. Set the test polarity to + and set the range to the Test 1 (or 1-Volt position for 4EX8K11) for all adjustments. Voltage readings at Position "F" may be converted to driver collector current by multiplying the reading by 10 (10 amperes full scale). Voltage readings at Position "G" (with HIGH SENSITIVITY button pressed) may be converted to PA collector current by multiplying the reading by 10 (10 amperes full scale).
7. All adjustments are made with the transmitter keyed. Unkey the transmitter between steps to avoid unnecessary heating.

TRANSMITTER ALIGNMENT PROCEDURE

STEP	METER POSITION	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
				EXCITER BOARD
1.	A MULT-1	L2 and L3	Maximum	Carefully tune L2 and L3 for maximum meter reading.
2.	A MULT-1	T1	Minimum	Tune T1 for a small dip in meter reading.
3.	B AMP-1	T1 and T2	See Procedure	Tune T1 for maximum meter reading and then tune T2 for a small dip or movement of meter indicator.
4.	C MULT-2	T3, T2 and T4	See Procedure	Tune T3 and then T2 for maximum meter reading. Then tune T4 for a small dip or movement of meter indicator.
5.	D MULT-3	T5, T4 and T6	See Procedure	Tune T5 and then T4 for maximum meter reading. Then tune T6 for a dip in meter reading.
				PA BOARD
6.	E AMP-2/3	L3/L27 and T6 (Exciter)	Maximum	Tune L3/L27 and T6 for maximum meter reading.
7.	F DRIVER Ic	C17, C11	Maximum	Tune C17 for maximum meter reading. If no indication on meter, adjust C11 slightly clockwise and re-tune C17 for maximum meter reading.
8.	F DRIVER Ic	PA BASE (C18)	Maximum	Tune PA BASE for maximum power output on wattmeter.
9.	G PA Ic		See Procedure	With the HIGH SENSITIVITY switch pressed, check meter reading for 1.0-Volt. If reading exceeds 1.0-Volt, adjust PA LOADING for a meter reading of 0.8-Volt.
10.	G PA Ic	PA COLLECTOR (C27)	Maximum	Tune PA Collector for maximum power output on wattmeter.
11.	G	PA LOADING & PA Collector (C28/C29) C27	1.0 Volts Maximum	Press the HIGH SENSITIVITY switch. Then adjust PA LOADING slightly clockwise and tune PA COLLECTOR for maximum power output. Repeat until the meter reads 1.0 Volts maximum. —NOTE— Reading will increase only when PA COLLECTOR is re-tuned for maximum power output following each slight clockwise adjustment for PA LOADING.
12.	G	C17, PA BASE & PA COLLECTOR	Maximum	Tune C18, PA BASE AND PA COLLECTOR for maximum power output on wattmeter.
13.	G		1.0 Volts Maximum	Press HIGH SENSITIVITY switch and check for meter reading of 1.0 Volts maximum. If necessary, repeat Step 11 until proper reading is obtained.
				FREQUENCY ADJUSTMENT
14.		C5 (C16 in 2-freq. units, and C20 or C42 in multi-freq. units).		Loosely couple frequency counter to output and adjust C5 for proper frequency output. (Switch to F2 and adjust C16 on 2-frequency units. In 3- or 4-frequency units, adjust C20 or C42 as required). ————NOTE———— For proper frequency control of the transmitter, it is recommended that all frequency adjustments be made when the equipment is at a temp. of approximately 75°F. In no case should frequency adjustments be made when the equipment is outside the temp. range of 50° to 90° F.
15.	G	R13		Adjust R13 on Power Regulator for 60 Watts or other desired power, down to 20 Watts.

TEST PROCEDURES

These Test Procedures are designed to assist you in servicing a transmitter that is operating--but not properly. Problems encountered could be low power output, low B plus, tone and voice deviation, defective audio sensitivity and modulator adjust control set too high. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once a defect is pin-pointed, refer to the "Service Check" and the additional corrective measures included in the Transmitter Troubleshooting Procedure. Before starting with the Transmitter Test Procedures, be sure the transmitter is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

for test hookup as shown:

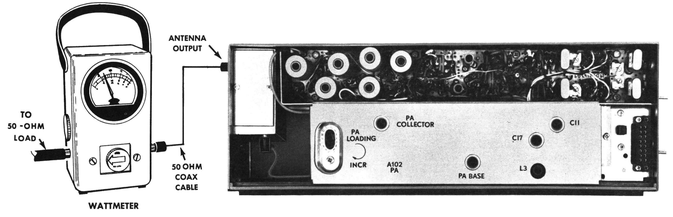
1. Wattmeter similar to:
   Bird # 43
   Jones # 711N
2. VTVM similar to:
   Triplett # 850
   Heath # 1M-21
3. Audio Generator similar to:
   GE Model 4EX6A10 or
   Heath # 1G-72
4. Deviation Meter (with a .75 kHz scale) similar to:
   Measurements # 140
   Lampkin # 205A
5. Multimeter similar to:
   GE TEST SET MODEL 4EX3A10,
   MODEL 4EX8K11 or
   20,000 ohms-per-volt voltmeter

STEP 1

POWER MEASUREMENT

TEST PROCEDURE

1. Connect transmitter output to wattmeter as shown below:



2. Turn Power Adjust R13 (Power Regulator) full clockwise. Key transmitter and check wattmeter for minimum reading of 60 Watts. Reset Power Adjust, R13, to the desired power out.

SERVICE CHECK

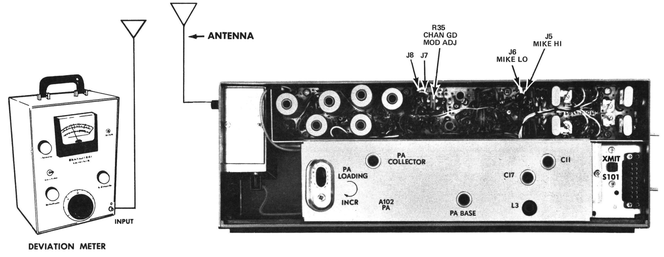
Refer to Service Hints on Transmitter Troubleshooting Procedure.

STEP 2

TONE DEVIATION WITH CHANNEL GUARD

TEST PROCEDURE

1. Set up Deviation Meter and monitor output of transmitter as shown below:



2. Unplug the MIC HI terminal from J5 on Transmitter Exciter Board.
3. Key transmitter and check for 0.75-kHz deviation. If reading is low or high, adjust Channel Guard MOD ADJUST (R35) for a reading of 0.75-kHz.

NOTES: --The Channel Guard MOD ADJUST (R35) may be adjusted for deviations up to 1.0 kHz maximum for all tone frequencies.

1. On units supplied with Channel Guard, the Phase Modulator Tuning should be peaked carefully to insure proper performance. (Refer to Steps 1 in the Transmitter Alignment Chart).
2. The Tone Deviation Test Procedures should be repeated every time the Tone Frequency is changed.

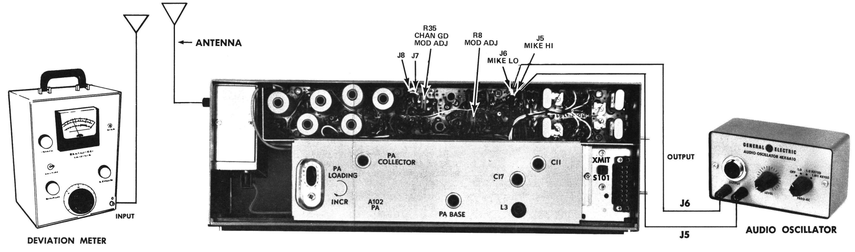
DEVIATION METER

STEP 3

VOICE DEVIATION AND SYMMETRY

TEST PROCEDURE

1. Unplug the High and Low Mike leads from the Exciter Board Jacks J5 and J6.
2. Connect test equipment to transmitter as shown below:



3. Set the generator output to 1.0 VOLTS RMS and frequency to 1 kHz.
4. Key the transmitter and adjust Deviation Meter to carrier frequency.
5. Deviation reading should be ±4.5 kHz.
6. Adjust Modulation Adjust Control R8 until deviation reads 4.5 kHz on plus (+) or minus (-) deviation, whichever is greater. This adjustment should be made with the correct level of tone applied on Channel Guard transmitters.

DEVIATION METER

NOTES: --Imperial transmitters are adjusted for 4.5 kHz deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 kHz under the worst conditions of frequency, voltage and temperature.

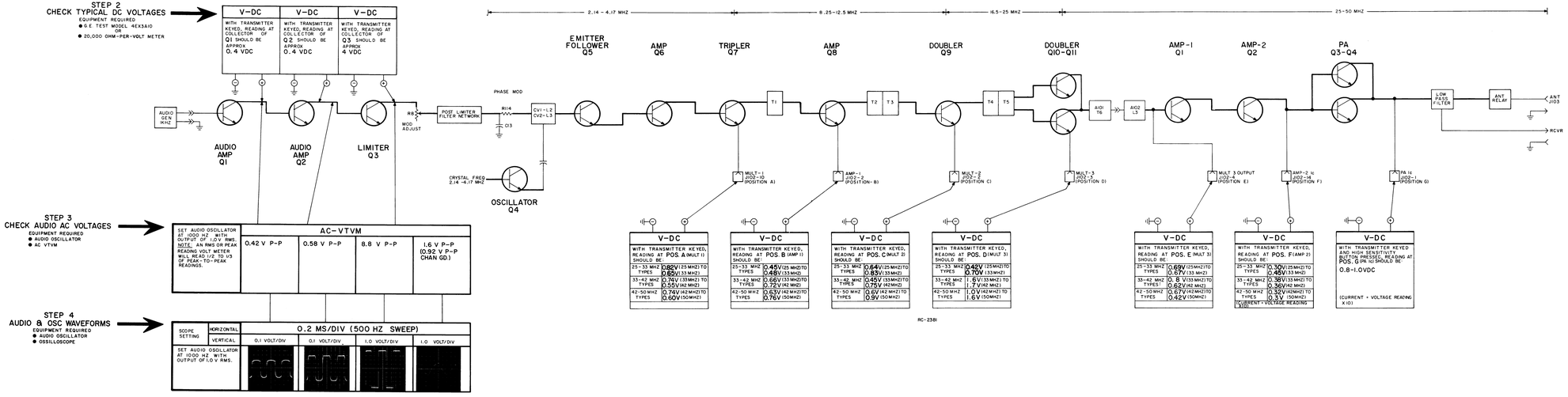
If the deviation reading plus (+) or minus (-) differs by more than 0.5 kHz, check the following:

1. Recheck Step 1 as shown in the Transmitter Alignment Chart.
2. Check Audio Sensitivity by reducing generator output until deviation falls to 3.0 kHz. Voltage should be LESS than 100 millivolts.

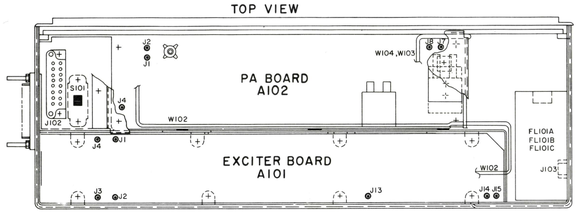
METER

STEP I - QUICK CHECKS

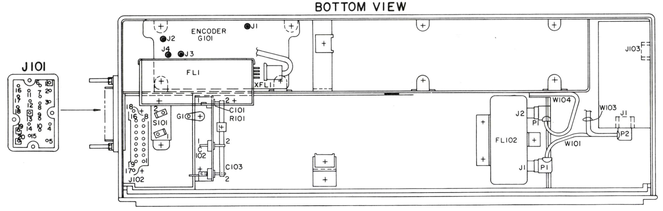
Meter Position GE Test Set	Probable Defective Stage		
	High Meter Reading	Low Meter Reading	Zero Meter Reading
"A" (MULT-1)	Q6, Q7, 10-Volt Regulator	Q4, Q5, Q6, Q7 L2, L3, 10-Volt Regulator	Q4, Q5, Q6, Q7, Crystal, 10-Volt, Gnd to Osc Ch.
"B" (AMP)	Q8, R60, R61, T2, 10-Volt Regulator	T1, Q8, R60, C60, R61, 10-Volt Reg.	Q8, R61, C60, R62, T2, 10-Volt Reg.
"C" (MULT-2)	T2, T3, Q8, R68, R71, T4 T4	T2, T3, Q8, R68, C70, R71 T4	Q8, T3, T4, R70, R72, C71
"D" (MULT-3)	T4, T5, Q10, R80, R83	T4, T5, Q10, C80, R83, C82, Q11	T4, T5, Q10, Q11, R83, C82, T6
"E" (AMP 1 DRIVE)	Q10, Q11, L3B, L3C, L27, Check Transmitter Alignment.	Q10, Q11, L3B, L3C, L27, Check Transmitter Alignment.	Q10, Q11, L3B, L3C, L27, CR1/CR2. C11, C17, Check Transmitter Alignment.
"F" (DRIVER)	Check Transmitter Alignment, Power Regulator.	Check Transmitter Alignment, Power Regulator, Q1, Q2.	Check Transmitter Alignment, Power Regulator, Q1, Q2.
"G" (Power Amp.) Current Reading	Check Transmitter Alignment, Q3, Q4, Antenna	Check Transmitter Alignment, Q3, Q4, Antenna, Power Regulator	Check Transmitter Alignment, Q1, Q2, Q3, Q4, Antenna, Power Regulator
"G" (Power Amp.) Voltage Reading	Power Regulator	Power Regulator	Short/Fuse Blown



TOP VIEW

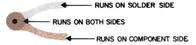


BOTTOM VIEW

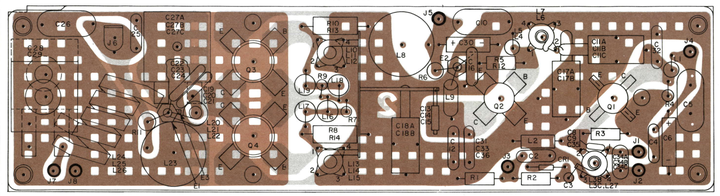


OUTLINE DIAGRAM

25-50 MHz, 60-WATT TRANSMITTER
TYPE KT-23-A

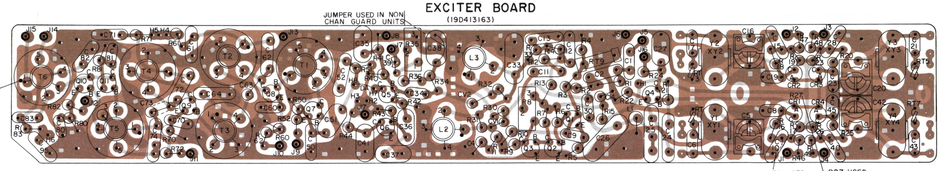


PA BOARD
(19D416099)



(19D416097, Sh. 1, Rev. 3)
(19D416097, Sh. 2, Rev. 3)

EXCITER BOARD
(19D413163)



(19D413028, Sh. 1, Rev. 0)
(19D413028, Sh. 2, Rev. 0)

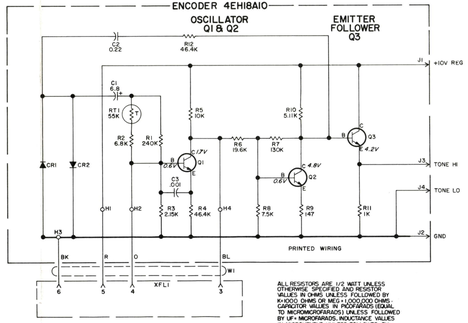
LEAD IDENTIFICATION FOR CR1 THRU CR4.
EXCITER BD. ONLY

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

(19B621855, Rev. 1)

CHANNEL GUARD ENCODER MODEL 4EH18A10

SCHEMATIC DIAGRAM



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION 000-000 FOR THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO. 4EH18A10	REV LETTER

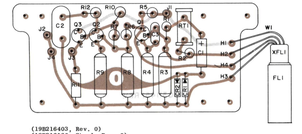
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED. RESISTOR VALUES IN OHMS OR MEGOHMS FOLLOWED BY K (KILO) OHM OR MEG (MEGOHM) OHMS. CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF = MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS, UNLESS FOLLOWED BY MH= MILLIHENRYS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

VOLTAGE READINGS

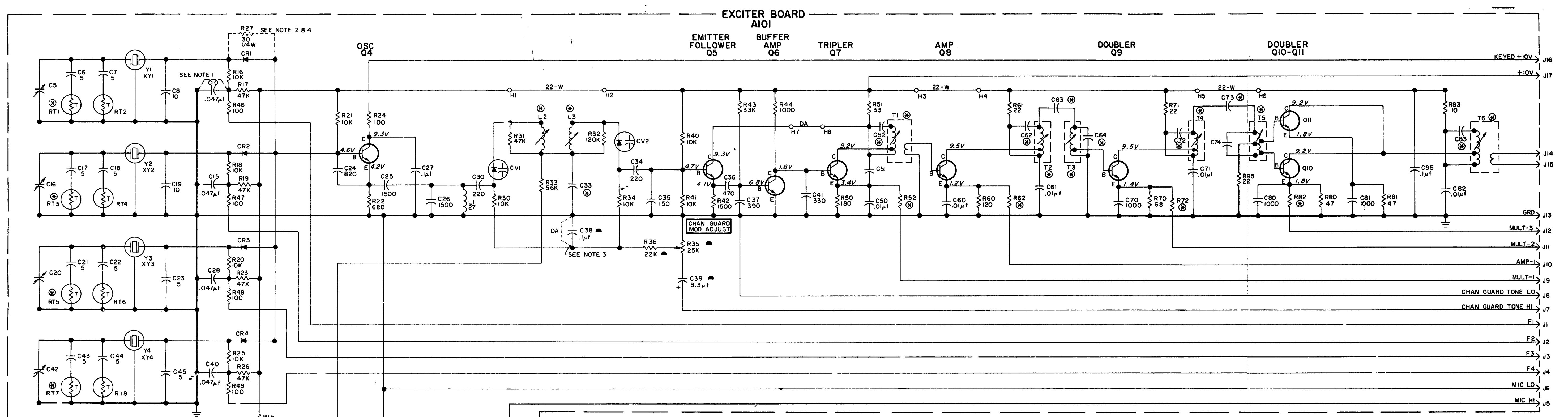
READINGS MEASURED FROM TRANSISTOR PIN TO GROUND WITH A 20,000 OHM-PER-VOLT METER.

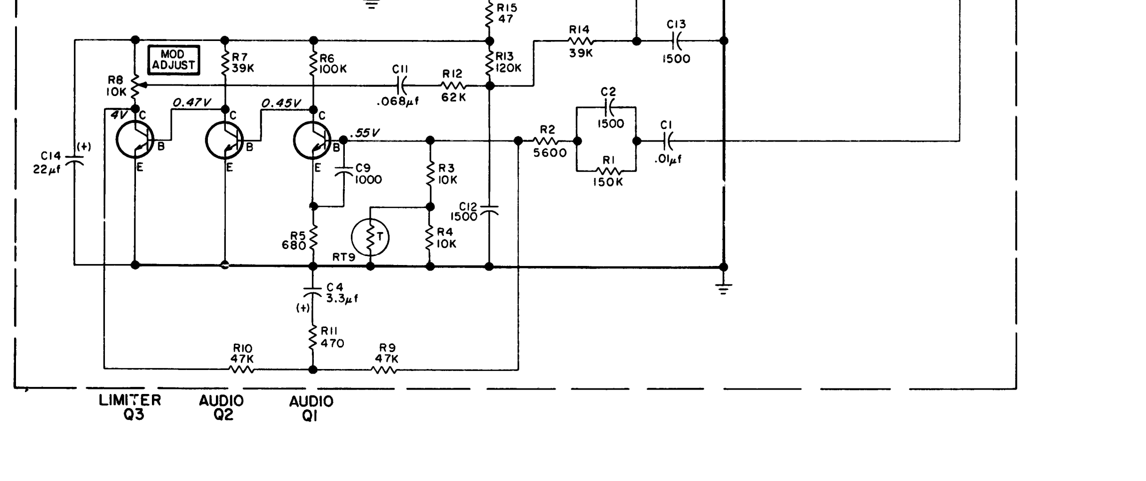
(19C311817, Rev. 1)

OUTLINE DIAGRAM



(19B216403, Rev. 0)
(19B216160, Sh. 1, Rev. 0)
(19B216160, Sh. 2, Rev. 0)





COMPONENT NUMBER	25-33 MHZ	33-42 MHZ	42-50 MHZ	REMARKS
C33A	680	680	680	
C33B	470			USED IN 25-33 MHZ CG ONLY
C52	A-100	B-110	C-91	
C62	A-91	B-100	C-82	
C63	A-1.8	A-1.8	B-24	
C64	A-91	B-110	C-82	
C72	A-82	B-68	A-82	
C73	A-8	B-4	C-2.4	
C74	A-82	B-75	C-43	
C83	A-47	B-30	C-30	
L2	A	B	C	
L3	A	B	C	
R52	A-82K	B-68K	C-47K	
R62	A-27K	B-10K	C-18K	
R72	A-39K	B-18K	C-27K	
R82	A-39K	B-22K	C-18K	
RT1	A	A	B	
RT3	A	A	B	USED IN 2 & 4 FREQ ONLY
RT5	A	A	B	USED IN 4 FREQ ONLY
RT7	A	A	B	USED IN 4 FREQ ONLY
T1	A	B	C	
T2	A	B	C	
T3	A	B	C	
T4	A	B	C	
T5	A	B	B	
T6	A	B	C	

EXCITER NO	REV LTR	FREQ RANGE MHZ	NO. OF FREQ	CHAN GD
19D413163-G1	B	25-33	1	
19D413163-G2	B	33-42	1	
19D413163-G3	C	42-50	1	
19D413163-G4	B	25-33	2	
19D413163-G5	B	33-42	2	
19D413163-G6	C	42-50	2	
19D413163-G7	B	25-33	4	
19D413163-G8	B	33-42	4	
19D413163-G9	C	42-50	4	
19D413163-G10	B	23-33	1	X
19D413163-G11	B	33-42	1	X
19D413163-G12	C	42-50	1	X
19D413163-G13	B	25-33	2	X
19D413163-G14	B	33-42	2	X
19D413163-G15	B	42-50	2	X
19D413163-G16	B	25-33	4	X
19D413163-G17	B	33-42	4	X
19D413163 G18	B	42-50	4	X

NOTES:

1. DA JUMPER USED IN 1 FREQ ONLY. C10 USED IN 2 & 4 FREQ ONLY
2. R27 USED IN 1 FREQ ONLY. CR1 USED IN 2 & 4 FREQ ONLY.
3. DA JUMPER USED WITHOUT CHANNEL GUARD ONLY.

● USED WITH CHAN GUARD ONLY

(*) THESE COMPONENTS HAVE AN ADDITIONAL SUFFIX LETTER. SEE TABLE FOR APPROPRIATE LETTER, VALUE & FREQ SPLIT.

4. FOR MASTR IMPERIAL SINGLE FREQUENCY COMBINATIONS:
   - A. REMOVE C10 & REPLACE WITH DA WIRE.
   - B. REMOVE CR1 & REPLACE WITH R27, 30Ω 1/4 WATT RESISTOR.
   - C. RETURN C10 & CR1 TO STOCK.

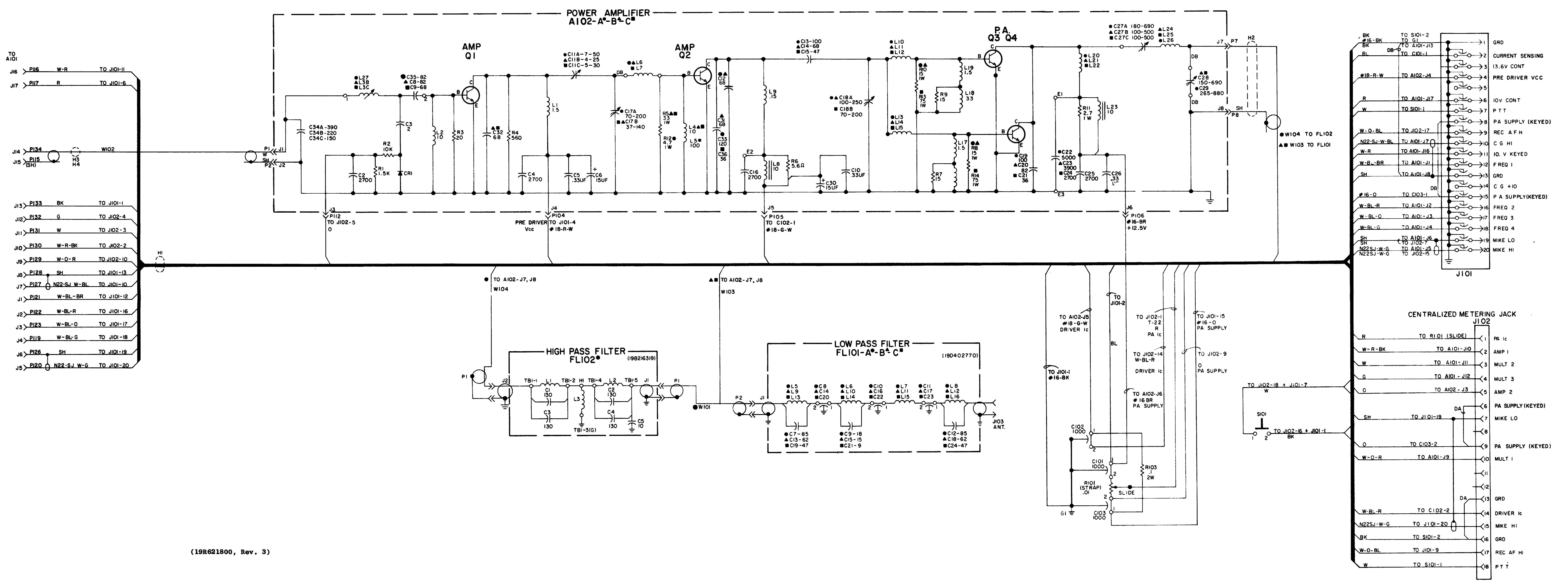
VOLTAGE READINGS

ALL VOLTAGES ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED TO GROUND WITH A 20,000 OHM-PER-VOLT METER. AN RF CHOKE (25 TO 50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS.

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 1/2 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.

(19B621245, Rev. 6)



(19B621800, Rev. 3)

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.

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
PL19D416555G1	
PL19D416555G2	
PL19D416555G3	

● USED IN 25-33 MHZ ONLY
▲ USED IN 33-42 MHZ ONLY
■ USED IN 42-50 MHZ ONLY

NOTES:

1. UNLESS OTHERWISE NOTED ALL WIRES ARE N22.
2. N22SJ-W-G WIRE IS A7134854P4. N22SJ-W-BL WIRE IS A7134854P5.
3. TERMINATE WIRES AT J101-PINS 1, 19 & 20 WITH 19A115793.

SCHEMATIC DIAGRAM

25-50 MHz, 50-WATT TRANSMITTER
TYPE KT-23-A

PARTS LIST

LBI-4411A

25-50 MHz TRANSMITTER
TYPE KT-25-A

SYMBOL	GE PART NO.	DESCRIPTION
A101A thru A101C		EXCITER BOARD A101A 19D413163G7 25-33 MHz A101B 19D413163G8 33-42 MHz A101C 19D413163G9 42-50 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116080P1	Polyester: 0.01 µF ±20%, 50 VDCW.
C2	7491385P111	Mica: Ceramic dim: 1500 pF ±10%, 500 VDCW; sim to RMC Type JL.
C4	5496367P9	Tantalum: 3.3 µF ±20%, 15 VDCW; sim to Sprague Type 150D.
C5	5491277P105	Variable, sub-miniature: approx 1.9-10.5 pf, 750 v peak; sim to EF Johnson 189.
C6	19C300685P93	Ceramic disc: 5 pF ±2%, 500 VDCW, temp coef 0 PPM.
C7*	19C300685P93	Ceramic disc: 5 pF ±2%, 500 VDCW, temp coef 0 PPM. Deleted in 19D413163G7, G8 by REV C. Deleted in 19D413163G9 by REV D.
C8	5496219P41	Ceramic disc: 10 pF ±0.25 pF, 500 VDCW, temp coef 0 PPM.
C9	5494481P111	Ceramic disc: 1000 pF ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C10	19A116080P5	Polyester: 0.047 µF ±20%, 50 VDCW.
C11	19A116080P6	Polyester: 0.068 µF ±20%, 50 VDCW.
C12 and C13	7491395P111	Ceramic disc: 1500 pF ±10%, 500 VDCW; sim to RMC Type JL.
C14	5496267P10	Tantalum: 22 µF ±20%, 15 VDCW; sim to Sprague Type 150D.
C15	19A116080P5	Polyester: 0.047 µF ±20%, 50 VDCW.
C16	5491277P105	Variable, sub-miniature: approx 1.9-10.5 pf, 750 v peak; sim to EF Johnson 189.
C17	19C300685P93	Ceramic disc: 5 pF ±2%, 500 VDCW, temp coef 0 PPM.
C18*	19C300685P93	Ceramic disc: 5 pF ±2%, 500 VDCW, temp coef 0 PPM. Deleted in 19D413163G7, G8 by REV C. Deleted in 19D413163G9 by REV D.
C19	5496219P41	Ceramic disc: 10 pF ±0.25 pF, 500 VDCW, temp coef 0 PPM.
C20	5491277P105	Variable, sub-miniature: approx 1.9-10.5 pf, 750 v peak; sim to EF Johnson 189.
C21	19C300685P93	Ceramic disc: 5 pF ±2%, 500 VDCW, temp coef 0 PPM.
C22*	19C300685P93	Ceramic disc: 5 pF ±2%, 500 VDCW, temp coef 0 PPM. Deleted in 19D413163G7, G8 by REV C. Deleted in 19D413163G9 by REV D.
C23	5496219P36	Ceramic disc: 8 pF ±0.25 pF, 500 VDCW, temp coef 0 PPM.
C24	5496372P178	Ceramic disc: 820 pF ±5%, 500 VDCW, temp coef -2300 PPM.
C25 and C26	5493367P1500K	Mica: 1500 pF ±10%, 100 VDCW; sim to Electro Motive Type DM-20.
C27	19A116080P7	Polyester: 0.1 µF ±20%, 50 VDCW.
C28	19A116080P5	Polyester: 0.047 µF ±20%, 50 VDCW.
C30	5496372P350	Ceramic disc: 220 pF ±5%, 500 VDCW, temp coef -4700 PPM.
C33A	7147203P4	Silver mica: 680 pF ±5%, 500 VDCW; sim to Electro Motive Type DM-20.
C34	5496372P350	Ceramic disc: 220 pF ±5%, 500 VDCW, temp coef -4700 PPM.
C35	5493369P150K	Mica: 150 pF ±10%, 100 VDCW; sim to Electro Motive Type DM-15.

SYMBOL	GE PART NO.	DESCRIPTION
C36	5493366P470K	Mica: 470 pF ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C37	5493366P390K	Mica: 390 pF ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C40	19A116080P5	Polyester: 0.047 µF ±20%, 50 VDCW.
C41	5493366P330K	Mica: 330 pF ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C42	5491271P105	Variable, sub-miniature: approx 1.9-10.5 pf, 750 v peak; sim to EF Johnson 189.
C43	19C300685P93	Ceramic disc: 5 pF ±2%, 500 VDCW, temp coef 0 PPM.
C44*	19C300685P93	Ceramic disc: 5 pF ±2%, 500 VDCW, temp coef 0 PPM. Deleted in 19D413163G7, G8 by REV C. Deleted in 19D413163G9 by REV D.
C45	5496219P36	Ceramic disc: 8 pF ±0.25 pF, 500 VDCW, temp coef 0 PPM.
C50	19B209243P1	Polyester: 0.01 µF ±20%, 50 VDCW.
C51	19A116080P7	Polyester: 0.1 µF ±20%, 50 VDCW.
C52A	5496219P363	Ceramic disc: 100 pF ±5%, 500 VDCW, temp coef -80 PPM.
C52B	5496219P364	Ceramic disc: 110 pF ±5%, 500 VDCW, temp coef -80 PPM.
C52C	5496219P262	Ceramic disc: 91 pF ±5%, 500 VDCW, temp coef -80 PPM.
C60 and C61	19A116080P1	Polyester: 0.01 µF ±20%, 50 VDCW.
C62A	5496219P262	Ceramic disc: 91 pF ±5%, 500 VDCW, temp coef -80 PPM.
C62B	5496219P263	Ceramic disc: 100 pF ±5%, 500 VDCW, temp coef -80 PPM.
C62C	5496219P261	Ceramic disc: 82 pF ±5%, 500 VDCW, temp coef -80 PPM.
C63A	5491601P124	Phenolic: 1.8 pF ±5%, 500 VDCW.
C63B	5491601P127	Phenolic: 2.4 pF ±5%, 500 VDCW.
C64A	5496219P262	Ceramic disc: 91 pF ±5%, 500 VDCW, temp coef -80 PPM.
C64B	5496219P264	Ceramic disc: 110 pF ±5%, 500 VDCW, temp coef -80 PPM.
C64C	5496219P261	Ceramic disc: 82 pF ±5%, 500 VDCW, temp coef -80 PPM.
C70	5494481P111	Ceramic disc: 1000 pF ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C71	19A116080P1	Polyester: 0.01 µF ±20%, 50 VDCW.
C72A	5496219P261	Ceramic disc: 82 pF ±5%, 500 VDCW, temp coef -80 PPM.
C72B	5496219P259	Ceramic disc: 68 pF ±5%, 500 VDCW, temp coef -80 PPM.
C73A	5496219P39	Ceramic disc: 8 pF ±0.25 pF, 500 VDCW, temp coef 0 PPM.
C73B	5496219P35	Ceramic disc: 4 pF ±0.25 pF, 500 VDCW, temp coef 0 PPM.
C73C	5491601P127	Phenolic: 2.4 pF ±5%, 500 VDCW.
C74A	5496219P261	Ceramic disc: 82 pF ±5%, 500 VDCW, temp coef -80 PPM.
C74B	5496219P260	Ceramic disc: 75 pF ±5%, 500 VDCW, temp coef -80 PPM.
C74C	5496219P254	Ceramic disc: 43 pF ±5%, 500 VDCW, temp coef -80 PPM.
C80 and C81	5494481P111	Ceramic disc: 1000 pF ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C82	19A116080P1	Polyester: 0.01 µF ±20%, 50 VDCW.
C83A	5496219P255	Ceramic disc: 47 pF ±5%, 500 VDCW, temp coef -80 PPM.
C83B and C83C	5496219P250	Ceramic disc: 30 pF ±5%, 500 VDCW, temp coef
C85	19A116080P7	Polyester: 0.1 µF ±20%, 50 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 thru CR4	19A115603P1	Silicon.
CV1 and CV2	5495709P8	Varactor, silicon: 33 pF ±20% at 4 VDC; sim to Pacific Semiconductors Varicap Type V-500.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J17	4033513P4	Contact, electrical: sim to Bead Chain L83-3.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
L1	7488079P48	Choke, RF: 27 µh ±10%, 1.40 ohms DC res max; sim to Jeffers 4423-9K.
L2A	19D403808G15	Coil. Includes tuning slug 5491798P1.
L2B	19D403808G16	Coil. Includes tuning slug 5491798P1.
L2C	19D403808G17	Coil. Includes tuning slug 5491798P1.
L3A	19D403808G15	Coil. Includes tuning slug 5491798P1.
L3B	19D403808G16	Coil. Includes tuning slug 5491798P1.
L3C	19D403808G17	Coil. Includes tuning slug 5491798P1.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q3	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q4	19A115330P1	Silicon, NPN.
Q5	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q6 thru Q9	19A115330P1	Silicon, NPN.
Q10 and Q11	19A116201P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P154K	Composition: 0.15 megohm ±10%, 1/2 w.
R2	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R3	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R5	3R77P681K	Composition: 680 ohms ±10%, 1/2 w.
R6	3R77P104K	Composition: 0.10 megohm ±10%, 1/2 w.
R7	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R8	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R9 and R10	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R11	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R12	3R77P623J	Composition: 62,000 ohms ±5%, 1/2 w.
R13	3R77P124K	Composition: 0.12 megohm ±10%, 1/2 w.
R14	3R77P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R15	3R77P470K	Composition: 47 ohms ±10%, 1/2 w.
R16	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R17	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R18	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R19	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R20 and R21	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R22	3R77P681K	Composition: 680 ohms ±10%, 1/2 w.
R23	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R24	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R25	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R26	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R30	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R31	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R32	3R77P126J	Composition: 0.12 megohm ±5%, 1/2 w.
R33	3R77P563K	Composition: 56,000 ohms ±10%, 1/2 w.
R34	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R40 and R41	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R42	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R43	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R44	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R46 thru R48	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R50	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R51	3R77P330K	Composition: 33 ohms ±10%, 1/2 w.
R52A	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R52B	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R52C	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R60	3R77P131K	Composition: 130 ohms ±10%, 1/2 w.
R61	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R62A	3R77P273K	Composition: 27,000 ohms ±10%, 1/2 w.
R62B	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R62C	3R77P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R70	3R77P680K	Composition: 68 ohms ±10%, 1/2 w.
R71	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R72A	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R72B	3R77P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R72C	3R77P273K	Composition: 27,000 ohms ±10%, 1/2 w.
R80 and R81	3R77P470K	Composition: 47 ohms ±10%, 1/2 w.
R91A	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R92B	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R92C	3R77P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R93	3R77P100K	Composition: 10 ohms ±10%, 1/2 w.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT1A	19B209284P12	Disc: 600 ohms DC res; sim to GE 16G2134.
RT1B	19B209284P9	Disc: 330 ohms DC res; sim to GE 16G3119.
RT2*	19B209284P13	Rod: 3200 ohms DC res; sim to GE 18I126. Deleted in 19D413163G7, G8 by REV C. Deleted in 19D413163G9 by REV D.
RT3A	19B209284P12	Disc: 600 ohms DC res; sim to GE 16G2134.
RT3B	19B209284P9	Disc: 330 ohms DC res; sim to GE 16G3119.
RT4*	19B209284P13	Rod: 3200 ohms DC res; sim to GE 18I126. Deleted in 19D413163G7, G8 by REV C. Deleted in 19D413163G9 by REV D.
RT5A	19B209284P12	Disc: 600 ohms DC res; sim to GE 16G2134.
RT5B	19B209284P9	Disc: 330 ohms DC res; sim to GE 16G3119.
RT6*	19B209284P13	Rod: 3200 ohms DC res; sim to GE 18I126. Deleted in 19D413163G7, G8 by REV C. Deleted in 19D413163G9 by REV D.
RT7A	19B209284P12	Disc: 600 ohms DC res; sim to GE 16G2134.
RT7B	19B209284P9	Disc: 330 ohms DC res; sim to GE 16G3119.
RT8*	19B209284P13	Rod: 3200 ohms DC res; sim to GE 18I126. Deleted in 19D413163G7, G8 by REV C. Deleted in 19D413163G9 by REV D.
RT9	5490828P60	Thermistor: 10,000 ohms ±10%, color code red and white; sim to Global Type 7B3B.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1A	19D402808G1	Coil. Includes tuning slug 5491798P2.
T1B	19D402808G2	Coil. Includes tuning slug 5491798P2.
T1C	19D402808G3	Coil. Includes tuning slug 5491798P2.
T2A	19D402808G4	Coil. Includes tuning slug 5491798P2.
T2B	19D402808G5	Coil. Includes tuning slug 5491798P2.
T2C	19D402808G6	Coil. Includes tuning slug 5491798P2.
T3A	19D403808G7	Coil. Includes tuning slug 5491798P2.
T3B	19D403808G8	Coil. Includes tuning slug 5491798P2.
T3C	19D403808G9	Coil. Includes tuning slug 5491798P2.
T4A	19D403808G10	Coil. Includes tuning slug 5491798P2.
T4B	19D403808G11	Coil. Includes tuning slug 5491798P2.
T4C	19D403808G12	Coil. Includes tuning slug 5491798P2.
T5A R95	19D403808G13 3R152P230K	Coil. Includes tuning slug 5491798P2. Composition: 22 ohms ±10%, 1/4 w.
T5B R95	19D403808G14 3R152P230K	Coil. Includes tuning slug 5491798P2. Composition: 22 ohms ±10%, 1/4 w.
T6A	19D402808G18	Coil. Includes tuning slug 5491798P2.
T6B	19D402808G19	Coil. Includes tuning slug 5491798P2.
T6C	19D403808G20	Coil. Includes tuning slug 5491798P2.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY1 thru XY4		(See Mechanical Parts, MC-2396).
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact frequency needed.
		Crystal freq = Oper. Freq / 12
Y1 thru Y4	19B206175P1	Quartz: freq range 2083 to 2750 KHz, temp range -30°C to +85°C. (25-33 MHz)
Y1 thru Y4	19B206175P2	Quartz: freq range 2750 to 3500 KHz, temp range -30°C to +85°C. (33-42 MHz)
Y1 thru Y4	19B206175P3	Quartz: freq range 3500 to 4500 KHz, temp range -30°C to +85°C. (42-50 MHz)
A102A thru A102C		PA BOARD A102A 19D415099G3 25-33 MHz A102B 19D415099G5 33-42 MHz A102C 19D415099G7 42-50 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2	19A116655P21	Ceramic disc: 2700 pF ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C3	5491501P25	Phenolic: 2.0 pF ±10%, 500 VDCW.
C4	19A116655P21	Ceramic disc: 2700 pF ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C5	19A116080P10	Polyester: 0.33 µF ±20%, 50 VDCW.
C6	5496267P14	Tantalum: 15 µF ±20%, 20 VDCW; sim to Sprague Type 150D.
C8		Part of L3B.
C9		Part of L3C.
C10	19A116080P10	Polyester: 0.33 µF ±20%, 50 VDCW.
C11A	19B209408P103	Variable, mica: 7-50 pF, 400 VDCW.
C11B	19B209408P102	Variable, mica: 4-25 pF, 400 VDCW.
C11C	19B209408P103	Variable, mica: 7-50 pF, 400 VDCW.
C12	19A116656P68K0	Ceramic disc: 68 pF ±10%, 500 VDCW, temp coef 0 PPM.
C13	7484398P11	Silver mica: 100 pF ±10%, 500 VDCW; sim to Underwood Type J18F.

SYMBOL	GE PART NO.	DESCRIPTION
C14	7484398P10	Silver mica: 68 pF ±10%, 500 VDCW; sim to Underwood Type J18F.
C15	7484398P2	Silver mica: 47 pF ±10%, 500 VDCW; sim to Underwood Type J18F.
C16	5494481P27	Ceramic disc: 2700 pF ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C17A	19B209408P106	Variable, mica: 70-200 pF, 400 VDCW.
C17B	19B209408P106	Variable, mica: 37-140 pF, 400 VDCW.
C18A	19B209408P110	Variable, mica: 100-350 pF, 400 VDCW.
C18B	19B209408P108	Variable, mica: 70-200 pF, 400 VDCW.
C19	5496218P21	Ceramic disc: 100 pF ±10%, 500 VDCW, temp coef 0 PPM.
C20	5496218P20	Ceramic disc: 82 pF ±10%, 500 VDCW, temp coef 0 PPM.
C21	5496218P52	Ceramic disc: 36 pF ±5%, 500 VDCW, temp coef 0 PPM.
C22	5494481P26	Ceramic disc: 5000 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C23	5494481P30	Ceramic disc: 3900 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C24	5494481P28	Ceramic disc: 2700 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C25	19A116655P21	Ceramic disc: 2700 pF ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C26	19A116080P10	Polyester: 0.33 µF ±20%, 50 VDCW.
C27A	19A115917P005	Variable, compression mica: 180-690 pF, 500 VDCW; sim to Electro Motive Type 30 W.
C27B and C27C	19A115917P004	Variable, compression mica: 100-500 pF, 500 VDCW; sim to Electro Motive Type 30 W.
C28	19A115917P005	Variable, compression mica: 180-690 pF, 500 VDCW; sim to Electro Motive Type 30 W.
C29	19A115917P006	Variable, compression mica: 265-880 pF, 500 VDCW; sim to Electro Motive Type 30 W.
C30	5496267P14	Tantalum: 15 µF ±20%, 20 VDCW; sim to Sprague Type 150D.
C31 and C32	19A116656P68K0	Ceramic disc: 68 pF ±10%, 500 VDCW, temp coef 0 PPM.
C33	19A116656P120K0	Ceramic disc: 120 pF ±10%, 500 VDCW, temp coef 0 PPM.
C34A	7489162P141	Silver mica: 390 pF ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C34B	7489162P135	Silver mica: 220 pF ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C34C	7489162P31	Silver mica: 150 pF ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C35		(Part of L27).
C36	19A116656P36J0	Ceramic disc: 36 pF ±5%, 500 VDCW, temp coef 0 PPM.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A115250P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J5	4033513P4	Contact, electrical: sim to Bead Chain L83-3.
J6	4033513P2	Contact, electrical: sim to Bead Chain L83-2.
J7 and J8	4033513P4	Contact, electrical: sim to Bead Chain L83-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	7488079P7	Choke, RF: 1.50 µh ±10%, 0.50 ohms DC res max; sim to Jeffers 4411-10K.
L2	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.

SYMBOL	GE PART NO.	DESCRIPTION
L3B		COIL ASSEMBLY 19D413121G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C8	7489162P25	Silver mica: 82 pF ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
L3C	5491798P2	Tuning slug. COIL ASSEMBLY 19D413121G2
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C9	7489162P33	Silver mica: 68 pF ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C101 thru C103	5493392P7	Ceramic: feed-thru: 1000 pF ±100%-0%, 500 VDCW; sim to Allen Bradley Type FA2.
FL1	19B205286G	Tone Detector. (Check group numbers for desired frequency).
	19B205286G1	CHASSIS G2 71.9 Hz G3 77.0 Hz G4 82.5 Hz G5 88.5 Hz G6 94.8 Hz G7 100.0 Hz G8 103.5 Hz G9 110.9 Hz G10 118.8 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 G30 76.6 Hz G31 79.7 Hz G32 82.9 Hz G33 87.5 Hz G34 97.4 Hz
FL101A	19D402770G2	Filter: 25-33 MHz.
FL101B	19D402770G3	Filter: 33-42 MHz.
FL101C	19D402770G4	Filter: 42-50 MHz.
FL102	19D216319G2	Filter.
		- - - - - - - JACKS AND RECEPTACLES - - - - -
J101	19C303426G1	Connector: 20 pin contacts.
J102	19B205689G1	Connector: 18 pin contacts.
J103		(Part of FL101A-FL101C).
		- - - - - - - - - - PLUGS - - - - - - - - - -
P104 and P105	402894G91	Contact, electrical: sim to AMP 41854.
P106	19B209151P1	Terminal, solderless.
P112	402894G91	Contact, electrical: sim to AMP 41854.
P117	402894G91	Contact, electrical: sim to AMP 41854.
P119 thru P121	402894G91	Contact, electrical: sim to AMP 41854.
P122	402894G92	Contact, electrical: sim to AMP 42927-2.
P123	402894G91	Contact, electrical: sim to AMP 41854.
P126 thru P128	402894G91	Contact, electrical: sim to AMP 41854.

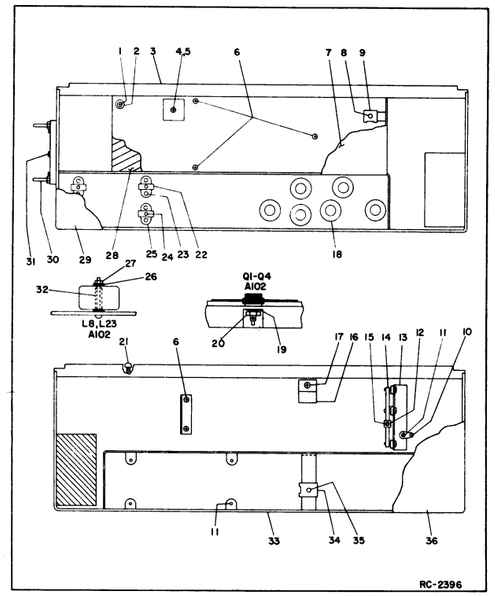
SYMBOL	GE PART NO.	DESCRIPTION
R11	5490305P15	Composition: 2.7 ohms ±10%, 1 w.
R12	5490305P8	Composition: 4.7 ohms ±5%, 1 w.
R13 and R14	3R78P75GJ	Composition: 75 ohms ±5%, 1 w.

(Cont'd on Page 13)

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

LBI-4411A (Cont'd from Page 12)

SYMBOL	GE PART NO.	DESCRIPTION
P129	4029840P2	Contact, electrical: sim to Amp 42827-2.
P130 thru P134	4029840P1	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R101		Includes:
	19A127071P1	Strap.
	19A127073P1	Slide.
R103	19B209022P89	Wirewound: 0.1 ohm ±5%, 2 w; sim to IRC Type BWH.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S101	4031922P1	Push: SPST, normally open, 1/2 amp at 12 VDC; sim to Stackpole Type SS-15.
		- - - - - - - - - - CABLES - - - - - - - - - -
W101	5491689P83	RF: 500 VDC. Includes 5 inch cable (19B209044P19).
W102	19A127143G3	RF: approx 16 inches. Includes:
	4029840P2	Contact, electrical: sim to Amp 42827-2.
	4029840P1	Contact, electrical: sim to AMP 41854.
W103	19A121948G2	Cable, RF: approx 6-1/2 inches long. Includes (P2, P7, and P8).
W104	19A121948G3	Cable, RF: approx 10 inches long. Includes (P1, P7, and P8).
		HARNESS ASSEMBLY 19D416555G7 (Includes J101, J102, P104-P106, P112, P117, P119-P123, P126-P134, W104).
		CHANNEL GUARD MODIFICATION 19A122552G1 25-33 MHz 19A122552G2 33-50 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C33B	5490008P143	Silver mica: 470 pf ±10%, 300 VDCW; sim to Electro Motive Type DM-15.
C38	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C39	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - - - - RESISTORS - - - - - - - -
R35	19B209358P107	Variable, carbon film: approx 75 to 25,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R36	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
		MECHANICAL PARTS (SEE RC-2396)
1	19B201074P208	Tap screw: No. 4-40 x 1/2.
2	19A122092P3	Stop.
3	19C311781P1	Heat sink.
4	7115130P6	Lockwasher: sim to Shakeproof 1214.
5	4032272P4	Hexnut, brass: No. 1/4-40. (Located on far side of C27 and C28).
6	19B201074P205	Tap screw: No. 4-40 x 5/16.
7	19B216290G2	Cover.
8	N113P1306C	Tap screw: No. 6-18 x 3/8.
9	7160861P16	Nut, sheet spring: sim to Tinnerman C8091-632-157.
10	4036994P1	Terminal, solder: sim to Zierick Mfg Corp 505.
11	19B201074P304	Tap screw: 6-32 x 1/4.
12	19A127073P1	Slide. (Part of R101).
13	19A122827P2	Angle.
14	19A127071P1	Strap. (Part of R101).
15	N44P9005C13	Machine screw: No. 4-40 x 5/16.
16	19A127296P1	Support.
17	N84P9004C6	Screw: No. 4-40 x 1/4.
18	19A122826P1	Can. (Used with T1-T6 on A101).
19	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-20.
20	N210P15C6	Hexnut: No. 8-32. (Used with Q1-Q4 on A102).
21	N170P16006P2	Cap screw: No. 10-32 x 3/8. (Secures heat sink to chassis).
22	4033089P1	Clip, spring tension. (Part of XY1-XY4).
23	19A115793P1	Contact, electrical: sim to Malco 2700. (Part of XY1-XY4).
24	19B200525P9	Rivet. (Part of XY1-XY4).
25	19C311172P2	Crystal socket. (Part of XY1-XY4).
26	7147306P2	Insulated bushing: sim to H.H. Smith Inc 2150. (Used with L8, L23 on A102).
27	7141225P3	Hex nut: No. 6-32. (Used with L8, L23 on A102).
28	19C311816G2	Heat sink. (Used with A102).
29	19C303396G1	Mobile Top Cover.
	19C303495G8	Station Top Cover. (Except Repeaters and VM).
	19C303673G3	Station Top Cover. (Repeaters and VM only).
30	19A121676P1	Guide pin.
31	19A115793P1	Contact, electrical: sim to Malco 2700. (Located on C103, J101).
32	7150727P14	Tubing vinyl. (Specify length when ordering).
33	19B205206G5	Chassis.
34	7160861P4	Nut, sheet spring: sim to Tinnerman C6452-8Z-67.
35	N115P1508C13	Flathead screw: No. 8-18 x 1/2. (Secures bottom cover).
36	19C303396G3	Mobile Bottom Cover.
	19C303495G7	Station Bottom Cover.



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 & B - Exciter Board 19D413163G1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 15, 16, 17, 18

Incorporated into initial shipment.

REV. A thru C - Exciter Board 19D413163G3, 6, 9, 12

Incorporated into initial shipment.

REV. D - To improve temperature compensation. Deleted C7, C18, C22, C44, RT2, RT4, RT6, RT8.

REV. C - Exciter Board 19D413163G1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 15, 16, 17, 18

To improve temperature compensation. Deleted C7, C18, C22, C44, RT2, RT4, RT6, RT8.

PARTS LIST

LBI-3938C

CHANNEL GUARD ENCODER
MODEL 4EH18A10
19B216161G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C2	19B209243P15	Polyester: 0.22 µf ±20%, 250 VDCW.
C3	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 and CR2	5494922P1	Silicon.
		- - - - - - - - - TONE NETWORKS - - - - - - - - -
FL1	19B205280	Tone Detector. (Check group numbers for desired frequency).
	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 J4	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 thru Q3	19A115362P1	Silicon, NPN; sim to Type 2N2925.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P244J	Composition: .24 megohm ±5%, 1/2 w.
R2	3R77P682J	Composition: 6800 ohms ±5%, 1/2 w.
R3	19A116278P233	Metal film: 2150 ohms ±2%, 1/2 w.
R4	19A116278P65	Metal film: 46.4 ohms ±2%, 1/2 w.
R5	19A116278P301	Metal film: 10,000 ohms ±2%, 1/2 w.
R6	19A116278P329	Metal film: 19,600 ohms ±2%, 1/2 w.
R7	19A116278P412	Metal film: 0.13 megohm ±2%, 1/2 w.
R8	19A116278P285	Metal film: 7500 ohms ±2%, 1/2 w.
R9	19A116278P117	Metal film: 147 ohms ±2%, 1/2 w.
R10	19A116278P269	Metal film: 5110 ohms ±2%, 1/2 w.
R11	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
R12	19A116278P365	Metal film: 46,400 ohms ±2%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - THERMISTORS - - - - - - - - -
RT1	5490828P36	Thermistor: 55,000 ohms ±10%, color code black/red; sim to Globar Type 723-B.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	19A121920G3	Cable assembly. Includes socket (XFL1), approx 4.25 inches long.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XFL1		(Part of W1).
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B216186G1	Cable assembly. (Connects to J1 thru J4).
	4029840P2	Contact, electrical: sim to Amp 42827-2. (Connects to J1, J3, J4).
	4029840P1	Contact, electrical: sim to AMP 41854. (Connects to J2).

*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 GE Part Number.

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

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

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

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

DF-3153

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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