MOBILE RADIO

LBI30819A
(DF3163)
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DESCRIPTION AND MAINTENANCE

406-512 MHz MASTR® EXECUTIVE II TRANSMITTER

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DESCRIPTION

MASTR® Executive II transmitters are crystal controlled, phase modulated transmitters designed for single frequency operation in the 406-512 MHz frequency bands. This solid state, high reliability transmitter uses one integrated circuit and discrete components to provide 300 milliwatts of transmitted RF power. The transmitter consists of:

- Exciter Board; with audio, modulator, amplifier and multiplier stages.
- Power Amplifier/Antenna Switch Assembly; with PA Final Solid State antenna switch and low pass filter assembly.

Figure 1 is a block diagram of the 406-512 MHz MASTR Executive II transmitter, showing the exciter, power amplifier/ antenna switch assembly.

The exciter contains the oscillator, audio IC, modulator and multipliers to provide 200 milliwatts of modulated RF power to the power amplifier.

The power amplifier/antenna switch assembly includes a single transistor stage to provide rated output power, a solid state switch to switch the antenna between the transmitter and receiver and a low pass filter with a 20 dB pad for connecting the antenna to the optional mobile detector.

MAINTENANCE

DISASSEMBLY

To service the transmitter, remove the two retaining screws from the front cap assembly and pull radio out of case assembly.

To remove Exciter Board:

1. Unplug cable W216 (exciter output).
2. Remove the six screws holding the Exciter Board to the mounting frame and gently lift Exciter Board out of radio.

To remove the PA Board:

NOTE

The PA heat sink assembly pivots 90° to permit access to the PA board.

1. Remove screws holding hinged PA heat sink to swing down PA heat sink.
2. Remove PA top cover and unplug the exciter/PA cable W216; unsolder the PA/low pass filter cable W214 from H9 and shield from ground.
3. Unplug receiver/PA cable W217; unplug power cable W215 from System Board.

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4. Remove screws and cable clamps on W215, W216 and W217.

5. Remove the four PA Board mounting screws and lift the board out.

TROUBLESHOOTING

A Troubleshooting Procedure, including QUICK CHECKS, permits rapid fault location in the exciter and power amplifier.

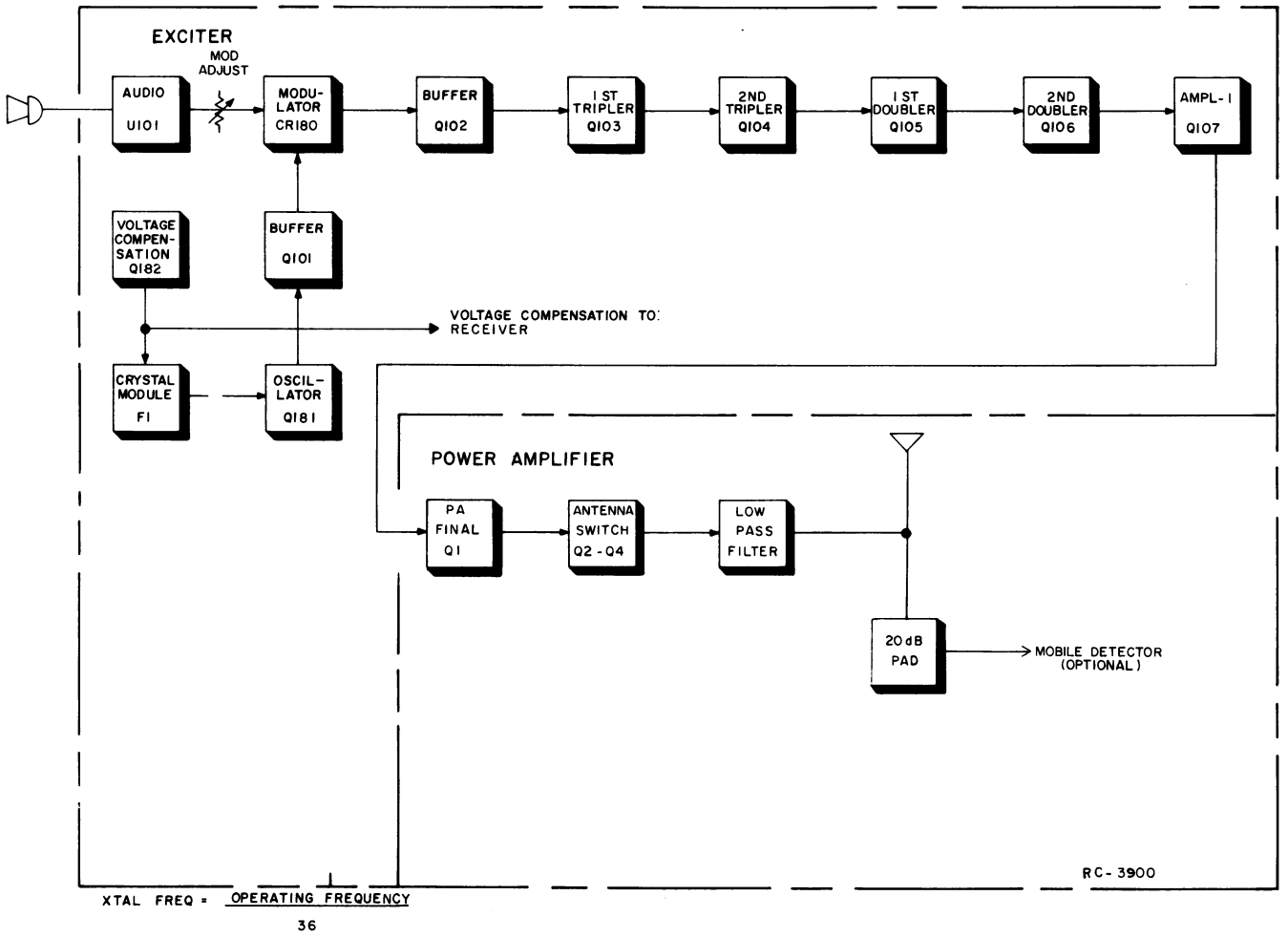

Figure 1 - Transmitter Block Diagram

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WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

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CAUTION

Before bench testing the radio, be sure of the output voltage characteristics of your bench power supply.

To protect the transmitter power output transistors from possible instant destruction, the following input voltages must not be exceeded:

Transmitter unkeyed: 20 Volts
Transmitter keyed (50 ohms resistive load): 18 Volts
Transmitter keyed (no load or non-resistive load): 15.5 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limits shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 18 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages.

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST R104 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. Audio oscillator
2. A frequency modulation monitor
3. An output meter or Voltmeter

PROCEDURE

1. Connect the audio oscillator and meter across P902-4 (Mic Hi) through a 0.5 microfarad (or larger) DC blocking capacitor and P902-5 (Mic Lo) on the Exciter Board.
2. Adjust the audio oscillator for 1 Volt RMS at 1000 Hz. Adjust R3 on Vehicular Repeater System board maximum clockwise.
3. Key transmitter by placing a ground on test point TP17 on the System Board.

DEVIATION ADJUSTMENT

1. Set MOD ADJUST control (R104) for a 4.75 kHz swing with the deviation polarity which gives the highest reading as indicated on the frequency modulation monitor.

   NOTE

   If the deviation reading plus (+) or minus (-) differs more than 0.5 kHz, recheck Step 1 as shown in the Transmitter Alignment Chart.

2. Reduce level of R3 to obtain 3 kHz deviation.

CRYSTAL MODULE FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency should be set using a frequency meter or counter with an absolute accuracy that is 5 to 10 times better than the tolerance to be maintained, and with the entire radio as near as possible to an ambient temperature of 30°C (86°F).

The oscillator should be reset only when the frequency shows deviation in excess of the following limits:

A. ±0.6 PPM, when the radio is at 30°C (86°F).

B. ±5 PPM at any other temperature within the range of -30°C to +75°C (-22°F to +167°F).

If an adjustment is required, proceed as follows:

If the radio is at an ambient temperature of 30°C (86°F), set the oscillator for correct operating frequency.

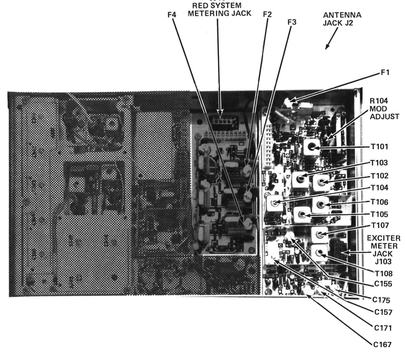
If the radio is not at an ambient temperature of 30°C, setting errors can be minimized as follows:

A. To hold the setting error to ±0.6 PPM (which is considered reasonably for 5 PPM crystal oscillators):

   1. Maintain the radio at 30°C and set the oscillator to desired frequency, or
   2. Maintain the radio at 30°C (+5°C, -15°C) offset the operating frequency as a function of actual temperature, by the amount shown in Figure 2.

For example: Assume the ambient temperature of the radio is 20°C (68°F). At that temperature, the curve shows a correction factor of 675 Hz.

Set C3 on the selected crystal module for a reading of 675 Hz higher than the licensed operating frequency. If a negative correction factor is obtained (at temperatures above 30°C), set the oscillator for the indicated frequency lower than the licensed operating frequency.



TRANSMITTER ALIGNMENT

EQUIPMENT

1. GE Test Set Model 4EX3A11 or Test Kit 4EX8K12.
2. A 50 ohm wattmeter connected to antenna jack J2.
3. A frequency counter.
4. Deviation Monitor.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal module on Exciter Board (crystal frequency = operating frequency ÷ 36).
2. For a badly mis-aligned transmitter, preset all slugs to the top of the coil form.
3. Set output impedance matching capacitor to 1/4 mesh.
4. Set all other air variable capacitors to minimum capacity (not meshed).
5. Connect the black plug to the Exciter metering jack. Set the polarity to +, and set the range to the Test 1 position (1 Volt position for 4EX8K12) for all adjustments.
6. All adjustments are made with the transmitter keyed.

NOTE

When the need for minor adjustments to the transmitter are indicated, perform steps 13 through 17 for a quick transmitter tune-up.

ALIGNMENT PROCEDURE

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
				NOTE: When aligning transmitter, proceed as instructed below. DO NOT retune a previously tuned control unless specifically directed to do so.
1.	B (MULT-1)	T101, T102 & T103	See Procedure	Tune T101 for maximum meter reading. Then tune T102 for a dip (small) in meter reading and tune T103 for maximum meter reading.
2.	C (MULT-2)	T104 and T105	See Procedure	Tune T104 for maximum meter reading, then tune T105 for a dip (small) in meter reading.
3.	D (MULT-3)	T106 and T107	See Procedure	Tune T106 for maximum meter reading and then tune T107 for a dip in meter reading.
4.	F (MULT-4)	T108 and C155	See Procedure	Tune T108 for maximum meter reading and then tune C155 for a dip in meter reading.
5.	G (AMPL-1)	C157 and C167	See Procedure	Tune C157 for maximum meter reading, and then tune C167 for a dip in meter reading.
6.	A (Rel. Power Out)	C171 and C175	Maximum	Tune C171 and then C175 for maximum meter reading.
7.	B (MULT-1)	T101	Maximum	Tune T101 for maximum meter reading.
8.	C (MULT-2)	T102, T103 & T104	Maximum	In order, tune T102, T103 and T104 for maximum meter reading.
9.	D (MULT-3)	T105 and T106	Maximum	Tune T105 and then T106 for maximum meter reading.
10.	F (MULT-4)	T107 and T108	Maximum	Tune T107 and then T108 for maximum meter reading.
11.	G (AMPL-1)	C155 and C157	Maximum	Tune C155 and then C157 for maximum meter reading.
12.	A (Rel. Power Out)	C167, C171 & C175	Maximum	In order, tune C167, C171 and C175 for maximum meter reading.
				NOTE: A quick transmitter tune-up procedure is provided in steps 13 through 17.
13.	C (MULT-2)	T102, T103 and T104	Maximum	Alternately tune T102, T103 and T104 for maximum meter reading.
14.	D (MULT-3)	T105 and T106	Maximum	Alternately tune T105 and T106 for maximum meter reading.
15.	F (MULT-4)	T107 and T108	Maximum	Alternately tune T107 and T108 for maximum meter reading.
16.	G (AMPL-1)	C155 and C157	Maximum	Alternately tune C155 and C157 for maximum meter reading. For optimum operation repeat steps 13 through 16.
17.	A (Rel. Power Out)	C167, C171 and C175	Maximum	Alternately tune C155, C171 and C175 for maximum meter reading on wattmeter.

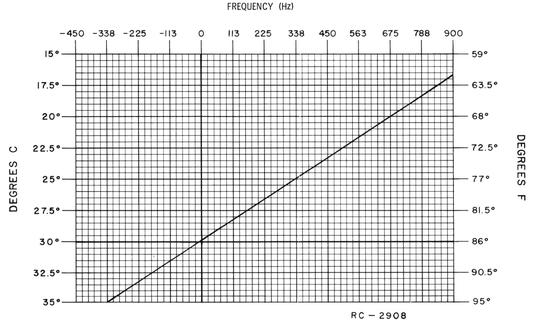
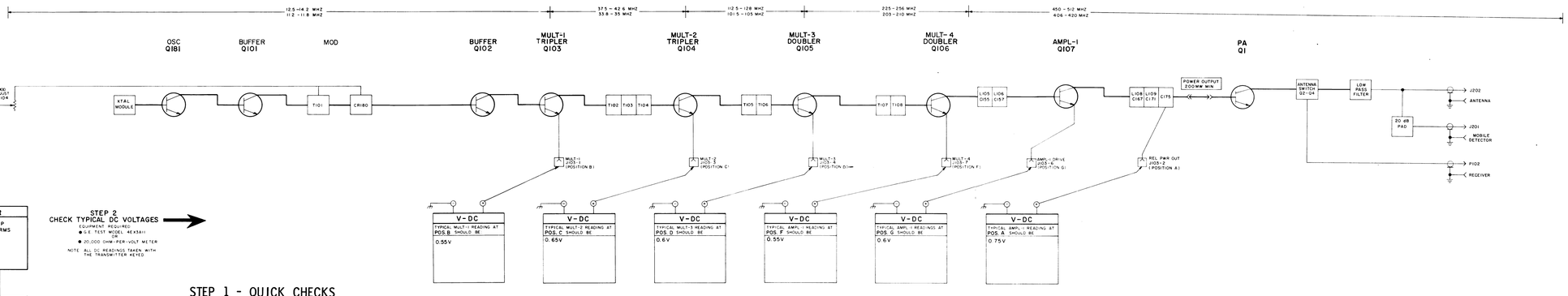


Figure 2 - Frequency Offset Chart



STEP 1 - QUICK CHECKS

METER POSITION GE TEST SET	PROBABLE DEFECTIVE STAGE		
	HIGH METER READING	LOW METER READING	ZERO METER READING
EXCITER			
B (MULT-1)	Q102, Q103, T102	Q102, Q103 T102	Q102, Q103, T102
C (MULT-2)	Q104, T105	T102, T103, Q104, T104	T102, T104, Q104, T105, T103
D (MULT-3)	Q105, T107	T105, T106, Q105	T105, T106, Q105, T107
F (MULT-4)	Q106, C155	Q106, T107, T108	Q106, T107, T108, L104
G (AMPL-1)	Q107, L113	Q107, C155-C157	Q107, C155-C157, L107
A (Power Out)	W216	CR181, C190 Q107	CR181, C190, Q107, C167, C171, C175

TROUBLESHOOTING PROCEDURE

406—512 MHz, MASTR EXECUTIVE II
300 MILLIWATT TRANSMITTER