DESCRIPTION AND MAINTENANCE
851-870 MHz, 100 WATT MASTR II STATION TRANSMITTER
19D901841G2

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ILLUSTRATIONS

DESCRIPTION

The 851-870 MHz, 100 Watt MASTR II transmitter is a crystal controlled, phase modulated transmitter designed for single frequency operation. The transmitter utilizes both integrated circuit (ICs) and discrete components and consists of the following modules:

- Exciter Board; with audio, modulator, amplifier and multiplier stages.
- Power Amplifier; with or without Antenna Relay.

Figure 1 is a Block Diagram of the 851-870 MHz MASTR II transmitter, showing the exciter, and the Power Amplifier assemblies.

The Exciter contains the ± 1 PPM Integrated Circuit Oscillator Module (ICOM), audio processor, modulator and multipliers to provide the station operating frequency.

The PA assembly uses 3 RF amplifier stages to drive a two transistor power output circuit. Each stage employs matching networks consisting of discrete components and strip line technology. The RF output power is fed to the antenna through a circulator containing a low pass filter.

The PA assembly includes a power control module. The power control module permits adjusting the power output over a range of 10 to 100 watts. R11 located on the power control board sets the output level. Three additional adjustments are located on the control board: R2, RS, and R8. These adjustments are not used in GE MARC applications.

CAUTION

The power adjust must be set for rated output only.

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A directional coupler is used to monitor the output power. The coupler output voltage is compared with the output of U1 which in turn controls the collector voltage of driver stages Q1 and Q2. The coupler voltage can be used as a power output level indication when properly calibrated. The feedthrough capacitor CS located on W3A1 is a convenient place to measure the control voltage.

MAINTENANCE

DISASSEMBLY

For a more complete mechanical parts breakdown, refer to the station MAINTENANCE MANUAL. To service the transmitter exciter from the front of the station:

1. Turn the two latching knobs on the front of the radio housing counterclockwise to unlatch the radio housing front door.

2. Swing the door down.

3. Remove cover from the radio housing.

To remove Exciter Board:

1. Unplug the cables P101 and J902 from the exciter.

2. Remove the four screws and two stand-offs holding the exciter board to the mounting frame and gently lift the exciter board out of the radio.

Power Amplifier Assembly Removal and Replacement

NOTE

Component placement and connections on the printed wire board are very critical on the PA. For this reason, it is recommended that the entire PA assembly be returned to the factory for servicing.

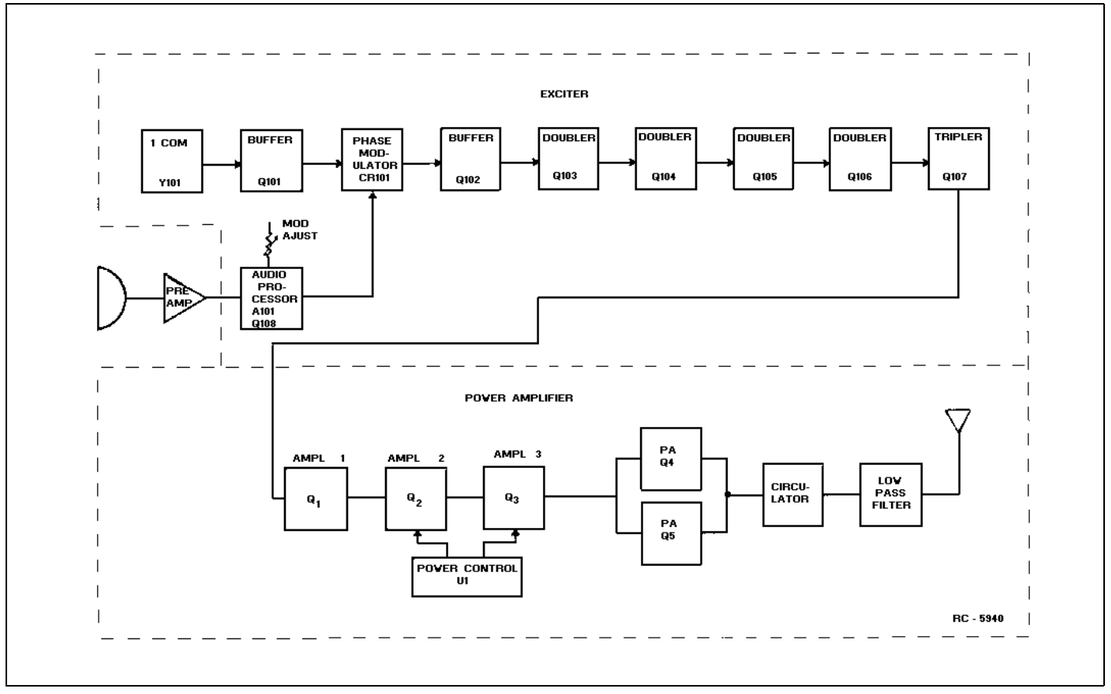

Figure 1 - Block Diagram

WARNING

The 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 escaping dust may be hazardous if inhaled. Be extremely careful to avoid damaging transistors when working with the PA Assembly.

PA Assembly Removal and Replacement

To remove PA assembly:

1. Disconnect the PA RF input cable from J1.

2. Disconnect the Antenna cable from J2.

3. Disconnect the Red and Black DC input power leads.

4. Remove the six screws securing the PA Assembly to the rack and remove the PA assembly.

To replace the PA assembly, perform the above procedure in reverse order.

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST control (R1 03) was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75 percent 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. Voltmeter

4. GE Test Set Model 4EX3A11 or 4EX8K12

5. Frequency Counter

6. Oscilloscope

7. 50 ohm Wattmeter

PROCEDURE

1. Connect the audio oscillator and the meter across audio input terminals J10 (Green-Hi) and J11 (Black-Lo) on GE Test Set, and connect red Test Set plug to the System red metering plug. If not using GE Test Set, connect audio oscillator and meter across P902-6 (Mike-High) through 0.5 microfarad (or larger) DC blocking capacitor, and P902-5 (Mike-Low) on the System Board.

2. Adjust the audio oscillator for 1 Volt RMS at 1000 Hz.

3. For NPSPAC transmitters without Channel Guard set MOD ADJUST R103 for ±4.0 kHz deviation.

4. For NPSPAC transmitters with Channel Guard, set MOD ADJUST R103 for ±3.25 kHz deviation and set Channel Guard MOD ADJUST R102 for ±0.75 Hz tone deviation.

Type	R103	R102
Non Channel Guard	± 4.5 kHz	
Channel Guard	± 3.7 kHz	± 0.75 kHz
NPSPAC, Non Channel Guard	± 4.0 kHz	
NPSPAC, Channel Guard	± 3.25 kHz	± 0.75 kHz

ICOM FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency should be set with 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 27.5°C (81.5°F).

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MASTR II ICOMs should be reset only when the frequency shows deviation in excess of the following limits:

A. ± 0.2 PPM, when the radio is at 27.5°C (81.5°F)

B. ± 1 PPM at any other temperature within the range of -30°C to + 85°C (-22°F to + 185°F)

If an adjustment is required, pry up the cover on the top of the ICOM to expose the trimmer, and use one of the following procedures:

If the radio is at an ambient temperature of 27.5°C (81.5°F), set the oscillator for the correct operating frequency.

If the radio is not at an ambient temperature of 27.5°C, setting errors can be minimized as follows:

A. To hold the setting error to 0.1 PPM (which is considered reasonable for 1 PPM ICOMs):

   1. Maintain the radio at 27.5°C (81.5°F) and set the oscillator to desired frequency, or -

   2. Maintain the radio at 27.5°C (10°C) and offset the oscillator, as a function of actual temperature, by the amount shown in the correction factor chart (Figure 2).

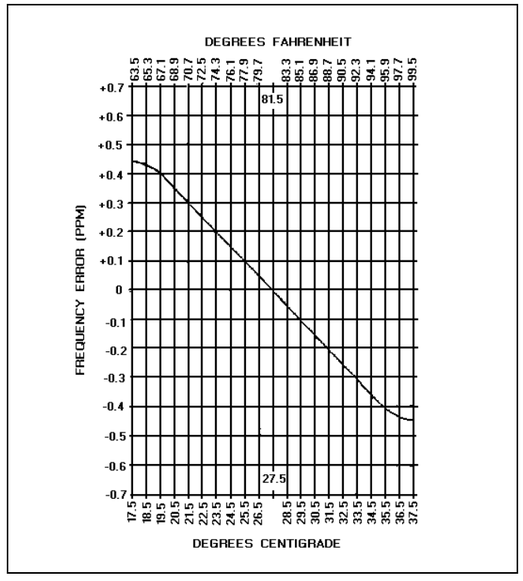


Figure 2 - Correction Factor Chart

For example: Assume the ambient temperature of the radio is 18.5°C (65.4°F). At that temperature, the curve shows a correction factor of 0.44 PPM. (At 851 MHz, 1 PPM is 851 Hz. At 875 MHz, 1 PPM is 875 Hz.)

With an operating frequency of 851 MHz, set the oscillator for a reading of 374 Hz (0.44 x 851 Hz) higher than the licensed operating frequency. If a negative correction factor is obtained (at temperatures above 27.5°C), set the oscillator for the indicated PPM lower than the licensed operating frequency.

TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Model 4EX3A11 or Test kit 4EX8K12.

2. A 50 ohm wattmeter capable of dissipating 150 Watts connected to the output terminal of the PA assembly.

3. A frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place ICOM on Exciter Board (crystal frequency = operating frequency • 48).

2. For a large change in frequency or a badly misaligned transmitter, preset all slugs to the top of the coil form.

3. Set Z101 and Z102 to top of coil form.

4. Set both air variable capacitors to minimum capacity (not meshed).

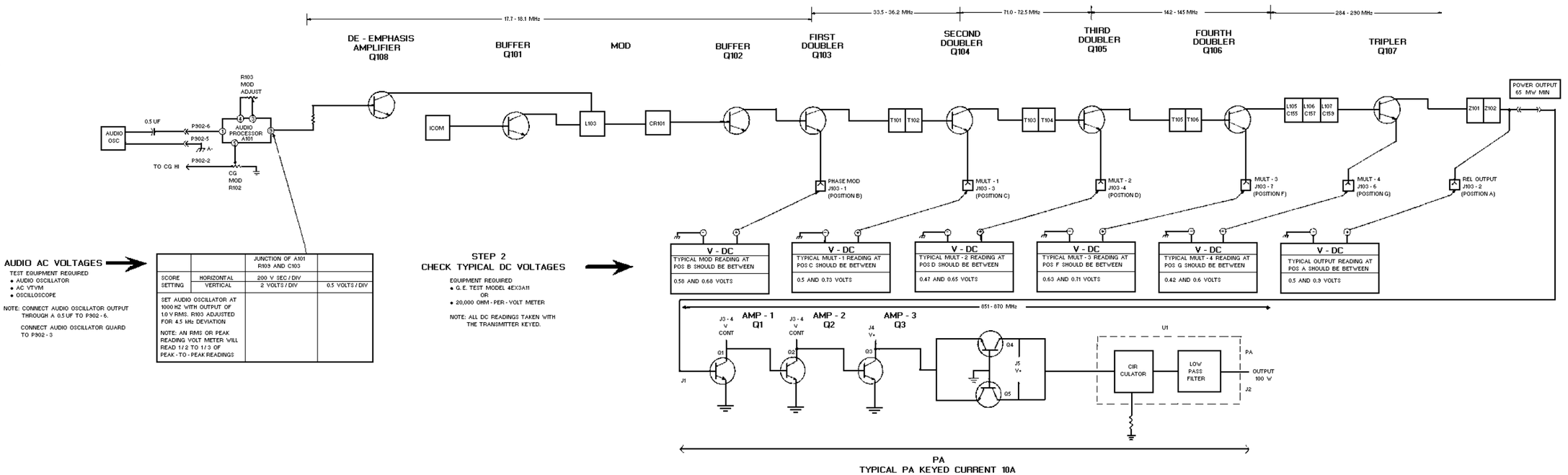
5. Connect the red plug on the GE Test Set to the System Board metering jack, and the black plug to the Exciter metering jack. Set the polarity to +, and set the range to the Test 1 position (1 Volt position for 4EX8K12) for all adjustments.

All adjustments are made with the transmitter keyed. Unkey the transmitter between steps to avoid unnecessary heating.

ALIGNMENT PROCEDURE

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
		EXCITER		
				NOTE When aligning transmitter, proceed as instructed below. DO NOT retune a previously tuned control unless specifically directed to do so.
1.	B (PHASE MOD)	L103, T101	See Procedure	Tune L103 for maximum meter reading. Then tune T101 for a dip (small) in meter reading.
2.	C (MULT-1)	T102 and T103	See Procedure	Tune T102 for maximum meter reading, then tune T103 for a dip in meter reading.
3.	D (MULT-2)	T104 and T105	See Procedure	Tune T104 for maximum meter reading and then tune T105 for a dip in meter reading.
4.	F (MULT-3)	T106 and C157	See Procedure	Tune T106 for maximum meter reading and then tune C157 for a dip in meter reading.
5.	G (MULT-4)	C159 and Z101	See Procedure	Tune C159 for maximum meter reading, and then tune Z101 for a dip in meter reading.
6.	A (REL OUTPUT)	Z102	Maximum	Tune Z102 for maximum meter reading.
7.	B (PHASE MOD)	L103	Maximum	Tune L103 for maximum meter reading.
8.	C (MULT-1)	T101 and T102	Maximum	In order, tune T101 and T102 for maximum meter reading.
9.	D (MULT-2)	T103 and T104	Maximum	Tune T103 and then T104 for maximum metering reading.
10.	F (MULT-3)	T105 and T106	Maximum	Tune T105 and then T106 for maximum meter reading.
11.	G (MULT-4)	C157 and C159	Maximum	Tune C157 and then C159 for maximum meter reading.
12.	D (INPUT DRIVE)	Z101, Z102	Maximum	Test set connected to Exciter metering jack. Then alternately tune Z101 and Z102 for maximum meter reading.
		100 WATT PA		
13.				Terminate the output power J2 with a 50 ohm watt meter capable of reading 150 watts.
14.				Key the transmitter and set R11 (control board) for 100 watt output.
15.				Read and record the DC voltage at feed through cap C5. This reading can be used for future output checks. DO NOT EXCEED 100 watts of output power.
16.				Using the test set connected to the Exciter metering jack and the transmitter keyed, detune Z102 10 percent from its peak reading. The output PWR should remain constant at 100 watts. This check insures ample operating margin.
17.				Tune Z102 back to a peak reading on the test set.
				NOTE Under no conditions should the Exciter be tuned using the PA output as a level indicator. The PA control circuits mask Exciter tuning procedures.

STEP 1 - QUICK CHECKS			
METER POSITION GE TEST SET	PROBABLE DEFECTIVE STAGE		
	HIGH METER READING	LOW METER READING	ZERO METER READING
EXCITER			
B (PHASE MOD)	Q102, Q103, T101	Q102, Q103, T101 ICOM	Q102, Q103, T101, ICOM
C (MULT-1)	Q104, T103	T101, T102, Q104	T101, T102, Q104, T103
D (MULT-2)	Q105, T105	T103, T104, Q105	T103, T104, Q105, T105
F (MULT-3)	Q106, C155	Q106, T105, T106	Q106, T105, T106, L105
G (MULT-4)	Q107, Z101, Z102	Q107, C159, C157	Q107, C159, C157, Z101, Z102
A (REL OUTPUT)		Q107	Q107, C174, CR102, R154, R153



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