

10-27-66

# TMC SPECIFICATION

NO. QA S-488

REV: A

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APPD: *JR*

SHEET 1 OF 10

TITLE:

PRODUCTION TESTING OF THE CMO-1 & 2

INSTRUCTION FOR THE  
PRODUCTION TESTING OF THE CMO-1 & 2

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1 INTRODUCTION

A. The CMO is a controlled master oscillator. For test purposes, it may be divided into 2 sections.

1. The Oscillator Section.
2. The High Frequency Loop Section.

B. The Oscillator Section

This section receives a correction voltage from the 510-520 KC phase detector in the high frequency loop section(see C). For example, 510,000 cycles from the CLL and 510,000 cycles from the high frequency loop deck are fed into the 510-520 KC phase detector. If there is any frequency difference, a voltage is derived from the phase detector and applied to the reactance tube in the oscillator section. This synchronizes the MO to the CLL. Any voltage variation from this phase detector will vary the MO frequency accordingly.

C. The High Frequency Deck

This section develops a 510-520 KC signal to be compared with the output of the CLL. A harmonic of the 10KC pulses from the CHL(Divider chain)are selected from 1.49 to 3.49 MC. This selected harmonic is mixed with the output of the MO to yield the desired comparison signal. The high frequency deck is analogous to a superheterdyne receiver. The harmonics of the KC pulse simulate the broadcast stations and the CMO simulates the local oscillator.

A tuned amplifier on the output of the MO is geared to the harmonic selector. Therefore, when the amplifier is tuned to the MO output frequency, the correct harmonic 510 KC below the MO frequency is selected. The selected harmonic frequency and the MO frequency are mixed in a converter, and the resultant difference frequency is selected and amplified by an IF amplifier. This output, is compared in the 510-520 KC phase detector on the high frequency deck with the output of the KC phase.

Associated with the high frequency deck is a "sync" indicator tube. The purpose of the latter is to light the sync indicator bulb on the CMO front panel only when the HF loop is synchronized.

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PRODUCTION TESTING OF THE CMO-1 &amp; 2 (continued)

- D. The CMO-1 differs from the CMO-2 in two(2) respects.
- a. The Tuning KC numeral engraving on the CMO-1 is from 1750-3750 KC. The CMO-2 is from 2000-4000 KC.
  - b. The counter of the CMO-1 is offset by 250 KC. That is to say, the MO is at 2000 KC with the counter set at 1750 KC. It can be said that varying the counter from 1750-3750 KC is shifting the MO from 2000-4000 KC. The CMO-2 counter and oscillator are set at 2000 KC.

2. TEST EQUIPMENT REQUIRED

- a. 1 70 ohm, non-inductive 5 watt load.
- b. 1 RFVTVM, HP 410B or equivalent.
- c. 1 HF counter HP 524 or equivalent.
- d. 1 CMO test setup(CHL-CLL-CSS-CPP-2).
- e. 1 PTE
- f. 115V or 220 VAC Power Source.

3. PRELIMINARY VOLTAGE & RESISTANCE CHECKS:

- \*a. Check for B+ shorts to ground at C333, C337, C328 and at C346. Resistance should be  $\infty$  with FX-161 removed and approximately 320K ohms with FX-161 installed. Resistance at C354 should be  $\infty$ .
- \*b. Check oven heater resistance by placing meter between pins of 7 and 10 of E 301. A reading of approximately 80 ohms should be obtained.
- \*c. Attach cable from power supply(CPP-2) to CMO, turn CPP-2's Power/Standby switch to Power. Oven indicator light must ignite, and oven should cycle after approximately 3-4 hours.
- \*d. Measure DC voltage at C333, C337, C346 and C328. This should be 160 VDC  $\pm$  4 VDC.
- \*e. Measure DC voltage at C354, this should be 200 VDC-230 VDC.  
(With CLL disconnected from Power Supply-CPP-2)

NOTE: Indicate completion and acceptance of portion(s) of this test preceded by(\*) by recording required observed value or by check(✓) mark as required on attached test Data Sheets.

4. 100 KC OSCILLATOR CALIBRATION

- \*a. Set function switch to CAL position and connect counter to pin 1 of V312.
- b. Adjust C311 for a 100,000 cycle reading on the counter. C311 is coupled to a bakelite shaft in the rear of the shock mounted oven assembly. A slot is provided on the end of this shaft for screw driver adjustment.

5. I.F. STRIP

- a. Remove 2-4 mcs MO input.
- b. Connect CLL-1 output (through pad) to pin 2 of V309. Adjust CLL-1 to 515KC, connect the RF meter to pin 7 of V310.
- \*c. Adjust T308, T307 and T306 for maximum amplitude, voltage should read between 12V-20V.
- d. Disconnect signal from CLL-1.

6. RF AMPLIFIER SECTION

- a. Connect 70 ohm load to J306, RF meter across load, and 2-4 mcs MO input to J302.
- b. Attach jumper between terminals 1 and 2 of E303.
- c. Set drive control, R321, in full clockwise position.
- d. Adjust C329 and C331 to half capacitance.
- e. Set oscillator frequency and Tuning KCS control to 1750.
- f. Adjust T301 and T302 for maximum amplitude.
- g. Set oscillator frequency and Tuning KCS control to 3750 and adjust C329 and C331 for maximum amplitude.
- h. Repeat steps "D" thru "G" until RF output is at maximum in both positions without further adjustments.
- \*i. Voltage across 70 ohm load should be 8.5 volts or better.
- \*j. Output meter should read approximately 8.
- \*k. Remove jumper from terminal 1 and 2 of E303, output voltage must drop to zero. (This checks CMO Keyline). Replace jumper.

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6. RF AMPLIFIER SECTION (continued)\*1. RF TRACKING

Tune MO dial and Tuning KCS control to engraved marking on front panel (1750-2250-2750-3250-3750). RF output meter must peak when MO and KCS Tuning control are at preset frequencies engraved on front panel. This checks RF tracking.

7. HARMONIC SELECTOR ALIGNMENT

- a. Connect the 10 KC signal from CHL-1 (in test setup) to 10KC's input jack, J307.
- b. Connect RF meter to center arm of R327.
- c. Set trimmers C332 and C336 to mid range.
- d. Set oscillator frequency and Tuning KCS control to 1750. Adjust T303 and T304 for maximum amplitude.
- e. Set oscillator frequency and Tuning KCS control to 3750. Adjust C332 and C336 for maximum amplitude. Repeat steps D & E until both extremes (1750-3750) are at maximum without further adjustments.
- \*f. Check output at center arm of R327 at following frequencies: 2250, 2750, 3250 and 3750. This output should not be less than 6V throughout the range from 1750-3750.

8. SYNC. METER & PHASE DETECTOR

- a. Connect 510KC output from CLL-1 to J308.
- b. Tune MO and Tuning KCS control to 2750.
- c. Place Cal/Operate switch in operate position and tune CMO for Sync. indication on Sync. meter.
- \*d. Adjust CMO MO Dial to a point where CMO falls out of Sync., then adjust R328 for center scale on Sync. meter.

9. SYNC. INDICATOR LIGHT

- a. Set CLL KCS AND CPS control to zero position.
- b. Set MO to 2750 mc and peak "tune" meter with Tuning KCS control.

NOTE: Indicate completion and acceptance of portion(s) of this test procedure by (\*) by recording required observed value or by check ( ) mark as required on attached test Data Sheet.

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9. SYNC. INDICATOR LIGHT (Continued)

- c. Vary MO control 500 cps above and below 2750 mc. The Sync. meter will follow in the same direction as this control is varied. This indicates that the H.F. loop is sync.
- \*d. With the loop in sync. and the meter in center position, vary R340 to the point where 1304, the sync. indicator light, ignites.
- \*e. Vary the MO control 1KC above and below 2750 mc (IE-2999 KC-3001 KC). The sync. indicator light should remain on, and the sync. meter should follow the variation of the MO control. This checks CMO's lock in range.
- f. As a final check, vary the MO control slowly 3 KC above and below 2,3 and 4 mc. As the loop drops out of sync. (sync. meter will fall to center scale position) the sync. indicator light will go off.

Check CMO throughout the range of CLL-1, Unit should perform as per para. E6 and E7. This checks operation of HF Deck.

10. MASTER OSCILLATOR ALIGNMENT

- a. Set CMO counter to 1750 KCS. 1750 KCS should be approached from the lower frequency side (i.e. 1650 KCS to 1750 KCS). This will prevent any error due to backlash.
- \*b. Rotate calibrate knob until beat on calibrate indicator light is observed. As an additional check, the output of the CMO through a 20 db pad, can be read on the counter.
- c. Set CMO counter to 3750 KCS. Again, as in the 1750 KCS case, 3750 KCS should be approached from the lower frequency side (i.e. 3650 KCS to 3750 KCS).
- \*d. Rotate MO "High End" trimmer until beat on calibrate indicator light is observed. This trimmer is located behind the front panel hole adjacent to the calibrate knob.
- e. Repeat step 1 through 4, until beat is observed at 1750 KCS and 3750 KCS without further adjustments. This completes the oscillator alignment.

NOTE: Indicate completion and acceptance of portion(s) of this test preceded by ( ) by recording required observed value or by check (✓) mark as required on attached test Data Sheet.

11. MASTER OSCILLATOR CALIBRATION

- \* 1. Without touching either end adjustment controls, record the amount of error in the MO dial against the 100 KCS standard at every 100 KCS point between 2 and 4 mcs. A form has been provided for this purpose. No unit may be passed where an error exceeds 200 cps.

SPURIOUS CHECK

- a. Connect CMO output analyzer to signal input thru 20, DB Pad.
- b. Turn drive control, R321, fully clockwise.
- c. Set MO at 1750 mcs.
- d. Set function switch to calibrate.
- e. Adjust Tuning KCS control for maximum indication on output meter.
- f. Panalyzor adjustments for measuring distortion Gain-fully clockwise.  
Amplitude scale switch to LOG.  
Cal. Osc. level-OFF.  
Input attenuators-OFF.  
I.F. Attenuation-20db.  
Sweep width selector-7 kc.  
AFC-OFF.  
The VOX should be set at 500 KC above the frequency being alalyzed. In this case, it would be approximately 2500 KC. The output is set at approximately .1 MA.
- g. Using the "Input Attenuator" switches on the alalyzer, adjust the amplitude on the screen as close as possible to the zero(0)line, then line adjust it with gain control.
- h. Any spurious should be 60-db or more below the carrier.
- i. Set function switch to operate position.
- j. Vary MO within the boundary of the lock-in range. As this is done observe the analyzer screen. Spurious should be 60db or more below the carrier.
- k. A check of D through K should also be made on 3 MC & 4 MC. Once unit has passed above requirements affix test stamp to unit.

NOTE: Indicate completion and acceptance of portion(s) of this test preceded by( )by recording required observance value or by check(✓) mark as required on attached test Data Sheet.

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CMO TEST DATA SHEET

### PRELIMINARY VOLTAGE & RESISTANCE CHECKS

- A. B+ to ground (FX-161 installed) \_\_\_\_\_ ohms
- B. Oven Resistance \_\_\_\_\_ ( )
- C. Oven indicator light and oven cycling \_\_\_\_\_ ( )
- D. Voltage at C333,C337,C346 and C326 \_\_\_\_\_ VDC
- E. Voltage at C354 \_\_\_\_\_ VDC

### 100 KC OSCILLATOR CALIBRATION

- A. Adjustment of C311 for 100 KC \_\_\_\_\_ ( )

### I.F. STRIP

- C. I.F. Output voltage \_\_\_\_\_ VRF

### RF AMPLIFIER SECTION

- I. Voltage across 70 load \_\_\_\_\_ (8.5V Min.)
- J. Output meter reading \_\_\_\_\_
- K. CMO Keyline \_\_\_\_\_ ( )
- L. RF Tracking \_\_\_\_\_ ( )

### HARMONIC SELECTOR ALIGNMENT

- F. Harmonic selector output \_\_\_\_\_ ( )

### SYNC. METER AND PHASE DETECTOR

- D. Adjustment of R328 \_\_\_\_\_ ( )

### SYNC. INDICATOR LIGHT

- D. Adjustment of R340 \_\_\_\_\_ ( )
- E. CMO lock in range \_\_\_\_\_ +KC

### MASTER OSCILLATOR ALIGNMENT

- B. & D. Calibrate Light \_\_\_\_\_ ( )

### MO CALIBRATION

- (chart provided) \_\_\_\_\_ ( )



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CMO TEST DATA SHEET (continued)

## SPURIOUS CHECK

H. Spurious output

\_\_\_\_\_ DB

MFG. NO. \_\_\_\_\_

SERIAL NO. \_\_\_\_\_

DATE \_\_\_\_\_

TESTER \_\_\_\_\_

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## MO CAM CALIBRATION

FREQUENCY KC

CYCLES DEVIATION

1750

1850

1950

2050

2150

2250

2350

2450

2550

2650

2750

2850

2950

3050

3150

3250

3350

3450

3550

3650

3750

TESTER \_\_\_\_\_

DATE \_\_\_\_\_

