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| **MW-5A Frequency Change**  |    | [Main Index](file:///C%3A%5CUsers%5Crhinka01%5CDesktop%5C2011%20August%20TechWeb%20on%20C%20Drive%5CTechweb.HTM)  |

MW-5 Frequency Change and Readjustment Procedure

The attached procedure assumes that the person making the frequency change is fairly familiar with the MW-5. It also assumes that the transmitter is functioning normally prior to attempting a frequency change. This includes that all transmitter meter reading are in the normal range of operation. The person performing the frequency change should be alert to any abnormalities in the transmitter's operation, and be equipped to troubleshoot any problems which may arise.


**THE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS. PERSONNEL MUST AT ALL TIMES OBSERVE SAFETY REGULATIONS.**

This procedure is intended as a general guide for trained and qualified personnel who are aware of the dangers inherent in handling potentially hazardous electrical/electronic circuits. It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

The installation, operation, maintenance and service of this equipment involves risks both to personnel and equipment, and must be performed only by qualified personnel exercising due care. HARRIS CORPORATION shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks.


**ALWAYS DISCONNECT POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, GATES, PANELS OR SHIELDS. ALWAYS USE GROUNDING STICKS AND SHORT OUT HIGH VOLTAGE POINTS BEFORE SERVICING. NEVER MAKE INTERNAL ADJUSTMENTS, PERFORM MAINTENANCE OR SERVICE WHEN ALONE OR WHEN FATIGUED.**

Do not remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields. Keep away from live circuits, know your equipment and don't take chances.


**IN CASE OF EMERGENCY ENSURE THAT POWER HAS BEEN DISCONNECTED.**


**Disconnect all power from the transmitter before working inside the transmitter.**

1. **Test Equipment Needed:**

RF signal Generator Capable of Producing the third harmonic of the Carrier Frequency at a level of at least 3 volt RMS. An Oscilloscope with at least a 20MHZ bandwidth. AM modulation Monitor Audio Test Set. Frequency Counter 10K, 51, 510, 2 watt resistors Transmitter Load capable of 10kw

1. **Installing Frequency Determined Components**

Verify and Install all Frequency Determined components. Refer to the Frequency Change Components list in the Technical Manual for the correct capacitor values and coils.

* 1. Install crystal(s) in the Oscillator P.C. Board, 1A2A1.
	2. For carrier frequencies above 1250 KHZ jumper terminal 8 to 9 (Crystal frequency divided by 2). For carrier frequencies below 1251 KHZ jumper terminals 7 to 9 and 8 to 6 (divide by 4).
	3. Install the correct values for 1A2A3C1, 1A2A3C1A, 1A2A3C2, 1A2A3C2A, 1A2A3C3, 1A2A3C3A, 1A2A3C3B, 1A2L1, 1A2L2, 1A2L3, 1A2L4, 1A2L5 and 1A2L6 in the RF driver section as needed by the Frequency chart.
	4. Install the correct values for 1A3T1, 1A3C1A ,1A3C1B, 1A3C2A, 1A3C12, on the PA grid Iso Plate as needed by the Frequency Chart.
	5. Install the correct value for 1C13, PA Resonator, in the Output Cabinet as specified by the frequency Chart.
	6. Install the correct value for PA Tune padding Capacitor C18 and C18A in the Output Cabinet as needed by the frequency Chart.
	7. Install The correct value of L8 in the output Compartment as needed by the frequency chart.
	8. Install the correct value for C19 in the output cabinet as needed by the frequency chart.
	9. Install the correct value for 1C20, Third Harmonic Trap, as specified by the Frequency Chart.
	10. Install the correct value for 1C21 as specified by the Frequency chart.
	11. Install the correct value for 1C22 , 2nd Harmonic trap as specified by the Frequency Chart.
	12. For frequencies above 1000KHZ, a jumper is used on the Plate Choke 1L4 from center tap to the C11 end. Dress the jumper away from ground.
1. **Output network Pre-Tuning**
	1. Using the pre-set tuning chart, Figure 1, set the coil taps or counter settings on 1L5, 1L8, 1L9, 1L10, 1L12, 1L13, and 1C14. Terminate the transmitter into a 50 ohm load. For pretuning, a non inductive 2 watt resister may be used.

**Plate Resonator Tuning**

* 1. Connect a Resistor divider between the P.A. Plate to ground using a 10K and a 51 ohm resistor. The 10K attached directly to the Plate. Set the signal generator to the new carrier frequency. Connect the signal generator to the center of the voltage divider. Connect the oscilloscope to the plate. See Figure 2 as needed.
	2. Drive the divider with the signal generator and by observing the waveform on the oscilloscope tune C14 (Plate Tune) for a peak.
	3. Change the signal generator to the new frequency's third harmonic and adjust Plate efficiency resonator, L5 for a maximum signal on the oscilloscope. Second Harmonic Trap
	4. Remove the tubing connection from the panel end of L12.
	5. Connect the resistor divider of a 10K and 51 ohm resistor to the panel end of L12 to ground. The 10K resistor close to the panel. Connect the oscilloscope to the panel end of L12 and the signal generator to the center of the divider. See Figure 3 as needed. Set the signal generator to the second harmonic and adjust the tap on L12 for a minimum deflection on the oscilloscope. (Sweeping the signal generator may aid in tuning.)

**Third Harmonic Trap**

* 1. Remove the tubing at the panel end of 1L9. Connect the 10K end of the resistor divider and the oscilloscope to the loose end of 1L9. Connect the 51 ohm end of the divider to ground. Set the signal generator to 3 times the carrier frequency and connect this to the center of the divider. See Figure 4 as needed.
	2. Tune 1L9 for minimum signal on the Oscilloscope.

**Grid Efficiency Resonator**

* 1. Connect the Resistor divider to the center tap of 1A3T3 to ground with the 10K end at the center tap. Connect the oscilloscope to the center tap of 1A3T3. Set the signal generator to 3 times the station frequency and connect it to the center of the divider. Refer to figure 5 as needed.
	2. Set C2, Grid efficiency capacitor to half mesh.
	3. Set the tap on 1A3L1 for maximum signal on the oscilloscope. Tune C2 for minimum signal.

**Neutralization**

* 1. Set the signal generator to the carrier frequency and connect it to the bottom of C12 (ungrounded end). See Figure 6 as needed.
	2. Connect the oscilloscope to the P.A. Plate.
	3. Tune 1A3C1, Grid Tuning, for a peak as observed on the oscilloscope.
	4. Tune 1AC3 for minimum signal on the oscilloscope. Both 1A3C1 and 1A3C3 should tune in the middle of their range.
	5. Reconnect all tubing.
1. **Oscillator, IPA, and RF driver Alignment**
	1. Secure all covers,doors and interlocks.
	2. Verify that the jumpers on the oscillator are correct.
	3. Open the RF driver interlocked compartment and remove fuses 1A2AF1 through F5.
	4. Close and secure RF driver interlocked panel.
	5. Return Ac power to the transmitter and Press Filament on.
	6. Place a clip lead to ground on pin 5 of the oscillator.
	7. Check the collector of 1A2A1Q3 using the oscilloscope for a 4.5 to 5.5 volt P-P rounded squarewave at the crystal frequency.
	8. Place the oscilloscope probe on terminal 8 of the oscillator. Verify that the waveform is a square wave close to the carrier frequency.
	9. Connect the frequency counter to terminal 8 of the oscillator board and adjust 1A2A1C1 for crystal Y1 or 1A2A1C7 for crystal Y2 to obtain the correct carrier frequency.
	10. Move the oscilloscope probe to terminal 3 of the Oscillator board
	11. Using a non inductive adjusting tool, adjust IPA input inductor 1A2A3L1 for a 30 volt P-P sine wave as observed on the oscilloscope.
	12. Remove the clip lead on terminal 5 to ground and turn off the filaments.
	13. Open the RF driver interlocked compartment and re-install 1A2A3F1. Adjust potentiometer 1A2A3R4 fully CCW.
	14. Connect the oscilloscope to terminal 3 on the input end of coil 1A2A3L2. Route the leads outside the transmitter and close the interlocked panel.
	15. Depress Filament On. Using a clip lead, ground pin 5 of the oscillator board.
	16. Operate the Multimeter switch to IPA I position. The indication on the multimeter should be between 0.8 and 1.0 amp. If it is not within this range:
		1. Depress Filament off and open the RF driver panel.
		2. Loosen coil 1A2A3L2 slug retaining bar and move the slug into or out of the coil as necessary a small amount, approximately 1/8 inch. Tighten the retaining bar.
		3. Close interlocked panel and turn on Filaments.
		4. Observe the Multimeter for an IPA I of 0.8 to 1.0 amps.
		5. Repeat steps a through d until the proper current is observed on the multimeter.
	17. Observe the waveform on the oscilloscope. The waveform should be a symmetrical sqarewave with slight ringing and an amplitude of 30 volts P-P. If the waveform is not symmetrical it will be necessary to replace the transistors in the IPA. After replacing transistors, repeat step 16.
	18. Adjust potentiometer 1A2A3R4 fully clockwise and observe the Multimeter. The current should be between 1 and 1.2 amps. The oscilloscope waveform should be a 30 volt P-P squarewave with slight ringing.
	19. Verify that the duty cycle and symmetry of the squarewave does not shift as 1A2A3R4 is rotated from one end of its range to the other. If the duty cycle or symmetry changes, it will be necessary to adjust 1A2A3L2 or change transistors for the IPA. Correct duty cycle and symmetry is vry important for best performance and reliability of the IPA.
	20. Disconnect the clip lead from terminal 5 on the oscillator board and Turn off the filaments.
	21. Disconnect and lock out transmitter main AC power. Discharge the Low voltage supply with the grounding stick.
	22. Open the rf driver compartment panel and re-install fuses 1A2A3F2 through F5.
	23. Close the rf driver panel.
	24. Depress Filaments on and ground pin 5 on the oscillator board.
	25. Alternately select IPA I and RF driver I on the multimeter. The IPA I should not exceed 1.2 amps and the driver current should be below 8.5 amps. If these limits are exceeded:
		1. Disconnect the clip lead on terminal 5 of the oscillator and turn off the Filaments.
		2. Lower the interlocked RF driver panel.
		3. Discharge the Low voltage supply with a grounding stick.
		4. Loosen the side retaining screws on coils 1A2A3L3 through L6 and move the slug rack out of the coils slightly.
		5. Close the RF driver panel.
		6. Depress Filaments on and ground pin 5 on the oscillator board.
		7. Monitor the RF driver and IPA currents on the Multimeter.
		8. Repeat step 25 until the currents are within limits.
	26. Adjust Grid Tune for maximum drive while monitoring IPA I and RF driver current on the multimeter. The drive should be between 250 and 300ma with an RF driver current of less than 8.5 amps.
	27. If the desired grid drive can not be obtained and the RF driver current is low then:
		1. Disconnect the clip lead on terminal 5 of the oscillator and turn off the Filaments.
		2. Lower the interlocked RF driver panel.
		3. Discharge the Low voltage supply with a grounding stick.
		4. Loosen the side retaining screws on coils 1A2A3L3 through L6 and move the slug rack into of the coils slightly.
		5. Close the RF driver panel.
		6. Depress Filaments on and ground pin 5 on the oscillator board.
		7. Adjust Grid Tune for a peak in Grid Drive.
		8. Repeat step 27 until the correct RF Driver current and Grid drive is obtained.
	28. Depress Filament off and remove the clip lead on pin 5 of the oscillator.
	29. Lower the RF driver Panel and connect the oscilloscope to the output terminal of one of the drivers.
	30. Route the oscilloscope leads out of the transmitter and close the RF driver panel.
	31. Depress Filaments on and ground pin 5 on the oscillator board.
	32. Observe the oscilloscope for a squarewave of at least 40 volts P-P with slight ringing.
	33. Verify that the output of each rf driver module (terminal 3) is a squarewave of at least 40 volts P-P with slight ringing as observed on the oscilloscope by repeating steps 29 through 33 for each RF driver module.
	34. This completes the Oscillator, IPA and RF driver tuning.
2. **Final Tuning.**
	1. Install all covers and close all interlocks
	2. Terminate the transmitter into a known good load capable of dissipating 10KW.
	3. Open the PDM panel and adjust both the HI power and Low power potentiometers fully counterclockwise.
	4. Restore Main AC power to the transmitter and depress filament on. Select Hi Pwr Mode.
	5. Ground pin 5 on the oscillator and peak the Grid Drive with the Grid Tune control.
	6. Remove the ground from pin 5 on the oscillator.
	7. Depress Plate On. The main contactor should pull in and the Supply Voltage should be present with zero power output.
	8. Refer to Figure 7 for typical meter readings at zero power. Investigate any discrepancies.
	9. Adjust HI Pwr potentiometer slowly clockwise while observing PA Plate current and PA Plate voltage on the meters. Continue adjusting control until the Plate current reaches 0.5 amps or the PA Plate voltages reaches 2300 volts.
	10. Dip the PA Plate current with the Plate Tuning Control.
	11. Using the Plate Loading to control Plate current and the HI power potentiometer to control Plate voltage adjust both controls until a ratio of 2300 Plate Volts with a Plate current of 0.5 amps is reached. Power output should be around 1KW.
	12. Refer to Figure 7 for typical meter readings at 1KW. Investigate any discrepancies.

**NOTE**

Because Antenna systems differ a VSWR overload may occur. If this happens, follow the Directional Coupler Alignment procedure as given in the Maintainence section of the technical Manual.

* 1. Continue adjusting HI power potentiometer to obtain a PA Plate voltage of 5300 volts.
	2. Adjust the PA loading for a Plate I of 1.5 amps.
	3. Verify that the PA Plate I is still in the dip by adjusting the PA Plate Tune control. The power output should be over 5000 Watts and the supply current should be 0.5 amps.
	4. Select the Efficiency position on the power meter. The meter should deflect more than half scale.
	5. Rock the PA Plate Tuning for a maximum reading on the power meter. (efficiency position)
	6. Adjust the PA Plate Resonator for a maximum reading on the power meter.(efficiency position). This control should not have to be adjusted more than two turns.
	7. Adjust Grid Efficiency Resonator for a slight dip in PA Plate Voltage. This control should not require more than two turns to find the dip.
	8. Repeat steps 17 through 19 until no change is noted.
	9. To verify that the resonators are set correctly, insert a scope probe in the top of PA enclosure about 1 inch.

USE EXTREME CAUTION WHEN INSERTING THE SCOPE PROBE INTO THE ENCLOSURE AS DANGEROUS VOLTAGE AND CURRENTS ARE PRESENT.

* 1. The waveform observed on the scope should match Figure 8. Slightly adjust Plate Tune, Plate Efficiency Resonator and Grid Efficiency until the proper waveform is obtained.
	2. Compare the transmitter readings with the typical readings chart, Figure 7 for 5KW no modulation.
	3. Modulate the transmitter with a 400 Hz tone to 95% and check meter readings against Figure 7.
	4. Perform an audio proof on the transmitter. Note that a slight adjustment of Plate Tune, Plate Loading, Plate and Grid Efficiency Resonators will affect response and distortion.