HARRIS COMMUNICATIONS AND INFORMATION HANDLING

SERVICE BULLETIN

MAINTENANCE AND MODIFICATION DATA

Broadcast Products Division

Bulletin No. AM-109-KDL

Equipment: MW-5 AM Transmitter

Date October 25, 1976

Subject: Additional Maintenance and Troubleshooting Information

A. Neutralization:

The MW-5 should not require frequent neutralization, but in the event of any component failure in the PA grid or plate circuits, the neutralization should be checked as follows:

1. Measure the DC resistance of the resistors used as grid (1A3Z1) and plate (1Z1) parasitic suppressors. An open parasitic suppression resistor can upset circuit stability and make neutralization difficult. These failures are often not detectable visually.

2. Disconnect the center lead of the coaxial cable attached to the PA grid transformer input tuning capacitor (1A3C12), located on the center side wall of the PA grid/cathode cavity. Connect an RF signal generator (previously zero-beated with the transmitter oscillator or adjusted to assigned carrier frequency using a counter) between capacitor input lug and ground. Connect an oscilloscope having at least a 5MHz. vertical bandwidth between tube plate and ground.

3. WITH NO AC POWER APPLIED TO THE TRANSMITTER, adjust the RF generator output level and 'scope vertical gain for a convenient display. Adjust neutralization padder capacitor 1A3C3 for minimum signal amplitude.

4. Check the degree of mesh of the plate of 1A3C3. If 1A3C3 is fully open or fully meshed, the neutralization procedure is not yet finished. Should a reasonable amount of mesh exist, neutralization is complete.

5. On original MW-5s (shipped prior to October, 1976), the center tap on PA grid transformer 1A3T1 is moved one turn at a time until minimum signal amplitude and within-range mesh of the plates of 1A3C3 is obtained.

6. On later MW-5s (identified by the presence of grid bias RF choke 1A3L2), the value of 1A3C11 or 1A3C10 may have to be changed to achieve within-range mesh of 1A3C3.

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7. If proper neutralization cannot be achieved, failure of neutralization blocker capacitors 1A3C9 and/or C10 or grid transformer secondary tuning capacitors 1A3C1A,B, etc. should be investigated.

8. When adjustments are completed, be sure to remove all test equipment from the transmitter and restore connection of the RF driver output cable center conductor to 1A3C12.

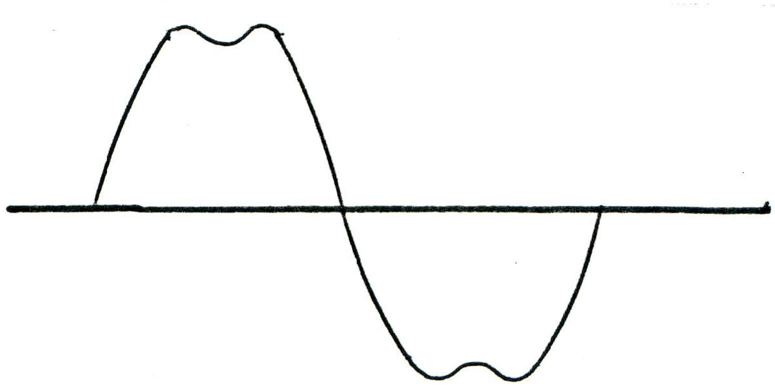
9. Restore transmitter operation at full carrier power and perform normal tuning procedures as necessary.

B. Checking of Grid and Plate Efficiency Resonators:

Poor efficiency, wierd tuning, excessive audio distortion, excessive RF harmonic output, and other operational instabilities may be caused by mis-adjusted or faulty efficiency resonators. When these symptoms are present, the resonators must be thoroughly examined and carefully adjusted.

1. Perform the adjustment procedure outlined in sections 4.3(17) through (19) on page 4-6 of the MW-5 Instruction Book. If tuning and operation still does not seem normal or an obvious component failure has occurred, further effort is required.

2. Drop a small oscilloscope probe (connected to the 'scope vertical input) through the grating above the PA tube and connect the ground clip to the grating. Observe the PA plate waveform at an RF sweep rate. It should look something like that shown below if operation is normal.



3. Find the setting of the resonators by the following method: Set up an RF generator, clip leads, resistors, and the 'scope as shown in the diagrams below. Vary generator frequency until a response peak is noted; determine the generator frequency at that point. It should be within ±200kHz. of the third harmonic of the assigned carrier frequency. If not, adjust the generator to the third harmonic and adjust the resonator for a response peak. In the case of the grid resonator, it may be necessary to change the tap on coil 1A3L1 one turn either way to place grid efficiency tuning capacitor 1A3C2 within range.

General Test Circuit:

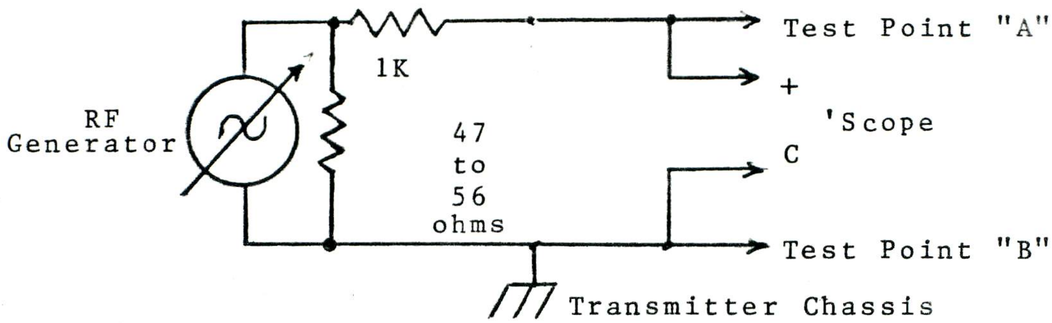
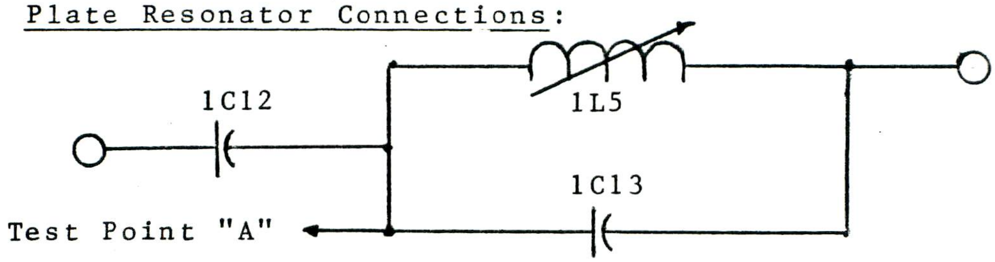
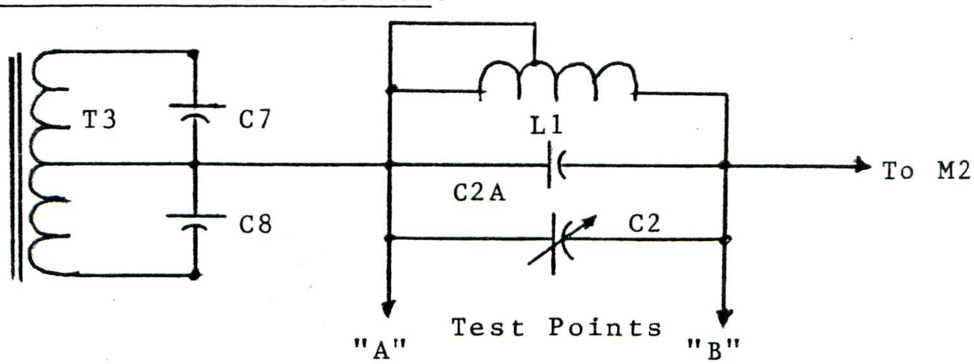


Plate Resonator Connections:



Grid Resonator Connections:



*all components have 1A3 prefix for grid circuit

4. Repeat the efficiency optimization procedure of sections 4.3(17) through (19) on page 4-6 of your Instruction Book. A waveform similar to that in (2) above should now be noted.

C. Optimization of Harmonic Distortion

A systematic procedure of adjustment will lead to reduction in audio distortion products generated by the transmitter.

1. Adjust plate tuning, efficiency resonator, grid tuning, and grid efficiency resonator with no modulation in accordance with the procedure outlined in sections 4.3(16) through (19) of your Instruction Book.

2. Modulate the transmitter into the normal load (antenna) to 95% positive or negative (whichever comes first) at 400 Hz. Measure and note harmonic distortion (T.H.D.).

3. Adjust the following controls for minimum T.H.D.:

   a. Modulator high-power screen voltage - 1A4R10

   b. Auxiliary modulation - 1A1R3

   c. Auxiliary driver - 1A1A3R8

   Several repetitions of the adjustment cycle above may be necessary to assure a distortion null.

4. Change audio generator frequency to 5kHz. and modulate the transmitter to 95% positive. Measure and note T.H.D. and PA plate tuning control dial counter reading. Adjust the PA plate tuning control for minimum T.H.D. and note both distortion and dial counter readings. Back off the PA tuning until the halfway point between the two distortion values or dial counter readings is reached. Then adjust the PA plate efficiency resonator for minimum T.H.D.

5. Return to 400Hz. at 95% modulation and repeat step (2) above. Note distortion with modulating frequencies of 400Hz., 1kHz., 2.5kHz., and 5kHz.

6. It may be possible to further reduce T.H.D. at 5kHz. through adjustment of the Auxiliary Modulation control. However, this control will not show a T.H.D. null at high audio frequencies. It reduces T.H.D. to a minimum value and further rotation of the control will not change T.H.D. The auxiliary modulation control should be adjusted to the point where T.H.D. is just on the verge of increasing. Distortion should be checked once again at 400Hz. and compared with previous results. In some transmitters, a slight trade-off between mid-band and high-frequency T.H.D. is necessary. This trade-off should not typically increase mid-band T.H.D. more than 0.2% in order to achieve in-spec. high frequency harmonic distortion.

7. A slight adjustment of the grid efficiency resonator may lower T.H.D. slightly in older MW-5s. Should you find this to be the case in your transmitter, leave the resonator set just to the verge of causing a T.H.D. increase. In no case should the PA plate voltage be allowed to increase more than 50 volts (½ division) above the dip obtained in (1).

8. Harmonic distortion problems at high audio frequencies are many times the result of asymmetrical or reactive antenna sideband impedances. Transmitters are designed by all manufacturers around an industry standard for a "normal load". This EIA specification calls for the reactive component of the load impedance to be adjusted to zero at the <u>transmitter output terminals</u> for operation at <u>assigned carrier frequency</u>. The resistive component of load impedance may not vary more than ±5% of the carrier frequency resistance value at sideband frequencies through 5kHz. either side of carrier. The reactive components cannot exceed ±18% of the <u>carrier resistive</u> value over the same frequency range. From 5kHz., through 10kHz. sidebands, the resistive component must be within ±10% of carrier resistive value and the reactive component must be within ±35% of carrier resistive value.

9. Old modulator tubes and PA tubes may sometimes affect distortion figures. Also, an open-delta AC primary power source will cause low-frequency distortion problems. If T.H.D. problems exist at low frequencies (less than 100Hz.) only, keep in mind that the transmitter was designed for connection to a <u>closed-delta</u> power source (as spelled out in the instruction book). Take appropriate action to assure a closed-delta AC primary power source.