

Tech Tips on the MW-1

by [Tom Osenkowsky](#)

I was requested by private email to provide further troubleshooting details on the MW-1 transmitter. Having considerable experience with this transmitter (I believe we had s/n #2 at 13-WAVZ) and the factory training course back in March, 1978. Let's get started!

Rule #1 for the MW-1. 52.0 PA volts, 22.5 PA amps = 1000 watts. Period. That volts:amps ratio is critical. Be careful how/where you measure the tx power. ATU losses, RF ammeter calibration, accurate common point or base resistance, etc. must be taken into consideration. Again, 52 volts, 22.5 amps, 1kw.

The more common failures tend to occur in the variable autotransformer T2 on the bottom of the tx. Frequently, the contact will burn or there will be dead spots on the windings. It is perfectly normal for the motor to crank away during modulation. Especially true during talk segments when the mod goes from zero to full during speech. If T2 is not normally resting near the middle of its travel, transformer T1 may have to be tapped to establish this condition. The 140 volt supply should normally equal 135 volts. A considerably lower value may produce insufficient positive modulation.

Sometimes poor contact between the fault neon lamps and the socket will fail to reveal a weak or defective module. Fault lamps that glow brightly with modulation often indicate bad audio transistors. On PA modules, R1 (100 ohms) can often change value. Ensure it is within tolerance. Also be sure the finger contacts on each module are lightly cleaned with a pencil eraser. (Anybody remember the DAP-310 contacts?).

The load sharing on each PA module can be significant to module reliability. This procedure MUST be followed very carefully. The 70 volt fuses serve only to protect the power supply, NOT the PA modules.

1. Remove any audio input from the tx.
2. Tune the transmitter for 52 volts, 22.5 amps.
3. Turn the transmitter off. Substitute a DC ammeter (Simpson 260, etc.) for the first 70 volt fuse. Ensure good contact. Isolate the DC ammeter from ground.
4. Turn on the transmitter. The module current should equal 1/12 of the PA current or about 1.9 amps. To adjust the module current draw, compress or expand the turns on the appropriate module tuning coil (L1-L12). Do not over compress or expand the turns. A wide variation may be due to a faulty module. Try interchanging modules to verify a problem. Due to their proximity to the cabinet wall, L11 and L12 may be slightly more compressed in comparison to their L1-L10 counterparts.
5. Repeat the above procedure for each module. NEVER operate the MW-1 without a 70 volt fuse or good external ammeter connection. Doing so can destroy a module.

RF Driver/Oscillator adjustment procedure:

1. Tune the transmitter for 52 volts, 22.5 amps.
2. Place a scope at P19-3.
3. Adjust pot on osc board until clipping occurs, then reset to just below clipping. It may also be further adjusted for minimum IPM and unwanted sidebands. Note that early MW-1's used a 4.7 volt Zener diode for CR2. It should be a 5.1 volt Zener.
4. Set Drive Bias and Voltage pots to midrange. Adjust L2 on IPA for max output.
5. Peak Drive Tune for maximum driver current.
6. Adjust Drive Load for 1.25 amps.
7. Repeat step 6, then step 5.
8. If an audio IM analyzer is available, adjust pots slightly for lowest IMD.

Symptoms/cures to add to Table 6-1 in manual:

Symptom: No PA Volts/Amps. RF Driver Volts Low. PS OK.

Cure: Q2 on audio driver shorted emitter/collector. Collector tab may be shorted to gnd. Q2 is often found to be leaky. Check all transistors on the audio driver for leakage.

Symptom: Downward shift of PA Volts/Amps during modulation.

Cure: Q3 on audio driver intermittent.

Symptom: 160 volt fuse on driver module blows. Transistors/diodes check OK.

Cure: Q3 on audio driver shorts under load. Replace.

Symptom: Collector volts on audio driver Q2 low. 160 volts OK. Q2 Ok.

Cure: Q3 on audio driver open.

Symptom: Erratic power control.

Cure: Ensure appx -13 vdc on the FP fine power control pot terminals or at the anodes of CR3 and CR4 on the Directional Coupler board. Replace these diodes (1N914) should the tx experience a lightning strike.

Symptom: High audio distortion

Cure: Check the 160 volt fuses. One may be blown yet meter readings appear normal.

Ensure the contacts on the mechanical latching relay above the Regulator board are clean. A good burnishing tool will be needed.

To measure tx RF load impedance with an OIB, remove the ANT/DUMMY shorting bar on the upper right front of the tx. Disassemble the shorting bar using a Phillips screwdriver. Use the two banana plus on the red leads of the OIB. The OIB will need to be propped up on some books, bricks, etc. This will ensure an accurate impedance reading right at the tx as opposed to a common point, ATU

input, etc. without the influence of non-concentric hardware such as J-Plugs, RF switches, etc. For safety reasons, be sure to use an external RF oscillator and receiver to perform this measurement.

It has been suggested that a 350 ohm pot be substituted for R7 (56 ohms) on the IPA module. This would allow adjustment of the RF drive to Q11. This control has been shown to reduce IPM and unwanted sidebands. Care should be taken not to exceed 2 amps of driver current.

That's about all I have for the MW-1. Be sure you have all the factory mod sheets. Dates on factory releases include July, 1978, Feb, 1980, and June, 1980. Harris has issued several modifications to work around discontinued parts, an AM stereo upgrade kit and a kit to assist those transmitters which fail to meet FCC 73.44 emissions ("NRSC") standards.

Tips From Alan Alsobrook

I just worked on the 2 remaining problems on the MW1 I just rebuilt

Problem 1- A Voltage overload would cause the SCR to fire and dump massive amounts of current through the 5 ohm 225 watt resistor (cooking it) without tripping an overload. That was found to be an open coil in K4.

Problem 2- The variac wouldn't turn. this one was a bit more fun, the motor wasn't running with voltage applied in either direction. Checked and found that the .5 uf cap between L1 & L3 was at 40 ohms. after replacing it, I then found that the mechanical shaft coupling was too low for the set screws to hit the motor shaft.

All in all I think this transmitter will be a reliable box for at least 10 more years.

From Jim Davies

I did come up with a loose rule lately...use the MJ15015 transistors for the audio pass (not the NTE equivalents) and the NTE-198 in place of the TIP-47's. The NTE for the TIP47 are hardier but the MJ15015's are hardier than the NTE's. I almost never get fuse troubles these days...have a nice LEA surge suppressor on the entrance. I Almost never have RF transistor failures either. I can fix a module in about 45 minutes. Open the door on it and keep it running....just switch it off long enough to pull a module and turn it back on while I fix it....takes less than 10 seconds down each way.

Look for bad solder joints in the early models. Sometimes those molex pin connectors had a tendency to fracture solder joints.

From Mike Patton

The finals in an MW-1 were originally selected 2N6340s that Harris had Motorola stamp a custom P/N on (SJ7349 or later SJ3125). Motorola discontinued that special number program, then sold the entire discrete semi division to ON Semiconductor, a Japanese firm.

ON and others still make a comparable transistor, a 2N5038, which works fairly well, although one has to pay closer attention to matching the gain of random transistor pairs than in the old days. The gain-matching procedure is in several Harris service bulletins and in the CD-ROM they released for the MW-1. Be careful, though--if you consistently get a dim light on a module no matter what transistors you put in it you've probably got a bad T1 input toroid (they get hot when run with shorted transistors and one or more of the primary turns shorts--they still work then, but they have the wrong turns ratio and don't drive the transistors fully into saturation--hence the dim light and funky output waveform).

As I write this, Newark Electronics (www.newark.com) carries the ON Semi 2N5038 and two other brands. I recommend the ONs--they have apparently inherited the quality tradition from Motorola. Using the ST brand I saw more gain problems.

For the audio transistor you should use an MJ15011, also available from Newark, also by ON and also a former Motorola #. The original was an RCA 2N6254--the MJ is much better. The audio driver is still the venerable TI TIP47, still made by several folks.

In a pinch, the NTE327 replacement transistor will work for the 2N5038 (be careful to match gains and be prepared to toss out the occasional low-gain transistor), and the NTE198 works just fine for the TIP47 (indeed, I highly suspect that it's nothing else than a TIP47 that's been restamped). The MJ15011 crosses to an NTE87, which appears to be a hardy transistor with appropriate ratings, but I have no experience with it.

I hope this helps. If you have any more problems, contact me. My firm rebuilds MW-1s, either in the field or at our facility.