

## A FIX FOR ELIMINATING KENWOOD MC-60A MICROPHONE HUM AND RFI Version 3.02

Version 3 completely replaces version 2, eliminates all hums, all RFI and an early wiring defect.

Designed by ZL4AI, Jeff King. (Copyright owned by Jeff King), date: 31-6-21

### Terminology used in this document:

MIC Plug: Plug which screws into the base of the microphone connecting to the wire base unit.

BASE Plug: Plug which screws into the base of connecting to the curly wire to the transceiver.

TRANSCIVER Plug: Plug on the curly wire which screws into the transceiver.

BASE UNIT CASE: The metal case of the base stand.

'MIC MIC + : The Mic + signal line wire from Transceiver Pin 1 to BASE Plug Pin 1 to MIC Plug Pin 1.

'MIC-GND MIC - : The Mic - signal line wire from Transceiver Pin 7 to BASE Plug Pin 7 to MIC Plug Pin 7.

CHASSIS GND -: The CHASSIS ground line wire from Transceiver Pin 8 to BASE Plug Pin 8 to MIC Plug Pin 8.

**STEP 0:** Conduct testing described below in Step 4 to establish audio hum.

### **STEP 1:**

Some early MC-60s were wired in the factory with a fault which is the wires inside the microphone with '**MIC-GND MIC -**' reversed with '**MIC MIC +**'. The circuit diagram in the Kenwood Owner's manual has this error (drawn out).

Use an ohm meter at the MIC Plug to verify if Pin 7 is connected to the Mic case; Connected shows the Mic is wired correctly.

The **Fix 1.0** is: Inside the 'MIC Plug' unsolder wires at pin 1 and pin 7: Reverse these wires by soldering the wire originally connected to pin 7 to pin 1 and the wire originally connected to pin 1 to pin 7.

### **STEP 2:**

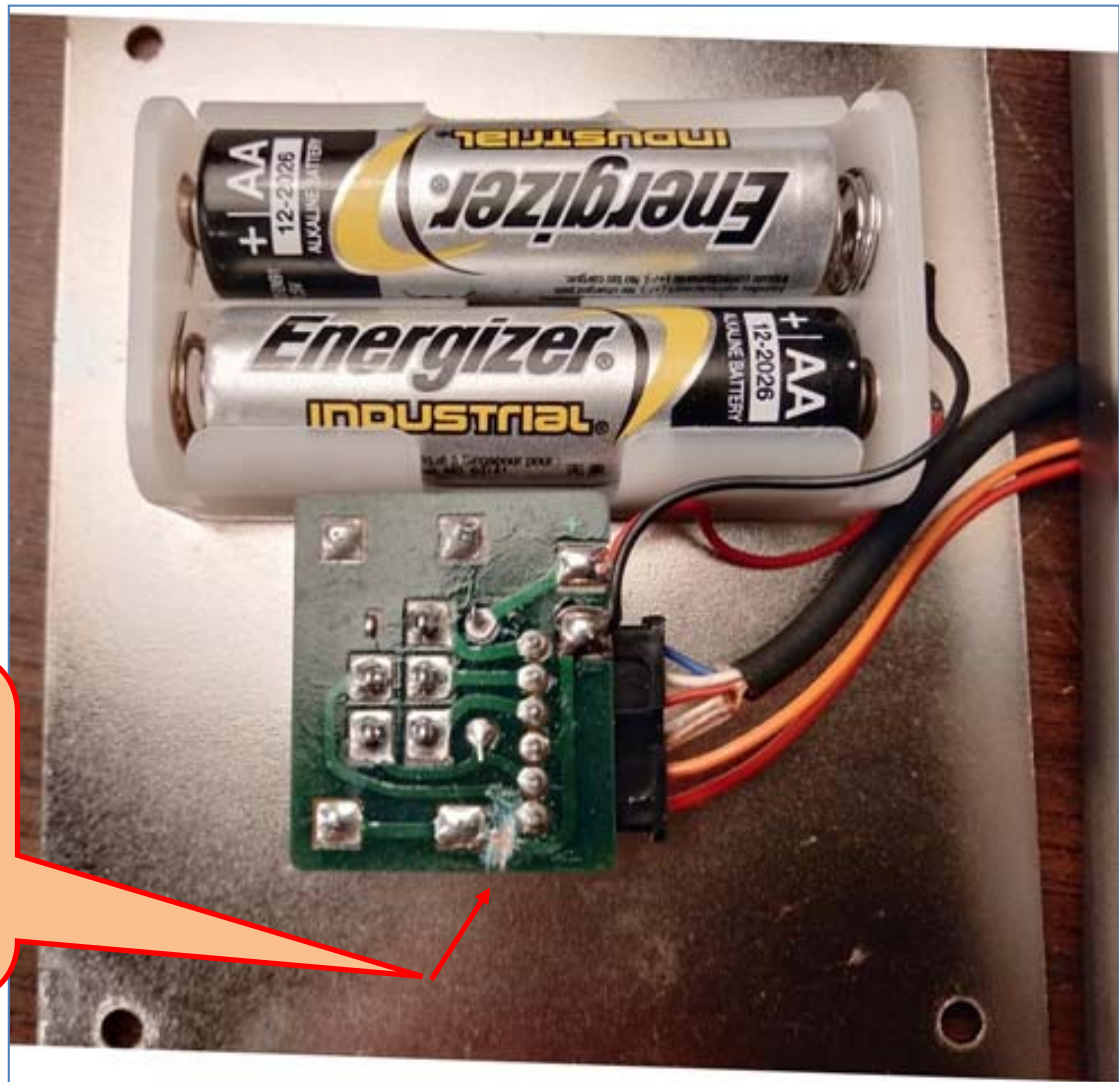
A significant Hum (when the pre- amplifier is switched on) and when touching the BASE UNIT CASE (with your fingers) occurs (when in transmit mode by pushing the lock button). This causes RFI (particularly when operating a power amplifier).

The major Hum #1 is eliminated by this fix.

The **Fix 2.1** is: The major Hum #1 completely disappears by: cutting through a single copper trace on the amplifier switch board. The copper trace is from the a battery negative to the metal brackets that contact touch the BASE UNIT CASE metal bottom plate.

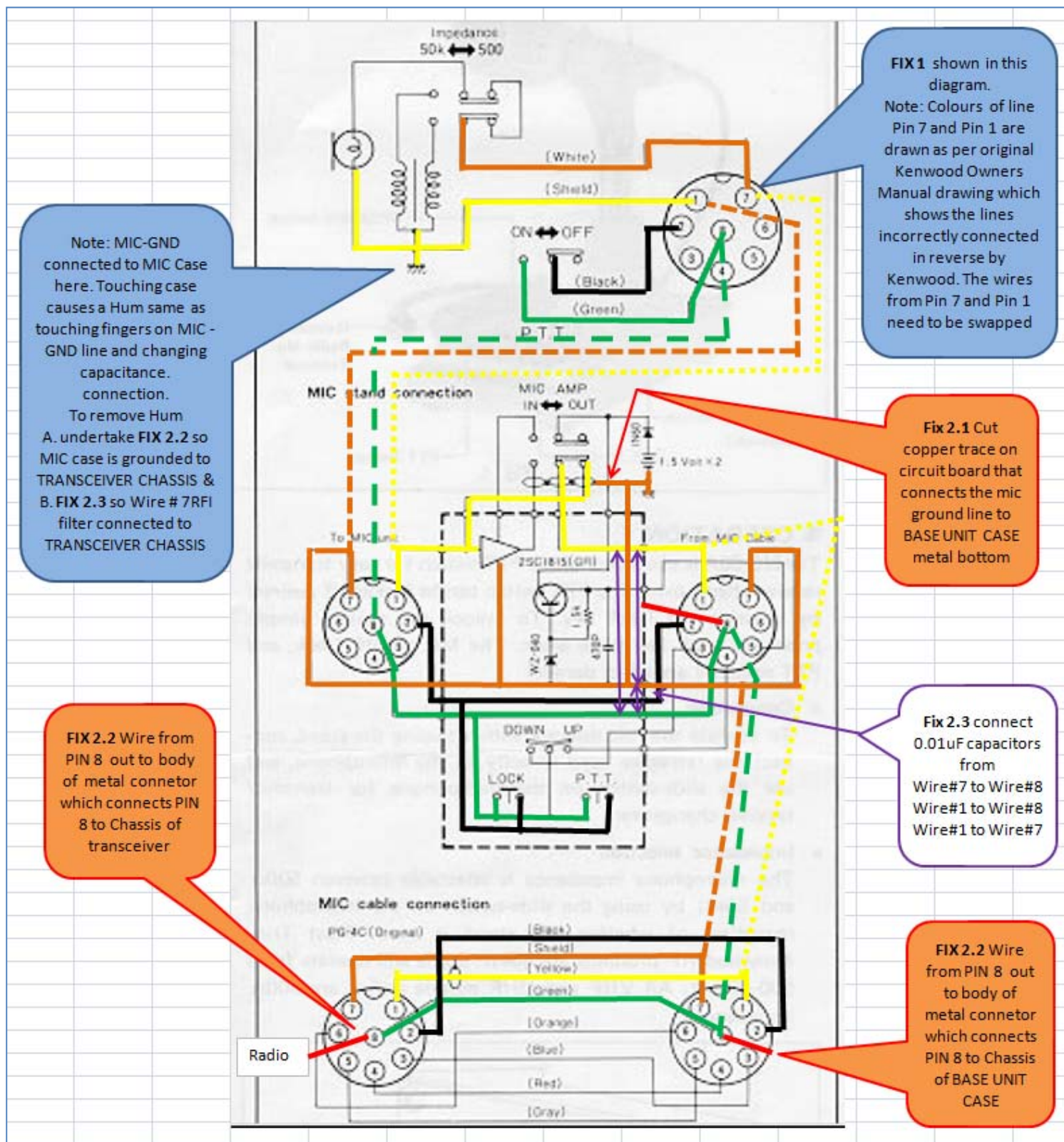
This cut:

- isolates the BASE UNIT CASE metal completely from the MIC-GND (microphone ground wire) which is connected to pin 7.
- disconnects the negative lead of the batteries of the amplifier circuit from the BASE UNIT CASE metal base plate and the upper metal case body.



**Fix 2.1** Cut copper trace on circuit board that connects the MIC-GND line to BASE UNIT CASE metal bottom plate

Reason this fix works? : The circuit diagram in the Kenwood MC-60 manual is badly drawn: It is not possible to follow the circuit logic in the broken format the circuit is drawn in the Owner's manual. When you draw out the entire circuit (shown below) you find Pin 7 the MIC GROUND connects to negative of the battery in the pre-amplifier circuit and then directly into the amplifier circuit itself. This negative microphone wire is connected directly to the BASE UNIT CASE metal bottom plate which is also screwed onto BASE UNIT CASE upper metal body stand. When the pre-amp is switched on, touching the outside body of the BASE UNIT CASE is the same as touching the microphone ground wire with your fingers and introducing more capacitance. As this MIC-GND circuit floats above ground and is not grounded onto the main chassis ground pin 8, this has the effect of significantly changing the capacitance in the pre-amplifier circuit. The change in capacitance causes the hum, which then causes the RFI.

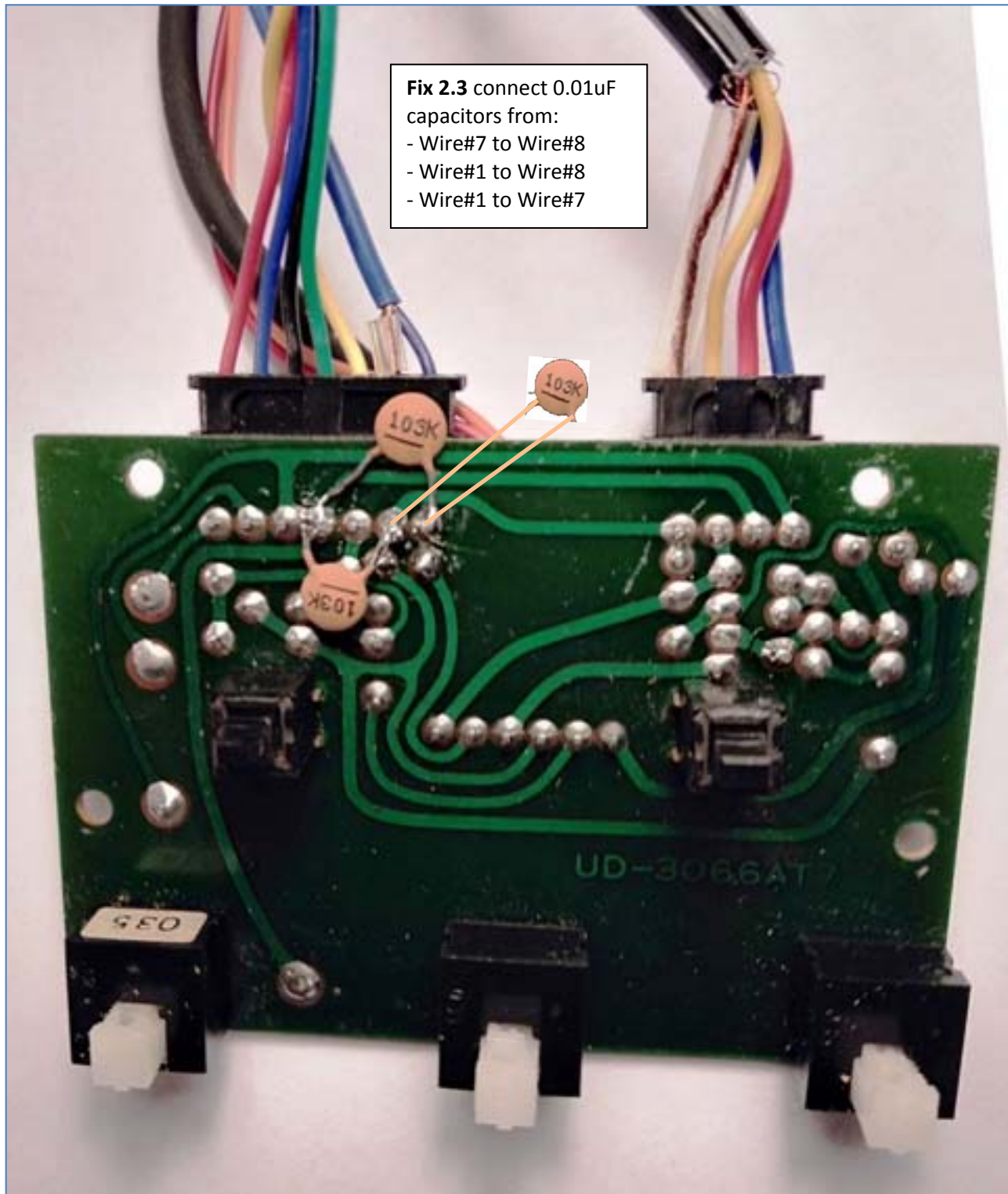


**Fix 2.2** is: Fix 2.1 above leaves 'BASE UNIT CASE' not connected to ground: A slight Hum #2 still occurs when the case is touched.

The **Fix 2.2** is: Inside the 'BASE Plug' and the 'TRANSCEIVER Plug' solder an additional wire (solid copper 30 mm long) to pin 8. Run this wire out through sleeve hole opening for the cord onto the screw on metal clamp and around 1 screw of the clamp. This grounds the BASE UNIT CASE to the **CHASSIS GND** - of the Transceiver and eliminates slight Hum #2.



The **Fix 2.3** is: A slight Hum #3 occurs when touching the outside metal shell of the Mic when transmitting. This fix occurs because the MIC- GND wire is directly connected inside Mic to the microphone outer shell case. A Fix (difficult to undertake to unscrew the glued together Mic body thread) is to take the Mic apart and break this connection. A much easier FIX 2.3 is to connect 0.01 uF (50 volt) ceramic capacitors from 'MIC MIC +' to CHASSIS GROUND, from 'MIC-GND MIC -' to CHASSIS GROUND and from 'MIC MIC +' to 'MIC-GND MIC -'. This is installed on bottom side the (switch and amplifier) circuit board inside the base unit case: shown in picture below.



### STEP 3:

The **Fix 3.1:** RFI can be further reduced by:

1. On the microphone curly cord lead soldering a 0.01uF ceramic capacitor (50V) inside the TRANSCEIVER Plug. These capacitors are located between:

- 'pin 7 MIC-GND MIC -' and 'pin 8 CHASSIS-GND', and
- between 'pin 1 MIC MIC +' and 'pin 8 CHASSIS-GND'.

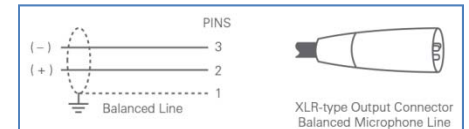
FIX 3.1 is not needed on the TS-590S or TS-590SG because 0.01 uF and 0.47uF capacitors are installed on the DISPLAY UNIT 9MIC) (XC1-0220-00) 9E/6) board. (The TS-890S, the TS-990S and other Kenwood transceivers probably will also have similar capacitors installed, but this yet needs to be verified on circuit diagrams from their Service Manuals.)

### STEP 4: TESTING ALL HUM HAS BEEN ELIMINATED

Initial testing is best not carried out using a transmitter because it is difficult to simulate Hum conditions while transmitting.

Instead connect the TRANSCEIVER PLUG pins 1, 7 and 8 to a microphone an audio preamplifier from the music industry \* which has not less than 55dB of gain to pins 2, 3 & 1 as laid out below

**MIC +:** MC-60 TRANSCEIVER PLUG pin 1 --> XLR Pin 2  
**MIC -:** MC-60 TRANSCEIVER PLUG pin 7 --> XLR Pin 3  
**CHASSIS GND -:** MC-60 TRANSCEIVER PLUG pin 8 --> XLR Pin 1



Then listen to output of the audio preamplifier on headphones or a speaker

This is much easier to do than trying to transmit on a transceiver and listen at the same time.

#### Test Setup for No Audio Hum:

Turn on the 50K switch on the MIC.

Turn on the MIC in switch (on the bottom of the MIC base) which adds 5.5dB of gain.

Turn 'the audio pre-amplifier \*' on with greater than 55dB gain.

This provides the worst testing condition.

This takes the MC-60 signal from -50.5dB (5millivolts) to about 0dB (about 1 Volt).

Listen on Headphones connected to 'the audio pre-amplifier \*'

You may hear Hum now.

Put your fingers on the Mic Base and you will hear Hum.

\* using only a Music Industry pre-amplifier with more than 55dB gain: I used a *Behringer Ultra Gain Pro MC2200*. This has very low noise audio amplifiers.

*Note: you do not need to push PTT because the MIC is continuously connected.*

Undertake the Fixes to Fix #2.3 above until you hear no Hum.

#### Test Setup for No RFI \*\*:

Then set MC-60 with MIC amp switched on and

- impedance switch set on (500 ohm to a connected [TS-940S, TS-590S, TS590SG, or TS-950SDX]), to provide an output microphone signal into the transceiver so the ALC meter does not exceed the peak limit value except for on an occasional voice peak and the Compression Meter does not exceed the 10dB peak limit value except for on an occasional voice peak,

\*\* Using a transceiver and power amplifier normal setup for transmission operation

feeding into a power amplifier set at 1,000 watts output PEP in SSB while speaking with your mouth 50 mm from the MIC mesh and your fingers holding onto the base of the MC-60 to verify no RFI occurs. [If some very slight RFI still occurs only when with fingers touch the case you should undertake STEP 3.]

Once you have made **Fix adjustments 1 to 2.3** above expect to find: NO MORE RFI.

from ZL4AI, Jeff King