Repairing the Marconi TF2002B Signal Generator Joe Bell G4PMY

This piece of equipment has sat in the Hack Green Bunker museum for 5 years and I often wondered if it worked. I decided to test it which was a mistake as once you know something is not working, then you are compelled to find out why.

Exact Model No TF 5002-035T
Frequency range 10Khz to 88Mhz in 8 bands
Modulation AM & FM from internal or external source.
Crystal marker-calibrator 1Mhz, 100Khz, 10Khz
RF oscillators are permeability tuned
AF oscillators are Wien Bridge 20Hz to 20Khz

Symptoms:-
No indication on modulation meter
No indication on carrier meter
No RF output.

An initial look at the internet produced very little in the way of schematic information. I found an article written by G1JBG who had repaired an older model, and eventually I found an on-line handbook, but again it was for an older model, and most of the circuits and PCB information did not match the unit to be repaired. However the manual was useful as the general concept of design had not changed with successive production runs.

With nothing apparently working, the first check was on the mains power system which was found to be ok, and producing 15v regulated which seems to be the main single supply source for all boards and modules. The equipment chassis is at + potential opposite to convention, and with the unit employing a fair number of PNP devices the normal upside down thinking has to be reversed because of the chassis reference to + volts.

Now what to do next. I decided to tackle the audio oscillator which is in fact a Wien Bridge circuit with switched capacitors for differing frequency ranges. The oscillator board is mounted on the side of the case and a scope revealed that no oscillation was taking place.

A quick voltage check found no bias on some of the transistors and this was tracked down to a short circuit electrolytic capacitor. The new (black) replacement capacitor can be seen in the following photograph. This repair produced audio oscillation and indication on the modulation meter.

There was still no RF output and no RF indication on the Carrier meter. This left no alternative but to remove the RF unit for examination and repair. The design of the unit makes this a simple task. Removing four screws in the side of the unit allows the whole unit including scale and knobs the be drawn out through the back of the instrument. The module plugs into the carcase via a multi-way plug and socket. Here you can see the RF unit half way out.

Once removed and the cover slid off the RF unit, it became apparent that the circuit I had did match some of the filter boards. All of the voltages and control lines into the RF unit go through two filter sections. The filters are wound on plastic formers and housed in ferrite pots. I found no less that 12 of these filters to be open circuit.

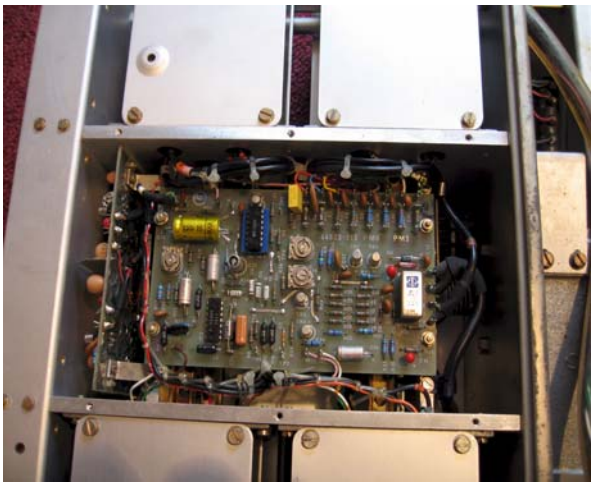
I removed the first one for examination and it read 20K ohms whilst on the board, but promptly fell to bits on removal. Heat being the main cause as both wire and former being brittle. Fortunately the filters are all stock values and were replaced with modern off the shelf units. I found that all 12 filters which were discovered to be OC were brittle and I eventually decided to replace all of the filters including those which measure OK.

The filters which were removed after being tested with an ohm-meter. Most read High Ks of resistance and should have been in the low 10s of ohms.

The RF unit can be powered up whilst out of the box by simply plugging in the mutli-way connector. This was done, but I still had no indication on the RF carrier meter.

The cover to the RF ALC board was removed and a scope test at the RF OSC input indicated that there was 5v of RF at the frequency indicated by the dial. The RF carrier level control was varied and found not the have any effect on the RF level. Following the control voltage from the RF level pot to the RF ALC board indicated that the varying control voltage was arriving at the ALC board. The control is effected by comparing the OSC with the output of the wideband amplifier unit which is mounted vertically adjacent to the ALC board. See photo below.

The output from the ALC unit to the wide band amplifier was checked and found to be broken off (brittle). It is a coaxial connection and this was remade. Retest now indicated that the RF output level did vary when the level control was altered, and now we had a low reading on the carrier meter.



The level of the raw oscillator was checked and this was found to be OK. I could not find any reason for the carrier meter to be showing a low level. The meter sits at the centre of a bridge circuit formed by two resistors and two diodes. This all check out OK.
I decided to follow each wire from the bridge to the meter as I notice it had quite high resistance. In fact I noted that one leg to the meter was OK with no resistance, and the other had some 15K of resistance.

That leg went to the toggle switch used for carrier on and off control. One side of the switch interrupted power to the RF oscillator section, and the other interrupted the meter connection to the bridge. It was this switch which was at fault having poor contacts on one side. Once changed the meter indication became correct and variable around the calibration points by use of the carrier level control.

Next to check was the calibrator. Nothing heard from the internal loudspeaker. A quick check indicated a loudspeaker resistance of 22K ohms. A quick look at the writing on the loudspeaker indicated 75 ohms. A replacement loudspeaker was fitted and all was well.

Here is a view of the two filter sections, extreme left and centre. To the right is the calibrator oscillator. In this picture you can see where I have removed 8 of the cores. To fit the new components I lifted the PCB and removed the metal studs which can be seen in the photo. This provided the extra space needed to fit the new inductors which were soldered to the original tags.

In this photo can be seen bottom left the suflex capacitors which are switched into the Wien oscillator to produce the audio for modulation.

The grey box at the centre of the photo is the switched RF attenuator.

Bottom right is the mains power inlet and the 15v regulator.

To the right can be seen the internal loud-speaker which can only be changed when the RF unit is out of the case. The grey box with the silver label is the mains power transformer.

Finally the RF output level was checked. With the RF attenuator switched to zero, the output level should be 1v into 50 ohms. This is normally done with an RF voltmeter, but I used a spectrum analyser. The 1v output should coincide with the Carrier level meter red calibration mark. All OK.

The final photographs are the PCB board A3 & A4 Modulation drive and monitor (A3) and RF oscillator supply stabilizer (A4).