UPDATE ON G3WDG 10GHz MODULES - November 1991 - Part 2

I am writing a second update this month as a result of feedback received from constructors of the G3WDG003 transmit converter, and from recent experiences gained personally with one unit sent to me recently to get working. Also, a new method of tuning up the G3WDG002 receive converter is described.

I am pleased to say that most constructors have been able to get their units working with few if any problems, as with all the previous modules in the series. With the G3WDG003 kits we decided to supply silver-plated screws and nuts along with the cavity filters. In a few cases these screws have proved to be just too short to resonate the cavities. This is a result of a build-up of mechanical tolerances in the filter dimensions. A suggested cure is to either file off 1mm or so of the conical threaded collar of the top of the cavity before assembly, or to cut or file the locknut to half its original thickness. We are looking to source some half nuts in future to supply these with the kits, but this has not yet been done. In case you are experiencing trouble tuning-up your G3WDG003, or indeed other modules from kits where screws were supplied, this may be the cause.

Now to some more specific problems which I found recently with one unit. These comments could apply to you, so please read on!

1. Filter veropins the wrong length. Constructor had used a ruler to measure the length of the pins, which resulted in the pins being not the right length. The tolerance of the length is -0.0, +0.1mm, for example the 3.4mm pins can be 3.4 - 3.5mm. Shorter pins will increase the loss and reduce the filter bandwidth unnecessarily, while longer pins increase the bandwidth and reduce spurious suppression. Please use vernier calipers or a micrometer when setting the length of the screws. One useful tip is to prepare the veropins before starting any assembly. Then any pins which are filed too short for use as filter probes can always be used as grounding pins.

2. Intermittent tuning. All of the cavities seemed unusually difficult to tune. The locknut had to be extremely tight to get sensible tuning, and even then the tuning was intermittent. Normally, the locknut needs to be just tight enough to require more than an "electricians" screwdriver to adjust the screw, but not too tight. Tuning should then be smooth and stable. Excessive torque may be a result of contaminated threads on the cavity or the screw. Use of solvent to clean up the threads may prove beneficial. The cause of the problem on this unit could have been use of excessive torque from the beginning, especially if other problems were present stopping the unit from working leading the constructor into much fruitless tweaking with the risk of damaging the threads. I cured the problem by replacing the cavity, which can be done in situ with a small blowlamp if care is taken. In case you do not get the unit to tune up first time and there are no other obvious causes, please note the above regarding the possibility that the screws are too short for your particular case. My recommendation then is to purchase some longer screws (B & Q or similar) and do the initial tune up with these. The silver plated screws can then be tried, one at a time, and nuts cut or filed as needed.

3. Cracked chip capacitors. In the unit, the 144MHz series dc blocking capacitor C9 was cracked and was preventing the unit from working. It is possible to crack these components if the board is flexed either by assembling the board before it is put into the box (note the build instructions recommend mounting the board in the box before assembly to avoid this possibility), or by being very heavy handed when tuning the cavities. It is almost impossible to see if a component is cracked, the only way being to melt the solder at one end and see if half the part comes away!

4. Poorly soldered bias wires. In some cases there were dry joints where the 0.2mm bias wires were soldered to the tips of the radial stubs (triangles). It is helpful to tin the 0.2mm wire before assembly.

5. Chip components mounted incorrectly. In the unit, the chip components had been mounted with the narrow sides against the board. This results in there being extra inductance in the connections to the components. The effect on the module was low gain from the LO input to the splitter output. This was increased by 1.5dB when the chips were refitted correctly, ie with the wider side next to the board allowing the soldered joint to be made to all the metal on the ends of the chips.

6. FETs poorly soldered. Some of the FETs had not been mounted as per the instructions. In some cases the devices were not flat on the grounding veropins, but mounted up on bumps of solder. It may have been that the constructor had pretinned the pins leaving large bumps of solder on them prior to fitting the FETs. This makes it very difficult to get the devices to sit flat. The effect of this is to lengthen the gate and drain connections, which detunes the circuits, as well as to have the source currents flowing through a lot of solder (which is lossy). Please follow the kit instructions carefully.

*

Several constructors of the G3WDG003 receive converter have found some difficulty in aligning the unit using the recommended method. Some have tried to tune up the filters using strong local signal sources, which does not always seem to work, after finding it difficult to locate the drop in noise associated with resonance of FL1. The reason is probably that the multiplier bias has not been set to optimum beforehand leading to low local oscillator injection at this stage. I have developed an alternative method, described below, which should make it much easier to tune up the module. This involves temporarily bridging out the image rejection filter and using the LNA stages as a noise generator to help with the alignment of FL1. The stepwise revised procedure is as follows:

1. Connect a wire (0.5mm dia eg ex-component lead) across FL2, mounted flat to the board and with no protrusions over the veropin pads.

2. Follow original steps 1-8.

3. Set RV2 and RV3 to give 0V gate bias to F2 and F3.

4. Adjust FL1 for a noise peak. Note comments above concerning locknut tightness.

5. Adjust RV1 for maximum noise.

6. Power off and remove shorting link across FL2.

7. Power on again and follow original step 12. The 2 peaks are approximately 3/8 turn apart.

8. Reset RV2/3 to give full -ve gate bias to F2/3.

9. Follow original step 10.

10. Follow original steps 13-15.

This completes alignment.

One last note: while debugging a returned 002 receive converter, the mixer diode was found to be blown, probably as a result of static or soldering iron leakage. Please take care with this component as well as the GaAs FETs. Following a recent price rise by our supplier, this is now the most expensive single item in the whole unit!

*

Please let me know of any other findings you may have or other comments you would like to share with other constructors. I am happy to summarise these from time to time in this newsletter to help others.

73

Charlie G3WDG