Harry Leeming G3LLL's In the Shop
The Cedars, 3a Wilson Grove, Heysham, Morecambe, Lancashire LA3 2PQ
Tel: (07901) 932763 E-mail: **G3LLL@talktalk.net**

Harry Says...

"a good r.f. signal generator is a valuable asset in the workshop!"

Harry Leeming G3LLL looks back at his days running a very busy radio and electronics business in the north west of England. This time he gives some advice on vital test equipment.

Welcome to *In The Shop* (*ITS*) where I'm starting off this month by mentioning that a good radio frequency (r.f.) signal generator is a valuable asset in the radio workshop. I think that no experimentally inclined Radio Amateur should be without one! Over the last 20 or 40 years many new low-priced signal generators and kits have been marketed, but most of these arrive with three basic shortcomings.

The shortcomings can be that the signal generator's frequency dial isn't particularly accurate, the generator drift, and the attenuator and output level isn't accurate. However, if a generator is a little off frequency, this is no great worry as you can connect a frequency counter to it, and use this as a 'digital dial', or even check its frequency with an accurately calibrated receiver.

If a generator drifts this can be a nuisance, but at least you can let it warm up for an hour or so and then correct the frequency. If however, the generator leaks out a strong signal when it's set for zero output – this makes it useless when it trying to measure the sensitivity of equipment, or when adjusting a receiver for the best weak signal performance.

Designing a signal generator that can generate signals in the region of a microvolt, requires that they are very well screened, and filtered. This is why the older valve operated 'portable' generators, such as those made by Marconi, were extremely heavy due to the extra filtering and screening.

Fig. 1: Harry's trusty TF2002B covers down to the upper audio band as well as its r.f. option.

I can still remember 50 odd years ago, the instructor at Blackburn Technical College, staggering into the room, red in the face, as he placed one on the bench! Transistorised units are of course somewhat lighter but still there's still a need for effective screening and filtering – so treat any lightweight generator with suspicion.

There doesn't seem to be a lot of demand for the older heavyweight generators. Some second hand units made by companies like Marconi, that are well screened with an accurate attenuator and reasonably stable in frequency, can go at bargain prices at surplus sales.

The older analogue generators are basically quite simple items, and if you can get the matching manual (ask about this before parting with your cash) you should be able to carry out any necessary repairs and clean the switches and controls without too much difficulty. The older valve units may be full of 'leaky' wax-paper capacitors but if you have time and patience this should cause no great problem, as replacements are easy to come by.

To tell the truth I had three very impressive looking models in prominent positions in the shop. They cost me a total of not much more than £100 and yet people looked at them and made comments about "the expensive equipment, that was needed to carry out repairs." I didn't trouble to correct them!

Once you have serviced a generator it's advisable to check the output level – you'll then know that when you set it to give (let's say 50µv output), this is what it gives. Providing that the unit has not been transmitted into (yes - it could happen!), or abused in some other way, you can probably take it that the attenuator steps are okay, so all you need to check is the calibration of the maximum output level.

Checking the output level can be quite simple if you can find a signal generator that covers down to the top end of the audio range – like my TF2002B shown in **Fig. 1**, for which I paid £25. This covers 10kHz to 88MHz, and can be calibrated with an ordinary AVO 8, as fortunately this has an accuracy of within a few percent at 10kHz. Once the generator is fed into a 50Ω load, and its output meter set to

be accurate at say 1V with reference to the AVO at this frequency, it will be 'near enough' on the other ranges.

The TF2002B can then be set to give – let's say 20µV output – into a receiver tuned to a frequency within the higher end of its range and the S-meter reading noted. If a v.h.f./u.h.f. generator that needs checking, when it's set at 20µV on the same frequency it should give the same reading. This might not be an accepted way of calibrating equipment to laboratory standards – but at least it gives you a good idea that the output is reasonably accurate.

Protecting Your Investment

So, you've purchase your unit – it's an investment really – you've cleaned it up, and swapped half a dozen leaky capacitors. Your pride and joy will then look like something from Star Ship *Enterprise* and will be the envy of any visiting Amateur. When used in an Amateur Radio radio shack however, the precision parts which determine the output level (such as the attenuator) are at very grave risk of being damaged.

Once or twice when I've been testing the receiver section of a transceiver with my generator, I have accidentally pressed the wrong button or keyed the microphone. Don't think this won't happen – it will! And when it does you'll almost certainly damage the attenuator, possibly beyond repair if you don't install some kind of protection. My protection unit is a modified CB standing wave ratio (s.w.r.) meter as shown in **Fig. 2**.

The printed circuit board (p.c.b.) track connecting the two SO-239 sockets has been cut and the break bridged by a small 6V-100mA lamp. I leave this protection device permanently connected to my generator, and should I accidentally transmit when the generator is connected to a rig – the lamp blows and protects my invest. My protection unit has a measured loss of about 4dB on the h.f. bands and so it's easy to take this into account when making measurements.

The FT102 & Relays Again

I really appreciate the way that so many readers freely share their experiences and in response to the saga about the Yaesu FT-102 relays. **Chris Hoare** sent me an E-mail which referred to **Peter Chadwick G3RZP**'s modifications for the rig. I contacted Peter, and he kindly gave me permission to publish his step-by-step instructions

Over a length of time any switch or relay contact will develop resistance, as it gathers dust and oxide, but small

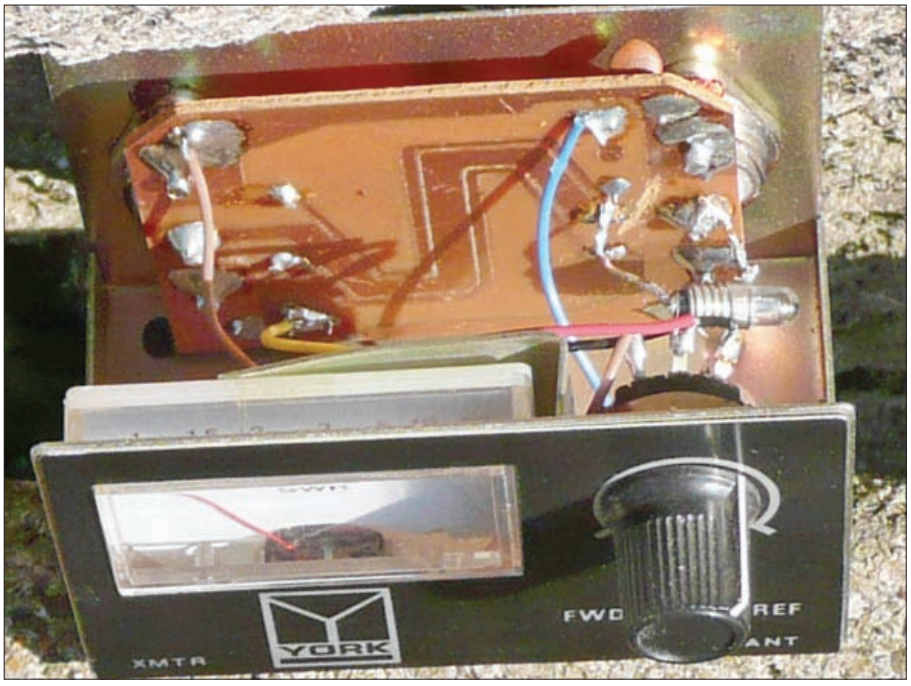

Fig. 2: A modified CB standing wave ratio (s.w.r.) meter, can serve as a protection unit for the output attenuator of a signal generator.

amounts of contamination do not matter, **if** there's sufficient voltage across the contacts to break down the resistance of the barrier. The problem with the FT-102 is that many of its relays only switch microvolts of signal levels and hence only the slightest layer of pollution or oxide is needed to upset their operation.

Many years ago it was muted that 'd.c. wetting' i.e. adding a few volts of d.c. to the signal path should cure the trouble. Indeed, I did once sketch out a possible circuit, but lacking a scrap FT-102 to experiment with I took the matter no further. However, Peter G3RZP went ahead and has had great success. He must have done something right, as once he'd completed the modification he's never needed to replace the relays. Chris Hoare followed his instructions and he was also able to retain the 30 year old relays.

Modifying the Yaesu FT-102 Relays (by Kind permission of Peter Chadwick G3RZP).

"You have to get at the bottom of the r.f. board, (remove the a.f. board) but you don't need to remove the r.f. board itself or the relays. You cut one track and put in a capacitor: otherwise, it's simply a matter of adding components on the underside of the board.

1. Cut track from J64 pin2 (antenna input) to junction T01 and T02. Bridge the gap with a capacitor - 0.01 or 0.1µF disc ceramic, 50V.

2. Connect a 150k 350V rated, 1W resistor across C22. That fixes RL02! You can go up to 470k 0.5W if it's easier to find.

3. Connect a 470µH or thereabouts choke from the junction of RL01 and C04 to ground.

4. Connect a 470µH or thereabouts choke from the junction of RL02 and C25 to ground.

5. Connect a 8.2k resistor from the junction of R09 and C30 to the junction of T01 and T02.

6. Connect a 8.2k resistor from the junction of L03 and C48 to junction C56 and RL05.

7. Connect a 2.2k resistor from the junction of R09 and C31 to junction C24 and RL03.

8. Connect a 8.2k resistor in parallel with C32"

To help I have marked the approximate location of the various stages on the circuit diagram **Fig. 3**.

Unfortunately, I don't have an r.f. board layout which is good enough for publication, but if you're stuck please E-mail me and I will reply and send you a copy of my rather tattered and scribbled on circuit. I would be very interested to hear from anyone who tries the modification out, as the work involved (while not simple) sounds much easier – and a lot cheaper – than swapping the relays. Again unfortunately, as I'm now clearing my workshop and no longer do repairs I'm unable to carry out the work myself

Yaesu FT-747 Switching Problem

'**Terry**' E-mailed me about a difficulty he was having with his Yaesu FT-747. Sometimes when he pressed the **On**/**Off** button, there was a slight click but the rig remained completely dead. He had checked all his leads and even cleaned the switch but he still had to

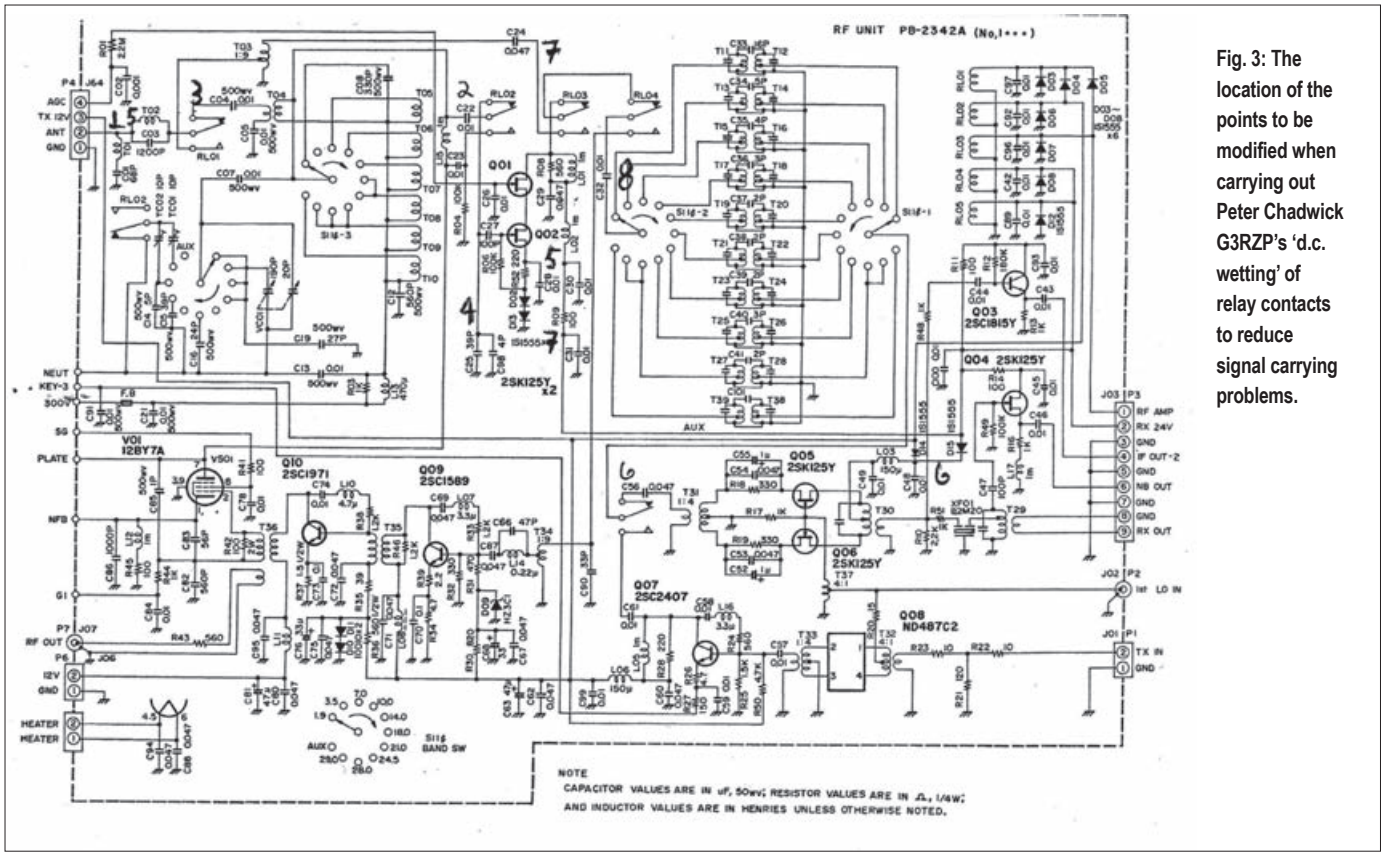

Fig. 3: The location of the points to be modified when carrying out Peter Chadwick G3RZP's 'd.c. wetting' of relay contacts to reduce signal carrying problems.

press the switch a few times to get the rig to fire up.

Let's look at the problem; the FT-747 has a somewhat unusual power switching circuit. The On/Off switch on the front panel doesn't itself power the set up, instead it connects the 13.5V feed by energising a relay that's on the 100W power amplifier board. Intermittent failure to switch on can usually be traced to either dirty contacts on this relay, or a dry joint on its connections – simple when you know. Terry applied a little switch cleaner, pulled a feeler gauge through the contacts a few times and all was well.

The Hara Kiri 13.5V Socket

In the repair trade I often spent hours trying to trace some elusive fault. In the end some turned out to be only a dry joint, or something else that was so simple that I couldn't possibly charge for a faction of the time involved. To compensate for this there were complicated looking faults, which once you knew the answer to, could be cleared in minutes. In cases like that I made up for lost time and charged for my 'experience'. The FT-747 had one of these!

'**Tom**' brought his FT-747 into me complaining that it was dead in transmit and receive and that also as soon as he switched the rig on the S-meter went hard over – I knew at once what it was the dreaded 'Hari Kari 13.5 Volt socket'

In the motor trade mechanics refer to 'paying faults' – supposedly weak parts, or stupid mistakes in the manufacture of cars which help to keep them in business! And so just to fill the service Engineer's pockets Yaesu fitted the 13.5V output socket on the FT-747. A 13.5V output socket can be very convenient, its use avoids running extra leads from the power supply unit (p.s.u.) to such items as a speech processor, or digital interface units – but there's a catch!

The 13.5V socket on the FT-747 is fed from the main circuit board by a thin strip of p.c.b. track and isn't fused. If the plug that's inserted, or the lead that's connected has a short circuit on it then the a whole strip of printed circuit acts as the fuse and the FT-747 stops working.

With the FT-747 a repair hopefully only requires the missing track to be bridged across. But how much better it would have been (for everyone except the repair man) if Yaesu had fused the socket? You can of course use an external fuse but even then this doesn't protect the rig if the plug shorts out. So, my advice is to never use the 13.5 volt out socket on the FT-747.

Beyond Belief

We were in the local branch of a large national grocery/ departmental store, and while **Brenda** looked round the lady's fashions, I went to the computing and electrical department. I looked at the display of TVs but unfortunately they were only displaying a pre-recorded demo-disk. This meant that the sets were acting as little more than computer monitors, and so I asked to see them connected to an antenna, so that I could compare ITV and BBC picture quality in both normal and high definition.

I was told, "Sorry this was not possible as the branch does not have a TV licence!" I couldn't believe it, and so when I got home I E-mailed their head office, and got the following reply.*"Dear Mr. Leeming, Thanks for your E-mail. I'm sorry that you were unable to see the BBC and ITV on the TVs on display in the Morecambe store. I can understand your frustration as picture quality is an important aspect when buying a TV.*

"We're proud of the service we provide. That's why it's disappointing to hear how let down you were at the Morecambe store recently. As explained, it would be illegal for us to connect the TV to a terrestrial antenna without a TV licence." Did I laugh or cry? See you soon! ●

Problems

I like to hear about problems with older equipment, particularly pre-1990 Yaesu rigs. Please E-mail me, (add some radio related term in the subject heading, to differentiate against spam), or write and enclose a stamped addressed envelope. Remember that electricity is dangerous, if you are not familiar with safety precautions you must never work on your equipment whilst it is plugged into the mains. (Switching off at the wall socket does not necessarily make equipment safe).