Instant HT on and off the M54

Dave Porter G4OYX with Paul Craven M1PVC

Readers will no doubt recall the constructional article in *Signal* for the 25 W, 60 m AM transmitter published in May 2013 **[1].** Modern components and techniques were used resulting in an Ofcom-compliant transmitter with respect to power output and transmitted modulated RF bandwidth. Paul Craven M1PVC was quick to build his version which was featured in colour on the back page of *Signal* **[2].** Both constructors used solid-state rectification in the HV and LV DC power supplies with modern, compact, high-value electrolytic capacitors typically 110 µF at 770 VW (made up of two 220 µF, 385 VW components in series) on both sides of a HT smoothing choke; this ensured a hum-free supply rail. However, this arrangement generated another problem which will be explained in this article.

Hum-free but with residue…

The PTT sequence switching for the power supplies was by 12 V DC relays with 10 A contacts, eminently suitable for interrupting AC mains and low voltage DC but not for HV DC use due to internal sparking; consequently none of the relays were used for switching the HV supply. It was noted by both authors that in use, on changeover from transmit to receive, an 'RF tail' of fading-to-zero plain carrier was evident over the received audio from the on-coming station. This was caused by the two 110 µF capacitor banks discharging slowly and keeping the M54's 12BY7A crystal oscillator stage running for up to 4 to 5 seconds.

Possible solutions

The authors envisaged at least two solutions to the problem though one such solution was not possible in this case. It was recommended that VFO control not be encouraged for AM operation on 5301 and 5317 kHz due to the tight constraints of absolute stability on nominated spot frequencies. Had a VFO been employed, then a voltage could have been switched across, say, a varicap diode connected across the frequency determining components in the oscillator when the PTT switch was released, shifting the VFO frequency away from the operating channel. With crystal control this approach is not as easy to effect as the operating frequency would only be moved by a kHz or so. The other option is to disconnect the DC supply rail between the PSU output section and the rest of the circuit. Suitable HV relays are not easy to source and, for this reason, G4OYX accepted the inconvenience of missing a few words after changing over to receive.

M1PVC's approach

Figure 1. Reed switch used to switch the HV supply

As is often the case, components collected over the years and bought at rallies can sometimes be found a use when least expected. M1PVC had acquired a supply of HV-rated reed relays by the Meder Electronics Company. Numbered V26 T10 ESF-18, these were of substantial construction as illustrated in **Figure 1**. A glass tube containing the normally open reed switch with a filling of an inert gas is partially encapsulated by a potted epoxy moulding. Two insulated lead-out wires are used for coil control and the glass phial has gold-plated spills for the HV connection. The unit is mounted by means of a single tapped 4BA hole in the epoxy base. It appeared that the reed coil was designed for 18–24 V operation and, of course, with all the control supplies in the M54 being 12 VDC, there was a problem with operating these relays. However, a voltage doubler circuit (**Figure 2**) driven from the 12 VAC heater supply produced *c*. 19 V on load. The circuit comprises the voltage doubler, the Meder relay RA1 and a small 12 VDC pilot relay, RA2, which connects across the coil of the antenna changeover relay. M1PVC fabricated a small printed circuit board to hold all the components.

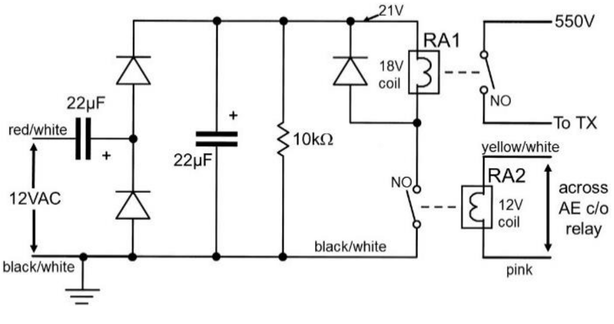

Figure 2. Voltage doubler circuit and switching arrangement. RA1 is an HV reed relay with 18 V coil and RA2 is OMRON GD6-ASI series with 12 V coil. The diodes are 1N4004 or better

M1PVC kindly offered some of these reed relays to G4OYX but, with the tight mechanical spacings in the G4OYX version of the M54, there was no room for an additional printed circuit board so a small tagstrip (**Figures 3 and 4**) was used for the doubler components with the reed relay RA1 being in one position and the pilot relay RA2 in another. On test, the doubler voltage was 24 VDC off-load. 100 µF 50 V electrolytic capacitors were used in the G4OYX doubler rather than 22 µF 63 V components as employed by M1PVC.

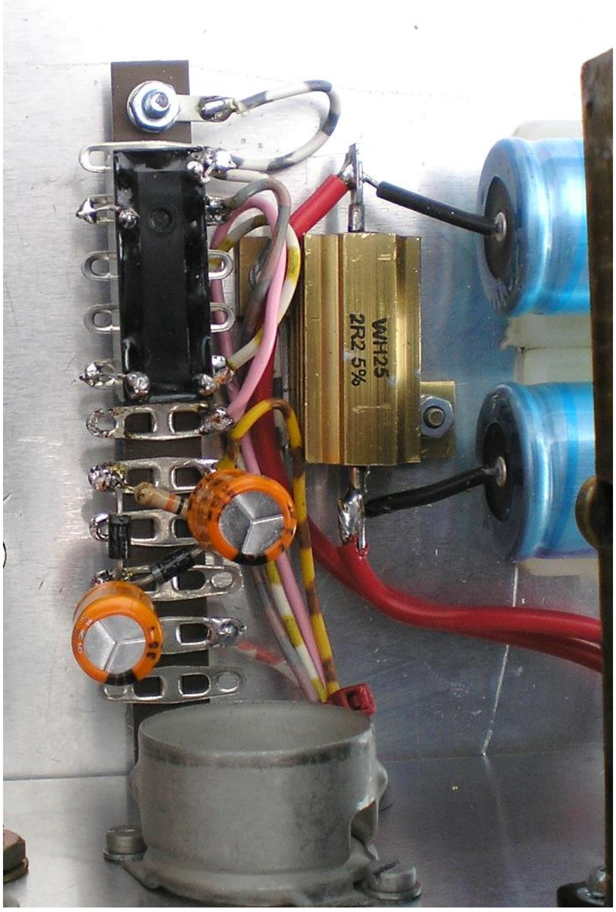

Figure 3. The voltage doubler tagstrip in the G4OYX transmitter

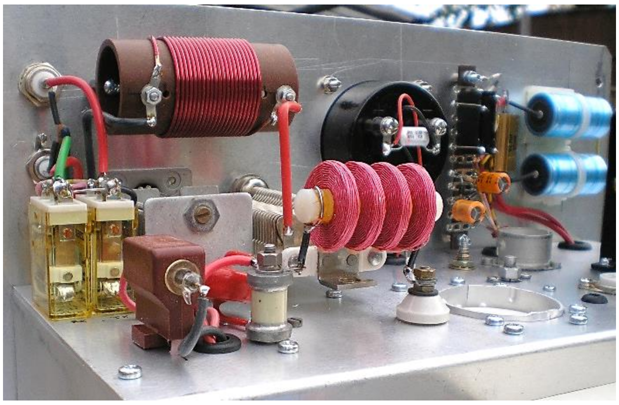

Figure 4. The aerial changeover relay (left) with the reed relay in front, and the voltage doubler tagstrip (right)

Ratings

Concerns were raised that the reed switch may have been of insufficient power capacity to support the DC requirements with specified power ratings to 50 W. However, the ranges of reed switches marketed by Meder have voltage switching capabilities of up to several kV and some up to a current of 3 A and hence the actual rating of the relay in question is not clear. So far neither of the transmitters has shown any problems with a reliable switch-over and only time will tell if they are fit-for-purpose.

Conclusion

This joint project is offered to the VMARS transmitter building fraternity as means of getting more out of the hobby and shows that, with the correct approach, only a small amount of modifications need be done to substantially improve a project.

Comment by M0DAF

Bronek Wedzicha M0DAF has added the following comment based on his experience after building the 80 m TT21 transmitter **[3]**:

The M54 transmitter is based on the same circuit as the TT21 transmitter except that the PA valves in the latter are a pair of TT21s giving rise to a significantly higher RF output than the single GU50 used in the M54. Hence, the original circuit of the TT21 transmitter included a 12BY7A crystal oscillator fed from the HV supply *via* a wirewound resistor and the HV supply was switched at the mains, mainly because the supply was built around a choke-input smoothing circuit which would normally require a substantial ballast resistor to pass current when the transmitter was not drawing on the HV power supply.

The use of a high value smoothing capacitor in the power supply meant that the ‘RF tail’ of fading-to-zero plain carrier was evident immediately after the transmit/receive switch was moved to receive and it was decided to remedy by providing a separate power supply for the oscillator and switching the HT to the oscillator. Indeed, the power requirements for the 12BY7A are modest (not measured but expected to be no more than *c*. 20 mA at 250 V) and an LT mains transformer wired in reverse across the heater supply, with a bridge rectifier and smoothing capacitor, could provide an easy solution. The 250 V supply can be switched safely with a small relay.

This solution provided an additional benefit since the separate power supply made it possible to turn on the oscillator with a ‘spot’ button, first to check and peak the drive to the TT21s and secondly to spot the crystal frequency on the receiver (an HRO) which tended to drift slightly after switch-on. Occasionally the spot facility is useful when an SSB station appears on frequency; it takes some time to set up the HRO (AGC off, BFO on and set BFO, set RF gain, set AF gain, tune) for the reception of SSB whereas the spot button provides an instant carrier which is usually sufficiently close in frequency. The output of the crystal oscillator is constant from day to day which means that even minor changes in receiver performance can be detected by pressing the spot button.

References

1. D Porter G4OYX. 60 m from the M54. *Signal* 2013, **27** (May), 3-12.
2. P Craven M1PVC. The Back Page. *Signal* 2014, **32** (August), 40.
3. D Porter G4OYX and B Wedzicha M0DAF. Build a QRO transmitter. Part I, The RF deck. *Signal* 2007, **2** (February), 9-14.

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