Band-pass Filters For VHF

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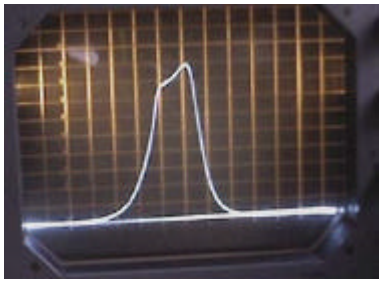
Following on from Richard Hankin's recent article describing harmonic performance of HF equipment and showing the use of a band-pass filter to attenuate harmonics, I thought it might be helpful to pass on some details of a couple of excellent band-pass filters for VHF that I have come across. These are the F1482/GRC and the F194/U. As the designations suggest these are both ex-military and are of USA origin. They were both originally obtained from Fair Radio Sales and at the time of writing, both are still listed but unfortunately the F194/U is apparently no longer available but may be available elsewhere, so is included for completeness.

F1482/GRC

This is a three chamber helical filter tuneable from 30MHz to 80 MHz and so will cover the 6 metre and 4 metre bands. Each chamber is tuned separately and has a frequency scale to allow coarse setting. A small (literally) power meter is included for measuring forward and reflected power. This has two power ranges, 6 watts and 60 watts and can be used for tuning the filter. Adjustment is straightforward and is simply a matter of setting each chamber to the required frequency. The associated transmitter is set initially to low power and keyed. Each chamber is then fine tuned for minimum reverse power and the transmitter is then set to full power and the adjustment finalised. For low power use the filter can be tuned using a VSWR bridge. The filter is designed for a 50 ohm system and typical input VSWR figures are 1.01:1 at 51MHz and 1.02:1 at 70MHz.

The screen shot (above right) shows the F1482/GRC filter characteristic at 70 MHz as displayed on a Rohde & Schwarz Polyskop. Unfortunately the Polyskop doesn't allow direct measurement of insertion loss and bandwidth but the plot below shows the measured response. This was taken using a Rohde & Schwarz VHF Monitoring Receiver that includes what is essentially a tracking oscillator and so can be used for measuring insertion loss. It should be mentioned that both the displayed and measured response were taken with 60 Ù source and load as both the Polyskop and Measuring Receiver use this impedance. The filter has a similar characteristic at 51 MHz. Insertion loss at 70 MHz and 51MHz is about 1.5dB, corresponding to a power loss of about 30%. To give an idea of harmonic attenuation possible with the F1482/GRC, insertion loss at both 140 MHz and 102 MHz was measured as better than –80dB.



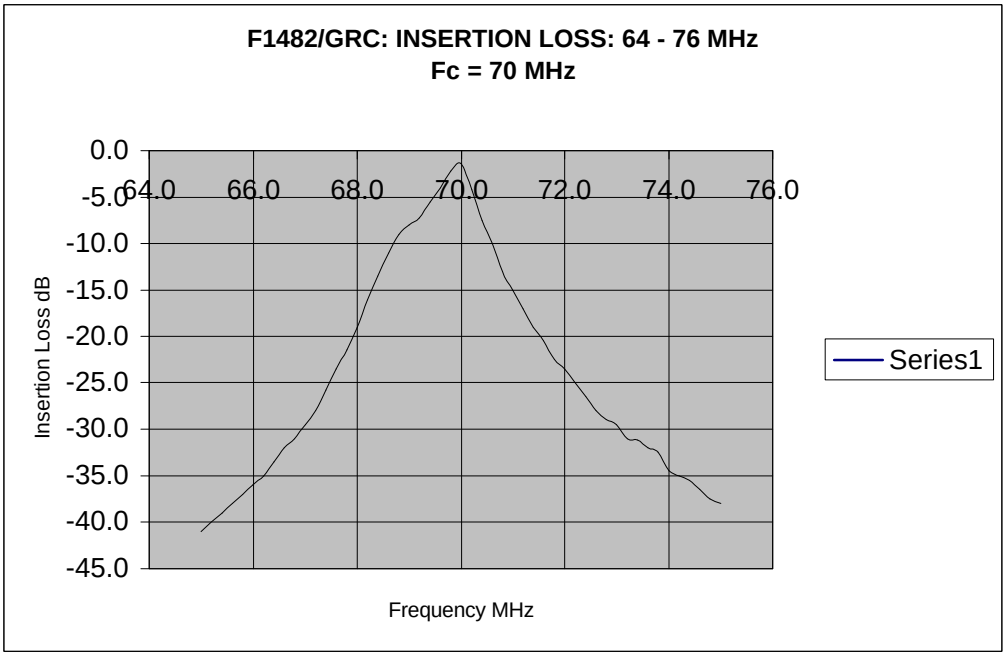
The response characteristic shows that the roll-off either side of centre frequency to be fairly steep, which of course is to be desired but unfortunately there is little room for manoeuvre in the pass-band and therefore the filter is best suited for fixed frequency use.

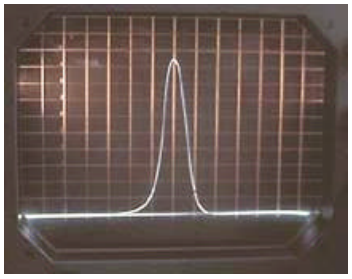
As delivered, the filter input connector is BNC while the output connector is unfortunately non-standard. However, this can be changed for a single hole fixing BNC, the hole is a little oversize and tightening the securing nut is somewhat tricky. A BNC panel connector that has the thread on the front side is a better fit but is rather difficult to get in position, although this can be done with a little care and patience.

F194/U

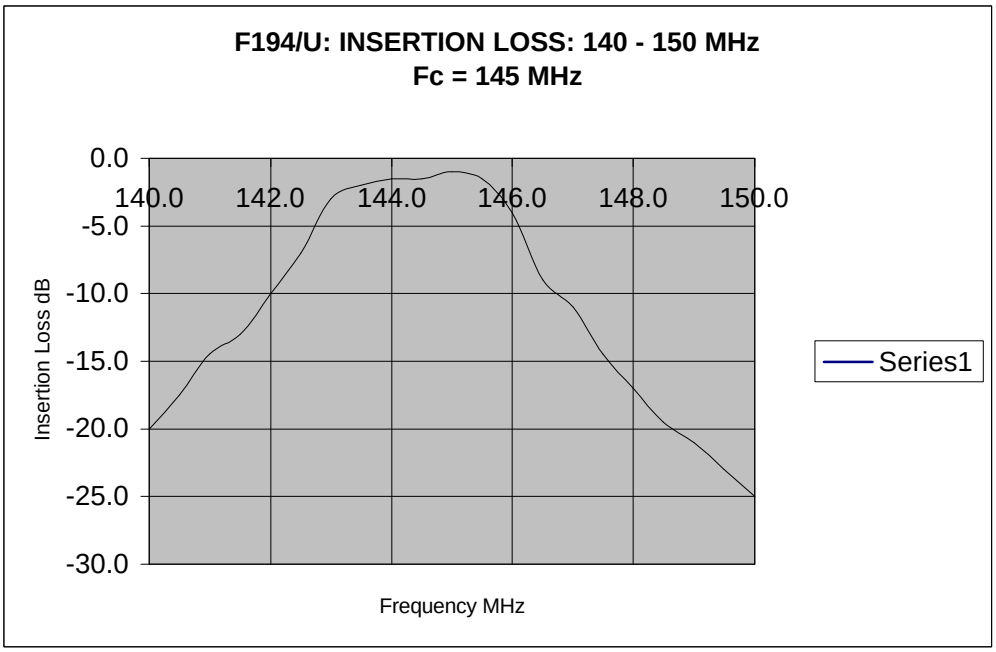
This is a twin cavity filter covering the range 142 – 163 MHz and so can be used for 2 metres. Each cavity has adjustable tuning and is calibrated to facilitate initial setting to the required frequency. The filter is bi-directional and standard "N" connectors are used

The filter is also designed for a 50 ohm circuit and is again tuned by adjusting for best input match., the typical input VSWR at 145MHz being 1.01 : 1. The Polyskop plot shows a fairly classic response characteristic and the actual measured response, again taken using the R & S Monitoring Receiver is shown below. Insertion loss at 145 MHz was about 1.2dB and corresponds to a power loss of about 22%. As can be seen, the pass-band is somewhat wider than the F1482/GRC, operationally this is an advantage but as is also evident, the roll-off is not as steep. Unfortunately I don't have the plug-in front end for the





receiver that would allow measurement of the insertion loss at 290 MHz but I would still expect significant attenuation of the harmonics. The F194/U can be used as it stands without any modification.



In summary, these filters are both high-grade components that will considerably improve the RF output spectrum of VHF transmitters. It has to be remembered that the RF output spectrum of VHF transmitters may well contain lower frequency components originating from harmonic multiplication as well as harmonics of the fundamental. Out of band products due to any mixing processes used in generating the final carrier frequency may also be present. The band-pass characteristic will act to attenuate these unwanted signals. The downside of using these filters is the inevitable insertion loss reducing transmitter output power, together with some loss of operational flexibility due to the restricted pass-band. Another point to note is that these filters are not electrically completely symmetrical. Reversing the filter after tuning shows an increase in input VSWR and insertion loss, something to bear in mind if they are to be used with a transceiver.