Documentation

VHF-/UHF-Diplexer

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Document information

Info	Content
Keywords	Diplexer, VHF, UHF, Frequenzweiche
Abstract	Documentation for a simple VHF-/UHF diplex filter.

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1 Introduction

This paper presents some information about how to build a cheap diplex filter for the VHF and UHF range. With this filter it is possible to connect two antennas (2m and 70cm) to a single transceiver or two transceivers to a single dual-band antenna.

The component values for the filter designs were adopted from DF3OJ
http://www.df3oj.de/trpl.html

DF3OJ uses a printed circuit board. The version which is proposed here is a ugly lumped element over ground plane construction. See figure 1 to get a picture of it.

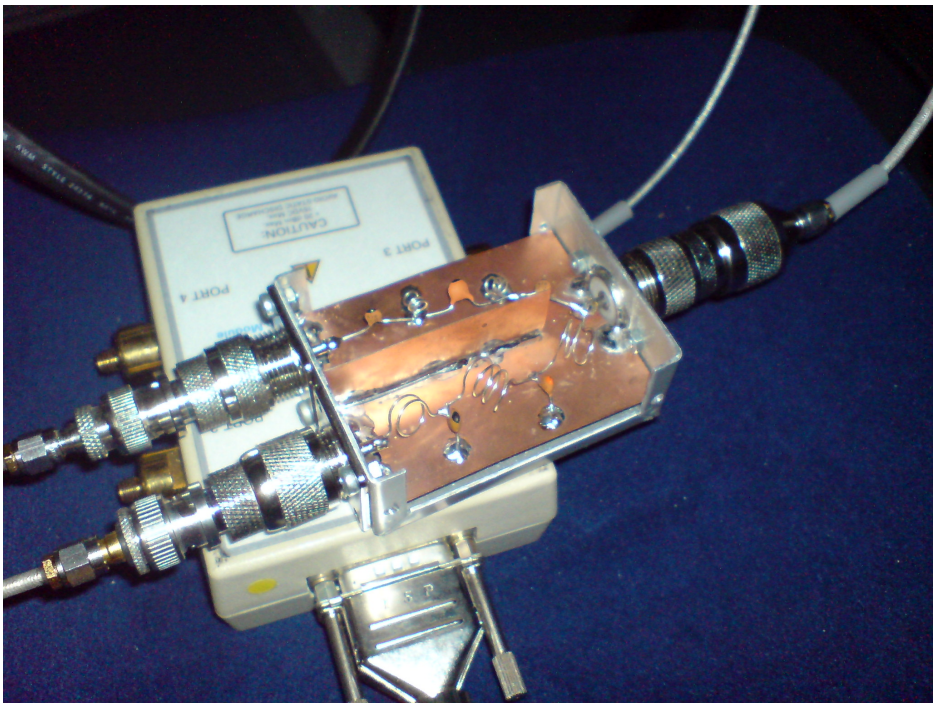

Figure 1: Top view of open Diplexer

2 Schematic

Figure 2 shows the schematic of the filter construction. Table 1 presents the used component values and details. To recalculate the coil values the tool CalCOILS from Fernando F. Almeida was used.

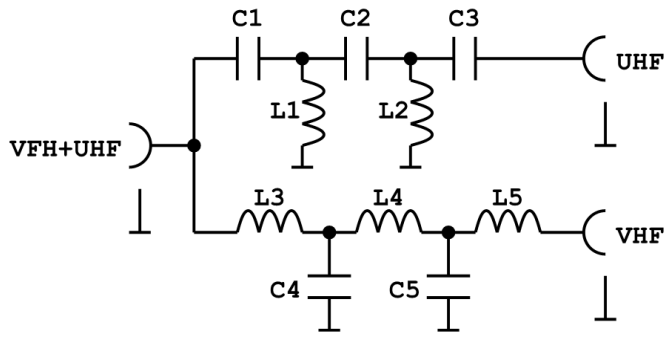

Figure 2: Diplexer Schematic

Table 1: Diplexer Component Values

Partname	Value	Type	Turns/Diameter/Length
C1	4.7pF	500V Ceramic	n/a
C2	2.7pF	500V Ceramic	n/a
C3	4.7pF	500V Ceramic	n/a
L1	27.2nH	Air Coil	3/0.6mm/2.5mm
L2	16.7nH	Air Coil	3/0.6mm/5.5mm
C4	27pF	500V Ceramic	n/a
C5	22pF	500V Ceramic	n/a
L3	63.5nH	Air Coil	3/7mm/4.5mm
L4	99nH	Air Coil	4/7mm/6mm
L5	36nH	Air Coil	2/7mm/3mm

3 Construction Details

The case is a TEKO A1 which you can get at your favourit dealer.

All connectors are PL type female (since these were available out of the box). The quality is ok for this type of construction. For lower insertion loss use a connector that fits to the cable you want to connect the diplexer.

A plate of thin PCB was soldered between the RF connectors. Very high temperature is needed to solder the connectors because of their large surface. To reach a better separation of

the both ports a additional piece of PCB material was soldered vertically between the botch connectors for the separate bands.

The capacitors are 500V ceramic types. The coils are made from blank silvered wire (diameter 0.6mm) turned around drillers with the correct thickness. The length of the pins of each element is long enough that the parts fit between input and output. No additional waveguide was needed.

The coils must not touch the PCB material groundplane ! They shall be placed orthogonal to each other in order to prevent mutual coupling.

4 Tuning

With the values stated in the table above the matching and cross band attenuation was not bad. To open the case did not change the behavior very much. In order to reach a matching better than -20dB at each port it was necessary to uncompress the coils until the resonances are ok.

This can be done also with a SWR meter. It is not essentially needed to have a network analyzer.

5 Measurement Results

For every port a matching of better than -20dB was reached. The crosscoupling is around -66dB for VHF and -46dB at UHF. Figure 3 gives an overview about the measured values.

The measured input reflection for port 1 (VHF+UHF) is given in figure 4. The values for the path through to the VHF port 2 is given in figure 5, figure 6 states the values for the UHF path. Figure 7 shows the crosscoupling between the both bands. The matching is better than -20dB at all ports. The reached decoupling is around 66dB at VHF and around 46dB at UHF.

6 Conclusions & Hints

The reached decoupling is sufficient for such a ugly design. It is enough for the most mobile transmitters. Room for improvement gives the decoupling between the both paths internally (better shielding wall) and the used antenna connectors (exchange against N-type). The insertion loss is surprisingly low around 0.5dB.

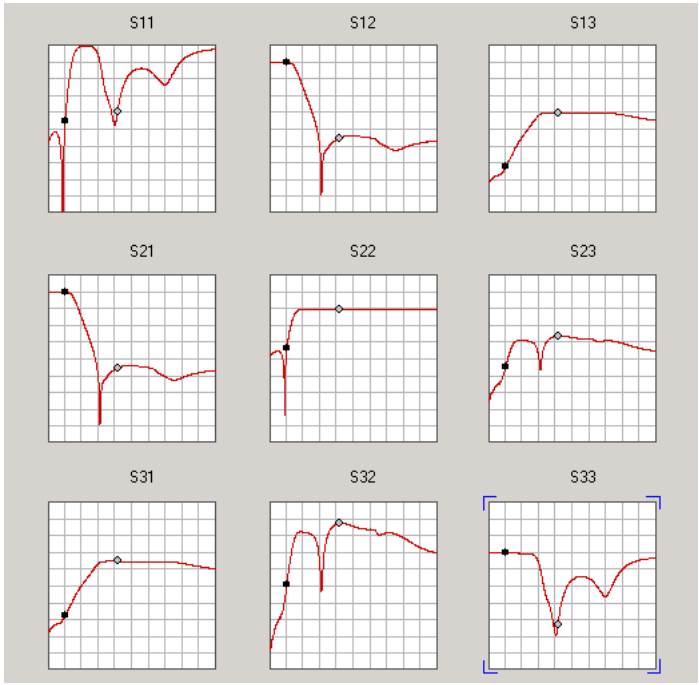

Figure 3: S-Parameter Overview

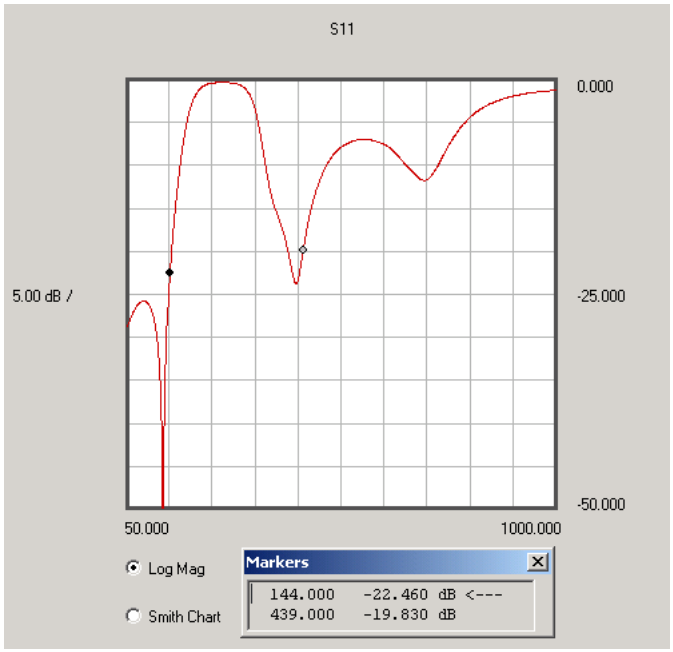

Figure 4: S11 (VHF+UHF)

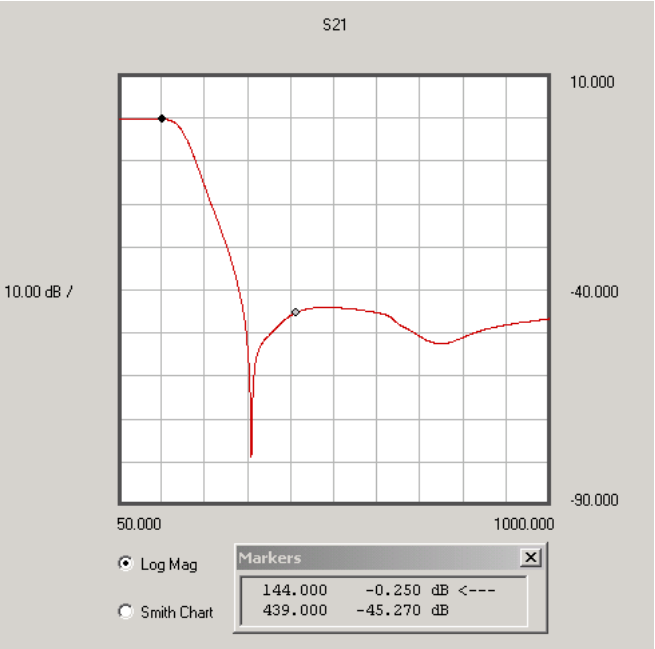

Figure 5: S21 (VHF)

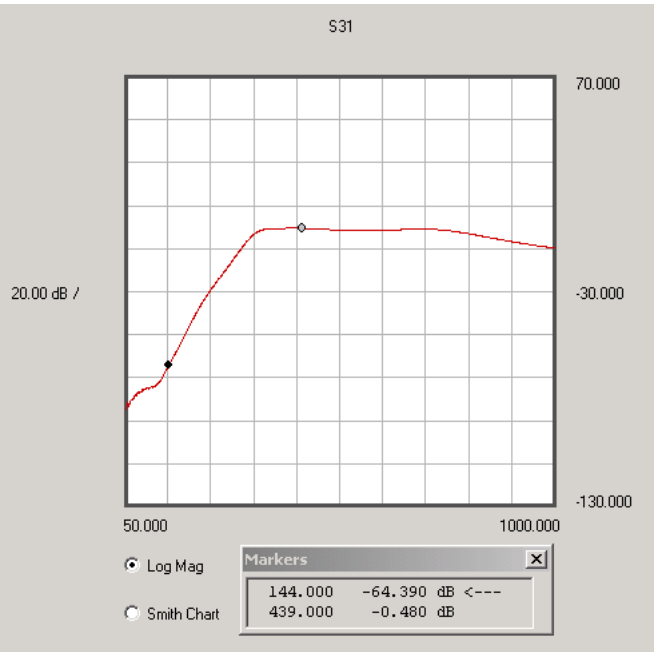

Figure 6: S31 (UHF)

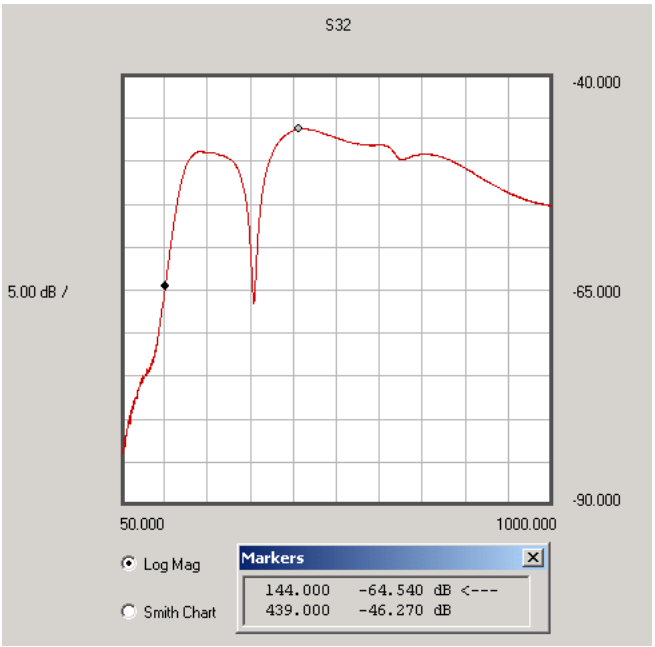

Figure 7: S32 (VHF/UHF Crosscoupling