

868 MHz bandpass filter for LORAWAN hotspot

Matthias, DD1US, March 31st 2022

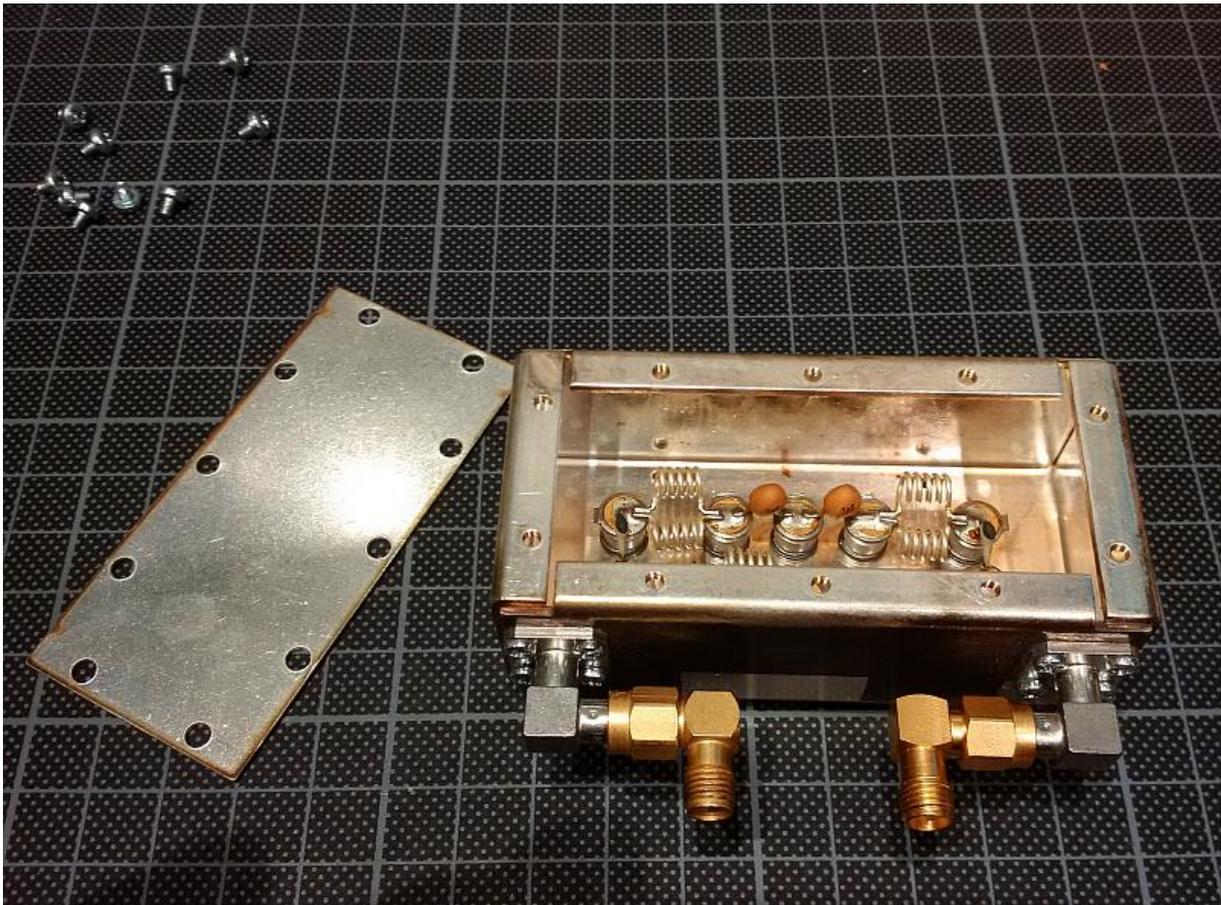
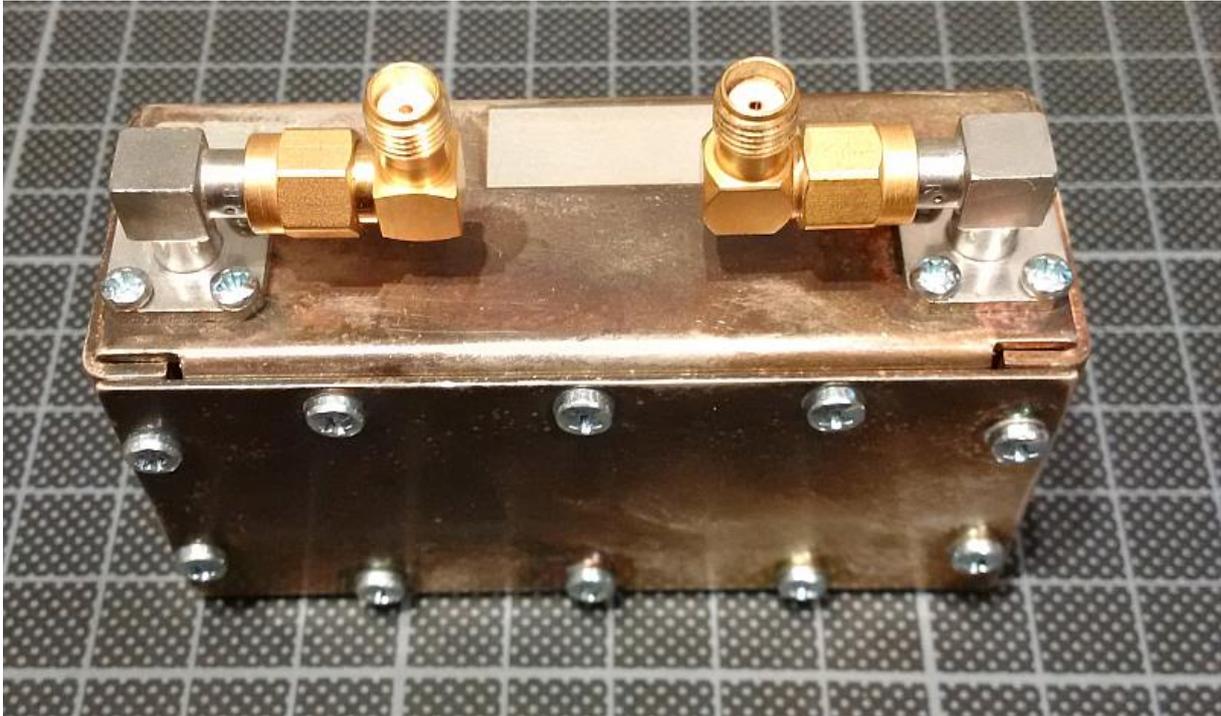
Some years ago, I got hold of an unknown UHF bandpass filter from a friend. I checked it and it was originally tuned to about 580MHz.

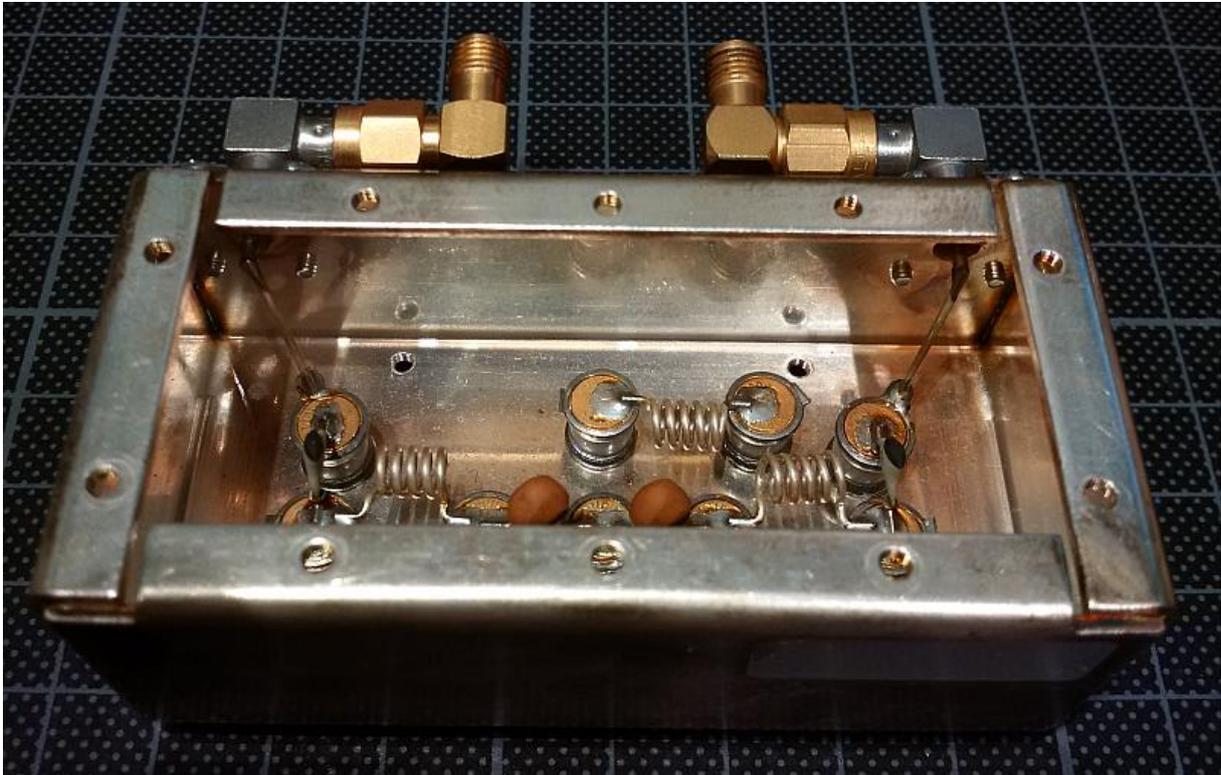
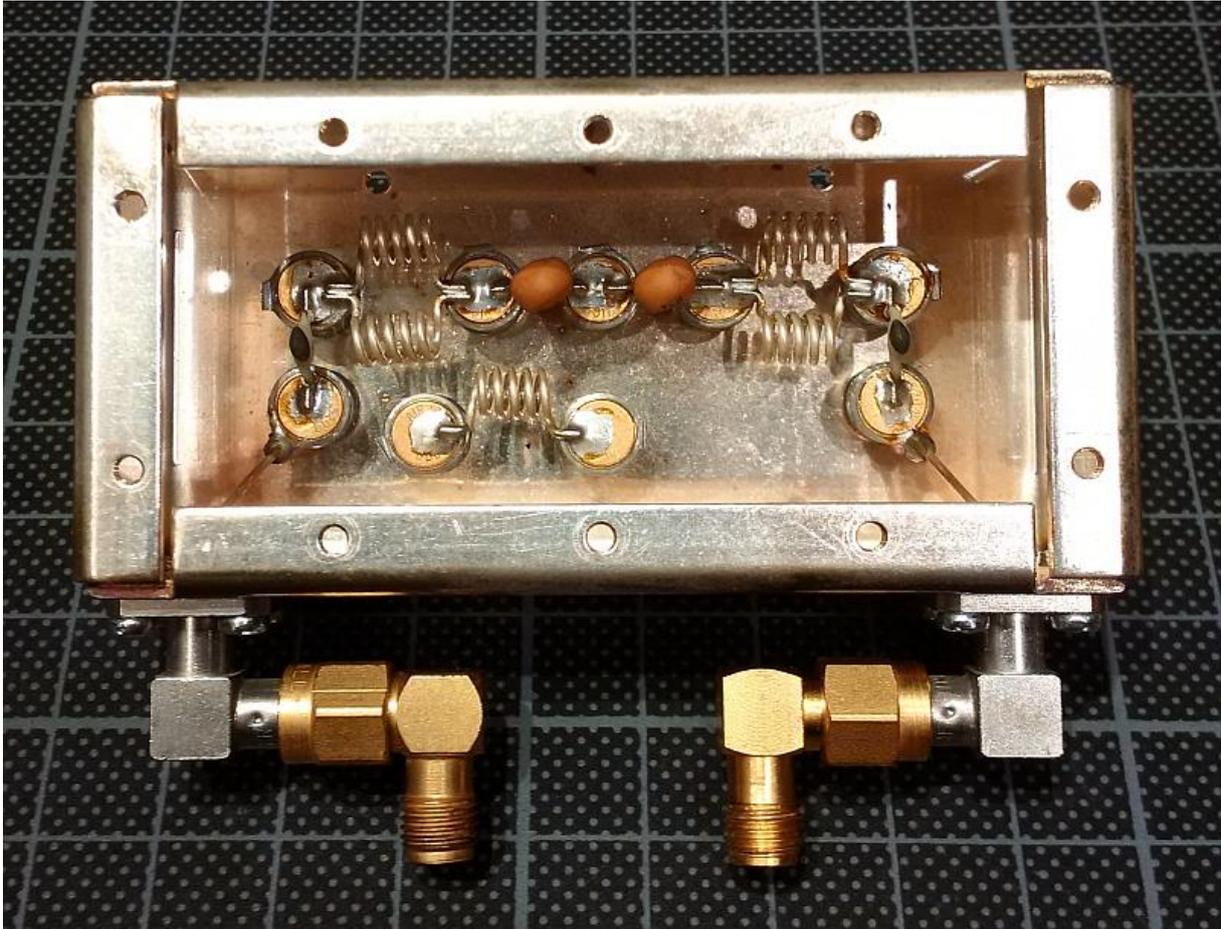
Initially I retuned the filter to 739MHz in order to use it as an IF receive filter in my QO-100 setup.

Meanwhile I found a different IF filter for QO-100 with a smaller form factor and therefore decided to retune the filter for LORAWAN at 868MHz.

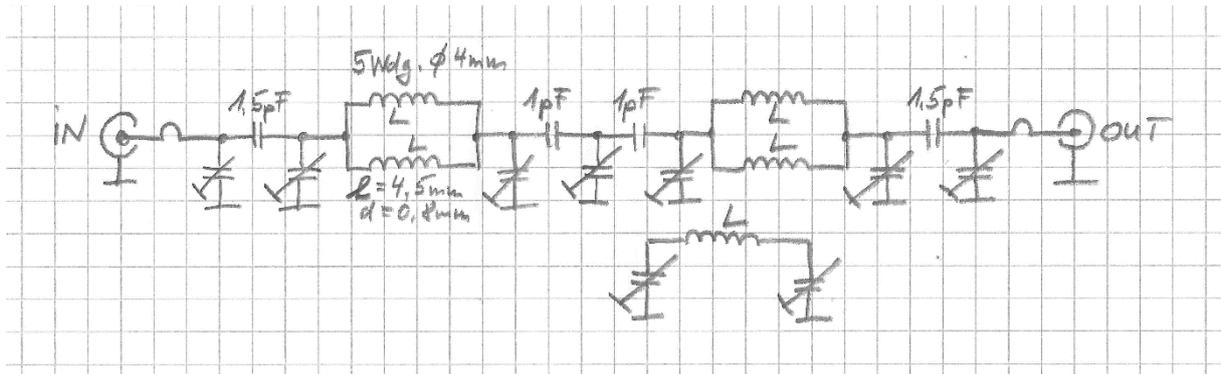
Here are some pictures of the filter:



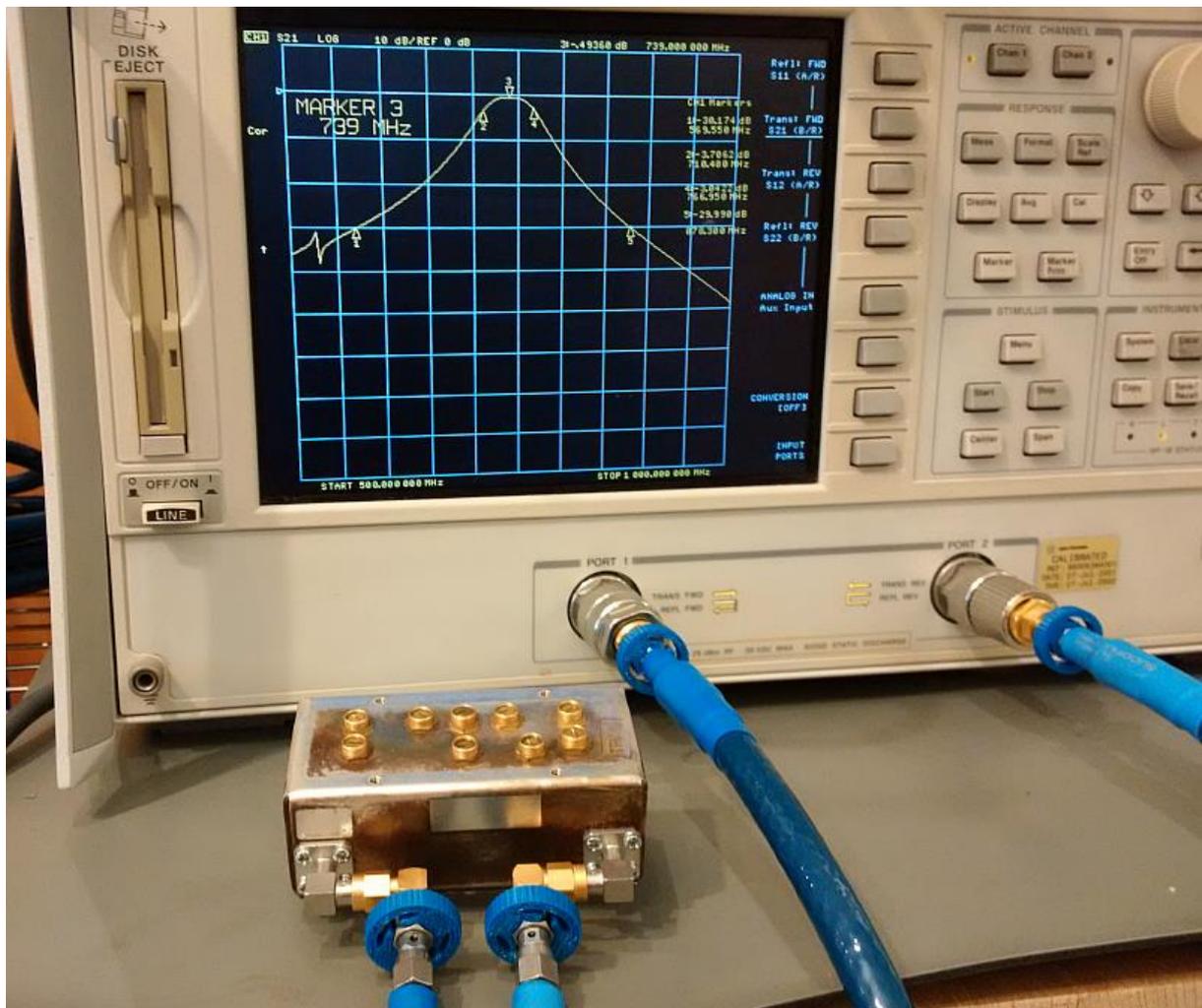




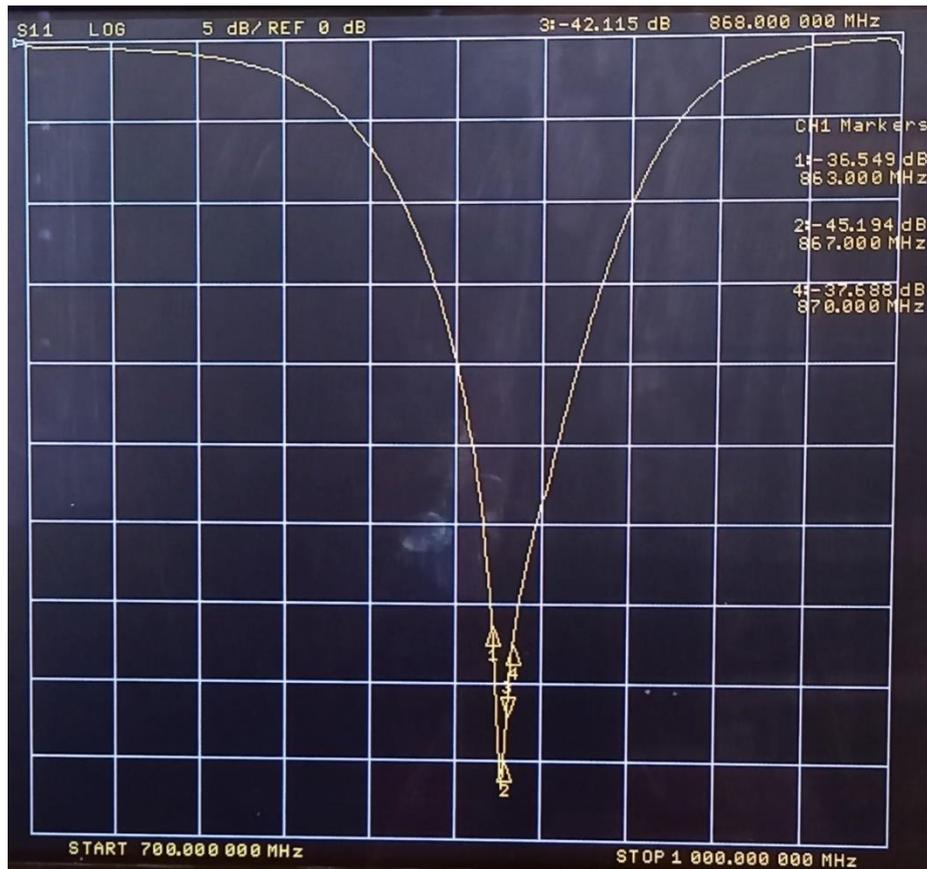
Here is a sketch of the schematic of this filter:



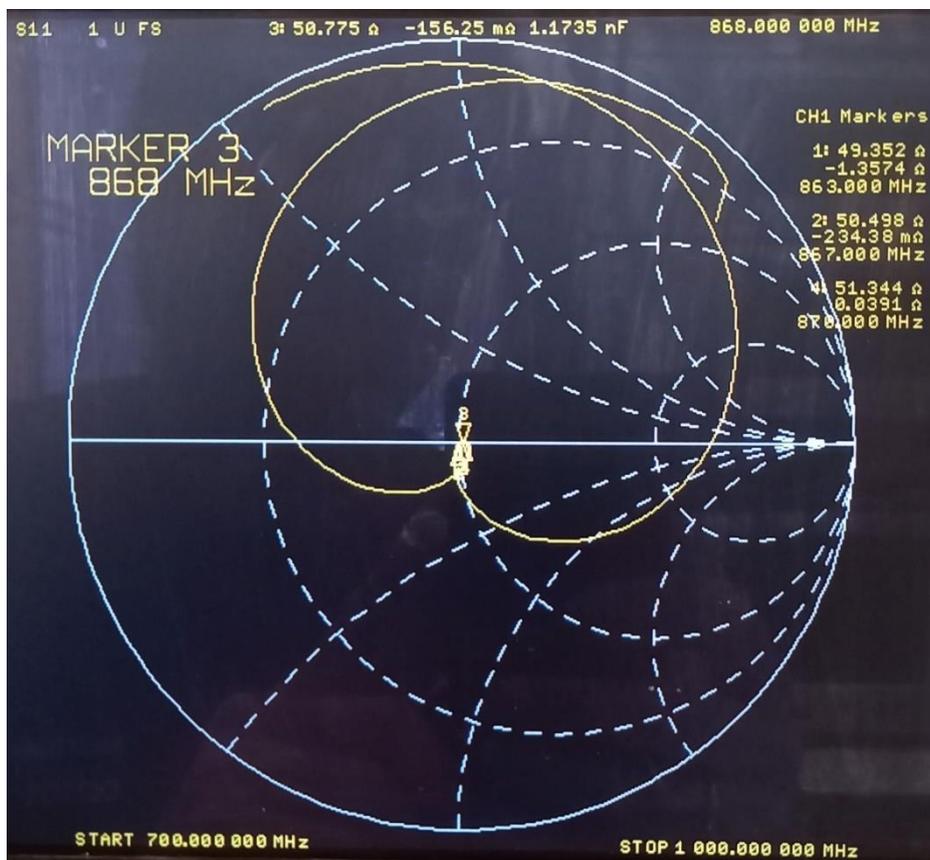
All trimmer capacitors are of the same type and apparently value. All Inductors are also the same type. A 0.8mm silver plated copper wire is used. The inductor has 5 windings, a diameter of 4mm and a total length of 4.5mm. The filter assembly includes a notch filter. The notch function is only effective when tuned close to the center of the bandpass filter. The notch filter is not used in my application and therefore, it has been tuned far out of the band of interest. The filter has SMA jacks at the input and output.



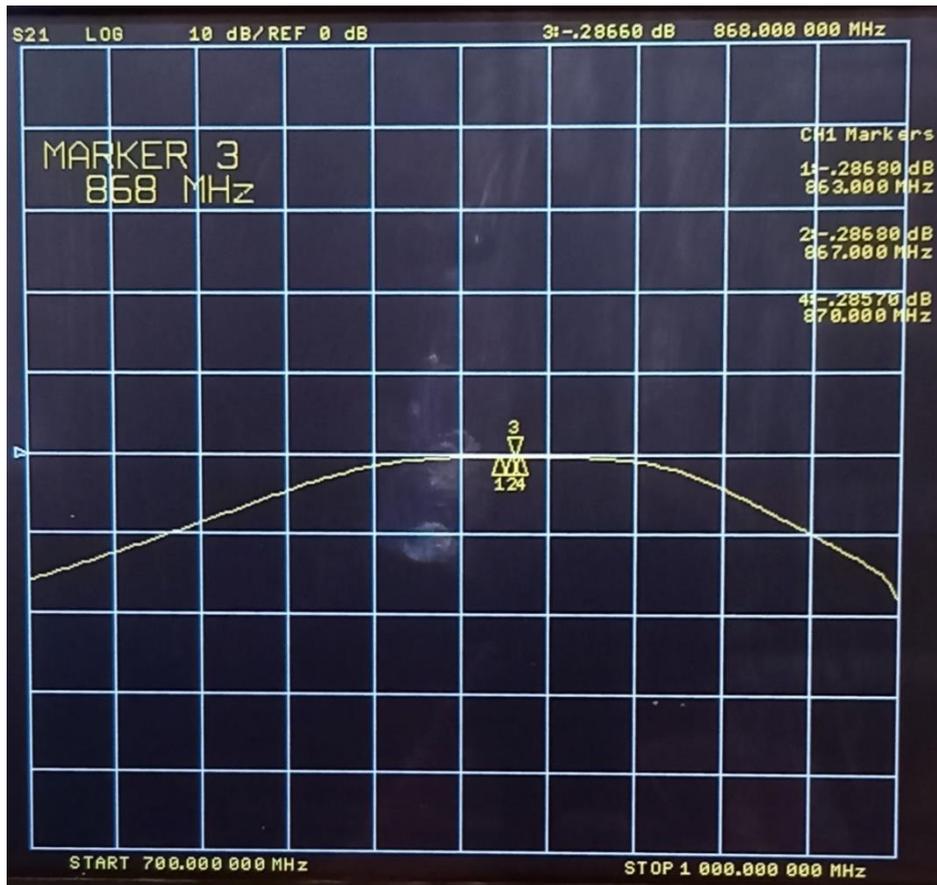
On the next pages you can find the measurement results after retuning the filter it to a center frequency of 868MHz. I optimized the filter for minimum insertion loss and not best selectivity.



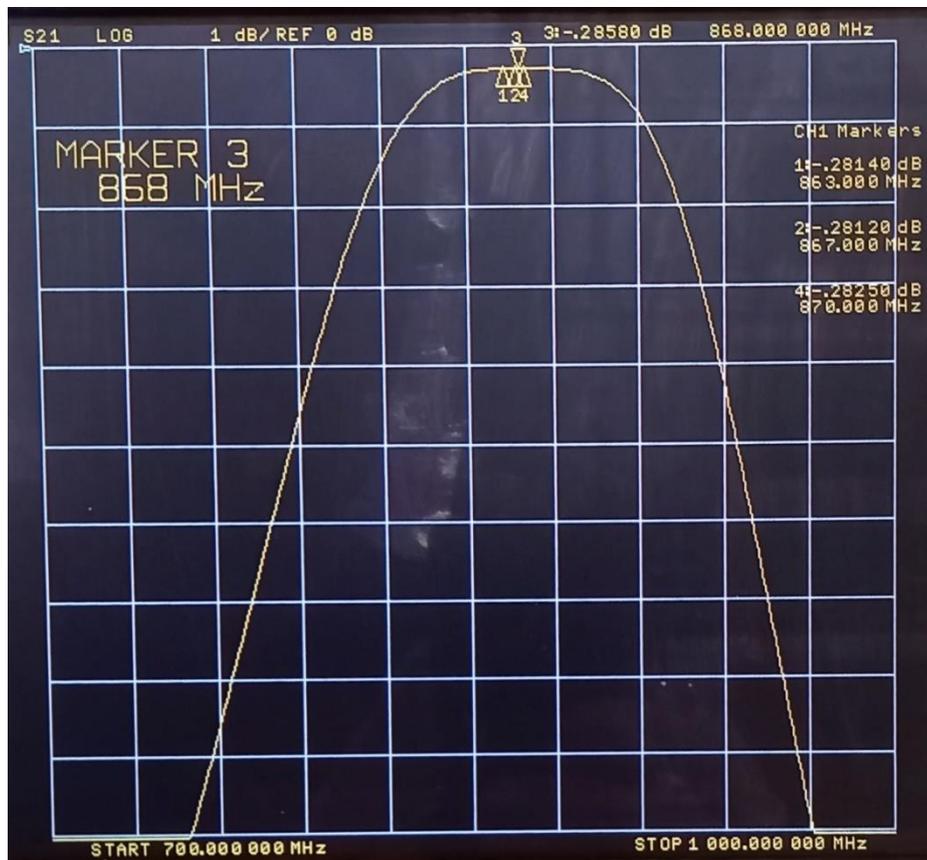
S11 log mag: return loss 42dB @868 MHz



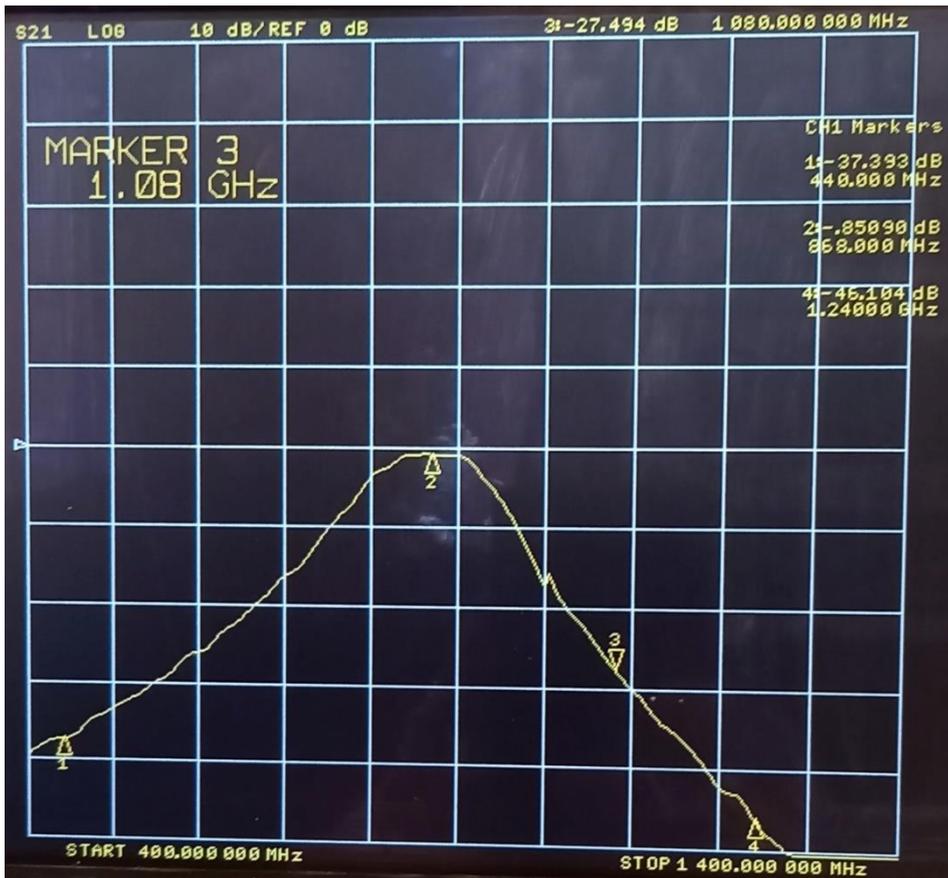
S11 Smith Chart



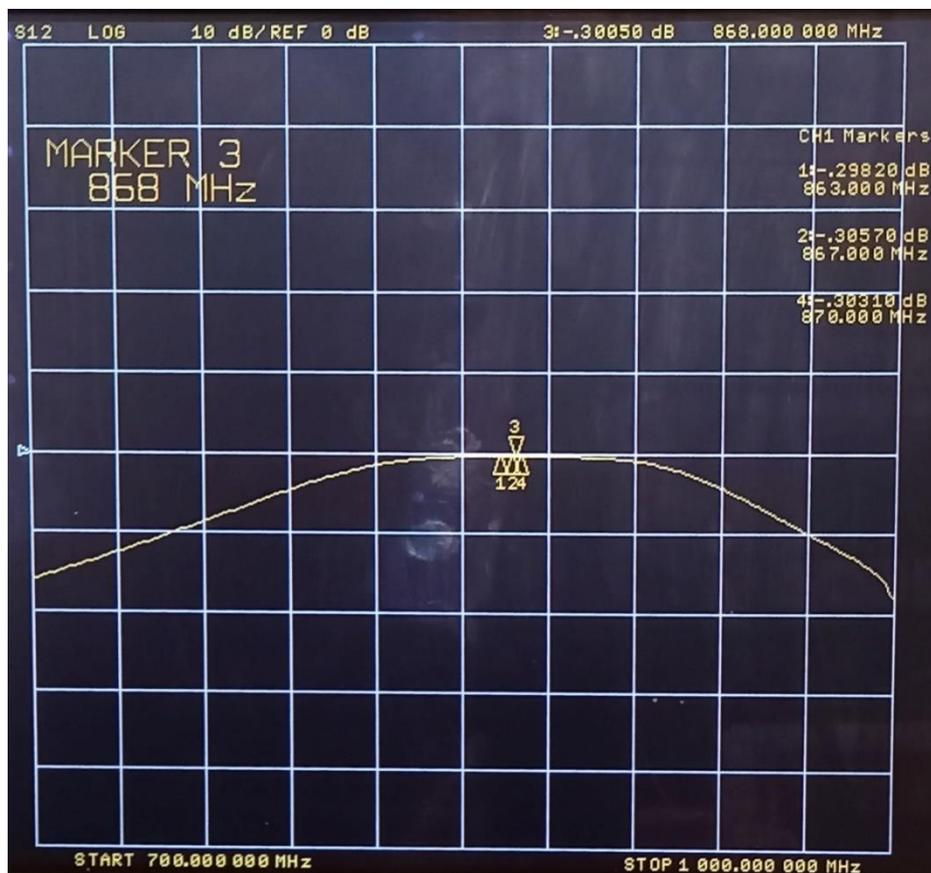
S21 log mag: insertion loss about 0.29dB @868 MHz



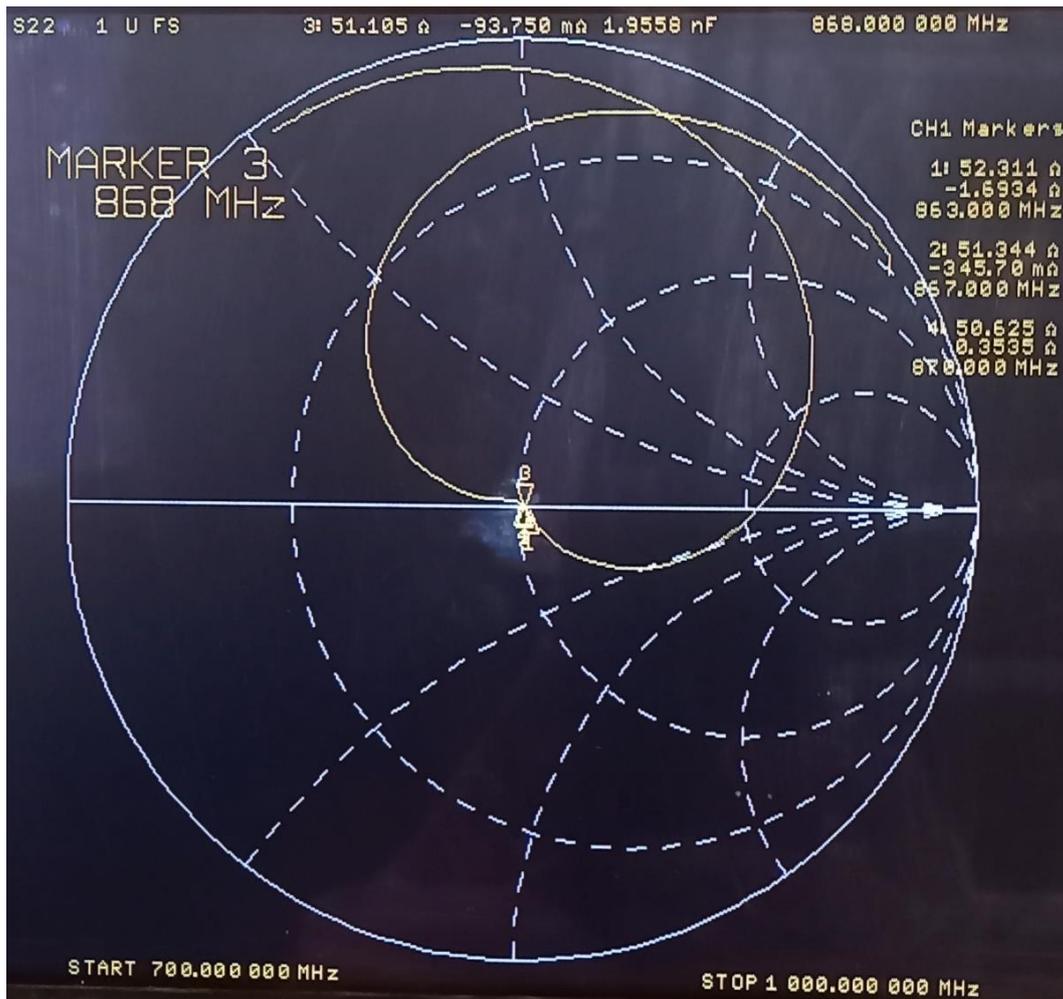
S21 log mag: 0.5dB bandwidth 180MHz, 3dB bandwidth 300MHz



S21 log mag: in this chart a wider frequency span was used. Please note that the VNA was NOT calibrated before this measurement. As can be seen the filter shows a rejection at 400MHz (70cm ham radio band) of about 37dB, at 1080MHz (ADS-B) of about 27dB and at 1240MHz (23cm ham radio band) of about 46dB.



S12 log mag: essentially the same as S21



S22 Smith Chart (return loss >30dB @868MHz)

In summary this filter makes a nice RF filter for 868MHz. It was tuned for minimum insertion loss in order to provide maximum sensitivity and transmit power of the hotspot. The insertion loss is 0.29dB and thus very low. The 0.5dB bandwidth is 180MHz, the 3dB bandwidth is 300MHz

Rejection in the next ham radio bands (70cm and 23cm) is more than 37dB and at the ADS-B frequency it is more than 27dB.

Whether the selectivity is sufficient needs to be seen in practical use. Possibly it might be necessary to tune the filter more narrowband and compromise insertion loss.

I always appreciate feedback and will be happy to answer questions. Please send them to the Email address given below. Many thanks in advance.

Best regards

Matthias DD1US

Email: DD1US@AMSAT.ORG
 Homepage: <http://www.dd1us.de>