



## Tuning Instructions Band Reject Filter

Manually Tunable Band Reject Filters from Wainwright Instruments can be tuned by tuning each resonator – either by screwdriver or by knobs. You can choose this tuning option.

**Please note: non-tunable filters can only be re-adjusted, tuning them to a different frequency can damage the filter.**

To tune one of Wainwright Instruments' tunable band reject filters, you need a network analyzer, where both channels (transmission and reflection) can be seen.

This is very helpful, the transmission channel is essential! It would be best if you can also display the other channel (reflection), which shows you the return loss. This helps you while fine tuning the filters.

You need to connect the filter to the analyzer and set the start and stop frequency in a way, so that the actual curve and the expected new curve can be seen.

Setting markers is strongly recommended. Please use the test report of your filter for settings. (supplied with the filter) The marker of the new center frequency is an additional help.

Additionally we recommend having the test report handy, since we supply individual resonator standings for low, mid and high end of the tuning range.

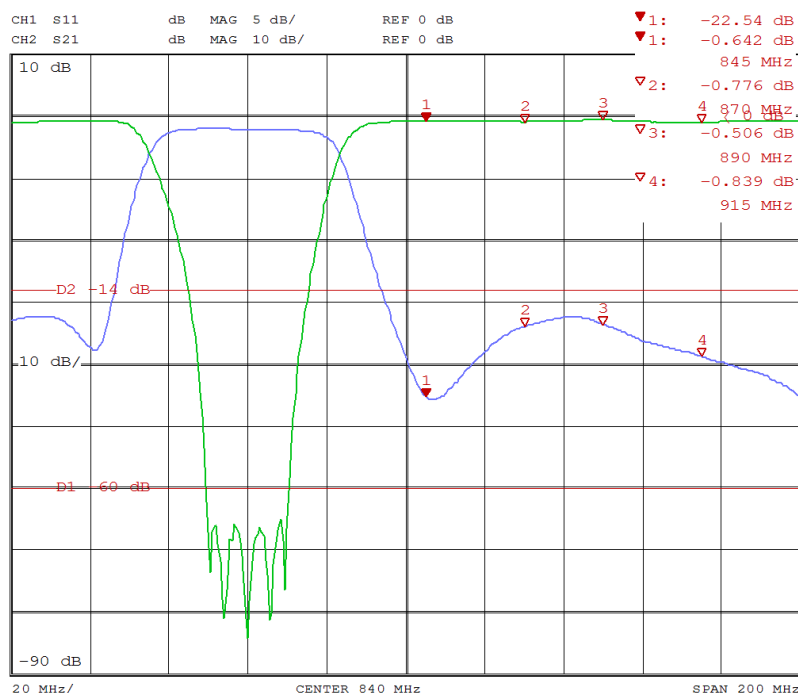


Figure 1: Band Reject Filter, all markers of new curve can be seen

For better understanding we explain the tuning for a filter with 5 resonators. More or less resonators are also available – depending on bandwidth, frequency, attenuation and steepness of slopes.

It would be best if you start by tuning resonator 2 (tuning a band reject filter should always start with the resonators in the middle and go (alternating the sides) to the outer ends)

Tune the resonator by turning the tuning screw or knob in a way that a little notch in the transmission curve will wander from the old notch to the new frequency. Tune the resonator, until the little notch will be at your new frequency. (turning clockwise will shift it to a lower frequency, turning anti-clockwise will shift it to a higher frequency) If you hear screeching noises - this should be avoided by turning the resonator slower oder faster.

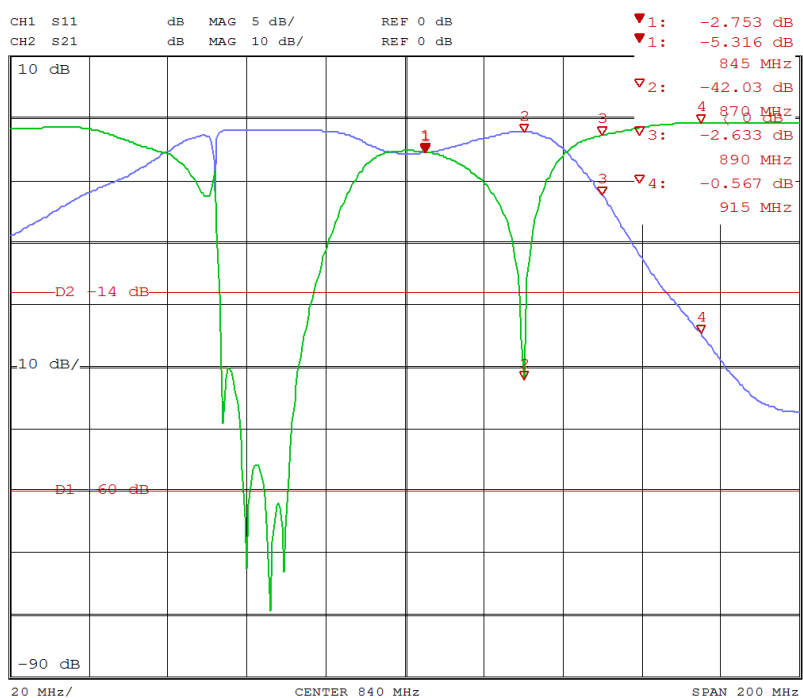


Figure 2: Resonator 2 tuned to new frequency

Then do the same with resonator 4. The result should be a curve with two little notches

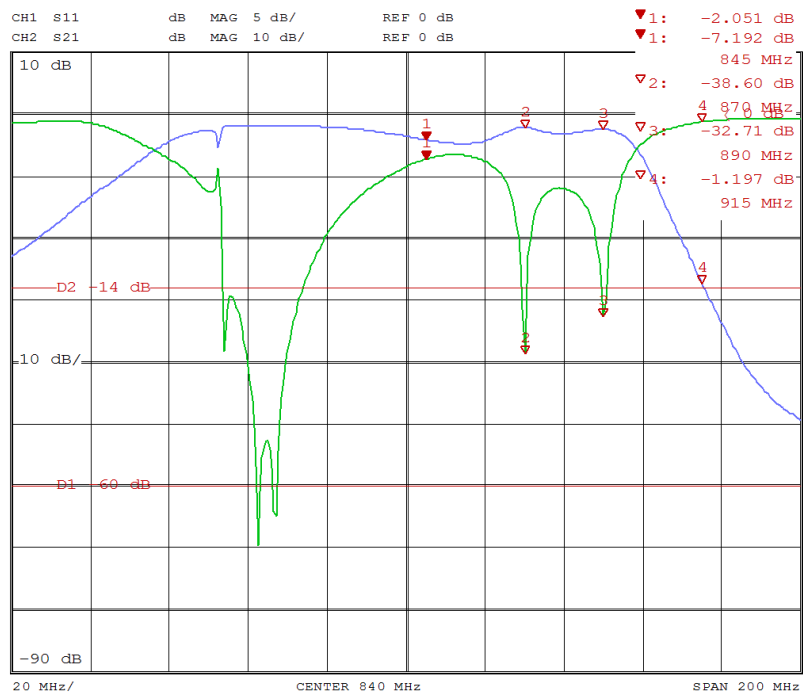


Figure 3: Resonator 2 and 4 tuned to new frequency

Continue with resonator 3.

Now we need the outer two resonators - resonator 1 and 5. Bring them to the new frequency. Try to place them similar to how they were on the old curve.

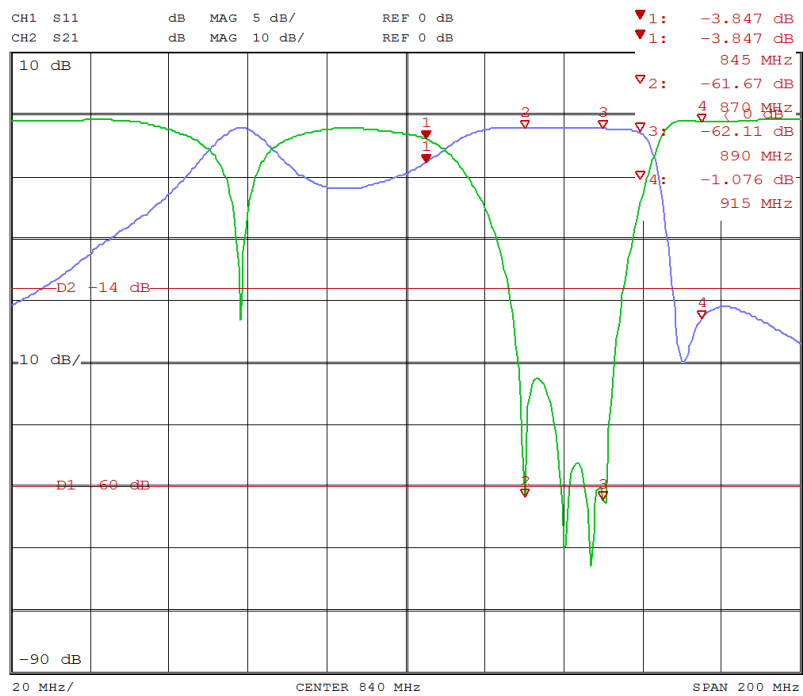


Figure 4: 4 out of 5 Resonators tuned to new frequency

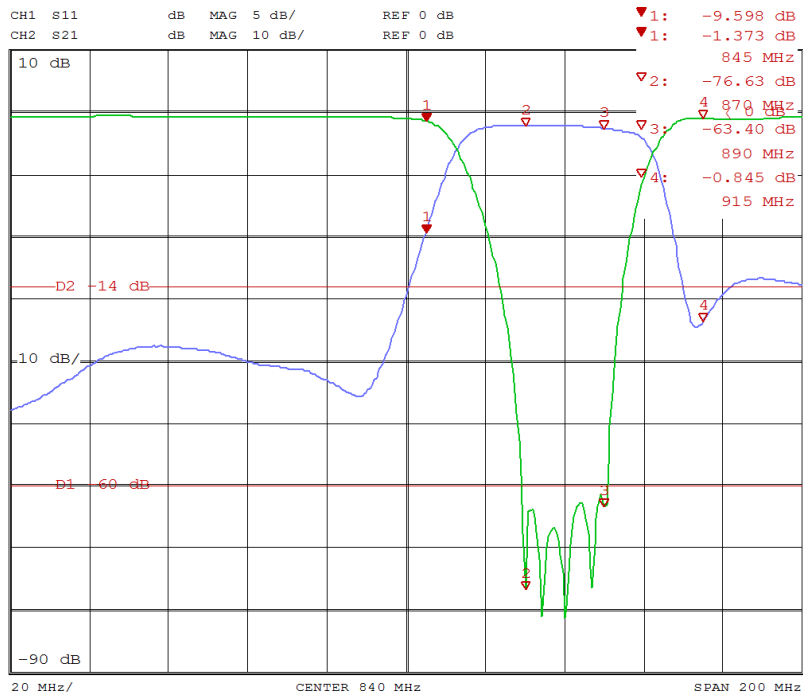


Figure 5: All resonators tuned to new frequency

## Fine Tuning

Now we would recommend changing the settings of your network analyzer. Set the center frequency to the center frequency of your new reject band and choose an appropriate span – depending on filter and reject bandwidth it can vary. 50 or 100 MHz could be a good value.

Now do some fine adjustment on the resonators you have already tuned to your new frequency. Try spreading them evenly and stick to the order that we suggest on the test report for the lower, middle and upper frequency. If you want to tune to a frequency between of the given ones you should stick to the order of the frequency that is closer to your desired frequency.

Your curve could look like this – good rejection, but if you look closely you will see that the return loss is still above the 14 dB line.

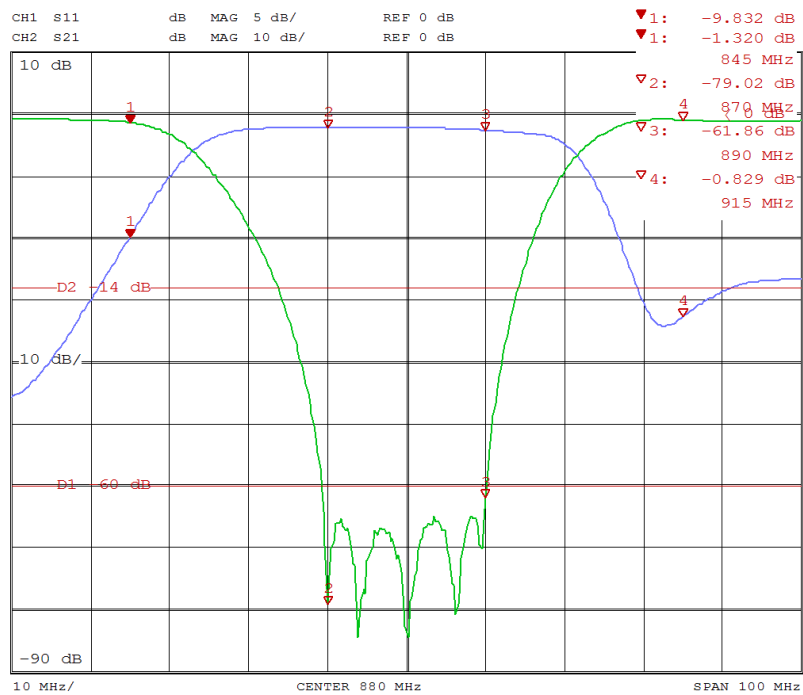


Figure 6: good rejection, but return loss is still above the 14 dB line.

For the final adjustments you would need to display the reflection channel also. If you cannot display it, you will probably also be fine, you might have a return loss of just close to 14 dB at the passband corner frequencies instead of 14 dB minimum – like shown in the curve above.

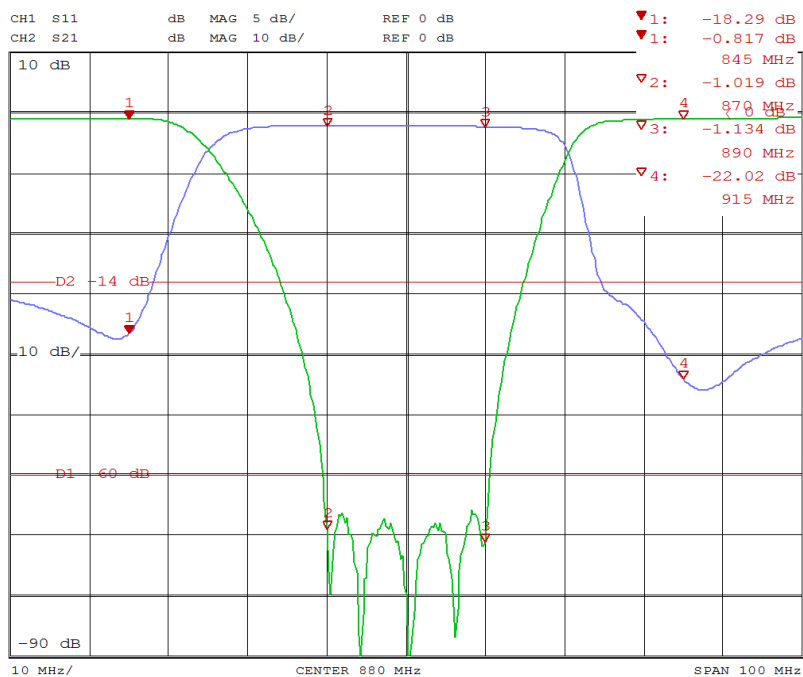


Figure 7: last resonator tuned to new frequency, fine adjustments have been made

On a band reject filter all resonators are basically spread somewhat evenly over the reject bandwidth. Now if you happen to experience that the return loss is not as good as it should, or if you want the most perfect filter, you might want to consider „playing“ a bit with the exact standings of the resonators.

If you watch the return loss and tune of the resonators just a little bit, you might see its impact on the return loss. There is no definite way to do this, every filter might be a bit different.

Good luck!

And remember – we are always here to help you.