Using a Kathrein Dual-Band Combiner as a UHF/SHF Diplexer

Matthias, DD1US, September 27th 2019, rev 1.0

Running out of coaxial cables from my antenna to the shack I decided to look for a diplexer to combine UHF and SHF receive antennas and run the signals via a single coaxial cable.

Checking my surplus parts, I found a Dual-Band Combiner from Kathrein. The part number is 791 145 and it was apparently originally used to combine GSM signals from different bands.

Here is the datasheet of this device:

Dual-Band Combiner

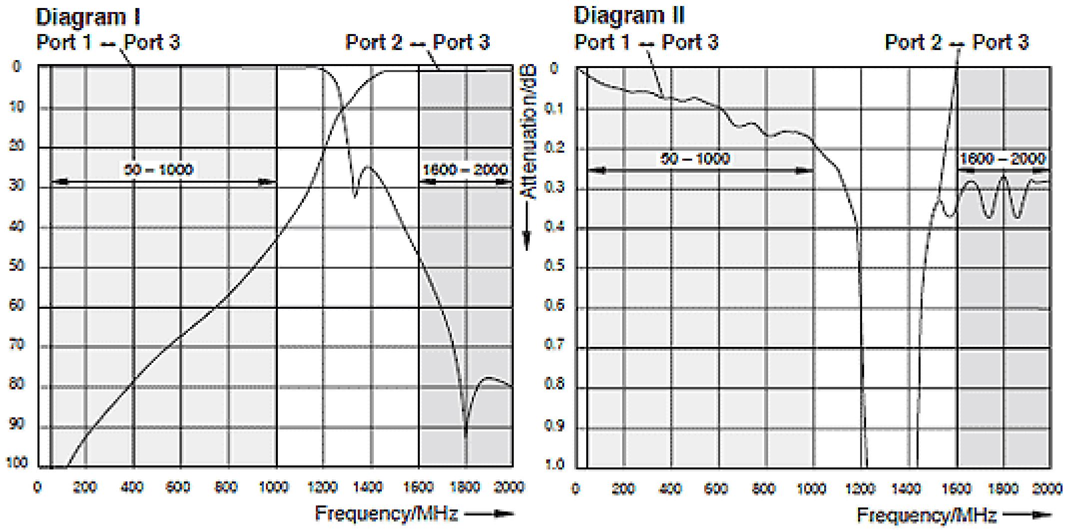
50 – 1000 MHz 80 / 160 / 400 / GSM 900	1600 – 2000 MHz GSM 1800

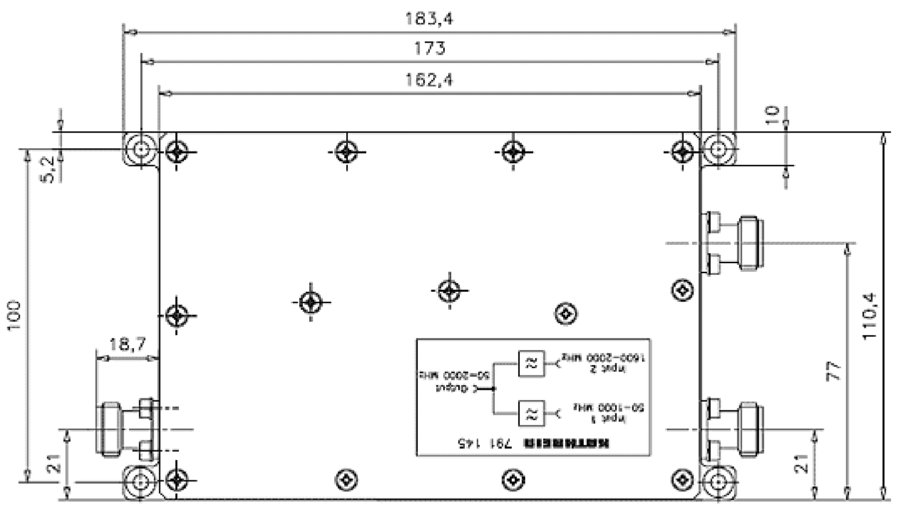
- Designed for inhouse multiband distribution network
- Enables feeder sharing
- DC by-pass between port 1 and port 3
- Built-in DC stop between port 2 and port 3

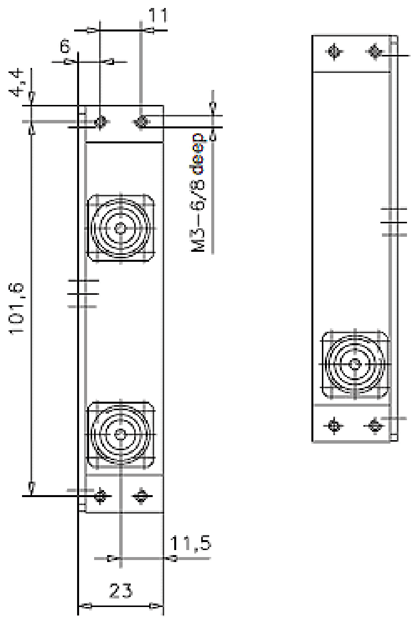
Technical Data

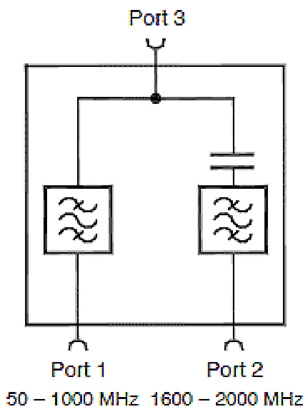
Type No.	791 145
Pass band Band 1 Band 2	50 – 1000 MHz 1600 – 2000 MHz
Insertion loss Port 1 ↔ Port 3 Port 2 ↔ Port 3	< 0.3 dB (50 – 1000 MHz) < 0.5 dB (1600 – 2000 MHz)
Isolation Port 1 ↔ Port 2	> 40 dB (50 – 1000 / 1600 – 2000 MHz)
VSWR (all ports)	< 1.2 (50 – 1000 / 1600 – 2000 MHz)
Impedance	50 Ω
Input power Band 1 Band 2	< 100 W < 50 W
Temperature range	–30 … +60 °C
Connectors	N female
Application	Indoor
DC transparency Port 1 ↔ Port 3 Port 2 → Port 3 Port 3 → Port 2	By-pass (max. 2500mA) Short circuited Stop
Mounting	With 4 screws (max.4 mm diameter)
Weight	0.7 kg
Packing size	220 x 40 x 140 mm
Dimensions (w x h x d)	201 x 23 x 112 mm (incl. connectors)

Typical Attenuation Curves

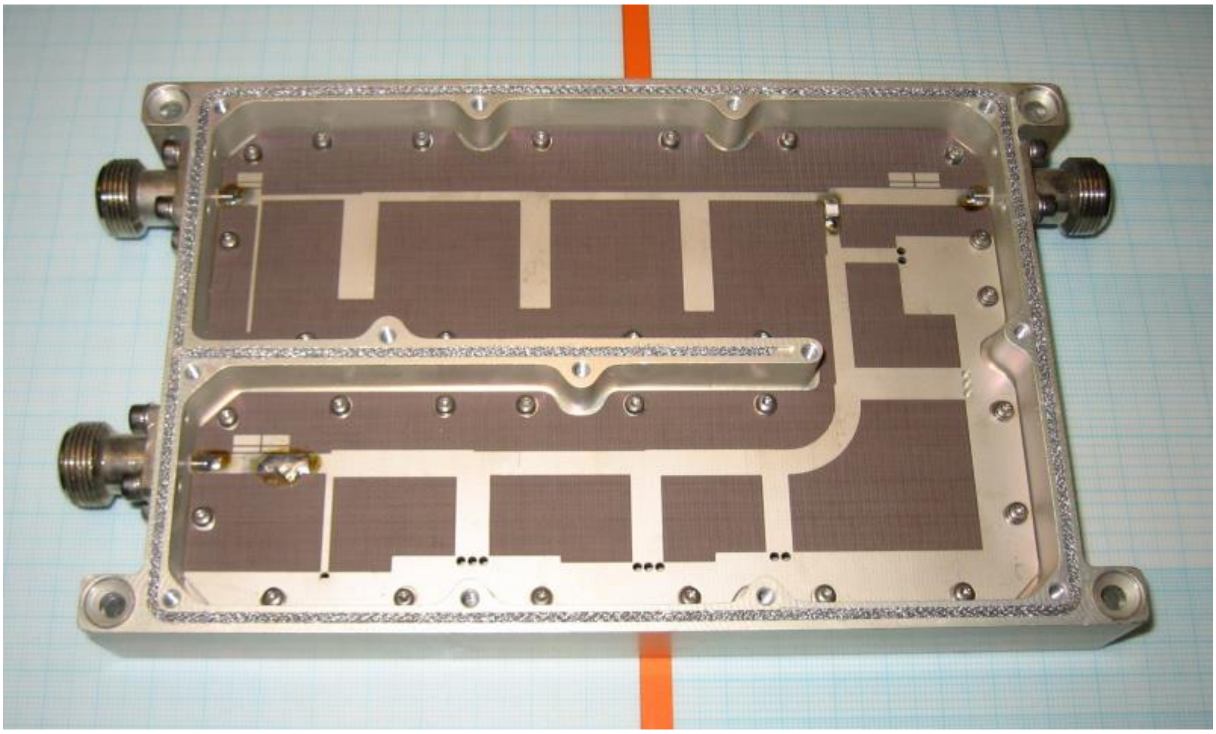




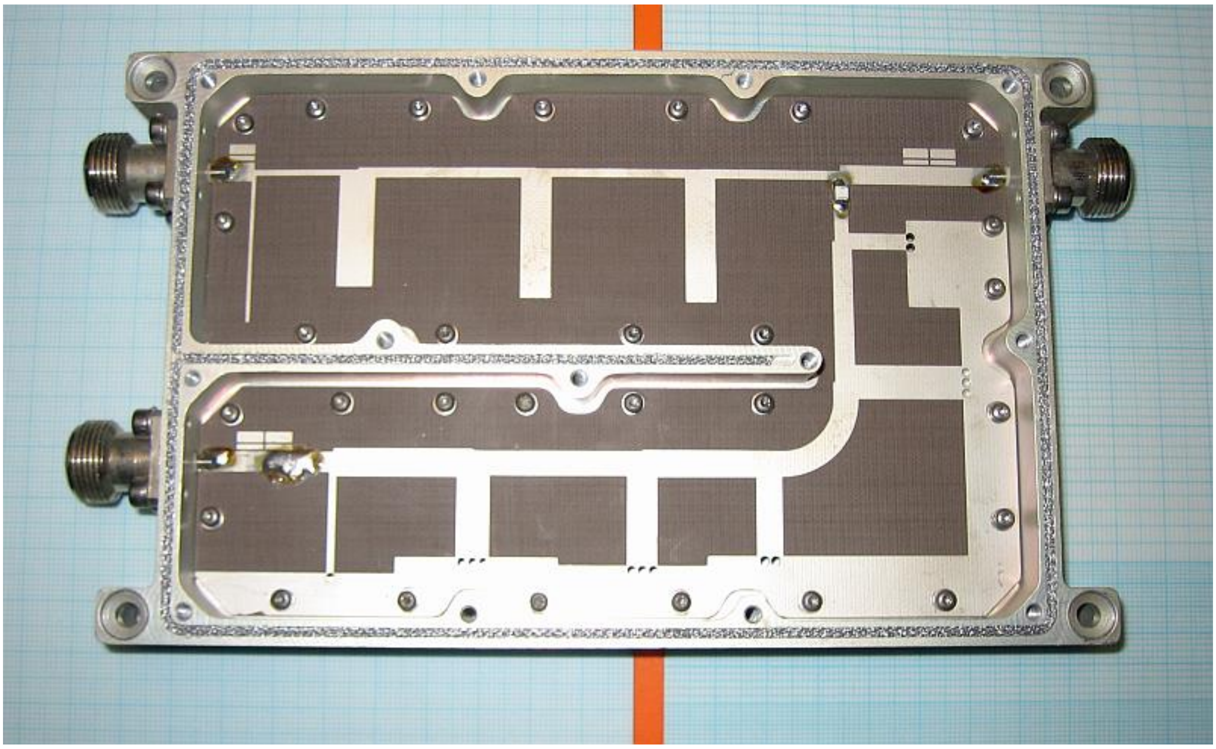




Being curious how such a diplexer is actually made, I had a look inside:

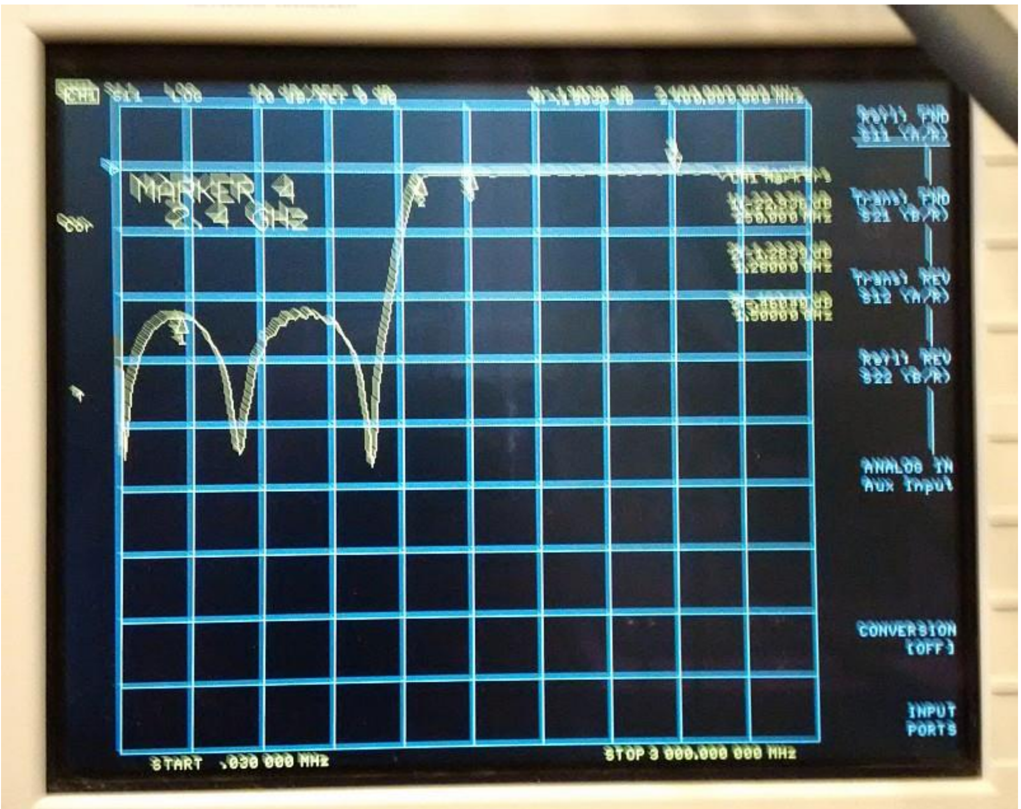


The device is based on a very professional design with high and low-pass filters printed on a Teflon substrate. I have not tested the maximum power the diplexer can withstand but have no concerns that the specified values of 100W in the low-band and 50W in the high-band can be easily achieved.

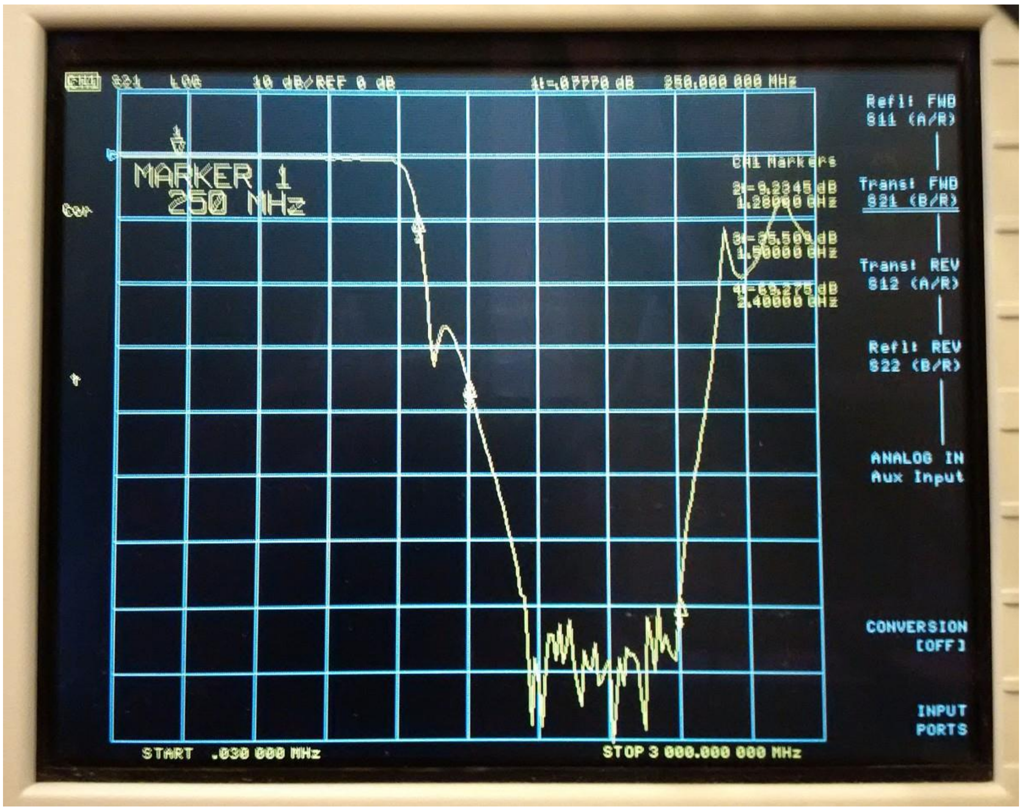


Next, I measured the diplexer’s S-parameters focusing on insertion loss, stop band attenuation and input and output matching.

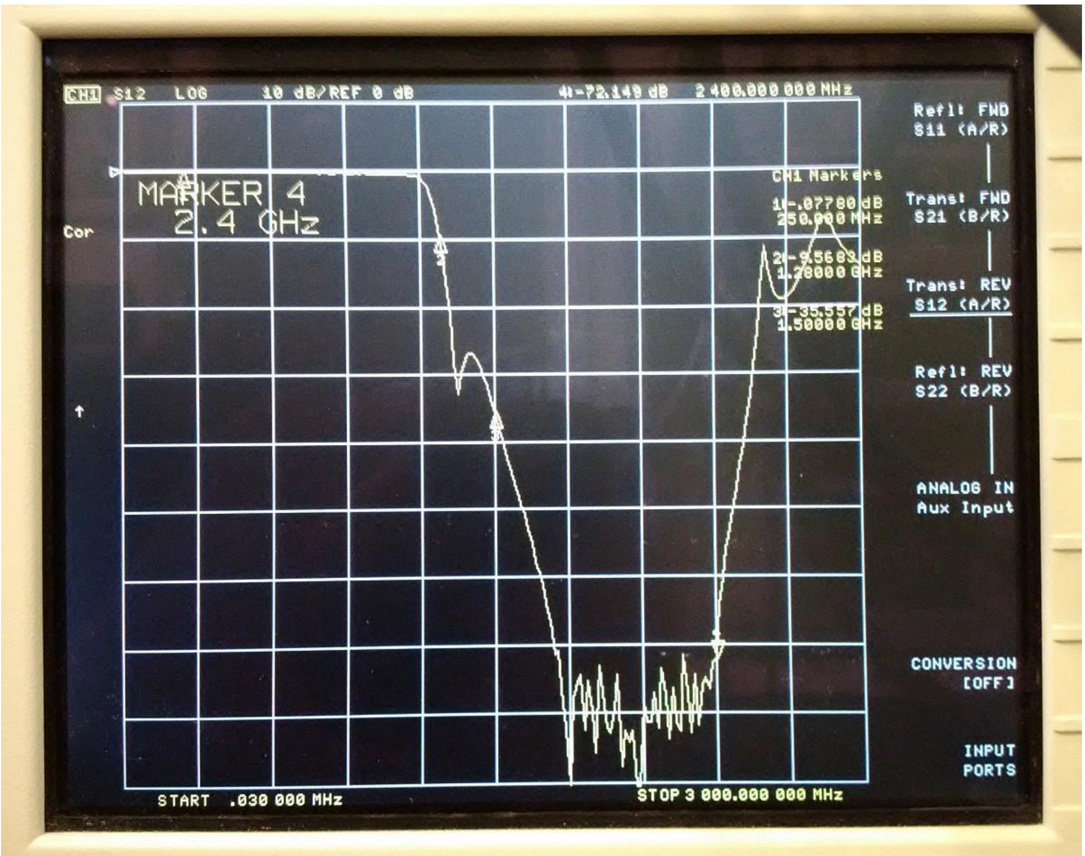
In the first series of measurements, I used the low-band input port as port #1 and the common output port as pot #2. The high-band input port was terminated with 50 Ohms.



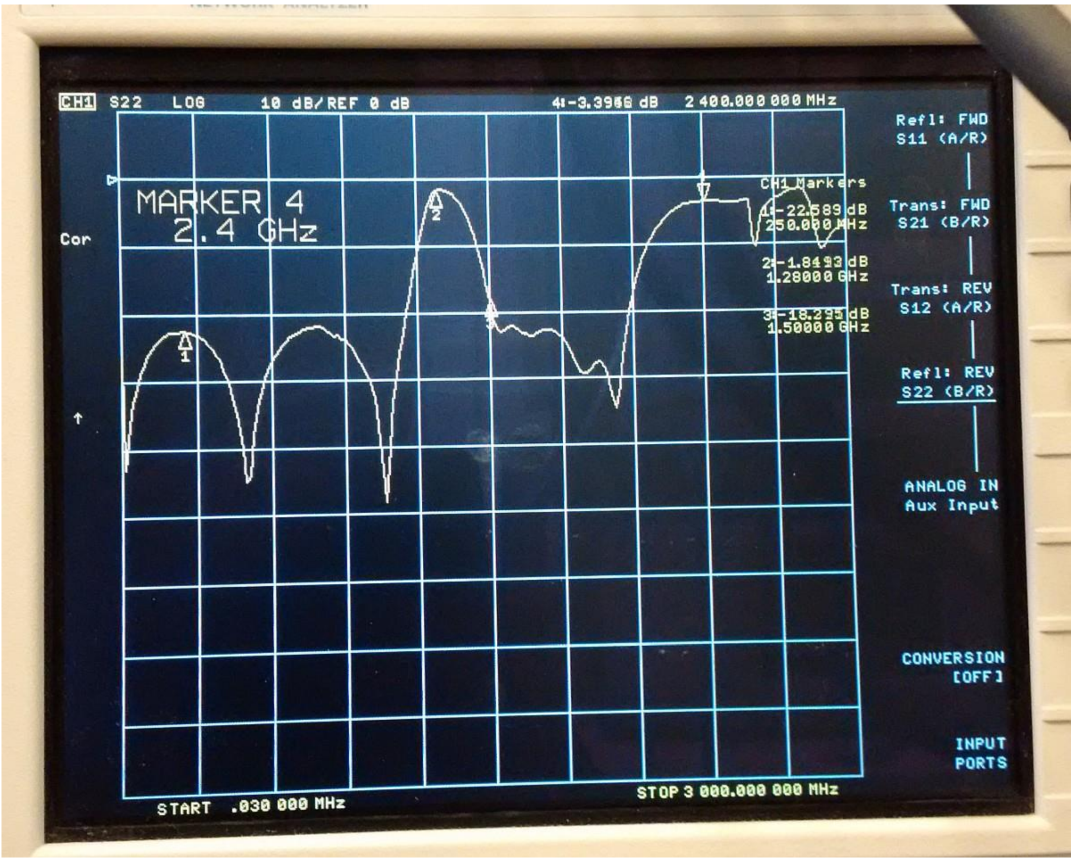
Input matching S11 of the low-band port is better than 20dB in the frequency range from DC to 1100 MHz



Insertion loss S21 from the low-band port to the common output port is extremely low in the frequency range DC to 1100 MHz (e.g. < 0.1dB @250 MHz). Stop-band attenuation is more than 35 dB in the frequency range from 1500 MHz to 2550 MHz

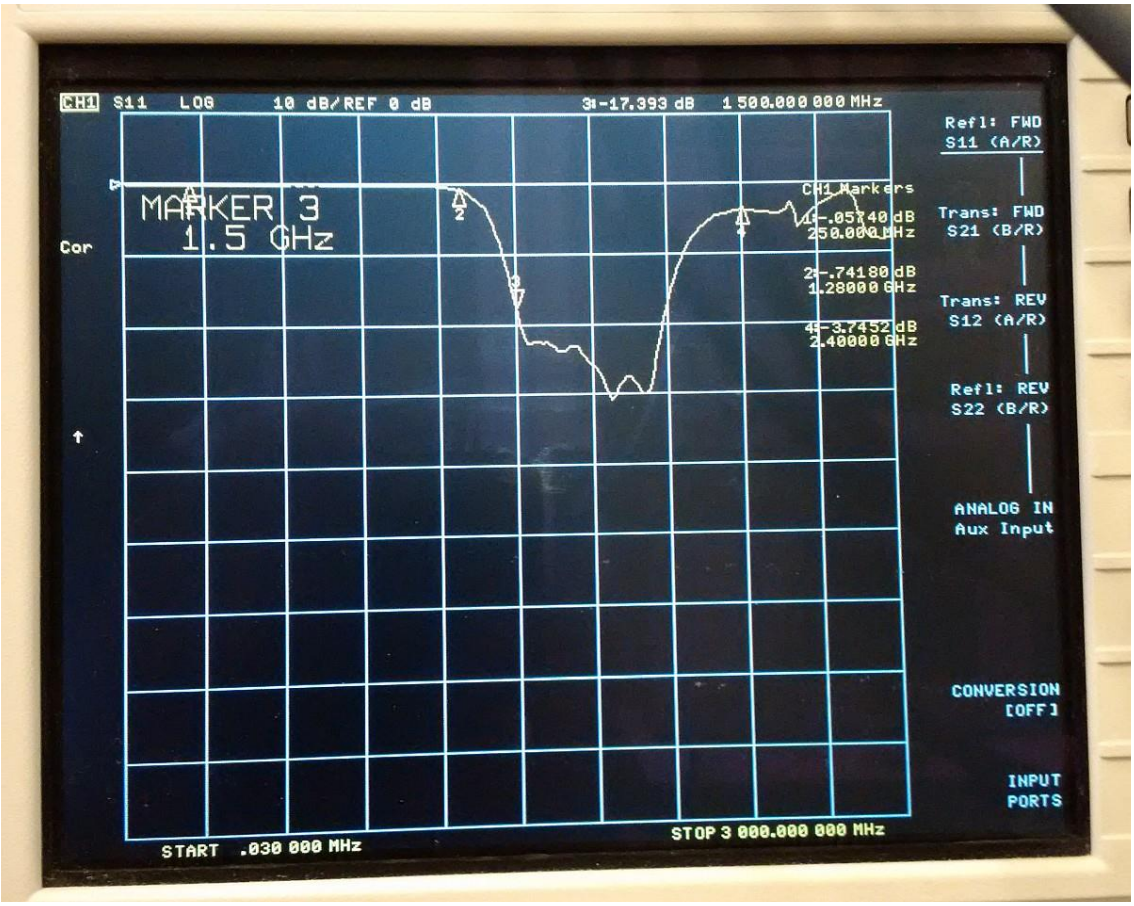


Insertion loss S12 from the common output port to the low-band port is basically identical to the previous measurement of S21. Maximum attenuation of 70B is achieved at 2.4 GHz

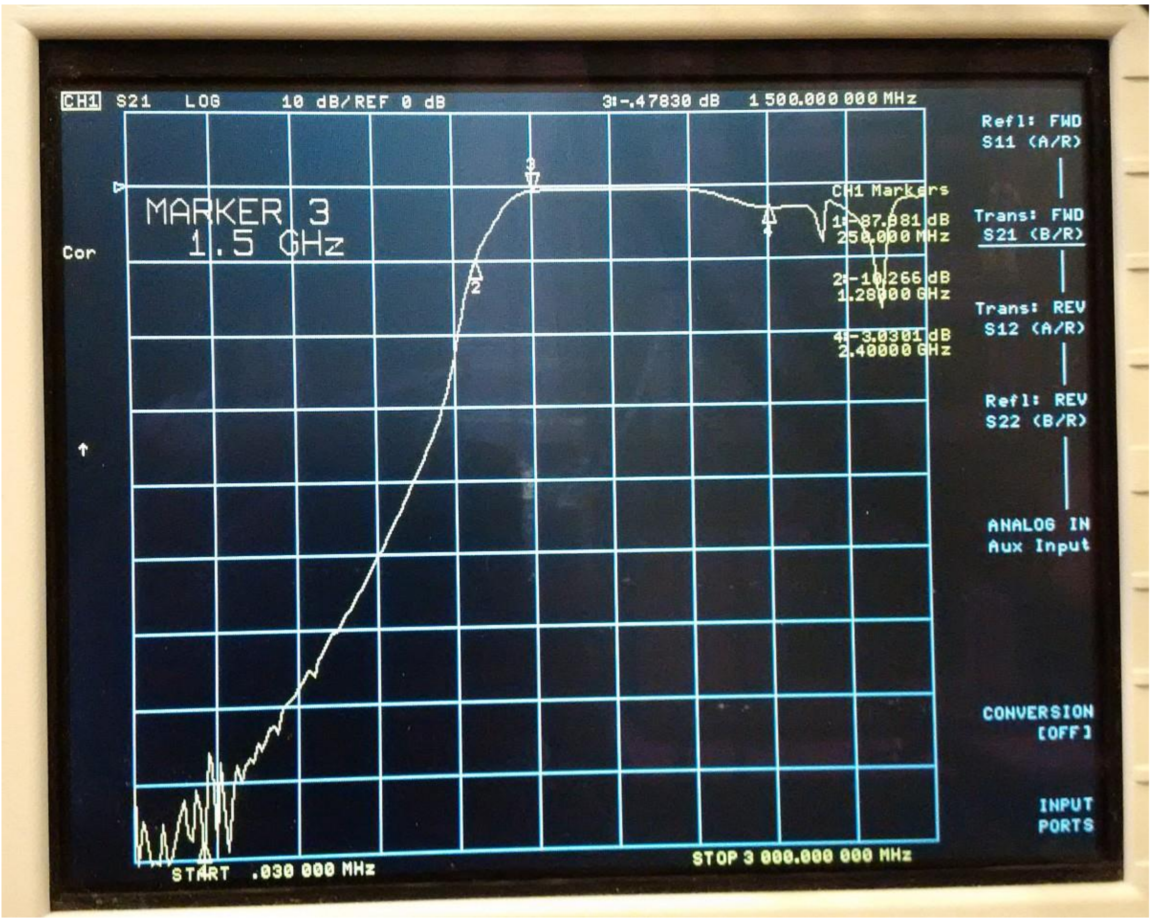


Output matching S22 of the common output port is better than 20dB in the frequency range from DC to 1100 MHz and from 1500 MHz to 2050 MHz

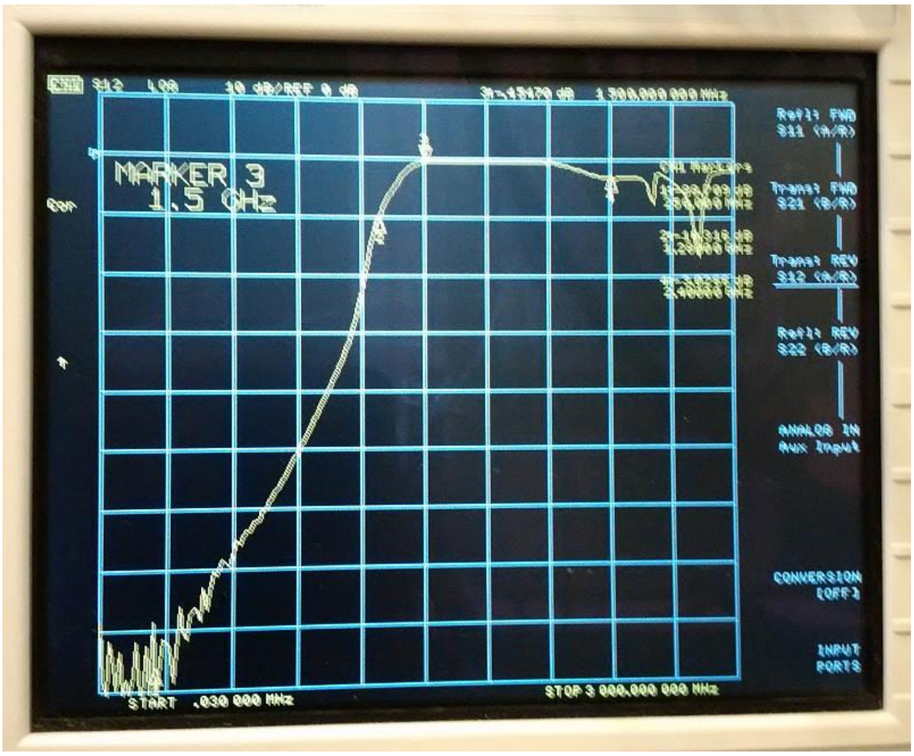
In the next series of measurements, I used the high-band input port as port #1 and the common output port as port #2. The low-band input port was terminated with 50 Ohms.



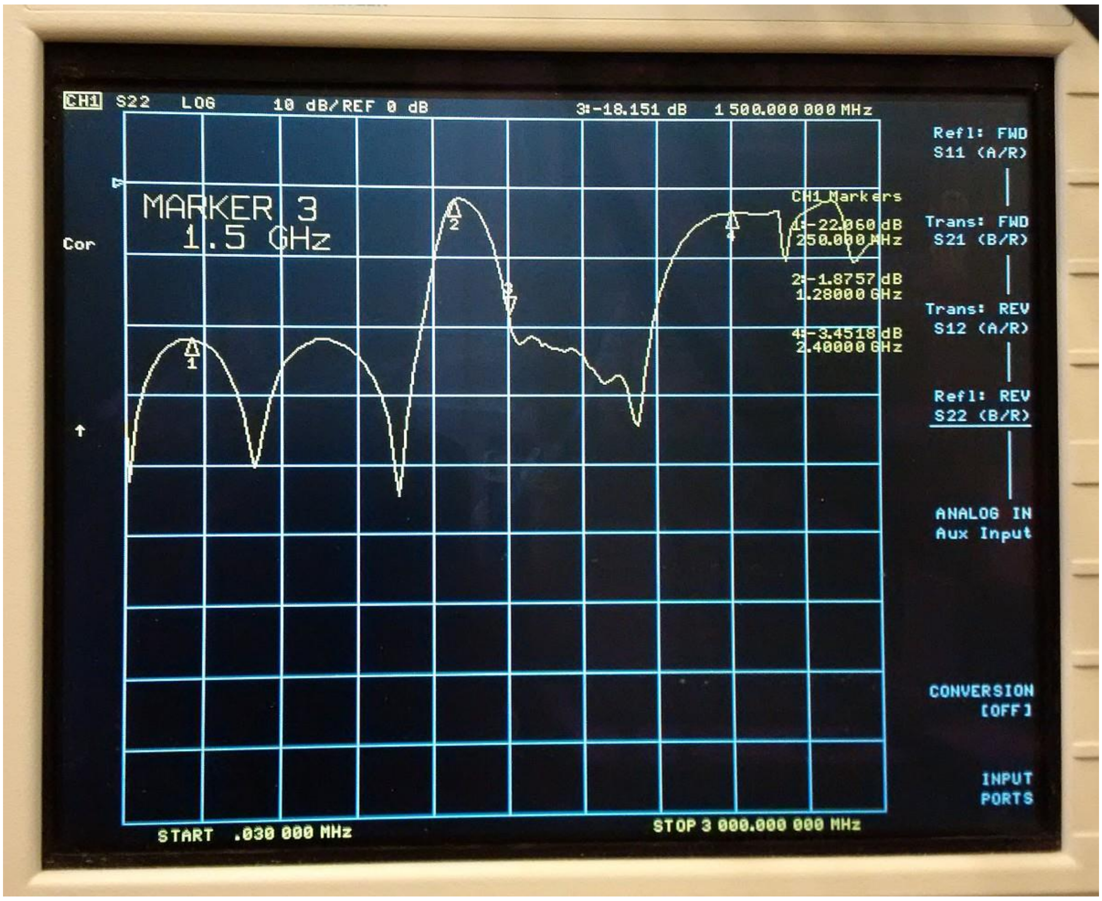
Input matching S11 of the high-band port is better than 20dB in the frequency range from 1500 to 2050 MHz



Insertion loss S21 from the high-band port to the common output port is quite low in the frequency range 1500 to 2050 MHz (e.g. < 0.5dB @1500 MHz). Stop-band attenuation is more than 50 dB in the frequency range from DC to 900 MHz (e.g. >80dB at 250MHz)

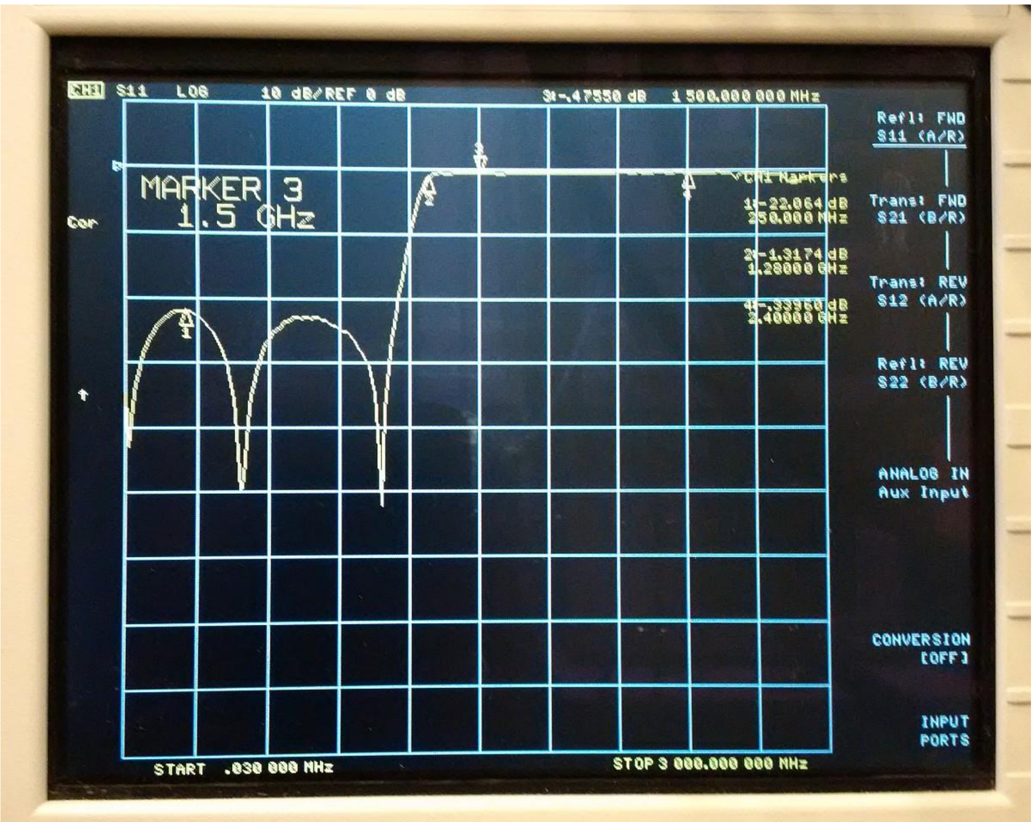


Insertion loss S12 from the common output port to the high-band port is basically identical to the previous measurement of S21.

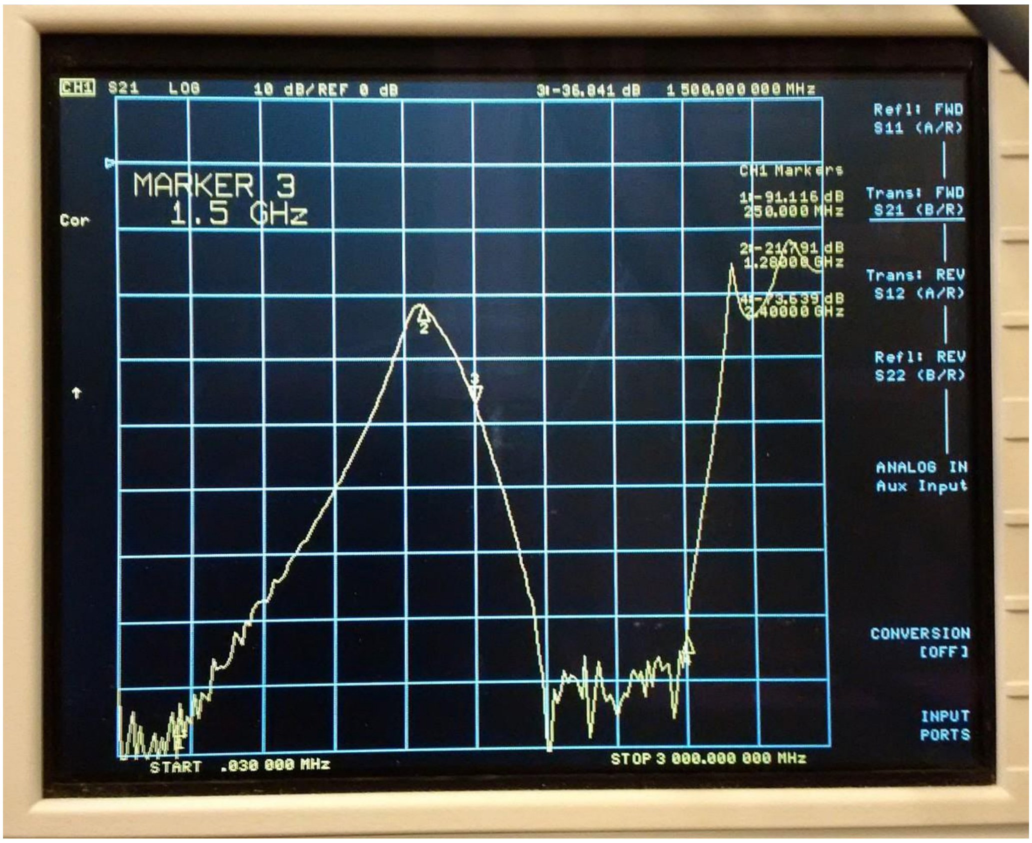


Output matching S22 of the common output port low-band port is better than 20dB in the frequency range from DC to 1100 MHz and from 1500 MHz to 2050 MHz

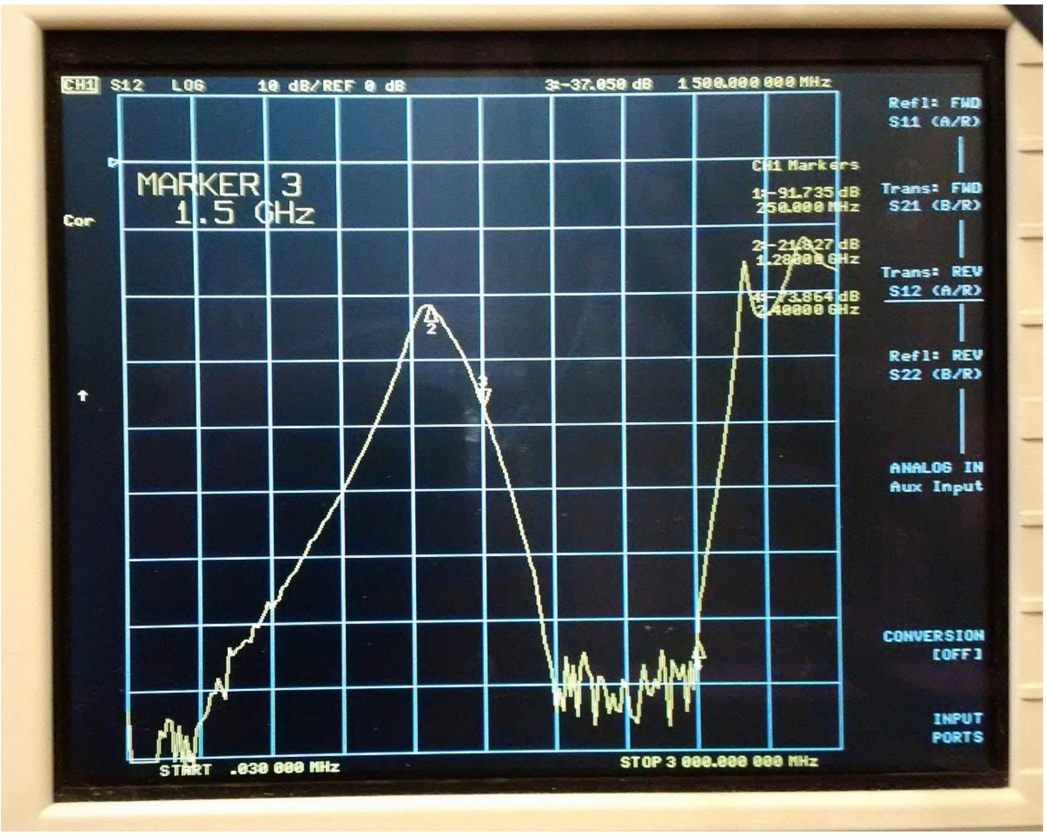
In the last series of measurements, I used the low-band input ports a s port #1 and the high-band input port as port #2. The common output port was terminated with 50 Ohms.



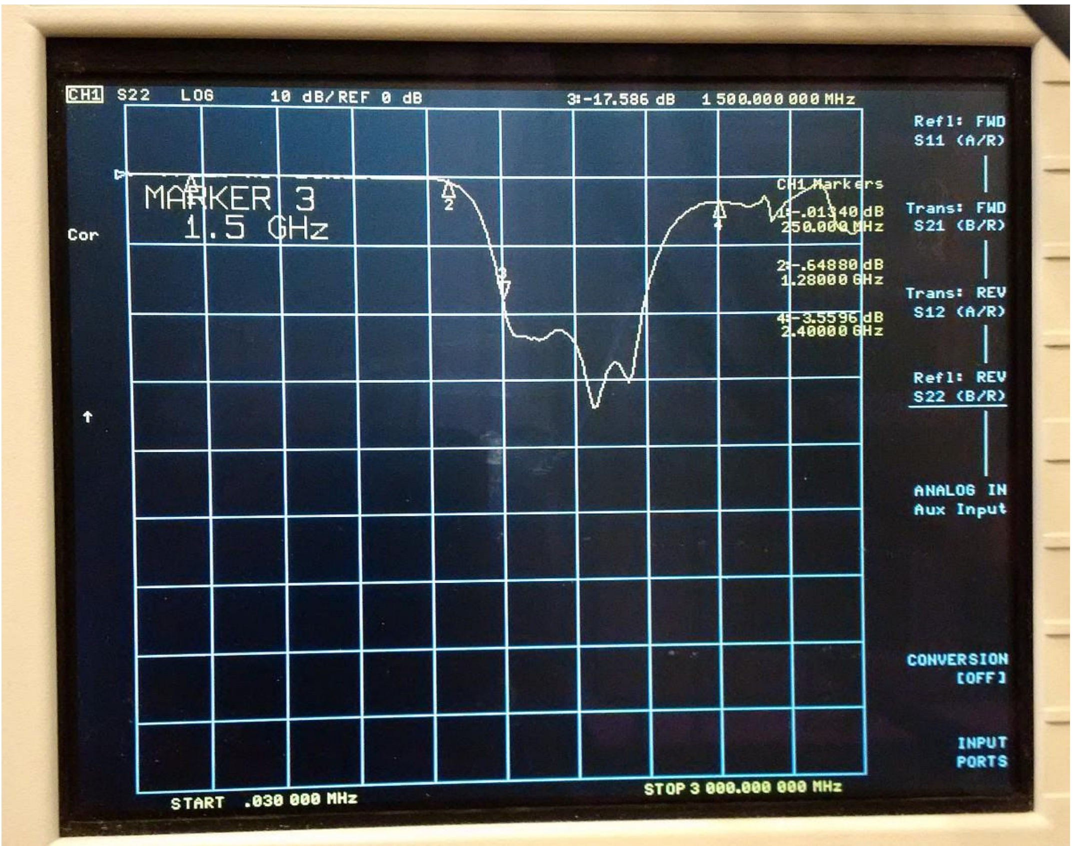
Input matching S11 of the low-band port is better than 20dB in the frequency range from DC to 1100 MHz



Isolation S21 from the low-band port to the high-band port is more than 35dB in the frequency range DC to 1100 MHz and 1500 MHz to 2550 MHz



Isolation S12 from the low-band port to the high-band port is basically identical to the previous S21 measurement.



Output matching S22 at the high-band port is better than 20dB in the frequency range from 1500 to 2050 MHz

Summary:

The Kathrein Dual Band Combiner 791 145 can be used as a diplexer in the frequency range between 50 MHz and 1100 MHz (low-band port) and 1500-2050 MHz (high-band port).

I am always interested in feedback and will be happy to answer questions. Please send them to the Email address given below.

Best regards

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