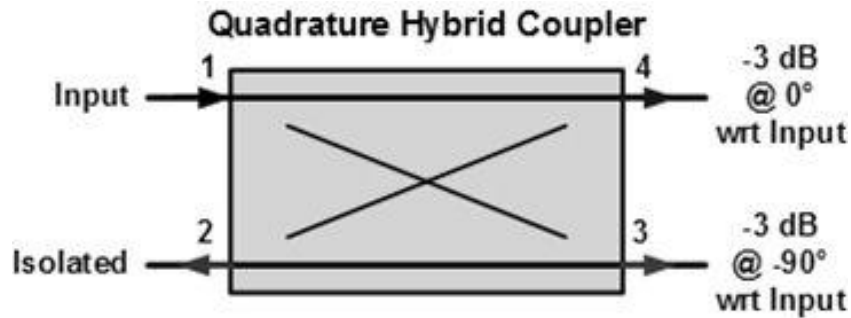


# High power 2320-2400 MHz quadrature hybrid coupler

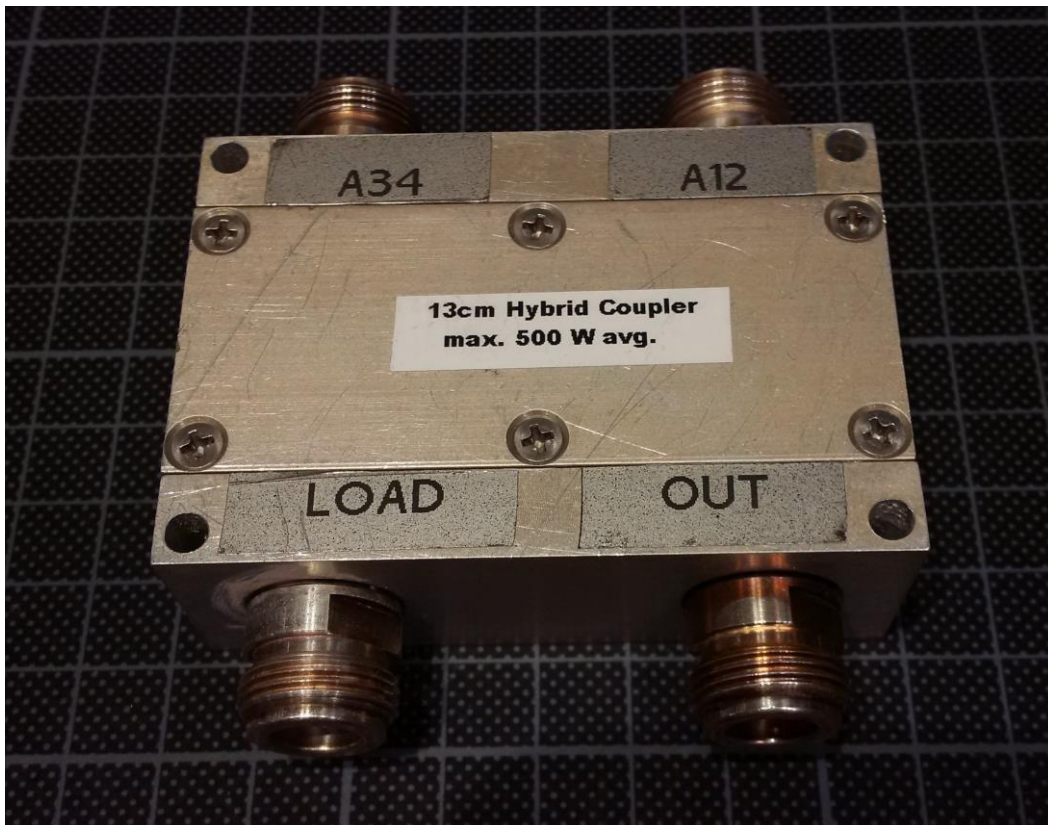
Matthias DD1US February 7<sup>th</sup>2020

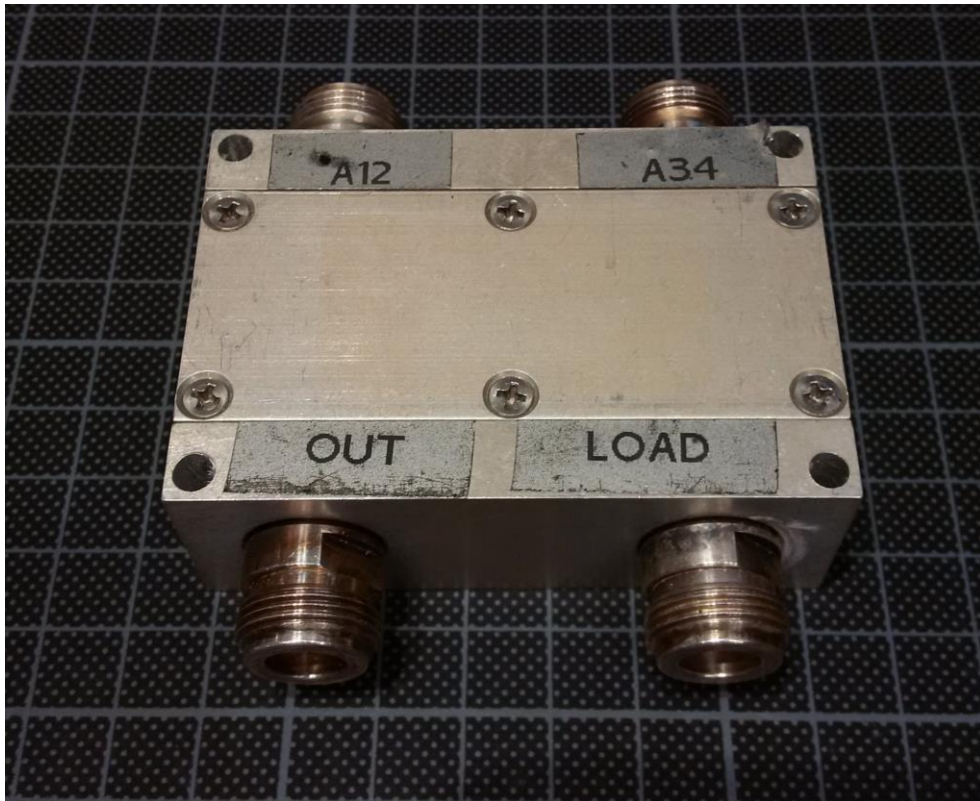
90 degree hybrid couplers are very useful for various RF applications.



Looking for a hybrid coupler to combine the output signals of 2 PAs which I am working at, a friend provided me a nice quadrature hybrid coupler which is capable of handling up to 500W output power. The combiner is housed in a solid milled aluminium encasing and has N-Jacks at all 4 ports.

Here are some pictures of my device:

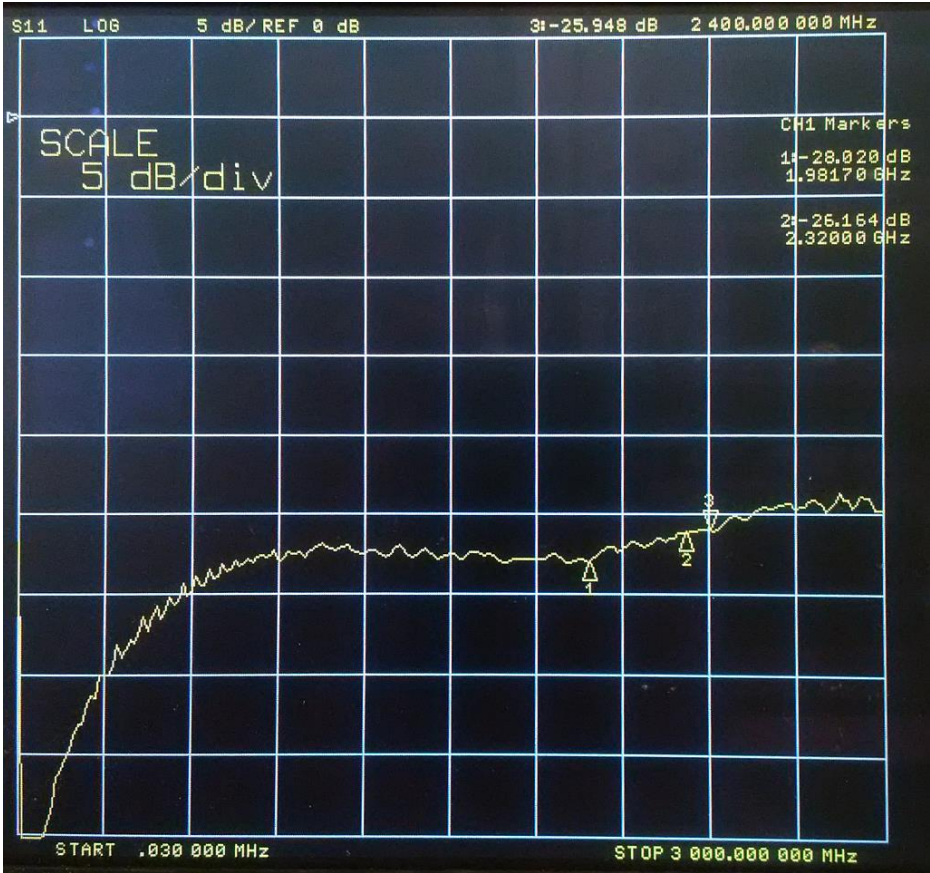
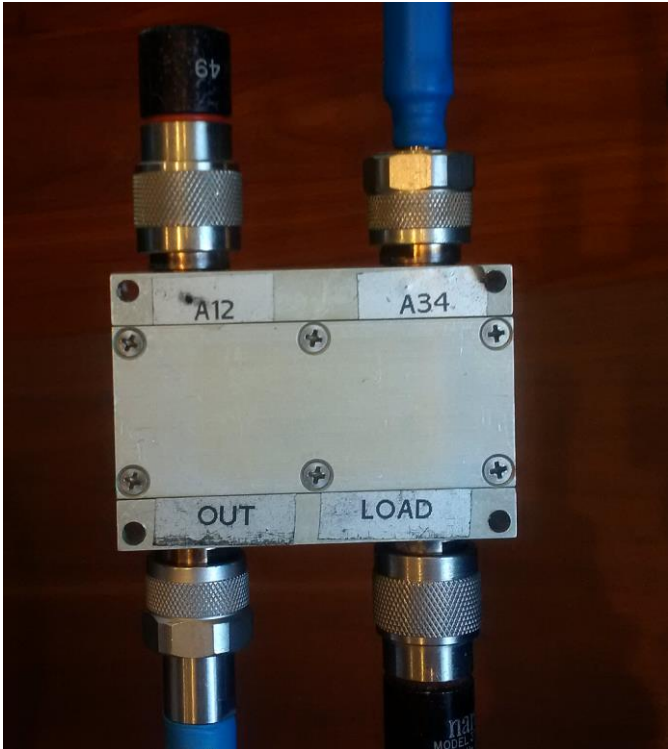




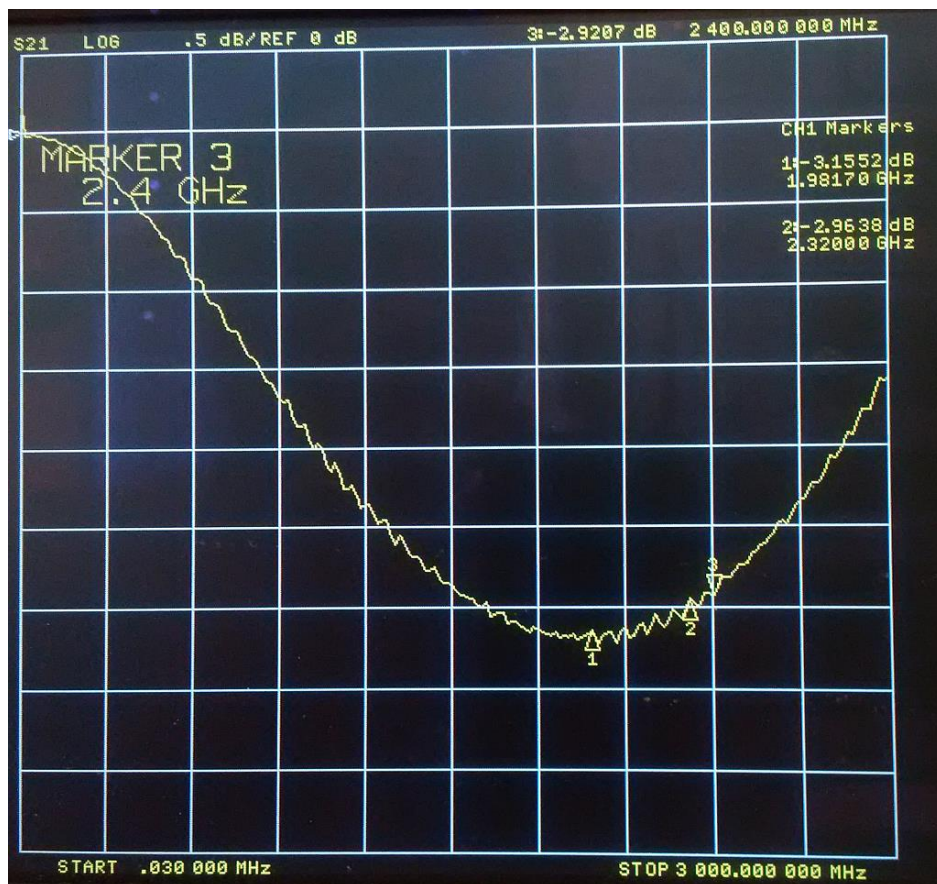
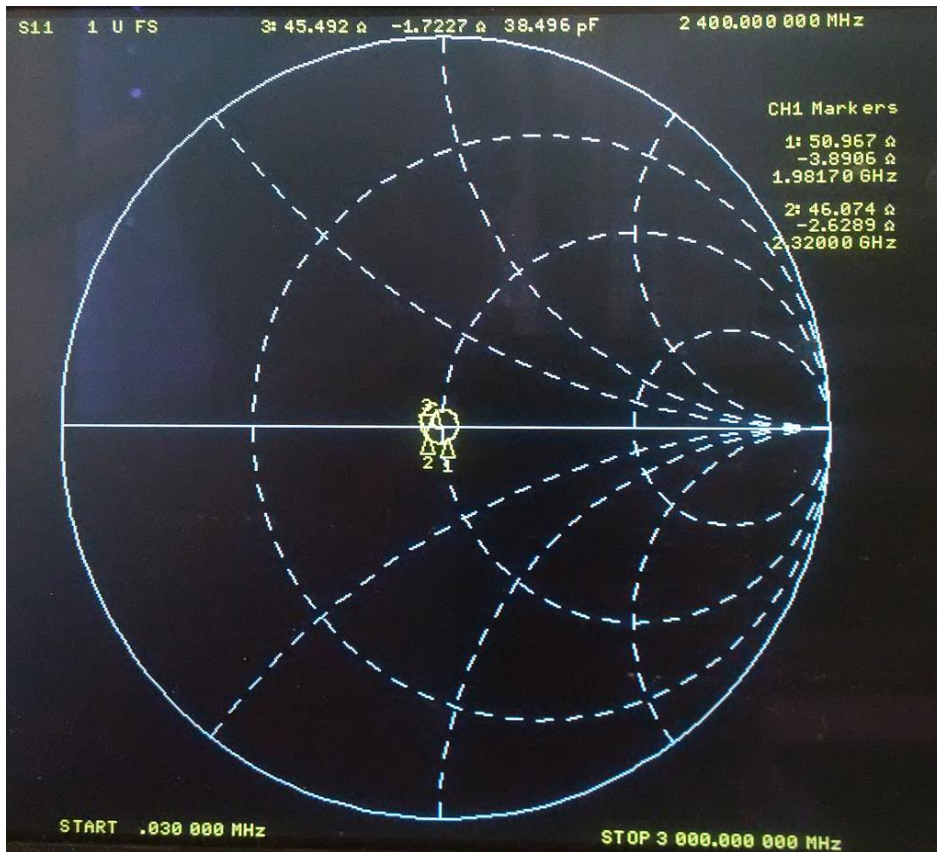
It looks very similar to this coupler, so probably it is from the same company "MECA":



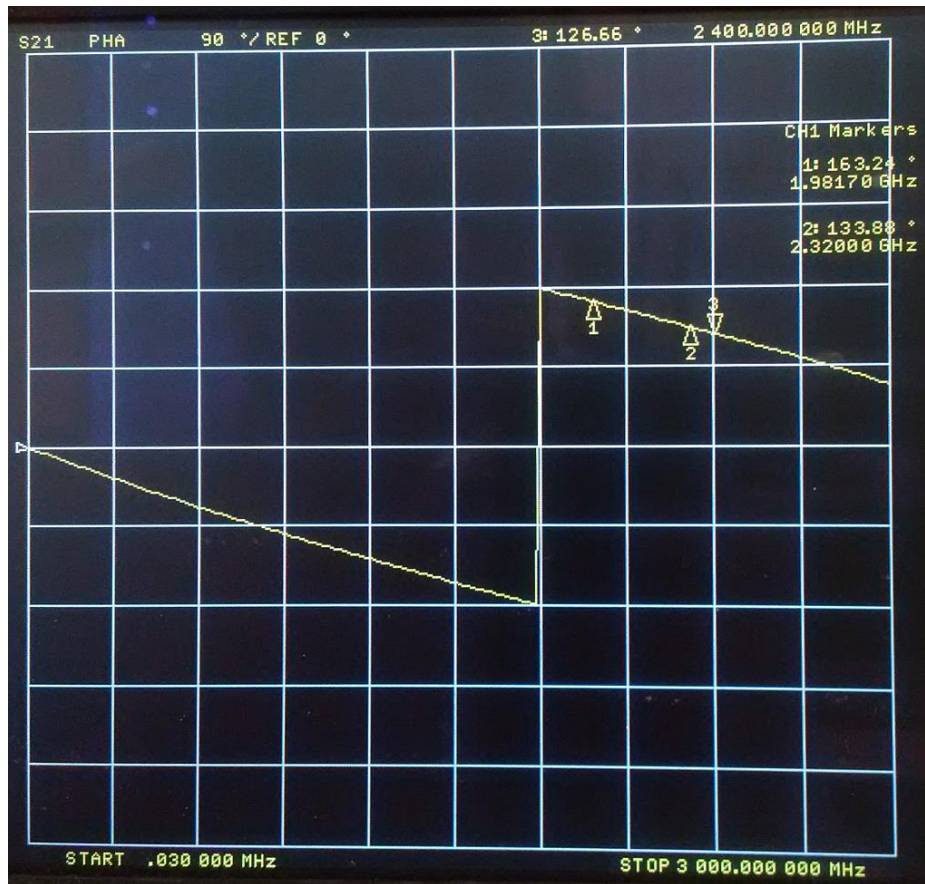
I started with measuring the characteristic from port "Out" to port "A34"



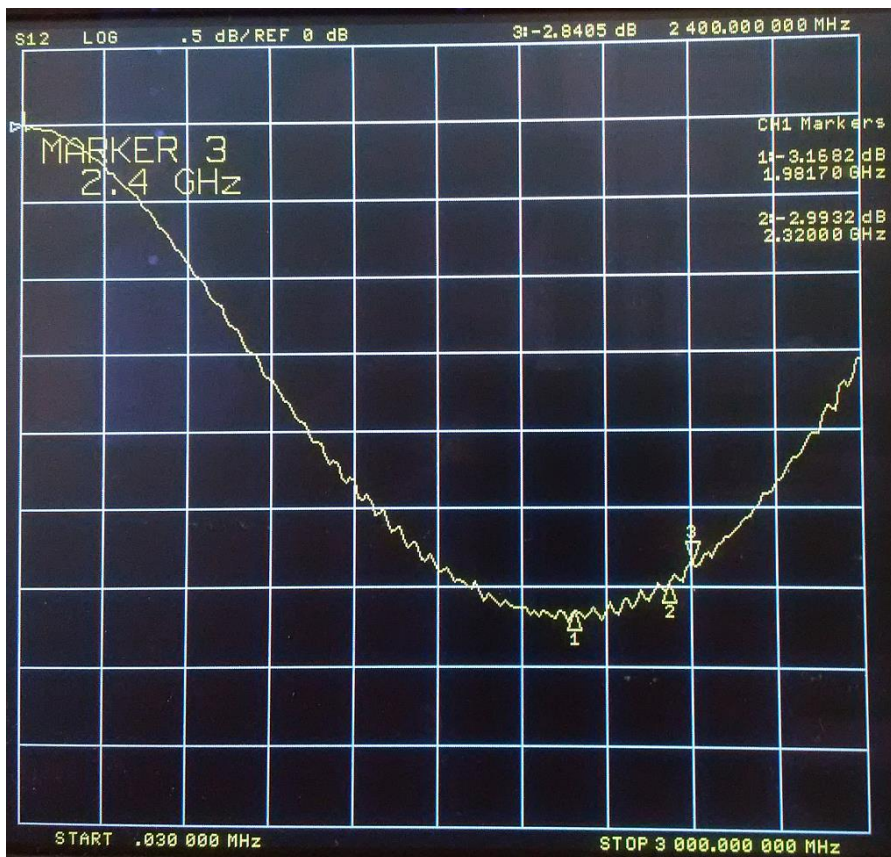
The quadrature coupler is quite wideband. Input return loss S11 is -26.2 dB at 2320 MHz and -25.9 dB at 2400MHz.



S21 log mag at 2320 MHz is -2.96 dB respectively -2.92 dB at 2400 MHz.



S21 phase at 2320 MHz is 133.88 degree, at 2400 MHz it is 126.66 degree.



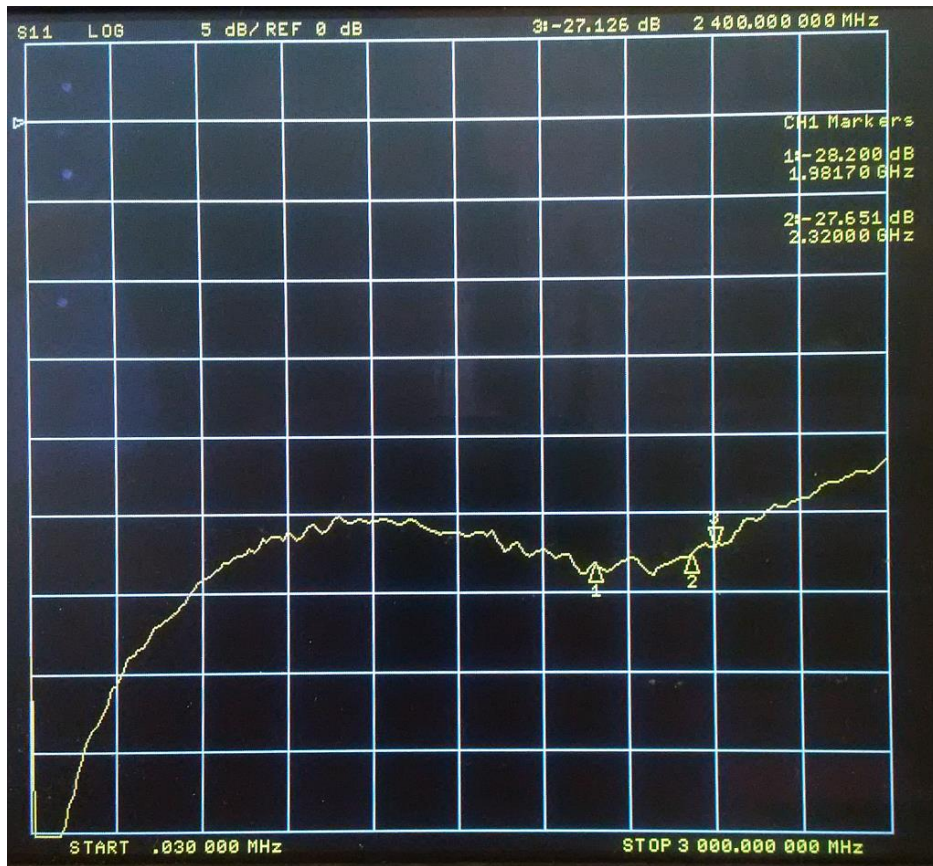
As to be expected S12 log mag is basically the same as S21.



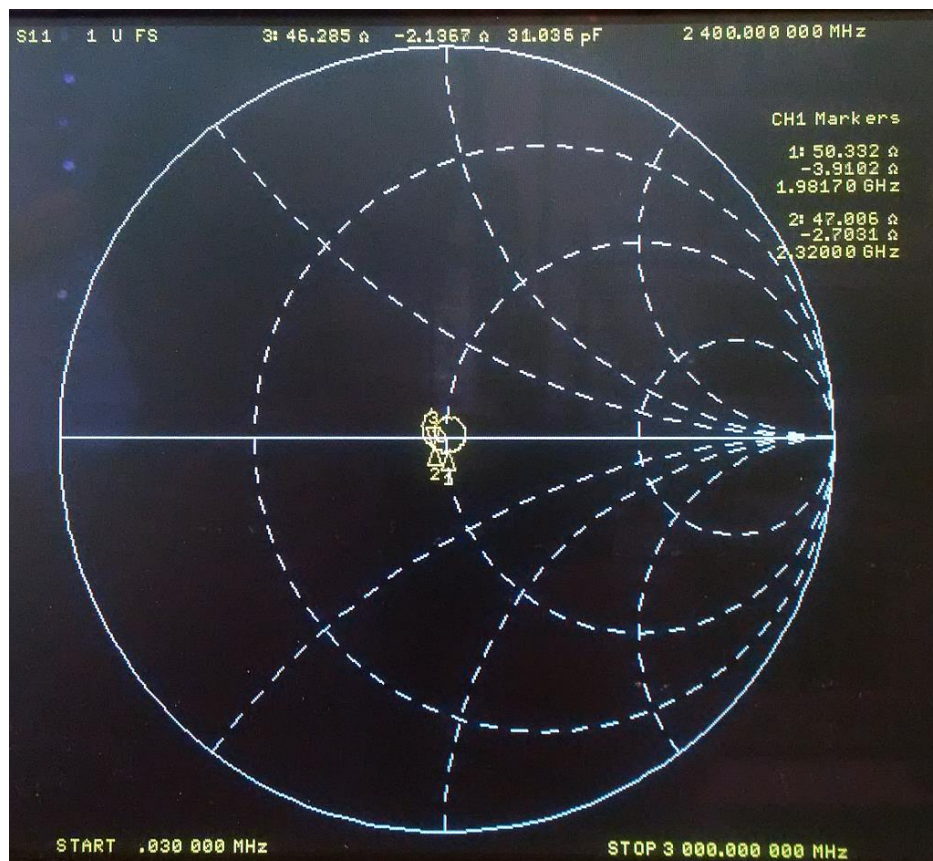
S22 log mag at 2320 MHz is -23.7 dB and S22 log mag at 2400 MHz is -23.1 dB.

Next I measured the characteristic from port "Out" to port "A12":



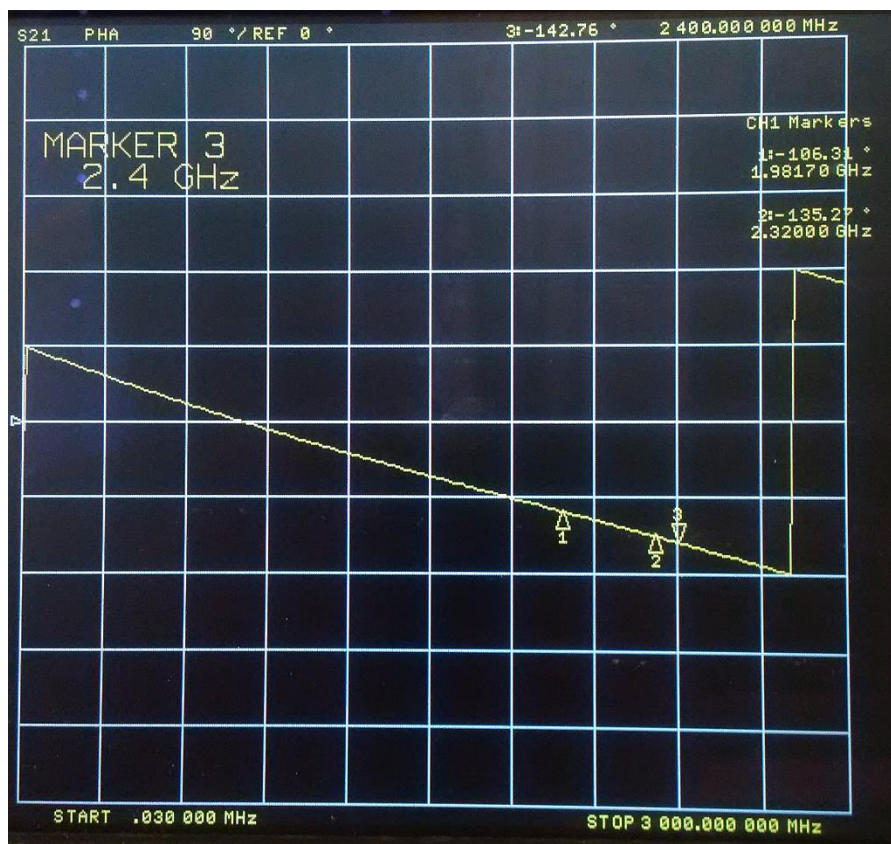


Input return loss S11 at 2320 MHz is -27.7 dB.  
 At 2400MHz the return loss S11 is -27.1 dB.



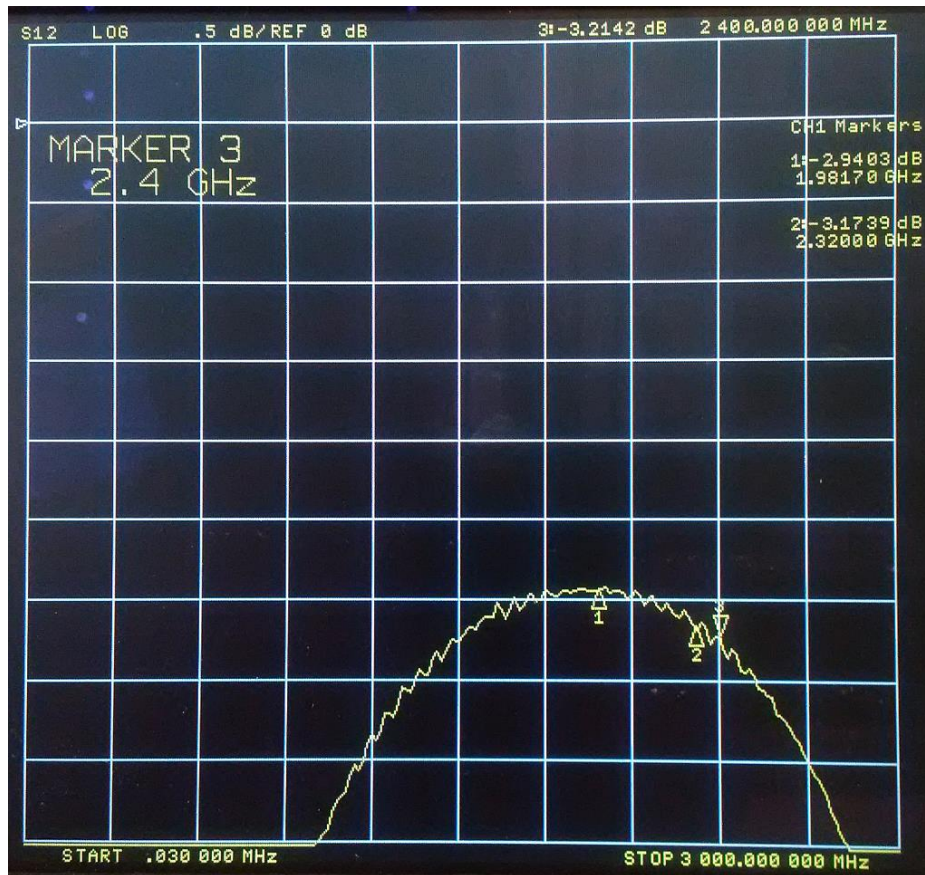


S21 log mag at 2320 MHz is -3.13 dB. S21 log mag at 2400 MHz is -3.30 dB.

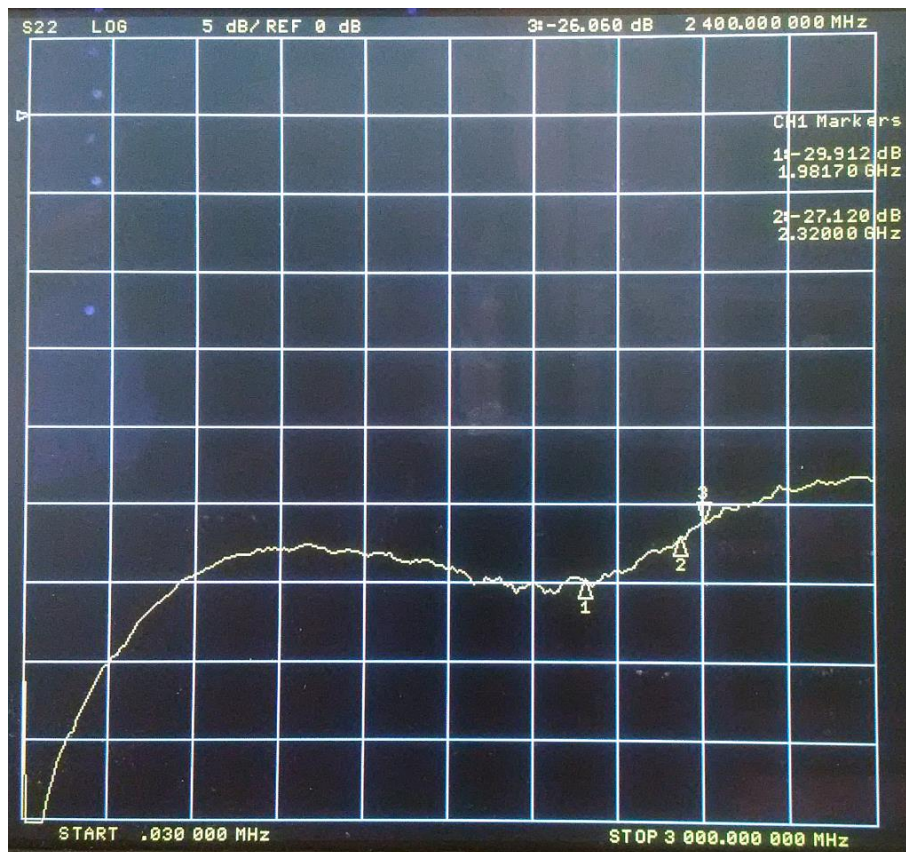


S21 phase at 2320 MHz is -135.2 degree, at 2400 MHz it is -142.76 degree.

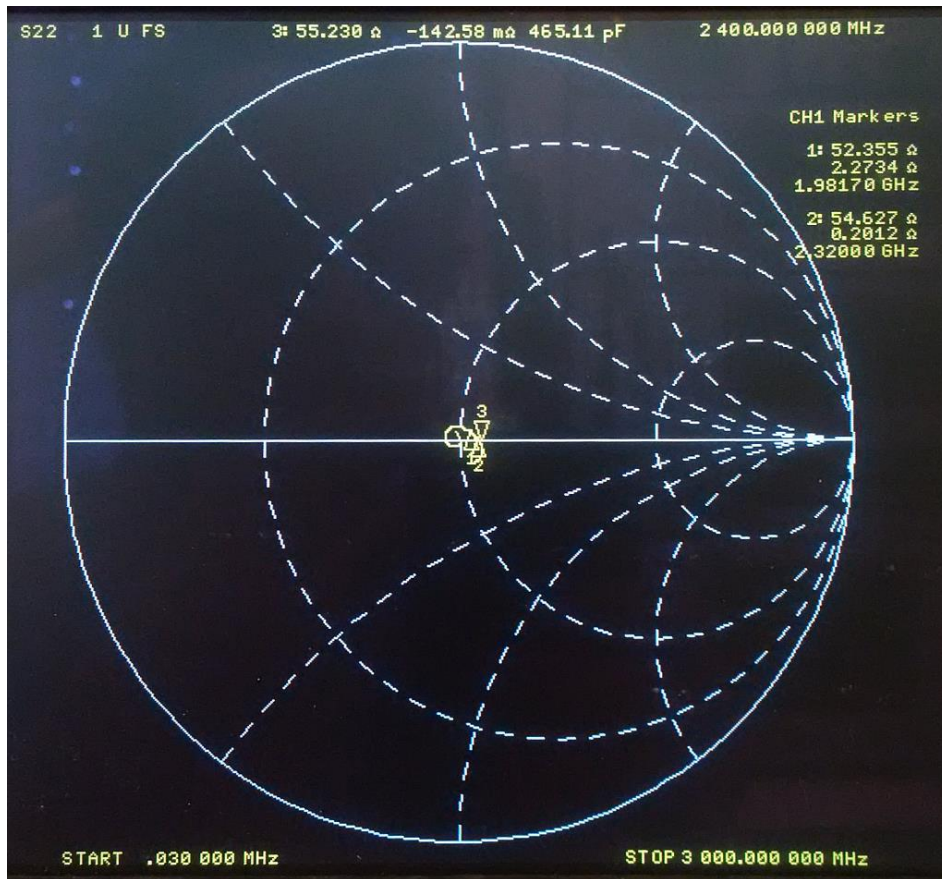




As to be expected S12 log mag is basically the same as S21.

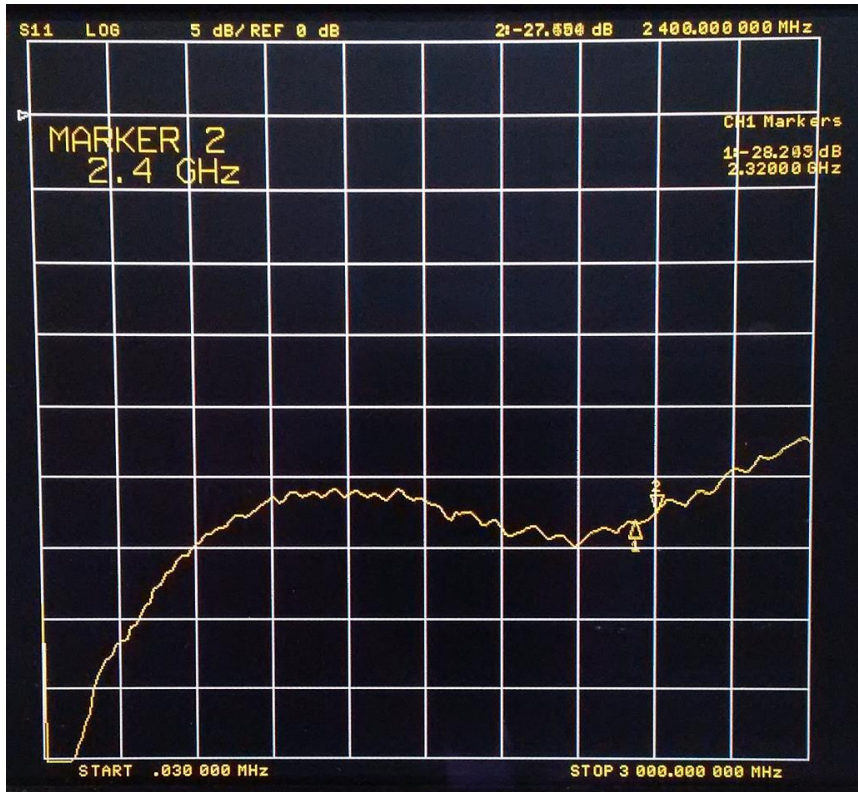


S22 log mag at 2320 MHz is -27.1 dB. S22 log mag at 2400 MHz is -26.1 dB.

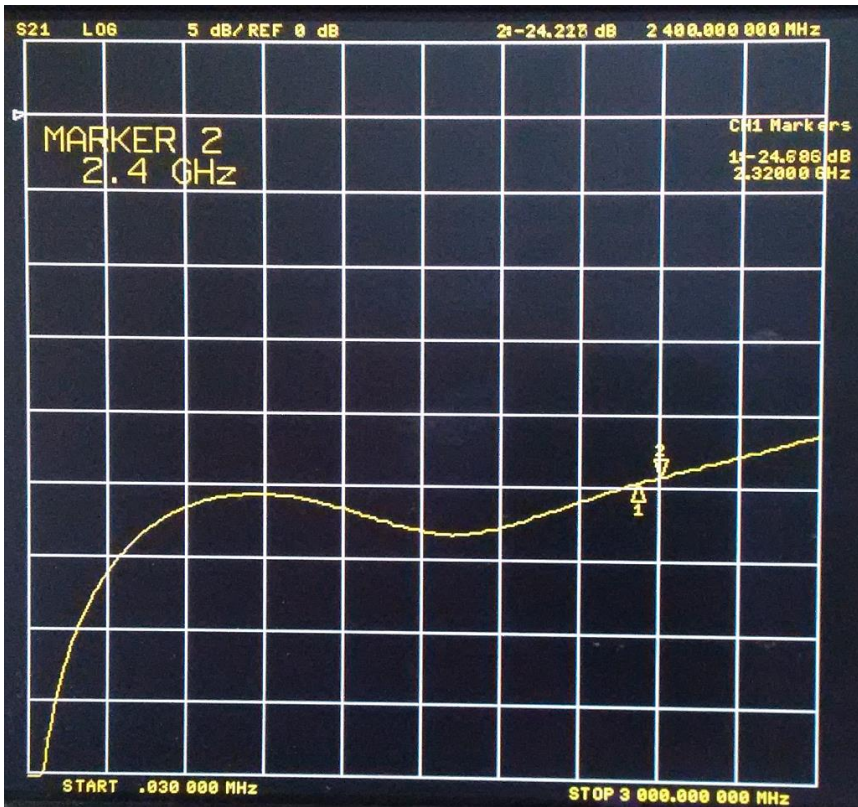


Finally, I measured the isolation S21 from port “Out” to port “Load”

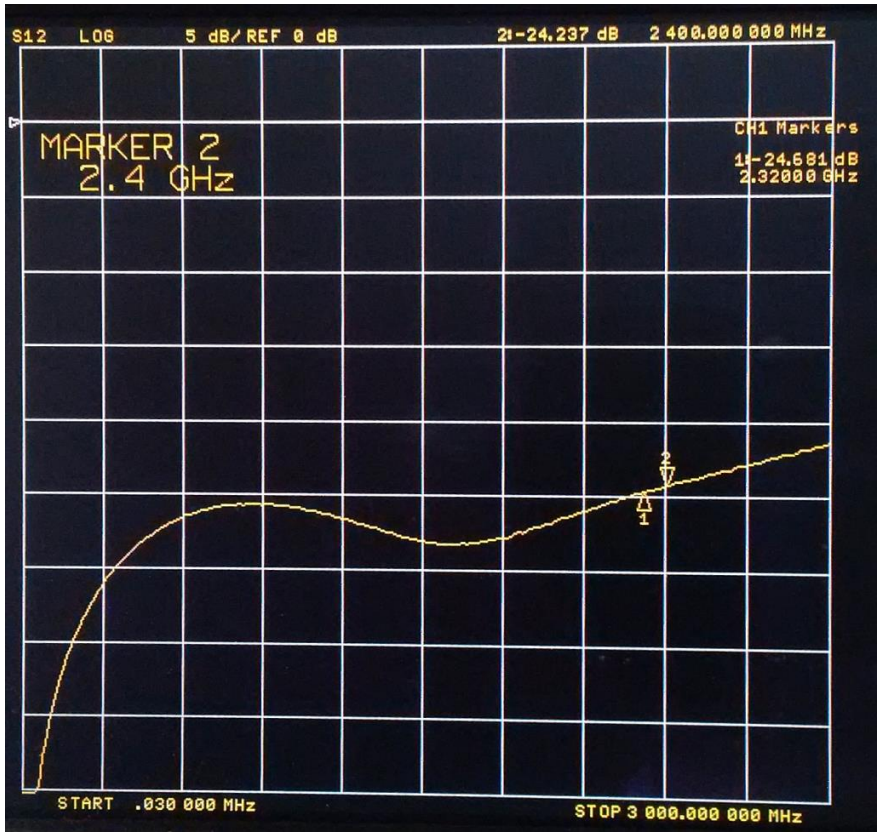




Input return loss S11 is -28.2 dB at 2320 MHz and -27.6 dB at 2400 MHz.



S21 from Out-port to Load-port is -24.6dB at 2320 MHz and -24.2 dB at 2400 MHz.



S12 is identical to S21.



Output return loss S22 is -21.3 dB at 2320 MHz and -21.1 dB at 2400 MHz.

This is the summary of the parameters of the hybrid coupler measured at 2320 MHz:

Amplitude imbalance	0.17 dB
Phase imbalance	0.85 degree
Avg. insertion loss	<0.1 dB (in addition to 3 dB because of splitting the signal)
Isolation	24.6 dB

In summary here are the parameters of the hybrid coupler measured at 2400 MHz:

Amplitude imbalance	0.38 dB
Phase imbalance	0.58 degree
Avg. insertion loss	0.11 dB (in addition to 3 dB because of splitting the signal)
Isolation	24.2 dB

The measurement results show, that the coupler is well suited to be used in the frequency range 2320 ... 2400 MHz.

If you have questions or comments please send them to the Email address given below.

vy 55 & 73 de

Matthias DD1US

Email: [dd1us@amsat.org](mailto:dd1us@amsat.org)

Website: [www.dd1us.de](http://www.dd1us.de)