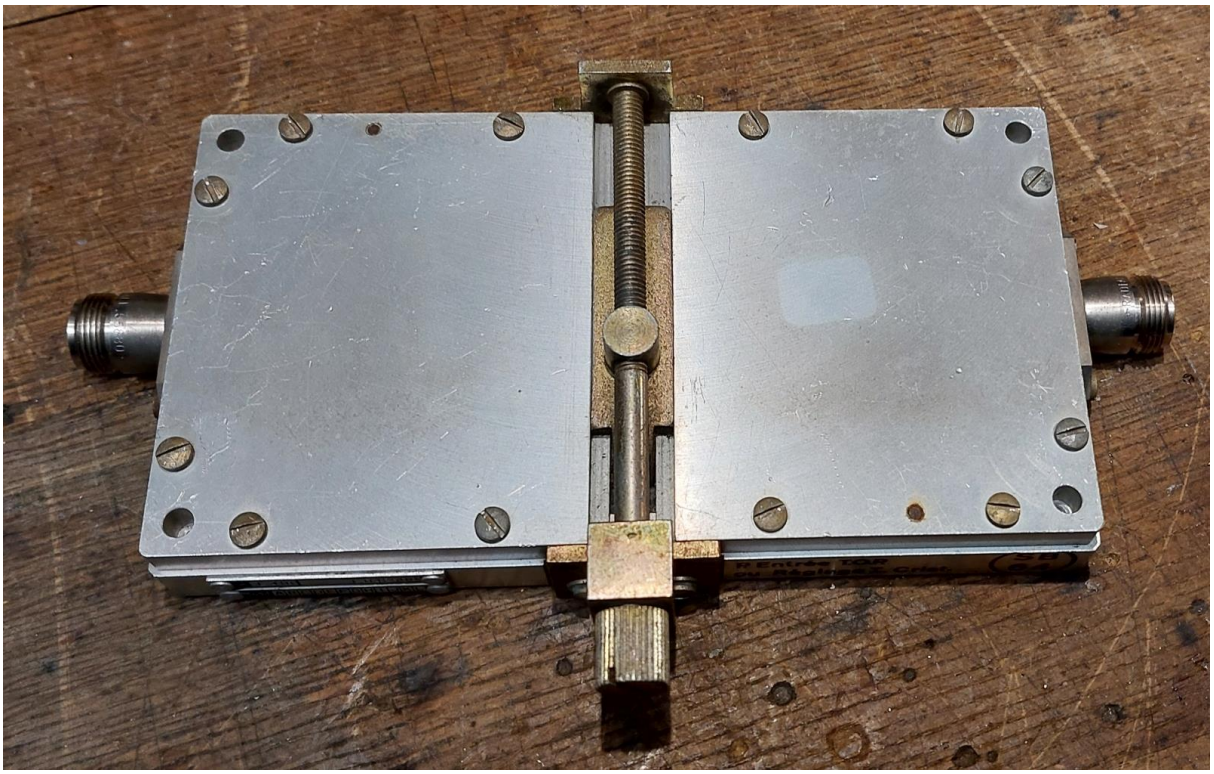
Analysis of an unknow variable attenuator

Matthias, DD1US, April 5th 2024, rev 1.0

Some time ago a friend gave me an unknown variable attenuator. It is an interesting construction and I am sharing my findings. Maybe someone knows these attenuators and can provide some more information such as the nominal specifications and the target applications.

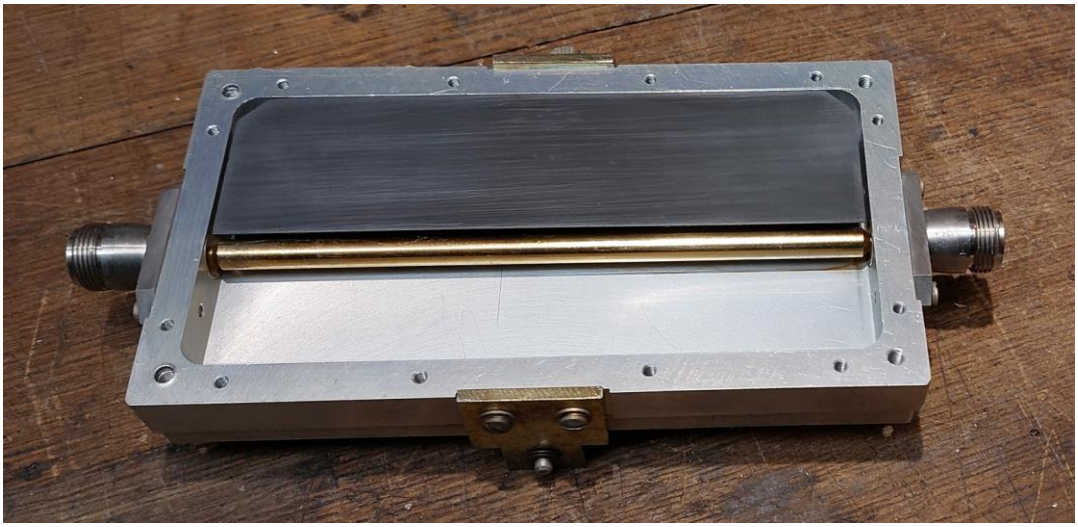
Here are some pictures of the device:



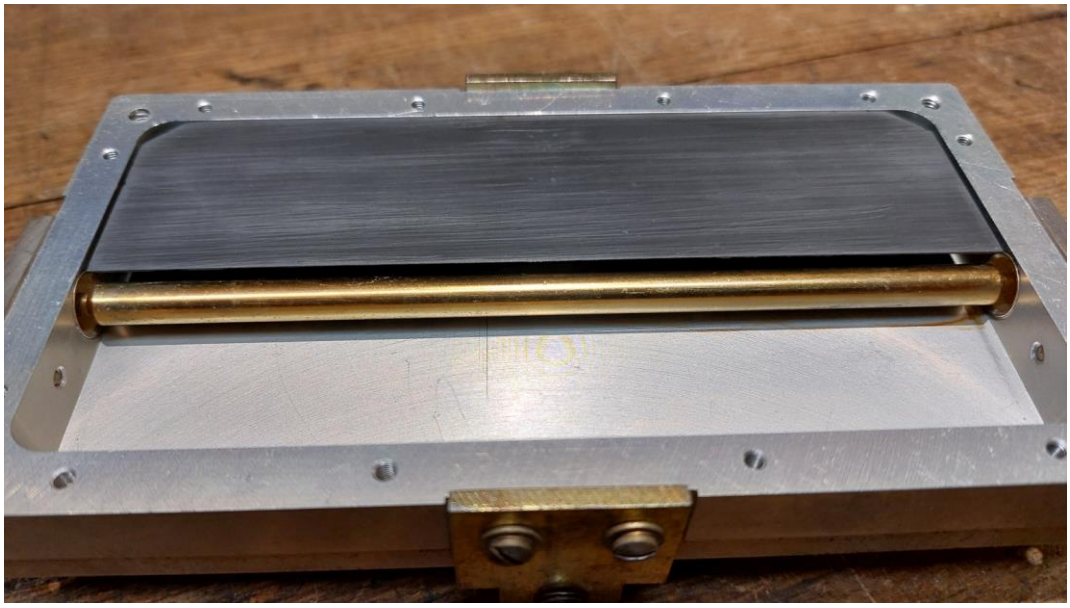
Input and output ports are N-jacks. Turning the screw on the bottom of the picture will move the vertical adjustment slide up and down.

Here are the labels on the device which suggest that the unit is from a French supplier:

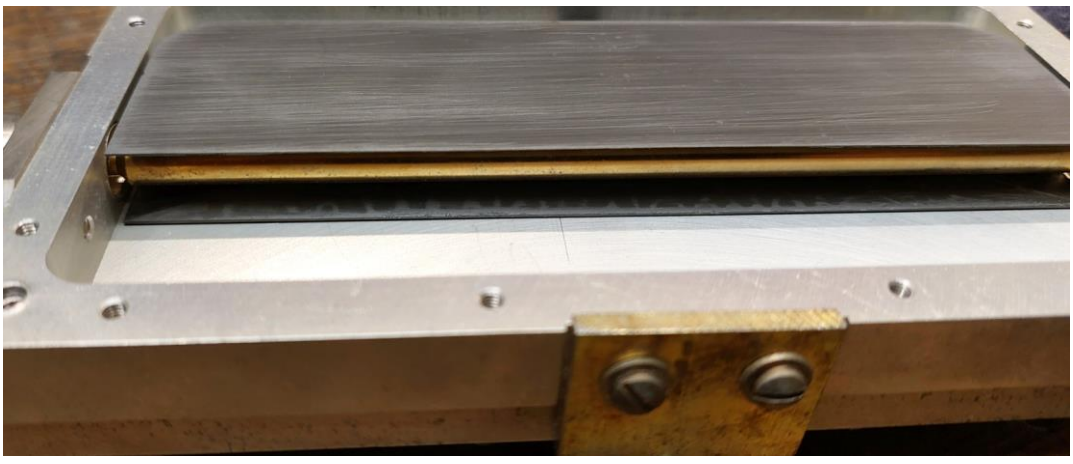
Next I removed the bottom lid:

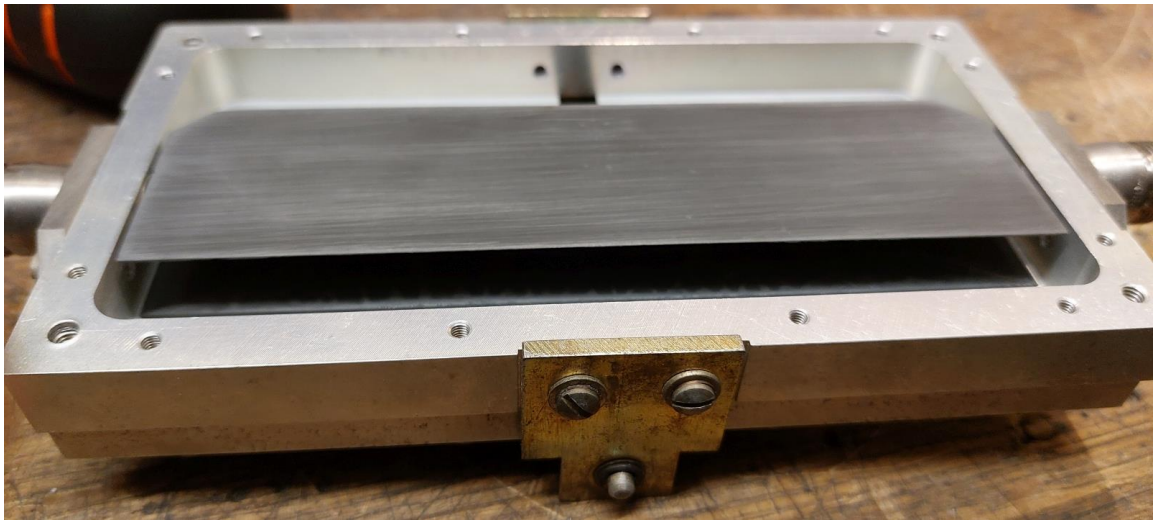


We can see the gold-plated center conductor and above a U-shaped black block of unknow material. I suppose it is made from a ferrite material.

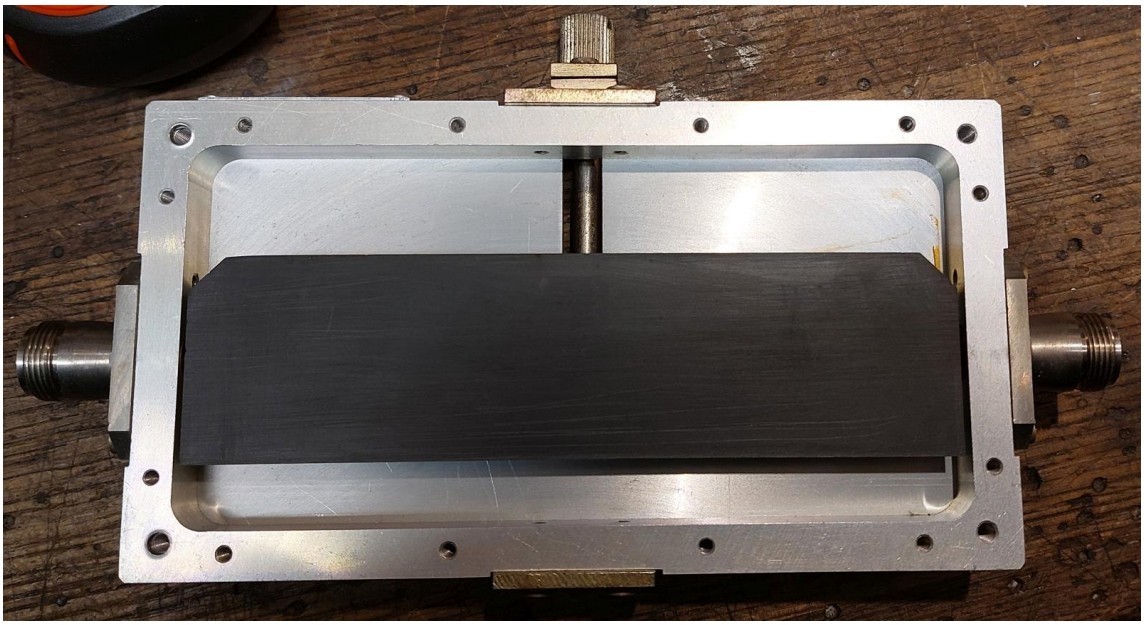


When turning the before mentioned screw the vertical adjustment slide will move that U-shaped block up and down (moving over the centre conductor without touching it).

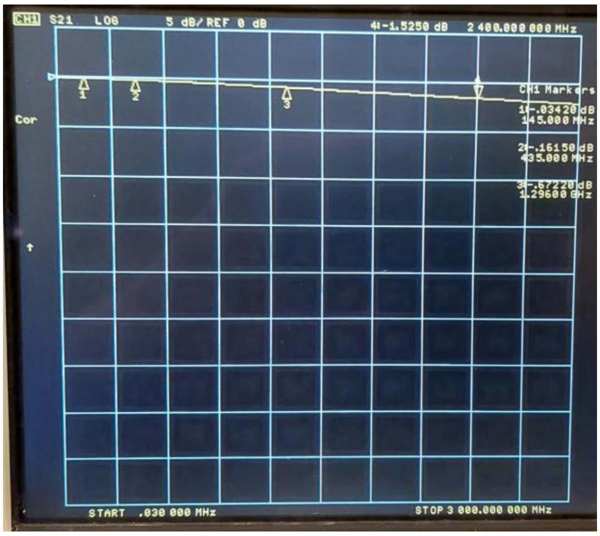


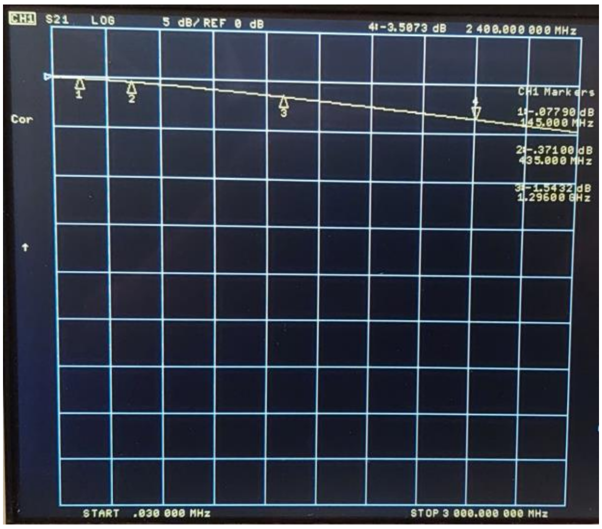


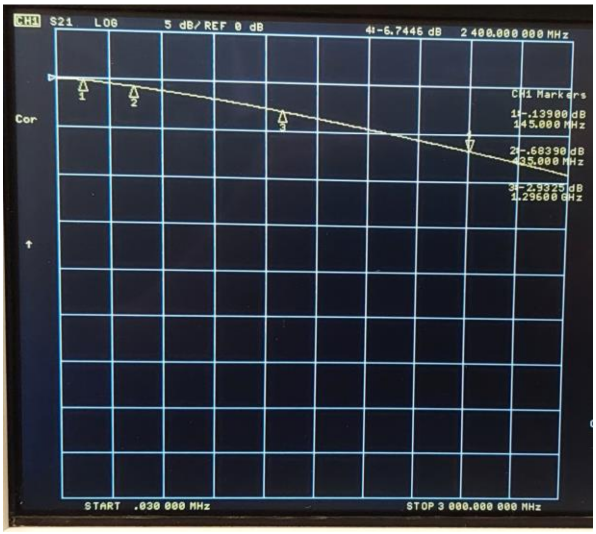
When the U-shaped block is completed moved up / not covering the centre conductor the minimum insertion loss is achieved. The further the block is moved over the centre pin, the higher the insertion loss. In the next picture you see the position of the block when maximum insertion loss is achieved:

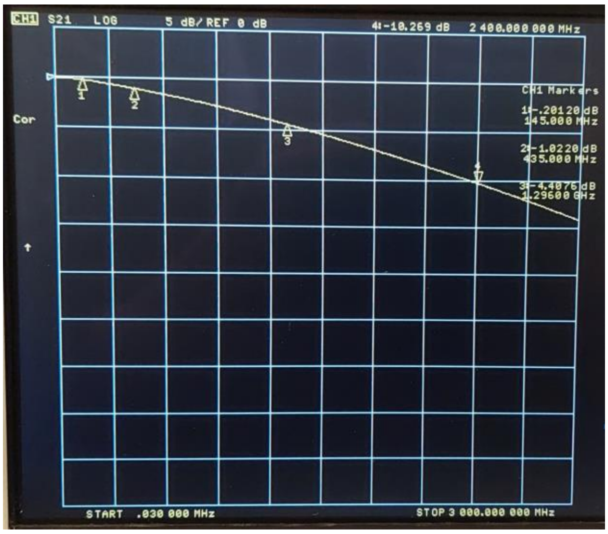


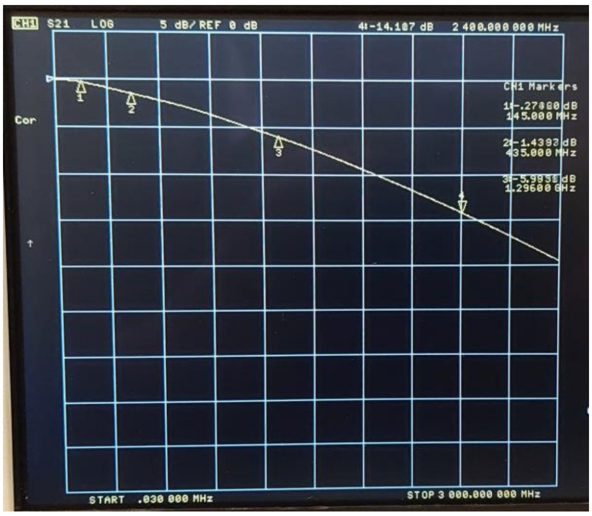
Finally, I did some measurements of the device for different positions of the vertical adjustment slide. Here are screen shots of the S21 (insertion loss) measurements starting with minimum insertion loss and gradually increasing it:

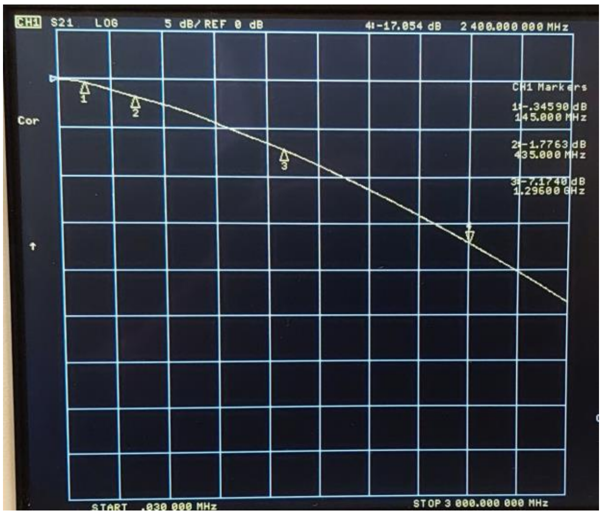


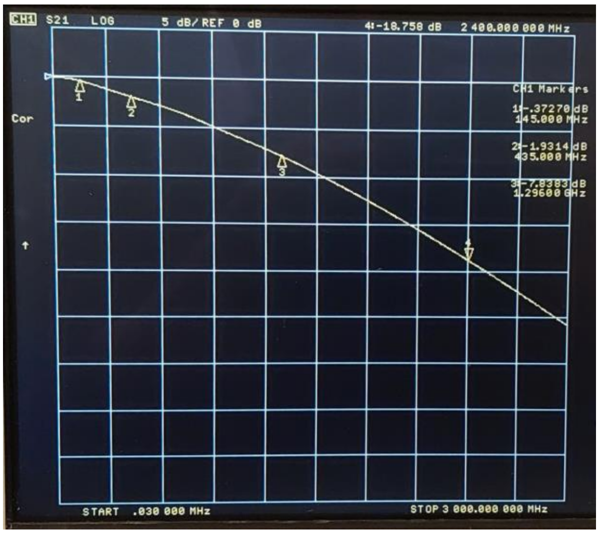


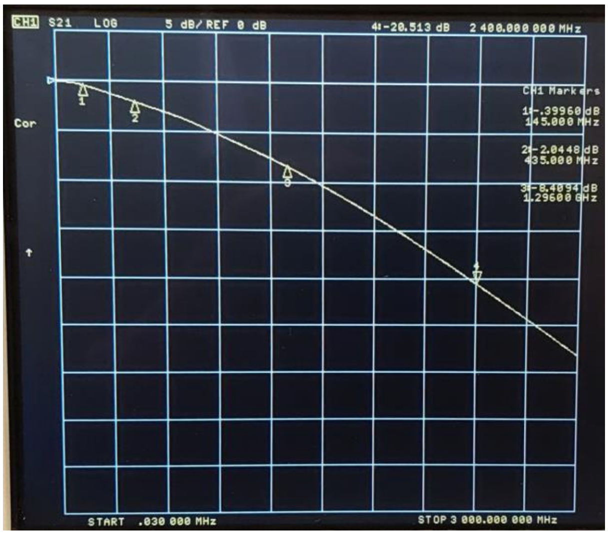


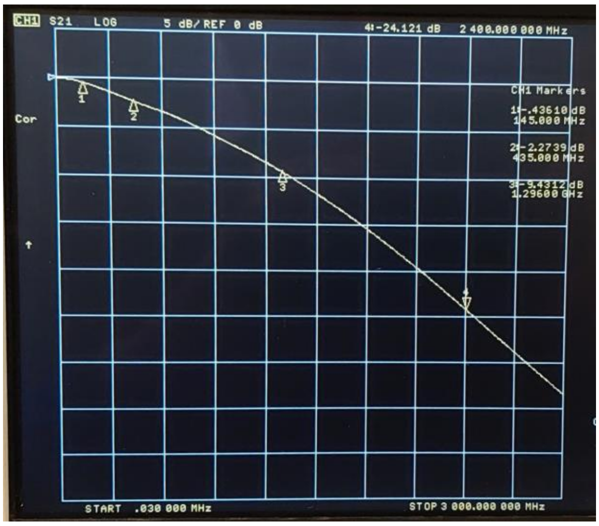


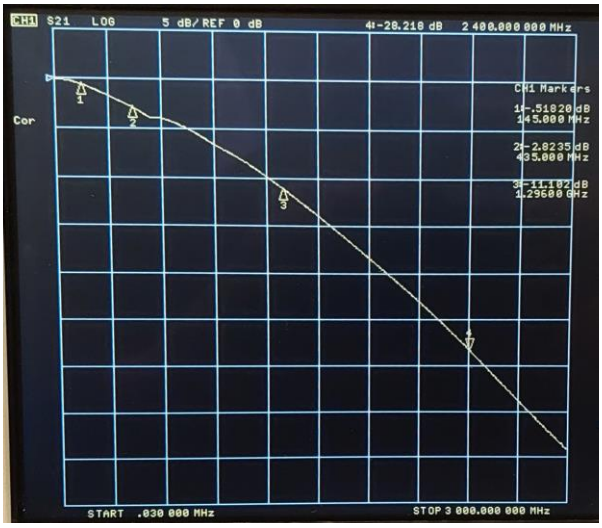






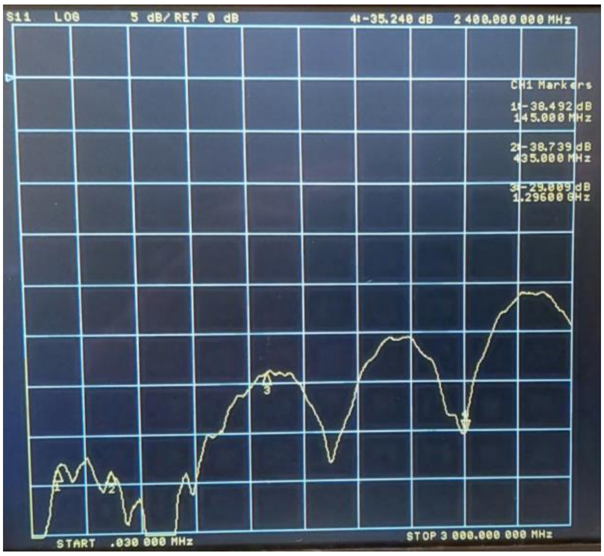


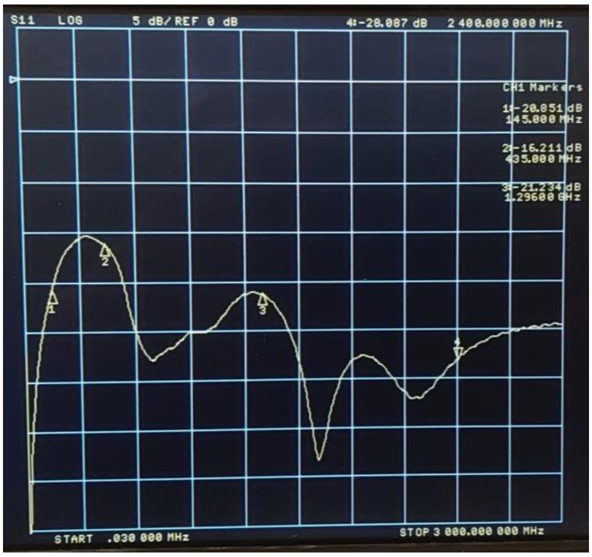




As can be seen the insertion loss is highly frequency dependent. At low frequencies the change of attenuation is very low. The minimum insertion loss is 0.03dB @145Mhz and 1.53dB @2.4GHz. The maximum attenation is 0.52dB @145MHz respectively 28.22dB @2.4GHz. Measured S12 is bascially identical to S21.

Next I measured S11 (input return loss) of the device at different attenuation settings. The left screenshot shows S11 at minimum attenuation, the right screenshot at maximum attenuation:





The minimum return loss observed at different setting was 15dB. S22 is basically identical to S11.

As mentioned, before I am very interested in getting more information about this variable attenuator.

Please send them to the Email address, which you find below.

Best regards

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