2495 MHz Band Pass Filter and Low Noise Amplifier

A band pass filter and low noise amplifier combination has been assembled to remove potentially interfering signals, and to increase the signal to noise ratio of measurements made when remotely operating a receiver connected to an experiment by a length of RF cable. This arrangement is appropriate for both magnetometer experiments whose receiver is a spectrum analyzer, and polarimetery experiments that use an I/Q receiver.

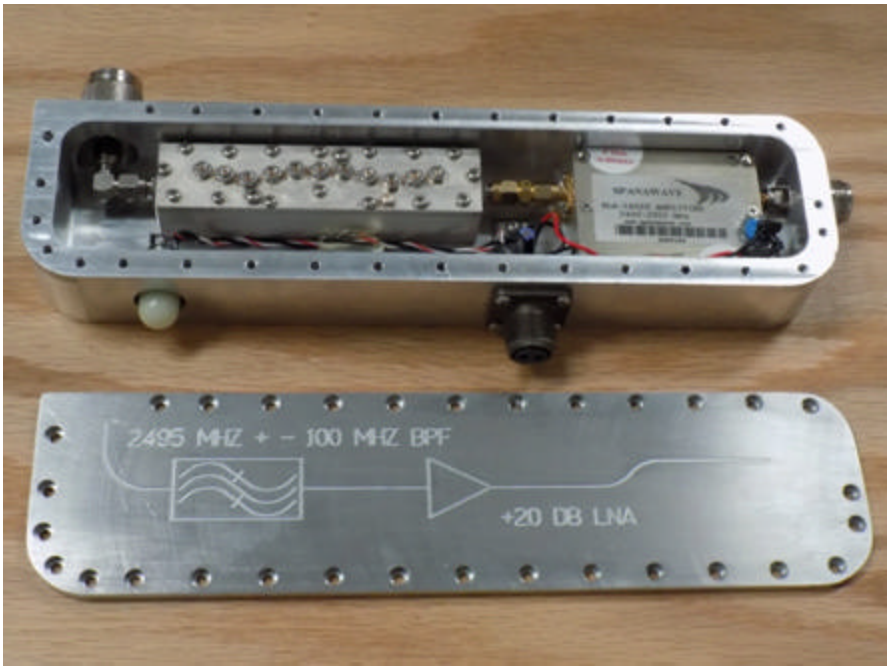

Figure 1. The filter and pre-amplifier assembly with the lid removed.

The assembly was constructed to be attached directly to the Polarimeter/Magnetometer cavity, and then connected to the receiver by a length of Heliax cable.

The Band Pass Filter: The purpose of the band pass filter is to efficiently transmit the frequency of interest, 2495 MHz, and reject signals that could interfere with this signal. Because receiver components, amplifiers and mixers, are nonlinear devices, they can produce harmonics of input signals[1]. The experiment involves measuring a cavity resonance at 2495 MHz excited by a 499 MHz beam. It is likely that the signal from the cavity could include 499 MHz and its harmonics due to non-resonant proximity coupling between the passing beam and the cavities antenna. The band pass filter rejects all of these outside of + - 100 MHz centered at 2495 MHz. This prevents a signal at 499 MHz for example, from creating harmonics in

the receiver that could overlap with the signal of interest. This bandpass filter is very efficient, attenuating the transmitted signal between .4 and .6 dB within its pass band.

The Low Noise Amplifier: This amplifier, Spanawave SLA-24029, has +20 dB of gain and a noise figure of 1.1 dB[2].

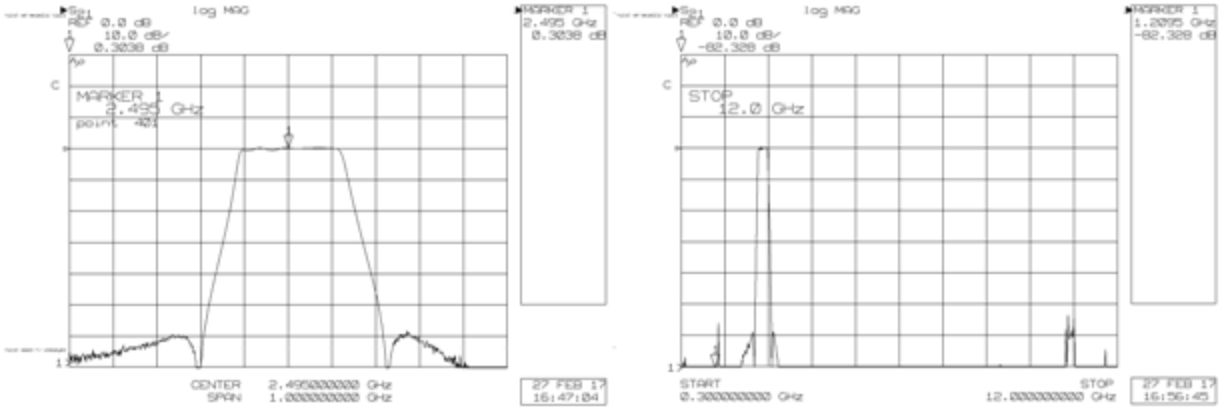

Figure 2: swept frequency transmission measurements of the filter amplifier combination demonstrating +20 dB of gain and excellent out of band rejection.

Tips for Measuring Small Signals Using a Spectrum Analyzer[3]:

1. If the band pass filter and amplifier (above) are used, make sure it is turned on. This is indicated by the green dome light on the side of the assembly.
2. Use the spectrum analyzers minimum RF input attenuation (0dB).
3. Operating the Spectrum Analyzer at 2495 MHz and a narrow span, minimize the Spectrum Analyzers Resolution Bandwidth.
4. Minimize the spectrum analyzers video bandwidth.
5. Apply signal averaging.

[1]Spectrum Analysis Back to Basics. Agilent Technologies, back to basics training: Page 13, 45
[2] Fundamentals of RF and Microwave Noise figure Measurements: Agilent AN 57-1. Page 6
[3]Spectrum Analysis Back to Basics. Agilent Technologies, back to basics training: Page 51