International Journal of Research in Advent Technology (E-ISSN: 2321-9637) Special Issue

National Conference "NCSEEE-2016", 19 March 2016

Available online at www.ijrat.org

"Designing of Signal Conditioning Circuit For Solar Astrophysical Study"

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Abstract:

The purpose of this project is to design signal conditioning circuit for Astrophysical study of sun and solar corona operating in range of 100MHz-1GHz. And to improve the strength of signal and remove the distortions and noise coming from terrestrial sources. To achieve this we have designed high pass passive filter with cut-off frequency 100 MHz.

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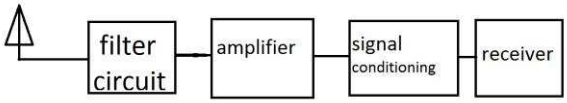
I. Introduction

Nowadays demands have rapidly increased for solar astrophysical study. There are many research work going on astrophysics operating in the range of 100MHz-1GHz. For getting this range of frequency we need log periodic antenna but problem with this type of antenna we get all frequency in this range. there are many signal coming from terrestrial sources and radio sources in this range which is not required and it cause interference to those signal in which we are interested.

To solve this type of problem we need to remove unwanted signal for this we need to design different types of filters like high pass low pass band pass and band reject.

This report is based on design of high pass filter with cut-off frequency 100 MHz.



II. simulation:

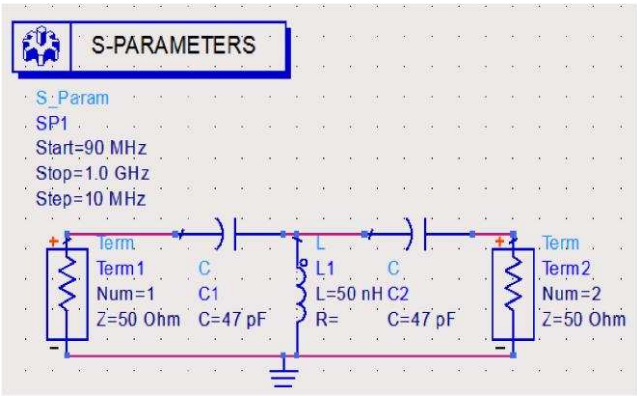


Fig. 2 circuit design of high pass filter

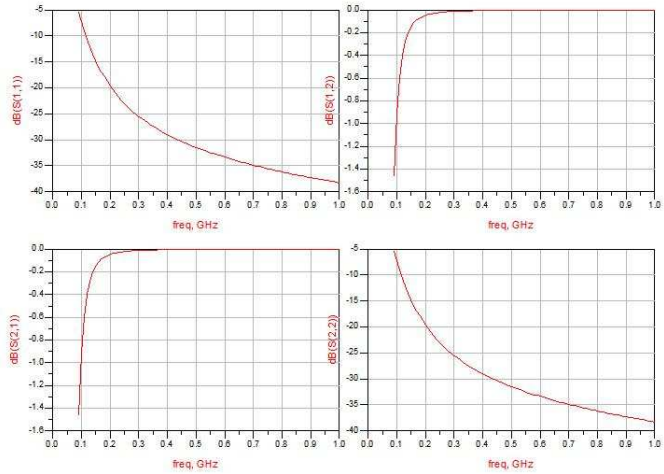


Fig. 3 simulation result

III. Circuit Diagram:

The specification of the filter is cut-off frequency 100MHz with insertion and return losses les then -10dB.we have used T-type filter. We have used cap-33nF and inductor-

Fig. 1 block diagram of receiver circuit 39nH and simulated on ADS(ADVANCED DESIGN SYSTEM)

Calculation
Calculation of inductor

$$L = R/(4 * PI * F_C)$$

Calculation of capacitor

$$C = 1/(4 * PI * R * F_C)$$

Calculation of cut-off frequency

$$F_C = 1/(4 * PI * \sqrt{LC})$$

***IV*.problem in designing HPF and their solution**: while designing instrumentation circuit design for higher frequency we need to take lot of precaution like impedance matching ,ground fill and capacitance and inductance due to material used ,impedance match between cable and connector .

Experimental result tested on VNA

V.Measurement of s-parameter:

S-parameters are complex matrix that show Reflection/Transmission Characteristics (Amplitude/Phase) in frequency domain. Two-port device has four S-parameters.The numbering convention for S-parameters is that the first number following the "S" is the port where the signal emerges, and the second number is the port where the signal is applied. So S21 is a measure of the signal coming out port 2 relative to the RF stimulus entering port 1. When the numbers are the same (e.g., S11), in indicates a reflection measurement, as the input and output ports are the same.

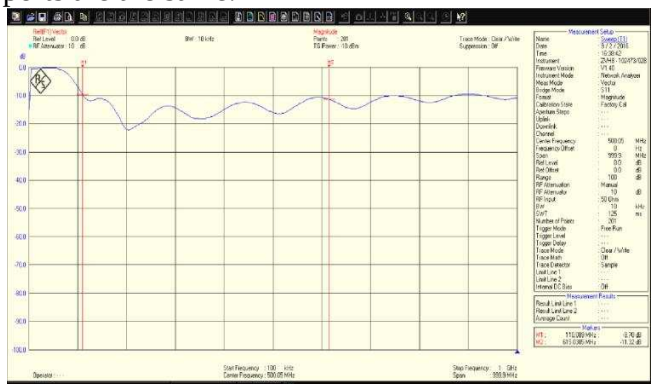


Fig.4 shows the in the signal when it is sent fron port.1

To port .2 ideally it should be less as low as possible but in practical case less then -10dB is consider as ideal result in this project we have S(11),S(22) is less then -10 dB**.**

Fig. 5 transmission characteristics (s12)

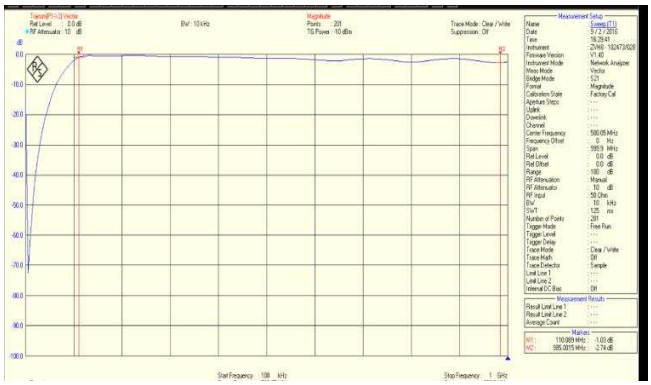


Fig. 6 transmission characteristics (s21)

Above fig. shows the transmission characteristic when signal is sent from port one and measure at another port ideally it should be zero and practically it should be as low as possible in this project s(12),s(21) is 0.06 which is very close to ideal value**.**

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Fig. 4 Reflection characteristics (s11)

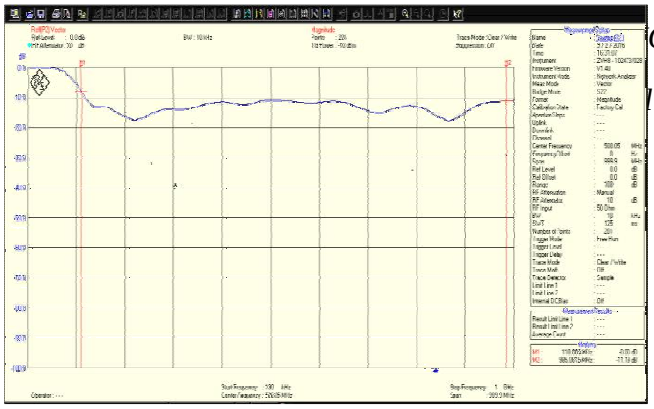

Fig. 7 Reflection characteristics (s22)

Fig.7 shows the in the signal when it is sent fron port.1

To port .2 ideally it should be less as low as possible but in practical case less then -10dB is consider as ideal result in this project we have S(11),S(22) is less then -10 dB.

Important consideration while installing circuit:

When we connect the circuit to the antenna and receiver circuit then we must take care about the impedance match and different types of losses and environmental condition. For Impedance match between cable and connector we must use wire with these specification.

RG 58/59
Impedance ohm: 50
Maximum operating frequency: 8GHz
Maximum operating voltage: 1900 volts
Operating temperature: -40 to +80

VI. Acknowledgement

We are very thankful to our project guide Prof. Ravindra pawase who helped us to develop this idea and kept us on track throughout the project by providing constant guidance and all the support we needed. Without their full support and cheerful encouragement the project would not have existed. We also wish to thank Prof. R.G.Purandare for the never ending support. Last, but not the least, we would like to thank each & every person who helped us directly or indirectly to complete this project.

VII. Conclusion

For designing signal conditioning circuit for higher frequency we need to take lot of consideration like impedance match, ground fill lead inductance and capacitance due to material used for ground fill, connectors and cable with impedance equal to the impedance of connector is required.

VIII. References:

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