Design and development of preamplifier for application of Doppler Sodar using proteus software

[1]Sreedevi singarapu, [2]V.Naveen Kumar, [3]M Purnachandra Rao, [4]P S V Subbarao

[1,3,4]Department of physics, Andhra University, Visakhapatnam, Andhra Pradesh, India.

[2]Department of BS&H, Gudlavalleru Engineering College, Gudlavalleru, Andhara Pradesh India.

[1]*sridevi.singarapu@mail.com*, [2]*vangipurapu1980@gmail.com*

Abstract— Low noise preamplifier of an acoustic echo sounder has been designed and developed. Details are given for the design and development of a low noise preamplifier used the proteus professional software for application of Doppler Sodar. It currently probes the thermal structure of the atmosphere up to 700m.This Sodar system was installed and operated at Andhra University , Department of systems design. This system has been operating successfully. Main function of the Sodar receiver is to receive the desired echo signal in the presence of noise interference or culture. It is necessary to separate echo signal to a level where targeted information can be processed. Amplifier receives signal in presence of noise interference because it has high input impendence. The filter detects noise in preamplifier part. Proteus is software for microprocessor simulation, schematic capture, and printed circuit board design. It is developed by Labcenter Electronics. Proteus is a single as tabbed modules. Integrated application with ISIS, ARES and 3D viewer modules appearing. The preliminary results of measurements are given.

Keywords – pre amplifier, Doppler Sodar, Proteus Software, low noise.

I. INTRODUCTION

Sodar (sonic detection and ranging) is an acoustic remote sensing technique that provides pictorial view of atmospheric boundary layer (ABL) thermal structure in space. In 1968 McAllister of Australia presented the first result of the sounding. It works on the principal of acoustic echo sounding. The principal of acoustic sounding is based on detection of the back scattered signal from acoustic refractive index discontinuities and disturbances in the atmosphere. A high power audio tone burst of 2kH is transmitted in the atmosphere and back scattered acoustic waves from scattering region.

This paper describes an instrument designed at Andhra University department of systems design which has been successfully used to make measurements in atmosphere

The preamplifier circuit shown in figure 1 consists of three parts 1) T/R switch 2) ferrite pot core transformer used as. Amplifier 3) low noise filter

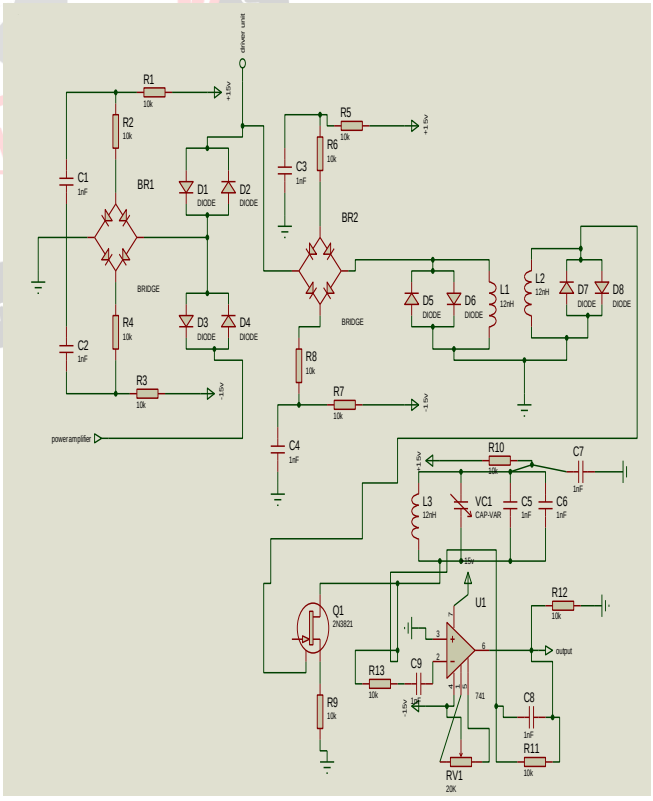

Figure 1 Component level diagram of Preamplifier

© 2018, IJREAM All Rights Reserved.

The purpose of the preamplifier unit is to protect the sensitive receiving section from high-voltage signals during the transmission and permit the echo-signal to pass through for further amplification.

1) T\R Switch

The power amplifier output is connected to the preamplifier through a pair of back-to-back (D1) diodes and the interconnecting cable to a diode bridge in the preamplifier. The IN4004 diodes serve to reduce the hum and noise generated by the power amplifier to less than 0.6 V, while the diode B-1 bridge is biased by the 2 K resistors to pass the resulting low-noise voltage to chassis ground. When a tone burst is generated, this B-1 bridge is biased off and D1 pair of back-to-back diodes passes the signal to the terminals of the transducer. The second B-2 diode bridge, which is in the transducer leg of the pre-amplifier, is also biased off from this high voltage signal.

In the absence of a tone burst, the back-to-back D2 diodes that were previously short-circuited are now open circuited, and the voltage present at the transducer terminals is passed to the ferrite pot core transformer.

2) Ferrite pot core Transformer used as Amplifier

The Ferrite pot core transformer has 1:60 step-up transformer through the B-2 diodes bridge. A third set of back-to-back D3 diodes are used to limit the leak-through signal form the B-2 diode bridge to the step-up transformer during the tone burst. The step-up transformer is used to obtain 40-dB of noiseless amplification of echo-signals varying from 0.1 to 400 BV. The BFW 10 low-noise FET operational amplifier provides another 40 dB of gain, raising the signal level into the mV range.

3) Filter

A band-pass filter is used to filter the other noise components in echo-signal and amplify up to a gain of 60 dB. The effects of ground loop currents are avoided by feeding a sample of control unit ground current back to the preamplifier through the non-inverting input of the last stage of amplification.

This filter is mixed-up with the low noise amplifier and placed in the feedback of the operational amplifier.

"Proteus professional" design combines the ISIS schmatic capture and ARES PCB layout programes to provide a powerful, integrated and easy to use toolls suite for education and professional pcb design as a professional pcb design software with integrated shape based auto router, it provides features such as fully featured schematic capture, highly configurable design rules, intaractive SPICE circuit simulator, extensive support for power planes, industry standered CAD, CAM & ODB++output and integrated 3D viewer.

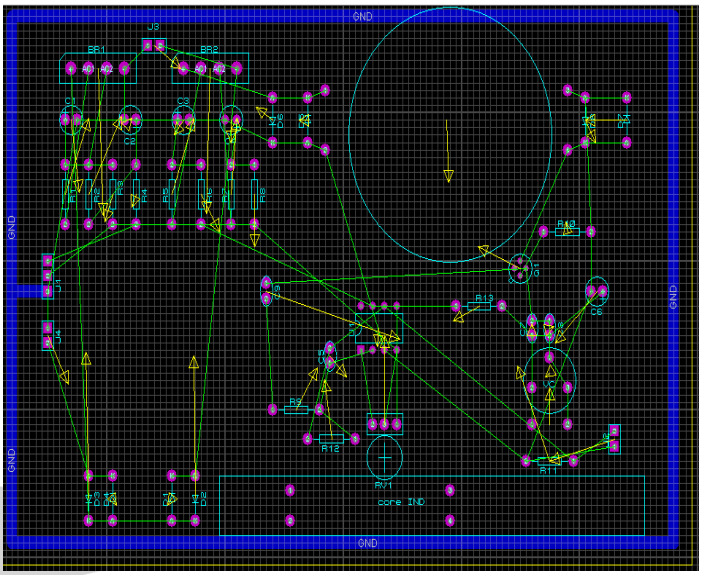

Figure 2 Single layer PCB component level diagram of preamplifier

The figure 2 shows the component level Single layer PCB.It drawn using proteus software and figure.

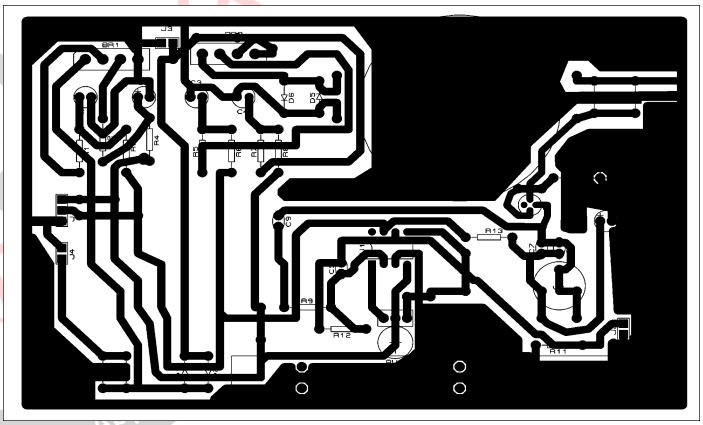

Figure 3 copper trace single layer PCB diagram of preamplifier

3 shows the copper trace single layer PCB diagram of preamplifierTthis is output of the proteus software its adjestablesize of components and traces also.

To view how our PCB will look like, select output on menu bar and click 3D visualization. Just press Esc keyboard to exit 3D visualization mode. The figure 4 shows 3D visualization diagram of preamplifier.

Now your PCB design is ready to be transferred to PCB board by way of chemical etching. Take the copper clad board and Laminate the Print out of that circuits, properly and then take the Strong Solution of $FeCl_3$. Immerse that laminated PCB until the excess copper is removed. The components are placed at appropriate places and solder all components. The figure 4 shows close view of complete preamplifier unit

© 2018, IJREAM All Rights Reserved.

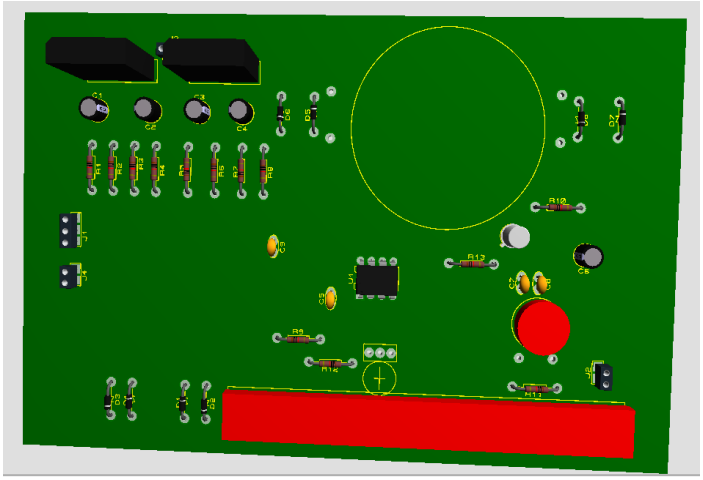

Figure 4 3D visualization diagram of preamplifier

Figure 4 shows 3Dvisual diagram in proteus software. It shows component place and closer view of circuit.

Frequency response depended on filter circuit in this circuit frequency calculated for 2 kHz.

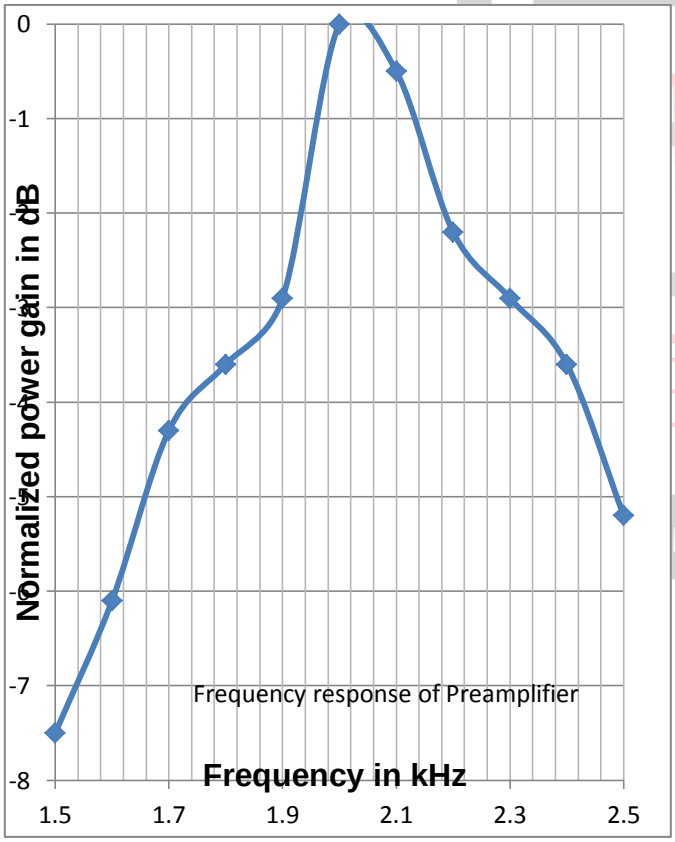

Figure 5 frequency response of preamplifier

Figure 5 shows frequency response of preamplifier. Here took frequency at X-axis and normalized power gain at Y-axis

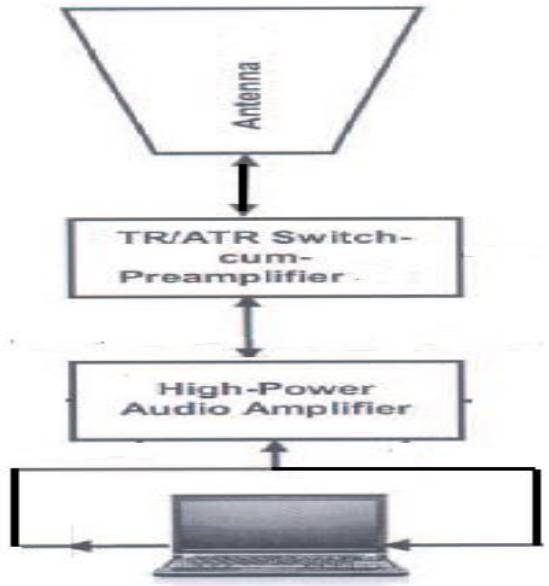

Figure 6 block diagram of sodar

Figure 6 shows block diagram of sodar. Carriersignal generated by by system using vc++ software togive the tone burst carrier,which is ten led into power amplifier through along wire in order to feed electrical power to antenne. Acoustic pulse transmitted from transducer into atmosphere and scattered signals are received by same transducer.Recieved signal amplified in preamplifierdelivered through along shielded wireto PC. Then facsimile recorded in system.

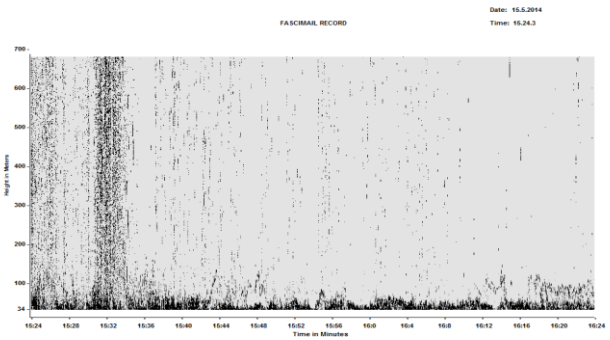

Figure 6.1 facsimile record

Figure 6.1 shows facsimile record of Sodar system installed at Andhra University department of systems design.

II. CONCLUSION

This works shown that the acoustic sounder could become a very important research tool in boundary layer meteorological studies also and with further development, an operational instrument. The acoustic described has proved capable of providing quantitative measurements of several important atmospheric parameters, turbulence vertical wind

© 2018, IJREAM All Rights Reserved.

velocity. The concept of pulse volume data analysis for noise filtration not only enables signals to be extracted from heavy noise, but also improves signal to noise ratio of facsimile plots and achieves increased operational range.

REFERENCES

[1] Coulter, R. L., Martin, T. J., 1986: Results from a high power, high frequency sodar. Atmos. Res., 20(2 - 4),257-270.

[2] Khanna, R. M. et al., 1994: Characterizing an array antenna for Doppler Sodar. Proc. 7th ISARS 1994, Boulder, pp.3-79-3-83.

[3] Khanna, R. M. et al., 1996: Design and study of an acoustic antenna for a phased array Doppler sodar. Proc. 8th ISARS 1996, Moscow, pp. 3-67-3-71

[4] Khanna R.M. et al., 1999: Design of a High Efficiency Acoustic Phased array antenna for an Acoustic Wind Profiler. Meterol.Atmos.Phys.71,35-41.

[5] Mousley, T. J. et al., 1978: Design of arrays for acoustic sodar antennas. J. Phys. E: Sci. Instrum., 11, 657-662.

IJREAM
International Journal for Research in Engineering Application & Management

© 2018, IJREAM All Rights Reserved.