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LOW COST HAND HELD RADIO FREQUENCY (RF) SIGNAL STRENGTH METER

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ABSTRACT

Radio Frequency (RF) communications is based on laws of physics that describe the behaviour of electromagnetic energy waves. To measure this signal strength various meters have been developed, but they are expensive. In this study a method to develop a low cost, hand held device is reported. This is an easy to use solution to measure signal strength. Operation of this device is very simple. This system was developed using a logarithmic detector IC AD8313 and a simple LED bar graph display with LM3914 driver IC. A copper wire was used as the antenna to capture RF signals. The strength of the captured radio frequency signals will be displayed using a bar graph. Developed device was tested using radio frequency emitting devices. One of the main advantages of this device is that anyone can use this device even without deep technical knowledge regarding this field. Using the device a brief idea about the radio frequency strengths can be obtained.

Keywords: Radio Frequency, Signal strength meter, Radio waves

1. INTRODUCTION

Radio waves and microwaves emitted by transmitting antennas are one form of electromagnetic energy. They are collectively referred to as 'radiofrequency' or 'RF. In the field of telecommunication radio waves are the most important parameter. Radio waves are used to communicate between two devices. RF is used in many products that most people interact with as a part of modern daily life, such as in Telecommunications, Microwave ovens, Radar, Industrial heaters and sealers, Medical uses[1].

Existing devices to measure RF signal strengths are comparatively very expensive. This study reports on a low cost solution which can detect RF signals within the range of 0.1 GHz to 2.5 GHz.

2. EXPERIMENTAL

2.1 Basic block diagram

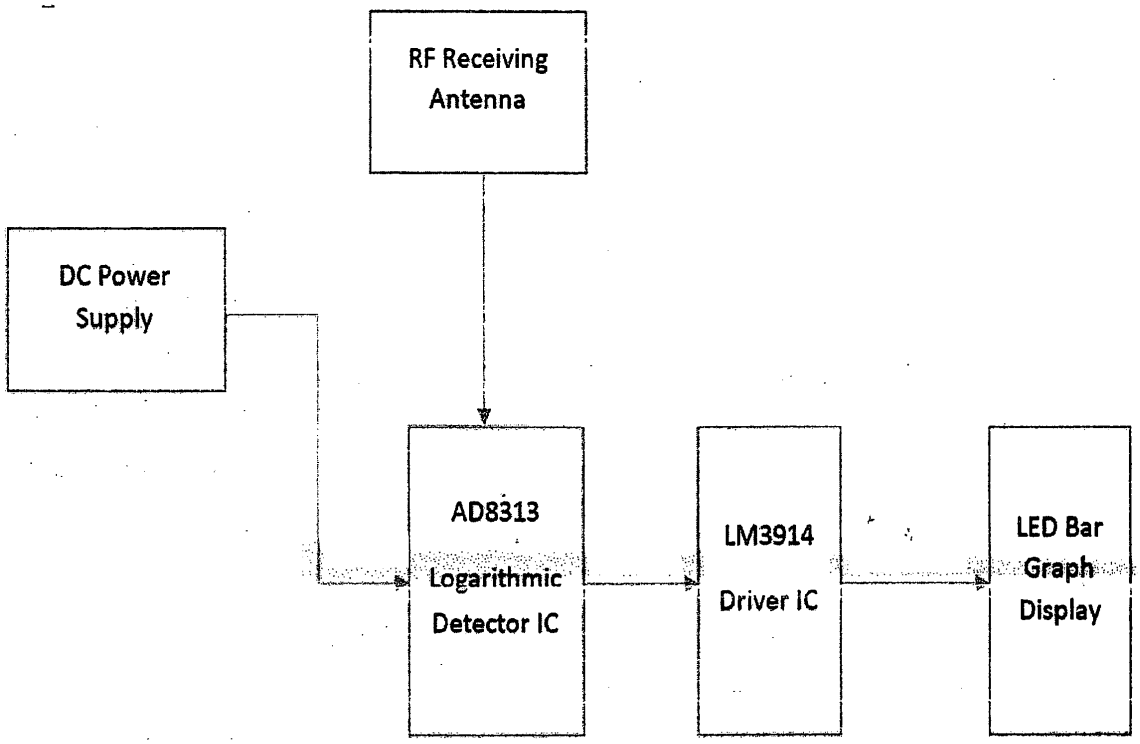

Figure 1: Basic block diagram of the system

The input for this device is RF signal. First of all the RF signal has to be converted into an equivalent decibel scale value. For this AD8313 logarithmic detector/controller IC was used. To display the output LED bar graph display was used. LM3914 IC was used to drive the LED bar graph display. A copper wire was used as the antenna to capture RF signals.

2.2 Circuit Diagram

The total circuit diagram is shown in figure 2.

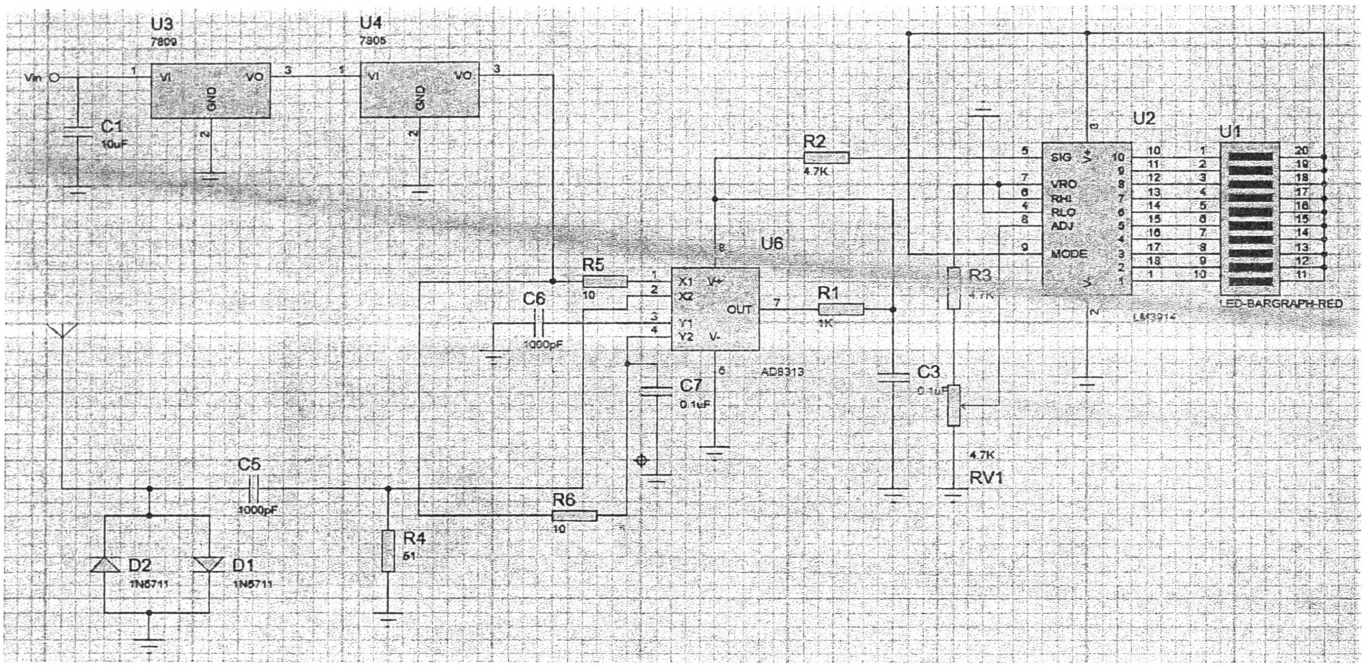

Figure 2: Circuit diagram of the system

Radio signal will be taken through the antenna which was built using a copper wire. 7809 voltage regulator will control the input voltage given to the circuit and keep it at 9 V. 7805 voltage regulator will keep the input voltage for the IC at 5 V. AD8313 IC converts input radio frequency signals to an equivalent decibel scaled value at its dc output. The output of the logarithmic detector IC will be given as the input to pin 5 of LED bar graph display driver IC LM3914. LM3914 will sense the voltage levels and drives LED bar graph display.

3. RESULTS AND DISCUSSION

The input RF signal was converted into an equivalent decibel scale value using AD8313 logarithmic detector/controller. The output was displayed through LED bar graph display which was drived using LM3914 IC. Device was tested using several mobile phones, Wi-Fi router, and cordless phones. Relative signal strengths were shown in the LED bar graph display. Total cost for the project is around Rs 1600.

The final outcome of this project is a low cost device which helps to observe radio frequency signal strength. It can detect radio frequencies from mobile phones.

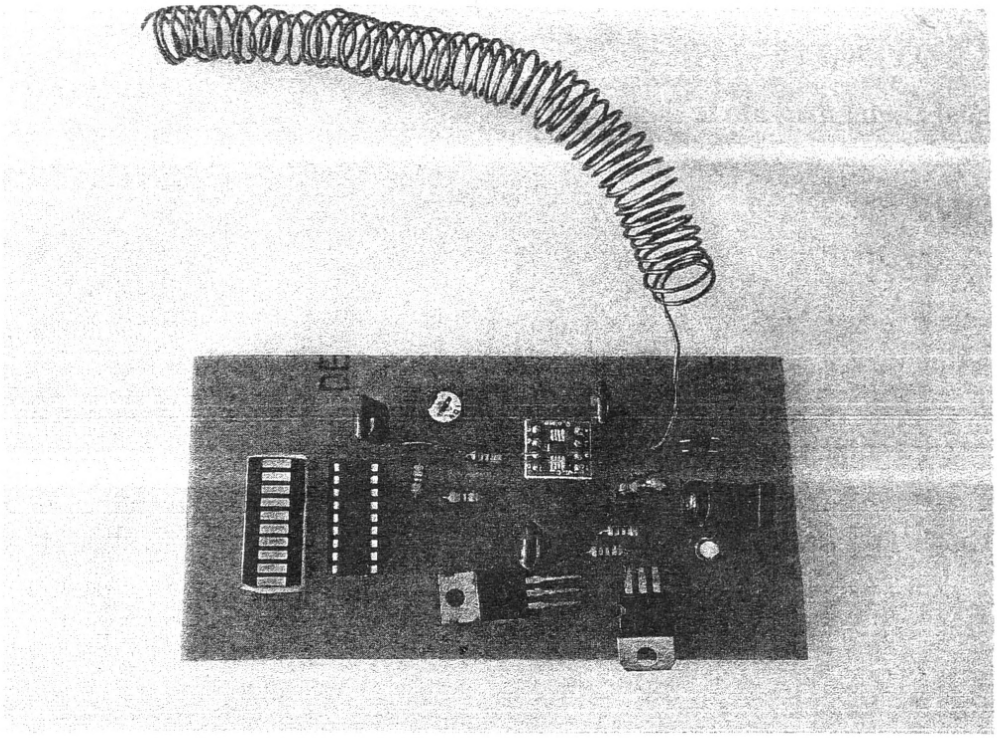

Figure 3: Implemented Circuit

Strengths

- Low cost device
- Easy to use
- Less time consumption
- Easy to develop
- Simple device

Limitations

- The outcome would be perfect if SMD components were used in the circuit.
- IC used only detects frequencies within 0.1 GHz to 2.5 GHz and range is only up to 70 dB^2.
- Background RF signals also affect the outcome.
- Since there is no bandpass filter included RF signals within the ICs range will be detected.
- Displaying is limited due to the use of 10 segment bar graph display. A LCD display would provide more accurate values.

4. CONCLUSION

This system was developed using a logarithmic detector IC AD8313 and a simple LED bar graph display with LM3914 driver IC. A copper wire was used as the antenna to capture RF signals. Radio signal will be taken through the antenna which was built using a copper wire. 7809 voltage regulator will control the input voltage given to the circuit and keep it at 9 V. 7805 voltage regulator will keep the input voltage for the IC at 5 V. AD8313 IC converts radio frequency signals at its input to an equivalent decibel scaled values at its dc output. The output of the logarithmic detector IC will be given as the input to pin 5 of LED bar graph display driver IC LM3914. LM3914 will sense the voltage levels and drives LED bar graph display. Device was tested using radio frequency emitting devices and the output was obtained through a visual reference. This device was developed mainly for a leading telecommunication provider in Sri Lanka. By developing these kinds of low cost devices within the company will save the money which can be invested in other important projects rather than spending them to buy devices.

ACKNOWLEDGEMENTS

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