Proc. Annual Symposium on Research & Industrial Training, 03(2016) 429-433
Department of Electronics – Wayamba University of Sri Lanka

MICROWAVE ANTENNA ALIGNING SYSTEM

J.J.Hettihewa*, G.A.K.S. Perera

Department of Electronics, Wayamba University of Sri Lanka, Kuliyapitiya, Sri Lanka
**jjhettihewa@gmail.com*

ABSTRACT

Most of the telecommunication service providers in Sri Lanka use microwave network to enhance their network coverage. This microwave connection is very important to the entire network because fault of the link may cause the sites out of control. Microwave link alignment is somewhat difficult task in the microwave installation process because it is done by using multi-meter. At the installation, a lot of problems occur. Sometimes manual alignment cannot find the most accurate align position and there is no any proper way to align those antennas.

As there is no any specific approach or specific device to locate the microwave antenna in the precise position, this study was carried out with the main objective of finding the correct alignment of the microwave antenna. The system has 16*2 LCD to display measured and calculated parameters and LED panel indicates whether the antenna rotation direction is correct or wrong. An ATmega328p microcontroller was used for sampling and fast analog to digital conversion. It has been confirmed that the device designed in this study has a considerable accuracy and is effective and efficient.

Keywords: Microwave link, Signal strength, Alignment level.

1. INTRODUCTION

Telecommunication industry currently experiences an exponential growth in technological advancements. New Technologies demand new regulations and the regulator is forced to keep abreast with its regulations, especially with the burden of installation at a level field. Microwave link and Microwave antenna aligning play a main role in Telecommunication Microwave link installation. Currently most installation teams use a multi-meter to align the Microwave antenna. They check the voltage of the receiving signal. If that voltage is near equal to the peak voltage, it confirms that antenna has been aligned to the correct position. But in this process, installation teams face a lot of problems such as they have to remember the peak voltage, need more man power to align the antenna and this process does not have any solid proof for correct alignment of antenna.

This research was conducted to find out an easy and more efficient way for microwave link alignment [1].

2. METHODOLOGY

The block diagram of the proposed system for the microwave link optimization is shown in figure 1.

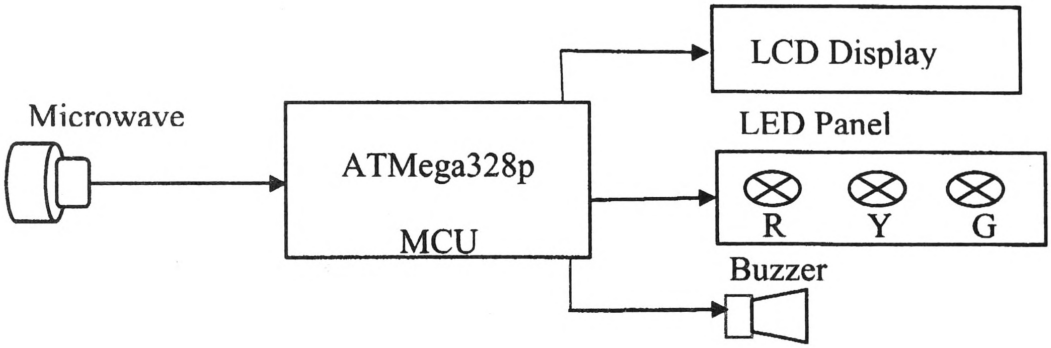

Figure 1: Block diagram of the system

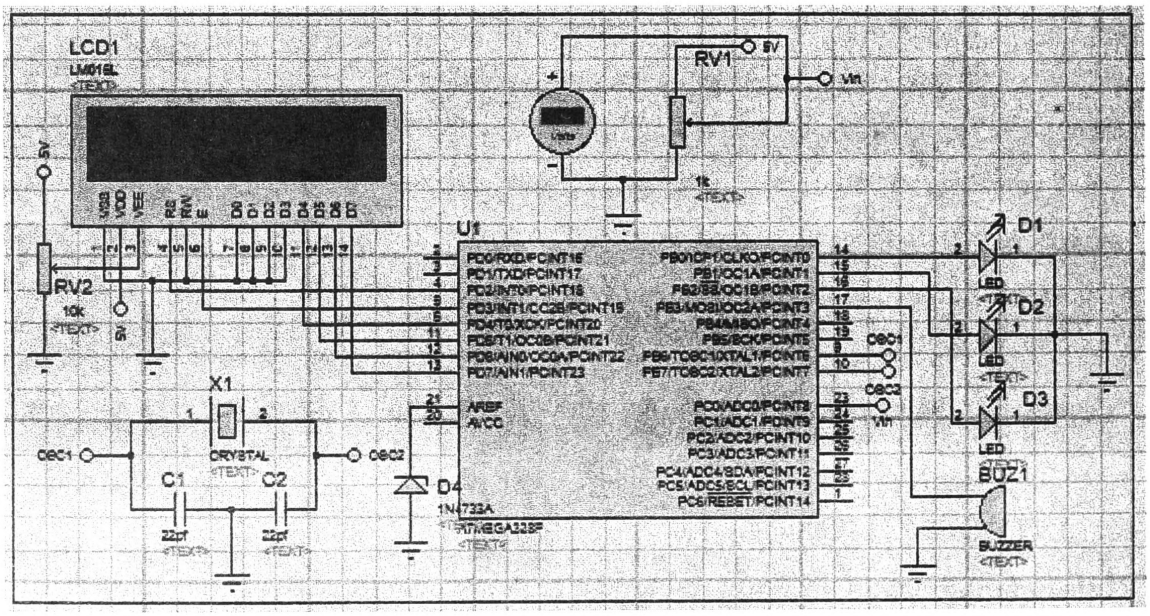

Figure 2: Circuit design of the system

This system has one LCD display, one LED panel and a buzzer. It also has a direct connection with radio unit of the Microwave antenna. If receiving signal power increases while changing the direction of the microwave antenna, green LED will light on and it means the microwave antenna should be rotated in the same direction manually. If power decreases, red LED will light on and it means the microwave antenna should be rotated in opposite direction. When power of receiving signal comes to peak voltage value, system will save that value and yellow LED will light on with the sound of buzzer. It means current position of antenna alignment is in correct direction. In this system, as the power of receiving signal differs from antenna to

antenna, data is recorded while antenna is rotating. As a result of that, antenna should be rotated until green LED bulb turns off. When the green LED bulb turns off, it means that the system has just reached the peak power of receiving signal. Also system will display current power and maximum power of receiving signal. By using this system, microwave antenna alignment can be adjusted to correct direction without any error.

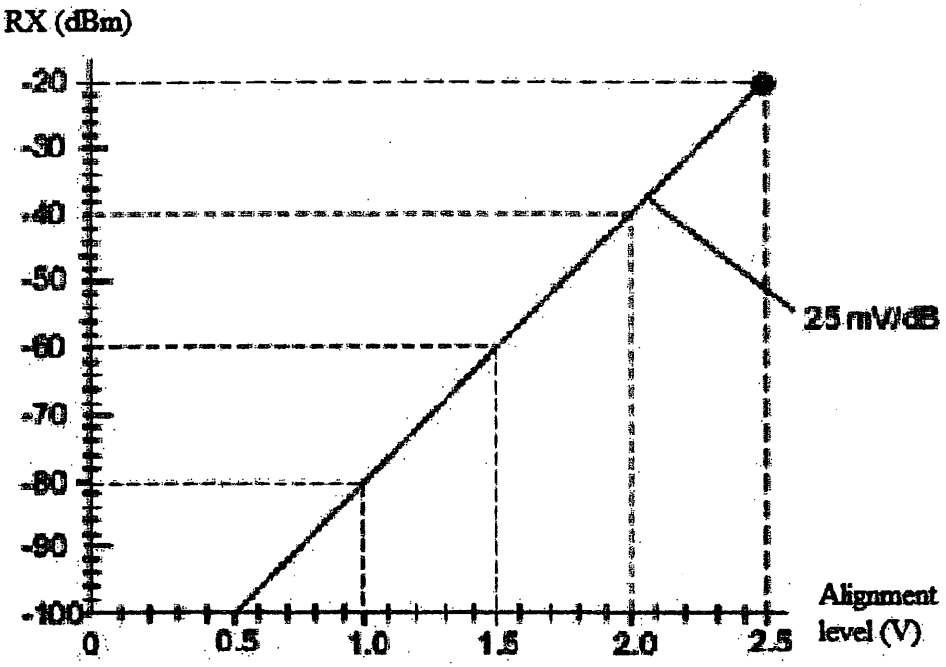

Figure 3: Alignment level (V) vs receiving signal power (dBm) [2]

The dBm is calculated through the formula given below.

RX (dBm) = 40* (Alignment level in Volts) – 120 [1]

where, RX (dBM) is Receiving signal power in dBm.

When aligning a Microwave antenna, it is always needed to give the position of the antenna referring to the receive signal power (dBm).

In order to convert the alignment level value (V) to receiving signal power (dBm) value, the relationship between those values has to be identified. Figure 3 was considered for that purpose. The "ERICSSON" company has used the above formula to calculate the dBm value for the device considered for this research. According to figure 3, it has linear relationship with alignment level (V) and the RF power (dBm) value [2].

3. RESULTS AND DISCUSSION

Normally, the microwave antennas are aligned by detecting the voltage of the receiving signal. Therefore, the device that has implemented through this study, has significant role to play in

the industry of telecommunication. It detects the peak value of dBm accurately and efficiently. Then, it can align the micro wave antenna in precise position. As a result of that, labour cost and time consuming will be reduced in large numbers [3].

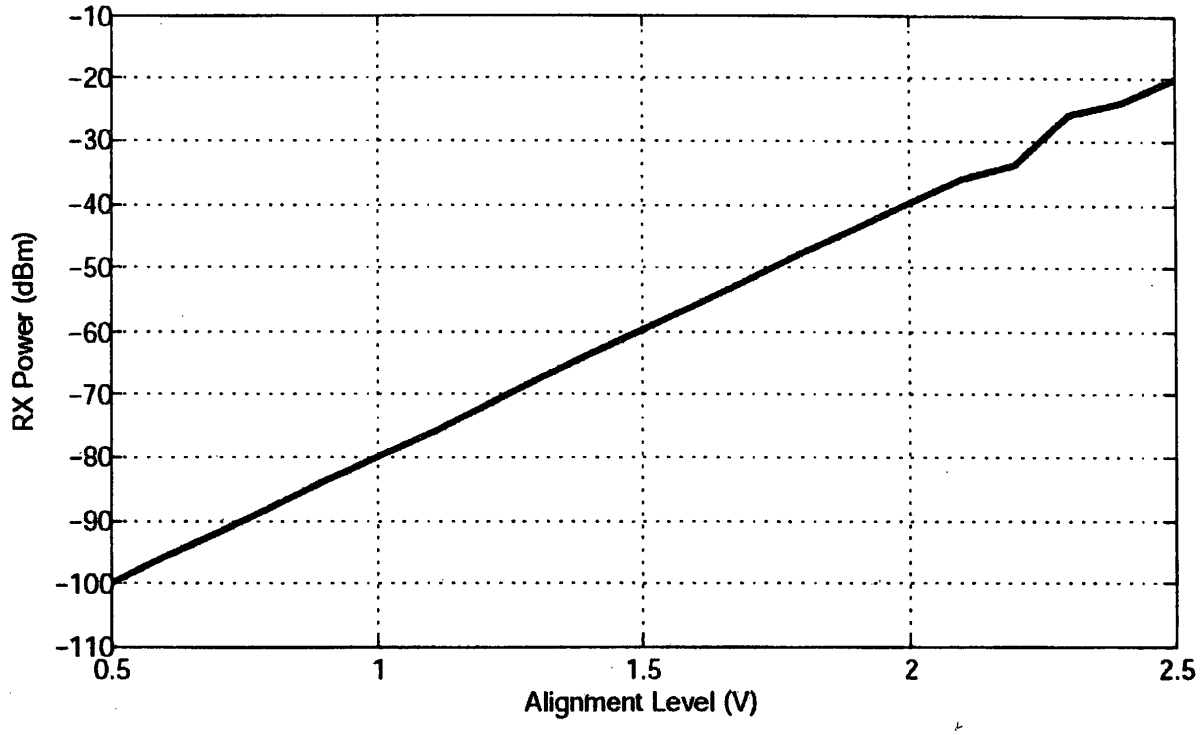

Figure 4: Alignment level vs RX power (dBm)

The above graph of the alignment level (V) vs RX power (dBm) was plotted by using the developed system. There is no opportunity to test this equipment in practical situation and due to that reason, an external power source was used to supply input signal to the system. Then the input voltage was varied from 0.5 V to 2.5 V and obtained RX power (dBm) values relevant to the input signals. By using the obtained results the graph of the figure 4 was plotted.

Present day Sri Lanka does not have any specific resources to align microwave antennas. Therefore with a low budget and high accurate reading the device designed in this study will give the country like Sri Lanka a better chance to overcome the problem of aligning microwave antenna.

The developed system can be used to identify the optimal position to align the antenna through dBm value. And also it is possible to get the optimal best position through LED light system that has been attached to the device. The light system will indicate whether the antenna is near the peak dBm value. An alarm attached to the device will warn the rigger that he has reached the optimal position. The system can be used only for the "ERICSSON" RAU, as the formula to calculate the dBm value is only used in "ERICSSON" product details [4].

4. CONCLUSION

Telecommunication industry requires lots of installation costs. In Sri Lanka, there are differe kinds of telecommunication activities and processes which need the precise installation. Mo of those activities are done as manual process which creates accuracy problems.

As there is no any program or specific device to locate precise position of the microwave antenna, this study is based on how to get the correct alignment for the microwave antenna through dBm values. The developed system get an input signal from the RX level monitoring point at the RAU, that signal is converted to the dBm value by using the system. And also th LED panel monitoring the rotation direction of the antenna to get an optimal position. As referring to figure 3 and figure 4 those are very much similar in shape. Therefore, it can be confirmed that the device designed in this study has a considerable accuracy and is effective and efficient.

ACKNOWLEDGEMENTS

The authors wish to express their indebt gratitude to the staff of Department of Electronics, Faculty of Applied Sciences, Wayamba University of Sri Lanka and Nayuja Engineering Telecommunication Division, Rahuman Building, Malwana.

REFERENCES

[1]. "Microwave antenna path alignment instructions" [Online] http://www.ehow.com/how_7505943_install-microwave-antenna.html

[2]. Ericsson, "MINI-LINK TN ETSI Technical Description." 2004.

[3]. Technical white paper, "Antenna Alignment-B-0209, paper for Microwave fundamental," XALT team.

[4]. C. Salema, "Microwave Radio Links: From Theory to Design," Electrical Engineering at the Instituto Superior Técnico (IST), Lisbon, Portugal, 2002.