A Literature Review on Dual Band Monopole Antenna for LoRa Applications

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***Abstract*: This paper describes the dual band monopole PCB antenna for LoRa applications. The substrate FR4 with relative permittivity of 4.5 will be used as dielectric substrate due to its advantages such as low cost, easy availability and light weight. The proposed antenna is to be designed for 433 MHz and 868 MHz and design is carried out in CST simulation tool for the various LoRa applications.**

***Index Terms*: Monopole Antenna, LoRa, CST Tool, FR4 Substrate, GSM, WLAN, Wireless communications**

I INTRODUCTION

The internet of things companies are bringing many technologies and solutions to the market with small chip manufacturing industries investing more money in the market so that it's growing drastically. It isn't anyway without its difficulties. One of the key difficulties in working out the iot is guaranteeing that those "things" or end hubs are in reality ready to speak with the web. The sheer number of current web gadgets is enormous and is required to reach 30 billion by 2020.

LoRa innovation was produced by an organization called Semtech and it is another remote convention planned explicitly for long-go, low-control interchanges. LoRa represents Long Range Radio and is essentially focused for M2M and IoT systems. This innovation will empower open or multi-inhabitant systems to interface various applications running on a similar system. LoRa Alliance was shaped to institutionalize LPWAN (Low Power Wide Area Networks) for IoT and is a non-benefit affiliation which highlights participation from various key market investors, for example, CISCO, actility, MicroChip, IBM, STMicro, SEMTECH, Orange portable and some more. This partnership is vital to giving interoperability among various across the nation organizes.

II RELATED WORK

The printed monopole antenna designed at the range of 902 to 915MHz frequency for ISM applications. The antenna resonates at 915MHz frequency with low operating frequency with high performance. The square monopole used for less degradation than circular, triangular and rectangular and simulated using the CST software. This can be extended further as dipole antenna for multiband in ISM applications [1].

The ability of a single layer strip fed printed monopole, which has a serial-slot and an end-stepped feed-strip, to operate at dual Industrial, scientific, and Medical-band (2.4 and 5.8 GHz bands) is demonstrated. This antenna combines omni-directional and broad bandwidth in an easy to fabricate structure. Experimental results indicate that the VSWR 2:1 bandwidths achieved were 8.2% and 18.2% at 2.45 GHz and 5.5 GHz. Effects of varying the serial-slot dimensions and the ground-plane size on the antenna performance are also described. The contribution of this paper is to implement a simple and low profile antenna for practical WLAN application. Measurements show that the structure indeed offers very impressive bandwidth characteristics. Although this antenna was designed for dual ISM-band applications, this design concept can be extended to other frequency bands of interest [2].

This paper studies a kind of miniature dual-frequency planar monopole antenna, which designed by using a inverted-F adds inverted-L structure and the balanced loading of inductance in the antenna structure. One of the most advantages of the antenna is small ground plane and wide band characteristics in synchronic frequency in low frequency band. It provides a new technique for the miniaturized design of planar monopole antenna. Based on the conventional planar monopole antenna technology, an ovel dual-frequency antenna can be designed by combining inverted-F and inverted-L structure with appropriate inductance coupling[3].

This paper intends to propose a new and simple printed dual-band planar monopole antenna for Wireless Local Area Network (WLAN) applications in IEEE 802.11 a/big. The proposed antenna effectively covers both 2.4/5GHz bands. The antenna comprises of a central arm and two side arm monopoles of different sizes, which generate two separate resonant modes for the desired dual-band operations. The smaller side arms resonate at the 5 GHz band while the central larger arm resonates at the 2.4 - 2.5 GHz band. This antenna can easily be fed by using a 50 ohm probe feed with SMA connector. Prototypes of the proposed antenna designed for WLAN operations in the 2.4 and 5.2 GHz bands have been constructed and successfully tested. The measured VSWR and radiation patterns indicate the suitability of this antenna for WLAN applications[4].

In this paper, a wideband monopole antenna with high gain characteristics has been proposed. Number of slits was introduced at the far radiating edge to transform it to multiple monopole radiators. Partial ground plane has been used to widen the bandwidth while by inserting suitable slits at the radiating edges return loss and bandwidth has been improved. The proposed antenna provides high gain up to 13.2dB and the achieved impedance bandwidth is wider than an earlier reported design. FR4 Epoxy with dielectric constant 4.4 and loss tangent 0.02 has been used as substrate material. Antenna has been simulated using HFSS (High Frequency Structure Simulator) as a 3D electromagnetic field simulator, based on finite element method. A good settlement has been found between simulated and measured results. A compact high gain monopole antenna with wideband characteristic has been proposed in this paper. The proposed antenna confirm its operation in the frequency range of 0.4-6.69 GHz which covers the frequency bands for GSM, GPS, DCS, PCS, UMTS, Bluetooth, WLAN, Wi-Fi, WiMAX, HIPERLAN and LTE applications. High gain up to 13 dB is the distinguishing feature of the proposed antenna with stable radiation pattern. It is also suitable for the mobile handsets[5].

Planar monopole antennas with multiple feed points are proposed to improve pattern and impedance bandwidth. A square planar monopole antenna including two feed points and a beveled variant are designed. These antennas exhibit an excellent performance compared to existing planar monopoles. A new feed configuration for the square planar monopole antenna has been presented. Electromagnetic simulations have been carried out for a square planar monopole antenna with a double feed and for its beveled variant. Enhanced impedance bandwidth with respect to a square monopole antenna with a single feed has been obtained and better cross-polarization levels within the impedance bandwidth have been achieved with respect to the CM[6].

This paper presents a summary of two different types of planar UWB monopole antennas, i.e. electric and magnetic types. The electric monopole uses copper disc/ring as the radiating element; while elliptical/circular slot serves as the radiator for the magnetic monopole[7].

A simple and compact coplanar wave guide (CPW)fed ultra-wideband (UWB) monopole-like slot antenna is presented. The proposed antenna consists of a monopole-like slot and a CPW circular patch with feeding stub structure, which is etched onto an FR4 printed circuit board (PCB) with an overall size of 25 mm× 25 mm ×1.6 mm. The simulation results shows consistent radiation patterns and impedance bandwidth over an entire operating frequency from 3.1 10.7 GHz. A compact coplanar wave guide (CPW)-fed ultra-wideband (UWB) monopole-like slot antenna is a coplanar structure with microstrip line feeding. The proposed antenna is easy to fabricate and can be easily interfaced with other microwave circuits[8].

The IoT is gaining high popularity in today's world. Embedded systems have become a major part of our lives. People are able to control, monitor, and do a lot more from remote distance. This is done by connecting various objects reducing physical distance. IoT is the connectivity of various objects with network connectivity. Many a times these systems are battery operated and need a high battery backup. These systems require a technology that consumes less power and also covers long distances. But many technologies such as Zig-Bee, Wi-Fi, Bluetooth popularly used at present consumes high power and is not suitable for battery operated systems. LoRa is a new found technology that is emerging rapidly. The LoRa technology addresses these needs of a battery operated embedded device. The LoRa technology is a long range low power technology. This paper discuses about the advantages of LoRa over the existing technologies used in IoT. It also discusses the features of LoRa. LoRaWAN (Long Range Wide Area Network) is an open grade secure standard for the IoT connectivity. The LoRa alliance is an open non profitable group that shares their experience to drive LoRa. LoRa or LPWA is a very recent technology that has been evolved[9].

In this paper, a novel and compact dual-band planar monopole antenna with well-tuning mechanisms of each individual band is proposed. This antenna is fabricated on a lowcost, easily available FR4 substrate by using etching or milling machines. The lower operation frequency can be adjusted to cover GSM 1800 band (1805 — 1880 MHz), and the upper band covers Worldwide Interoperability for Microwave Access (WiMax) band (3.3 GHz) for more than 200 MHz. After setting the desired operation frequencies, a thin wire and microstrip pad is designed to achieve dual-band matching. The overall antenna area is compact and effectively shrinks to 0.018302. The measured antenna gains are from -1.78 to -1.12 dBi and from 1.05 to 2 dBi at its low and high frequency band, respectively[10].

III PROPOSED METHODOLOGY

The proposed dual band monopole antenna will be designed for 433 MHz and 868 MHz which will covers the various applications of LoRa technology unlike a single band monopole antenna covering or satisfying a single application. The design and development of dual band monopole antenna has many advantages such as small in size, cost effective, high performances. The design of dual band monopole antenna is bit complicated as compared to single band monopole antenna but it has more scope in emerging technology. The following steps to be carried out for the development of dual band monopole antenna.

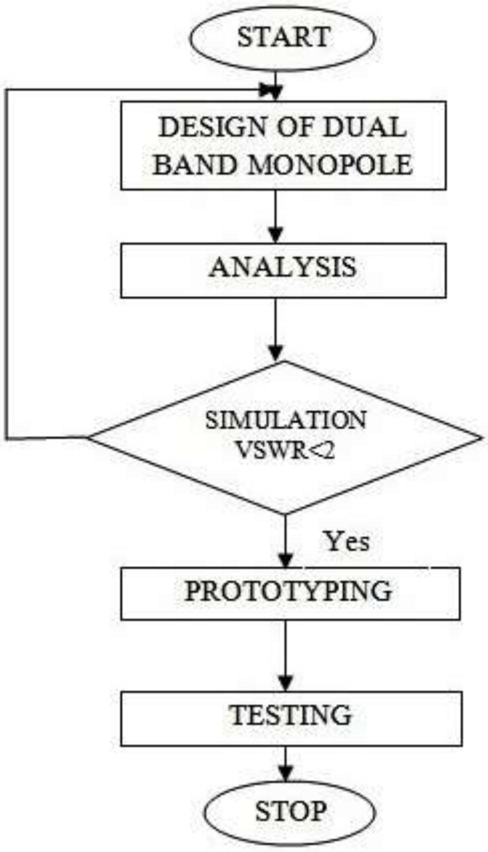

Figure 1: Flow chart of proposed methodology

IV TOOLS USED

The design and simulation will be done on CST and hardware or fabricated antenna will be tested and measured in VNA. Vector Network Analyzer will gives the return losses and VSWR.

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V CONCLUSION

This paper presents the design and development of proposed dual band monopole antenna of 433 MHz and 868 MHz for LoRa applications and it will designed using CST tool and measured in vector network analyzer.

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