ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 8, August 2016

Review on CPW Compact Wideband Microstrip Patch Antenna Designing

Ankit Gumasta [1], Ranjana Batham [2]

PG Student [DC], Dept. of ECE, SVCST, Bhopal, Madhya Pradesh, India[1]

Assistant Professor, Dept. of ECE, SVCST, Bhopal, Madhya Pradesh, India [2]

ABSTRACT: In this paper, a review on coplanar waveguide (CPW) fed compact size wideband (WB) microstrip antenna designing techniques for wider band width applications are proposed. The proposed work introduces a methodology that minimizes the monopole antenna by use of various techniques over the conventional monopole patch antenna to reduce the size of the antenna. The ground was vertically extended towards both sides of the single radiator is proposed. Therefore, the large space around the antenna that is usually wasted can be effectively saved. The prototype with overall good impedance matching, constant gain, stable radiation pattern, and constant group delay over a bandwidth of 500 MHz..

KEYWORDS: CPW fed Microstrip Antenna, WB Antenna, WB Antenna Designing, Compact Antenna Review on WB, Wide Band Antenna etc

I.INTRODUCTION

An Wideband is a technology for transmitting information spread over a large bandwidth greater than 500 MHz; this should be able to share spectrums with other users. Regulatory body by the Federal Communications Commission (FCC) in the US intend to provide an efficient use of radio bandwidth while enabling high-data-rate for personal area network (PAN) connectivity; low-data-rate applications; and radar and imaging systems. For example, orthogonal frequency-division multiplexing (OFDM)—can access the WB spectrum by the rules. The rate of Pulse repetition may be either low or very high. Pulse-based WB radars and imaging systems tend to use very low repetition rates. (FCC) allocated the spectrum from 3.1 to 10.6 GHz for unlicensed WB measurements and communication applications with EIRP less than 41.3 dbm/Mhz. The microstrip WB antennas have much advantages like simple structure, high data rate, easy integration with monolithic microwave integrated circuits (MMICs), and easy in fabrication. Thus, the UWB antenna has become the most effective solution for future short-range high data rate of wireless communication applications, UWB for short-range (10 m), peer-to- peer ultra- fast communications, and many more application. Various shapes of monopole antennas, such as a beveled rectangular patch and a circular printed monopole with steps , and various shapes of slot antennas, such as inverted cone slot and tapered slot with tuning patch have been designed for a compact WB antenna. In this paper, a novel coplanar waveguide (CPW) fed compact WB microstrip antenna is proposed. The antenna is mainly composed of a radiation patch with good radiation performance range of 3.1 to 10.6 GHz. The antenna proposes a method to minimize the monopole antenna by loading of rotated L-strip over the conventional radiator patch antenna to reduce the size of the antenna. The ground was vertically extended toward both sides of the radiator. Thus, the large space around the radiator that is usually wasted can be effectively saved.

II. WB ANTENNA DESIGNING TECHNIQUES

WB antennas design is preferred due to its applications in portable electronics and mobile communications. The conventional WB antenna is not suited well for normal requirements. For different needs such as size, gain and radiation patterns, many design approach of antennas have been proposed.

Here are some popular categories in WB antenna. For example

1. Slotted type WB Antennas

2. Biconical, Bowtie and Monopole Antennas

3. Fractal WB Antennas

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 8, August 2016

4. Tapered Slot WB Antennas

Slotted typed WB Antennas: Slotted antennas are used in ultra-wideband (WB) systems due to the attractive advantages such as low profile, lighter weight, fabrication ease and wide frequency bandwidth. The antenna consists of the ground-plane with rectangular slot and microstip feeding line with a fork-shaped tuning stub. It is measuring bandwidth covers the WB band of 2.5 GHz to 11.3 GHz i.e 127 % fractional bandwidth of S11 < -10dB. Its bandwidth is improved by using a tuning pad, madeup of copper. The improved antenna covers from 2.3 GHz to 12 GHz and uses a tapered monopole like slot instead of the rectangular one to decrease the low resonant frequency. Wen-Fan Chen et al. introduced new shape WB antenna, keyhole shaped slot antenna, consisted of an circular-pie slot, rectangular stub slot and microstip feed line WB Slot Antenna

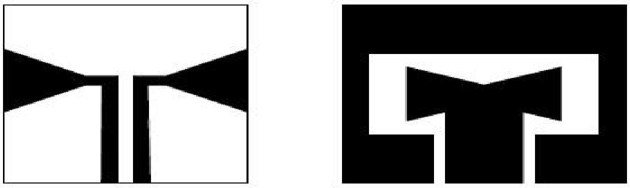

Figure 1. Bow type WB Antenna

Bowtie, Monopole Biconical Antennas: Many planar monopole WB antennas are introduced. Further bowtie antenna with round corners and ultra wideband dipoles has a wideband property. The optimized design of antenna has an impedance bandwidth and consistent radiation parameters over a range of frequency range with excellent polarization. And the example of the antennas in fig WB bowtie antenna (Kwon et al.; Nakasuwan et al.. Their bandwidth achieves more than the 3~10.6 GHz needed for WB communication systems.

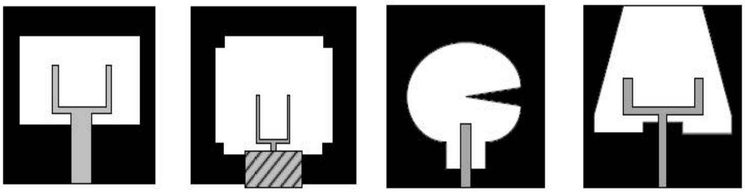

Figure 2. Monopole Slot Antenna

Fractal WB Antennas:- Fractical antennas are significant because they are of small size, low weight and thin shape for portable devices that have a trivial limitation in space, but also wide bandwidth and wider radiation patterns. So the fractal technology is applied in realizing the WB characteristic with its similarity and space filling properties. Two fractal antennas for WB applications as shown in fig. The design used a circular patch along with triangular slot, which is called a crown circular microstrip fractal antenna

Figure 3. Fractal Antenna

Tapere Slotted WB Antennas: Tapere slotted antennas (TSA) belongs to the general class of endfire traveling-wave (TWA) antennas. It has advantages of low profile, light weight, easy fabrication, suitability for conformal installation and the compatibility with microwave integrated circuits (MIC). In addition to it, TSA has multi frequency bandwidth with high gain and symmetrical E- and H- plane beam-pattern.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 8, August 2016

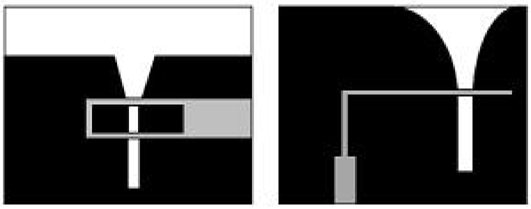

Figure 4. Tappered Slotted WB Antenna.

III. DESIGN TECHNIQUES ON FEEDING STYLE

The main challenge in designing a WB antenna is to cover larger bandwidth because the matching and energy transmission is required to be verified for the entire bandwidth. However, the traditional trade-offs such as size - efficiency and size - bandwidth still influences the characteristics and performance parameters of antennas. Some of the techniques discussed are following:

Microsrip line feed technique:

A. Compact design for microstrip WB antenna has been designed by variation in transmission line modal analysis. By this rectangular patch antenna parameters is calculated. It can support larger bandwidth excited by a time domain pulse to ensure better transmission and reception of WB signal. For providing further enhancement of the antenna performance in terms of impedance matching in bandwidth range stepped-matching technique is applied on the antenna.

B. It has impedance bandwidth of 1.78GHz to 11.13GHz. The parameters such as slot size, its positioning and dimension, feed width and shape of the width has been also investigated to obtain significant S11 value. The antenna with FR4 substrate with that of the thickness of 1.6 mm and dielectric constant 4.4, low return loss is obtained by placing slot near near the feed-line. WB characteristic range 1.78GHz to 11.13GHz is obtained by further optimizing antenna parameters.

C.WB antenna: Two slots are inserted in both sides of the feed-line on the ground plane. In order to generate band-notch characteristics H- shaped back-plane is used with varying the frequency components. The antenna operates on the frequency range of (3.1 and 14) GHz with band rejection in the frequency band of 5.1 to 5.9 GHz. In order to achieve wider bandwidth with small size compact two parasitic elements have been introduced. For wider band impedance matching is carried out by coupling between the main patch and parasitic patches have been realized by either vertical or horizontal gaps. The proposed antenna is designed taking a small ground plane for the application of compact transceivers. Comparing with conventional patch antennas slight better gains of 6.4dB and 5.2 dB at each resonant frequency is obtained.

Proximity coupled feeding technique: A single-layer microstrip antenna is one of the baisc examples for proximity coupled fed microstrip antenna in which arrays of rectangular microstrip patches were arranged in the log periodic way and proximity-coupled to the micro-strip feeding line. A large scale factor of 1.1 was first reported and proved highly effective to reduce the number of microstrip patches in the WB log-periodic arrays. The impedance bandwidth (measured VSWR< 2.5) of an example antenna is from 2.26–6.85 GHz with a ratio of near about 3.03:1. Very low-profile and low fabrication cost, suitable for various broadband applications.

Aperture coupled feeding technique: An aperture coupled fed micro -strip patch antenna has been examined along with a rectangular patch on top of two slots above the ground plane. There is a feed-line of having impedance 50 divided into two 100 feed line below the ground plane by microstrip power divider.

IV. RESULT AND DISCUSSION

A Software Simulater HFSS was used to measure the values of electrical performance of the proposed antenna. The parameters such as impedance bandwidth, Voltage standing wave ratio, and gain. Here reviewed the measured and simulated VSWR curves of the patch i.e. inverted L - strip WB antenna. The small difference in simulated results on different software environment is due to the approach of their attributes.

Group delay is also an important parameter in the design aspect of the WB antenna since it provides the distortion of the transmitted pulses in ultra wideband communication. To get a reliable pulse transmission, group delay should be almost constant in the WB band. As it can be observed, the variation in the group delay for the proposed antenna remains almost constant (near about 1 ns) for the entire WB band. This confirms the suitability of the proposed antenna for very wider band of communication. We found that the antenna has satisfactory omnidirectional radiation patterns at all frequencies in the E plane and H plane respectively. This pattern is suitable for application in most of the wireless communication equipment, as was expected.

V. CONCLUSION

A novel CPW fed compact WB microstrip antenna is design and proposed. The results of the simulated antenna show stable radiation patterns for the whole of the ultra wide band and for extra bands as well. Also significantly almost constant group delay is achievement in this design. The good impedance matching characteristic, constant gain, and an omnidirectional radiation patterns over the entire operating bandwidth range which make this technique antenna a good choice for WB applications.

REFERENCES

[1] Federal Communications Commission, Washington, DC, USA, "Re-vision of Part 15 of the commission's rules regarding ultra-wide-band transmission systems First Report and Order FCC 02.V48," Tech. rep., 2002.
[2] H. G. Schantz, "A brief history of UWB antennas," IEEE Aerosp. Elec-tron. Syst. Mag., vol. 19, no. 4, pp. 22–26, Apr. 2004.
[3] X. Qing and Z. N. Chen, "Monopole-like slot WB antenna on LTCC," in Proc. IEEE ICUWB, 2008, pp. 121–124.
[4] C.-L. Tsai and C.-L. Yang, "Novel compact eye-shaped WB an-tennas," IEEE Antennas Wireless Propag. Lett., vol. 11, pp. 184–187, 2012.
[5] M. Bod and M. M. S. Taheri, "Compact WB printed slot antenna with extra Bluetooth, GSM, and GPS bands," IEEE Antennas WirelessPropag. Lett., vol. 11, pp. 531–534, 2012.
[6] Y. Sung, "UWB monopole antenna with two notched bands based on the folded stepped impedance resonator," IEEE Antennas WirelessPropag. Lett., vol. 11, pp. 500–502, 2012.
[7] S. R. Emadian, C. Ghobadi, J. Nourinia, M. Mirmozafari, and J. Pourahmadazar, "Bandwidth enhancement of CPW-fed circle-like slot antenna with dual band-notched characteristic," IEEE AntennasWireless Propag. Lett., vol. 11, pp. 543–546, 2012.
[8] D. T. Nguyen, D. H. Lee, and H. C. Park, "Very compact printed triple band-notched WB antenna with quarter-wavelength slots," IEEE An-tennas Wireless Propag. Lett., vol. 11, pp. 411–414, 2012.
[9] L. N. Zhang, S. S. Zhong, X. L. Liang, and C. Z. Du, "Compact om-nidirectional band-notch wideband antenna," Electron. Lett., vol. 45, pp. 659–660, 2009.
[10] O. Ahmed and A. R. Sebak, "A printed monopole antenna with two steps and a circular slot for WB applications," IEEE Antennas Wire-less Propag. Lett., vol. 7, pp. 411–413, 2008.
[11] S. Cheng, P. Hallbjörner, and A. Rydberg, "Printed slot planar inverted cone antenna for wideband applications," IEEE Antennas WirelessPropag. Lett., vol. 7, pp. 18–21, 20011.
[13] R. Azim, M. T. Islam, and N. Misran, "Compact tapered shape slot antenna for WB applications," IEEE Antennas Wireless Propag. Lett., vol. 10, pp. 1190–1193, 2014.
[14] Jayaram Kizhekke Pakkathillam and Malathi Kanagasabai, "Circularly Polarized Broadband AntennaDeploying Fractal Slot Geometry", IEEE Antennas And Wireless Propagation Letters, Vol. 14, 2015.