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A Survey On Ultra Wideband Planar Antenna

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Abstract- Ultra-wideband (UWB) technology has taken a special place in both the academy and manufacturing places due to its low price, potential to hold high data rate and quite low power requirement. A UWB antenna is the basic components to understand the UWB systems. We saw that designing a UWB antenna for high performance is more challenging than dealing with the conventional narrowband antennas. Typically, A UWB antenna capture a wide bandwidth range of 3.1GHz-10.6GHz, to fabricate an Omni-directional radiation pattern, and it's size is also compact and easy in configuration. In this paper we deals with design and analysis of planer printed UWB antennas, Development in the field of UWB antennas is discussed here, some research have also discussed, and finally with the help of this paper research/review we find a conclusion and future scope related to UWB is showed.

Keywords- *UWB Antenna, Planner Antenna, Monopole Antenna, Printed Slot Antenna, Notch Printed Antenna*

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I. INTRODUCTION OF ULTRA WIDEBAND [UWB]

UWB is also known as digital pulse wireless communication. UWB is a wireless technology used for transmitting data over a wide spectrum of frequency range of 3.1GHz to 10.6GHz **[**2**].** with low power density due to which it can be travel a limited distance and less interference with other surrounding waves.

The power spectral densities of UWB are about 10 thousand to 100 thousand of signals embedded by movable phone, so the impact on human health is negligible.

UWB is generally known as pulse radio but the FCC [Federal Communication Commission] and the ITU-R [International Telecommunication Union Radio Communication] [3**]**. Sector currently define UWB as an antenna transmission for which emitted signal bandwidth exceeds the lesser of 500MHZ or 20% of the arithmetic center frequency.

The significant difference between conventional radio transmission and UWB radio transmission is that:-

(a).Conventional systems transmit information by varying the power level, frequency or phase of a sinusoidal wave.

(b).UWB transmission transmits information by generating radio energy at specific time intervals and occupying a large b.w thus enabling pulse position or time modulation.

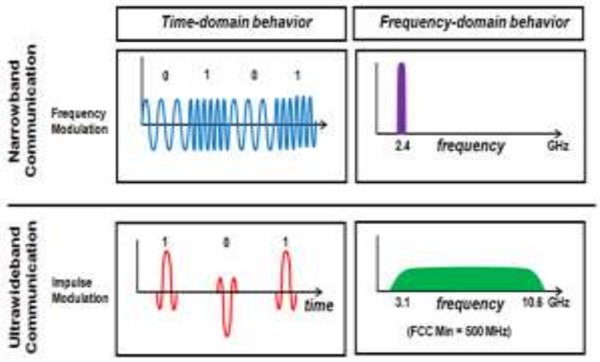

Figure 1.1 Time- and frequency-domain behaviors for conventional Narrow-band versus UWB communications [14].

So UWB pulses can be sent sporadically at relatively low pulse rates to support time or position modulation. These pulses are considered UWB signals because starting from 500MHz up to 7.5 GHz [10]. Figure 1.1 shows the time and frequency behavior for conventional narrowband versus UWB communication.

II. WORKING OF UWB

UWB data transmission technique is different from others because it does not require carrier signal to transfer information. UWB share a single wireless transmission system with a number of users simultaneously due to spread spectrum technology.UWB operates in both single-band mode and multi-band mode; Single band mode is similar to that of spread spectrum technology while in Multi- band mode whole frequency spectrum is divided into smaller, non overlapping bandwidth above 500MHz. One of the best advantages of UWB technology is to increase channel capacity compare to others.

APPLICATIONS OF UWB

Ultra wideband has two main applications:

1) It is used in radar **[**11**],** in which signal penetrate nearby object but reflect the farther object or surfaces, allowing things to be detected after penetration behind walls.

2) Digital pulses are used for voice and data transmission.

UWB-ANTENNA REQUIREMENTS:-

UWB antenna is operated at the frequency range of 3.1to 10.6 GHz[2]. Another parameter that must be considered is a group delay. Group delay is the derivatives of unwrapped phase. If the phase is linear throughout the transmission then the group delay will be constant.

This is important because it indicate UWB transmission tendency or by what degree it may be disappeared or distorted.

Radiation pattern and its efficiency are also very important in UWB antenna design. Omni-directional radiation pattern are used because it has freedom in transmitter and receiver location [13]**.** It means that by increasing the half power beam width and decreasing directivity and gain. Conductor and dielectric losses should be decreased in order to increased radiation efficiency.

1. ULTRA WIDE BAND PLANAR ANTENNA PLANAR-ANTENNA:-

Planar Antennas for Wireless Communication is a solution for transmitting and receiving data from 880 MHz to 5.875 GHz; point-to-point telecommunications.

In telecommunication system a **planar** array is a antenna which has its active and parasite element in one plane. It provides a large aperture and use as a directional beam control by the difference of relative phase [1]. The advantage of planner antenna is that they can reduce the backward radiation towards the top of the antenna by absorbing power, which enhances the efficiency.

2. DEVELOPMENT IN THE FIELD OF ULTRA WIDE BAND PLANAR ANTENNA:-

Ultra wideband wireless communication system directly transmits and receive the radio pulses over a large bandwidth for short range.

- One of the challenges associates with UWB antenna implementation is that it should have wide bandwidth or omni-directional pattern over the entire range of frequency **[**14**]**, and also have appropriate phase linearity, UWB antennas are unproblematic because of their qualities such as low price, manufacture low profile, compatibility to PCB, light weight.

2(a) UWB PRINTED MONOPOLE ANTENNA:-

This antenna consists of a monopole patch and a ground plane printed either on the same side or on the reverse side of a substrate, with a micro-strip line/CPW in the center of the ground plane to provide for the monopole patch .One of the simplest antennas is a printed circular disc monopole fed by a CPW [Co-planer Wideband] **[**7]. (seeFig.1)

achieving an ultra-wide bandwidth with suitable omni-directional radiation properties. A small micro-strip fed monopole antenna consisting of a rectangular patch with two steps and a truncated ground plane is presented, as shown in Fig.2. This design provides a matching impedance bandwidth from 3.1 GHz to 11 GHz [2], and an almost stable omni-directional radiation pattern at the same time. One of the main features of this antenna is its size decreased compared to other UWB planar antenna designs found in the literature such as U-type monopole, elliptical monopole, inverted triangular monopole, and knight's helm shape monopole.

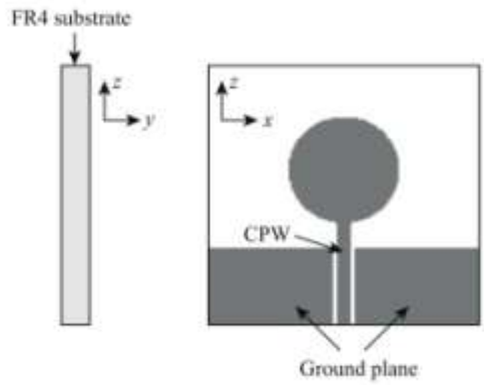

Figure1:- CPW-fed circular disc monopole antenna [15].

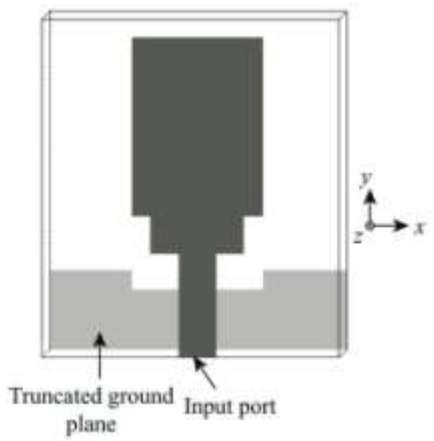

Figure2:-Compact rectangular monopole antenna [15].

2(b) UWB PRINTED SLOT ANTENNA

Printed slot antennas with ultra-wide bandwidth are also micro-strip line fed printed slot antenna where a wide-slot cut in the ground plane is energized by a micro-strip feed line with either a shorting or an open termination **[4]**. Over the years, characteristics of the printed wide-slot antenna fed by a micro-strip line with various tuning-stubs such as rectangular and cross-shaped stub and circular stub have been broadly studied to expand the impedance bandwidth. We have suggested a rectangular wide-slot antenna fed by a fan-shaped stub together with a strip line as shown in Fig.3. This achieved an impedance bandwidth of 114% for voltage standing-wave ratio (VSWR)_2 and showed constant behaviors across entire bandwidth.

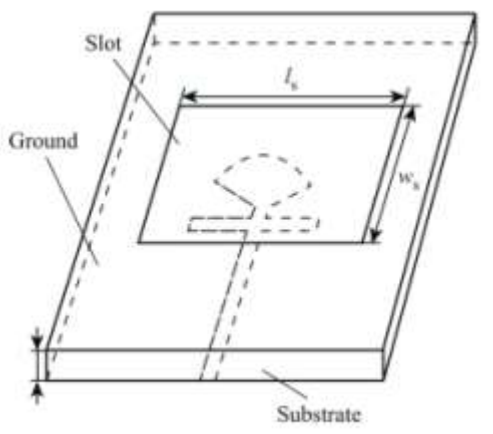

Figure3:-Wide Slot Antenna fed by a fan shaped stub [15].

Another type is the CPW-fed printed slot antenna. [9],Various wideband CPW-fed slot antennas have been reported in the literature including the strip-loaded square slot, the cured bow-tie slot and inductively coupled rectangular slot, *etc*. These antennas provide impedance bandwidths of 60%-100% that are inadequate to operation the entire frequency span allocated to UWB applications. In July 2005, a modified bow-tie slot antenna with asymmetric apertures fed by a taper CPW to CPW transition and loaded with inductively coupled slots was proposed (see Fig.4) provided a bandwidth of 123% that is enough for UWB applications. In December 2005, another printed elliptical slot antenna fed by a tapered CPW with the U-shaped tuning stub was reported with a bandwidth from 3.1 GHz to 10.6 GHz,

2(c) UWB BAND NOTCHED PRINTED ANTENNA

There exist wireless local area network (WLAN) bands such as the 5.2 GHz (5.15-5.35 GHz) and 5.7 GHz bands, which may interfere with UWB systems **[5].** In order to avoid possible interference with existing WLAN systems, UWB antennas with band-notch characteristics has been presented, *e.g*., by loading a half-wavelength U-shaped or quarter wavelength V-shaped slot, inserting proper slits, or adding parasitic patches[8**]**. For instance, a staircase and ball-shaped printed monopole antenna was presented in July 2005 (see Fig.), with a compact structure and a frequency band notch of 5.150-5.825 GHz, which can be adjusted by varying the length of two parasitic patches. The bandwidth is about 3 GHz to 18 GHz without parasitic patches. We have proposed a UWB circular disc monopole antenna with an inserted arched slot in which the notched band.

III. RESEARCH IN THE FIELD OF UWB-WIRELESS COMMUNICATION

- **Lu *et al*.(2004):-** He presented Diamond and rounded diamond antennas which had wide-band properties suitable for ultra-wide-band (UWB) applications. In their work, the author experiments with two antennas in terms of radiation pattern, gain versus frequency, impedance properties, etc. The simulation was verified by experimental measurements conducted in an anechoic chamber. The approach of the authors circumvents measurement difficulties and established confidence in using simulation software for studying UWB antennas.
- **Bolin *et al.* (2005):-** He reported diversity gain performance of a two-antenna setup in an office environment. The terminal was handheld in front of the user simulating a data mode Scenario while walking around. The dual polarized base station sector antenna is placed at the end of a corridor. The results indicated that experimentally achieved diversity performance is similar to previously predicted theoretical data .The antenna designed by the authors was designed in the UWB range.
- **Chong *et al., (*2006):-** He described UWB is a radio technology, which operates in the frequency range of 3.1 GHz to 10.6 GHz at very low power level for short-range communications without causing interferences to the licensed users. People want greater freedom in connecting personal computer, cell phone etc. when the user is moving into the home and office. The UWB technology provides the real wireless freedom by replacing short wire links. The authors presented an UWB antenna which offers the desirable cost effective, power-efficient, high bandwidth solution for transmitting multiple digital video and audio streams data among the short range devices.
- **Wang *et al* (2006):-** Author reported and described antennas as a filter with frequency dependent response during the transmitting and receiving process. To capture the waveform dispersion so we can maintain stability at the transmitter/receiver, a new circuit modeling style that handles omni-directional small antennas was projected by the authors. By transform the antennas into the

degenerated Foster canonical forms and using the waveform-omni-directional property, it was shown that the transmitted far field waveform was a appropriate version of the voltage across the radiation resistor in the model. By extending Thevenin /Norton equivalent circuits with dependent sources tracking the frequency dependence of the antenna effective length were also built for UWB receiving antennas. Simulation and new outcome after experiment shows that this methodology is helpful over a wide bandwidth and appropriate for fabrication of UWB antennas.

- **Chang *et al.*(2008):-** The authors presented a method to form a notch band .A complementary split-ring resonators was etched in the T-stub region. A CPW-feed is used to designed ultra-wideband (UWB) antenna. Two resonators are connected to the common slot edge because of the limited space in this region. The author claims that with two separated CSSRs, this design not only occupies less space but also yields high mismatch losses. It was found that high mismatch losses and deep suppression level was obtained at the desired notch band. The interferences were rejected in 5-6 GHz band. The design was superior to single slot design as it has more mismatch
- **Koohestani *et al.* (2014):-** He designed a compact coplanar-fed antenna suitable for polarization diversity in ultra wideband (UWB) applications .The antenna designed by the author consists of two identical monopoles that are printed on a low-loss substrate with 3mm spacing and positioned perpendicular to each other. Results shown that the proposed antenna had not only ultra-wide bandwidth, but also good port isolation above 22 dB over the entire band of interest. The radiation patterns demonstrated good orthogonal polarization operation. The envelope correlation coefficient (ρe) ≤ -20 dB calculated to evaluate the diversity performance across the ultra-wide bandwidth.
- **Gao *et al.* (2014).** The author presented a novel compact printed ultra wideband (UWB) slot antenna for Multiple Input Multiple Output/diversity applications. The antenna consists of two modified coplanar waveguides (CPWs) feeding staircase-shaped radiating elements for orthogonal radiation patterns. A rectangle stub was placed at 45° between the CPW to ensure high isolations. The author etched two split-ring resonator (SRR) slots on the radiators to achieve the band notched property. The antenna meets a 10-dB impedance bandwidth and 15 dB isolation from 2.5 to 12 GHz, with a notched band at 5.5 GHz.

IV. CONCLUSION

In this paper, we have discussed about UWB antennas and have found some interesting fact about UWB that help in the designing of high performance UWB antennas. we have discuss about major practical applications and working of UWB antennas. In this paper we also discuss about the development in the field of UWB wireless communications with the help of UWB planer antenna. Looking into future, we consider that UWB antennas show vast promise and that they will observe more developments along with the quick and volatile expansion of wireless communication technology that we are witnessing these days

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