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REVIEW ON LOG-PERIODIC DIPOLE ARRAY FOR GSM, 3G AND 4G

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Abstract - The review of the log periodic dipole array antenna for the purpose of the GSM, 3G and 4G applications and their frequency ranges are 690-960 MHz and 1710-2650 MHz and having bandwidth of 270 and 940 MHz respectively. In the antenna using CST tool and it will be manufactured on the printed circuit board for the required specifications. The log periodic dipole array antenna is selected because it provides a wide range of frequency could be matched suitably using this antenna.

Key Words: Log-Periodic Antenna, 3G, 4G, Bandwidth, Wireless Communications

I. INTRODUCTION

The first detailed mathematic analysis of LPD antenna is performed by Carrel R. Considering the feeder structure being infinitely small comparing with the lengths of dipoles, so that it can be adequately described in terms of currents and voltages which do not interfere in the result radiation pattern. According to the classical representation LPDA consists of plurality of parallel linear dipoles made from metal tubes and symmetrically fed by balanced transmission line. A log periodic dipole antenna (LPDA) is a promising candidate since it is the antenna whose principle performance is frequency independent, reasonable gain, high front-to-back ratio (F/B). The antennas on printed circuit board are thus an interesting choice to overcome this problem because of compact size and weight, low cost, and ease of fabrication and integration.

The radiation resistance and pattern of the antenna do not depend on frequency. The wide bandwidth is great advantage of this antenna compare to YAGI and other antenna types. Low to moderate gains can be obtained. It offers uni-directional and bi-directional radiation patterns. It is highly directional antenna. It can be used for HF/VHF/UHF communication as well as for TV reception. It is available in wide variety of shapes.

II. RELATED WORK

The Log-Periodic Dipole Array (LPDA) has been widely used around the world since inception in the 1950's because it provides a performance of high-gain across a broad, easily configurable bandwidth. However, the overall size of the LPDA drastically increases when the LPDA is designed to operate over a very broad bandwidth. Additionally, the antenna element is typically a λ/2 dipole, and, therefore, the size reduction of the LPDA is preferred as the frequency goes down to a lower range [9].

The traditional Log-periodic dipole array (LPDA) antennas introduced by are widely used in the modern wireless communication systems because of their advantages of fixed peak radiation, stable radiation pattern, wideband, and moderate gain. Henceforth their design principle and performance had been deeply studied. But the traditional LPDA antennas are difficult to integrate with planar circuits, and therefore not suitable for mass-production, especially at millimeter wave frequencies. In order to be compatible with modern planar systems, the LPDA antenna implemented based on the printed circuit board (PCB) technology, called printed log-periodic dipole arrays (PLPDA) antenna, was proposed and has already been investigated and it is implemented in the present manufacturing process [7].

A constant radiation is one of the most important parameter in antenna design and this characteristic is very important which implies here that the radiation pattern of the array over its operational frequency is equal to the radiation pattern of a single dipole at its resonant frequency. The terminal voltages can be analytically determined if the dipoles are electrically short, i.e. all dipoles only support the fundamental current mode, which is not the case for broadband LPDAs. We can also use the various elements in order to obtain the desired bandwidths of the sequence in the antenna parameters [3].

The log-periodic dipole antenna is best suited to achieve because of its advantages of Log-periodic dipole array (LPDA) antennas have many such as stable gain, wide bandwidth, and low cost, which are very suitable for many wideband wireless communication systems. In the UHF band, LPDA antennas using metal cylindrical dipole elements have been widely applied in the ground transmitting wireless systems, which have good radiation performance and high power handling over a very wide frequency band [1].

The feeder structure is also important for the log periodic antenna which is infinitely small comparing with the lengths of dipoles, so that it can be adequately described in terms of currents and voltages and do not enter in between the resulting radiation pattern. All dipoles have

symmetrical sinusoidal distribution of current along its length. So this is easy in order to analyse the antenna pattern with less noise [2].

One of the problems with LPDAs, however, is large antenna size. Since LPDAs are a combination of multiple λ/2-dipole elements, they are not feasible when required space for the antenna is limited. Thus, size reduction of LPDAs is desired to make them more applicable in various communication environments with limited volume, or in portable applications. So in order to make it compact we are going to use certain design methodologies in order to make the antenna compact with high gain and directivity of these antennas [4].

Given the correct terminal voltages on each element of a log periodic dipole array constant radiation characteristics can be achieved for an Omni-directional radiation pattern. In this communication it is shown that this can only be achieved through optimization, correcting a previously reported oversimplification which resulted in an analytical approach being tractable. This oversimplification assumed that vanishing terminal currents on a dipole's terminal/feed element implies no radiation from that dipole [5].

The first reflect array that was proposed in uses a rectangular waveguide as its element, this reflects array is bulky and heavy. To overcome these disadvantages, planar reflect arrays composed of a micro strip array element have been proposed. Planar reflect arrays have numerous advantages compared with the conventional waveguide reflect array, specifically, flatness, compactness, and easy fabrication. Therefore, various planar reflect arrays have been developed for specific applications such as satellite and wireless communications. The most severe drawback of planar reflects arrays are the narrow bandwidth. [6].
The difference between Circularly Polarized (CP) Log Periodic Dipole Array (LPDA) antennas are CP is widely used in various modern wireless communication systems such as satellites, RFID, and GPS since CP improves detectability regardless of positions and reduces multipath effects but LPDA suitable for broadband communication systems due to simplicity and low cost[8].

The Size reduction is one of the important parameter including integrated and distributed inductor loaded, unit bend, terminal load, electric capacity feed system, etc. indicate whole size-reduced to be feasible, but is following the sudden drop of performance, Increasing the unit count, which will make the structure of the aerial long, will reduce drops of performance because size-reduction of dipoles, which gives an idea to decrease the antenna size without affecting the performance of antenna [9].

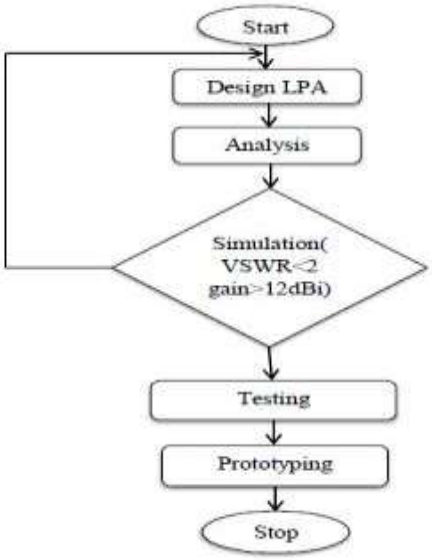
III. COMPARISION

AUTHORS AND YEAR	TITLE	CONTRIBUTION
Lei Chang, Shuai He, Jian Qiang Zhang, and Dan Li . 2017	A Compact Dielectric-Loaded Log-Periodic Dipole Array (LPDA) Antenna	Good radiation performance and high power handling over a very wide frequency band
F.F. Dubrovka, M.M. Lytvyn, S.M. Lytvyn, S.Y. Martynyuk, Yu.V. Ryabkin , O.O. Vtorov 2016	Ultrawideband log-periodic dipole antenna arrays for the frequency range 0.7-12 GHz	The reduction of feeder effects on antenna gain parameters.
Robert Lehmensiek and Dirk I. L. de Villiers 2015	Optimization of Log-Periodic Dipole Array Antennas for Wideband Omnidirectional Radiation.	Planar arrays have been included in order to enhance compactness, easiness.
Robert Lehmensiek and Dirk I. L. de Villiers 2017	Optimization of Log-Periodic Dipole Array Antennas for Wideband Omni-Directional Radiation	Large size of log periodic antennas which has a complex design is reduced
Hiroki Ito, Keisuke Konno , Hiroyasu Sato ,Qiang Chen 2016	Wideband Scattering Performance of Reflect array Using Log-Periodic Dipole Array	Planar reflect arrays have been proposed, which has a narrow beam for antennas
Guohua Zhai , Yong Cheng Qiuyan Yin , Shouzheng Zhu , Jianjun Gao 2016	Gain Enhancement of Printed Log-Periodic Dipole Array Antenna Using Director Cell	The log-periodic antenna is implemented on the circuit board.

By comparing the various parameters and their advantages will be combined together and the log-periodic dipole array antenna will be designed in further processes.

IV. PROPOSED METHODOLOGY

The design procedure of traditional and proposed printed PLPDA antennas is to be confirmed in this thesis. Log- periodic dipole array antenna is used and the design calculation have to be developed, based on the gain of the antenna the size and varios other parameters shoukd be decided.



V. TOOLS USED

CST offers accurate, efficient computational solutions for electromagnetic design and analysis. CST 3D EM simulation software is user-friendly and enables to choose the most appropriate method for the design and optimization of devices operating in a wide range of frequencies. A network analyser is an instrument that measures the network parameters of electrical networks. Network analysers commonly measure s– parameters because reflection and transmission of electrical networks are easy to measure at high frequencies, but there are other network parameter sets such as y-parameters, z-parameters, and h-parameters.

An anechoic chamber ("an-echoic" meaning non-reflective, non-echoing or echo-free) is a room designed to completely absorb reflections of either sound or electromagnetic waves. They are also insulated from exterior sources of noise. The combination of both aspects means they simulate a quiet open-space of infinite dimension, which is useful when exterior influences would otherwise give false results.

VI. CONCLUSION

The research motivation for this paper is to develop a log-periodic dipole array antenna for GSM, 3G and 4G applications by knowing the various advantages and its parameters. The log periodic dipole array antenna designing is made using CST tool and is analyzed through network analyzer.

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