A Review on UWB Microstrip Patched Log-Periodic Antenna

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Abstract- Lately, ultra wideband (UWB) technology has appealed a lot awareness each within the industry and academia as a result of its low rate, advantage to manage excessive data price and fairly low vigor requirement. A UWB log-periodic antenna is the key add-ons for realizing the UWB systems. We observe, nevertheless, that designing a UWB log-periodic antenna to provide high efficiency is rather more difficult than it is when dealing with the conventional narrowband antennas. This paper focuses on the survey and analysis of planar printed UWB log-periodic antenna, and provides some representative performance outcome of previously designed UWB antennas to illustrate the advantages as well as drawbacks of those antennas. Existing state of progress of UWB log-periodic antennas is reviewed in the paper and a few future trends of UWB antenna designs are provided. Additionally, the topics of wideband enhancement techniques for UWB log-periodic antenna.

Keywords – : Log-Periodic Dipole Antenna (LPDA), Ultra Wide Band (UWB), Printed log-periodic dipole antenna (PLPDA), Power Spectral Density (PSD), Computer Simulation Technology (CST).

I. INTRODUCTION

The intensive development and vast utility of new generations of communique approaches have expanded the demand for company vast new antenna designs. Probably the most common requisites these methods pose on antennas are huge bandwidth, immoderate radiation readily, small measurement, and integration with developed-in circuits and MMICs. Considering the fact that these requisites, printed mm-wave antennas appear to be a suitable option of antenna technology for brand new wi-fi verbal exchange methods, as they preclude the want for cumbersome horn antennas and associated losses as a result of routing alerts off-chip to a transition from the active MMIC to the horn.

In telecommunication, the frequency spectrum is a uncommon commodity and each band is assigned for a exceptional software. A log-periodic antenna is a broadband, multi-detail, unidirectional, narrow-beam antenna that has impedance and radiation features that are most often repetitive as a logarithmic function of the excitation frequency.

The vigorous log periodic antenna that the title for A Single Broadband Antenna whose features changes as a periodic participate of the logarithm of the frequency. This operation is to look into the design of a broadband antenna that covers the foremost low-return-loss printed log-periodic dipole antenna (PLPDA) fed by way of a coaxial cable is provided. The widths of dipole reasons are optimized to broaden the bandwidth. It is informed of coaxial cable function is integrated with the intention to fortify the antenna habits. The measured return loss is cut down than 15 dB from 2.1 to 4.3GHz. The measured reap varies between 6 and 7 dBi. The measurements, together with enter impedance, reap and radiation patterns, and simulations are in contract. Aside from utility as a high satisfactory dimension antenna and course finder, this antenna can be superb applicable as a directional antenna for WLan, WiFi, and extraordinary directional conversation functions. A small bodily antenna-dimension plus low weight will make this antenna a forte for cellular use and the detection of unusable signal sources like military radar, relatively numerous satellite choices and quite high frequency bugs.

II. LITERATURE REVIEW

Amrollah Amini et al (2015) in this letter, the log-periodic rectangular fractal geometry is offered for the design of a miniaturized patch antenna for the extremely-wideband (UWB) offerings (3.1-10.6 GHz). A miniaturization aspect of 23% is finished with a usual and stable gain within the favored band. The radiation pattern is broadside, which finds suitable purposes within the UWB radars and scientific imaging. Furthermore, the time-discipline performance of the proposed antenna is investigated. A prototype mannequin of the proposed antenna is fabricated and measured as a proof of suggestion.

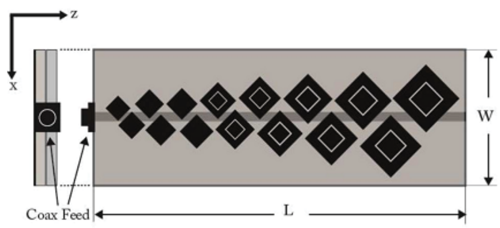


Fig.1Log-periodic patch antenna.

Fractal geometries are appropriate buildings for miniaturization and multi-banding of antennas. For this reason, a log-periodic formation of rectangular fractals is offered for broadside radiation in UWB offerings, where square slots are scale down within the square patches. The greater rectangular patches are equipped with square slots, but the smaller patches lack such slots, with a purpose to preserve the effectivity of radiation patterns at better frequencies. The geometry of log-periodic antenna is adjusted to accumulate 23% dimension reduction relative to the effortless rectangular patch array. The habits of the proposed log-periodic fractal configuration is further investigated in time-domain. A prototype model of the antenna is fabricated and measured which verifies its fascinating traits.

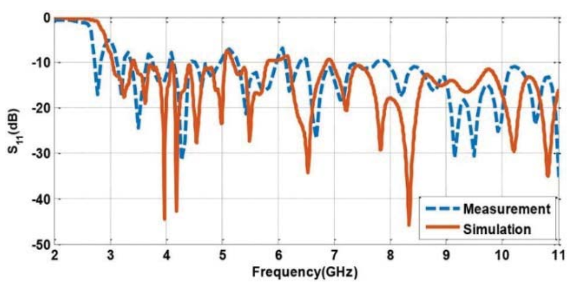


Fig.2 Return loss of proposed antenna.

Antoine Chauloux et al [2014] in this letter, a low-return-loss printed log-periodic dipole antenna (PLPDA) fed with the aid of a coaxial cable is provided. The widths of dipole factors are optimized to broaden the bandwidth. A be trained of coaxial cable position is integrated so as to beef up the antenna conduct. The measured return loss is scale back than -15 dB from 2.1 to 4.3 GHz. The measured acquire varies between 6 and 7 dBi. The measurements, including enter impedance, gain and radiation patterns, and simulations are in agreement.

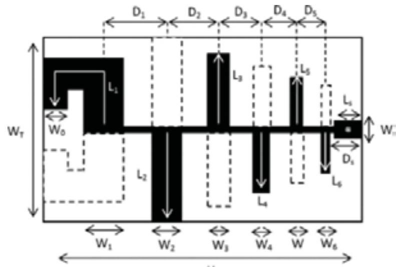


Fig.3 Details of the design of the modified PLPDA on both sides of the substrate.

The antenna (see Fig.3) is printed on a NELTEC dielectric substrate (NX9300) with and a thickness equal to 0.8 mm. Consistent with, when scale and spacing factors are equal to 0.824 and 0.146, respectively, the expected acquire is 8 dBi, and the bandwidth is [2–4 GHz] with eight dipoles. In this case, the total top of the antenna is 98 mm, which exceeds our dimensional constraint. To shrink this size to 85 mm, the smallest and the longest dipoles are eliminated. This leads to the decreasing of the frequency bandwidth of the antenna. To be able to prolong the higher a part of the bandwidth, the lengths of the dipoles are adjusted. The size of the longest dipole is now 54 mm as an alternative of 63 mm earlier than modifications. Centered on the length of the longest dipole, the lengths of different dipoles are calculated.

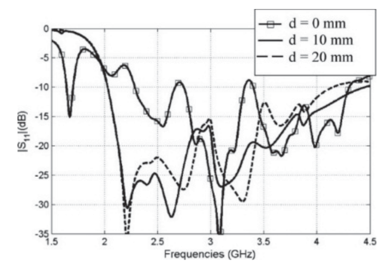


Fig.4 Return losses of the proposed antenna versus, the distance between the antenna and the cable.

Noted that the antenna is also size-reduced—in fact, the height of the antenna proposed in this letter is 83.5 mm instead of 98 mm for an antenna designed using Carrel procedure. The antenna is fed by a coaxial cable, and the distance between this cable and the antenna has been optimized. An appropriate scale factor used for the width of dipoles has also been determined. As a result, the measured return loss is close to -20 dB between 2.2 and 3.9 GHz. The gain of this optimized antenna varies from 6 to 7 dBi. Theoretical results and measurements are satisfactory for all the significant parameters of the antenna. With the results described in this letter, we consider that this antenna should be a good candidate for high-power applications.

GA Casula printed et al [2013] Log-periodic dipole array (LPDA), operating between 3 and 6 GHz and fed with a coplanar waveguide, is presented. The antenna has been designed starting from Carrel's theory, optimized using CST Microwave Studio 2012, and then realized. The comparison between simulated and measured results shows that the proposed antenna can be used for broadband applications in the whole operating frequency band (3–6 GHz), with a very good input matching and a satisfactory end fire radiation pattern.

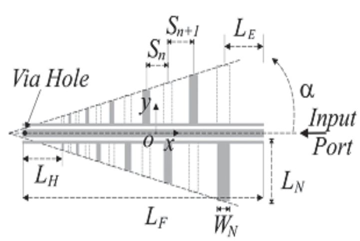


Fig.5 Antenna layout (top layer) not in scale. L_F=117.15 mm, L_H=22.97 mm, L_E=26.44 mm.

Printed log-periodic dipole array with a new feeding method, operating between 3 and 6 GHz, has been designed and analyzed utilizing CST. The return loss and the radiated a long way subject within the design frequency band are much like other options employing the coaxial cable feeding, whereas the proposed solution avoids manufacturing time and problems as a result of soldering of the coaxial cable. The brand new feeding configuration makes it possible for easy awareness, with low rate and compact measurement, and is handy to attach with the external SMA connectors. The simulated and measured outcome are in an excellent agreement, displaying that the proposed LPDA may also be effectually used as a broadband antenna in the entire working frequency band.

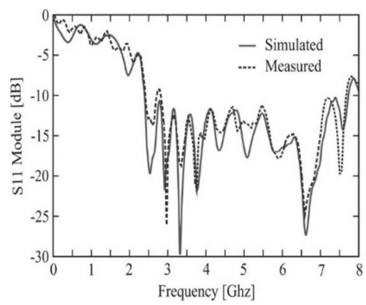


Fig. 6. Reflection coefficient of the designed LPDA antenna.

Prateek Wankhade et al[2013] A double-band attribute of multilayer aperture coupled microstrip log-periodic dipole antenna is discussed. Additional loading of patches is carried out and its effects are investigated. It is a probe fed antenna for impedance matching of 50Ω coaxial cable. This antenna works good in the frequency variety 4.3 GHz to 8.5 GHz. It is clearly a low price, mild weight, medium acquire antenna, which is used for wi-fi communique. The multilayer microstrip antenna constitution involves addition of a couple of layers one over the other. When a microstrip antenna is stacked with a superstrate dielectric layer, its properties like resonance frequency, attain and bandwidth are converted, which may impact the system efficiency.

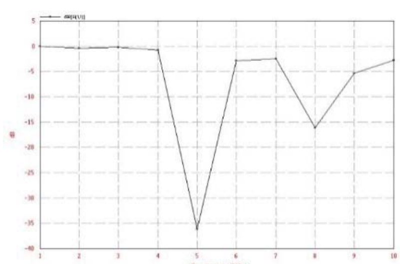


Fig. 7. Return Loss

With appropriate alternative of the thickness of substrate and superstrate layers, tremendous increase in bandwidth and return loss can be achieved for practical applications. This structure uses stacked configuration of three one-of-a-kind substrates. One dielectric substrate as a feeding plane, one dielectric substrate as aperture aircraft and a dielectric substrate as a LPDA. The simulated antenna yields -29.16 dB return loss with 33% bandwidth with a size of 14.80x16.89x6mm^3. The proposed antennas present a high-quality candidate for compact and affordable microwave integrated techniques. In this paper we load two further patches onto the LPDA constitution thereby making improvements to the results. We have now investigated the outcome by way of altering dimensions of patches. We have loaded two patches akin to L9 and L8. Size of the patches is saved L/2 after which variation in width of first patch is found at the same time the width of 2nd patch is stored regular (2*Width of L8). Because of gradual trade in width, it has been determined that return lack of the antenna is making improvements to and at the side of this bandwidth can also be getting increased.

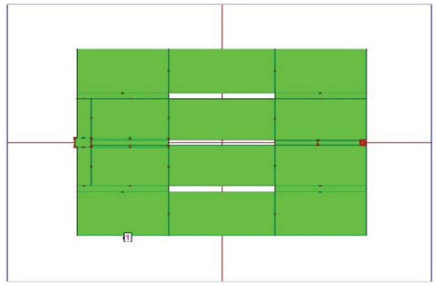


Fig. 8 Aperture Layer Structure

Alternatively on increasing the length of the loaded patch output all of the sudden deteriorates.

Multilayer aperture coupled antenna is offered. Probe feeding is used in this constitution as a feeding mechanism. Through using multilayer-stacked configuration, we are able to attain dimension discount and obtain just right performance at the tested frequency of 5 GHz. Through varying width of patch of the LPDA we are able to have higher return loss and for this reason bandwidth. It is also necessary in decreasing mutual inductance between the dipoles of the antenna, which reasons the reinforcement of the radiation by way of antenna.

In future this will also be proved as an excellent candidate of mutual inductance discount.

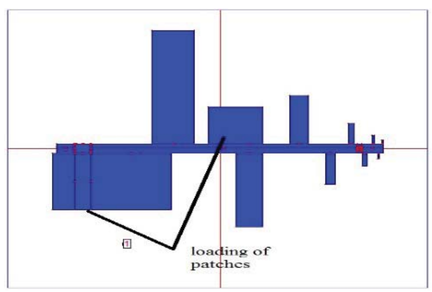


Fig. 9. LPDA structure

Ali Khaleghi et al [2011] A novel inspiration headquartered on time-reversal system is awarded to reap a non-dispersive log-periodic dipole array (LPDA) antenna concentrating on in an impulse radiating antenna (IRA). The idea is to use a passive interface circuit module at the feeding line of the antenna, which works because the time-reversal pre filtering. The proposed procedure results in a non-dispersive (high-fidelity) antenna via maintaining the identical LPDA structure that has the elements of the LPDA antenna in terms of radiation pattern, VSWR, achieve, and efficiency. The results show forty% growth in the constancy component of the antenna.

A time-reversal UWB technique is proposed to get to the bottom of the dispersive nature of an LPDA antenna. A pre distortion circuit is assigned to the antenna, for that reason an LPDA antenna is converted to an impulse radiating prototype without any modification on the antenna structure.

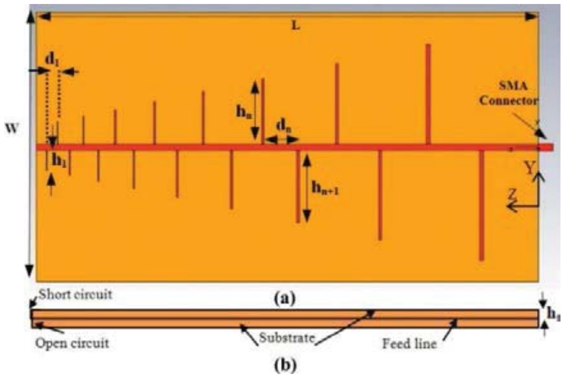


Fig. 10. (a) Top and (b) side view of the designed LPDA antenna.

A conventional time-reversal process wants the prolong traces and the lively obtain elements. A brand new simplified method is proposed with the aid of doing away with the energetic achieve elements. The antenna fidelity element is improved to 93%, and the radiated peak sign is expanded by using 31% in comparison with the height amplitude accomplished without TR procedure. The proposed system can be generalized to diminish the heart beat distortion of any directive UWB antenna.

The antenna elements are printed on a 3-layer substrate. The dielectric substrate is RT/Duroid-5880 with ε_r=2.2 the thickness of h_s=0.787mm.The antenna elements are printed on a three-layer substrate. The dielectric substrate is RT/Duroid-5880 with $\varepsilon_r = 2.2$ and the thickness of $h_s = 0.787$ mm.

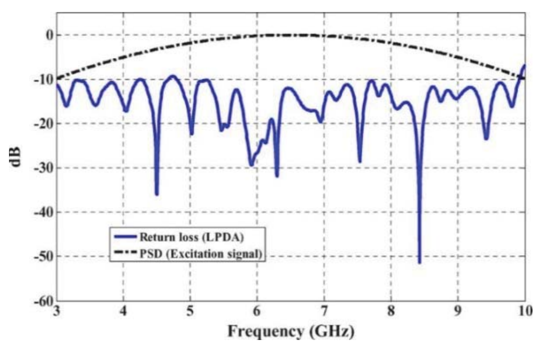
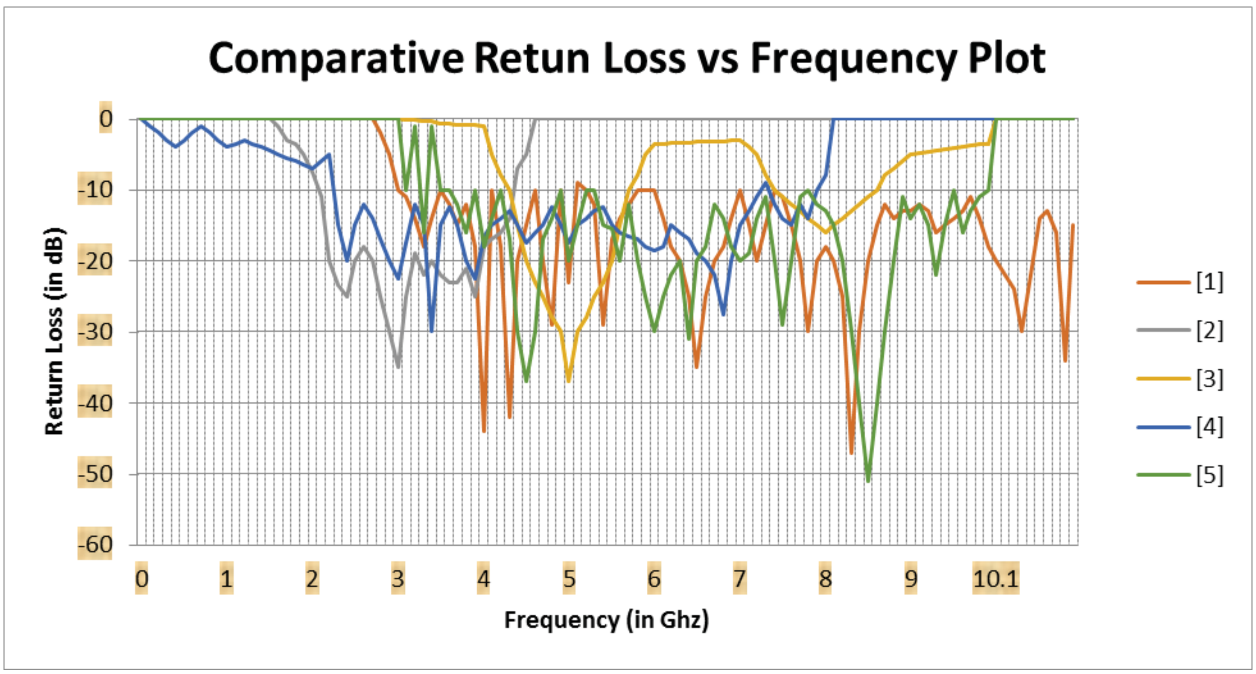


Fig. 11. Illustration of the antenna return loss and the PSD of the excitation.

The antenna is simulated by using the time- domain solver of CST-MWS. A modulated Gaussian pulse is applied to the antenna port [6]. The heartbeat has a wide bandwidth of 7 GHz for the power spectral density (PSD) of 10 dB. Fig.11 shows the PSD of the applied pulse.

Antenna parameter	Miniaturized UWB Log-periodic Square Fractal Antenna.	Low-Return-Loss Printed Log-Periodic Dipole Antenna	A Printed LPDA Fed by a coplanar waveguide for Broadband application	Multilayer Microstrip Log-Periodic dipole antenna for C and X band communication	Impulse radiating Log-Periodic dipole array antenna using Time-Reversal Technique
Year	2015	2014	2013	2013	2011
Author	Amrollah Amini	Antoine	G.A Casual et	Prateek	Ali Khaleghi

	et al.	Chauloux et al.	al.	Wankhade et al.	et al.
publication	IEEE	IEEE	IEEE	Elixir	IEEE
dielectric	Rogers RO4003	NX9300	ARLON AD450	FR4	RT/Duriod 5880
software	-	CST	CST	IE3D	CST
Feeding method	-	Coaxial /differential feeding	Coaxial Feeding	Aperture Couple feeding	-
Return loss	-45db	-35 db	-30 db	-29.16 db	-51db
Operating frequency	2 – 11 GHz	1.5 – 4.5 GHz	3 - 6 GHz	1 – 10 GHz	3 – 10 GHz
Usable frequency	3.1 to 10.6 GHz	2 – 4 GHz	2.4 – 5.5 GHz	4.3-8.5 GHz	4.5 - 8.3 GHz
bandwidth	7.5 GHz	2.6 to 4 GHz	33%	33%	-



III. CONCLUSION

The study motivation for this paper used to be miniaturization of Log-Periodic Microstrip Antenna utilizing quarter-wavelength transmission line. We selected this antenna when you consider that of its benefits in terms of low profile, cost, ease of fabrication, light weight and its advantage for conformal installations. A proximity coupling method used to be used to feed the radiating square patches. Two substrates with unique quarter-wavelength transmission line cognizance was offered and designed to cut down the scale of the LPMA.

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