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Study on diamond antenna for ultra wideband technology

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Abstract
In this Study, a little monopole radio wire with jewel state of the fix (30×26 mm²) printed microstrip took care of monopole reception apparatus has been planned, a few boundaries like return misfortune (S11), Voltage Standing Wave Ratio (VSWR), radiation design has been performed to test the legitimacy of reproduction and confirm qualification of the recieving wire for the remote correspondences reason. Late investigations of UWB reception apparatus structures are uncommonly focused on microstrip, opening and planar monopole radio wires. In this paper Antennas are popular for different UWB applications, for example, remote interchanges, clinical imaging, radar and indoor situating. This is because of its capacity to empower high information transmission rate and low force utilization.

Keywords: Diamond Antenna and Ultra Wideband Technology

Introduction
Microstrip fix reception apparatus is regularly utilized in UWB recieving wire plans because of its preferences, for example, lightweight, simplicity of reconciliation, little size and conservative [5]. Numerous UWB microstrip fix reception apparatuses have been examined in the writing to accomplish the necessity for various applications, one of which to expand the transfer speed. Since microstrip fix radio wires innately have limited data transfer capacity trademark, there have been various procedures produced for data transmission upgrade to accomplish the UWB qualities [6]. These reception apparatuses have been examined in the writing, for example, Squarering opening recieving wire, double band opened radio wire, and double band indented reception apparatus. Different strategies utilized to expand the transmission capacity of radio wires incorporate wandered ground plane, opening stacking and fractal reception apparatus.
In this paper, the reception apparatus is imprinted on microstrip substrate with a precious stone state of the fix, which works in the scope of 3.39 - 14 GHz, subsequently accomplishing the UWB transfer speed upgrade.

Antenna Geometry
Fig.1 shows the math of the proposed planar reception apparatus whose boundaries have been acquired utilizing financially accessible recreations programming CST Microwave Studio [7] and contrasted with IE3D programming [8]. This recieving wire is imprinted on FR4 Rogers substrate with thickness 1.6 mm and size 30 x 26 mm² and the reception apparatus taking care of structure is 50 Ω microstrip line. A few methods have been received to gain enormous impedance data transfer capacity including a precious stone like three-sided transmitting patch with five stages of different sizes and a fractional ground plane. The feed line is signified by W_f.
The fix recieving wire structure is imprinted on one side of the FR4 substrate with the ground on the opposite side. The ground plane is meant by G and adjusted corner with rayon F as appeared in Figure 1. The actual structure of five stages with different measurements have been received to build the successful electrical length at the lower recurrence band (3-4 GHz).
The plan boundaries, for example, the fix shape, steps, the feed line width and state of halfway ground plane are improved to get the best return misfortune, S11 and impedance transmission capacity prior to deciding the best measurements for the proposed recieving wire. The components of the reception apparatus structure are as appeared in Table 1.

Table 1: The components of the reception apparatus structure

Parameters		*Dimensions* (mm)
PATCH ANTENNA	W	30
	L	26
	W_f	2.5
	R	4,5
	S	14
	Q	15
Ground plan	F	10
	G	9.5

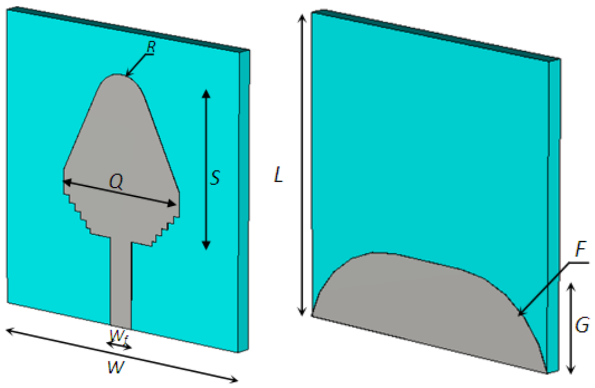

Fig 1: (a) - geometry of patch antenna (b) - ground plan

Results and Discussions

To verify the design and optimize antenna dimensions, numerical simulations have been used. Two numerical models of the antenna based on different computational methods have been built in order to cross-verify the results. The first model is based on the finite integrate technique (FIT) within the commercially available solver CST Microwave Studio. The results have been compared to the second model, which is based on mixed-potential form of the IE formulation in frequency domain. The metal parts as well as the dielectric substrates are modeled using surface integrals. The integral equations of the model are solved using Method of Moment (MoM) by the commercially available solver IE3D.

Return Loss, S11

Figure 2 illustrates the simulated return loss against frequency of the antenna. The results given by CST and IE3D agree with each other only with small deviations. The -10dB bandwidth given by CST is from 3.38 GHz up to 14 GHz while that given by IE3D is from 3.13 GHz to 14 GHz. The observed deviation is due to the different numerical modeling and meshing techniques. Nevertheless, the variations are within tolerance, so we could say both CST model and IE3D model gave us good estimation of the antenna performance.

The plots of the return loss (Fig. 2) of the antenna show that simulated impedance bandwidth is 10.62GHz (from 3.38 GHz to 14 GHz), which is equivalent to 122% (CST) and 10.87 GHz equivalent to 126% (IE3D),both band width are calculated by using relation (1).

$$BP\%2\times\frac{f_h - f_1}{f_h + f_1}\times 100 \quad (1)$$

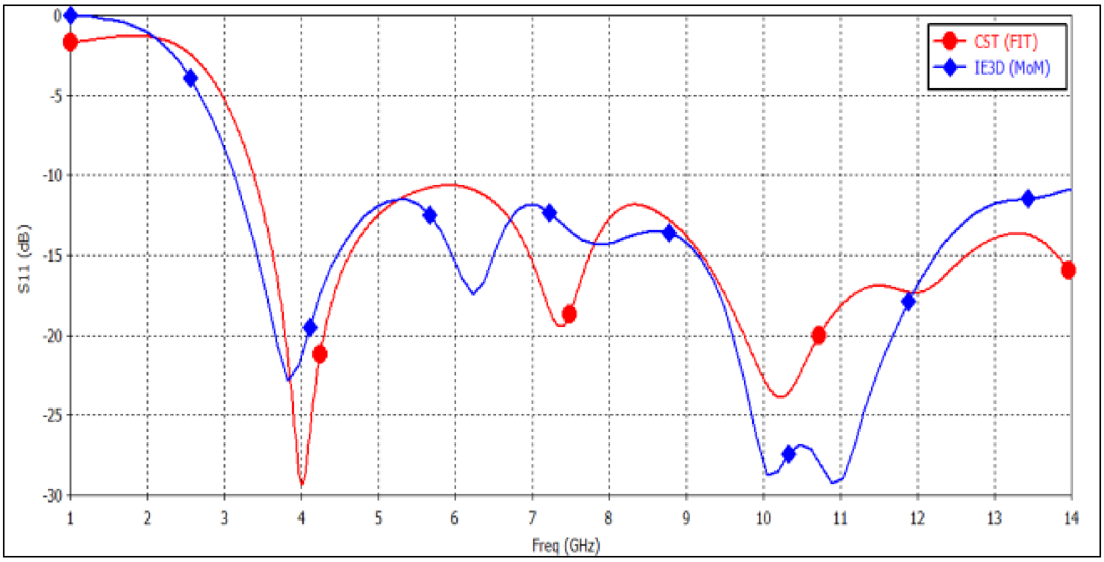

Fig 2: Comparison of the return loss simulated by IE3D and CST

Overall, this antenna exhibits good UWB characteristics in terms of impedance bandwidth and return.

Voltage Standing Wave Ratio (VSWR).

Figure 3 illustrates the simulated voltage standing wave ratio (VSWR) against frequency of the antenna. Based on the simulated result, the VSWR value ranges from 1 to 2 throughout the frequency range. Both results are validated because the same frequency regions do fall in S11 above – 10 dB as is shown in Figure 2.

Radiation Pattern

Figures 4 and 5 show two and three dimensional radiation patterns of the proposed antenna at different frequencies (3, 5, 7 and 10 GHz) which depict antenna's omnidirectional pattern over wide range of frequency.

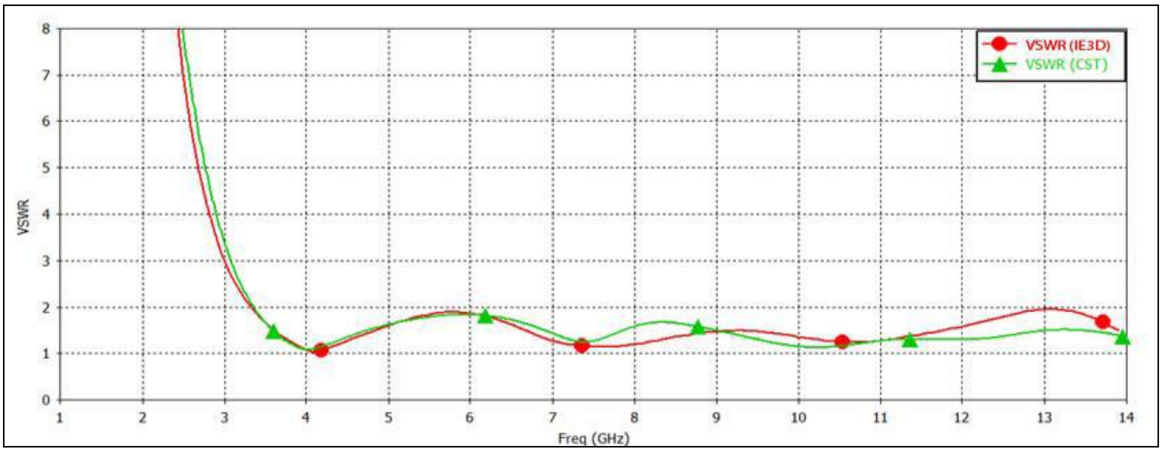

Fig 3: simulated results of voltage standing wave ratio (VSWR) against frequency by ie3d and CST (GHz)

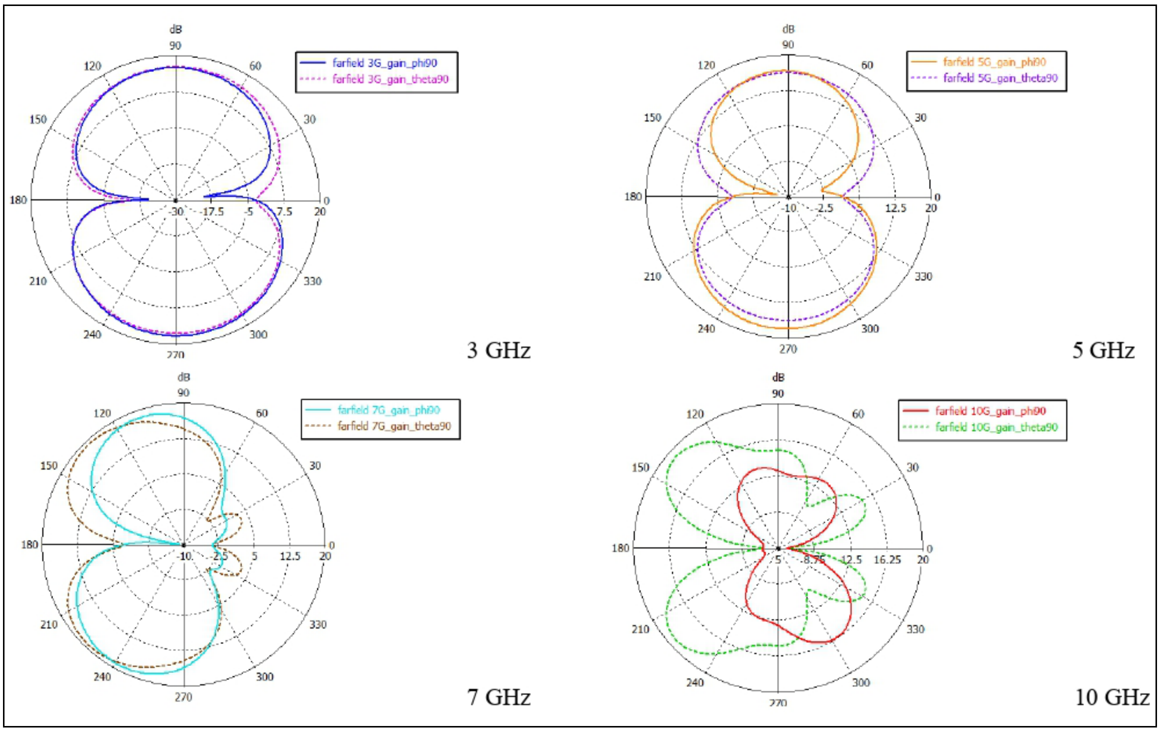

Fig 4: simulated two dimensional radiation patterns

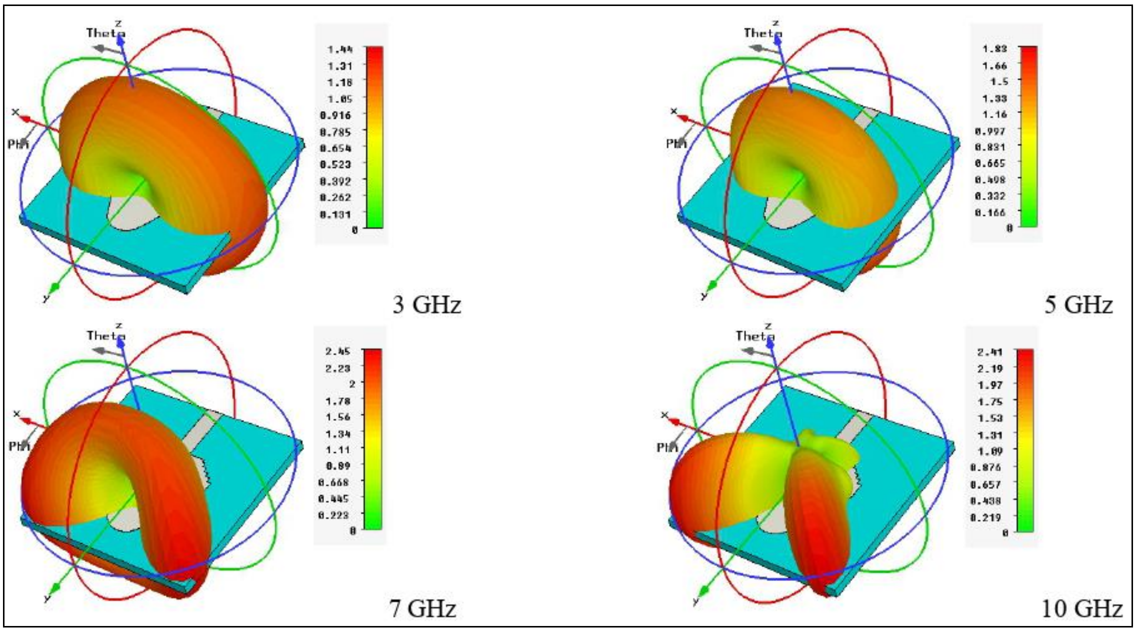

Fig 5: simulated three dimensional radiation patterns

Conclusions

The proposed reception apparatus shows great UWB qualities, with its recreated result working from 3.38 GHz to 14 GHz, having partial transmission capacity of over 122% reenacted with two unique solvers. The radio wire has effectively accomplished upgraded UWB transfer speed, in which UWB recurrence range covers the reach from 3.1 GHz to 10.6 GHz. Moreover, it consents to the VSWR range from 1 to 2 all through the impedance data transmission, though the radiation designs with stable radiation attributes. The proposed reception apparatus, with great UWB qualities and mathematically little nature, is reasonable for remote correspondence frameworks.

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