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Low - Profile Tapered fed Polygon shape Fourport MIMO Antenna for Extended WidebandApplications

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Abstract

In this project, an extremely wideband, low-profile "Multiple-Input Multiple-Output" (MIMO) antenna has been investigated. The proposed antenna possesses four mutually orthogonal tapered fed polygon radiators for achieving a wide bandwidth. Proposed antenna has been designed on Rogers RT / Duroid5880 substrate material having dielectric constant of 2.2, loss tangent 0.009 within size of 30mm x 30mm.The antenna exhibits an extremely wide frequency bandwidth covering 5.3 to 120 GHz with one notch 7.96 to 9.77GHz and offers fractional bandwidth (FBW) of 183.05%.Additionally, Envelope Correlation Coefficient (ECC < 0.002), Diversity gain (DG ~ 10dB), Total Active Reflection Coefficient (TARC < 0.3), Channel Capacity Loss (CCL < 0.2) and -5dB < MEG < -7dB are analyzed for obtaining the high isolation between radiating elements. The proposed antenna is designed and simulated by using the HFSS software.

Keywords

Tapered fed, MIMO antenna, Extreme wide band, FBW, ECC, HFSS.

1. INTRODUCTION

A dramatic increase in data rates is mandatory by the new generation wireless systems, which rise to challenges of the communication systems industry .In advanced wireless communications, extremely wideband antennas have gained rising popularity because of their low manufacturing cost, high data rate, convenient design, and provision of wide-range of resonance frequencies. The ultra-wideband (UWB) and super wideband (SWB) planar monopole antennas are good candidates for both long and short-range communication. To overcome the common disadvantage of multipath fading and to utilize the advantage of diversity of pattern, Multiple-Input-Multiple-Output (MIMO) technology had been proposed. Later, it was combined with ultra-wideband (UWB) technology to achieve the advantageous features of both. The MIMO technology, however, suffers from the serious disadvantage due to the mutual coupling effect between the different radiating structures located in vicinity.

2. LITERATURE SURVEY

Among the apprehensions for this area, we have the micro strip antennas which are essential elements to ensure the emission or reception of electromagnetic waves present in wireless communication systems [1].Also, future 5G wireless communication networks will likely use millimeter wave frequency bands [2] namely 28 GHz, 38 GHz, 60 GHz, and 70 GHz. For guaranteeing effective coverage in mm wave communication systems, the distributed antenna systems and cooperative multi-hop relaying with designing of antenna arrays have been presented in [3].For example, 4G generation failed to tackle the main communication problems such as of flexibility, crowded users, low quality and unreliable connection [4].The Structure of the proposed antenna in [5] was a spiral with two arms, each arm responsible for a different resonant frequency. According to feasibility reports, mm wave spectrum is a promising candidate for 5G services providing high-data rates and low latency over the entire band [6].Several frequency bands have been allotted for 5G standards including 28 and 38 GHz as most prominent (O2 band) and 164–200 GHz (H2O band) as unlicensed spectrum [7,8].

3. DESIGN EQUATIONS

$$W = \frac{c}{2f_r\sqrt{\frac{\varepsilon_r+1}{2}}}$$

……(1)

$$\varepsilon_{reff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left[1+12\frac{h}{W}\right]^{-\frac{1}{2}}$$

……(2)

$$\Delta L = 0.412h\frac{(\varepsilon_{reff}+0.3)(\frac{W}{h}+0.264)}{(\varepsilon_{reff}-0.258)(\frac{W}{h}+0.8)}$$

……(3)

$$L_{eff} = \frac{c}{2f_r\sqrt{\varepsilon_{reff}}}$$

……(4)

$$A = 2\pi\frac{Z_o}{Z_f}\sqrt{\frac{\varepsilon_r+1}{2}} + \frac{\varepsilon_r-1}{\varepsilon_r+1}(0.23+\frac{0.11}{\varepsilon_r})$$

……(5)

Wg=6*h+W…….(6)

Lg=6*h+L ……(7)

4. PROPOSED SYSTEM

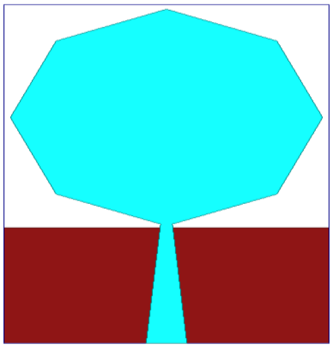


Fig: 1 Tapered fed polygon shape patch antenna.

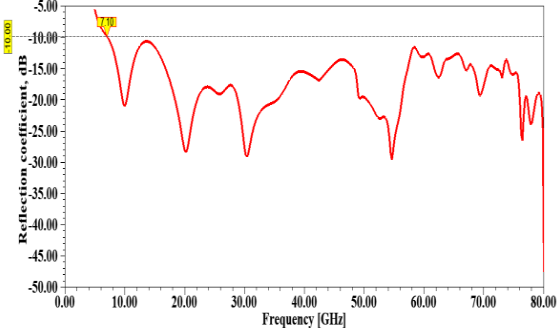


Fig:2 Reflection coefficient characteristics of tapered fed polygon patch antenna.

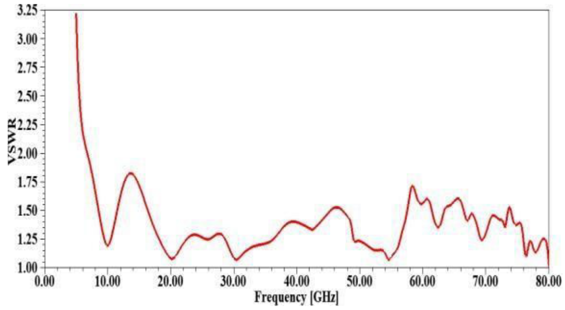


Fig:3 VSWR characteristics of tapered fed polygon patch antenna.

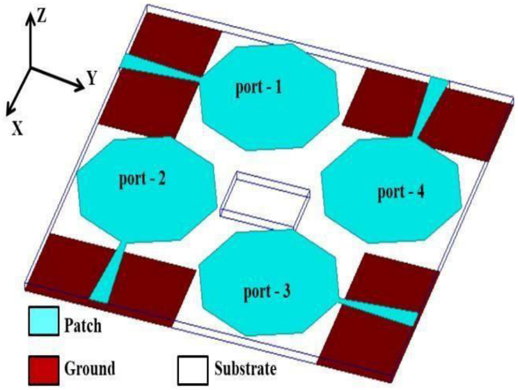


Fig: 4 3D view.

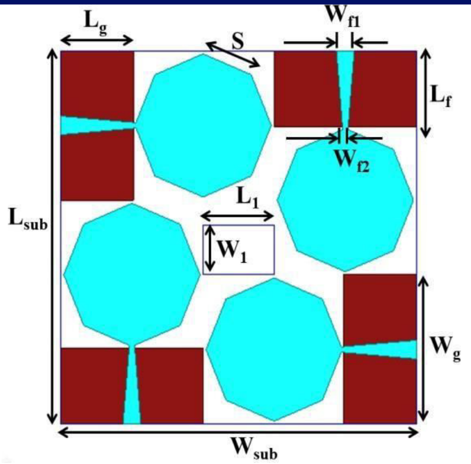
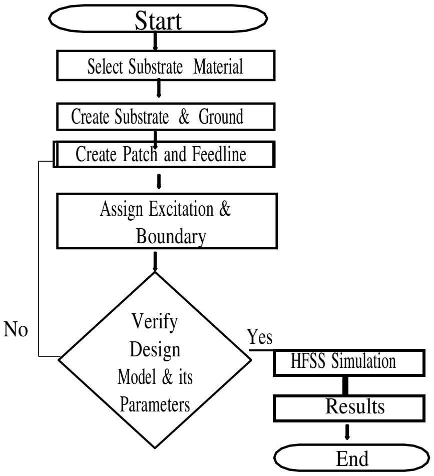


Fig: 5 Geometrical view.

5. WORKFLOW DIAGRAM



6. RESULT ANALYSIS

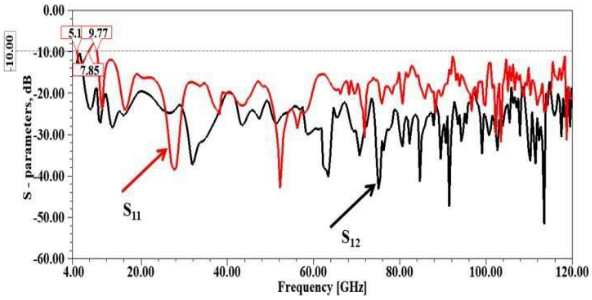


Fig: 6 S – parameters of the proposed MIMO antenna design.

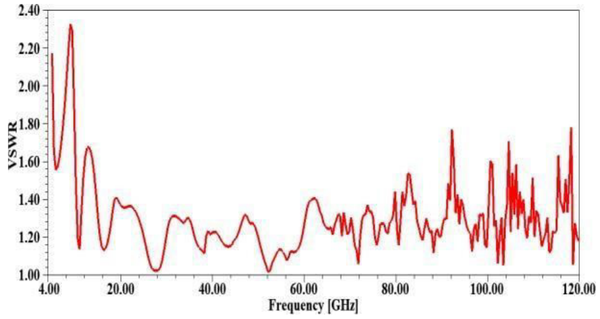


Fig: 7 VSWR characteristics of the proposed MIMO antenna design.

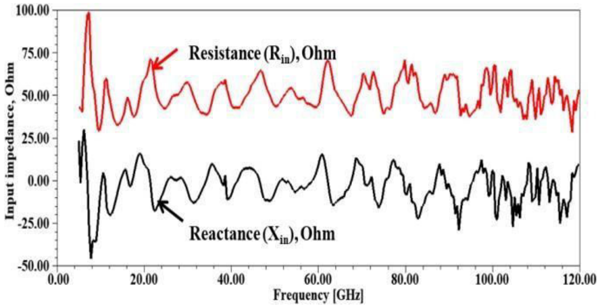


Fig: 8 Input impedance characteristics of the proposed MIMO antenna design.

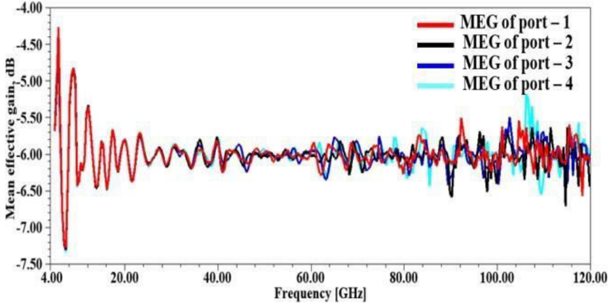


Fig: 9 Simulated Mean effective gain characteristics of four element MIMO configuration.

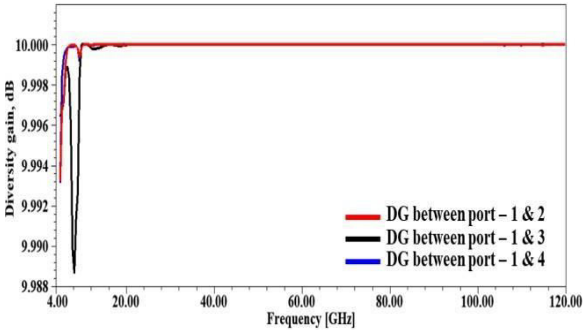


Fig: 10 Simulated diversity gain plot of four element MIMO configuration.

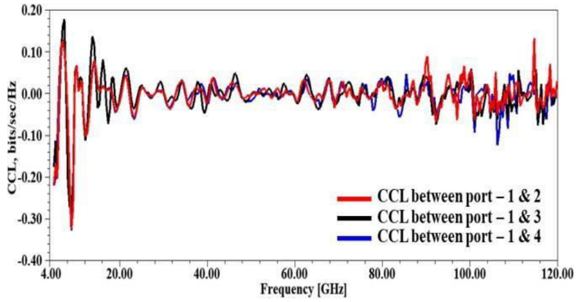


Fig: 11 Simulated channel capacity loss plot of 4 - element MIMO configuration.

7. CONCLUSION

A Four – port MIMO antenna design has been presented for extreme wide band (EWB) applications. The presented design has been described that the use of a polygon structure with a tapered feed line tends to achieve enhanced impedance bandwidth. Therefore, from simulation results, it has been noted that the proposed antenna offers an impedance bandwidth of 114.69GHz from 5.31 to 120GHz with a ratio bandwidth of 22.598:1 and FBW of 183.05%.Furthermore, the designed antenna exhibits good radiation characteristics and offers acceptable gain and efficiency for the entire operating bandwidth.

REFERENCES

[1] Mak A, Rowell C and Murch R (2008) Isolation enhancment between two closely packed antennas. IEEE Transactions on Antennas and Propagation 56, 3411–3419.

[2] Li Z, Du Z, Takahashi M, Saito K and Ito K (2012) Reducing mutual coupling of MIMO antennas with parasitic elements for mobile terminals. IEEE Transactions on Antennas and Propagation 60, 473–481.

[3] Khan M, Capobianco A, Najam A, Shoaib I, Autizi E and Shafique M (2014) Compact ultra-wideband diversity antenna with a floating parasitic digitated decoupling structure. IET Microwaves, Antennas & Propagation 8, 747–753.

[4] Zhang S, Ying Z, Xiong J and He S (2009) Ultrawideband MIMO/ diversity antennas with a tree-like structure to enhance wideband isolation. IEEE Antennas and Wireless Propagation Letters 8, 1279– 1282.

[5] Ren J, Hu W, Yin Y and Fan R (2014) Compact printed MIMO antenna for UWB applications. IEEE Antennas and Wireless Propagation Letters 13, 1517–1520.

[6] Chacko B, Augustin G and Denidni T (2013) Uniplanar polarisation diversity antenna for ultra wideband systems. Microwaves, Antennas & Propagation 7, 854–857.

[7] Gao P, He S, Wei X, Xu Z, Wang N and Zheng Y (2014) Compact printed UWB diversity slot antenna with 5.5 GHz band-notched characteristics. IEEE Antennas and Wireless Propagation Letters 13, 376–379.

[8] Lee J, Kim K, Ryu H and Woo J (2012) A compact ultra wideband MIMO antenna with WLAN band-rejected operation for mobile devices. IEEE Antennas and Wireless Propagation Letters 11, 990–993.

[9] Toktas A (2017) G-shaped band-notched ultra-wideband MIMO antenna system for mobile terminals. IET Microwaves, Antennas & Propagation 11, 718–725.

[10] Li J, Chu Q, Li Z and Xia X (2013) Compact dual band-notched UWB MIMO antenna with high isolation. IEEE Transactions on Antennas and Propagation 61, 4759–4766.

[11] Liu L, Cheung S and Yuk T (2015) Compact MIMO antenna for portable UWB applications with band-notched characteristic. IEEE Transactions on Antennas and Propagation 63, 1917–1924.

[12] Cho YJ, Kim KH, Choi DH, Lee SS and Park SO (2006) A miniature UWB planar monopole antenna with 5.0 GHz band-rejection filter and the time-domain characteristics. IEEE Transactions on Antennas and Propagation 54, 1453–1460.

[13] Najam A, Duroc Y and Tedjini S (2012) Multiple-input multiple-output antennas for ultra wideband communications. IntechOpen 10, 209–236.