MULTI-BAND CDR SMART ANTENNA FOR 5G APPLICATION: MID-BAND (7 GHZ) EXTENSION AND VISION 2030

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Recently, a new analysis of the spectrum needs of 5G networks across low-, mid-, and high-bands has been released by Global System for Mobile Communication Association (GSMA) [1]. Actually, GSMA's recommendation is concerned with the extension of the existing spectrum or search for a new and adequate band for the business and consumer services demand, which is part of vision 2030. Mid bands for 5G applications are found in the range of 1 GHz to 7 GHz in which lower mid-bands and the upper mid-bands are in use for rural areas or deep-indoor coverage in cities. However, an extension of another 7 GHz of the 5G spectrum is needed, so that telecom operators can provide enhanced mobile broadband (eMBB) in a dense urban environment [2].

Nowadays, cylindrical di-electrical resonator antenna (CDRA) is becoming a reveling antenna at higher microwave frequencies [3, 4] due to its several features like high gain, low loss, compactness, and supportive feasibility with different radiating modes [5].

This paper investigates a multiband CDRA that supports the IOT based telecom environment more efficiently in 7 GHz to 8 GHz. It meets the all standard requirement as the GSMA suggested for the vision of the 5G spectrum for 2030. Figure-1 shows the geometry of the proposed antenna which is mounted over the FR-4 (ϵ_r=4.3; tanδ=0.025) substrate plate (60 mm × 6 mm × 2 mm).

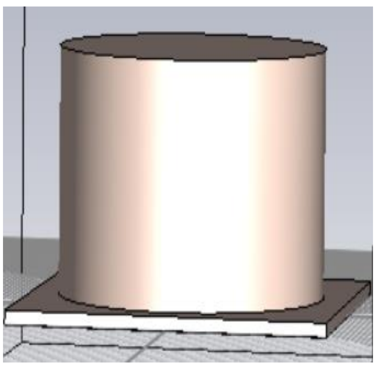

Figure 1. Proposed CDRA

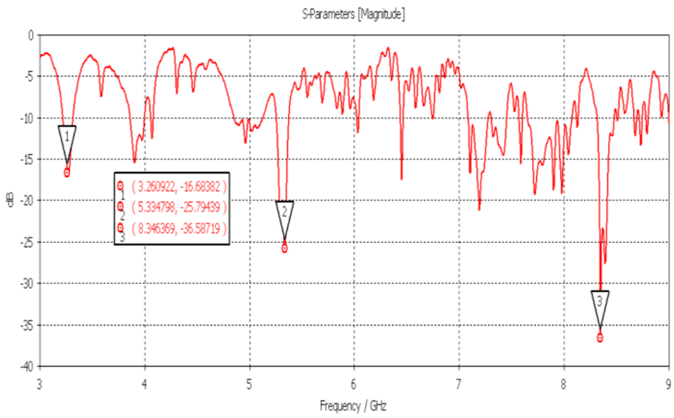

Figure 2. Return loss (S11) plot for proposed CDRA

An annealed copper based square patch (14 mm × 15 mm × 0.035 mm) is used to excite the CDRA which is sandwiched coaxially in between the substrate and CDRA. A microstrip line (23 mm × 2 mm × 0.035 mm) of 50 ohms has been etched on FR-4 to connect the exiting port to the square patch. Conventional ground plain is also made up of annealed copper. A cylindrical dielectric resonator (height=35 mm; radius=25 mm) of material Alumina (99.5%) having

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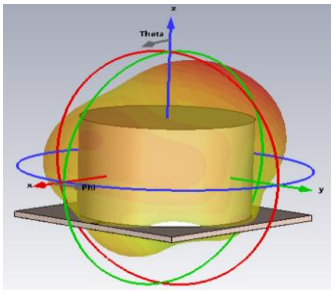
ϵ_r=9.9; tanδ=0.0001 is coaxially fixed on the top layer of the substrate by using an adhesive material.

Plotted graph of return loss (S11) as figure 2, reveals that the proposed antenna has multiband characteristics and can be supportive in traditional 5G (3.7 GHz to 4.2 GHz) services, high speed Wi-Fi (5 GHz band) too. But as a whole, it covers the entire range of 7.09 GHz to 8.08 GHz under the -10 dB return loss.



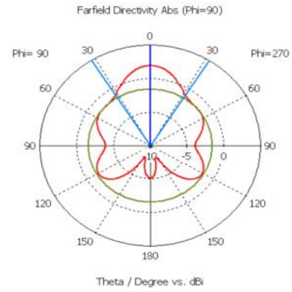
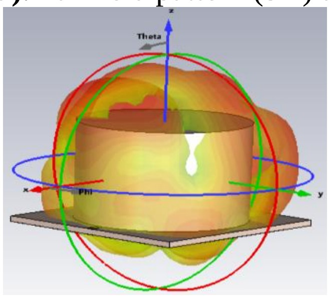


Figure 3(a). Far field pattern (3D) at 3.8 GHz **Figure 3(b).** Far field pattern (2D) at 3.8 GHz



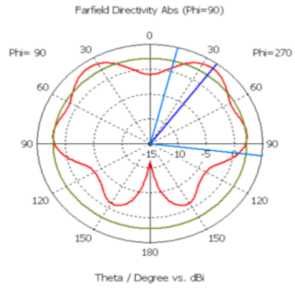


Figure 4(a). Far field pattern (3D) at 7.5 GHz **Figure 4(b)**. Far field pattern (2D) at 7.5 GHz

Simulated result for far field at 3.8 GHz and at 7.5 GHz has been depicted in figure-3 (a, b) and figure-4 (a, b) respectively shows a gain of 7.51dBi and 6.17dBi at both frequencies and above the antenna plane. Theoretically, antenna performance is highly acceptable if its far-field radiation pattern gives a high gain (practically it should be greater than 6 dBi) [6]. Rather than its gain, directivity and radiation efficiency within the 7 GHz extended spectrum is also well satisfied. Additionally, this antenna radiation in between 3.7 GHz to 4.2 GHz also meets the better presentation for LTE and CBRS [7] based mobile band.

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