shows better return loss (< -18 dB). The isolation among the ports (S_{11}, S_{31}, S_{51}, S_{71}) are greater than 20 dB. Isolation > 20 dB is also observed for other ports (S_{22}, S_{24}, S_{26}, S_{28}).

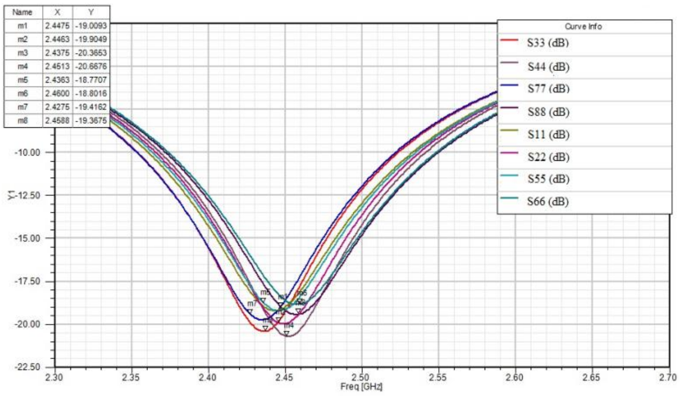

Figure 13. Simulated S –parameters (S_{11} to S_{88})

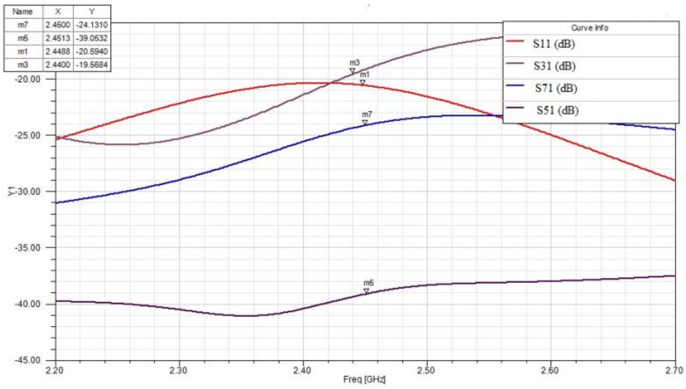

Figure 14. Simulated S –parameters (S_{11}, S_{31}, S_{51}, S_{71})

F. CONCLUSIONS

A printed pentagonal microstrip antenna is suitable for Massive MIMO BS antenna was presented. The five slits were optimized and using the suspended sudstarte, the antenna‘s gain (6.17 dB) and impedance bandwidth (171.9 MHz) is enhanced. The AR 1.78 (< 3 dB) with bandwidth of 135 MHz was achieved. The HFSS and experimental results are found to be in good agreement. The inter-element spacing of linear and planar antenna array for the Massive MIMO BS were optimized using systemVue. The 2 × 2 MIMO antenna exhibits return loss (< -18 dB) and greater isolation (> 20 dB).

G. Future Work

The Massive MIMO BS antenna will be developed by mounting 64 pentagonal microstrip elements (or 128 ports). Using the spatial and polarization diversity, correlation among the radiating elements can be minimized. These elements will be placed on each side of the octagonal shaped architecture. Each side consists of 8 elements (2 × 4 antenna array). The reason behind the octagonal shaped architecture for Massive MIMO BS is that, it uses space more efficiently. Also, this structure will be suitable for Smart antennas.

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