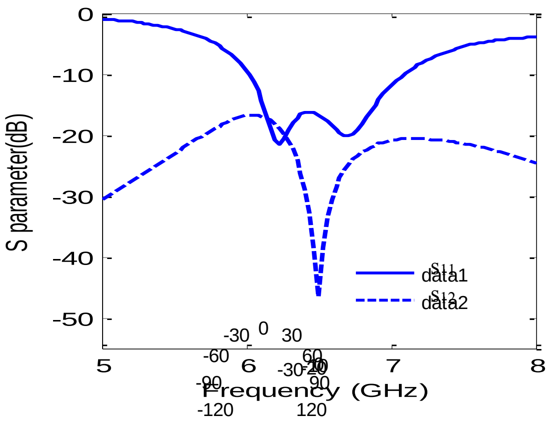
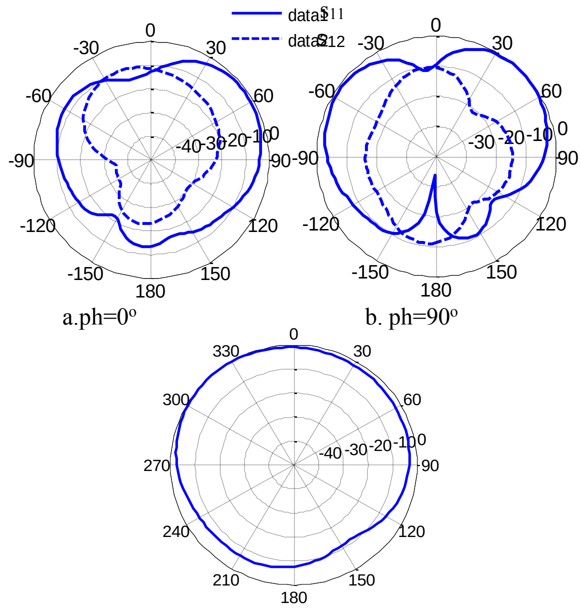



Figure 13: S-parameter simulation result of SDRA antenna array with Bucky parasitic element.



a.ph=0°

b. ph=90°

c.th=90°

Figure 14: Radiation pattern of two SDRA antennas

In case better improvement in isolation level is achieved due to the additional kinetic inductors and quantum capacitors that characterize the CNTs which in turn affects the frequency response [23]. Using CNT based materials results in a very little variation in the radiation patterns.

Finally, the results of our proposed structures are compared with some results found in the literature. Table1. Summarizes the results of the previous researchers as well as our results. The comparison ensures the effectiveness of our proposed design which presents a compact MIMO antenna system with high inter-element isolation that is desired for practical applications.

Table 1: Summary of some previous research results as well as our results

| reference | Structure | Isolation |
|---|---|---|
| [24] | (patristic)/ mushroom wall structure | 42dB |
| [25] | (parasitic)/ an array of split-ring resonator unit-cells | 30 to 47 dB |
| [26] | (parasitic) /Rectangular parasitic tape | 37.2 dB |
| [27] | H shaped DGS | 10 dB |
| [28] | Concentrated circular split ring resonator DGS | 27 to 33 dB |
| Our results | | |
| 1st structure | copper parasitic element | 35 dB |
| 2nd structure | DGS is composed of splitting a spiral slot | 37 dB |
| 3rd structure | CNTs parasitic element | 48 dB |

## 3. Conclusions

In this paper design and simulation of two SDRA for MIMO applications are presented. The mutual coupling reduction is achieved exploiting two different methods; the first method based on defecting the ground plane through etching a spiral shape in the ground and the second one based on inserting a resonant parasitic element between the two elements of MIMO array. The DG method resulted in an isolation of 18.4 dB, where the parasitic element method resulted in an isolation of 17.5 dB in case of copper and 29.5 dB in case of CNTs based-material. The impact of the two different methods of the SDRA characteristics is studied in each case.

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