DESIGN AND ANALYSIS OF LOW COST TRANSMISSION LINE PHASE SHIFTER

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Abstract--- This paper presents simple and low cost transmission line phase shifter. A Microstrip patch array antenna of 2X1 resonating at 2.6 GHz frequency with transmission line feeding is designed. Also the FR4 dielectric substrate of dielectric constant 4.4 and thickness 1.6 mm is used. Modification in transmission line feeding technique is done in order to achieve different phase shift values as compared to conventional path array antenna. The phase shifter is provided using different lengths of transmission line feeding. HFSS simulator tool is used to design the different lengths in transmission line to achieve different phase shift values.

Keywords: Phase shifter, Beam steering, Antenna array, Transmission line feeding, HFSS

2. Proposed Transmission line phase Shifter

A array of 2 X 1 rectangular Microstrip patch antenna operating at 2.5 GHz frequency is designed using FR4 dielectric substrate having dielectric constant 4.4 and thickness of 1.6 mm. The optimized patch length and width are 36.5 mm and 27.5 mm respectively. The substrate length and width are 193 mm and 73.6 mm respectively. By providing small delay line for the length of transmission line feeding in 2 x 1 Microstrip antenna we obtained different phase shift values. A +20° phase shift is achieved by taking length of delay line 50.4 mm in right side as in Fig.1. similarly a -20° phase shift is achieved by taking length of delay line 46.4 mm in left side as in Fig.2.

Fig 1.microstrip patch array antenna with transmission line phase shifter of +20°
4. Conclusion

In this paper +20° & -20° phase shift is achieved using transmission line feeding technique which is low cost & simple. By varying the length of transmission line we observed phase shift as compared to conventional patch array antenna but there is no change in operating frequency & gain of the antenna. The proposed antenna system can be used in radar application, where beam steering is done.

3. Results

Fig.3 shows return loss plot for array antenna with +20° phase shifter structure, which operates at 2.6 GHz operating frequency. In Fig. 4. Red line indicates the +20° phase shift value as compared to conventional array antenna which is indicated in blue line. It also indicates that there is around 4.8297dB gain obtained for this proposed antenna.

Fig.5 shows return loss plot for array antenna with -20° phase shifter structure, which operates at 2.6 GHz operating frequency. In Fig. 6. Red line indicates the -20° phase shift value as compared to conventional array antenna which is indicated in blue line. It also indicates that there is around 5.0095dB gain obtained for this proposed antenna.
References


BIOGRAPHIES

A.S. Pradeep received the BE degree in Electronics and Communication Engineering from UBDT Engineering College, Davanagere, Karnataka and M.Tech degree in Electronics from Sir MVIT, Bangalore, Karnataka in 2003 and 2006 respectively. Currently he is pursuing Ph.D degree from Visvesvaraya Technological University, Belagavi, Karnataka. Currently he is working as an Assistant Professor in the Department of ECE at GEC, Hoovinahadagali, since 2010. His research interest include microwave and antenna design.

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