Beam Switching Antenna

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Abstract— In this paper is showing about Beam Switching Antenna that able to shift the antenna direction by using four microstrip antenna and aluminum. The antenna is using FR-4 and the saiz is 40 mm × 78 mm. By using aluminum it able increase the gain from 5.269 dB to 8.128 dB while the directivity is from 7.126 dBi to 11.09 dBi. With this antenna it able to control the direction of the radiation pattern up to four location.

1. INTRODUCTION

A beam-switching antenna consists of generating a multiplicity of juxtaposed beam (generated by an array) whose output may be switched to a receiver or a bank of receiver [1]. The addressed space is therefore served by a set of beam that may be switched on or off according to an algorithm that is able to sense the desired direction of transmission or reception beam switching antennas may, in some case [1]. Be cheaper than an equivalents phased array at millimeter wave communications, particularly when few beams are needed. It deploys fixed set of relatively narrow azimuthal beam [1].

A technique that able to switch the beam of the signal of an antenna with durable material that able make the signal stronger. The reason for switching the signal for the place that unwanted for signal is to reduce energy that did not used. It also able use as for security reason that for switch the location that only authorize people in the longing place of the area.

With using aluminum it able support four antenna in different direction and it also able to increase the gain by 64% and increase dielectric by 64.25%. The compounds of greatest importance are aluminum oxide, the sulfate, and the soluble sulfate with potassium (alum) [3]. The oxide, alumina, occurs naturally as ruby (al_2o_3), sapphire, corundum, and emery, and is used in glassmaking and refractories. Synthetic ruby and sapphire are used in lasers for producing coherent light [3].

2. ANTENNA DESIGN

The Figure 1 is show the front view of a microstrip antenna that able to generate 2.45 GHz frequency with the gain of 5.269 dB and the directivity is 11.09 dBi. The saiz of the antenna is 60 × 80 mm. This antenna is using FR-4 material. FR-4 is a grade designation assigned to glass-reinforced epoxy laminate sheets, tubes, rods and printed circuit boards (PCB). FR-4 is a composite material composed of woven fiberglass that flame retardant, chemical resistance and water absorption [2].

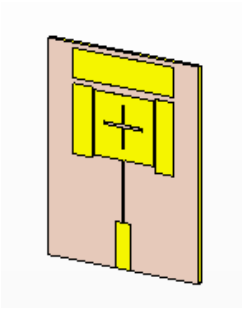

Figure 1: Front view of the anatenna.

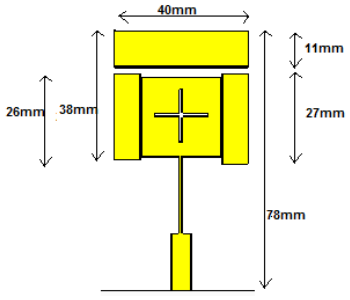

Figure 2: Dimension of the antenna.

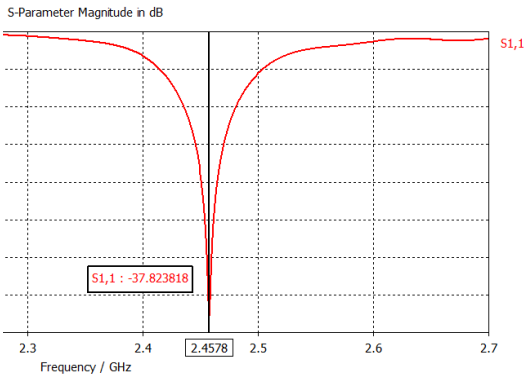

Figure 3: S-parameters.

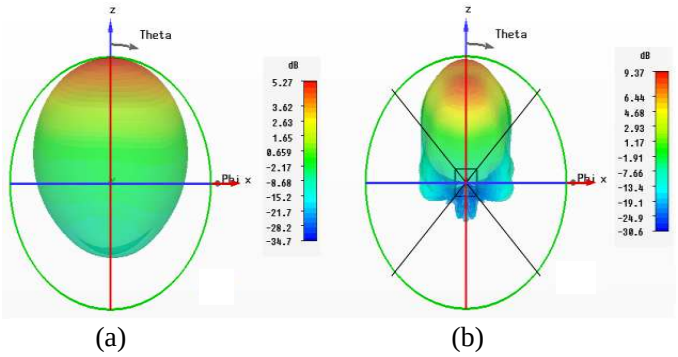

Figure 4: (a) Antenna without alumnium plate, (b) antenna with alumnium plate.

3. RESULT AND DISSCUSSION

The dimension in terms of width of the antenna is 40 mm while the length of the antenna is 78 mm and the height of the FR-4 material is 1.635 mm. The upper site of the antenna is 40 mm in width and 11 mm in height. The both site of the antenna is different saiz and on the right is a bit larger. On the left is 7.5 mm (Width) × 26 mm (height) while on the right site is 7.5 mm (Width) × 27 mm (height).

Figure 3 shows that the S-parameter magnitude of the antenna that have been simulate and it show that the frequency is at 2.4578 GHz and the $S_{1,1}$ is −37.823818.

Figure 4 shows two different type of antenna that the different is with and without aluminum plate. From Figure 4(a) it shows that the antenna is without aluminum plate while Figure 4(b) is with aluminum plate and the two black line that across in the middle of the picture is the location of the aluminum.

The antenna on the right it show that the farfield is much higher than the left side and the radiation pattern also show antenna with aluminum plate is much sharp compare with the antenna on the left without aluminum plate this is because the aluminum play important role it not only act as the antenna holder and also make the antenna gain and dielectric stronger.

4. CONTROLLER PART

The HMC241QS16 & HMC241QS16E are general purpose low-cost non-reflective SP4T switches in 16-lead QSOP packages. Covering DC — 3.5 GHz, this switch offers high isolation and has a low insertion loss of 0.5 dB at 2 GHz. The switch offers a single positive bias and true TTL/CMOS compatibility [3]. A 2 : 4 decoder is integrated on the switch requiring only 2 control lines and a positive bias to select each path, replacing 8 control lines normally required by GaAs SP4T switches [3].

From Figure 5 shows that the IC model HMC241QS16 can be used to control all the four antennas. RF 1, 2, 3, and 4 are connect to the each of SMA connector that been solder to the

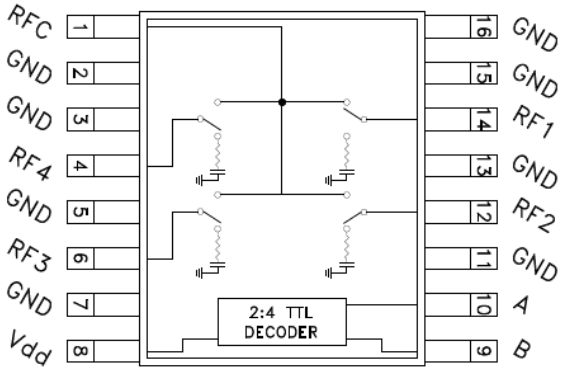

Figure 5: Function diagram.

Table 1: Truth table for HMC241QS16.

Control Input		Signal path State
A	B	RF com to:
Low	Low	RF 1
High	Low	RF 2
Low	High	RF 3
High	High	RF 4

patch antenna respectively. The FRC in pin 1 is the input signal that from the AP (Access Point) while Pin 9 and 10 are decoders that use to select which antenna that need to function [3].

From Table 1 it shows that the controller that used to control which direction of antenna that wanted. As can see from the Control input there have Input A (Pin 10) and Input B, (Pin 9) that able to control the direction of the signal of the antenna by using two switches it able to bring the signal that input from pin1 (RFC) and to Pin 14 (FR1), Pin 12 (FR2), Pin 6 (RF3) and Pin 4 (RF4) [3].

By using the switch is easy to control and can use several of electronic devices such as PLC, Microcontroller and much more to control the antenna direction.

5. CONCLUSION

This project can be implement in to various kind of place such as library, office, home and much more. With using 2.45 GHz frequency it not only suitable with Wi-Fi and also Bluetooth, video devices and much more device because 2.45 GHz in Industrial, Scientific and Medical (ISM) radio bands this is a free frequency. By changing different type of antenna it able to produce different frequency and by using same technic it able to use several of product such as for GSM used and military used.

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4. http://periodic.lanl.gov/13.shtml.