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UB LOGO-SHAPED ULTRA-WIDEBAND MICROSTRIP ANTENNA

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ABSTRACT

We proposed an UB Logo-Shaped microstrip antenna for Ultra Wideband Frequency (UWB) applications. The antenna is fabricated using FR-4 Epoxy material with dielectric constant (ε_r) of 4.4 with the thickness of the material is 1 mm. From simulations and measurements,t he antenna performances results VSWR less than 2 at frequency range 2.2 GHz to 10.8 GHz and has circular polarization in several frequencies range.

Keyword: ultra-wideband antenna, UB icon, microstrip.

INTRODUCTION

In this decade, wireless telecommunications technology is rapidly growing. This technology cannot be separated from the antenna as an important element of the application of Radio Frequency (RF). By using the technology of radio frequency (RF), the network transmits and receives data over the air so as to minimize the use of connection cables.

The Ultra Wideband Frequency (UWB) technology could be used to fulfill all the development of wireless technologies. UWB is a short range communication system having a wide bandwidth. System can be categorized as an ultra wideband communication if the bandwidth is greater than 500 MHz [1].

This experiment attempted to produce a UWB microstrip antenna with shape of design is University of Brawijaya logo "Join UB be The Best" (see Figure-2). The material of the antenna was FR4 substrate for achieving operating frequency of 1000 to 2700 MHz that has bandwith greather than 500 MHz.

DESIGN AND RESULT

Design concept

Microstrip antenna has a small size and and usually square, triangle, and circle shaped.

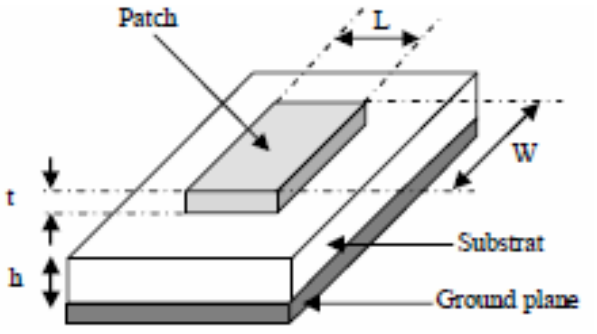

Figure-1. Microstrip Antenna Structure [1].

Figure-1 shows the structure of a microstrip antenna. In general, the microstrip antenna consists of 3 parts: the patch, the substrate, and the ground plane. Patch is located on top of the substrate, while the ground plane is located at the bottom. Patch is made very thin and has a variety of shapes. The shape of patch of microstrip antenna is usually made with rectangular shape, triangle, and circle. Associated with Figure-1, sizes W and L parameters vary and depend on the patch design, while t parameter is 0.01 mm. On the substrate, size of h parameter is 0.8 mm. Thickness of ground plane is equal with patch.

The shape of the antenna design in this experiment was inspired by the logo of our university which has a motto "Join UB, be The Best". Figure-2 shows a logo of one of the universities in Indonesia. This logo has a unique shape with three wings surrounding a circle. Figure-3 shows a patch design of UWB microstrip antenna inspired by the logo. Figure-4 shows a ground plane design of antenna. The shape of ground plane is rectangle. Related to Figure-3, the dimensions of antenna are given in Table-1. The substrate size is 40 × 50 mm^2. Overall size of antenna is same with the substrate size.

Figure-2. The Basic model of antenna patch design. [4].

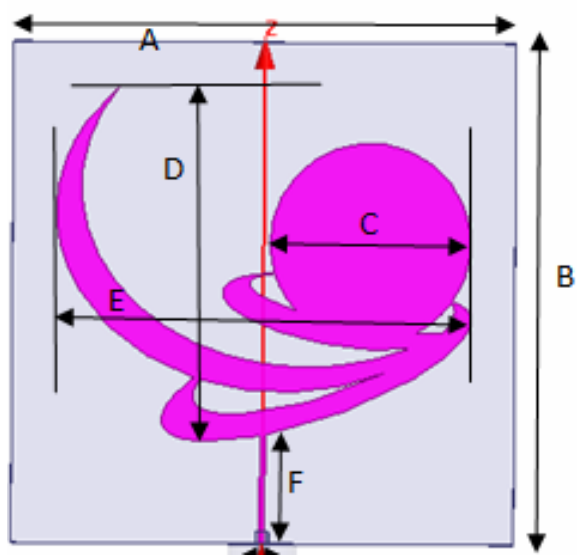

Figure-3. Patch antenna design; front view.

Table-1. Dimensions of antenna.

No.	Parameters on Figure-3	**Size** (mm)
1	A	40
2	B	50
3	C	9.5
4	D	30.6
5	E	34.5
6	F	7.65

The antenna is fabricated using FR-4 Epoxy material with dielectric constant (ε_r) of 4.4 with the thickness of the material is 1 mm.

RESULT

Voltage standing wave ratio (VSWR)

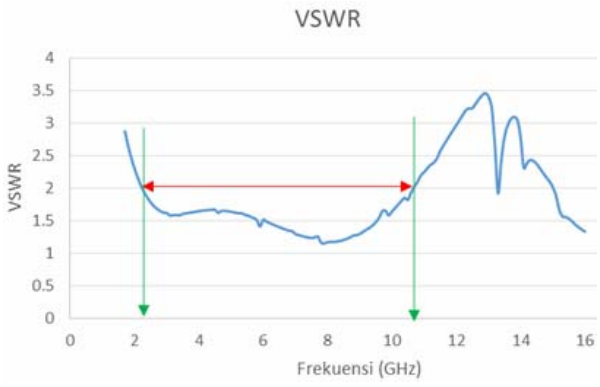

Figure-4. VSWR.

From obtained VSWR in Figure-4, the antenna can work at frequency of 2.2 GHz to 10.8 GHz, which mentioned from the green line below the red line that obtains the VSWR level is less than 2.

From the frequency range that was mentioned, can be obtained as below:

The lowest frequency was 2.2 GHz,
The highest frequency was 10.8 GHz, and
The center frequency was 4.2 GHz.
Hence, can be obtained the bandwidth = 10.8 -2.2=8.6 GHz.

From the obtained frequency range, the antenna can be applied in several wireless technology applications; i.e. Wi-Fi in frequency of 2.4 GHz and Ultra-Wideband Communication in 3 to 10 GHz.

Axial ratio

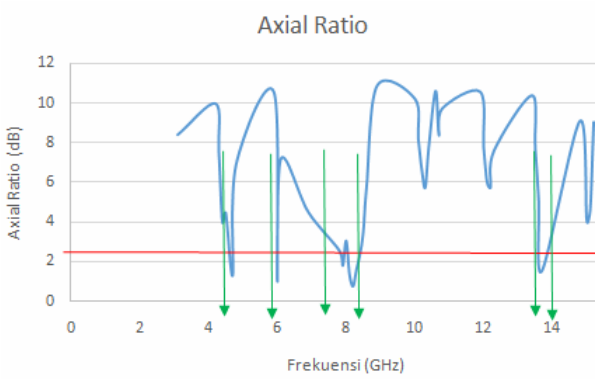

Figure-5. Axial ratio.

The axial ratio from Figure-5 obtains that the antenna has several of the polarization in each frequency range. In frequency points of 4.7 GHz, 6 GHz, and in frequency range from 7.8 GHz to 8.4 GHz, the antenna has circular polarization which obtained from the axial ratio level below 3 dB as mentioned in red line.

Gain

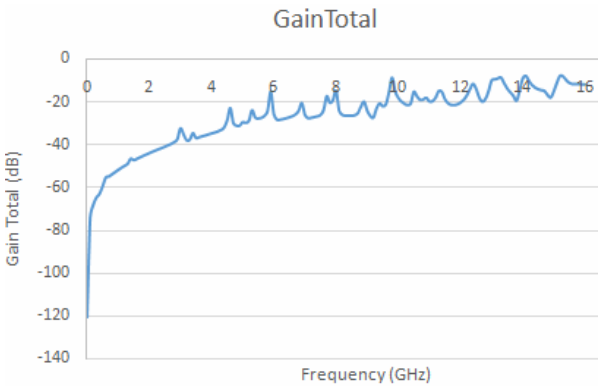

Figure-6. Antenna gain.

The antenna gain to designated direction is defined as 4π times the ratio of radiation intensity at designated direction with the received power by connected transmitter antenna [2]. As obtained from Figure-7, the antenna has average gain -26 dBi.

CONCLUSIONS

The antenna performance, as obtained from the result, had a VSWR less than 2 at frequency range 2.2 GHz to 10.8 GHz. At those frequencies, the antenna can be applied in several wireless technology applications, such as Wi-Fi in frequency of 2.4 GHz, and Ultra-Wideband Communication from FCC, at frequency range of 3 to 10 GHz. In several frequencies, the antenna can be circularly polarized, based from the axial ration level which has below 3 dB. The antenna gain is the disadvantage, because the gain level does not reach greater than 0 dBi, which means the antenna cannot be used for far range applications.

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