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ECTI-CON 2011

KHON KAEN UNIVERSITY

8th Electrical Engineering/ Electronics, Computer, Telecommunications and Information Technology (ECTI) Association, Thailand - Conference 2011

Khon Kaen, Thailand

May 17-19, 2011

Pullman Khon Kaen Raja Orchid Hotel

ECTI Association

KHON KAEN UNIVERSITY

IEEE THAILAND SESSION

Message from general chairman of ECTI-CON 2011

It is my great pleasure and privilege to welcome you to the 2011 Electrical Engineering, Electronics, Telecommunications and Information Technology Conference (ECTI-CON 2011). This conference aims to gather researchers to share information and bring old friends together. The venue is at the Pullman Raja Orchid, down town in Khon Kaen, and the conference date is May 17-19, 2011.

ECTI-CON 2011 is the eighth ECTI-CON, which started in 2004 at Pattaya. It makes a remarkable progress in the fields related to ECTI-CON that achieves the objective of this conference. This time, the conference is technical co-sponsored by IEEE Thailand Section and Faculty of Engineering, Khon Kaen University.

I appreciate Dr.Adisorn Tuantranont of National Electronics and Computer Technology Center, Prof.Jun-ichi Takada of Tokyo Institute of Technology, and Prof.K.R.Rao of University of Texas at Arlington for spending their time to give keynote addresses at the opening ceremony and during the conference.

We organize a special issue on ECTI-CON 2011. The authors are encouraged to extend the materials published in the proceedings for consideration for publishing in ECTI-EEC and ECTI-CIT Transactions.

The social events during the conference will be a reception party and a banquet on May 17 and 18, respectively. The best paper will be awarded in the banquet.

I would like to express my sincere appreciation to all the sponsors and all committee members including reviewers to make this conference success. Last but not least, I appreciate all the authors and speakers whom without them the conference might not be possible.

I look forward to seeing in Khon Kaen.

Monai Krairiksh
General Chair ECTI-CON 2011

Message from Dean of Faculty of Engineering Khon Kaen University

On behalf of the ECTI-CON 2011 organizing committee, we are very pleased to welcome you to Khon Kaen, Thailand for the eighth Electrical Engineering/ Electronics, Computer, Telecommunications and Information Technology (ECTI) Association (or ECTI-CON 2011).

This is the first time ECTI conference is held in Khon Kaen, and it is an honor for the Faculty of Engineering of Khon Kaen University to be the host and to have the opportunity to receive a large number of participants from many parts of the world. Khon Kaen is the commercial and political center of Northeastern Thailand. The city is well known for high quality silk, noteworthy Buddhist temples, dinosaur fossils, and delicious Isan food. We hope you enjoy your stay in Khon Kaen.

We would like to thank the technical program committee members, staff and reviewers for their diligent reviews of the submitted papers, the organizing committee members for their dedication and time preparing ECTI-CON 2011 and the authors, presenters and delegates for their contribution and participation. Also we are grateful to all distinguished keynote speakers: Prof.Dr.Jun-ichi Takada, Prof.Dr.K.R.Rao, and Dr.Adisorn Tuantranont as well as all session chairs.The success of the conference depends on the help of many people, and our thanks go to all of these people.

Welcome to ECTI-CON 2011 and the City of Khon Kaen. We hope that you enjoy both the technical program and the city of Khon Kaen.

Associate Professor Dr. Somnuk Theerakulpisut
Honorary Chair ECTI-CON 2011
Dean of the Faculty of Engineering, Khon Kaen University

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Increasing bandwidth of Flambeau-shape monopole antenna for UWB Application

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Abstract - This article presents the increasing bandwidth of a flambeau-shaped monopole antenna for UWB application. The prototype antenna has small size of about 38 x 45 mm^2 and fabricated on a simple FR-4 PCB with a CPW-fed structure. This antenna is supported UWB (Ultra-wideband) applications as required by the Federal Communications Commission (FCC) with the frequency range of about 3.1-10.6 GHz, covering of IEEE 802.15.3a and also IEEE 802.16a standards. The structural simulation technique was used to analyze the antenna characteristics, utilizing the commercial software Computer Simulation Technology (CST). The measured input impedance bandwidth (return loss < -10 dB) of the prototype antenna was 162.52% for the frequency range of about 2.49 - 24.09 GHz. The radiation patterns were bidirectional along the proposed frequency band.

Keywords: Increasing bandwidth, Flambeau-shaped, CPW-Fed, and UWB

I. INTRODUCTION

Presently, FCC standard required 3.1 - 10.6 GHz (Ultra-wideband: UWB) [1-3], a short distance form of communication that became popular. It possessed the wide bandwidth for the wireless communication on IEEE 802.15.3a and IEEE 802.16a standard [4-6]. Consequently, for those who used the UWB standard system had brought it to develop the devices that could be employed to various applications such as Ground Penetrating Radar (GPR), Near field detection, and Microwave radar system etc. The GPR was investigated objects under ground surface without damages. Systems enhanced the large amount of information transmitting and were also potential applications with high speed. The important part of the mentioned systems were their effectiveness in wideband operation that is antenna. That antenna had added more potential to use the systems. There fore, the antenna was designed to response to UWB. The antenna structure was designed with two-sided PCB. Previously, researcher [4-7] had antennas more tuning shapes and more complex structures with two-sided PCB design in order to match with the required impedance bandwidth. Therefore, it was designed by using Coplanar Waveguide: CPW technique. For the good point, there was no need to make the hole to connect the ground since the signal lead wire. The ground plane was on the same side and the matching of impedance could be done more easily. However, the previous antenna sizes were bulky with very thick structure [8-11] that was difficult to compose with the small devices. For this reason, in this paper, we had developed slots on the antenna structure to reduce the size and increase the bandwidth. In this work, we presented the flambeau-shaped monopole antenna by using the ground slotting technique [11]. The slotting technique increases the bandwidth to create over than 50 ohm of impedance sending through UBW. The antenna simulation by using CST program. Had been employed to adjust parameters for the best characteristic.

II. Structure and designing principles

A. Antenna Structure

The design of antenna structure [11] had been adapted to develop into new flambeau-shaped monopole antenna. It began with slot making technique [12-15] on both points of ground plane. The experimental method had employed CST program until getting the prototype of antenna as shown in figure 1. The antenna prototype was built on PCB type FR-4 with the length (L) at 45 mm. and width (W) 38 mm. The PCB had a constant dielectric value (ε_r) = 4.3 and the base material thickness (h) = 0.764 mm. Then, adjusting the size until getting the highest efficiency of antenna as shown in Table 1.

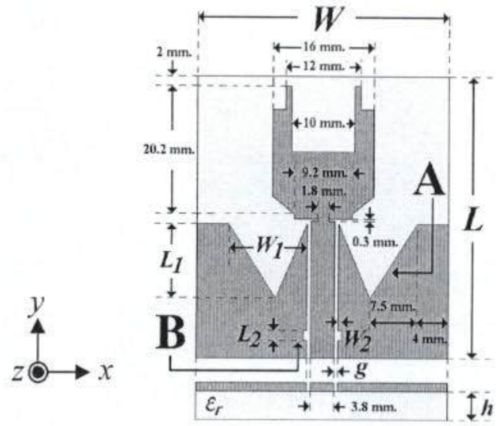

Figure 1 Prototype antenna structure.

Table 1 The parameters of prototype antenna.

Width (W)		Length (L)	
variations	size (mm.)	variations	size (mm.)
L	45	W	38
L_1	11	W_1	12
L_2	1.6	W_2	0.4
H	0.764	g	0.6

B. The result of simulation

The simulation technique by CST program was used to study important characteristics of the antenna such as return loss, radiation pattern and bandwidth. Then, the results of simulation would be examined to adjust the parameters of antenna. It was found that adjusting two parts of the antenna were gained best return loss responses. Firstly, the asymmetric ground slot both left and right at point (A), by adjusting W_1 at the constant value of $L_1 = 11$ mm, to reduce the return loss and wider bandwidth the lengths of W_1 of 3, 6, 9 and 12 mm as shown in figure 2. It was found that the appropriate value was $W_1 = 12$ mm which responded to the frequency from 2.98 - 17.41 GHz (141.53%).

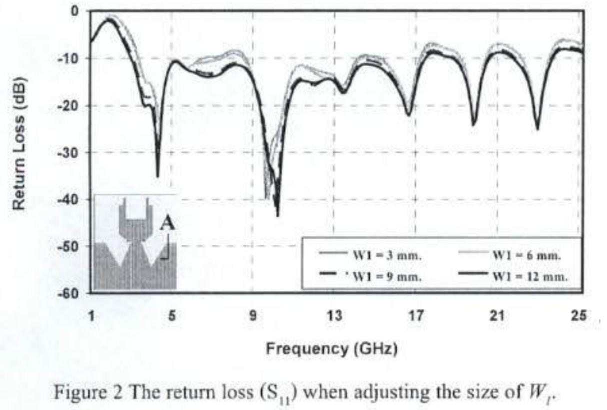

Figure 2 The return loss (S_{11}) when adjusting the size of W_1.

Second part was to make the slot of rectangular ground plane both on the left and right side at point (B). The changes of this result in return loss value and the bandwidth as shown in Figure 3. By adjusting the length of the stripe and get the best value of $W_2 = 0.4$ mm. Then, adjust the width of L_2 from 0.4, 0.8, 1.2 and 1.6 mm and found that the fitting value was $L_2 = 1.6$ mm. This yields the corresponding bandwidth of 155.90% (2.98 - 23.52 GHz) that made the return loss value reduce both in high and low frequency edges. The results in more bandwidth from the first adjustment (Figure 2) was about 29.74% as shown in Figure 3.

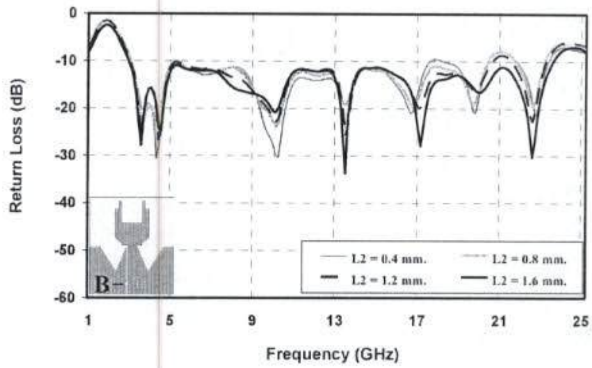

Figure 3 The return loss (S_{11}) when adjusting L_2.

III. Fabrication and measurement

The appropriate antenna parameters from simulation were shown in Figure 1 and table 1. After that, the outcomes were brought to create the real antenna as shown in Figure 4. For the part of return loss value and antenna's bandwidth measured results, it was found that both the simulation and measurement results tended to be in the same way which can be used with the frequency range from 2.49 GHz to 24.09 GHz as shown in Figure 5. The responding result of frequency range used in the form of Voltage Standing Wave Ratio (VSWR) was also presented.

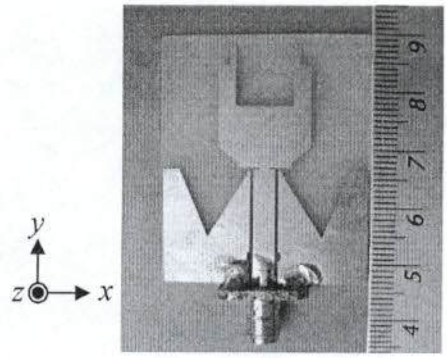

Figure 4 Prototype of flambeau-shaped monopole antenna.

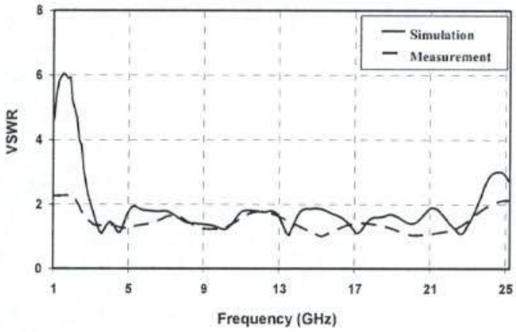

Figure 5 The comparison results of model simulation and measurement of the VSWR.

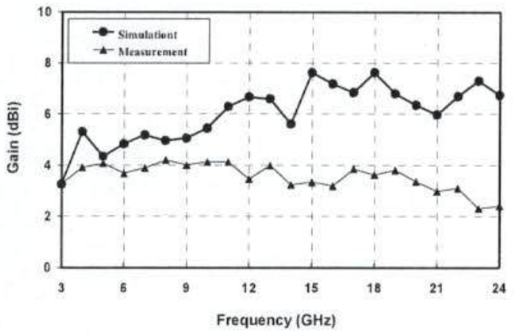

Figure 6 Gain comparison of the simulated results compared to the measured results.

Figure 6 shows the comparison of gain of antenna prototype from simulation and measurement. Starting with 3 GHz frequency of gain 3.26 dBi to the frequency of 24 GHz with gain of about 2.41 dBi.

The antenna directions were tested by using the methods of simulation and measurement to find the radiation pattern of the antenna. The comparison of the simulation and the measurement results at any range of frequencies were shown in figure 7-10. It was found that the antenna radiation pattern was bidirectional.

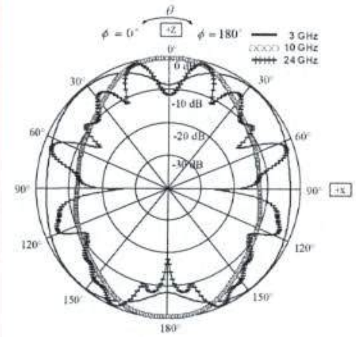

Figure 7 The simulation results of the radiation pattern at the frequencies of 3 GHz, 10 GHz and 24 GHz on E-plane.

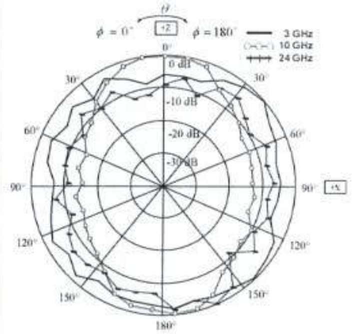

Figure 8 The measurement results of radiation pattern at the frequencies of 3 GHz, 10 GHz and 24 GHz on E-plane.

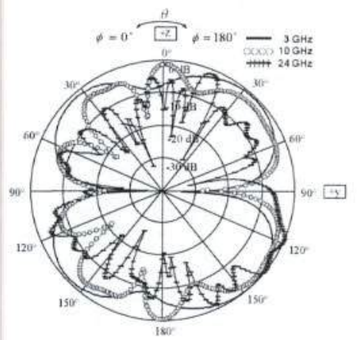

Figure 9 Radiation pattern simulations results at the frequencies of 3 GHz, 10 GHz and 24 GHz on H-plane.

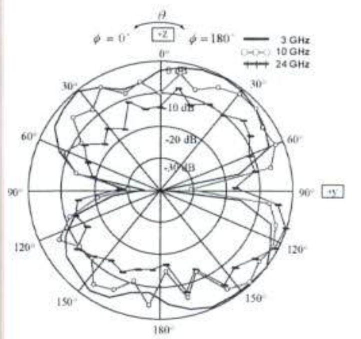

Figure 10 Radiation pattern measurements results at the frequencies of 3 GHz, 10 GHz and 24 GHz on H-plane.

IV. CONCLUSION

This article was presented the increasing of bandwidth in flambeau-shaped monopole antenna with the slot making on two points of ground plane. This was aimed to increase the UWB that can be used with the wireless communication on IEEE 802.15.3a, IEEE 802.16a and future development standards. The results of antenna simulation and measurement in responding to the frequencies were constantly conformed to the frequency used in 3.1 - 10.6 GHz and having VSWR less than 2. In addition, it was found to have 162.52% of bandwidth (2.49 - 24.09 GHz). The results gained from the average measurement through the operating band of 3.54 dBi was found as be able to reduce the size of former antenna. In the research [11], the antenna of size 40 x 50 mm^2 was reduced to 38 x 45 mm^2 and the antenna from this research had reduced in size about 14.5% with more bandwidth than the previous research about 55.55%.

V. ACKNOWLEDGMENT

I would like to express my grateful thank to Faculty of Technical Education, Rajamangala University of Technology Thanyaburi for the supporting of CST program.

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