2nd CALL FOR PAPERS

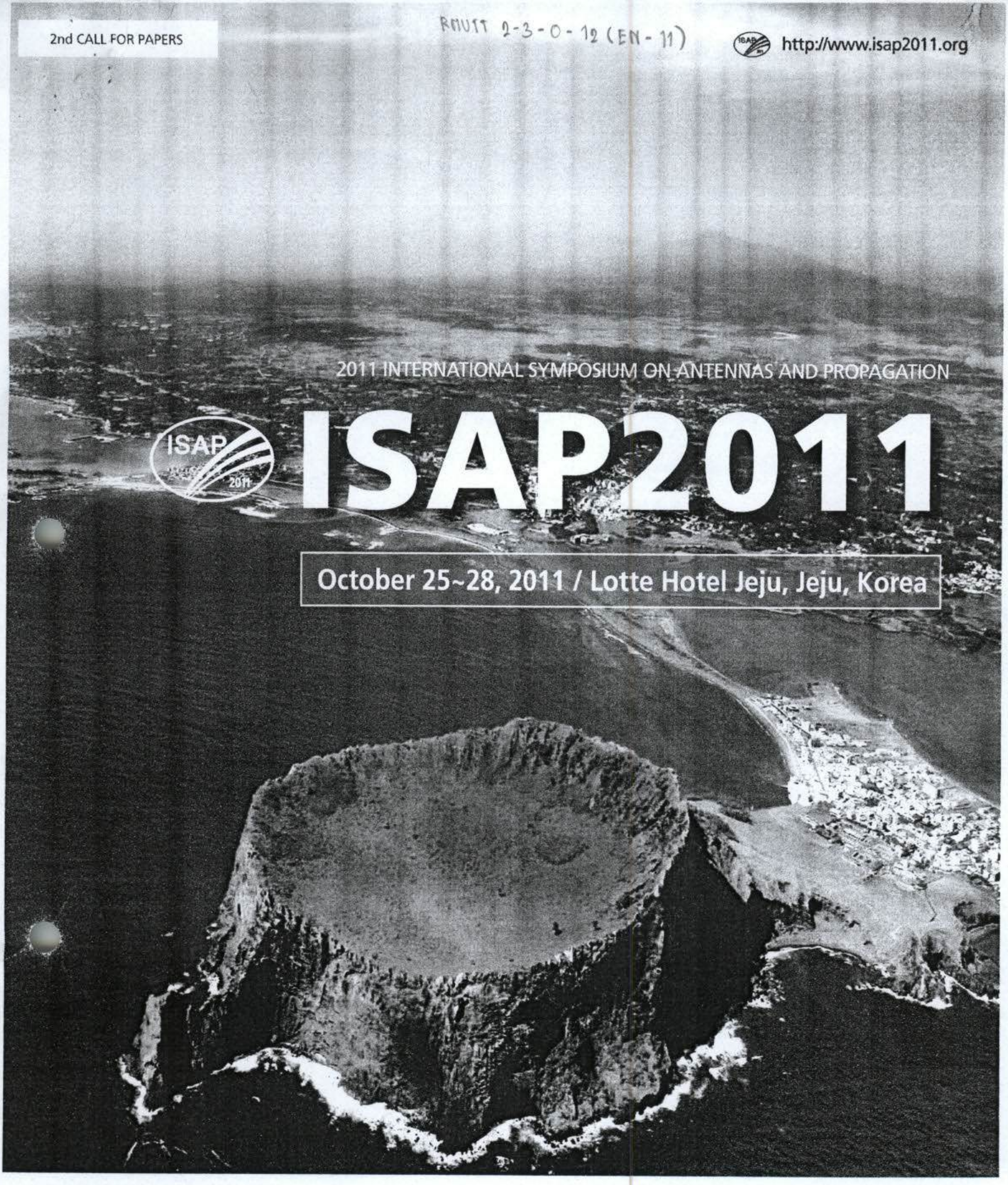


http://www.isap2011.org

2011 INTERNATIONAL SYMPOSIUM ON ANTENNAS AND PROPAGATION

# ISAP2011

October 25~28, 2011 / Lotte Hotel Jeju, Jeju, Korea



## Important Dates

- **Special Session Proposal Deadline** — **March 15, 2011**
- **Paper Submission Deadline** — **May 15, 2011**
- **Acceptance Notification** — **July 15, 2011**
- **Camera-Ready Manuscript Submission** — **August 15, 2011**
- **Advance Registration** — **August 15, 2011**

## Organized & Sponsored by

- Korean Institute of Electromagnetic Engineering and Science (KIEES)

## Co-Sponsored by

- Institute of Electronics, Information and Communication Engineers (IEICE)

## Technically Co-Sponsored by

- Antennas and Propagation Society of the Institute of Electrical and Electronics Engineers (IEEE/AP-S)
- Antennas Society of CIE (CIE-AS)
- International Union of Radio Science (URSI)

2011 INTERNATIONAL SYMPOSIUM ON ANTENNAS AND PROPAGATION

# ISAP2011

The 2011 International Symposium on Antennas and Propagation (ISAP2011) will be held at the Lotte Hotel Jeju, Korea, during October 25~28, 2011.The Jeju island is famous for several scenic masterpieces, three of which have been designated as World Heritages by UNESCO. This symposium is sponsored and organized by The Korean Institute of Electromagnetic Engineering and Science (KIEES) and cosponsored by the Communications Society of the Institute of Electronics, Information and Communication Engineers (IEICE). This symposium is held under the technical co-sponsorship of the Antennas and Propagation Society of the Institute of Electrical and Electronics Engineers (IEEE/AP-S) and is held in cooperation with the Antennas Society of CIE (CIE-AS) and the International Union of Radio Science (URSI).

## OBJECTIVE

ISAP2011 is intended to provide an international symposium for exchanging information on the progress of research and development in antennas, propagation, electromagnetic wave theory, and related fields, as shown in the scope. An important objective of this meeting is to promote mutual interaction among participants. In particular, a variety of sessions for cutting-edge/emerging technologies is included in the category E, which offers participants valuable opportunities to look around the trend of the future research in IT industry.

## SCOPE

This symposium will cover a wide range of topics on antennas, propagation, electromagnetic wave theory, and wireless application systems, as suggested below. Papers concerned with other related topics will also be considered.

### A. Antennas and Related Topics

(A1) Microstrip and Printed Antennas (A2) Active and Integrated Antennas
(A3) Array Antennas, Phased Arrays and Feeding Circuits (A4) Small Antennas
(A5) Adaptive and Smart Antennas (A6) Multiband / Wideband Antennas
(A7) Slot Antennas (A8) Millimeter Wave and Sub-Millimeter Wave Antennas
(A9) Reflector/Lens Antennas and Feeds (A10) Optical Technology in Antennas
(A11) Mobile and Base Station Antennas (A12) MIMO Antennas (A13) UWB Antennas
(A14) RFID (A15) Others

### B. Propagation and Related Topics

(B1) Mobile and Indoor Propagation (B2) Mobile Channel Characterization and Modeling
(B3) Millimeter and Optical Wave Propagation (B4) Earth-Space and Terrestrial Propagation
(B5) Radio Astronomy (B6) Remote Sensing
(B7) SAR Polarimetry and Interferometry (B8) Ionospheric Propagation (B9) Others

### C. Electromagnetic Wave Theory

(C1) Complex Media and Artificial Media (C2) Computational Electromagnetics
(C3) Theoretical Electromagnetics and Analytical Methods (C4) High-Frequency Techniques
(C5) Inverse Problems (C6) Random Media and Rough Surfaces (C7) Scattering and Diffraction
(C8) Waveguiding Structures (C9) Periodic and Band-Gap Structures
(C10) Time Domain Numerical Methods (C11) Others

### D. Systems and Other Related Topics

(D1) High Power Microwave Applications (D2) Advanced Materials for EM Applications
(D3) UWB and Impulse Radio (D4) Ubiquitous Network Systems (D5) Satellite Communication Systems
(D6) Radio Technologies for Intelligent Transport Systems (D7) Subsurface Sensing
(D8) EMC/EMI Simulations and Measurements (D9) Others

### E. Emerging/Special Topics

(E1) Wireless Energy Transmission (E2) EMI/EMC of Wireless Power (Energy) Transmission
(E3) Terahertz Devices (E4) Terahertz Applications
(E5) Subwavelength Optics (E6) Nanoantenna (E7) MIMO System (E8) Metamaterial and Application
(E9) Biological Effects and Medical Application of EM Wave (E10) Antenna Measurements
(E11) Basic Measurement Technology in RF and Microwaves
(E12) Electromagnetic and RF Engineering Education

## PAPER SUBMISSION

Authors are requested to send their papers in PDF file through the conference web site no later than May 15, 2011. Paper should be typed in the on-line system including paper title, list of authors, affiliations, and corresponding e-mail. Fit all the text, figures, and references within the limit of 4 pages. Sample template and more detailed information can be found on the web site (http://www.isap2011.org).

## Young Scientist Award

Young scientist award is to encourage outstanding young scientists to submit their excellent papers. Outstanding young scientist papers presented at ISAP 2011 will be selected and granted the Young Scientist paper Awards.

## Call for Special Sessions

Proposals are due March 15, 2011 and should be submitted via the ISAP Web Site (http://www.isap2011.org). Proposals will be evaluated based on the timeliness of topic as well as the qualifications of organizers and paper authors. Notification of acceptance will be sent to the organizers by March 22, 2011. Manuscripts should conform to the formatting and electronic submission guidelines of regular papers.

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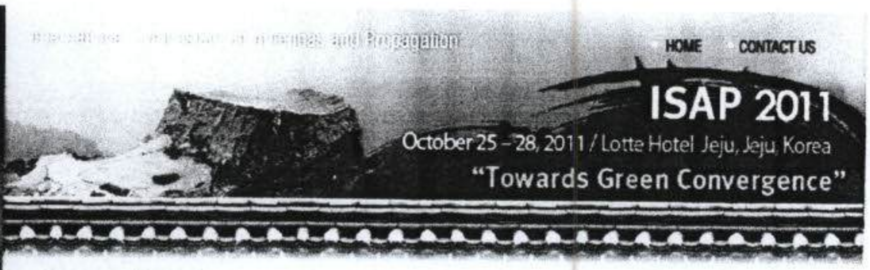


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**[FrP1]**

**DATE**: October 28, 2011
**TIME**: 09:30~11:30
**PLACE**: Emerald

| **<No.>** | **<Paper Title>** |
|---|---|
| A01_1004 | A Circularly-Polarized Microstrip Monopole Antenna by Utilizing Dual-Loop Topology |
| A01_1008 | A Compact Patch Antenna for Polarization Diversity in a MIMO System |
| A01_1010 | U-Shaped Planer UWB Antenna with Unsymmetrical Feed |
| A01_1011 | Monopole Antenna with Three Branch Strips and Rectangular Slit Ground for WLAN/WiMAX Applications |
| A01_1012 | Dual-Frequency Circular Patch Antenna for RFID Reader Application |
| A01_1013 | Bionic Antenna with Low RCS for Microstrip Application |
| A01_1014 | The design of A broad-band uniplanar printed antenna with random |
| A01_1015 | Design on X-band Wideband and High-gain Microstrip Antenna |
| A01_1018 | Multiband Antenna with Parasitic Element for Wireless Applications |
| A01_1019 | Design of a Short Circuited Microstrip Antenna Using Differential Evolution Algorithm |
| A01_1020 | Self-Complementary Ring Planer Antenna of Very Wideband Operation |
| A01_1022 | The impact of dielectric materials on patch antenna efficiency in the 2 and 5 GHz bands |
| A01_1023 | Flexible T-DMB Antenna on windshield with meander dipole structure |
| A01_1025 | Antipodal Dual Exponentially Tapered Slot Antenna (DETSA) with Stepped Edge Corrugations for Front-to-back Ratio Improvement |
| A01_1027 | An implementation of variational technique microstrip patch antenna for X-Band applications |
| A01_1028 | Optimization Design of Parasite PIFA for Personal Communication Networks |
| A01_1029 | Implementaion of High Gain Circularized Antenna Using FPC |
| A01_1030 | Optimization Analysis For UHF RFID Tag Antenna Using CST Microwave Studio |
| A01_1035 | Wideband Antenna for Portable Ground Penetrating Radar System |
| A01_1037 | Rectangular Grooving with Comb-shaped Tuning Stub Antenna for Dual BandApplication |
| A03_1002 | A Retrodirective Array Using Slope Detection and Phase Shifting |
| A03_1003 | Calibration of radar beam weighting effect for VHF atmospheric radar using multiple beam directions and 2-D radar imaging technique |
| A03_1006 | Dual and Linearly Polarized SIW Series Slot Array Antenna for Ka Band |
| A03_1008 | Discussion on Tapered Amplitude Multiple Beam Forming Networks for Array Antenna Design |
| A03_1009 | Characteristics Dependence of a Partially Driven Array Antenna Using Transmission Line Coupling on the Thickness of a Dielectric Substrate |
| A03_1010 | Space-filling Curve Based RF MEMS Miniaturized Single-bit Phase Shifters |
| A03_1014 | Circularly Polarized Patch Array Antenna with Enhanced Isolation Characteristic |
| A03_1021 | Feeding Structure to Widen Bandwidth for Dual-polarization Corporate-feed WaveguideSlot Array Antenna |
| A03_1022 | Null Beam Forming Study for Space Use Active Phased Array Antenna |
| A03_1023 | The Positional Effect of Array Curved Strip Dipole On Electromagnetic Band Gap Reflector Plane |
| A03_1024 | The Positional Effect of Array Curved Strip Dipole On Electromagnetic Band Gap Reflector Plane |
| A04_1002 | Wearable Planar Inverted-F Antenna (PIFA) at 2.45 GHz for On-Body |

| | |
|---|---|
| | Communications |
| A04_1006 | Novel UWB Wearable Button Antenna |
| A05_1004 | Dipole and Loop Combined Antenna for Switchable Radiation Patterns |
| A06_1001 | Compact Internal Coupled-fed PIFA for Mobile Phone |
| A06_1004 | Small Sized Wide Band T-shaped Monopole Antenna with Asymmetric Parasitic Elements |
| A06_1006 | Low Profile Multi Band Antenna for UNderground |
| A06_1007 | Quad band frequency reconfigurable printed monopole antenna with switchable stub for unwanted resonance suppression |
| A06_1008 | Multi-band Characteristics of WB U-slot Patch Antenna with a Shorting Pin |
| A06_1011 | A novel design of the internal eight-band mobile phone antenna with a tuning element |
| A06_1016 | Design and Implementation of Multi-Band Folded PIFA for Mobile Communication |
| A06_1017 | Miniaturized Multifunction Shared-Aperture Automobile Antenna for Terrestrial and Satellite Communications |
| B01_1001 | Fundamental Study on Channel Model of MIMO sensor for Event Detection |
| B02_1006 | Study of Random Line-of-Sight Caused by Arbitrary User Positions and Orientations with Application to MIMO OTA Measurements |
| B02_1009 | Estimation Accuracy of Ray-Tracing for Spatial Dynamic Channel Properties |
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| B07_1002 | Three-Component Scattering Power Decomposition Method with Phase Rotation of Coherency Matrix |
| C01_1001 | A Design Method of Composite Right/Left Handed Transmission Lines by Genetic Algorithm |
| C02_1002 | FDTD Simulation of Radio Wave Propagation at Intersection Surrounded by Concrete Block Walls in Residential Area for Inter-Vehicle Communications Using 720 MHz Band |
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| D05_1001 | CP-generating Waveguide Polarizer Using Multi-Staged Elliptical Cross Sections |
| D06_1002 | Radio marker for lane-keeping support system using WLAN |
| D06_1003 | A 24GHz CMOS RF Transceiver for Car Radar Applications |
| D06_1005 | A Method of Radar Protection from ARM with Active Decoys |
| D08_1002 | Estimation of Average Rician K-factor in Reverberation Chamber |
| E01_1002 | Analysis on Transmission Efficiency of Magnetic Resonance Based Wireless Energy |

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|---|---|
| | Transmission Resonator |
| E01_1006 | Modelling of Loop Antenna Depending on Interval between Source Coil and Resonant Coil |
| E06_1002 | Characteristics of Nano-sized Circularly Polarized Light in Medium Generated by a Plasmonic Asymmetric Cross Antenna |
| E07_1007 | Field Experimental Results on Cooperative Multi-Point Wireless Transmission |
| E07_1008 | Broadband MIMO relay network with phase control |
| E08_1003 | Particle Energy Momentum Transport for Negative Refractive Index Material (NRM) - Anomalous Concepts |
| E08_1004 | Frequency splitting of a multi-layered metamaterial |
| E08_1005 | A Comparative Study on Different Magnetic Inclusion Structures with Analytical Modeling and Simulation Studies |
| E08_1013 | Reflection and RCS Characteristic of Electromagnetic Gradient Surfaces due to Perpendicular and Parallel Polarization |
| E09_1002 | Animal Studies of Simultaneously Combined Exposure of CDMA and WCDMA Electromagnetic Fields |

A.01-1037

# Rectangular Grooving with Comb-shaped Tuning Stub Antenna for Dual BandApplication

Boonchai Kaewchan[1] and Amnoiy Ruengwaree[2]

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## Abstract

This paper presents a rectangular grooving with comb-shaped tuning stub antenna. This antenna was fabricated by grooving technique and be analyzed by CST software. The proposed antenna was designed to 30 x 30 mm$^2$ using FR4 PCB with $\varepsilon_r = 4.3$ and its thickness (h) = 0.764 mm for dualbands application i.e. first band was 2.37-2.57 GHz with low resonance frequency of 2.45 GHz and second band was 5.01-6.34 GHz with high resonance frequency of 5.79 GHz. These frequency bands entirely cover IEEE 802.11b/g 2.4 GHz (2.40 - 2.4835 GHz), IEEE 802.16a 5.2 GHz (5.13-5.35 GHz) and 5.8.GHz (5.7-5.9 GHz) as required.

**Keywords:**PCBComb-shapeWireless communication networkDouble frequency range

## 1. Introduction

Nowadays, most of communication system in Thailand and other countries have use wireless communication to facilitate short and long distance transmission. Nevertheless, huge volume in communication system may affect to slower traffic and the related provider needs to increase more communication channels for faster response and more selective frequency band. So the IEEE has extend the existing IEEE standard i.e. first band IEEE.802.11b/g 2.45 GHz (2.4-2.4835 GHz) and shifting to higher frequency band IEEE.802.16a 5.2 GHz (5.13-5.35 GHz) and 5.8 GHz (5.7-5.9 GHz) from WAN wireless communication system. However, the necessary element need to be developed is the antennae which can response mentioned frequency bands and it is require some research [1-5] regarding the antenna responding dual frequency bands but those antenna still was bully size [1-4] and some smaller size antenna has a bandwidth impedance that cannot response over the required frequency band [5]. The simulation of prototype antenna used the teeth and groove tuning [6-7] to find out the optimized parameters for obtaining the optimized antenna by experimental method and CST software.

## 2. Antenna Design and Simulation

### 2.1 Antenna Structure

Microstrip antenna is a rectangular grooving on PCB with comb-shapedtuning stub as shown in Fig. 1. This antenna was designed on single-sided circuit board and FR4 substrate with dielectric constant ($\varepsilon_r$) = 4.3 and thickness (h) = 0.764 mm and its dimension was 30 x 30 mm$^2$. The signal was fed at the bottom of prototype antenna and its parameters are shown as Table 1.

### 2.2 Simulation Results

The proposed antenna was simulated with CST software for studying the frequency responding, for example, return loss, radiation, and bandwidth to optimize the antenna structure covering wireless communication according to IEEE 802.11 b/g and IEEE 802.16a/d. The result showed that when adjusting both width and length of prototype antenna by cutting as scalene-triangle to reduce the return loss ($S_{11}$) for low frequency and high frequency. To obtain the optimized parameters with required frequency band, four steps was conducted. Firstly, to groove the antenna using tuning technique with comb-shaped stub [6-8] to obtain parameter $W_2$ by adding lines $W_2$ as 2, 3, 4, and 5 lines and found that 5 lines is an optimized value. The simulation output showed that this modified antenna can responses dual frequency bands i.e. point a with the return loss at low frequency of 2.61 GHz is -17.76 dB and point b with return loss at high frequency is -18-27 GHz. So now this antenna can responses dual frequency bands as required.

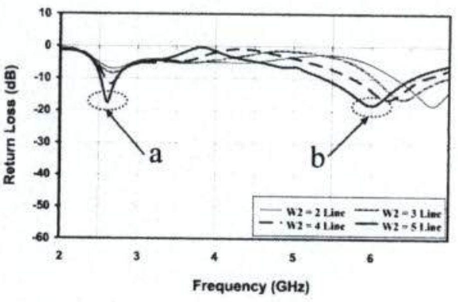


Fig. 2 return loss ($S_{11}$) when adding $W_2$

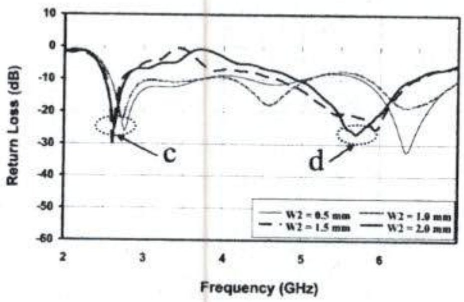


Fig. 3 return loss ($S_{11}$) when adjusting $W_2$

The second steps was to adjust the line width ($W_2$) to the optimized value and found that when adjusting, the return loss is lower point a and point b for low frequency and high frequency bands. $W_2$ value was adjusted from 0.5, 1.0, 1.5, and 2.0 mm and found that the optimized value is 2 mm. This value will result in point c with return loss is -25.49 dB at low frequency of 2.62 GHz and point d with return loss is 26.56 dB at high frequency of 5.69 dB as shown in Fig. 3.

The third step was to adjust the line length ($L_2$) to optimized value and found that when adjusting, the return loss is lowerby adjusting from 6, 7, 8, and 9 mm. The optimized value of $L_2$ is 9 mm, at point e the return loss is -30.40 dB at low frequency of 2.55 GHz and point f with return loss of -28.32 dB at high frequency of 5.49 GHz. We found that at these points the return loss is lower point c and d as shown in Fig. 2 but it cannot cover low and high frequency band as required, illustrated in Fig. 4.

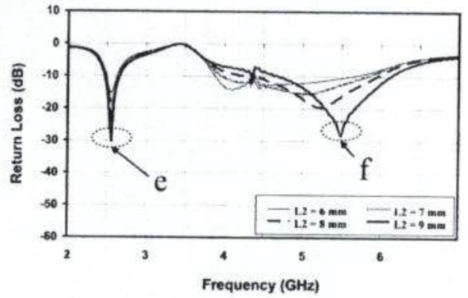


Fig. 4 return loss ($S_{11}$) when adjusting $L_2$

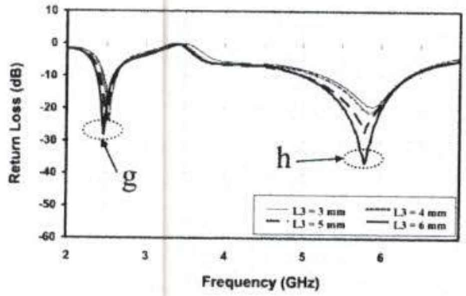


Fig. 5 return loss ($S_{11}$) when adjusting $L_2$

The final step was to groove between comb-shaped stub and upper signal feeder to obtain the resonance frequency of low and high band as standard required. This groove induces the length parameter of strip ($L_3$) as shown in Fig. 5. The $L_3$ value was adjusted to obtain the optimized value for reducing the return loss. The adjustable values are 3, 4, 5, and 6 mm and found that the optimized value is 6 mm. at point g the return loss is -28.17 with low frequency of 2.45 GHz anand point h with return loss of-36.63 dB at high frequency of 5.79 GHz. We found that at these points the return loss ($S_{11}$) can cover IEEE 802.11 b/g 2.4 GHz (2.40 - 2.4835 GHz), IEEE 802.16a 5.2 GHz (5.15 - 5.35 GHz), and 5.8 GHz (5.7 - 5.9 GHz) as shown in Fig. 4.

## 3. Fabrication and Measurement

From the simulation result we obtain the optimized parameter of antenna and it was fabricated to prototype antenna. The interesting parameter were return value, bandwidth, and gain of antenna was measured by E8363B network analyzer. The measurement and simulation values were compared and obtaining the return loss and gain we found that both values are consistent as shown in Fig. 7 and Table 2.

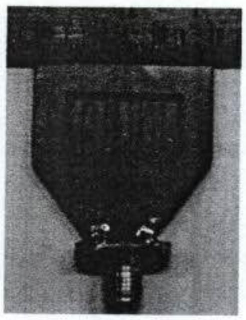

Fig. 6 physical antenna

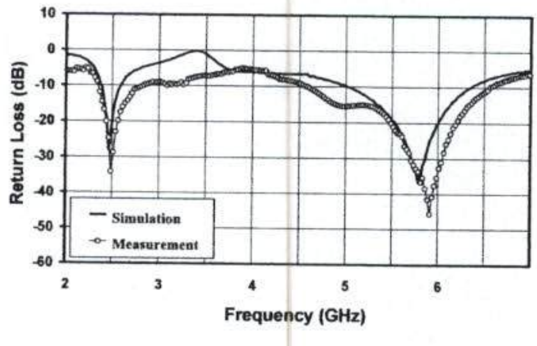


Fig. 7 measurement and simulation comparison of return loss ($S_{11}$) for prototype antenna

In addition, simulated and physical antennas were compared the radiation parameters and found that at 2.48 GHz and 5.81 GHz the radiation is bidirectional on x-z plane as shown in Fig 8-9 and y-z plane as shown in Fig. 9-10.

Fig. 8 radiation simulation at resonance frequency of 2.45 GHz and 5.79 GHz on x-z plane

Fig. 9 radiation simulation at resonance frequency of 2.45 GHz and 5.79 GHz on y-z plane

Fig. 10 radiation simulation at resonance frequency of 2.45 GHz and 5.79 GHz on x-y plane

Fig. 11 radiation simulation at resonance frequency of 2.45 GHz and 5.79 GHz on y-z plane

## 4. Conclusion

The rectangulargrooving with comb-shaped tuning stubantenna was fabricated and measured found that length tuning of groove was to add more line to 5 lines and reducing its length $W_2$ = 1.0 mm, to increase its length $L_2$ = 9mm, and final step was to create grooves between comb-shaped stub and upper signal feeder with length $L_3$ = 6 mm together with rectangular groove tuning and cutting the antenna as scalene-triangle of both sides. The bandwidth of low frequency range is 0.45 GHz (2.35-2.80 GHz) and high frequency range is 1.91 GHz (4.61-6.52 GHz) covering IEEE 802.11b/g and IEEE 802.16a/d as well. The gain of prototype antenna are 4.76 and 5.21 dBi for low and high frequency ranges, respectively.


## Acknowledgement

The author would like to thank Mr. WatcharaphonNaktong for useful documents and information.

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