

**BANDWIDTH ENHANCEMENT OF MICROSTRIP ANTENNA FOR
WIRELESS LOCAL AREA NETWORK APPLICATIONS**

By

YOHARAAJ DORAISINGAM

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia,
in Fulfilment of the Requirement for the Degree of Master of Science**

January 2007

Dedicated to,
My parents, brother and sisters,
whose encouragement and support
have been instrumental during the course of my research.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment
of the requirement for the degree of Master of Science

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Faculty: Engineering

These days, there is a very large demand for wireless applications. Antennas which are used in these applications should be low profile, light weight, low volume and broad bandwidth. The microstrip antenna suits the features mentioned except for its narrow bandwidth, typically ranges from less than one percent to several percent of relative bandwidth. By reducing that limitation, the advantages using microstrip antenna can further outweigh its disadvantages. In this research, an alternative bandwidth enhancement technique is studied and then proposed in order to broaden the bandwidth of the microstrip antenna. The wireless application that is selected to be studied is the Wireless Local Area Network (WLAN) based on the IEEE 802.11b standard. In Malaysia, this WLAN band spans from 2.4GHz to 2.5GHz.

Initially, the characteristic of a microstrip transmission line is analyzed. This is done to determine the cause for microstrip antenna in having narrow bandwidth. Then, a basic single-layer microstrip antenna without bandwidth enhancement technique is designed. A substrate with low permittivity namely RT/Duroid 5880

is used as the dielectric for the radiating patch. The feeding method used is the coaxial probe. Parameters such as the operating frequency, input impedance and the bandwidth are observed. This design will serve as a benchmark for the design of the microstrip antenna with bandwidth enhancement technique. The bandwidth enhancement technique which is selected is the Identical Dual-Patch Microstrip Antenna with Air-Gap (IDMA). This technique makes use of the air gap for bandwidth enhancement of the microstrip antenna. By using this technique, a bandwidth enhancement of about 11% has been achieved. This bandwidth very well covers the required WLAN band with an operating frequency of 2.45GHz.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

**PERLEBARAN JALUR ANTENA MIKROSTRIP BAGI APLIKASI
RANGKAIAN KAWASAN TEMPATAN TANPA WAYAR**

Oleh

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Dewasa ini, terdapat permintaan yang tinggi kepada penggunaan applikasi tanpa wayar. Antena yang digunakan untuk applikasi tersebut perlu berprofil rendah, ringan, isipadu rendah dan berjalur lebar. Antena mikrostrip adalah bersesuaian dengan ciri-ciri yang disebutkan tadi kecuali ia berjalur kurang lebar, biasanya di dalam lingkungan dari kurang satu peratus hingga ke beberapa peratus. Dengan mengatasi kekurangan ini, kelebihan menggunakan antena mikrostrip jauh lebih menarik jika dibandingkan dengan kekurangannya. Dalam penyelidikan ini, satu teknik alternatif untuk memperlebar jalur telah dikaji dan dicadangkan untuk memperlebar jalur antena mikrostrip. Aplikasi tanpa wayar yang dipilih untuk dikaji ialah rangkaian kawasan tempatan tanpa wayar (WLAN) berasaskan kepada piawai IEEE 802.11b. Di Malaysia, jalur WLAN adalah dari 2.4GHz hingga 2.5GHz.

Pada mulanya, ciri-ciri talian penghantaran mikrostrip dianalisis. Ini dibuat untuk menentukan punca antena mikrostrip mempunyai jalur sempit. Kemudian, antena mikrostrip satu lapis asas tanpa menggunakan teknik memperlebar jalur dikaji.

Satu bahan yang mempunyai permittiviti rendah iaitu RT/Duroid 5880 telah digunakan sebagai bahan untuk tompok radiasi. Cara pengujian yang digunakan ialah prob sepaksi. Parameter seperti frekuensi operasi, impedans input dan saiz jalur telah diperhatikan. Rekabentuk ini akan menjadi garis panduan dan rujukan kepada kajian antenna mikrostrip dengan teknik memperlebar jalur. Teknik memperlebar jalur yang digunakan ialah Antena Mikrostrip Dua Tompok Serupa dengan Ruang Udara (IDMA). Teknik ini menggunakan ruang udara untuk memperlebar jalur antenna mikrostrip. Dengan menggunakan teknik ini, pelebaran jalur hingga lebih kurang 11% dapat dicapai. Jalur ini sememangnya dapat merangkumi jalur WLAN yang dianalisis.

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I certify that an Examination Committee has met on 11th January 2007 to conduct the final examination of Yoharaaj Doraisingam on his Master of Science thesis entitled "Bandwidth Enhancement of Microstrip Antenna for Wireless Local Area Network Applications" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

YOHARAAJ DORAISINGAM

Date: 8 FEBRUARY 2007

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