

# ANTENNAS AND PROPAGATION

*Modeling, Simulation & Measurements*

Edited by

**MD. RAFIQUUL ISLAM** B.Sc., M.Sc., Ph.D., MIEEE  
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IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

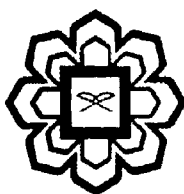
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IIUM Press

Published by:  
IIUM Press  
International Islamic University Malaysia

First Edition, 2011  
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Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Md. Rafiqul Islam & Jalel chebil: Antennas and Propagation: Modeling, Simulation & Measurements

Bibliography p.  
Includes Index  
ISBN

ISBN: 978-967-418-138-3

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM  
(Malaysian Scholarly Publishing Council)

**Printed By:**  
**IIUM PRINTING SDN.BHD.**  
NO. 1, JALAN INDUSTRI BATU CAVES 1/3  
TAMAN PERINDUSTRIAN BATU CAVES  
BATU CAVES CENTRE POINT  
68100 BATU CAVES  
SELANGOR DARUL EHSAN  
TEL: +603-6188 1542 / 44 / 45 FAX: +603-6188 1543  
EMAIL: iiumprinting@yahoo.com

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## Chapter 13

# Overview of Smart Antenna Systems

Ibrahim A. Haji<sup>1</sup>, Md. Rafiqul Islam<sup>1</sup>, A.H. M Zahirul Alam<sup>1</sup>, Othman O. Khalifa<sup>1</sup> and Khaizuran Abdullah<sup>1</sup>

### 13.1 Introduction

This chapter presents the fundamental theories and applications of smart antennas. It includes the general theory of antenna array and their applications. A smart antenna system combines multiple antenna elements with a signal-processing capability to optimize its radiation and/or reception pattern automatically in response to the signal environment [1,3,5]. It is the port through which radio frequency (RF) energy is coupled from the transmitter to the outside world and, in reverse, to the receiver from the outside world. In the subsequent sections of this chapter, an introduction to the essential concepts of smart antenna systems and the important advantages of smart antenna system design over conventional omnidirectional approaches are presented.

### 13.2 Antenna Systems

The electromagnetic energy from one medium (space) is coupled to another (e.g., wire, coaxial cable, or waveguide) by antennas whose physical designs can vary greatly. Since the early days of wireless communications, there has been the simple dipole antenna, which radiates and receives equally well in all directions. To find its users, this single-element design broadcasts omnidirectionally as shown in Figure 13.1 [2]. While adequate for simple RF environments where no specific knowledge of the users' whereabouts is available, this unfocused approach scatters signals, reaching desired users with only a small percentage of the overall energy sent out into the environment [1,3, 10].

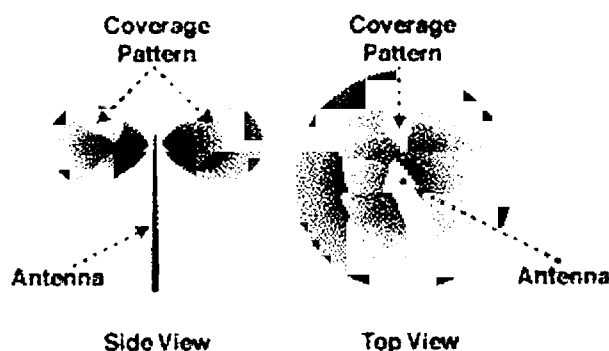


Figure 13.1 Omnidirectional Antenna and Coverage Patterns [3]

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