INTERFACING ELECTRONIC FOR MEASUREMENT, SIGNAL PROCESSING AND WIRELESS COMMUNICATION

Edited by

Sheroz Khan, International Islamic University Malaysia

AHM Zahirul Alam, International Islamic University Malaysia

Anis Nurashikin Nordin, International Islamic University Malaysia

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INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

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Chapter 21

COGNITIVE RADIO VS INTELLIGENT ANTENNA

SITI RABANI MAT NAWI, NURUL FARHAH TOHA, KHAIZURAN ABDULLAH, M. RAFIQUL ISLAM, SHEROZ KHAN

21.1. DEFINITION

21.1.1. Cognitive Radio

Mobile radio systems have shown rapid growth and hence have increased the awareness for more efficient use of spectrum. With the advancements of technology, the development of radio systems which are dynamic and efficient in terms of spectrum usage can be realised. Cognitive radio coined by Joseph Mitola is one of the advancements which may enhance the adaptive capabilities of radio systems and may contribute to more efficient, versatile and flexible use of spectrum. It is based on software defined radio with added intelligent signal processing, ideally based on logic, analysis and intuition, though early cognitive radios need not meet that level of sophistication. Cognitive radio has the ability to sense its surrounding environment and detect spectrum holes or white spaces, namely unoccupied frequencies, which it can use, rather than a fixed frequency assigned to it by the spectrum manager or regulator, as is currently the case (Omar). In the 1999 paper that first coined the term "cognitive radio", Joseph Mitola III defines a cognitive radio as (Mitola III, 1999): "A radio that employs model based reasoning to achieve a specified level of competence in radio-related domains." However, in his recent popularly cited paper that surveyed the state of cognitive radio, Simon Haykin defines a cognitive radio as (Haykin, 2005): "An intelligent wireless communication system that is aware of its surrounding environment (i.e., outside world), and uses the methodology of understanding-by-building to learn from the environment and adapt its internal states to statistical variations in the incoming RF stimuli by making corresponding changes in certain operating parameters (e.g., transmit-power, carrier frequency,and modulation strategy) in real-time, with two primary objectives in mind:

- Highly reliable communications whenever and wherever needed;
- Efficient utilization of the radio spectrum.

21.1.2. Intelligent Antenna

The term smart antenna refers to any antenna array terminated in sophisticated signal processor, which can adjust or adapt its own beam pattern in order to emphasize signals of interest and to minimize interfering signals. Smart antenna generally encompassed both switched beam and beam formed adaptive systems. Switched beam systems have several available fixed beam patterns. A decision is made as to which beam to access, at any given point in time, based upon the requirements of the system. Beam formed adaptive system allows the antenna to steer the beam to any direction of interest while simultaneously