

# Standards for Advanced, low-cost Wireless Solutions

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## 1.0 Introduction

This paper presents the highlights of a very dynamic industry and marketplace, that of standards for advanced wireless applications. There are too many wireless standards to fully summarize in a brief discussion, so this paper focuses on advanced wireless standards developed and currently being worked on in the Radiocommunication Sector of the ITU (ITU-R), International Telecommunication Union. The ITU, being a specialized agency of the United Nations, has a very broad participation and membership, including myriad standardization organizations, so a discussion of the activities of the ITU-R is at least a good starting point for an overview of the wireless standard landscape. The objective of this discussion is to provide the reader with an initial basis to facilitate further inquiry into the types of standards already available and under development.

## 2.0 Standards for Mobile and Nomadic Wireless Applications

Since the late 1980s, the ITU-R has had an organization in its Mobile Services Study Group (SG) that has been sponsoring the development of first third generation, and now Beyond 3G, standards for digital mobile wireless communications. This is the IMT-2000 and IMT-Advanced projects (IMT: International Mobile Telecommunications) in Working Party (WP) 5D of SG 5 of the ITU-R. The major achievement of this endeavor has been the development of a deliverable, Recommendation ITU-R M.1457, that specifies six radio interface standards that meet the requirements for IMT-2000. This represents a cooperative effort that is worldwide in scope between the ITU, regulators and wireless industry stakeholders to present a portfolio of technologies that meet the needs of the vast worldwide marketplace. The key unique feature is the partnership between the ITU and standard development organizations, such as 3GPP (3<sup>rd</sup> Generation Partnership Project) and IEEE, that allows these organizations to directly update the specifications of their radio interface technologies to keep pace with advances in mobile wireless communications, so that the worldwide membership of the ITU has ready access to a catalogue of the latest innovations in technology.

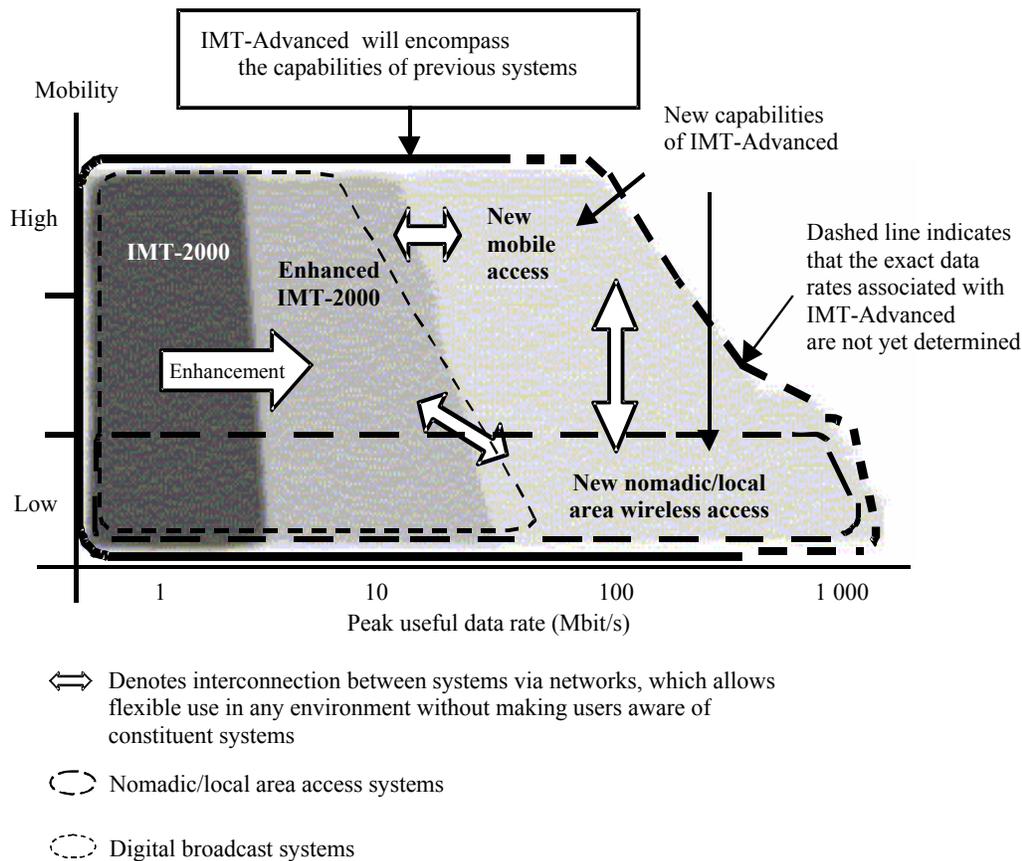
Presently WP 5D is developing a procedure to specify radio interface standards for what are called IMT-Advanced systems, or systems that have capabilities greater than those of IMT-2000, in terms of data rates supported by the radio interface. Figure 1 is a diagram that illustrates the evolution of the capabilities of IMT-2000 toward those of IMT-Advanced. For IMT-Advanced, the peak useful data rate approaches 1 Gbit/s and encompasses nomadic/local wireless access.

Another WP of SG 5, WP 5A, has developed a Recommendation (Rec.) M.1801, "Radio interface standards for broadband wireless access systems, including mobile and nomadic applications, in the mobile service operating below 6 GHz." The technologies detailed in this Rec. can support data rates that are defined by the ITU-R in Rec. F.1399<sup>1</sup> to be those of broadband capability, or a transmission bit rate of at least 1.544 Mbit/s (T1) or 2.048 Mbit/s (E1).

WP 5A, in cooperation with a WP of the fixed services SG (formerly SG 9) has also produced a Rec. that specifies technologies for broadband radio local area networks (RLAN), M.1450-2. This deliverable contains information for several RLAN technologies, including the IEEE 802.11 series and ETSI and ARIB standards.

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<sup>1</sup> Recommendation ITU-R F.1399, "Vocabulary of Terms for Wireless Access," (1999-2001), page 4.



Dark shading indicates existing capabilities, medium shading indicates enhancements to IMT-2000, and the lighter shading indicates new capabilities of IMT-Advanced.

The degree of mobility as used in this Figure is described as follows: low mobility covers pedestrian speed, and high mobility covers high speed on highways or fast trains (60 km/h to ~250 km/h, or more).

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Figure 1. Illustration of capabilities of IMT-2000 and IMT-Advanced (formerly referred to as Systems Beyond IMT-2000)<sup>2</sup>

### 3.0 Standards for Fixed Wireless Access

The former WP 9B of SG 9 of the ITU-R (now WP 5C of SG 5) produced a Rec. that provided details of systems for fixed broadband wireless access (BWA), M.1763, "Radio interface standards for broadband wireless access systems in the fixed service operating below 66 GHz." This Rec. features technologies for high performance radio Metropolitan Area Network (HiPERMAN) networks, including the IEEE 802.16 series and the ETSI BRAN series.

<sup>2</sup> Recommendation ITU-R M.1645, "Framework and Overall Objectives of the Future Development of IMT 2000 and Systems Beyond IMT 2000", 2003, page 7.

## **4.0 Standards for Mobile Multimedia Broadcasting Applications**

The broadcasting SG of the ITU-R, SG 6, produced a deliverable that catalogues broadcasting standards for handheld reception. Rec. ITU-R BT.1833, “Broadcasting of multimedia and data applications for mobile reception by handheld receivers”, gives details for five technologies that can be used in mobile handheld operating environments. Several of these technologies are based on digital terrestrial broadcasting standards, such as DAB and DVB, and optimized for reception in a mobile environment.