

Towards 4G Wireless Technology

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I. INTRODUCTION

4G is a technology which refers to the fourth generation of cellular wireless standards. It is a successor to 3G and 2G standards. Its main aim is to provide a wide range of data rates up to ultra-broadband (gigabit-speed) Internet access to mobile as well as stationary users.

A 4G cellular system must have target peak data rates of up to approximately 100 Mbit/s for high mobility such as mobile access and up to approximately 1 Gbit/s for low mobility such as nomadic/local wireless access, according to the ITU requirements. Scalable bandwidths up to at least 40 MHz should be provided. A 4G system is expected to provide a comprehensive and secure all-IP based solution where facilities such as IP telephony, ultra-broadband Internet access, gaming services and HDTV streamed multimedia may be provided to users.

The pre-4G technology 3GPP Long Term Evolution (LTE) is often branded “4G”, but the first LTE release does not fully comply with the IMT-Advanced requirements. LTE has a theoretical net bitrate capacity of up to 100 Mbit/s in the downlink and 50 Mbit/s in the uplink if a 20 MHz channel is used and more if Multiple-input multiple-output (MIMO), i.e. antenna arrays, are used. Most major mobile carriers in the United States and several worldwide carriers have announced plans to convert their networks to LTE beginning in 2009. The world’s first publicly available LTE-service was opened in the two Scandinavian capitals Stockholm and Oslo on the 14 December 2009, and branded 4G. The physical radio interface was at an early stage named High Speed OFDM Packet Access (HSOPA), now named Evolved UMTS Terrestrial Radio Access (E-UTRA).

LTE Advanced (Long-term-evolution Advanced) is a candidate for IMT-Advanced standard, formally submitted by the 3GPP organization to ITU-T in the fall 2009, and expected to be released in 2011. The target of 3GPP LTE Advanced is to reach and surpass the ITU requirements. LTE Advanced should be compatible with first release LTE equipment, and should share frequency bands with first release LTE.

UMB (Ultra Mobile Broadband) was the brand name for a discontinued 4G project within the 3GPP2 standardization

group to improve the CDMA2000 mobile phone standard for next generation applications and requirements. In November

2008, Qualcomm, UMB’s lead sponsor, announced it was ending development of the technology, favouring LTE instead. The objective was to achieve data speeds over 275 Mbit/s downstream and over 75 Mbit/s upstream.

In all these suggestions for 4G, the CDMA spread spectrum radio technology used in 3G systems and IS-95 is abandoned and replaced by frequency-domain equalization schemes, for example multi-carrier transmission such as OFDMA. This is combined with MIMO (i.e. multiple antennas (Multiple In Multiple Out)), dynamic channel allocation and channel-dependent scheduling.

The Mobile WiMAX (IEEE 802.16e-2005) mobile wireless broadband access (MWBA) standard is sometimes branded 4G, and offers peak data rates of 128 Mbit/s downlink and 56 Mbit/s uplink over 20 MHz wide channels.

4G guarantees QoS (QUALITY OF SERVICES) and rate requirements set by further development of existing 3G applications like wireless broadband access, Multimedia Messaging Service (MMS), video chat, mobile TV, but also new services like HDTV content, minimal services like voice and data, and other services that utilize bandwidth. It may be allowed roaming with wireless local area networks, and be combined with digital video broadcasting systems.