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Subject: **Liaison Statement to ITU-R WP8A regarding Radio Interface Standards for Broadband Wireless Access Systems, including Mobile and Nomadic Applications, in the Mobile Service Operating Below 6 GHz**

Date: 6 July 2006

Dear Colin

ETSI Technical Committee (TC) BRAN thanks ITU-R Working Party 8A for their Liaison Statement (Document 8A/TEMP/212 Rev. 1) regarding the Preliminary Draft New Recommendation M.[BWA] and Preliminary Draft New Report M.[LMS.CHAR.BWA]. TC BRAN has considered this liaison statement and provides three attachments as a contribution towards the development of M.[BWA]:

Attachment A: Proposed amendments to Annex 1 (to Annex 17 to Doc. 8A/376)

Attachment B: Proposed amendments to Annex 3 (to Annex 17 to Doc. 8A/376)

Attachment C: Provides the requested entries pertaining to the harmonized IEEE 802.16 WirelessMAN/ETSI HiperMAN standards and the ETSI HiperLAN standard in Table 1 in Annex 6 (to Annex 17 to Doc. 8A/376).

With regard to the Preliminary Draft New Report M.[LMS.CHAR.BWA], ETSI TC BRAN has no further input at this time to provide towards this PDNR.

ETSI TC BRAN looks forward to continued cooperation with Working Party 8A on the development of future Recommendation(s) on radio interface standards for Broadband Wireless Access Systems in the Mobile Service.

Yours faithfully,

Bernd Friedrichs

Chairman ETSI TC BRAN

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION STUDY GROUPS

Document 8A/ -E
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English only

Attachment A

Proposed Amendments to Annex 1
(to Annex 17 to Doc. 8A/376)

Broadband radio local area networks

RLANs offer an extension to wired LANs utilizing radio as the connective media. They have applications in commercial environments where there may be considerable savings in both cost and time to install a network; in domestic environments where they provide cheap, flexible, connectivity to multiple computers used in the home; and in campus and public environments where the increasing use of portable computers, for both business and personal use, while travelling and due to the increase in flexible working practices, e.g. nomadic workers using laptop personal computers not just in the office and at home, but in hotels, conference centres, airports, trains, planes and automobiles. In summary, they are intended mainly for nomadic wireless access applications, with respect to the access point (i.e. when the user is in a moving vehicle, the access point is also in the vehicle).

Recommendation ITU-R M.1450 recommends standards for broadband radio local area networks, which can be grouped as follows:

- IEEE Project 802.11
- ETSI BRAN HIPERLAN 2
- Japan MAC HSWA HiSWAN a

IEEE Project 802.11 has developed a set of standards for RLANs, which have been harmonized with IEC/ISO[1]. The medium access control (MAC) and physical characteristics for wireless local area networks (LANs) are specified in ISO/IEC 8802-11:2005, which is part of a series of standards for local and metropolitan area networks. The medium access control unit in ISO/IEC 8802-11:2005 is designed to support physical layer units as they may be adopted dependent on the availability of spectrum. ISO/IEC 8802-11:2005 contains five physical layer units: four radio units, operating in the 2 400-2 500 MHz band and in the bands comprising 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.725-5.825 GHz, and one baseband infrared (IR) unit. One radio unit employs the frequency-hopping spread spectrum (FHSS) technique, two employ the direct sequence spread spectrum (DSSS) technique, and another employs the orthogonal frequency division multiplexing (OFDM) technique.

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1 ISO/IEC 8802-11:2005, Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications.

ETSI BRAN HIPERLAN 2

The HiperLAN 2 specifications were developed by ETSI TC (Technical Committee) BRAN (Broadband Radio Access Networks). HiperLAN 2 is a flexible Radio Local Area Network (RLAN) standard, designed to provide high-speed access up to 54 Mbit/s at Physical Layer (PHY) to a variety of networks including Internet Protocol (IP) based networks typically used for RLAN systems. Convergence layers are specified which provide interworking with Ethernet, IEEE 1394 and ATM. Basic applications include data, voice and video, with specific Quality of Service parameters taken into account. HiperLAN 2 systems can be deployed in offices, classrooms, homes, factories, hot spot areas such as exhibition halls and, more generally, where radio transmission is an efficient alternative or complements wired technology.

HiperLAN 2 is designed to operate in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz. The core specifications are TS 101 475 (Physical layer), TS 101 761 (data link control layer), and TS 101 493 (convergence layers). All ETSI standards are available in electronic form at: http://pda.etsi.org/pda/queryform.asp, by specifying the standard number in the search box.

ETSI TC BRAN has also developed conformance test specifications for the core HIPERLAN2 standards, to assure the interoperability of devices and products produced by different vendors. The test specifications include both radio and protocol testing.

ETSI TC BRAN has worked closely with IEEE-SA (Working Group 802.11) and with MMAC in Japan (Working Group High Speed Wireless Access Networks) to harmonise the systems developed by these three fora for the 5 GHz bands.

Japan MAC HSWA HiSWAN a

[To be completed.]

Attachment B

Proposed Amendments to Annex 3
(to Annex 17 to Doc. 8A/376)

IEEE and ETSI harmonized radio interface standards, for broadband wireless access (BWA) systems including mobile and nomadic applications in the mobile service

1 Overview of the radio interface

The IEEE standard 802.16 (including the 802.16e-2005 amendment), and ETSI HiperMAN standards define harmonized radio interfaces for the OFDM and OFDMA Physical layers (PHY) and MAC (Media Access Control) / DLC (Data Link Control) layer, however the ETSI BRAN HiperMAN targets only the nomadic applications, while the IEEE 802.16 standard also targets full vehicular applications.

The use of frequency bands below 6 GHz provides for an access system to be built in accordance with this standardized radio interface to support a range of applications, including full mobility, enterprise applications and residential applications in urban, suburban and rural areas. The interface is optimized for dynamic mobile radio channels and provides support for optimized hand-off methods and comprehensive set of power saving modes. The specification could easily support both generic internet-type data and real-time data, including applications such as voice and videoconferencing.

This type of system is referred to as a wireless metropolitan area network (WirelessMAN in IEEE and HiperMAN in ETSI BRAN). The word “metropolitan” refers not to the application but to the scale. The design is primarily oriented toward outdoor applications. The architecture for this type of system is primarily point-to-multipoint, with a base station serving subscribers in a cell that can range up to a few km. Users can access various kinds of terminals, e.g. handheld phones, smart phone, PDA, handheld PC and notebooks in a mobile environment. The radio interface supports a variety of channel widths, such as 1.25, 3.5, 5, 7, 8.75, 10, 14, 15, 17.5 and 20 MHz for operating frequencies below 6 MHz. The use of orthogonal frequency division multiplexing access (OFDMA) offers considerable improvement in bandwidth efficiency due to combined time/frequency scheduling and flexibility when managing different user devices with a variety of antenna types and form factors. It brings a reduction in interference for user devices with omni-directional antennas and improved NLOS capabilities that are essential when supporting mobile subscribers. Sub-channelization defines sub-channels that can be allocated to different subscribers depending on the channel conditions and their data requirements. This gives the service providers more flexibility in managing the bandwidth and transmit power, and leads to a more efficient use of resources, including spectrum resources.

The radio interface supports a variety of channel widths and operating frequencies, providing a peak spectral efficiency of up to 3.5 bits/s/Hz in a single receive and transmit antenna (SISO) configuration.

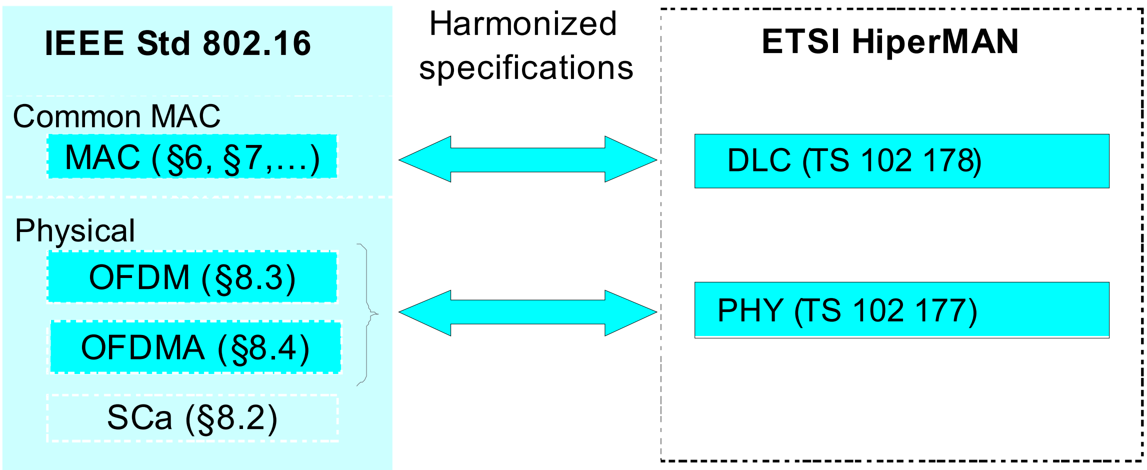
The radio interface includes PHY as well as MAC/DLC. The MAC/DLC is based on demand-assigned multiple access in which transmissions are scheduled according to priority and availability. This design is driven by the need to support carrier-class access to public networks, through supporting various convergence sub-layers, such as Internet Protocol (IP) and Ethernet, with full quality-of-service (QoS).

The harmonized MAC/DLC supports the OFDM (orthogonal frequency-division multiplexing) and OFDMA (orthogonal frequency-division multiple access) PHY modes. Supplementary, the IEEE 802.16 supports a Single Carrier (SCa) PHY mode.

Figure 1 illustrates pictorially the harmonized interoperability specifications of the IEEE WirelessMAN and the ETSI HiperMAN standards, which include specifications for the OFDM and OFDMA physical layers as well as the entire MAC layer, including security.

FIGURE 1

BWA Standards harmonized for interoperability for frequencies below 6 GHz



The WiMAX Forum, IEEE 802.16 and ETSI HiperMAN define profiles for the recommended interoperability parameters. IEEE 802.16 profiles are included in the main standards document, while HiperMAN profiles are included in a separate document. WiBRO services requirements are also covered by the WiMAX Forum profiles.

2 Detailed specification of the radio interface

IEEE 802.16

IEEE Standard for local and metropolitan area networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems.

IEEE Std 802.16 is an air interface standard for broadband wireless access (BWA). The base standard, IEEE Std 802.16-2004, address fixed and nomadic systems only. The amendment IEEE 802.16e-2005 enables combined fixed and mobile operation in licensed frequency bands under 6 GHz. The current IEEE 802.16 (including the IEEE 802.16e amendment) is designed as a high-throughput packet data radio network capable of supporting several classes of IP applications and services based on different usage, mobility, and business models. To allow such diversity, the IEEE 802.16 air interface is designed with a high degree of flexibility and an extensive set of options.

The mobile broadband wireless technology, based on IEEE-802.16 standard offers scalability in air interface and network architecture thus enables flexible network deployment and service offerings. Some relevant key standard features are described below:

High Throughput, Spectral Efficiency and Coverage

Advanced multiple antenna techniques work with OFDMA signaling very well to maximize system capacity and coverage. OFDM signaling converts a frequency selective fading wideband channel into multiple flat fading narrow band sub-carriers and therefore smart antenna operations can be performed on vector flat sub-carriers. From receiver design perspective, this significantly simplifies the equalizer design otherwise required to compensate frequency selective fading impairment. Major multiple antenna technique features are listed here.

- 2^{nd}, 3^{rd} and 4^{th} order Multiple Input Multiple Output (MIMO) and Spatial Multiplexing (SM) in Uplink and Downlink
- Adaptive MIMO switching between Spatial Multiplexing/Space Time Block Coding to maximize spectral efficiency with no reduction in coverage area
- UL Collaborative Spatial Multiplexing for single transmit antenna devices
- Advanced Beamforming and Null Steering.

QPSK, 16QAM and 64QAM modulation orders are supported both in up-link and downlink. Advanced coding schemes including Convolution Encoding, CTC, BTC and LDPC along with Chase Combining and Incremental Redundancy Hybrid ARQ and Adaptive Modulation and Coding mechanism enables the technology to support a high performance robust air link. Support of HARQ in particular is crucial to improve the robustness of data transmission over the fading wireless channel through fast retransmission.

Mobile WiMAX technology supports peak sector data rates up to 50 Mbps in a 10 MHz channel with MIMO (2x2). Higher throughputs are achieved by using higher order multiple antenna techniques.

Support for Mobility

The standard supports BS and MS initiated Optimized Hard Handoff for bandwidth-efficient handoff with reduced delay achieving a handoff delay less than 50 msec. The standard also supports Fast Base Station Switch (FBSS) and Marco Diversity Handover (MDHO) as options to further reduce the handoff delay.

Also is supported a comprehensive set of power saving modes including multiple power saving class types sleep mode and Idle mode.

Service Offering and Classes of Services

Compressive set of QoS options such as UGS, Real-Time Variable Rate, Non-Real-Time Variable Rate, Best Effort and Extended Real-Time Variable Rate with silence suppression (primarily for VoIP) to enables support for guaranteed service levels including committed and peak information rates, minimum reserved rate, maximum sustained rate, maximum latency tolerance, jitter tolerance, traffic priority for varied types of internet and real time applications such as VoIP.

Variable UL and DL subframe allocation supports inherently asymmetric UL/DL data traffic.

Multiple OFDMA adjacent and diversified subcarrier allocation modes enable the technology to trade off mobility with capacity within the network and from user to user. OFDMA with adjacent sub-carrier permutation makes it possible to allocate a subset of sub-carriers to mobile users based on relative signal strength. By allocating a subset of sub-carriers to each MS for which the MS enjoys the strongest path gains, this multi-user diversity technique can achieve significant capacity gains. Adaptive beamforming techniques effectively work with frequency selective scheduling on adjacent sub-carrier permutation.

Subchannelization and MAP-based signaling schemes provide a flexible mechanism for optimal scheduling of space, frequency and time resources for simultaneous control and data allocations (multicast, broadcast and unicast) over the air interface on a frame-by-frame basis.

MS and BS initiated Service Flow creation and Multicast and Broadcast Services with customized security support enables flexible service offering.

Scalability

The IEEE-802.16 standard is designed to be able to scale to work in different channel bandwidth sizes from 1.25 to 20 MHz to comply with varied worldwide requirements as efforts proceed to achieve spectrum harmonization in the longer term.

Scalable Physical layer based on concept of Scalable OFDMA enables the technology to optimize the performance in a multipath fading mobile environment, characterized with delay spread and Doppler shift, with minimal overhead over a wide range of channel bandwidth sizes. The scalability is achieved by adjusting the FFT size to the channel bandwidth while fixing the sub-carrier frequency spacing. By fixing sub-carrier spacing to an optimal value of around 10 KHz, the performance is maximized with respect to multipath tolerance and mobility irrespective of channel bandwidth. More specifically, although large channel sizes and small sub-carrier spacing decreases overhead required to mitigate degradation due to multipath delay spread, but mobility link performance typically degrades due to the Doppler shift. Scalable FFT sizes keeps subcarrier spacing fixed and as a result system performance in a mobile environment is maintained.

Flexible and Ease of Reuse Planning

IEEE 802.16 OFDMA PHY supports various subcarrier allocation modes and frame structures such as Partially Used Sub-Channelization (PUSC), Fully Used Sub-Channelization (FUSC) and Advance Modulation and Coding (AMC). These options enables service providers to flexibly perform wireless network reuse planning for spectrally efficient reuse one, interference robust reuse 3 or optimal fractional reuse deployment scenarios.

In the case of reuse one, although system capacity can typically increase, due to heavy interference in this case, users at the cell edge may suffer low connection quality. Since in OFDMA, users operate on sub-channels, which only occupy a small fraction of the channel bandwidth, the cell edge interference problem can be easily addressed by reconfiguration of the sub-channel usage and reuse factor within frames (and therefore the notion of fractional reuse) without resorting to traditional frequency planning. In other words, the sub-channel reuse pattern can be configured so that in each frame users close to the base station operate on the zone with all sub channels available. While for the edge users, each cell/sector operates on the zone with a fraction of all sub-channels available. In this configuration, the full load frequency reuse of one is maintained for center users with better link connection to maximize spectral efficiency while fractional frequency reuse is achieved for edge users to improve edge user connection quality and throughput. The sub-channel reuse planning can be adaptively optimized across sectors or cells based on network load, distribution of various user types (stationary and mobile) and interference conditions on a per frame basis. All the cells/sectors can operate on the same RF frequency channel and no conventional frequency planning is required.

Security sublayer

IEEE 802.16-2004/802.16e-2005 supports Privacy and Key Management - PKMv1 RSA, HMAC, AES-CCM and PKMv2 – EAP, CMAC, AES-CTR, MBS Security

Standard: The IEEE Standard is available in electronic form at the following address:

Base Standard: http://standards.ieee.org/getieee802/download/802.16-2004.pdf

Amendment 802.16e: http://standards.ieee.org/getieee802/download/802.16e-2005.pdf

[Editor's Note: A copy of the standard has been provided to the BR (SG 8 counsellor) so that it can be made available to members for review purposes as needed. The document will be attached electronically to the document to be submitted to SG 8 for adoption.]

ETSI standards

The specifications contained in this section include the following standards for BWA, the last available versions being:

– ETSI TS 102 177 v1.3.2: Broadband Radio Access Networks (BRAN); HiperMAN; Physical (PHY) Layer.

– ETSI TS 102 178 v1.3.2: Broadband Radio Access Networks (BRAN); HiperMAN; Data Link Control (DLC) Layer.

– ETSI TS 102 210 v1.2.1: Broadband Radio Access Networks (BRAN); HiperMAN; System Profiles.

Abstract: The HiperMAN standards addresses interoperability for BWA systems below 11 GHz frequencies, to provide high cell sizes in non-line of sight (NLoS) operation. The standard provides for FDD and TDD support, high spectral efficiency and data rates, adaptive modulation, high cell radius, support for advanced antenna systems, high security encryption algorithms. Its existing profiles are targeting the 1.75 MHz, 3.5 MHz and 7 MHz channel spacing, suitable for the 3.5 GHz band.

The main characteristics of HiperMAN standards, which are fully harmonized with IEEE 802.16, are:

- All the PHY improvements related to OFDM and OFDMA modes, including MIMO for the OFDMA mode;
- Flexible channelization, including the 3.5 MHz, the 7 MHz and 10 MHz raster (up to 28 MHz);
- Scalable OFDMA, including FFT sizes of 512, 1 024 and 2 048 points, to be used in function of the channel width, such that the subcarrier spacing remains constant;
- Uplink and downlink OFDMA (sub-channelization) for both OFDM and OFDMA modes;
- Adaptive antenna support for both OFDM and OFDMA modes;

Standards: All the ETSI standards are available in electronic form at:
http://pda.etsi.org/pda/queryform.asp, by specifying in the search box the standard number.

Attachment C

Proposed Amendments to Annex 6
(to Annex 17 to Doc. 8A/376)

System	Nominal RF channel bandwidth	Modulation/coding rate[2] – upstream – downstream	Coding support	Peak channel transmission rate per 5 MHz channel	Beam-forming support (yes/no)	Support for MIMO (yes/no)	Duplex method	Multiple access method	Frame duration	Mobility capabilities (nomadic/mobile)
IEEE 802.16e-2005 WirelessMAN/ ETSI HiperMAN	Flexible from 1.25 MHz and above. Typical sizes are: – 3.5, – 5, – 7, – 8.75, – 10 and – 20 MHz	Up: – QPSK-1/2, 3/4 – 16QAM-1/2, 3/4 – 64QAM-1/2, 2/3, 3/4, 5/6 Down: – QPSK-1/2, 3/4 – 16QAM-1/2, 3/4 – 64QAM-1/2, 2/3, 3/4, 5/6	CC/CTC Other options: BTC/LDPC	Up to 35 Mbps with (2x2) MIMO	Yes	Yes	TDD/FDD/HFDD	OFDMA TDMA	5 msec Other options: 2, 2.5, 4, 8, 10, 12.5 and 20 msec	Mobile
ETSI BRAN HIPERLAN 2	20 MHz	64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM both upstream and downstream	CC	6, 9, 12, 18, 27, 36 and 54 Mbit/s in 20 MHz channel (only 20 MHz channels supported)	No	No	TDD	TDMA		Nomadic

ETSI TC BRAN proposes that the row in Table 1 of Annex 6 labeled 'ETSI BRAN HIPERLAN 1 ETS 300-652' should be deleted.

2 Including all applicable modes, or at least the maximum and the minimum.