ITU-D Regional Development Forum for the Asia Pacific Region:
"NGN and Broadband, Opportunities and Challenges"
Yogyakarta, Indonesia, 27-29 July 2009

ITU-R Standards Development on Broadband Wireless Access (BWA)

Colin LANGTRY
Counsellor, ITU Radiocommunication Bureau (BR)
E-mail: colin.langtry@itu.int

ITU-R Standards on Terrestrial BWA

ITU-R studies

- **Studies on terrestrial BWA in ITU-R are carried out in Study Group 5:**
- **Working Party 5A** – non- IMT BWA (fixed and mobile)
- Working Party 5C – FWA systems not related to public access systems for potentially mass market coverage (e.g. P-MP fixed systems)
- **Working Party 5D** – IMT systems

Committed to Connecting the World
International Telecommunication Union

Some key publications on terrestrial BWA

- **Rec. ITU-R F.1763** - Radio interface standards for broadband wireless access systems in the fixed service operating below 66 GHz
- **Rec. ITU-R M.1801** - Radio interface standards for broadband wireless access systems, including mobile and nomadic applications, in the mobile service operating below 6 GHz
- **Handbook on Land Mobile** (including Wireless Access) Volume 1: Fixed Wireless Access
- **Handbook on deployment of IMT-2000 systems** (and Supplement 1)
- Many more! - addressing system characteristics, frequency band channeling, sharing, performance, …

Yogyakarta, Indonesia, 27-29 July 2009

ITU-R texts on terrestrial BWA

Type		Num	Rev	Approved	Title	WP
Recommendation	F	**757**	3	01-Feb-03	Basic system requirements and performance objectives for fixed wireless access using mobile-derived technologies offering telephony and data communication services	*5A*
Recommendation	F	**1399**	1	01-Feb-01	Vocabulary of terms for wireless access	*5C*
Recommendation	F	**1400**	0	01-May-99	Performance and availability requirements and objectives for fixed wireless access to public switched telephone network	*5C*
Recommendation	F	**1401**	1	01-Jan-04	Considerations for the identification of possible frequency bands for fixed wireless access and related sharing studies	*5C*
Recommendation	F	**1402**	0	01-May-99	Frequency sharing criteria between a land mobile wireless access system and a fixed wireless access system using the same equipment type as the mobile wireless access system	*5C*
Recommendation	M	**1454**	0	05-May-00	E.i.r.p. density limit and operational restrictions for RLANS or other wireless access transmitters in order to ensure the protection of feeder links of non-geostationary systems in the mobile-satellite service in the frequency band 5 150-5 250 MHz	*5A*
Recommendation	M	**1457**	7	19-Oct-07	Detailed specifications of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)	*5D*
Recommendation	SF	**1486**	0	01-May-00	Sharing methodology between fixed wireless access systems in the fixed service and very small aperture terminals in the fixed-satellite service in the 3 400-3 700 MHz band	*SG4, 5C*
Recommendation	F	**1488**	0	01-May-00	Frequency block arrangements for fixed wireless access systems in the range 3 400-3 800 MHz	*5A*
Recommendation	F	**1489**	0	01-May-00	A methodology for assessing the level of operational compatibility between fixed wireless access and radiolocation systems when sharing the band 3.4-3.7 GHz	*5A*
Recommendation	F	**1490**	1	01-Sep-07	Generic requirements for fixed wireless access systems	*5A*
Recommendation	F	**1499**	0	01-May-00	Radio transmission systems for fixed broadband wireless access based on cable modem standard	*5A*
Recommendation	F	**1518**	0	01-May-01	Spectrum requirement methodology for fixed wireless access and mobile wireless access networks using the same type of equipment, when coexisting in the same frequency band	*5A*
Recommendation	F	**1568**	1	01-Jan-05	Radio-frequency block arrangements for fixed wireless access systems in the range 10.15-10.3/10.5-10.65 GHz	*5A, 5C*

Committed to Connecting the World
International Telecommunication Union

Current studies on terrestrial BWA

- Update of Rec. ITU-R M.1801 (MBWA < 6 GHz);
- Draft new (Recommendation/Report) - Mobile wireless access systems providing communications to a large number of ubiquitous sensors and/or actuators scattered over wide areas in the land mobile service;
- Draft new Recommendation - Performance and availability requirements and objectives for wireless access systems;
- Draft new Report – Studies on compatibility of non-IMT Broadband wireless access networks (in the mobile service) and fixed-satellite service networks in the 3 400-4 200 MHz band;
- Land Mobile Handbook - Volume 5 -Broadband Wireless Access Systems.

Scope of BWA Standardization

Committed to Connecting the World

Protocol stack		Specified items
Higher Layer	Application	–
	TCP	
Network layer (IP)		・Network routing ・Mobility management
Data Link Layer	DLC Sub-layer	・Send-receive flow control ・ARQ control ・QoS control
	MAC Sub-layer	・Medium access control ・Error detection & correction
Physical Layer (PHY)		・Radio frequency arrangement ・Modulation/Demodulation ・Transmission bit rate ・Necessary bandwidth ・Frequency sharing criteria

3GPP's
ETSI
IEEE
ARIB
Etc.

ITU-R Recommendation

TCP : Transmission Control Protocol IP : Internet Protocol
MAC : Media Access Control DLC : Data Link Control

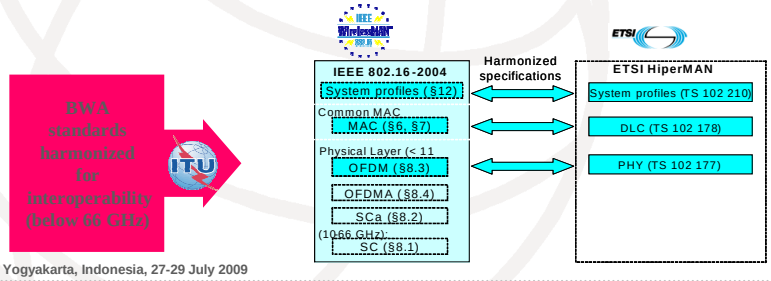
Fixed BWA

Committed to Connecting the World

Rec. ITU-R F.1763 - Radio interface standards for broadband wireless Access systems in the fixed service operating below 66 GHz

The Recommendation identifies specific radio interface standards for BWA systems in the FS, addressing profiles for the recommended interoperability standards.

The **interoperability** standards referenced in the Recommendation include the following specifications: system profiles; PHY layer parameters, i.e. channelization, modulation scheme, data rates; MAC layer messages and header fields; conformance testing methods:



Mobile BWA

Committed to Connecting the World

International Telecommunication Union

Rec. ITU-R M.1801 - Radio interface standards for broadband wireless access systems, including mobile and nomadic applications, in the mobile service operating below 6 GHz

This Recommendation identifies specific radio interface standards for BWA systems in the mobile service operating below 6 GHz.

- Broadband radio local area networks
- IMT-2000 terrestrial radio interfaces
- Harmonized IEEE and ETSI radio interface standards
- ATIS WTSC radio interface standards
- Next-generation PHS

ITU-R Standards on Satellite BWA

International Telecommunication Union

Committed to connecting the world

ITU-R studies

- **Studies on satellite BWA in ITU-R are carried out in Study Group 4:**
- **Working Party 4A** – Efficient orbit/spectrum utilization for FSS and BSS
- **Working Party 4B** – Systems, air interfaces, performance and availability objectives for FSS, BSS and MSS, including IP-based applications and satellite news gathering
- **Working Party 4C** – Efficient orbit/spectrum utilization for MSS and RDSS

Committed to Connecting the World
International Telecommunication Union

Some key publications on satellite BWA

- **Rec. ITU-R S.1782** - Possibilities for global broadband Internet access by fixed-satellite service systems;
- **Rec. ITU-R S.1709-1** - Technical characteristics of air interfaces for global broadband satellite systems;
- **Rec. ITU-R S.1711** - Performance enhancements of transmission control protocol over satellite networks;
- **Rec. ITU-R S.1783** - Technical and operational features characterizing high-density applications in the fixed-satellite service;
- Others addressing system characteristics, maximum emission requirements and off-axis e.i.r.p. densities.

Yogyakarta, Indonesia, 27-29 July 2009

Current studies on satellite BWA

- Draft revision of Recommendation ITU-R S.1711;
- Draft new Report – Transmission control protocol (TCP) over satellite networks;
- Draft new Recommendation and Report – Quality of service (QoS) architectures, mechanisms and their provisioning in IP-based satellite networks;
- Draft new Report – Studies on compatibility of non-IMT broadband wireless access networks (in the mobile service) and fixed-satellite service networks in the 3 400-4 200 MHz band.

Committed to Connecting the World
International Telecommunication Union

RECOMMENDATION ITU-R S.1782

Possibilities for global broadband Internet access by fixed-satellite service systems

Yogyakarta, Indonesia, 27-29 July 2009

- Satellite telecommunication technology has the potential to accelerate the availability of high-speed Internet services in developing countries, including the least-developed countries, the land-locked and island countries, and economies in transition;
- FSS frequency allocations can be used in the short, medium and long term for the global provision of high-speed Internet services;
- Studies into possibilities for providing global access to the Internet at a high data-rate via satellite have been carried out and are contained in ITU-R standards.

Committed to Connecting the World
International Telecommunication Union

- **First example**: suitable fixed-satellite service (FSS) bands are identified and up and downlink characteristics are developed for direct satellite links from user terminals with 30 cm antennas;
- **Second example**: up and downlink characteristics are developed for a system that would provide direct satellite links for user terminals with 1.2 m antennas;
- **Third example**: the characteristics are developed of an example system based on user access via terrestrial radio links to “community” earth stations and thence via a satellite to a single central earth station.

Yogyakarta, Indonesia, 27-29 July 2009

Frequency band considerations

- **4/6 GHz**: not suitable for low cost, very small antennas and already heavily used;
- **11/14 GHz**: already heavily used;
- **20/30 GHz**: most suitable in the near term, technology reasonably well developed;
- **40/50 GHz**: technology still not well developed.

Committed to Connecting the World
International Telecommunication Union

RECOMMENDATION ITU-R S.1709-1

Technical characteristics of air interfaces for global broadband satellite systems

Yogyakarta, Indonesia, 27-29 July 2009

- This Recommendation proposes air interface characteristics which can be used as guidance by designers of broadband satellite networks.
- Annex 1 - a generic description of the network architecture of broadband satellite networks.

- The remaining Annexes each contain a summary of existing air interface standards
- Annex 2 - TIA-1008-A dealing with Internet protocol (IP) over satellite (IPoS)
- Annex 3 - the DVB-RCS standard as described in ETSI Document EN 301 790
- Annex 4 - air interface specification for global broadband communications between earth stations and regenerative satellites based on ETSI BSM/RSM-A.

Committed to Connecting the World
International Telecommunication Union

RECOMMENDATION ITU-R S.1711

Performance enhancements of transmission control protocol over satellite networks

Yogyakarta, Indonesia, 27-29 July 2009

- satellite systems are being used increasingly for Internet Protocol (IP) packet transmissions, in particular providing broadband applications directly to users in addition to their role as backbone links;
- Most of the current IP transmissions use transmission control protocol (TCP) as transport protocol. However, the performance of TCP may suffer from degradation due to long satellite transmission delay, which affects the quality of service of end-users' applications;
- The enhancement of TCP performance is therefore critical in designing satellite links to carry IP packets. Various techniques, collectively referred to as "TCP performance enhancements" were developed to overcome satellite link limitations due to propagation delay and link errors.

Committed to Connecting the World

RECOMMENDATION ITU-R S.1783

Technical and operational features characterizing high-density applications in the fixed-satellite service

Yogyakarta, Indonesia, 27-29 July 2009

Features relating to HDFSS

- flexible, rapid and ubiquitous deployment of earth stations;
- large numbers of earth stations deployed with high-geographical density;
- urban, suburban and rural earth station sites;
- wide range of telecommunications applications;
- different systems may employ GSO or non-GSO satellites.

- Includes an Annex providing the technical characteristics of existing and planned GSO HDFSS networks
- administrations planning future GSO HDFSS networks are encouraged to submit their technical characteristics to ITU-R to update this data source.

Committed to Connecting the World
International Telecommunication Union

Yogyakarta, Indonesia, 27-29 July 2009