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| **Radiocommunication Study Groups** |  |
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| Working Party 5A | |
| Liaison statement to EXTERNAL ORGANIZATIONS on the revision WORK oN report itu-r f.2086 (Copy to ITU-T SG 2 for information) | |
| Technical and operational characteristics and applications of broadband wireless access  in the fixed service | |

At its November 2009, Working Party 5A ITU‑R WP 5A initiated a revision of Report ITU-R F.2086 “Technical and operational characteristics and applications of broadband wireless access in the fixed service”.

WP 5A kindly invites external organizations to review the information contained in the current document (attached) and provide any updates that might be relevant for the continued development of the Report ITU-R F.2086.

WP 5A has the objective to complete the revision work by its November 2010 meeting. In order to ensure consideration of input materials, external organizations are encouraged to submit materials to the November 2010 meeting, which has a deadline for input contributions of 1 November 2010 at 1600 UTC.

**Contact:**  Mr Lang Baozhen  
Chairman, WG 5A-2  
[langbaozhen@catr.cn](mailto:langbaozhen@catr.cn)

**Attachments:** 1: Document 5A/TEMP/146 – The preliminary draft revision of Report ITU-R F.2086 on technical and operational characteristics and applications of broadband wireless access in the fixed service

**2:** Report ITU-R F.2086 (embedded object)

Attachment 1

Source: Document 5A/TEMP/146

Preliminary draft revision of Report ITU-R F.2086

Technical and operational characteristics and applications of  
broadband wireless access in the fixed service

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# 1 Introduction

(No change)

# 2 Scope

(No change)

# 3 References

(No change)

# 4 List of acronyms and abbreviations

AP Access point

APS Antenna pattern shaping

ARIB Association of Radio Industries and Businesses

ATM Asynchronous transfer mode

BEM Block edge mask

BER Bit error ratio

BRAN Broadband radio access network (ETSI)

BS Base station

BWA Broadband wireless access

CDMA Code division multiple access

*C*/*I* Carrier-to-interference

Diffserv Differentiated services

DL Downlink

DLC Data link control

ETSI European Telecommunications Standards Institute

FDD Frequency division duplex

FSK Frequency shift keying

FWA Fixed wireless access

GPS Global positioning system

HDTV High Definition TeleVision

H-FDD Half duplex FDD

HIPERMAN HIgh PErformance radio Metropolitan Area Network

HQSA High Quality Service Application

IEEE Institute of Electrical and Electronics Engineering

ISI Inter-symbol-interference

IP Internet protocol

ISP Internet service providers

LAN Local area network

LoS Line-of-sight

MA Multiple access

MAN Metropolitan area network

MIMO Multiple input multiple output

MPEG4 Moving Picture Experts Group 4

MP-MP Multipoint-to-multipoint

MPLS Multi-protocol label switching

MUD Multi-user detection

NLOS Non-line-of-sight

OFDM Orthogonal frequency division multiplex

OFDMA Orthogonal frequency-division multiple access

PoI Points of interface

POTs Plain Old Telephone Service

P-P Point-to-point

P-MP Point-to-multipoint

QAM Quadrature amplitude modulation

QoS Quality of service

RLAN Radio local area network

RSVP Resource reservation protocol

SDH Synchronous digital hierarchy

SLA Service level agreement

SME Small medium enterprise

SINR Signal and interference to noise ratio

SNMP Simple network management protocol

SOHO Small office home office

ST Subscriber terminal

SU Subscriber unit

TCP/IP Transmission control protocol/Internet protocol

TDD Time division duplex

UL Uplink

VoIP Voice over Internet protocol

WAN Wide area network

WAS Wireless access systems

# 5 Application and services

(No change)

# 6 Characteristics

(No change)

## 6.1 Operating frequency ranges

(No change)

## 6.2 Spectrum utilization efficiency (SUE)

(No change)

## 6.3 Topology structures

(No change)

## 6.4 Antennas

(No change)

## 6.5 Duplexing

(No change)

## 6.6 Types of deployment

### 6.6.1 Line-of-sight (LoS) operation

(No change)

### 6.6.2 Non-line-of-sight (NLoS) operation

(No change)

### 6.6.3 Planar deployment

(No change)

### 6.6.4 Spot deployment

(No change)

### 6.6.5 Backhaul deployment

(No change)

### 6.6.6 Combination deployment

Fixed BWA systems are often deployed in combination with other kinds of BWA, i.e. mobile and nomadic, providing integrated BWA services. Such applications are particularly useful in the environments where cable infrastructure is not yet deployed.

If the design of the radio equipments in the BWA are based on the interoperable specifications such as those referred to in Recommendation ITU-R F.1763, the entire cost for wireless facilities may reasonably be reduced. Specific examples of converged BWA applications are described in Annex 1 and Annex 2.

## 6.7 Transport characteristics

(No change)

## 6.8 System management function

(No change)

## 6.9 Interference mitigation

(No change)

## 6.10 Technical characteristics of BWA providing high quality service applications (HQSA)

Broadband systems such as FTTH provide various kinds of HQSAs, such as high-speed Internet access, multicast high definition television (HDTV) streaming and high-quality telephony/voice service. The conventional BWA system for mass-market can provide data transmission speed of about 40 Mbit/s at most and its service type is best effort without QoS control. Therefore they cannot achieve the HQSAs.

Technical characteristics to achieve each HQSA are presented as follows.

1) High-speed Internet access

There are several grades of FTTH service providing different user interface data speed. The user interface data speed of Internet access data rate provided by the lowest grade of FTTH services is up to 100 Mbit/s. Internet access speed of higher than 100 Mbit/s is required to support HQSAs provided by FTTH.

2) Multicast HDTV streaming

Multicast steaming and HDTV signal transmission is achieved by QoS control and multicast function.

3) High-quality telephony/voice service

The quality of IP telephone is influenced by parameters such as packet loss and delay, etc. QoS is required to achieve the quality of Plain Old Telephone Service (POTs). Performance objectives for IP packet transmission are provided in ITU-T Recommendations Y.1540 and Y.1541. ITU-T Recommendation Y.1540 defines availability performance parameters, and Y.1541 specifies six QoS class and IP packet transfer performance parameters.

Example technical characteristics of the BWA system providing HQSAs are described in Annex 3.

## 6.11 New technologies system support

(No change)

Annex 1

(No change)

Annex 2 (*New text*)

Example of integrated BWA application in rural area

# 1 Introduction

This Annex describes another example of the technical aspects of the BWA application referred to in § 6.6.6. This BWA system is composed of fixed and nomadic applications including RLANs, and is particularly useful in the environments where cable infrastructure is not deployed.

The integrated BWA system could be installed flexibly to a rural area, where multiple clusters of users are scattered widely in a remote community, at lower cost compared with a new network cable infrastructure.

In addition, NWA service in outdoor environment could be provided with portable VoIP terminals, personal digital assistants (PDAs), etc.

# 2 System configuration

The objective of this service is to provide broadband access for residents at a rural area in the distance from the core networks. In such an area several households are scattered widely, and cannot be covered by one AP of RLAN alone. As shown in § 6.3.4, by sharing the BWA system integrated with P-P solutions and P-MP networks, the many users can obtain Internet connection.

The broadband service includes three kinds of wireless connections, i.e. backhaul link, relay link and access link (see Fig. 10).

Backhaul link

– P-P connection is deployed between the APs placed in a service area and a backbone network.

– The distance is a few kilometres with a clear line-of-sight (LoS) path, and can be extended by arranging several P-P connections according to the geographical conditions in case of need.

Relay link

– P-MP connection is deployed between each AP in a service area.

– The distance is hundreds of metres under LoS conditions, and can be deployed by multi‑hop relay techniques with P-MP topology structure.

Access link

– P-MP connections are directly deployed between an outdoor AP and indoor SUs, such as note PCs or repeaters.

– The distance is a few hundred metres under non-LoS conditions.

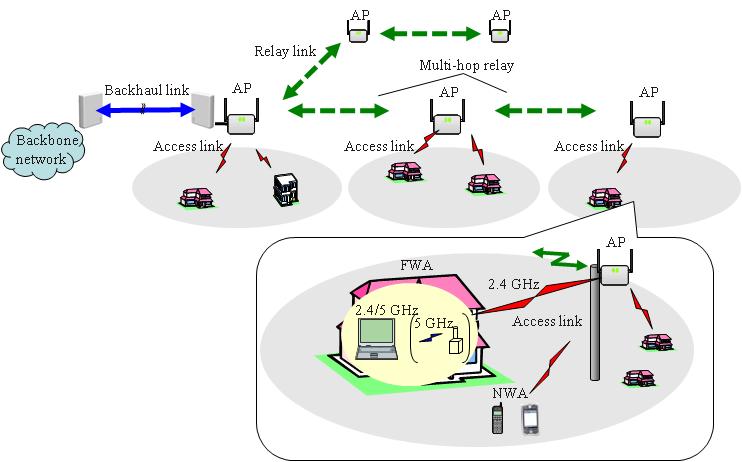
Two types of wireless system are applicable to backhaul link. If the number of the subscriber is large, the backhaul link needs large transmission capacity. The 25 GHz band is a proper solution to support total traffic of several RLAN users in AP areas, since it has the maximum capacity of 80 Mbit/s and performance of transmission distance of a few kilometres. On the contrary, if the number of the subscriber is not large, IEEE 802.11j (4.9-5.0 GHz) or IEEE 802.11b/g (2.4 GHz) may also be as backhaul link, if its transmission capacity is enough to support total traffic.

There are two types of multi-hop relay for the relay link, the one is called dual-radio; the APs use the same frequency channel in the multi-hop relay. Though the AP of dual-radio is available at low cost, it has a disadvantage that the throughput of the relay link decreases as the number of hops increases. The other type is called multi-radio; the APs are mounted more than two radio modules, and maintain the throughput of the relay link in any number of hops.

The outdoor APs could be placed on the top of a pole, and make connections to the SUs in houses directly using IEEE 802.11 b/g (2.4 GHz). When the direct connection between the AP and the SU is difficult, it is useful to establish an access link via a radio repeater which converts a radio frequency channel to another radio channel, for example, in switching from IEEE 802.11 b/g (2.4 GHz) to IEEE 802.11a (5.2-5.3 GHz).

Figure 10

System configuration of integrated BWA service



# 3 Basic system parameters

This system includes three kinds of wireless link as depicted in Fig. 10. Basic system parameters are as follows:

Table 5

Basic system parameters to integrated BWA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Link | Backhaul link | | | Relay link | | | Access link |
| Frequency | 25 GHz1) | 4.9-5.0 GHz | 2.4 GHz | 5.6 GHz | 4.9-5.0 GHz | 2.4 GHz | 2.4 GHz |
| Transmit output power | 0 dBm | 20 dBm | 11 dBm | 12 dBm | 15 dBm | 20 dBm | 20 dBm |
| Channel bandwidth | 26 MHz | 18 MHz | 18 MHz | 18 MHz | 18 MHz | 18 MHz | 18 MHz |
| Channel separation | 20 MHz | 20 MHz | 20 MHz | 20 MHz | 20 MHz | 20 MHz | 20 MHz |
| Antenna type | Directional | | | Omnidirectional | | | Omni- directional |
| Antenna gain | 31.5 dBi | 13 dBi | 19 dBi | 6 dBi | 6 dBi | 5 dBi | 5 dBi |
| 1) Unlicensed band in Japan. | | | | | | | |

# 4 Feasibility test

The field test of this system has already been conducted in a rural community in Miyagi Prefecture, Japan. At the field test, the relay link was composed of 2-hop relay by using IEEE 802.11j of 4.9‑5.0 GHz band. Various applications such as Internet access, IP announcement, and VoIP were achieved a relatively low budget. The throughput of the note PCs connected to the 3rd AP was obtained more than 3 Mbit/s.

Annex 3 (*New text*)

Example of BWA system providing high quality  
service applications (HQSAs)

# 1 Introduction

This Annex describes example of BWA system providing HQSAs, hereinafter called HQSA BWA, referred to in Section 6.10.

# 2 Service images

Figure 11 shows a service image configuration of HQSA BWA. This type of network has a considerable cost advantage compared to FTTH in a low-density residential area in rural or sub‑urban areas. This system can be topologically configured with a point-to-multipoint (P-MP) or a point-to-point (P-P) connection.

Radio backhaul link using P-P connection can be used in rural areas where optical fibre system is located far away.

A P-MP system with an omnidirectional AP antenna is mainly deployed for detached houses scattering in a service area. The service area radius is approximately 1 km, which depends on service availability objective and regional rain conditions.

A P-MP system is also applied to a multi-dwelling building which is not equipped with available wiring ducts in urban areas. A horn antenna is implemented in such multi-dwelling buildings.

Multiple IP-based user terminals, such as PCs, can be accommodated by a wireless terminal (WT). It is easy to deploy this type of system and is cost-effective because WTs are very compact; of 19 cm × 19 cm × 3 cm, and low cost.

Figure 11

Service image



# 3 Main specifications and comparison to conventional BWA

Table 6 gives the main specifications for the HQSA BWA system with comparison to conventional BWA, whose parameters are proposed to be listed as one of the typical BWA systems in Recommendation ITU-R F.758 used for a sharing study.

The operating frequencies for the system are the various frequencies regulated by organizations. The radio-frequency arrangements comply with Annex 3 of Recommendation ITU-R F.748.

The HQSA BWA system can newly employ high-level modulation schemes (64QAM) and high‑speed symbol rate (40 MHz) to achieve high-speed transmission of 240 Mbit/s. The media access control protocol enables a throughput of approximately 180 Mbit/s. A new minimum guaranteed bandwidth, rate limit, and priority queuing function are supported to achieve high-quality VoIP service comparable to POTs.

Table 6

Main specifications and comparison to conventional BWA



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