Fixed Wireless Access Working Group

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An industry forum group consisting of:

- **Alcatel**
- **Ericsson**
- **Intersil**
- **Motorola**
- **Nokia**
- **Solectek**
- **Wi-LAN**
- **IoWave**
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- **Silicon Automation Systems**
- **SiWorks**
- **TIL-TEK Antennas**
- **4G Networks Technologies**

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Decision	
Discussion	**X**
Information	

Agenda item: **"FWA below 11 GHz" group**

1. INTRODUCTION

1.1 Scope

1.2 Overview

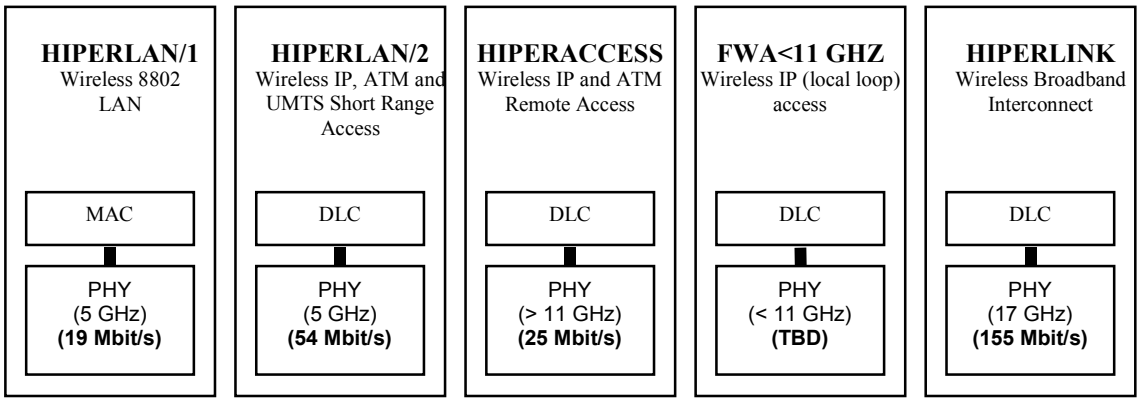

Figure 1 Positioning of "FWA<11GHz" in BRAN standards

The "FWA<11GHz" standard, for which this document describes the system requirements, fits in the existing BRAN standardization efforts as shown in Figure 1. Although the final aim is principly the same as that of HIPERACCESS, namely providing fixed remote or local loop access, it differentiates itself in the market segments targeted, as well as in the spectrum utilized, since the HIPERACCESS standardization has focused entirely on solutions optimized for above 11 GHz bands.

Due to the distinctly different radio channel behavior, which can be efficiently exploited to improve system performance, as well as the stringent conditions the system must meet to enable a successful standard for the targeted market segments, "FWA < 11 GHz" complements rather than duplicates the remaining BRAN efforts.

1.3 Target Markets

The target markets that SHALL be addressed are residential (single family, as well as multitenant dwellings) SOHO, telecommuters and small businesses.

The critical parameters for serving these markets are the combination of coverage / capacity factors that affects access cost per user, deployability, maintainability, product costs associated with the CPE installation, and the spectrum efficiency / reuse for economically serving the required number of customer locations with a minimum cost of infrastructure.

1.4 Regulatory constraints in targeted spectrum

2. SYSTEM MODEL

This section presents a high level description of a system model to be used as a framework for standards development.

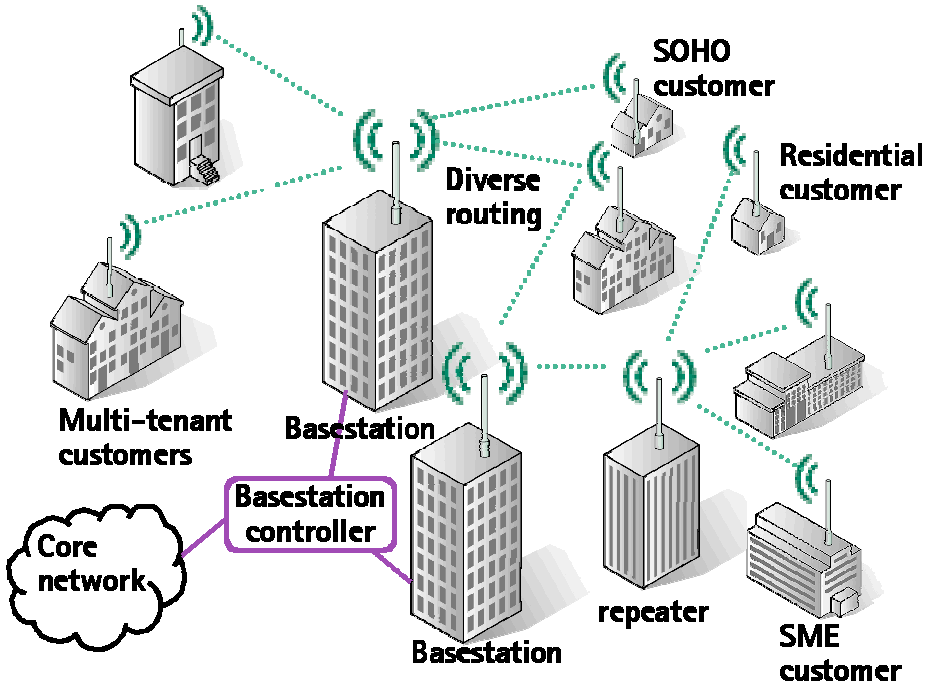

Figure 2 Example network deployment configuration

Figure 2 shows an example deployment configuration. The basestation can serve individual buildings, multiple subscribers in multiple buildings (using multiple radio links), or multiple subscribers in a single building by use of a single radio link and further in-building distribution systems. It shows the use of a repeater and route diversity in order to provide extended coverage and coverage in difficult areas. This does not imply the use of these features in all systems. However, it does require the capability to implement them if required, and leave them out if not.

In the targetted frequency bands, radio communications can benefit significantly from capabilities of operating under near- and non-line-of-sight conditions in terms of link quality and coverage. Therefor, NLOS operation SHOULD be supported. Due to the significant multipath propagation inherent in these bands, the system MUST be robust in adverse channels

To be able to support a variety of markets with a wide range of customer density, the system SHOULD be flexible with regards to cell-size and be able to operate in all environments.

The system SHALL be bandwidth/spectrally efficient, both in single and multi-cell architectures.

To counter channel condition variations and maximize spectral efficiency, the system SHOULD support adaptive modulation and various encoding schemes. The system SHOULD be flexible with regard to the MAC-interface.

In order to ensure timely completion of the standard and minimize risks, the standard SHOULD be based on proven technology.

An important standard requirement for the targetted markets is minimized cost. The standard SHALL therefor aim at low cost networks, which not only implies aiming at low-cost reduced complexity equipment, but also at minimum CPE installation complexity to enable customer-installable devices. The system SHOULD be capable of using low-gain antennas

3. SUPPORTED SERVICES

3.1 Internet Protocol services

The system MUST directly transport variable-length IP datagrams. Both IP version 4 and 6 MUST be supported. For efficient transport of IPv6, TCP/IP header compression over the air interface SHOULD be supported. It SHOULD be possible to support the emerging IP-QoS efforts.

3.2 Bridged LAN services

The protocols SHOULD support full bridged LAN service capabilities.

3.3 Voice services

The system SHALL support voice communications. The voice access transport SHALL be packet based. The system MUST support the QoS requirements of these services.

4.

5. PERFORMANCE AND CAPACITY

5.1 Scalability

5.2 Data rates

As the available bandwidth per channel, and hence the achievable data-rate, may vary, peak data rates cannot easily be specified (without further study). Instead, modulation types will be specified.

In the upstream, the system is REQUIRED to support QPSK, whereas 16 QAM and 64 QAM SHALL be specified as optional modulation types.

In the downstream, the system is REQUIRED to support both QPSK and 16 QAM, whereas 64 QAM SHALL be specified as optional modulation type.

5.3 Channel conditions

Due to the multipath inherent in the targeted frequency bands, the system SHOULD be capable of handling several us of delay spread with limited performance degradation.

Although cell radii will vary strongly based on the environment, propagation conditions, antenna gain etc., the system should be such that it supports the typical cell-sizes as listed in Table 1.

	LOS (km)	NLOS (km)
urban	7.5	2
suburban	10	2.5
rural	15	4

Table 1 Typical cell-sizes

5.4 Flexible Asymmetry

The system SHALL effeciently support assymmetric traffic. In TDD mode, assymmetry of 10% upstream, 90% downstream to 90% upstream, 10% downstream SHOULD be supported. In FDD mode, the modulation type and coding SHOULD be adjustable to maximize total sector capacity.

5.5 Radio Link Availability

The system SHOULD be available to transport all services with an availability from about 99.9 to 99.99 % of the time. The standard SHALL NOT preclude the ability of the radio link to be engineered for different link availabilities, based on the preference of the system operator.

5.6 Radio Link Error Performance

The radio link bit error rate, after application of the appropriate error correction mechanisms, SHALL be 10E-6 in accordance with ITU FWA recommendation ???, or better.

5.7 Capacity Issues

6. WIRELESS MEDIA CHARACTERISTICS

6.1 Duplex model

The system SHALL support both FDD and TDD efficiently. The basestation SHALL support full-duplex FDD. The CPE SHOULD be able to operate in half-duplex FDD to reduce equipment cost.

6.2 Cellular deployment

6.3 Channelization

7. CLASSES OF SERVICE AND QUALITY OF SERVICE

7.1 Types and Classes of Service

Three classes of service are recognized, which SHALL be supported:

- Expedited Forwarding (EF): This class of service may have a varying bandwidth requirement over time, but tolerance of delay and jitter are limited (example: VoIP)
- Assured Forwarding(AF): Within this class of service, the bandwidth may vary over time within limits, but the tolerance of delay and jitter are loose.
- Best Effort: The bandwidth in this class varies widely and is allowed to burst up to the link capacity not occupied by EF and AF traffic. Delay and jitter tolerance is high.

7.2 Parameters

7.3 Service QoS Mappings

8. MANAGEMENT

8.1 Service Level Agreements

The protocols MUST permit operators to enforce service level agreements (SLAs) with subscribers by restricting access to the air link, discarding data, dynamically controlling bandwidth available to a user or other appropriate means. The protocols MUST NOT prohibit performance monitoring of the provided services by the subscriber at the delivery point.

8.2 Malfunctioning Subscriber Station or Base Station

The management functionality MUST include reboot and shut-down capabilities.

8.3 Accounting and Auditing

9. SECURITY

The system SHALL provide secure means of authentication, authorization and adequate means of encryption to ensure privacy.

9.1 Authentication

9.2 Authorization

9.3 Privacy

10. REFERENCES

11. DEFINITIONS AND ABBREVIATIONS

[local] access: This term is used in the telecommunications sense: short range (< 100 m) wireless access to other, possibly wired, networks.

[remote] access: This terms is used in the telecommunications sense: long range (< 10 km) wireless access to other, possibly wired, networks. Remote access networks are also referred to as "**local loop networks**".

Data Link Control (DLC): Layer 2 of the ISO/OSI reference mode.