C802.16sgm-02/11

Broadband Mobile Wireless Access SG

PAR and Five Criteria Working Document

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Chair – MBWA SG Chair
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Purpose of this Document

- Consolidated comparison of the content of the two PAR/5C proposals.
- Facilitate reaching an agreement based on recommended merging of text and agreements reached during May discussion.
- Elicit contributions to the July MBWA SG meeting. Please try to post contributions by June 25, 2002.

Issues to Be Resolved in order to progress PAR and Five Criteria

- Market addressed (Purpose)
- Scope of Project Based on Market to be addressed
- Work to be done in SG vs in WG
- Point of Departure for work
- Recommendation on 802 Structure to deliver on the project

Possible Way Forward

- Divide work into two projects:
  - New project for an optimized vehicular mobility solution with new PHY/MAC layers.
  - Amendment to 802.16a to support nomadic and portable capability.
- Prioritize Vehicular Mobility Project into Near Term and Long Term
  - Near Term to address existing licensed spectrum in current carrier market (1.25 – 5 Mhz FDD channels and appropriate TDD channels) with commensurate cell capacities
  - Long Term to address future licensed spectrum with rates possible as high as 100 Mbps and commensurate channels (per ITU-R Vision)

PAR Scope Section (Section 12)

Agreed at May Meeting

12. Scope of Proposed Project

This standard specifies the physical and media access control layer of the air interface of interoperable mobile broadband wireless access systems targeting aggregate channel data rates higher than 20Mbps. Channel data rates shall be scalable with the channel bandwidth. The user data rate may be allocated on a fully flexible and adaptive basis . This standard supports cell sizes appropriate to ubiquitous metropolitan-area networks and supports vehicular mobility classes (e.g REF) up to 250 km/h. It applies to systems operating in licensed bands allocated by the ITU-R or other radio regulators to the Mobile Service. Systems may employ either a TDD or an FDD channel structure. The air interface is designed to carry IP based traffic.

Text to be included in Section 18 (Additional Explanatory Notes) of PAR

Spectrum may be reallocated for mobile use. The proposed project will address those allocations.

PAR Purpose Section (Section 13)

C802.16SGM-02/02	C802.16SGM-02/08
13. Purpose of Proposed Project: To enable rapid worldwide deployment of innovative, cost-effective and interoperable multi-vendor mobile broadband wireless access products. To facilitate competition in broadband access by providing wireless mobile alternatives to fixed wireline broadband access. To facilitate coexistence studies, encourage consistent worldwide allocation, and accelerate the commercialization of mobile broadband wireless access spectrum. Utilization of frequencies from 0.45 to 6 GHz will address a market that includes residences, Small Office-Home Office (SOHO), telecommuters and Small and Medium Enterprises (SME).	13. Purpose of Proposed Project: To enable worldwide deployment of cost effective, spectrum efficient, ubiquitous, always-on and interoperable multi-vendor mobile broadband wireless access networks. To provide for the simplification of mobile data network architectures by providing an efficient packet based air interface. To provide for a channel organization that is compatible with frequency allocations worldwide for cellular wireless networks. To provide for a wireless data access architecture that transparently extends current wired data access architectures.

Proposed: To enable worldwide deployment of cost effective, spectrum efficient, ubiquitous, always-on and interoperable multi-vendor mobile broadband wireless access networks. To provide an efficient packet based air interface optimized for IP. To provide for a wireless data access architecture that transparently extends current wired data access architectures. Utilization of frequencies that are compatible with ITU-R and other regulatory agencies frequency allocations to Mobile Services will address end user markets that include access to Internet and intranet applications by mobile professionals as well as access to infotainment services

PAR Miscellaneous Sections

C802.16SGM-02/02	C802.16SGM-02/08
3. Type of Document: Standard	**3. Type of Document**: Standard
4. Title of Document:: Local and Metropolitan Area Networks Amendment to Standard Air Interface for Fixed Broadband Wireless Access Systems Media Access Control and Physical Layer Modifications to support vehicular mobility at frequencies 0.45 - 6 GHz	**4. Title of Document**:: Local and Metropolitan Area Networks – Standard Air Interface for Mobile Broadband Wireless Access Systems Supporting Vehicular Mobility – Physical and Media Access Control Layer Specification
5. Life Cycle: Full Use (5 years)	**5. Life Cycle**: Full Use (5 years)
6. Type of Project: Amendment to an existing standard	**6. Type of Project**: New standard
10. Sponsor Balloting Information: Individual Balloting Expected Date of Submission for Initial Sponsor Ballot: 2003-05-31	**10. Sponsor Balloting Information**: Individual Balloting Expected Date of Submission for Initial Sponsor Ballot: 2004-03-30

Issue: The crux of the issue that needs to be resolved is as to whether this is a project that extends 802.16a or a project to define a vehicular mobility solution without any prior assumption about the PHY/MAC. Possible solution maybe to define two projects:

1. New project for an optimized vehicular mobility solution with new PHY/MAC layers
2. Amendment to 802.16a to support nomadic and portable capability.

Five Criteria – Broad Market Potential (A)

C802.16SGM-02/03	C802.16SGM-02/08

a) Broad sets of applicability
 	
Access networks in the centimeter-wave region are a rapidly emerging technology on a worldwide basis. Such networks have the potential to compete with copper-and fiber-based systems in terms of capacity, and they offer the advantage of not requiring the installation of buried or pole-based infrastructure. This is particularly advantageous in countries where the infrastructure is not widely deployed. The capability of the wireless medium to support mobility is a feature unmatched by the capabilities of wireline broadband access networks. The mobile capability has thus far proven vastly successful as can be seen from the abundance of narrow-band mobile devices.
 	
b) Multiple vendors and numerous users
 	
The interest of many vendors is attested by the participation of 45 companies in the tutorial and CFI session on mobile broadband wireless access.
 	
c) Balanced costs (LAN versus attached stations)
 	
Given that a base station in a point-to-multipoint network can serve many user stations, the cost of the equipment can easily be spread over many users. Typically it is expected to compete with the prices of cellular phones and similar equipment while providing superior performance in terms of capacity and available bandwidth.
	a) Broad sets of applicability.
	b) Multiple vendors and numerous users.
	c) Balanced costs
	
	• Mobile broadband wireless access, based on IP mobility, unlocks all Internet content to the general public, potential addressable market is all Internet users. Applications include:
	  ◦ Enterprise Intranets and VLAN Services
	  ◦ Entertainment & Gaming
	  ◦ Internet and Location Services
	• Mobile station and terminal equipment is provided by multiple international telecommunications equipment vendors, deployed by international carriers and made available to the end-user community. Tutorial and Call for Interest sessions were held at the March 802 plenary. The tutorial session was attended by 180 individuals from 110 organizations. The CFI was attended by 55 individuals from 45 organizations expressing support for the project.
	• This project will achieve cost balance between terminal devices and network infrastructure equipment that is comparable to existing cellular wireless networks and encourage mass deployment of wireless data services.

Proposed: See Next Slide

Five Criteria – Broad Market Potential (B)

C802.16SGM-02/03	C802.16SGM-02/08
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Proposed:

a) Broad sets of applicability.
b) Multiple vendors and numerous users.
c) Balanced costs

- The capability of the wireless medium to support mobility is a feature unmatched by the capabilities of wireline broadband access networks. The mobile capability has proven vastly successful as can be seen from the abundance of narrow-band mobile devices. Mobile broadband wireless access, based on IP mobility, unlocks all Internet content to the general public, potential addressable market is all Internet users. Applications include:
  - Enterprise Intranets and VLAN Services
  - Entertainment & Gaming
  - Internet and Location Services
- Mobile station and terminal equipment is provided by multiple international telecommunications equipment vendors, deployed by international carriers and made available to the end-user community. Tutorial and Call for Interest sessions were held at the March 802 plenary. The tutorial session was attended by 180 individuals from 110 organizations. The CFI was attended by 55 individuals from 45 organizations expressing support for the project.
- This project will achieve cost balance between terminal devices and network infrastructure equipment that is comparable to existing cellular wireless networks and encourage mass deployment of wireless data services. Given that a base stations can serve many user stations, the cost of the network equipment can easily be spread over many users. Terminal devices and associated chip-sets are expected to benefit from volume deployment and low-cost due to large scale integration.

Five Criteria – Compatibility

C802.16SGM-02/03	C802.16SGM-02/08
IEEE 802 defines a family of standards. All Standards shall be in conformance with the IEEE 802.1Architecture, Management and Interworking documents as follows: 802 Overview and Architecture, 802.1D, 802.1Q and parts of 802.1f. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with 802. Each standard in the IEEE 802 family of standards shall include a definition of managed objects which are compatible with systems management standards. The proposed standard will conform to the 802 Functional Requirements Document, with the possible exception of the Hamming distance.	a) Conformance with 802 Overview and Architecture b) Conformance with 802.1D (MAC Bridges) and 802.1F (VLAN Bridges) c) Conformance with 802.1F and compatible managed object definitions d) Identification of any variance in conformance • The proposed standard will conform with the appropriate IEEE 802 functional requirements. • Compatibility will be addressed during development of the standard and any variance that may be required will be clearly identified and justified . • The standard will include the definition of a compliant MIB in support of the PHY and MAC layer capabilities.

Proposed:

a) Conformance with 802 Overview and Architecture
b) Conformance with 802.1D (MAC Bridges) and 802.1F (VLAN Bridges)
c) Conformance with 802.1F and compatible managed object definitions
d) Identification of any variance in conformance

- The proposed standard will conform with the appropriate IEEE 802 functional requirements.
- Compatibility will be addressed during development of the standard and any variance that may be required will be clearly identified and justified .
- The standard will include the definition of a compliant MIB in support of the PHY and MAC layer capabilities.

Five Criteria – Coexistence (Compatibility)

C802.16SGM-02/03	C802.16SGM-02/08
No text provided	The proposed standard is applicable to licensed spectrum and will be compliant with the respective constraints imposed by the spectrum license.

Proposed:

The proposed standard is applicable to licensed spectrum and will be compliant with the respective constraints imposed by the spectrum license.

Five Criteria – Distinct Identity (A)

C802.16SGM-02/03	C802.16SGM-02/08
a) Substantially different from other IEEE 802 standards. IEEE 802 presently has no project that supports vehicular mobility (speeds up to 200 Km/H). The mobile BWA standard is intended to provide for public access networks operated by a third party, where the user typically makes use of a wide-area network through an access network when mobile. It differs also from a wireless LAN, which typically is operated by a single organization over smaller distances and has less-stringent requirements for system integrity and resistance to unauthorized usage. The access network is optimized for distances comparable with the propagation of microwaves through the atmosphere. The extension of the air interface specification to support mobility for systems operating in licensed bands between 0.45 and 6 GHz is expected to extend the 802.16a air interface specification currently under development by adding the PHY and MAC extensions required to support mobile subscribers. b) One unique solution per problem (not two solutions to a problem). It is envisioned that the standard will provide protocols sufficiently flexible to provide efficiently for a variety of services, some of which may have stringently bounded delay requirements. Hence it will not be necessary to have a multiplicity of different and incompatible versions. An effort will be made to utilize the 802.16a MAC and PHY layers or applicable elements thereof. c) Easy for the document reader to select the relevant specification. It is anticipated that the document will be easily selectable by the reader.	a) Substantially different from other IEEE 802 standards. b) One unique solution per problem. c) Easy for the document reader to select the relevant specification. • This project will specify an air-interface supporting vehicular mobility in a cellular system. IEEE 802 presently has no project addressing this capability. • The project has been socialized with the existing 802 Wireless groups. (To be done at the July meeting). • The proposed project will specify a unique solution to the physical and MAC layer of the air-interface operating below 3.5 GHz and utilizing both TDD and FDD modes. This solution will incorporate traffic engineering and QOS aspects adequate for both real-time and non-real-time data traffic. • The specification will be a stand-alone document with clearly defined scope.

Proposed: See Next Slide

Five Criteria – Distinct Identity (B)

C802.16SGM-02/03	C802.16SGM-02/08
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Proposed:

a) Substantially different from other IEEE 802 standards.

b) One unique solution per problem.

c) Easy for the document reader to select the relevant specification.

- IEEE 802 presently has no project that supports vehicular mobility. The mobile BWA standard is intended to provide for public access networks operated by a third party, where the user typically makes use of a wide-area network through an access network when mobile. It differs also from a wireless LAN, which typically is operated by a single organization over smaller distances and has less-stringent requirements for system integrity and resistance to unauthorized usage.
- The project has been socialized with the existing 802 Wireless groups. (To be done at the July/November meeting).
- The proposed project will specify a unique solution to the physical and MAC layer of the air-interface operating in spectrum allocated to the Mobile Service and utilizing both TDD and FDD modes. It is envisioned that the standard will provide protocols sufficiently flexible to provide efficiently for a variety of services, some of which may have stringently bounded delay requirements. This solution will incorporate traffic engineering and QOS aspects adequate for both real-time and non-real-time data traffic.
- The specification will be a stand-alone document with clearly defined scope.

Five Criteria – Technical Feasibility

C802.16SGM-02/03	C802.16SGM-02/08
a) Demonstrated system feasibility The feasibility of such systems has been demonstrated by proprietary systems covering some if not all of the capabilities intended for this standard and now going into operation in many cities worldwide. b) Proven technology, reasonable testing Mobile radio technology in centimeter-wave systems has been demonstrated in recent years in point-to-multipoint systems, as used in commercial and military environments. Many systems are now in commercial use. c) Confidence in reliability Commercial deployment of point-to-multipoint systems at centimeter-wave frequencies by carriers is evidence of proven reliability.	a) Demonstrated system feasibility. b) Proven technology, reasonable testing. c) Confidence in reliability. • The technical feasibility of such a system has been demonstrated by proprietary systems currently in trial. These systems utilize technological components in wide deployment today, such as modems, radios, antennas and MAC protocols. • The solution may utilize well understood spread spectrum techniques (such as frequency hopping), radio technologies (such as OFDM), advanced signal processing techniques (such as adaptive antennas) and a cellular architecture. These technologies have been successfully used and tested over the past decades and are finding increased usage in the LAN/MAN environment. • Commercial deployment of cellular wireless networks in the bands below 3.5 GHz demonstrates that carrier grade reliability can be achieved.

Proposed:

- The technical feasibility of such a system has been demonstrated by proprietary systems currently in deployment and trial. These systems utilize technological components in wide deployment today, such as modems, radios, antennas and MAC protocols.
- The solution may utilize well understood spread spectrum techniques (such as frequency hopping), radio technologies (such as OFDM), advanced signal processing techniques (such as adaptive antennas) and a cellular architecture. These technologies have been successfully used and tested over the past decades and are finding increased usage in the LAN/MAN and Cellular environments.
- Commercial deployment of cellular wireless networks in the bands licensed for Mobile Services demonstrates that carrier grade reliability can be achieved.

Five Criteria – Economic Feasibility (A)

C802.16SGM-02/03	C802.16SGM-02/08
a) Known cost factors, reliable data The economic feasibility of the equipment has already been demonstrated at the level of proprietary systems now going into operation. And by the vast success of mobile naroow-band devices. The willingness of investors to spend large sums to acquire spectrum rights, plus the large additional investment required for hardware in public networks, attests to the economic viability of the mobile wireless access industry as a whole. b) Reasonable cost for performance. Point-to-multipoint communication is efficient in handling data, which is characterized by high peak demands but bursty requirements overall. As demonstrated in many IEEE 802 standards over the years, such shared-media systems effectively serve users whose requirements vary over time, within the constraints of the total available rate. The cost of a single base station is amortized over a large number of users. c) Consideration of installation costs. Installation of any wireless customer-site system is relatively simple in that no offsite cabling need be installed. In contrast, with wireline networks the plant expense to connect the customer to the network is a very substantial part of the total cost and must be incurred for the first user in a coverage area. With wireless, the expenses can be incurred as customers come on-line. The siting of base stations is a more complex issue, but since one base station supports many users, the costs involved are very nominal on a per-user basis.	a) Known cost factors, reliable data. b) Reasonable cost for performance. c) Consideration of installation costs. • Cost factors for wireless services and components are well known and understood. Worldwide deployment of mobile wireless networks and burgeoning demand for mobile services demonstrates the economic viability of mobile networks. • The solution will offer better cost/performance characteristics than existing solutions since it is based on a pure packet architecture and designed for optimal spectral efficiency. • Installation and operating costs will be reduced by designing the system so as to allow for one-by-one frequency reuse and automatic configuration capabilities, eliminating the need for frequency planning.

Proposed: See Next Slide

Five Criteria – Economic Feasibility (B)

C802.16SGM-02/03	C802.16SGM-02/08
See Previous Slide	See Previous Slide

Proposed:

a) Known cost factors, reliable data.
b) Reasonable cost for performance.
c) Consideration of installation costs.

- Cost factors for wireless services and components are well known and understood. Worldwide deployment of mobile wireless networks and burgeoning demand for mobile services demonstrates the economic viability of mobile networks. The willingness of investors to spend large sums to acquire spectrum rights, plus the large additional investment required for hardware in public networks, attests to the economic viability of the mobile wireless access industry as a whole.
- The solution will offer better cost/performance characteristics than existing mobile networking solutions since it is based on a pure packet architecture and designed for optimal spectral efficiency. Data services which are characterized by high peak demands but bursty requirements overall are best handled by packet technologies. As demonstrated in many IEEE 802 standards over the years, such shared-media packet systems effectively serve users whose requirements vary over time, within the constraints of the total available rate.
- Installation and operating costs will be reduced by designing the system so as to allow for one-by-one frequency reuse and automatic configuration capabilities, eliminating the need for frequency planning.