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Title	**Desired Characteristics of Mobile Broadband Wireless Access Air Interface**	
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Re:	802.20 Call for Contributions for the May 2003 meeting	
Abstract	The attached document provides the desired characteristics of Mobile Broadband Wireless Access Air Interface.	
Purpose	For discussion and action	
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Desired Characteristics of Mobile Broadband Wireless Access Air Interface

1 Introduction

The MBWA Air-Interface (AI) will be optimized for high-speed IP-based data services operating on a distinct data-optimized RF channel. The AI will provide for compliant Mobile Terminal (MT) devices for mobile users, and will enable significantly improved performance relative to other systems targeted for wide-area mobile operation. The AI will be designed to provide improved performance attributes such as peak and sustained data rates and corresponding spectral efficiencies, system user capacity, air-interface and end-to-end latency, overall network complexity and Quality-of-Service management.

Table of Requirements from 802.20 PAR

Characteristic	Target
Mobility	Vehicular mobility classes up to 250 km/hr (as defined in ITU-R M.1034-1)
Sustained spectral efficiency	> 1 b/s/Hz/cell
Peak user data rate (Downlink (DL))	> 1 Mbps*
Peak user data rate (Uplink (UL))	> 300 kbps*
Peak aggregate data rate per cell (DL)	> 4 Mbps*
Peak aggregate data rate per cell (UL)	> 800 kbps*
Airlink MAC frame RTT	< 10 ms
Bandwidth	e.g. 1.25 MHz, 5 MHz*
Cell Sizes	Appropriate for ubiquitous metropolitan area networks and capable of reusing existing infrastructure.
Spectrum (Maximum operating frequency)	< 3.5 GHz
Spectrum (Frequency Arrangements)	Supports FDD (Frequency Division Duplexing) and TDD (Time Division Duplexing) frequency arrangements
Spectrum Allocations	Licensed spectrum allocated to the Mobile Service
Security Support	AES (Advanced Encryption Standard)

* Targets for 1.25 MHz channel bandwidth. This represents 2 x 1.25 MHz (paired) channels for FDD and a 2.5 MHz (unpaired) channel for TDD. For other bandwidths, the data rates may change.

2 Desired Characteristics

The table above presents only information within 802.20 PAR. Beyond those described above, the following is a more detailed presentation of characteristics that would be desirable for 802.20 MBWA systems.

2.1 Service Characteristics

- **Applications**: The AI shall support interoperability between an IP Core Network and IP enabled mobile terminals. This allows applications including, but not limited to, full screen, full graphic web browsing, e-mail, file upload and download without size limitations (e.g., FTP), video and audio streaming, IP Multicast, VPN connections, VoIP, instant messaging and on-line multi-player gaming.
- **Always on**: The AI should provide the user with "always-on" connectivity. The connectivity from the wireless MT device to the Base Station (BS) should be automatic and transparent to the user.
- **Interworking**: The AI should support interworking with different wireless access systems, e.g. wireless LAN, 3G, PAN, etc. Handoff from 802.20 to other technologies should be considered and where applicable procedures for that hand-off shall be supported.
- **Open interfaces**: The AI should support open interfaces between any network entities in the AI that may be implemented by service providers and manufacturers as separate systems, sub-systems, or network entities. IETF protocols should be considered and adopted in these open interfaces, if appropriate.
- **QoS support**
    - ? The AI should support the means to enable end-to-end QoS within the scope of the AI and should support a Policy-based QoS architecture. The resolution of QoS in the AI should be consistent with the end-to-end QoS at the Core Network level.
    - ? The AI should support IPv4 and IPv6 enabled QoS resolutions.
    - ? The AI should support efficient radio resource management (allocation, maintenance, and release) to satisfy user QoS and policy requirements.

4 Air Interface Characteristics

- **Layered architecture**: The AI should support a layered architecture and separation of functionality between user, data and control planes.
- **Optimized for IP Data Transport** – The AI is designed to efficiently convey bidirectional packetized, bursty IP traffic with packet lengths and packet train temporal behavior consistent with that of wired IP networks.

- **Efficient signaling and state transitions:** The AI should support multiple protocol states with fast and dynamic transitions among them. It will provide

efficient signaling schemes for allocating and de-allocating resources, which may include logical in-band and/or out-of-band signaling, with respect to resources allocated for end-user data. The AI should support paging schemes for idle terminals to promote power conservation for MTs.

- **Resource allocation**: The AI should support fast resource assignment and release procedures on the uplink and downlink for maximum utilization, especially for bursty IP applications.
- **Handoff**: The AI should provide inter-sector, inter-cell, and inter-frequency handoff procedures at vehicular speeds that minimize packet loss and latency for robust and seamless (i.e., without service interruption) IP packet transmission.
- **Latency**: The AI should minimize the round-trip times (RTT) and the variation in RTT for acknowledgements, within a given QoS traffic class, over the air interface. The RTT over the airlink for a MAC data frame is defined here to be the duration from when a data frame is received by the physical layer of the transmitter to the time when an acknowledgment for that frame is received by the transmitting station. The airlink MAC frame RTT, which can also be called the "ARQ loop delay," shall be less than 10 ms. Fast acknowledgment of data frames allows for retransmissions to occur quickly, reducing the adverse impact of retransmissions on IP packet throughput. This particularly improves the performance of gaming, financial, and other real-time transactions.

- **Spectrum:** The AI should be designed for deployment within existing and future licensed spectrum below 3.5 GHz. The MBWA system frequency plan should include both paired and unpaired channel plans with multiple bandwidths, e.g., 1.25 or 5 MHz, etc., to allow co-deployment with existing cellular systems. Channel bandwidths are consistent with frequency plans and frequency allocations for other wide-area systems. Receiver sensitivity, blocking and selectivity specifications should be consistent with best commercial practice for mobile wide-area terminals.

- **Cell sizes**: Metropolitan area cells with sizes typical of macro-cellular wireless networks shall be supported. Smaller cells should also be supported to accommodate operational, deployment and capacity considerations.
- **Sustained Spectral Efficiency**: Sustained spectral efficiency shall be in excess of 1 b/s/Hz/cell in a loaded network. Sustained spectral efficiency is computed in a network setting. It is defined as the ratio of the expected aggregate throughput (bits/sec) to all users in an interior cell divided by the system bandwidth. The sustained spectral efficiency calculation should assume that users are distributed uniformly throughout the network and should include a specification of the minimum expected data rate/user. Additionally, the AI should support universal frequency reuse but also allow for system deployment with frequency reuse factors of less than 1 (e.g., using spatial diversity to reuse spectrum within a cell).

- **User Data Rate Management**: The AI should support automatic selection of optimized user data rates that are consistent with the RF environment constraints. The AI should provide for graceful reduction in user data rates, on the downlink and uplink, as a mechanism to maintain an appropriate frame error rate performance.
- **Link Adaptation**: Link adaptation should be used by the AI for increasing spectral efficiency, peak data rate, and cell coverage reliability. The AI [shall/should] support adaptive modulation and coding, adaptive bandwidth allocation, and adaptive power allocation.
- **Authentication Functions**: The AI should provide messaging for mutual authentication of the MT and network, as well as supporting network authentication of the accessing user and measures to thwart MT cloning.
- **Data rates:** For a 1.25 MHz channel bandwidth[1], the AI should support peak aggregate data rate (user payload) per cell in excess of 4 Mbps in the downlink and in excess of 800 Kbps in the uplink. The AI should support peak per-user data rates in excess of 1 Mbps on the downlink and in excess of 300 kbps on the uplink. These data rate targets are established without consideration of channel conditions, traffic loading, and system architecture. The peak per user data rate targets are less than the aggregate per cell data rate to allow for design and operational choices.

- **Antenna Diversity**: The AI should support antenna diversity techniques to increase system capacity and reliability.

- **Bulk Encryption:** The air interface shall support either block- or stream-based cipher with shared secret keys.

[1] This represents 2 x 1.25 MHz (paired) channels for FDD and a 2.5 MHz (unpaired) channel for TDD. For other channel bandwidths, the data rates may change.