Project	**IEEE 802.20 Working Group on Mobile Broadband Wireless Access** <http://grouper.ieee.org/groups/802/20/>	
Title	**Plurality of Technologies & Channel-bandwidths in the IEEE 802.20 Standard**	
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Re:	MBWA Call for Contributions: **Session # 5** - November 10-14, 2003	
Abstract	The 802.20 System Requirements definition work seems to be going down on a path that would eventually lead to a multi-technology, multi-channel BWs "family" of standards. The contribution presents the ambiguities of the PAR and the current version of the System Requirements Document.	
Purpose	The issues of FDD versus TDD duplex modes as well as the required Channel BWs are critical to the proposals evaluation process and will have a significant impact on the IEEE 802.20 standard's appeal and acceptance in the market. The purpose of this contribution is to trigger discussion and decision making by the group on where we want to go with this standard.	
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1. Introduction

The 802.20 System Requirements definition work seems to be going down on a path that would eventually lead to a **multi-technology**, **multi-channel BWs** family of standards. This is a critical issue that may have a significant impact on the IEEE 802.20 standard and its market acceptance. Therefore, the issues discussed in this contribution, must be better understood, decided upon and clarified in the SRD.

2. The IEEE 802.20 PAR

The IEEE 802.20 PAR appears to have been worded with the view that the standard would include at least two technologies, one that support FDD and another that support TDD and the channel bandwidths specification (" e.g., 1.25 MHz, 5 MHz") was left open for the 802.20 working group to define. The PAR does not require nor rule out one standard radio transmission technology that supports both FDD and TDD mode.
The current version of the SRD seems to be biased toward two separate PHY/MACs.

For easy reference, the following, section 18 of the 802.20 PAR is shown below. The light-green shading highlights the FDD/TDD elements of the PAR.

18. Additional Explanatory Notes: (Item Number and Explanation)
Item #12 - As stated in item 12, the standard to be developed "targets spectral efficiencies, sustained user data rates and numbers of active users, which are all significantly higher than those achieved by existing mobile communications systems". The table below provides additional information on air interface characteristics and performance targets that are expected to be achieved.

Characteristic	***Target Value***
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.*

3. The 802.20 System Requirements Document

Note: The IEEE 802.20 System Requirements Document (SRD) is still in draft stage. Version 8c was current at the time this contribution was written.

3.1 FDD/TDD Air Interfaces

The 802.20 System Requirements document provides no explicit requirement for technology proposals to support **both** FDD and TDD modes. Thus, it is fair to assume, that this is **not** a requirement. If this is the common understanding and expectation, the SRD should clearly state that.

Note that the current SRD text (sections 3.1.1 and 3.1.2), although somewhat vaguely, implies that the IEEE 802.20 standard may include **two PHY/MAC technologies -** one that supports FDD and one that supports TDD.

> **3.1.1 MBWA System Reference Architecture (open)**
> ..
> …."To provide the best possible performance, the MAC layer design may be optimized for the specific characteristics of the air interface PHY."

> **3.1.2 Layer 1 to Layer 2 Inter-working (Closed)**
> "The interface between layers 1 and 2 is not an exposed interface; it may be handled at the implementer's discretion."

> **4.1.4 Duplexing (open)**
> "The AI shall support both Frequency Division Duplexing (FDD) and Time Division Duplexing (TDD)."

> **4.2.4 Duplexing – FDD & TDD (Closed)**
> "The 802.20 standard shall support both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) frequency arrangements."

3.2 Block Assignments and Channel Bandwidth

The following SRD text (section 4.1.3) discusses FDD and TDD frequency block assignments. **No explicit definition of the required channel bandwidths is provided.** This deficiency causes major confusion. Discussions in the previous 802.20 interim meeting (session #4) and on the email reflector seem to indicate that this text lends itself to conflicting interpretations and therefore requires further clarification. Also note that section 4.3, which was provided in an early version of the SRD, is not consistent with section 4.1.3 either.

4.1.3 Support for Different Block Assignments (open)
"The AI shall support deployment of 802.20 systems in the following sized block assignments:"

FDD Assignments	2 x 1.25 MHz 2 x 5 MHz 2 x 10 MHz 2 x 20 MHz
TDD Assignments	2.5 MHz 5 MHz 10 MHz 20 MHz 40 MHz

4.3 Spectral Requirements (Closed)
"The system shall be targeted for use in **TDD** and **FDD** licensed spectrum allocated to mobile services below 3.5GHz. The AI shall be designed for deployment within existing and future licensed spectrum below 3.5 GHz. The MBWA system frequency plan shall 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
The design shall be readily extensible to wider channels as they become available in the future."

One interpretation of section 4.1.3 is that technology proposals are required to support all channel bandwidths defined for either mode (FDD or TDD). Thus, an FDD proposal should support 1.25, 5, 10 and 20 MHz channels while a TDD proposal should support 2.5, 5, 10, 20 and 40 MHz channels.

Another interpretation of section 4.1.3 is that technology proposals need NOT support all channels. Thus, according to this view, one FDD proposal may support 1.25 and 5 MHz while another FDD proposal may support only a 20 MHz channel and so on. The requirement is wide open. **The important question in this case is: should the 802.20 standard include both technologies?**

The last sentence in section 4.3 seems to imply that a given proposal may initially offer support only for some lower bandwidth channels and add "extensible" support for wider channels later. So, if we understand this requirement correctly, a proposal that only supports 20 MHz channels should be declined. Is this really what the 802.20 group wants? Clearly, we need to clarify the projects objectives and provide consistency and clarity in the 802.20 SRD.

4. Conclusion

The issues and questions raised in this document demand an in-depth discussion and debate in the 802.20 working-group. The objective should be to better understand the system requirements and the implications on the IEEE 802.20 standard.

The discussion conclusions and decisions made by the group should be reflected in a revised System Requirements Evaluation Criteria documents.