Project	**IEEE 802.20 Working Group on Mobile Broadband Wireless Access** <**http://grouper.ieee.org/groups/802/20/**>	
Title	**UMBFDD Draft Technology Overview**	
Date Submitted	**2007-3-5 (5 March 2007)**	
Source(s)	Al Jette	Voice: 1 (847) 632-4201 Email: A.Jette@motorola.com
	Shirish Nagaraj	Voice: 1 (847) 632-2362Email: shirish.nagaraj@motorola.com
	Val Oprescu	Voice: 1 (847) 435-0053 Email: voprescu@motorola.com
Re:	MBWA Call for Proposals (802.20 - 07/02)	
Abstract	This contribution covers some of the differences between the UMBFDD and the existing FDD proposal.	
Purpose	For consideration by 802.20 as it evaluates proposals for FDD MBWA.	
Notice	This document has been prepared to assist the IEEE 802.20 Working Group. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.	
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.20.	
Patent Policy	The contributor is familiar with IEEE patent policy, as outlined in Section 6.3 of the IEEE-SA Standards Board Operations Manual <http://standards.ieee.org/guides/opman/sect6.html#6.3> and in *Understanding Patent Issues During IEEE Standards Development* <http://standards.ieee.org/board/pat/guide.html>.	

UMBFDD vs. MBFDD

The Ultra Mobile Broadband FDD (UMBFDD) proposal shares common ancestry with the MBFDD proposal. However, UMBFDD has evolved over the last year and includes many changes and enhancements. Reflective of evolution, most of the changes are additive, but occasionally, some less important or appealing capabilities of MBFDD could have been removed. In several cases, some of the same information has been restructured to better match the functional requirements.

The UMBFDD specifications are almost 1200 pages long while the MBFDD proposal (or the MBFDD part of the combined MBFDD and TDD proposals) is at least 600 pages. It is not the intention of this contribution to list all the differences between those proposals. Nor is it the intention to assign relative levels of significance to those differences. Many differences are given by example, in an illustrative fashion.

This contribution provides a list of ***some*** of the differences between the two proposals:

1. Differences in protocols and grouping of protocols in layers and planes.

Table 1. Bearer Protocols

MBFDD		**UMBFDD**	
Group	**Protocols**	**Protocols**	**Group**
Convergence Sublayer	• Signaling Transport (SNP + SLP) • Data Transport • Packet Consolidation	• Radio Link • Stream • Route	*Radio Link Layer*
Security Sublayer	• Encryption • Authentication • Security	• Ciphering • Message Integrity	*Security Functions*
Lower MAC Sublayer	• Control Channel • Shared Signaling • Forward Traffic • Reverse Control • Reverse Traffic • Access	• Packet Consolidation • Superframe Preamble • Fl Control Segment • Forward Traffic • Reverse Control • Reverse Traffic • Access • Reverse QoS	*MAC Layer*
Physical Layer	• Physical Layer	• Physical Layer	*Physical Layer*

Table 2. Non-Bearers Protocols

MBFDD		UMBFDD	
Group	**Protocols**	**Protocols**	**Group**
Session Control Sublayer	• Inter RAT • Session Mngmt. • Session Config • Capability Discov • Address Mngmt	• Inter-Route Tunneling • Signaling	*Application Layer*
		• QoS Management	*Radio Link Layer*
		• Session Mngmt. • Session Config	*Session Control Plane*
		• Route Control	*Route Control Plane*
Security Control Sublayer	• Key Exchange	• Key Exchange	*Security Functions*
Lower MAC Control Sublayer	• Air Link Mngmt. • Init State • Idle State • Connected Sate • Overhead Messages • Active Set Mngmt.	• Air Link Mngmt. • Init State • Idle State • Connected State • Overhead Messages • Active Set Mngmt.	*Connection Control Plane*

These different organizational groupings are only partly reflective of different functionality and they lead to different nomenclature, different states and transitions and different messages.

2. Differences in Channel names(e.g.) and numbers:
   MBFDD: F-pBCH0, F-pBCH1; UMBFDD: F-PBCH, F-SBCH
   MBFDD: F-SSCH UMBFDD: F-SCCH

3. Support for OFDMA control channel in RL by UMBFDD besides R-ACKCH. Reverse link ACK channel (R-ACKCH) is enhanced also in UMBFDD.

4. Support for an optional CDMA Data Channel (and associated control) that can be used to carry low-rate traffic in an autonomous mode in the RL by UMBFDD

5. Support for optional Rotational OFDM (DRCH mode only) by UMBFDD

6. Differences in Superframe Preamble structure:
   MBFDD: F-ACQCH / F-OSICH takes 2 slots / 1 slot in SF preamble
   UMBFDD: F-ACQCH / F-OSICH takes 1 slot / 2 slots in SF preamble
   The superframe preamble design contains the primary broadcast channel which occupies one whole OFDM symbol regardless of transmission bandwidth. Further

TDM1 is transmitted using GCL sequences. Structure of the F-OSICH in TDM2, TDM3 is also different.

7. Ability to specify technology to use in case of redirection off-carrier in MBFDD

8. FFT sizes of 128 and 256 (in addition to 512, 1024 and 2048) are defined in UMBFDD, allowing for < 5 MHz deployments (e.g, 1.25 MHz bandwidth).

9. UMBFDD support for residual assignments and VoIP-oriented group resource assignment in the forward link, via bitmap-based resource allocation and sharing.

10. UMBFDD support for different and extra H-ARQ interlaces:

MBFDD FL:	(k, k+3,k+6n)
UMBFDD FL:	same optional + (k, k+5, k+8n) mandatory
MBFDD RL:	(k, k+2, k+6, k+2+6n)
UMBFDD RL:	(k, k+3, k+8, k+3+8n)

In addition extended transmissions are also different.

MBFDD FL:	(k : k+6, k+8/k+9, k+12n : k+12n+6)
UMBFDD FL:	(k: k+2, k+5, k+8n : k+8n+2) mandatory (k: k+1, k+5, k+8n : k+8n+1) mandatory (k: k+1, k+3/k+4, k+6n : k+6n+1) optional
MBFDD RL:	(k, k+2 : k+8, k+12, k+12n+2: k+12n+ 8)
UMBFDD RL:	(k, k+3 : k+5, k+8, k+8n+3 : k+8n +5)

11. Quick page and Channel Info blocks can be sent in each superframe in MBFDD, but only in separate (odd/even) superframes in UMBFDD:
    MBFDD sends the QuickChannelInfo/QuickPage blocks in even/odd superframes;
    UMBFDD sends the QuickChannelInfo/QuickPage block in even/odd superframes
    The structure of the information block is more complex in MBFDD to allow for the extra flexibility.

12. Hashed quick pages formats:

MBFDD:	LSB-oriented QuickPage formats
UMBFDD:	some formats are LSB-oriented, but some use hashing for compression of sets of paging ids.

    At higher page loads the UMBFDD formats may be able to reduce the number of false positives.

13. UMBFDD supports different settings of the parameters for the access probes used for R-ACH. For example, in MBFDD the pilot level used in determining the sequence id is computed based on the 2nd OFDM symbol of F-ACQCH (OFDM

symbol 6 in the FL superframe), while in UMBFDD is computed based on F-PBCCH (OFDM symbol 0 in the FL superframe).

14. Differences in the assignment blocks:
    MBFDD: FLAB, FLAB-HO, RLAB, RLAB-HO, CCB
    UMBFDD: FLAB, PDCAB, RLAB
    The contents and size of some blocks is slightly different, and so is the encoding of their type.

15. SISO modes packet formats and their spectral efficiency is different (Table 71 of MBFDD section 7.5.6.7.1 vs. Table 6-4 of UMBFDD C.P0084-0-02).

16. 4-bit CQI and 5-bit CQI values sent on the RL are different (Table 81 of MBFDD in section 7.6.6.3.6.3 vs. Table 7-7 of UMBFDD C.P0084-0-02).

17. Differences in the RL: e.g. extra channels transmitted on the RL by UMBFDD (e.g power amplifier headroom channel).

18. Differences in Security functionality (examples):
    UMBFDD: Encryption key is "salted" MBFDD: No
    UMBFDD: max # PMK = 3 MBFDD: max # PMK = 8
    In UMBFDD, the MIKey is generated separate from temporary session key (TSK), while in MBFDD MIKey, encryption key and authentication key are generated together.

19. Pilot Sets:
    MBFDD: Active, Candidate, Neighbor, Remaining
    UMBFDD: Active, Candidate, Remaining
    Unlike UMBFDD, MBFDD explicitly allows dynamic threshold parameters (e.g. SoftSlope, AddIntercept, etc.) used in deciding when to move pilots between sets.

20. MBFDD uses SLP for signaling and RLP for bearer traffic. UMBFDD uses RLP for both signaling and bearer traffic.

21. BCMCS Supercast: Superposition of Broadcast and Unicast traffic is permitted.

22. BCMCS Hierarchical modulation: Hierarchical modulation is supported in broadcast.

23. Broadcast/Multicast: unlike MBFDD, in UMBFDD, the broadcast related functionality is instantiated at the MAC layer via 3 protocols.

24. UMBFDD explicitly allows for power down registration with reason code. MBFDD does not.

25. UMBFDD explicitly supports multiple "personalities" (sets of protocol instances) for each AT.

26. Multiplexing of DRCH and BRCH: A distributed resource channel and a block-hopped resource channel is defined in UMBFDD, and further, two flexible modes of multiplexing them within the same frame are defined in UMBFDD.

27. The F-SCCH format is different in UMBFDD in order to allow for the different combinations of resource allocation, namely, residual resource allocation (RRA), grouped resource allocation (GRA), support of STDD, etc.

28. PDCAB: There is support for dynamic sharing of resources between FL data and control in UMBFDD.

29. STDD: Space-time Transmit Diversity is supported in UMBFDD.

30. UMBFDD Precoding: There are two types of precoding codebooks that are defined, including support for knockdown precoders. Further, downloadable codebooks are allowed.

31. Layer Superposed OFDMA: Non-orthogonal layering of RL OFDMA transmissions without multiple receive antennas is allowed in UMBFDD. This is on top of the quasi-orthogonal RL using SDMA, which is present in both UMBFDD and MBFDD.

32. RL OFDMA control channel; An OFDMA control channel is introduced in UMBFDD that can be used to carry periodic control channels.

33. Fractional Frequency Reuse: FFR is based on the notion of sub-zones, and is defined for both DRCH and BRCH, and for both multiplexing modes in UMBFDD.

34. Softer Handoff Groups in UMBFDD: Softer handoff is supported using FFR and SFN transmissions.

35. Beacon Pilots: Beacon pilots are used in UMBFDD only for other-carrier sector searching.

36. Cell Null channel in UMBFDD: A cell-null channel is defined for estimation of the other-cell interference.

37. CDMA control segment hopping: CDMA segment hopping in UMBFDD is defined such that it is independent of the number of guard tones etc.

38. Power control: A deterministic algorithm is defined in addition to the stochastic power control in UMBFDD. The request channel can contain the suggested psd in addition to being sent in-band.

39. Fast OSICH power control in UMBFDD: A fast OSI channel is introduced that allows for faster response of the transmit psd to interference fluctuations which also allows for the psd to change from one transmission to another.