Project	**IEEE 802.20 Working Group on Mobile Broadband Wireless Access** <**http://grouper.ieee.org/groups/802/20/**>	
Title	**Questions and Issues on IEEE 802.20 proposals**	
Date Submitted	**2006-01-18**	
Source(s)	Anna Tee, Farooq Khan, Joseph Cleveland, CH Koo 1301 E Lookout Dr., Richardson, TX 75082	Voice: (972) 761-7437 Fax: (972) 761-7909 Email: atee@sta.samsung.com
	Hassan Yaghoobi, Leo Razoumov Intel Corporation	Email: Hassan.yaghoobi@intel.com
	K. Sivanesan, CH Suh, YK Cho, DS Park Samsung Electronics, 416 meatan-3dong, young Tong Gu,, Suwon, S-Korea.	
	Al Wieczorek Motorola, Inc.	Al.wieczorek@motorola.com
	Jiezhen Lin Siemens Ltd China	jiezhen.lin@siemens.com
	Luo Ping Panasonic Singapore	ping.luo@sg.panasonic.com
Re:	IEEE 802.20 session #18, January 16-19, 2005	
Abstract	This document provides an initial list of questions and open issues on various IEEE 802.20 proposals, which is based on the discussions during the Q & A sessions.	
Purpose	To facilitate the evaluation, comparison and selection of IEEE 802.20 proposals.	
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>.	

1. Introduction

The IEEE 802.20 WG has developed the requirements[1], channel models[2] evaluation criteria[3], traffic models[3] and technology selection process documents[4] over a period of over 2.5 years, i.e., between March 2003 and September 2005. These documents have been developed to define the performance goals of the 802.20 standard, the simulation modeling and evaluation methods for use in technology selection process.

On Nov 15, the second day of the November 2005 Plenary meeting, the WG started the presentations and discussions on various proposals that had been submitted on Oct 28, 2005. The WG decided to keep the technology selection process as scheduled for Nov 16 & 17 on the original agenda, despite the objections by a significant percentage of WG members and meeting participants, who are affiliated with various major companies in the Telecommunications Industry respectively.

This document lists the outstanding questions and open issues in various 802.20 proposals that have been identified at this time.

2. Basis of proposal evaluation

Proposals are evaluated based on the methodology that is described in the evaluation document [3]. Note that the final approved version of the evaluation criteria document at the end of the September Interim meeting is substantially different from the version of the latest working draft V15r1 [5], which was updated just before the start of that meeting. Major changes have been made, with unclear reason, to multiple sections of the document that have previously agreed upon by the WG members.

According to the technology selection process document, also approved in the September Interim meeting with substantial changes made without any explanations, two reports are required for technology evaluation, namely, Evaluation Report 1 and Evaluation Report 2.

In Report 1, the followings are required:

- link-level simulation results
- system-level calibration
- full buffer traffic model
- Suburban macro, 3 km/h, Pedestrian B
- Suburban macro, 120 km/h, Vehicular B
- RF characteristics
- Link budget

In Report 2, the followings are required:

- System-level simulation
- Traffic model mix – VoIP, Video streaming, FTP, HTTP, gaming(opotional)
- System-level channel model mix (MS speed 250 km/h not included)
- Suburban macro, 250 km/h, Link-level channel model[1]
- Network and loss model
- Mobility model
- Overhead channel model

Meeting minutes for the September Interim meeting [6] have indicated that the results of a straw poll allow Report 2 to be optional at the beginning of the November meeting. However, the technology selection document that was approved in an official vote after the straw poll has stated clearly that both Report 1 and Report 2 are required for proposal submission.

Thus it was inappropriate to start the technology selection before these reports were presented and discussed. Because the other proponents had not planned to bring Report 2 to the November meeting, based on the chair's direction, the technology selection process should not have taken place because not all of the requirement information was available.

Even though Report 2 was posted by one of the proponents just a few hours before the technology selection, it was not presented nor discussed during the meeting.

3. List of questions on 802.20 proposals

3.1. MBFDD

3.1.1. OFDM signaling parameters

1. When the shortest CP length, i.e., 6.51us is supported, the overhead is about 9%. What could be the worst case overhead percentage, i.e., when CP length is 4 times longer at 26.04us?
2. In Table 6-1, the guard subcarriers are said to be functions of bandwidth. What is the mathematical representation of the function?
3. In Table 6-1, the bandwidth of operation for 2048 pt FFT is used for BW of operation <= 20 MHz, what other configuration parameters would be changed when the BW is 15 MHz, as compared to 20 MHz?

3.1.2. Acquisition and synchronization

[1] Inconsistent to the first bullet on system simulation

4. Could you explain the details of cell acquisition and synchronization procedure employing the preamble channel? In your scheme, what is the mean acquisition time? What is the mean acquisition time for a user located at the cell edge?
5. Would there be more detail description on the asynchronous mode and the semi-synchronous mode? How to determine which mode is to be used?
6. Synchronization is an important issue for a system to work. What is the performance of the synchronization design? For example, what are the probabilities for detection and false alarm? Where is the analysis or simulation data for acquisition time? What is the performance versus jitter, phase noise and offset? What are recommended jitter, phase noise and offset requirements?
7. What is the advantage of placing the primary broadcast channels before the TDM pilots in the superframe?

3.1.3. Multicarrier operation

8. How much guard band is required between 5 MHz, 10 MHz and 20 MHz for feasible scenario of multi-carrier mode?
9. What is a whole operation scenario of multi-carrier mode I and II?
10. What are the differences between guard and quasi-guard subcarriers, as specified in section 9 of 05/69? How many of these are used when Multicarrier mode is turned on?

3.1.4. MIMO schemes

11. How are the mapping between the effective antennas and physical antennas done in SCW and MCW modes?
12. It seems that more sophisticated receiver is required to support the proposed multi-code word (MCW) modes. What is the complexity of the simulated receiver?
13. How was the multiuser MCW mode with rank adaptation supported?
14. In the MCW mode the streams are periodically circulated over the effective antennas. Then, why is it necessary to have different CQI for different effective antennas?
15. In the FDD mode operation, it is unclear how the codebook based closed loop MIMO schemes obtain the CSI. Could you provide more details on this?
16. The support for SDMA is not very clear. Could you provide us with some more details?
17. On one of the presentation slides (35), different antennas have to use different codes, what type of codes is used here?

3.1.5. Reverse link design

18. What is the distribution of the ratio of instantaneous signal power to average signal power for the reverse link transmit waveform?
19. How much backoff is necessary for a typical power amplifier?
20. Slide 39 of 05/59 shows that the access latency with power ramping is within 22ms for 90 percentile of users, what was the number of simultaneous access users simulated?
21. Maximum power control update rate is only 180 Hz for the RL control channel (CDMA), would this be sufficient for different mobility classes? How much is the performance degradation when the update rate is even slower, also taking into consideration the intra-sector interference that exists in the CDMA control segment?
22. The uplink interference indicators are transmitted through the OSICH only once per superframe, which imply the PC loop for traffic channel update rate is less than 50 Hz. Would this be sufficient especially for high mobility users?
23. In contribution 05/61, CCDF of IoT is simulated for Pedestrian B, 3 km/h channel model case only, how about the performance at higher mobility cases?
24. For the case of 0.866 km cell radius, 2 Antennas, the 1%tail of the IoT CCDF is at 1.6 dB away from the target of 6 dB, i.e., 60% higher than the value in the text description.
25. Can the stability of the algorithm be maintained? Tail shown for 1% only, could there be a few users 0.1 or 0.001% of users with much higher noise rise?
26. When the OSICH indicator is “2”, a faster PC rate is applied. How exactly would the PC rate be increased, and is there simulation or analytical results that guaranteed stability?
27. What does the distribution of user transmit power in the RL look like?
28. RL control segment is described as occupying a subband of 1.25 MHz (?), and hops over the whole band, what is the hopping frequency and sequence? How many codes (Walsh codes?) are accommodated?
29. What are the modulation schemes used for the control channels, PCB, CQICH, ACQCH and F-OSICH etc.?

3.1.6. Forward link, multiple access, scheduling issues

30. What is the distribution of the ratio of instantaneous signal power to average signal power for the forward link transmit waveform, including the multicarrier modes?

31. How is the proposed fractional frequency reuse scheme operated? In addition, could you show the adequate performance results displaying the relative advantage when compared to fixed frequency reuse scheme (1 or 3)?

3.1.7. Performance issues

32. How can the spectral efficiency of 11 be calculated without MIMO support? Could you clarify the calculation method and assumptions?
33. What is exactly the average retransmission interval? In the system simulation, what is the distribution of retransmission interval?
34. What are the performance targets for the QoS classes and the mappings between these and the DiffServ classes?
35. What are the requirements for frequency error, timing error, phase noise characteristics?
36. Any simulation data or analysis to show that the handoff delay is about 8 ms? What are the channel models and mobile speed?
37. What is the performance on fairness criteria for the GoS scheduling algorithm? Is this a fairness standard as defined by the proponent?
38. Is there a plot showing the calibration for the reverse link simulator?
39. About the link budget, what is the assumption on the interference margin?
40. As the PCB, OSICH and ACK bits are not encoded, what could be the bit error rate performance of these channels, especially in high mobility situation?
41. How much degradation in performance would be incurred because of errors in these channels as stated in the above question?
42. What is the total overhead in the system? For example, superframe header, PHY frame header, guard and pilot tones etc. What is the increase in overhead after CRC is extended from 16 to 24 bits in the updated proposals?
43. What is the assumption on backhaul delay in the mobility simulations?

3.2. MBTDD

3.2.1. Wideband mode (Some of the FDD questions are valid for this mode)

44. For the values of guard time between transmit and receive frame supported, what is the assumption on the largest cell size?
45. In the TDD proposal, it is described that CQI reporting is less than or equal to 150 Hz, does that imply PC rate of RL control channel has the similar value?

3.2.2. 625k MC mode

46. For the adaptive array at the BS, 9 or 12 antennas and at the terminal 1, 2 or 4 antennas are employed. What is the adaptive algorithm used? Is it beamforming? What kind of feedback information may be required?
47. Could you provide the performance results of adaptive antenna system at 120 km/h Veh. B? What are the effects of Doppler in the performance?
48. Could you show us the link and system level simulation results as required by the system requirement document and compliance requirement?
49. Could you show the calibration data for C/I distribution as required by performance report 1?
50. Why is uplink spectral efficiency shown in section 8 of contribution 05/77 higher than that of downlink, in the case of Vehicular-B channel model?
51. The simulation results of the enhanced system seem to have worst performance than the field data of the base system as shown in section 9, how to quantify the performance improvement provided by the enhancement in the proposal?
52. For the modulation classes 9 & 10, link curves are not provided, and not included in the link budget computation, have they actually be included in the system simulation? If so, what are the probabilities of choosing these modulation classes?
53. In the link budget tables, what features contribute to "the other gains"? What type of handoff support is assumed to provide the 2 dB gain?
54. What is the proponent's definition latency? What is the tradeoff of latency versus % of discarded packets?

4. Non Compliance Items: Not meeting the System requirements (SRD) [1]

1. The MBTDD/FDD proposals do not address Radio Transmitter and receiver Requirement subject of Sections 4.2.5.2 and 4.2.5.3 of 802.20 SRD which is a requirement for compliance and completeness as defined in 802.20 TSP.
2. The MBTDD/FDD proposals do not cover the 1.25 MHz channel BW as it is specified in 802.20 PAR and interpreted by 802.20 chair and captured in EC minutes as per IEEE 802.16-04/58. The issue is also mentioned in the following email. "http://ieee802.org/secmail/msg05358.html ". Based on this, the MBTDD/FDD proposals are not complete as defined in 802.20 TSP and 802.20 PAR.

5. Performance Items: Require further essential data to evaluate technology

3. The MBTDD/FDD proposals' performance reports do not provide the following performance results that are essential for evaluating the proposed technology.

a. Simulation/analysis results on simultaneous operation of Closed Loop and Optional Open Loop power control which is susceptible to possible instability problem.
b. Simulation/analysis results on compliance with spectral mask when partial BW allocation in UL with diversity or sub-band allocation modes. Worst case scenarios require detail analysis of tones allocated at the edge of signal bandwidth.
c. Only provided analytical results for MIMO configuration, the MIMO performance did not follow the simulation methodology.
d. In all performance reports for both MBTDD and MBFDD (see C802.20-05/87r1 and C802.20-05/89r1) the Reverse Link (RL) is loaded at 10% of Forward Link (FL). As a result the system performance was evaluated for highly unbalanced FL/RL traffic pattern that does not adequately represent system performance under realistic conditions.
e. Simulation results failed to provide specific VoIP user outage criteria.
f. Traffic mix used in simulations on FL: 30% FTP, 30% HTTP, 30% NRTV, 10% VoIP while traffic mix on RL is limited to 10% VoIP and ACK TCP low-bit-rate traffic for FTP, HTTP, NRTV.
g. The throughput and delay performance requirements can not be met simultaneously.
h. The scenario of multicarrier was not simulated. The specific details of the use of quasi-guard subcarriers are not provided in the specification. Information on the quasi-guard subcarrier as provided by the proposal is insuffficient for a potential standards draft.
i. As the probability of packet lost during handoff is not included in simulation, performance data for handoff scenario is not complete.
j. Access delay is an important aspect of a mobile broadband wireless access system, but the performance is not clear analyzed. Further investigation should be performed to evaluate the performance of the access design.
k. MIMO simulations were performed at the link level, for Pedestrian B channel model with low mobility of 3 km/h only, thus it does not indicate the realistic performance at the system level, i.e., in a multi-cell, multi-sector environment.
l. Simulation results for traffic mix seem to indicate an insufficient number of statistical samples and low confidence level, as shown on slide 11 of contribution 05/89r1.
m. The performance comparison between the use of MBTDD wideband mode or 625k MC mode for a given channel block size, e.g., 5 MHz, is not available.
n. According to Section 13.2 of the adopted evaluation criteria document, the proponents shall provide contour plots of constant minimum service levels. This information is not available for MBFDD and the wideband mode of MCTDD.
o. The MBTDD 625k MC mode uses beamforming at the base station. The proponent cannot provide clear information on whether the transmit power emission satisfies the FCC regulatory requirements under the beamforming condition.

p. Link budget computation for the reverse link was performed for cell edge data rate of 64 kbps, which is relatively low.
q. Signaling overhead has not been modeled in accordance to the evaluation criteria document.

6. Major changes in the Evaluation Criteria document in the September 2005 Interim meeting

Substantial differences have been identified in a comparison between the two versions of evaluation criteria documents:

1. IEEE 802.20 Evaluation Criteria Document V.17r1, September 14, 2005 [5], which is an ***"Updated Version of Evaluation Criteria document based upon Editor's clean up of the document and agreements from Session #14, May 17-19, 2005; plus additional Editorial cleanups per notes from Members; and changes agreed at Session #15 plus inputs from Two Conference Calls",*** as quoted from the cover page of the document.

2. IEEE 802.20 Evaluation Criteria Document V1.0, 802.20-PD-09, September 23, 2005[3], which is the final version approved in September 2005 Interim meeting, Session #16.

Reasons for the fundamental changes have not been provided in the meeting minutes, which contained only ambiguous notes. The followings are examples of the major changes that would affect the performance evaluation methodology.

6.1. Section 6: (Phased) Approach for Technology Evaluation

Until Version 17R1, this section has described clearly about the two-phase approach of proposal evaluation, as quoted below:

"The 802.20 evaluation will be structured in two phases with each phase progressively adding more complexity. The evaluation work for each proposal may then be compared at each phase to ensure a progressive "apples to apples" comparison of proposals. This structured approach will also provide performance metrics for the physical and link layer performance early rather than later in the evaluation process."

For Phase 1: ***"The goals at the end of phase 1 are, first, to achieve confidence that different simulation models are calibrated and, second, to present fundamental performance metrics for the physical and link layer of various proposals."***

The followings have been specified for each phase of evaluation.

Phase 1:

- System-level calibration
- Channel models: Pedestrian B, 3km/h; Vehicular B, 120 km/h
- Full-Buffer traffic model

Phase 2: Additional traffic models

- Additional channel models/channel model mix
- TCP model etc.

In the approved version, the two-phase approach has been replaced by two reports, with the description quoted as follows:

"The goals of the first report are, first, to achieve confidence that different simulation models are calibrated and, second, to present fundamental performance metrics for the physical and link layer of various proposals."

Comparing the two documents, the approved version has basically separated the original Phase 1 into two reports. Thus, the important information on the performance characteristics of the proposed technology that should have been obtained in Phase 2 evaluation is not available. The throughput performance as affected by TCP flow control algorithms has not been included in the evaluation.

6.2. Section 9: Channel Modeling-channel Mix

In the original version of evaluation criteria document [5], one of the mobile speeds to be evaluated in the channel models mix has included a non-zero probability for the case of 250 km/h, in order to evaluate against the 802.20 PAR and requirements.

However, in the evaluation criteria document 802.20 PD-09 that was approved in September meeting, the channel model mix does not include simulation of the case with user speed above 120 km/h.

The approved text is misleading as the table entries for 250 km/h remained in the text, even though the assigned probability is "0". Thus, editorial changes should be made to the document to indicate the actual evaluation cases.

6.3. Section 16: Simulation and evaluation of various block assignments

The original text in this section has specified the requirement to simulate spectral block sizes of 2x5 MHz and 2x 15 MHz. But this requirement has suddenly been deleted during the September 2005 Interim meeting.

This change has caused the problem that the simulation results are not comparable across proposals.

7. Conclusions

As discussed during the Interim meeting in January 2006, the items in Sections 4-5 have to be included in the meeting minutes to reflect the fact that the current proposals for 802.20 are not ready for confirmation voting.

The calibration data between different simulation models from different proponents have not been compared in the November 2005 Plenary meeting, before technology selection. Furthermore, as mentioned earlier, Report 2 was not even presented at the time of technology selection.

Discussions on technology proposal have not been completed because of the outstanding list of questions, non-compliant items and insufficient as discussed above.

8. References

[1] IEEE 802.20-05/06r1, IEEE 802.20 System Requirements document
[2] IEEE 802.20-05/08, IEEE 802.20 channel models document
[3] IEEE 802.20-05/09, IEEE 802.20 Evaluation criteria document, September 23, 2005.
[4] IEEE 802.20-05/10, IEEE 802.20 technology selection document
[5] IEEE 802.20 Evaluation criteria document V.17r1, September 14, 2005.
[6] IEEE 802.20-05/08 Meeting minutes, 802.20 Interim meeting, session #16, September 19-22, 2005.
[7] IEEE C802.20-05/61 QFDD Performance Report I
[8] IEEE C802.20-05/80 Arraycomm proposal
[9] IEEE C802.20-05/72 ETRI proposal technology overview
[10] IEEE C802.20-05/70 KDDI proposal
[11] IEEE C802.20-05/66 QTDD Performance Report I
[12] IEEE C802.20-05/64 QTDD Technology Overview
[13] IEEE C802.20-05/77 BEST-WINE Technology performance and evaluation criteria Report 1, Kyocera, Oct 28, 2005.
[14] IEEE 802.20-05/86 QFDD Performance Report 2, Nov 15, 2005
[15] IEEE 802.20-05/88 QTDD Performance Report 2, Nov 15, 2005
[16] IEEE 802.20/83r1, QFDD Clarifications, November 4, 2005
[17] IEEE 802.20/84r1, QTDD Clarifications, November 4, 2005
[18] IEEE 802.20/91, Lack of completeness of QFDD and QTDD proposals based on documented Technology selection process, November 16, 2005