Report of the First IEEE 802.16 IMT-Advanced Evaluation Group Coordination Meeting

1. Introduction

The first IEEE 802.16 IMT-Advanced Evaluation Group Coordination Meeting was held on 13 January 2010, in San Diego, CA, USA, hosted by the IEEE 802.16 Working Group on Broadband Wireless Access (802.16 WG) and chaired by Mr. Reza Arefi, Chair of IEEE 802.16 ITU-R Liaison Group. This meeting had been announced in IEEE's *Submission of a candidate IMT-Advanced RIT based on IEEE 802.16* (IMT-ADV/4). Sixty-one experts and representatives from the proponents, the Independent Evaluation Groups (IEGs), and the 802.16 WG membership participated in the meeting. Mr. Nader Zein acted as recording secretary of the meeting. The agenda is contained in Annex 1 and the list of participants in Annex 2. Annex 3 contains the list of documents that were considered during the meeting. Annex 4 provides a record of questions and answers.

2. Welcoming remarks

In opening the meeting, the chair introduced the agenda and pointed out the web page set up by the 802.16 WG for the meeting:

http://ieee802.org/16/imt-adv/mtg.html

It was pointed out that representatives from the three proponents (IEEE, Japan, and TTA) were present at the meeting. It was also pointed out that representatives of the following IEGs were present:

- ARIB Evaluation Group
- ATIS WTSC
- Canadian Evaluation Group (CEG)
- Chinese Evaluation Group (ChEG)
- ETSI
- Israeli Evaluation Group (IEG)
- Russian Evaluation Group (REG)
- TCOE India
- TR-45
- TTA PG707
- WiMAX Forum Evaluation Group (WFEG)
- WCAI
- WINNER+

Mr. Roger Marks, Chair of 802.16 WG, welcomed the delegates and explained the meeting objectives as included in the meeting invitation (IEEE L802.16-09/0132r1). It was noted that the purpose of the meeting was to facilitate communication between the proponents and the evaluation groups and to facilitate the exchange of views among evaluation groups. He noted that technical experts were available to review the IEEE's candidate IMT-Advanced RIT (IMT-ADV/4) and to answer any questions and provide necessary explanations.

3. Introduction of participants and presentations

IEGs participating in the meeting presented updates on the status of evaluation activities.

The following IEGs presented:

- ARIB Evaluation Group
- Chinese Evaluation Group (ChEG)
- Russian Evaluation Group (REG)
- TTA PG707
- WCAI
- WiMAX Forum Evaluation Group (WFEG)
- TCOE India
- ETSI
- WINNER+
- Canadian Evaluation Group (CEG)
- ATIS WTSC
- TR-45

4. Presentation on IEEE proposal

Following these introductions, the meeting proceeded to two presentations on behalf of the proponents. These presentations were:

- Overview of the IEEE P802.16m Technology and Candidate RIT for IMT-Advanced
- Report on candidate RIT self-evaluation simulation assumptions and results

Discussions following these two presentations are recorded in Annex 4 in Q&A format for future reference.

5. Working session and Q&A

The meeting continued with more discussion on the proposed RIT, including consideration of questions from the floor and those received through email. IEEE experts present at the meeting provided answers and necessary explanations. A detailed record of Q&A from this working session is contained in Annex 4, with the answers refined for clarification by the WG experts.

Evaluation groups are encouraged to use the material in Annex 4 for evaluation purposes and to use the resources indicated in Annex 3 to seek further clarifications as needed.

6. Closing remarks

Mr. Nader Zein reviewed the draft meeting report with the participants. Mr. Roger Marks indicated that the report will be finalized on 14 January and will be included as part of an input contribution to be submitted to the February meeting of ITU-R WP 5D. It will also be submitted to the ITU-R IMT-Advanced Evaluation Correspondence Group.

Mr. Marks discussed the possibility of holding a second IEEE 802.16 IMT-Advanced Evaluation Group Coordination Meeting on 17 May 2010 in Beijing, China, and solicited the views of the attendees. It was reported that the 3GPP is also discussing the possibility of having a workshop on 18 May 2010 in Beijing, China. Mr Stephen Blust, Chair of WP 5D, commented that a second workshop would be useful to facilitate on-going dialog and makes sense in this timeframe. He encouraged IEEE and 3GPP to coordinate these workshops to the extent possible to maximize the opportunity for the evaluation groups and to advance industry consensus. The meeting supported

proceeding with the Second IEEE 802.16 IMT-Advanced Evaluation Group Coordination Meeting as proposed. Mr. Marks indicated that he would contact Mr. Takehiro Nakamura, Chair of 3GPP RAN, to coordinate the May activities.

Mr. Marks acknowledged the participation of Mr. Arefi and Mr. Zein and thanked them for their contributions towards a successful meeting.

The meeting closed at 17:20, followed by a social reception hosted by Intel Corporation, InterDigital, LG Electronics, Samsung Electronics, and ZTE Corporation.

Annex 1
Agenda for the meeting

First IEEE 802.16 IMT-Advanced Evaluation Group Coordination Meeting
13 January 2010 – San Diego, USA

http://ieee802.org/16/imt-adv/mtg.html

Agenda

1.	08:00 – 08:30	*Registration*
2.	08:30 – 08:45	Welcoming remarks
3.	08:45 – 10:00	Introduction of participants and presentations from: - ARIB Evaluation Group - Chinese Evaluation Group - Russian Evaluation Group - TTA PG707 - WCAI Evaluation Group - Other
4.	10:00 – 10:30	*Break*
5.	10:30 – 12:00	Overview of IEEE P802.16m technology and candidate RIT for IMT-Advanced, followed by Q&A
6.	12:00 – 13:30	*Break*
7.	13:30 – 15:00	Report on candidate RIT self-evaluation simulation assumptions and results, followed by Q&A
8.	15:00 – 15:30	*Break*
9.	15:30 – 16:45	Working session and Q&A
10.	16:45 – 17:00	Closing remarks, plans for meeting report, Second IEEE 802.16 IMT-Advanced Evaluation Group Coordination Meeting (17 May 2010, Beijing, China)
11.	17:30 – 19:30	*Social reception – Ballroom ABC and foyer*

Meeting Information

For meeting details, including documents, see:
http://ieee802.org/16/imt-adv/mtg.html.

Annex 2

Attendance List

Family Name	Given Name	Independent Evaluation Groups / Proponents / Attendees
Andelman	Dov	Attendee
Arefi	Reza	IEEE, WCAI EG, meeting Chair
Barck	Esa	ETSI
Blust	Stephen	ETSI
Chander	Sharat	ETSI
Chayer	Remi	CEG
Cho	Jaeweon	IEEE
Choi	Hokyu	IEEE
Choi	Hyoungjin	TTA PG707
Chung	Hyun-Kyu	TTA PG707
Crowley	Steven	Attendee
Cudak	Mark	IEEE
Dhaliwal	Upkar	Attendee
Du	Ying	ChEG
Fu	I-Kang	IEEE, WFEG
Gal	Dan	Attendee
Goldhamer	Mariana	IEG
Gundlach	Michael	Attendee
Hillery	Bill	IEEE, TR-45
Imata	Satoshi	IEEE
Juang	Rong-Terng	Attendee
Kang	Chung	TTA
Khatibi	Farrokh	ATIS WTSC, TR-45
Kim	DJ	TTA
Kim	Su Nam	IEEE
Kito	Eiji	ARIB EG
Kuchi	Kiran	TCOE India
Lee	Wook-Bong	IEEE

Lim	Kwangjae	IEEE
Lin	Hsin-Piao	Attendee
Lynch	Michael	IEEE
Maeder	Andreas	Attendee
Meredith	John M	ETSI
Mohr	Werner	WINNER+
Nakamura	Michiharu	IEEE
Ng	Put Fan	CEG
Nurse	Peter	TR-45
Oh	Seong-Jun	TTA PG707
Olfat	Masoud	Attendee
Pan	Danjie	Attendee
Papathanassiou	Apostolos	IEEE
Park	Jeongho	IEEE
Peel	Christian	Attendee
Peterson	Bror	Attendee
QIN	Fei	ChEG
Ragsdale	Jim	ATIS WTSC
Ran	Yaniv	IEG
Roger	Marks	IEEE
Ruck	Herbert	Attendee
Sambasivan	Sam	Attendee
Sampath	Venkatesh	CEG
Seely	Mark	Attendee
Shalash	Ahmed	Attendee
Shono	Takashi	Japan
Smith	Jack	CEG
Spatafora	Vince	ATIS WTSC
Taylor	Shawn	Attendee
Vook	Fred	Attendee
Wilson	Tim	Attendee
Zein	Nader	IEEE, meeting Secretary
Zelmer	Don	ATIS WTSC

Annex 3
List of documents

The following documents (available at this link) were considered by the meeting:

1. IEEE L802.16-09/0132r1
   Letter to IMT-Advanced Independent Evaluation Groups: Invitation to IEEE 802.16 IMT-Advanced Evaluation Group Coordination Meeting
2. IEEE L802.16-09/0130r2
   Agenda for the First IEEE 802.16 IMT-Advanced Evaluation Group Coordination Meeting
3. IEEE L802.16-10/0002
   Overview of IEEE P802.16m Technology and Candidate RIT for IMT-Advanced
4. IEEE L802.16-10/0003
   Report on candidate RIT self-evaluation simulation assumptions and results
5. IEEE L802.16-10/0004
   Meeting Report
6. IEEE L802.16-10/0005
   Update from ARIB Evaluation Group
7. IEEE L802.16-10/0006
   Chinese Evaluation Group Status Update
8. IEEE L802.16-10/0007
   IEEE 802.16m Evaluation by Russian Evaluation Group
9. IEEE L802.16-10/0008
   IEEE 802.16m Evaluation by TTA PG 707
10. IEEE L802.16-10/0009
    WCAI Evaluation Group for IMT-Advanced
11. IEEE L802.16-10/0010
    WiMAX Forum Evaluation Group
12. IEEE L802.16-10/0011
    India Evaluation Group: An Overview
13. IEEE L802.16-10/0012
    Presentation of the ETSI Evaluation Group for IEEE 802.16 IMT-Advanced Evaluation Group Coordination Meeting
14. IEEE L802.16-10/0013
    WINNER+ plans as IMT-Advanced evaluation group
15. IEEE L802.16-10/0014
    Canadian Evaluation Group
16. IEEE L802.16-10/0015
    ATIS WTSC Evaluation Group
17. IEEE L802.16-10/0016
    TR-45 Ad-hoc Group on International Mobile Telecommunications

Annex 4

Questions and Answers

	Question	Source	Answer	IMT-ADV/4 Reference
1	*Received through email:* About the rank adaptive among rank-1/2/3/4 in CL-MU-MIMO mentioned in the 16m self-eval doc, is it based on throughput maximizing principle? How to decide which users can be paired together? And can you provide some details about the algorithm of scheduling in the simulation? Or is there some document we can refer to?	ChEG member	There are different methods that were followed for MU-MIMO scheduling by different entities contributing to the RIT submission. One method is based on the exhaustive search of the possible number of MU-MIMO sets (2, 3, or 4 users per set) along with their Proportional Fair (PF) metric value. The selected candidate MU-MIMO set for transmission in a given allocation corresponds to the set with the maximum PF value. At this point, the aggregate data rate of the selected candidate MU-MIMO set is compared to the rate-1 SU-MIMO (single user) with the highest single user PF metric for the specific allocation. The final decision for transmission in the specific allocation (candidate MU-MIMO set or single user) is made based on the throughput maximization principle. Another method is based on the successive addition of users to a MU-MIMO set by considering the PF metric of each set each time a user is added to form a new set. The final decision for transmission in a specific allocation follows the same rationale as the one described above for the exhaustive search approach. Based on the results from extensive simulations, no significant difference was observed between the two methods with respect to the cell and cell edge user spectral efficiency.	Section 7.2.1
2	For the above, if we have HARQ running along with MU-MIMO if 1 user fails and the other user	TCOE India	Since HARQ in the DL is asynchronous, the scheduling approach described in the previous answer is fundamentally not	Section 7.2.1

	succeeds, how do you handle HARQ operation?		disrupted: The scheduler observes the HARQ status of each user and assigns an HARQ retransmission to a specific user with higher priority than a new transmission whenever the specific user is selected for transmission in a given allocation (either as part of a MU-MIMO set or in the SU-MIMO mode). Certainly, other methods can be applied where a user requiring an HARQ retransmission is assigned higher priority than the MU-MIMO set selection, e.g., the user in HARQ mode is first selected for transmission in a specific allocation and then the scheduler tries to include other users in MU-MIMO transmission mode. Although different companies used slightly different scheduling approaches for HARQ, the cell and cell-edge user spectral efficiency results did not appear to be sensitive to the slightly different HARQ handling mechanisms.	
3	What is the gain of MU-MIMO in 4x2 over 2x2 SU-MIMO configuration?	TCOE India	Compared to 2x2 SU-MIMO with beamforming and adaptive switching between 1 stream and 2 streams, 4x2 MU-MIMO with beamforming and a maximum of 4 streams has shown spectral efficiency gains that range from 40% to 50% depending on the IMT-Advanced test environment.	N/A
4	*Received through email:* Our comprehension is that the Transformed Codebook Based Precoding and long term Beamforming are all based on codebook, the only difference is the (codebook) PMI transformed or not? Is it right? If not, Which method is used about the beamforming?	ChEG member	For subband scheduling, transformed codebook is used and for wideband scheduling long term BF is used. In transformed codebook, the mobile station reports transformed PMI. There are 2 methods in the IEEE802.16m draft standard for long term BF. One is based on the base codebook (long-term PMI) and the other is based on the covariance matrix (long-term covariance matrix).	Section 7.2.1
5	Clarification on the BF use of Covariance matrix and Long term PMI?	ChEG	For full buffer data traffic simulations, the long-term covariance matrix approach is used. It is noted that there is no significant performance difference between long-term covariance matrix and long-term PMI for the system configurations in the RIT submission. For VoIP traffic simulations, long-term PMI	Sections 7.2.1 and 7.2.2

			feedback method was used because of its advantage over the long-term covariance matrix with respect to the uplink control overhead.	
6	In document L802.16-10/0002, the HO time was shown as 0, could you please elaborate?	Attendee	The effective HO time was shown to be equal to 0 because the required information from the Target BS was already exchanged and the network entry is contention free.	Section 6.1, item 4.2.3.2.5.2
7	In document L802.16-10/0003, slide 23, in relation to the control overhead, does this take into account Pilot overhead?	ChEG	The pilot overhead is not accounted for in slide 23 because it has been already explicitly accounted for during the simulation by calculating the user throughput using the information carried on the data subcarriers.	Sections 7.2.1 and 7.2.2
8	In document L802.16-10/0003, is the spectral efficiency computed with or without guard-band interval?	Attendee	The spectral efficiency calculation is computed by taking into account guard-band.	Section 7.2
9	In the Mobility performance, do you use long TTI?	TCOE India	Yes .	Section 7.2.3
10	In the calculation of the control overhead, the pilot overhead is not included. How do you take the pilot overhead into your evaluation?	ChEG	The control overhead is calculated either in LRUs or OFDMA symbols depending on the control channel. The pilot overhead is explicitly accounted for by calculating the user throughput based on the successfully transmitted data bits carrier carried by the data subcarriers.	Section 7.2
11	In slide 21 of L802.16-10/0003, how is dynamic overhead calculation performed?	ChEG	In the full-buffer data traffic simulations, the overhead per frame is dynamically calculated based on the scheduled allocations in each frame. The average control overhead including all control channels is used for the calculation of the cell and cell edge user spectral efficiencies. In the VoIP traffic simulations, dynamic overhead is explicitly modeled due to the FDM nature of control and VoIP traffic transmission. This was necessary in order to accurately allocate the control and VoIP traffic resources in each subframe depending on the VoIP scheduler selections.	Section 7.2
12	In relation to interference reduction and combining, did you only use MMSE only or	ChEG	We used information about the interference covariance matrix in the MMSE filter. The covariance matrix used in the MMSE filter is	Section 7.2

	MMSE and Interference Cancellation?		the average value over all subcarriers in an allocation, e.g., one subband (in long-TTI mode) for 2x10 MHz FDD or two subbands for 20 MHz TDD.	
13	How do you consider interference in channel estimation in MMSE receiver?	ChEG	The information on the interfering signals is reflected in the interfering covariance matrix used in the MMSE filter.	Section 7.2
14	In the long term BF, how many bits do use for correlation matrix feedback?	ChEG	28 bits are used for the covariance matrix feedback as defined in the draft standard. The covariance matrix feedback is averaged over 20 ms and reported to the ABS every 20 ms.	Section 7.2
15	In slide 16 of L802.16-10/0002, can we use partition numbers larger than 4?	TCOE India	No, the maximum is 4 as this is a hard partition.	Section 5.3.3
16	In L802.16-10/0002, on page 17, why do we need multiple steps of permutation? Is this a type of hashing?	TTA PG707	We have CRU and DRU. Up to the Miniband permutation stage the process is the same for DRUs and CRUs. Only after the frequency partition we can permute at sub-carrier level that only applies to DRUs and not to CRUs. Simply because of the CRU and DRU we need these multi-steps of permutation. DRUs utilize more frequency diversity than CRUs.	Section 5.3.3
17	Slide 23 in L802.16-10/0002, with reference to bottom diagram and slide 24, could you clarify the operation of HARQ?	TTA PG707	Detailed explanation of HARQ was provided.	Section 6.1, item 4.2.3.2.10.1
18	In self-evaluation results for VoIP capacity it seems that VoIP capacity is limited by downlink. But in 3GPP case this is the opposite!	TTA PG707	The trends of the VoIP results for the IEEE technology are the same as the trends of the VoIP results for the 3GPP technology.	Section 7.2.2
19	Femtocell and SON; is there provision in IEEE standard to support these features?	TTA PG707	All base station features apply to Femtocell. One additional feature is a new synchronization method to better support Femtocells. There are also discussions on special treatment for femtocells, e.g. Low Duty Mode (LDM) to minimize interference to neighboring cells and allowing femtocells to directly talk to overlay Macrocell.	Section 6.1, item 4.2.3.2.23.2

20	Do 802.16 legacy systems support Femtocells?	TTA PG 707	Yes.	N/A
21	On slide 69 of L802.16-10/0002, do you have to re-authenticate in fast network reentry?	TTA PG 707	You do have to re-authenticate. However, if information about the MS is readily available, the re-authentication could be simplified.	Section 6.1, item 4.2.3.2.6.3
22	In simulations to arrive at the self-evaluation results such as coverage and spectral efficiency, did you include relay?	ATIS WTSC	No. The IMT-Advanced requirements were met without using relay.	Section 7.2
23	In the self-evaluation presentation, on the LB table slide 11 in L802.16-10/0003, the code rate for UMi DL in first two rows is about 0.5 but for the third row it is a very small number. What does the last row mean?	TTA PG 707	Third row demonstrates how we can achieve the minimum spectral efficiency required by the ITU-R. However, by using a code rate of ~ 0.5 as in the first row we can achieve higher spectral efficiency.	Section 6.2
24	Slide 33 in L802.16-10/0002 if you increase number of TX antennas you increase the number of codebook bits used. For the case of 8 TX antennas, why the number of bits is not increased?	TTA PG 707	In the case of 8 TX antennas, typical deployment requires closely spaced antenna elements which will be highly correlated. In such case, the use of 4-bit codebook is sufficient.	N/A
25	In slide 11 of L802.16-10/0003 attachment 3, why the parameter of UL control channel is the same as the one used for UL data channel?	WFEG	In original LBT template provided by ITU-R there is no distinction between UL control and data channel bandwidths. There is only 1 row for the bandwidth. We decided to use the most conservative parameter. In real deployments, the UL control channel coverage is expected to be better than the figures shown in IMT-ADV/4.	Section 6.2
26	Elaborate on multi-RAT operation and handover in slide 83 of L802.16-10/0002.	ATIS WTSC	Explanation was provided.	Section 6.1, item 4.2.3.2.6.2