Date: **2 April 2007**

To: **IEEE 802.16, WiMAX Forum**

Copy: **IP-OFDMA Evaluation Groups**

From: **CEG**

Subject: **Comments/Questions/Answers on the IP-OFDMA submission to ITU-R**

Reference: **Doc. 8F/1079(Rev.1)**

The Canadian Evaluation Group has received the questions listed below from our members. In some cases, answers were proposed by other members, and we solicit the concurrence of the proponents that those answers are correct. In other cases, where the answer line below contains no answer, we solicit answers from the proponents.

Part 1 – Questions organized by page number in Doc. 8F/1079(Rev.1)

1) Pg. 10, para on "Security," 2nd sentence: Paragraph 1
Need to clarify "topology." MS cannot communicate directly with the CSN – has to pass thru' the ASN. Further this statement leads one to believe that the ASN is not part of the authentication mechanism. Why is there not a triangle of trust? Please provide further information on the security transfer between NSPs in the handover calculations.

Answer:

Attribute: *No specific attribute. Question is fundamental as no services should be offered without ASN authentication.*

2) Pg. 10, para on "Mobility and Handovers," 2nd point (point b): Paragraph 1
Is there handover *between NSPs* – or simply support for roaming between NSPs?

Answer: IP-OFDMA supports roaming and handover between NSPs.

Attribute: A3.2.10

3) Pg. 14, Figure 8: Paragraph 1
Are there no pilots for Symbol 1?

Answer: Yes, no pilots for Symbol 1.

Attribute: A3.4.2.2

4) Pg. 15, Figure 9:
Does each group contain 2 clusters (48 data sub-carriers, 8 pilot sub-carriers)? Is the correspondence between physical and logical allocations on a symbol-by-symbol basis?

Answer: This diagram is more conceptual. There is no "group" concept in IEEE 802.16e. In general, the correspondence between physical and logical allocations is on a symbol-by-symbol basis. However, for MIMO case, it could be on 2 OFDM symbols.

Attribute: A3.4.2.2

5) Pg. 18, Table 5:
What is the relationship between symbols and sub-carriers or between symbols and sub-channels?

Answer: One OFDM symbol consists of multiple subcarriers (=FFT size). Multiple subcarriers form one sub-channel.

Attribute: A3.4.2.2

6) Pg. 18, footnote:
Can some information be provided on the no. of info.bits/symbol? Does it not depend on the modulation and coding schemes used?

Answer: Yes, it depend on coding and modulation. Further clarification could be provided.

Attribute: A3.4.2.2

7) Pg. 18, 3rd sentence below Table 6:
Shouldn't the CQI be present for every user in figure 10? As currently shown, this supposes an identical channel for all users (1 thru' 5)?

Answer: Figure 10 shows a CQICH cahnnel region, which consist of multiple CQICH channels, this is similar to a burst regions. Each user or burst has a CQICH channel. The size varies.

Attributes: A3.4.2.2, A3.4.2.2.2

8) Pg. 20, para on "Collaborative Spatial Multiplexing," 5th sentence "transmitted spatial streams are uncorrelated …":
To claim this, the MSs have to be sufficiently separated in space – what is this minimum distance for their signals to be spatially uncorrelated?

Answer: Collaborative Spatial Multiplexing is used for 2 MSs. Usually if two antenna seperation is larger than 10 Lamda, then they are likely uncorrelated. This is typically true for two MSs.

Attributes: A3.2.6, A3.2.6.1, A3.6.9, A3.7.1.1, A3.7.1.2

9) Pg. 22, Table 7:
How do these definitions map into the four classes (Conversational, Streaming, Interactive, Background) defined in Recommendation ITU-R M.1079?

Answer: As IP-OFDMA is IP based, it uses IP QoS approach. It would be nice to know how the rows in Table 7 map to the four QoS classes.

Attribute: A3.4.1.7

10) Pg. 27, A1.2.6, RH column:
Should this not be the other way round – *35* data symbols per frame, *32* symbols in sub-frame, 1 symbol for …?

Answer: No, the orginal doc is correct, here the data symbol refers the OFDM symbols used for data traffic. There are also preamble overheads.

Attribute: A3.4.2.2

11) Pg. 27, A1.2.6, RH column, Maximum data rate for 10 MHz bandwidth: Paragraph 2
From Table 6, this number is clearly for the U/L. For the D/L, it is 31 680 kbit/s.

Answer: A1.2.6 is correct. In Table 6, peak data rate is calsulated based on the assumption that the entire 5 ms frame is used for DL (44 OFDM symbols), while in A1.2.6, DL peak data rate is given based on WiMAX profile, i.e., the maximum DL ratio supported (32 OFDM symbols). Hence the Dl date is reduced from 31680 kbit/s to 23040 kbit/s (32/44 = 0.727273 = 23040/31680)

Attributes: A3.4.1.5, A3.1.1.2

12) Pg. 27, A1.2.6, RH column, Maximum data rate for 5 MHz bandwidth: Paragraph 2
From Table 6, this number is clearly for the U/L. For the D/L, it is 15 870 kbit/s.

Answer: See answer for 11)

Attribute: A3.4.1.5

13) Pg. 27, A1.2.6, RH column, Uplink, Maximum data rate for 10 MHz bandwidth: Paragraph 2
From Table 6, 14 110 kbit/s.

Answer: See answer for 11)

Attribute: A3.4.1.5

14) Pg. 27, A1.2.6, RH column, Uplink, Maximum data rate for 5 MHz bandwidth: Paragraph 2
From Table 6, 6 850 kbit/s.

Answer: See answer for 11)

Attribute: A3.4.1.5

15) Pg. 30, A1.2.16.1.2:
The response does not provide the required answer to the question. Need to clarify the relation between peak and average.

Answer:

Attribute: A3.2.2.1

16) Pg. 30, A1.2.16.2:
This response does not provide the required answer to the question.

Answer: For the base station there is no power control; it is fixed.

Attribute: A3.2.2.1

17) Pg. 32, A1.2.18.1:
Again, the values provided for the bit rates clash with Table 6. Is the latter wrong or applicable in a different set of circumstances?

Answer: See answer for 11)

Attributes: A3.4.1.5, A3.1.1.2

18) Pg. 35, A1.2.23.1, "State the dB of performance improvement introduced by the use of diversty":
Though there are several diversity scenarios possible with MIMO technology, perhaps an answer can be provided for the simplest diversity scheme. Please provide further details.

Answer:

Attributes: A3.2.6, A3.2.6.1, A3.6.9, A3.7.1.1, A3.7.1.2

19) Pg. 35, A1.2.23.2:

Same comment as above – can a number be provided, before referring the reader to another portion of the text? Please provide further details.

Answer:

Attributes: A3.2.6, A3.2.6.1, A3.6.9, A3.7.1.1, A3.7.1.2

20) Pg. 32, A1.2.24.1:

Reasonable assumption is this is not applicable (since no answer is provided)? Please clarify.

Answer:

Attributes: A3.2.10, A3.3.3, A3.3.4

21) Pg. 40, A1.3.7.2:

Is this RTD or one-way delay? Sounds more like the latter. Please clarify.

Answer:

Attribute: A3.3.2

22) Pg. 41, A.1.3.9.1:

This is not a complete answer. Need answers for specific loads: how are the features used for different loading conditions?

Answer:

Attribute: A3.3.8

23) Pg. 42, A1.4.4:

Out of curiosity, what is the bit time (T_b)? Yes, it is dependent on the modulation (bits/symbol), but the values are fixed, not arbitrary.

Answer: Useful symbol time (μs) (Tb = 1/Δf), T_b varies depends on the B/W. IT is around 91 us.

Attribute: No specific attribute

24) Pg. 43, A.1.4.8:

So, to confirm, handover between fixed networks (say WiFi or Wi Max) and mobile networks is possible? Are there any security issues?

Answer: Yes assuming that terminal is multi-mode. Need to clarify the security issue.

Attributes: A3.2.10, A3.3.1, A3.3.2

25) Pg. 44, A.1.4.10:

What is –Nused/4 to 1 and +1 to Nused/4?

Answer: It is assumed that **Nused** refers to the number of userful subcarriers.

Attribute: A.3.4.2.2

26) Pg. 45, A1.4.12: 5With a receiver Noise Figure of 8 dB (from A.1.5.1 and A.1.5.2) and required SNR of 10 dB, Rx sensitivity for a 10 MHz bw is –96 dBm. Shouldn't sensitivities go much lower? Aren't the values too conservative? (cf. -88 for QPSK at 10 MHz on page 45 and -91 for 5 MHz). Compare also with the simulation sc enarios on page 63 (-117dBm).

Answer: .

Attribute: A3.2.2.4

27) Pg. 45, A1.4.12: 5 With the same assumptions as above, Rx sensitivity for a 5 MHz bw is –114 dBm. Why such conservative numbers for receiver sensitivity?

Answer:

Attribute: A3.2.2.4

28) Pg. 46, A.1.4.13:

Need further detail to be able to assess.

Answer:

Attribute: A3.6.15

29) Pg. 46, A.1.4.15:

Why are the sub-carriers unmodulated – do they correspond to pilots that don't require modulation?

Answer: No, preamble is transmitted on 1/3 of subcarriers only to reduce interference.

Attribute: A3.6.15

30) Pg. 46, A.1.4.16:

In the absence of an answer, is it correct to assume other technologies cannot evolve to IP-OFDMA?

Answer: This is correct. IP-OFDMA is a new air interface that was not intended as an evolution for established technologies

Attribute: A3.4.2.4.2

Part 2 – Questions based on specific criteria/attributes in Section 3 of Doc. 8F/1079(Rev.1)

Attribute: **A3.1.1.1**

8F/1079R1, §2.3.1.1, step 2 picks a SINR at random. How is the range and distribution of the random values determined to ensure that it reflects path loss, shadowing, and interference?

This simulation appears to mix two environments – is it reasonable to use ITU Pedestrian-B at step 3 of §2.3.1.1, yet use vehicular path loss and antenna height in §2.3.1.2?

§2.3.1.2 lists three codecs. Are all three used in the simulation? What is the distribution among users?

Why is 2.3 GHz used in page 23 and 2.5 GHz used elsewhere (e.g., page 58, Table 20)? What is the relationship to link budget?

Answer:

Attribute: **A3.1.1.2**

8F/1079R1, Table 18 states channel estimation is assumed to be ideal. This is not practical, particularly when the delay spread exceeds the period of the cyclic prefix, 11.4μs. It is difficult to obtain meaningful channel estimates for channels whose delay spread exceeds the cyclic prefix interval, see for example:

3GPP TSG-RAN-1, "Link Level Simulation Results for OFDM",
Tdoc R1-030780, Meeting #33, New York, August 25-29, 2003

What are the practical numbers? Does it support Vehicular B?

Answer:

Attribute: **A3.2.9**

We suggest that the proponents discuss AAS/MIMO since these are features that impact the BS and overall system complexity and cost.

Answer:

Attribute: **A3.2.10**

Doc. 8F/1079R1 refers to Section 2.2.2.2 for handover performance analysis but this section is non-existent in 8F/1079R1. Handover performance is in Section 2.3.2. The section numbers and tables need some editorial cleanup.

How would the implementation of one ASN profile over another impact handover complexity?

Answer:

Attribute: **A3.3.5**

What does “well above” mean? The proponents’ comment in A3.4.1.1 states a maximum DL of 23040 kbit/s, and maximum uplink of 6048 kbit/s. Are these the correct figures?

(cf. A3.4.1.1)

Answer:

Attribute: **A3.3.7**

How about other factors besides the codec? What is the effect of impairments? Is it vocoder independent or simulations have been performed with various vocoders?

The RTT does not specify a codec. Consequently, on what basis do we assess whether these requirements are met?

If we assume G.726, what are the MOS scores of this codec operating over the IP-OFDMA radio channel under the same conditions as A3.1.1.1? What are the MOS scores in the presence of 3% frame erasures?

Answer:

Attribute: **A3.4.1.4**

8F/1079R1, §2.1, A1.2.14 states "The length of cyclic prefix is 1/8 of symbol duration thus 11.4 μs." Please explain the rationale for the proponent comment that 20μs of delay spread can be tolerated without an equalizer

Answer:

Attribute: **A3.7.1**

Doc. 8F/1079R1 refers to Section 2.2.4.2 for more details but this section is non-existent in 8F/1079R1. The section that discusses coverage efficiency is 2.3.4.2.

Answer: