

Project	<b>IEEE 802.16 Broadband Wireless Access Working Group</b> < <a href="http://ieee802.org/16">http://ieee802.org/16</a> >	
Title	Proposed <del>Mandatory</del> Technical Requirements for IEEE 802.16 TGj	
Date Submitted	<b>2006-07-<del>1807</del></b>	
Source(s)	<p>Hyunjeong Kang, <a href="mailto:hyunjeong.kang@samsung.com">hyunjeong.kang@samsung.com</a> Jaeweon Cho, Hyoung Kyu Lim, Changyoon Oh, Panyuh Joo Samsung Electronics</p> <p>Rakesh Taori <a href="mailto:rakesh.taori@samsung.com">rakesh.taori@samsung.com</a> Samsung Advanced Institute of Technology</p> <p>Peter Wang, <a href="mailto:peter.wang@nokia.com">peter.wang@nokia.com</a> Yousuf Saifullah, Shashikant Maheshwari, Adian Boariu, Haihong Zheng Nokia Inc.</p>	<p><a href="mailto:Hyunjeong.Lee@intel.com">Hyunjeong Lee</a> <a href="mailto:hyunjeong.hannah.lee@intel.com">hyunjeong.hannah.lee@intel.com</a> <a href="mailto:Wendy.C.Wong@intel.com">Wendy C. Wong</a>, <a href="mailto:Sydir.Jerry@intel.com">Sydir Jerry</a>, <a href="mailto:Kerstin.Johnsson@intel.com">Kerstin Johnsson</a>, <a href="mailto:Frank.R.Favichia@intel.com">Frank R. Favichia</a> <a href="http://www.intel.com">Intel Corporation</a></p> <p><a href="mailto:Aimin.Zhang@huawei.com">Aimin Zhang zam@huawei.com</a> <a href="http://www.huawei.com">Huawei Technologies</a></p> <p><a href="mailto:Fang-Ching.Ren@itri.org.tw">Fang-Ching Ren frank_ren@itri.org.tw</a> <a href="mailto:Tzu-Ming.Lin@itri.org.tw">Tzu-Ming Lin</a>, <a href="mailto:Chie-Ming.Chou@itri.org.tw">Chie-Ming Chou</a>, <a href="mailto:Ching-Tarng.Hsieh@itri.org.tw">Ching-Tarng Hsieh</a>, <a href="mailto:I-Kang.Fu@itri.org.tw">I-Kang Fu</a>, <a href="mailto:Jen-Shun.Yang@itri.org.tw">Jen-Shun Yang</a>, <a href="mailto:Yu-Ching.Hsu@itri.org.tw">Yu-Ching Hsu</a>, <a href="mailto:Shiao-Li.Tsao@itri.org.tw">Shiao-Li Tsao</a> <a href="http://www.itri.org.tw">Industrial Technology Research Institute</a></p> <p><a href="mailto:Koon.Hoo.Teo@merl.com">Koon Hoo Teo teo@merl.com</a> <a href="mailto:Toshiyuki.Kuze@merl.com">Toshiyuki Kuze</a>, <a href="mailto:Yukimasa.Nagai@merl.com">Yukimasa Nagai</a> <a href="http://www.merl.com">Mitsubishi Electric Corp. &amp; MERL</a></p> <p><a href="mailto:Peiyong.Zhu@nortel.com">Peiyong Zhu pyzhu@nortel.com</a> <a href="mailto:Hang.Zhang@nortel.com">Hang Zhang</a>, <a href="mailto:Mark.Naden@nortel.com">Mark Naden</a>, <a href="mailto:David.Steer@nortel.com">David Steer</a>, <a href="mailto:Guo-Qiang.Wang@nortel.com">Guo-Qiang Wang</a>, <a href="mailto:Gamini.Senarath@nortel.com">Gamini Senarath</a>, <a href="mailto:Dean.Kitchener@nortel.com">Dean Kitchener</a>, <a href="mailto:Derek.Yu@nortel.com">Derek Yu</a>, <a href="mailto:Wen.Tong@nortel.com">Wen Tong</a> <a href="http://www.nortel.com">Nortel</a></p> <p><a href="mailto:Yong.Sun@toshiba-trel.com">Yong Sun sun@toshiba-trel.com</a> <a href="mailto:Dharma.Basgeet@toshiba-trel.com">Dharma Basgeet</a> <a href="http://www.toshiba-trel.com">Toshiba Research Europe Limited</a></p> <p><a href="mailto:Youn-Tai.Lee@nmi.iii.org.tw">Youn-Tai Lee lyt@nmi.iii.org.tw</a> <a href="mailto:Shiann-Tsong.Sheu@nmi.iii.org.tw">Shiann-Tsong Sheu</a>, <a href="mailto:Kanchei.Loa@nmi.iii.org.tw">Kanchei (Ken) Loa</a>, <a href="mailto:Heng-Iang.Hsu@nmi.iii.org.tw">Heng-Iang Hsu</a>, <a href="mailto:Yung-Ting.Lee@nmi.iii.org.tw">Yung-Ting Lee</a> <a href="http://www.nmi.iii.org.tw">Institute for Information Industry (III)</a></p> <p><a href="mailto:Aik.Chindapol@siemens.com">Aik Chindapol Aik.chindapol@siemens.com</a> <a href="http://www.siemens.com">Siemens Corporate Research, Inc.</a></p>
Re:		
Abstract	This document contains general high level and <del>mandatory</del> requirements for TGj specification.	

Purpose	This document is a proposal for <del>mandatory</del> requirements to be considered while submitting technical proposals to TGj.
Notice	This document has been prepared to assist IEEE 802.16. 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 802.16.
Patent Policy and Procedures	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <a href="http://ieee802.org/16/ipr/patents/policy.html">http://ieee802.org/16/ipr/patents/policy.html</a> , including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <a href="mailto:chair@wirelessman.org">mailto:chair@wirelessman.org</a> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <a href="http://ieee802.org/16/ipr/patents/notices">http://ieee802.org/16/ipr/patents/notices</a> .

# Proposed ~~Mandatory~~ Technical Requirements for IEEE 802.16 TGj

## 1. Introductory remarks

This document is submitted in response to the call for contributions on system requirements that was issued by the IEEE 802.16 task group j [1].

In this document, we provide

- general high level requirements
- a table for the mandatory requirements and
- a table for the optional requirements

In the mandatory requirements table, we further specify whether the function is mandatory for the MMR base station (MMR-BS) only, or whether it is mandatory for both MMR-BS and the relay station (RS). Apart from the General high level requirements, in this document we focus solely on the mandatory requirements. This document is a subset, including refinements based on feedback from others, of an earlier document presented during the May 2006 meeting [2] that dealt with optional as well as mandatory features. The term mandatory, in this document, refers to those requirements which are required to be fulfilled by ~~the relay station (RS) and the MMR base station (MMR-BS)~~, as opposed to the optional requirements which will be addressed by the specification but implementations are not required to fulfil them.

It is noted that the purpose of this requirements document, as well as the document that will eventually be adopted by the TG, will be to provide additional *guideline* for submitting proposals to TGj and will supplement the 802.16j PAR and 5 Criteria [23] documents, which provide the overriding requirements for Task Group j. The split into mandatory and optional parts, as well as the split of the function between MMR-BS and RS is intended to serve as a guideline and does not force the proponents to adhere to the split strictly.

~~It is not the intention of this submission to exclude the consideration of, or discussion on, the optional requirements in any way. The requirements that are optional or in scope will be duly considered based on various submissions to the TG.~~

## 2. General high level requirements

As a general requirement, which follows directly from the PAR and 5 criteria document, proposals to TGj shall not require modifications to the mobile stations (including subscriber stations). Proposals shall ensure backward compatibility with the mobile stations as specified in the legacy standard (i.e., IEEE Std 802.16-2004 and IEEE Std 802.16e-2005) to the extent that the relay operation is transparent to the mobile stations.

It is also hereby proposed that the submissions should minimize the modifications related to the MAC and OFDMA PHY as specified in the legacy standard. Proponents of contributions are encouraged to maximize the re-use of the procedures defined in the legacy standard.

As another general requirement, submitted proposals should support LOS as well as non-LOS operation for the deployment of the RS.

MMR-BS will distinguish itself from a BS, as defined in the legacy standard, in that it shall support the operations of RS, while at the same time maintaining full compliance with the legacy standard.

Hop count greater than or equal to 2 shall be supported. The specification shall consider 2-hop support mandatory while considering general multi-hop (>2) support optional.

In addition to the requirements on the relay functionality (discussed below), a general requirement on RS is that it shall be compliant with the BS in order to meet the transparency requirement. RS shall not have mandatory requirement to support optional features as specified in the legacy standard. It is assumed that the RS will not generate user traffic of its own, but it is expected that the RS shall support the generation of control and management messages that are necessary for proper relay operation.

### **3. ~~Mandatory~~ Functional requirements**

The following table describes the mandatory and optional functional requirements ~~of an RS. Throughout the document, unless specified otherwise, it is assumed that the MMR-BS will accommodate the functions defined for the RS and support the RS to fulfill these requirements. The mandatory requirements tabulated in this document are in agreement with the features identified as mandatory in contribution C802.16j-06/046 for MMR-BS and RS, as well as those which are identified as mandatory for MMR-BS but optional for RS. The explicit split in functionality between MMR-BS and RS is still under discussion.~~

\* legacy: IEEE Std 802.16-2004 + IEEE Std 802.16e-2005

### 3.1 Mandatory functional requirements

Name	Requirements	Subject (MMR-BS/RS)	Notes
Capability management	Capabilities of RS shall be managed by MMR-BS.	<u>MMR-BS (M)</u> <u>RS (M)</u>	
<del>Hop count</del>	<del>The specification shall mandate to support at least 2 hops (i.e. MMR-BS to MS via RS).</del>		<del>The functions (e.g. routing) to support multi-hop (&gt;2) shall be optional.</del>
RS control	The specification shall define a mechanism for MMR-BS to perform automatic topology learning in its own MMR cell as well as to control and manage RSs in the MMR cell.	<u>MMR-BS (M)</u>	
PHY frame structure for backward compatibility with legacy 16 mobile station	The specification shall define a frame structure which shall accommodate both BS-RS link and BS-MS link.	<u>MMR-BS (M)</u> <u>RS (M)</u>	RS-RS link shall also be accommodated with the same frame structure.
RF part	The specification shall define OFDMA RF parameters necessary for the correct operation of the BS-RS link. <u>RF parameters such as frequency band and channel bandwidth, as well as transmitter/receiver requirements including RS-emission and RS-susceptibility, shall be defined/specified for the BS-RS and RS-RS link.</u>	<u>MMR-BS (M)</u> <u>RS (M)</u>	
Baseband part	The specification shall define/specify baseband parameters/operation necessary for the correct operation of the BS-RS link. <u>Baseband parameters such as FFT size, symbol CP, and baseband operations such as preamble transmission, synchronization, channel quality measurement shall be defined/specified for BS-RS link and RS-RS link.</u>	<u>MMR-BS (M)</u> <u>RS (M)</u>	<u>Preamble aspect TBD</u>
Flexible radio resource assignment	The specification shall support various forms of radio resource assignment.	<u>MMR-BS (M)</u> <u>RS (M)</u>	Sharing channels between access links and relay links, sharing channels between multiple relay links, using different channels for different links, etc.

Duplexing Mode	The specification shall support either TDD or FDD for relay link	<a href="#">MMR-BS (M)</a> <a href="#">RS (M)</a>	
RS network entry	The specification shall define network entry process for RS.	<a href="#">MMR-BS (M)</a> <a href="#">RS (M)</a>	
MS network entry support	RS shall support network entry process for MS.	<a href="#">MMR-BS (M)</a> <a href="#">RS (M)</a>	
Scheduling	The specification shall provide signaling to support MAC scheduling of data and control message transmission on relay and access links.	<a href="#">MMR-BS (M)</a> <a href="#">RS (M)</a>	Scheduling may be centralized, distributed, or a hybrid thereof.
Bandwidth request and allocation	MMR-BS shall support the bandwidth request and allocation mechanism for RS.	<a href="#">MMR-BS (M)</a> <a href="#">RS (O)</a>	
QoS support	The specification shall support QoS as defined in the legacy 16 system for multi-hop.	<a href="#">MMR-BS (M)</a> <a href="#">RS (TBD)</a>	
Unicast data delivery	The specification shall support unicast data delivery via RS.	<a href="#">MMR-BS (M)</a> <a href="#">RS (M)</a>	
MAC PDU processing	RS shall support MAC PDU processing.	<a href="#">MMR-BS (M)</a> <a href="#">RS (TBD)</a>	
Control information processing	The specification shall enable RS to process and forward the DL and UL control information.	<a href="#">MMR-BS (M)</a> <a href="#">RS (M)</a> <a href="#">MOB_NBR-ADV is TBD</a>	DL and UL control information includes DL/UL-MAP, DCD/UCD, MOB_NBR-ADV.
Connection management	The specification shall support MS connections (i.e., CIDs) <a href="#">for multi-hop.</a>	<a href="#">MMR-BS (M)</a> <a href="#">RS (O)</a>	

MS handover support	RS shall support MS handover.	<u>MMR-BS (M)</u> <u>RS (M)</u>	
Relay security	The specification shall define security mechanisms to ensure security between MMR-BS and RS, and between RSs and between RS and MS.	<u>MMR-BS (M)</u> <u>RS (M)</u>	
<del>Secure Message Exchange</del>	<del>The specification shall define a mechanism to exchange secure data/management messages.</del>		

### 3.2 Optional functional requirements

<u>Name</u>	<u>Requirements</u>	<u>Subject (MMR-BS/RS)</u>	<u>Notes</u>
<u>Relay path selection</u>	<u>The specification shall define a mechanism to set up and maintain multi-hop paths</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	<u>There can be centralized and distributed approaches to determine a relay path.</u>
<u>Multicast/broadcast data delivery</u>	<u>The specification shall support multicast and broadcast data delivery via RS.</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	
<u>ARQ support</u>	<u>The specification shall support ARQ of MS via RS.</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	
<u>HARQ support</u>	<u>The specification shall support HARQ of MS via RS.</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	
<u>Mobile RS handover support</u>	<u>The specification shall support RS with mobility and its subordinate MSs including hard handover, MDHO and FBSS..</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	
<u>Handover decision for subordinates stations</u>	<u>The specification shall allow the handover decision originated by a serving RS or MMR-BS on behalf of moving stations.</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	
<u>MMR-BS authentication</u>	<u>The specification shall permit RS to authenticate MMR-BS when it joins an MMR network.</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	
<u>PHY parameters</u>	<u>The specification shall allow an MMR-BS or RS to use different PHY parameters on the different RF frequency on the relay and access links.</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	

<u>Multiple antenna support</u>	<u>The specification shall allow the use of multiple antennae to enhance spectral efficiency of the system or extend the coverage.</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	<u>This includes MIMO, beamforming, transmit diversity, etc.</u>
<u>CQICH</u>	<u>The specification shall enable RS to allocate a CQICH subchannel to support fast feedback quality report and AMC</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	
<u>Cooperative relay</u>	<u>The specification shall enable RS to participate in cooperative relay.</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	
<u>Location information</u>	<u>The specification shall support RS to perform location update.</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	
<u>Power saving</u>	<u>The specification shall support sleep/idle mode.</u>	<u>MMR-BS (O)</u> <u>RS (O)</u>	

#### 4. References

- [1] Call for Comments and Contributions IEEE 802.16 Relay Task Group, IEEE 802.16j-06/006  
~~[2] Proposed Functional Requirements for IEEE 802.16 TGj, IEEE C802.16j-06/022r1~~  
 [3] Draft P802.16j PAR and Five Criteria, IEEE 802.16mmr-06/002r1