Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**RS network entry procedure**
Date Submitted	**2007-04-25**

Source(s)	Mike Hart, Yuefeng Zhou, Sunil Vadgama Fujitsu Laboratories of Europe Ltd. UK Masato Okuda Fujitsu Laboratories Ltd. Japan	Voice: +44 20 8606 4523 Fax: +44 20 8606 4539 mike.hart@uk.fujitsu.com
	Hang Zhang, Peiying Zhu, Mo-Han Fong, Wen Tong, David Steer, Gamini Senarath, Derek Yu, Mark Naden, G.Q. Wang Nortel 3500 Carling Avenue Ottawa, Ontario K2H 8E9	Voice: +1 613 7631315 wentong@nortel.com pyzhu@nortel.com
	Sungjin Lee, Hyunjeong Kang, Hyoungkyu Lim Samsung Electronics	Voice: +82 31 279 5248 Fax: +82 31 279 5130 E-mail : steve.lee@samsung.com
	Shyamal Ramachandran, Aparna Pandey, Eugene Visotsky, Philippe Sartori Motorola, Inc. 1064 Greenwood Blvd. Ste. 400 Lake Mary, FL 32746	E-mail : shyamal.ramachandran@motorola.com aparna.pandey@motorola.com eugenev@motorola.com
	Kenji Saito, Takashi Inoue KDDI R&D Laboratories Inc. Hikarino-oka 7-1, Yokosuka, Kanagawa 239-0847, Japan	Email : saito@kddilabs.jp
	Ozgur Oyman, Sumeet Sandhu, Nageen Himayat Intel Corporation 2200 Mission College Blvd. Santa Clara, CA 95054, U.S.A. Djamal-Eddine Meddour	ozgur.oyman@intel.com Ph.: +1 (408) 765-8558 Email : sumeet.sandhu@intel.com Ph : +1 (408) 765-5043 Email : nageen.himayat@intel.com

France Telecom R&D Lab   djamal.meddour@orange-ftgroup.com
2, avenue Pierre Marzin   Tel : + 33 (0)2 96 05 29 36
22307 Lannion Cedex - France   Fax : + 33 (0)2 96 05 14 70

Re:	Call for technical proposals 802.16j-07/007r2

Abstract	This contribution provides a technical proposal for the RS network entry procedure for the case of a non-transparent RS. It is based on reusing many of the stages executed in the SS network entry procedure with the only major change being the introduction of new SBC and REG TLV values to enable exchange of information about PHY & MAC features supported by the RS. It also defines how the RS switches from using the access link to using the relay link following successful registration with the MR-BS.

Purpose	For discussion and approval of inclusion of the proposed text into the P802.16j baseline document.

RS network entry procedure

[***This contribution propose a harmonization text proposal on RS network entry procedure in MR***]

Introduction

This contribution provides a technical proposal for the network entry procedure to be followed by the MR-BS or RS to enable an RS to enter the MR enabled network[2-4].

The proposed procedure is based on reusing as much of the procedure currently defined in the IEEE Std. 802.16 for the purpose of SS network entry.

The current IEEE Std. 802.16 SS network entry procedure is illustrated in Figure 1 for reference.
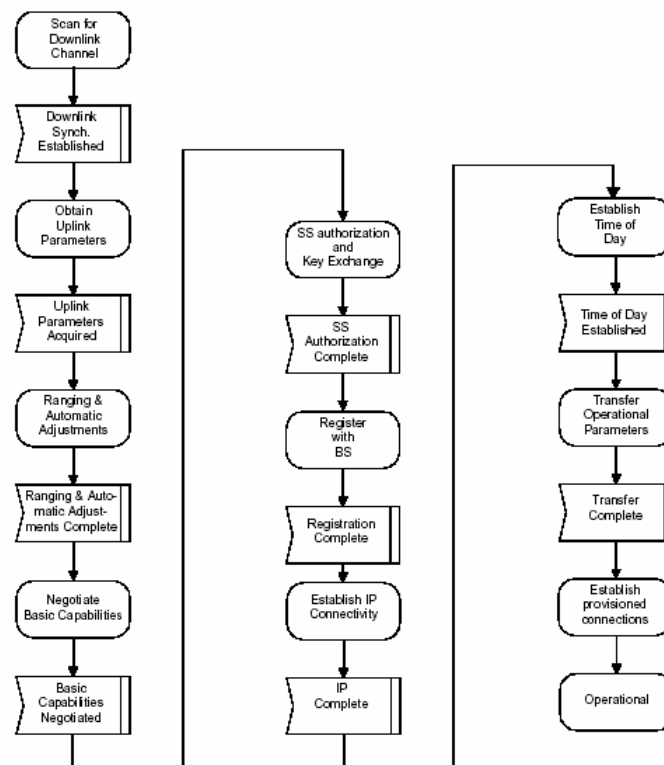
Figure 1. IEEE Std. 802.16 SS network entry procedure.

Overview of proposed procedure

It is assumed that the network could consist of some IEEE Std. 802.16 BS and some MR-BS. It is also assumed that a MR-BS may be operating in a legacy mode until it receives a request from an RS for it to enter the network. The reason the BS may operate in such a mode would be to preserve transmission resources.

However, it is proposed that the MR-BS will at least broadcast the MAC version support TLV [1] indicating its capability to support the IEEE 802.16j MAC in the DCD message. The RS will then be able to identify that the BS is in fact an MR-BS at an early stage in the network entry procedure and decide whether to continue once it learns whether it is attempting to connect to a BS or MR-BS.

The RNG process will be unchanged from the used for SS network entry, the only change being that the RS will indicate support of IEEE 802.16j through the MAC version support TLV. The MR-BS will respond indicating that it can support IEEE 802.16j.

Similarly in the SBC process, a new RS capability TLV is defined to indicate basic capabilities of the RS to the BS. This TLV will identify the type of relay (i.e. transparent, non-transparent, centralized scheduling, distributed scheduling) and also any other MR-BS or RS related features required to support the RS. This TLV is defined in this proposal. By placing it in SBC it allows the RS to abort connection if it finds that fundamental basic parameters are not supported.
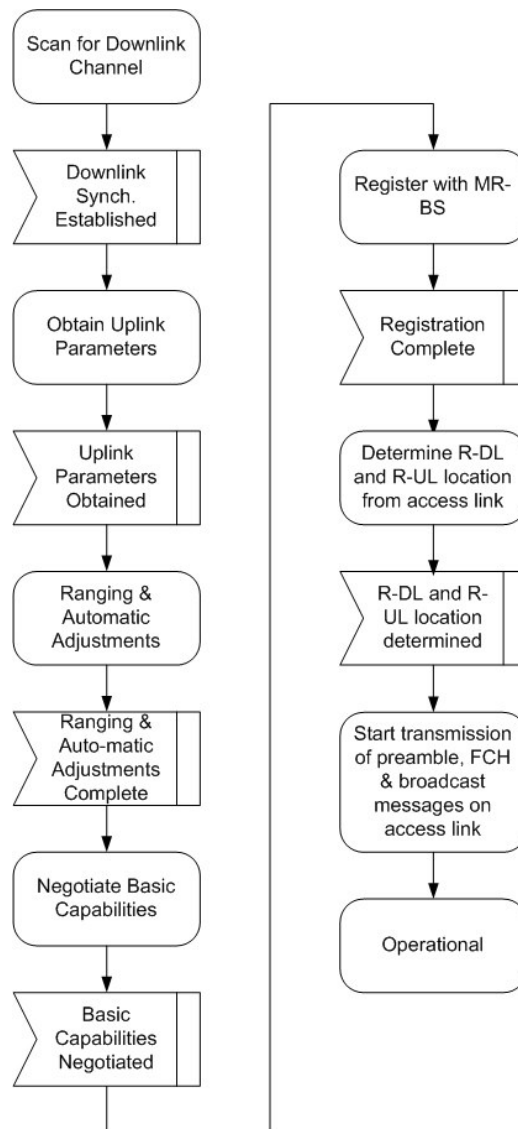
Figure 2. RS network entry procedure.

Proposed text changes

[Modify the last row in Table 14 in page 46 as follows]

Type	Message name	Message description	Connection

~~82-255~~ 82	RS_Path-REQ	RS path selection request message sent by MR-BS	Basic
83	RS_Path-RSP	RS path selection response message sent by RS	Basic
84-255		Reserved	

6.3.2.3.1 Downlink Channel Descriptor (DCD) message
[Insert the following text at the end of the 6.3.2.3.1:]

The following parameter, which are coded as TLV tuples as defined in 11.4, may be included in the DCD message.

ETE Metric
The ETE metric of the path between the RS transmitting the DCD and the BS it is associated to.

6.3.2.3.6 Ranging Response (RNG-RSP) Message
[Insert the following to the end of 6.3.2.3.6:]

The following TLV parameter shall be included in the RNG-RSP message when the RS is attempting to perform network entry or re-entry and the target MR-BS wishes to identify entry or re-entry process management messages that may be omitted during the current entry or re-entry process

RS Network Entry Optimization (see 11.6)

Identifies entry or re-entry process management messages that may be omitted during the current entry or re-entry attempt.

6.3.2.3.23 SS **and RS** Basic Capability Request (SBC-REQ) message

[Change the text in the first paragraph as indicated:]
The SS SBC-REQ shall be transmitted by the SS or RS during initialization. An SS or RS shall generate SBC-REQ messages in the form shown in Table 51.

[Insert the following text at the end of 6.3.2.3.23:]
An RS shall generate SBC-REQs including the following parameter:

Basic CID *(in the MAC Header)*
The CID in the MAC Header is the Basic CID for this RS, as assigned in the RNG-RSP message.

All other parameters are coded as TLV tuples.

Basic Capability Requests contain those RS Capabilities Encodings (11.8) that are necessary for effective communication with the RS during the remainder of the initialization protocols.

6.3.2.3.24 SS **or RS** Basic Capability Response (SBC-RSP) message

[Insert the following text before the last sentence:]
An MR-BS shall generate SBC-RSPs in the form shown in Table 52, including both of the following

4

parameters:

> **CID** *(in the MAC Header)*
> The CID in the MAC Header is the Basic CID for this RS, as appears in the RNG-REQ message.

The following parameters shall be included in the SBC-RSP if found in the RS SBC-REQ:

> **Physical Parameters Supported** (see 11.8.3)
> **Bandwidth Allocation Support** (see 11.8.1)
> The MR-BS response to the subset of RS capabilities present in the SBC-REQ message. The MR-BS responds to the RS capabilities to indicate whether they may be used. If the MR-BS does not recognize an RS capability, it may return this as "off" in the SBC-RSP.

Only capabilities set to "on" in the SBC-REQ may be set "on" in the SBC-RSP, as this is the handshake indicating that they have been successfully negotiated.

[Add new sections 6.3.2.3.83 and 6.3.2.3.84 after section 6.3.2.3.62 in page 46]

6.3.2.3.83 RS path selection response (RS_Path-RSP) message

This message may be transmitted by a RS to acknowledge the reception of the RS_Path-REQ message .

Table XXX. RS_path-RSP message format.

Syntax	Size	Notes
RS_path response format {		
Management message type = 67	8 bits	
}		
}		

6.3.2.3.84 RS path selection request (RS_Path-REQ) message

This message shall be transmitted by a MR-BS to a RS to indicate the access station the RS shall attach to.

Table XXX. RS_path-REQ message format.

Syntax	Size	Notes
RS_path request format {		
Management message type = 67	8 bits	
Preamble Index	8 bits	Preamble Index of the access station the RS shall attach to.
RS network re-entry optimization	8 bits	For each bit location, a value of '0' indicates the associated reentry management messages is required, a value of '1' indicates the reentry management message is omitted. Bit #0: Omit SBC-REQ/RSP management messages if set to '1' Bit #1: Omit PKM Authentication phase

		except TEK phase if set to '1'. Bit #2: Omit PKM TEK creation phase if set to '1'. Bit #3: Omit REG-REQ/RSP management if set to '1'. Bit #4: Omit neighbor station measurement report if set to '1'. Bit #5: Omit path selection phase if set to '1' Bit #6: Omit relay station operational parameter configuration if set to '1' Bit #7: Reserved
}		

Preamble Index
Preamble Index of the access station the RS shall attach to
RS network re-entry optimization
For each bit location, a value of '0' indicates the associated reentry management messages is required, a value of '1' indicates the reentry management message is omitted.
Bit #0: Omit SBC-REQ/RSP management messages if set to '1'.
Bit #1: Omit PKM Authentication phase except TEK phase if set to '1'.
Bit #2: Omit PKM TEK creation phase if set to '1'.
Bit #3: Omit REG-REQ/RSP management if set to '1'.
Bit #4: Omit neighbor station measurement report if set to '1'.
Bit #5: Omit path selection phase if set to '1'. When ETE is broadcasted in DCD, this bit shall be set to '1'.
Bit #6: Omit relay station operational parameter configuration if set to '1'.
Bit #7: Reserved

6.3.9 Network entry and initialization

[Change the first paragraph as indicated:]

Systems shall support the applicable procedures for entering and registering a new SS or RS or a new node to the network. All network entry procedures described hereunder through and including 6.3.9.13 apply only to PMP operation and PMP operation with MR support. The network entry procedure for Mesh operation is described in 6.3.9.14.

[Insert the following text after the second paragraph:]

The procedure for initialization of an RS shall be as shown in Figure xxx. For the RS the stages g), h), i) and j) in the figure 55 are not required, for all other stages the RS shall behave in the same manner as an SS during network entry unless otherwise specified in the subclauses of 6.3.9. The more detailed finite state machine representations of the individual sections (including error paths) and the timeout values shall be the same as those provided for the SS, unless otherwise specified.
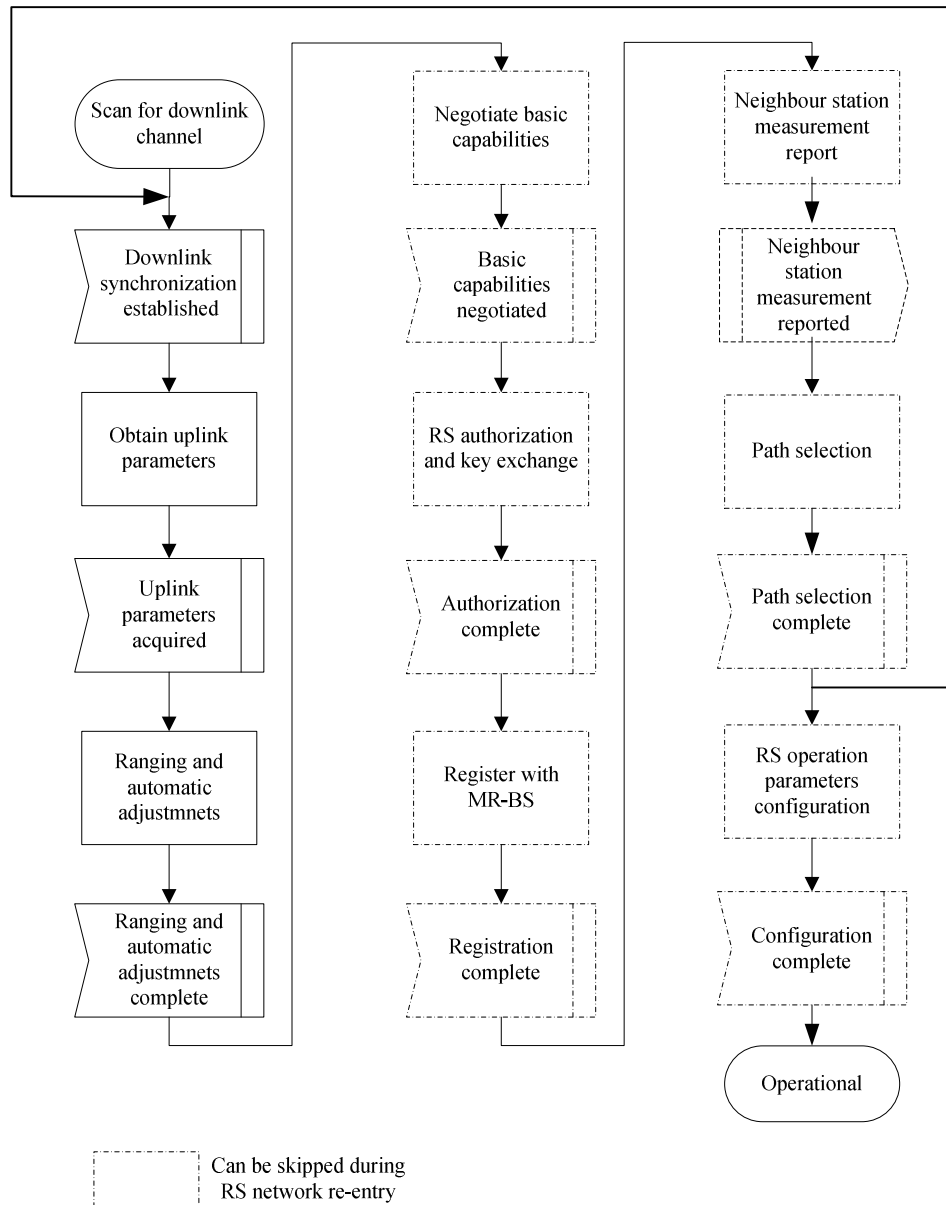
[Insert the following figure]

Fig. xxx RS initialization overview

[Insert a new subclause after 6.3.9.16]

6.3.9.16.1 Neighbor station measurement report

During network entry or re-entry, an RS may be required, as indicated in the RS network entry optimization TLV in the RNG-RSP message, to report the signal strength and preamble index of neighbor stations. If required, the RS shall send the RS_NBR-MEAS-REP message (6.3.2.3.68) to the MR-BS to report the neighbor station measurements after completion of registration.

[Insert a new subclause after 6.3.9.16]
6.3.9.16.2. Relay station operational parameter configuration
In MR networks, a RS operational parameter configuration procedure may required after RS registration procedure. This procedure allows a RS to obtain necessary operational configuration parameters that must be configured over-the-air. One example of such parameters is the frame start beginning preamble index (802.16e preamble) configuration since the configuration of such parameters usually requires radio environment

measurement of a RS. During this procedure, RS and MR-BS shall use RS configuration request /response message (6.3.2.3.66 and 6.3.2.3.67) to negotiate the configuration. A MR-BS shall determine the parameter configurations and indicate to the RS using RS configuration request message. After configuration, the RS responds MR-BS configuration response message to the MR-BS. Before this relay station operational parameter configuration procedure, MR-BS may need to authenticate the entering RS by admission control.
The parameters configured during this procedure include:

•   802.16e frame start preamble index for a relay station which is configured to transmit 802.16e frame start preamble

[*Insert a new subclause after 6.3.9.16.2*]

6.3.9.16.3. Initial path selection procedure

An initial path selection procedure may be performed either before "RS operation parameter configuration" procedure or before "obtain uplink parameters" procedure in Fig. XXX.

The path selection procedure performed prior to "RS operation parameter configuration" is an optional procedure as indicated by the RS network entry optimization TLV in the RNG-RSP message. This operation happens after neighbor station measurement report and before RS operation parameter configuration. During this operation, the MR-BS shall determine the path (i.e. access station) of this RS based on the reported neighbour station measurements and other information such as path loading. The MR-BS shall send the RS_Path-REQ message to the RS to indicate the preamble index of the selected access station and RS network re-entry optimization parameters to assist the RS network (re)-entry process. The RS shall respond with the RS_Path-RSP message. If the access station indicated in the RS_Path-REQ message is not the access station the RS currently attaches to, the RS shall perform network re-entry as described in 6.3.9.

If the path selection is processed prior to "obtain uplink parameters", the MR-BS and the RS may transmit the TLV encoded parameter ETE Metric in the DCD message to support initial RS path selection in the MR network.

The use of these TLV encodings is defined in section 11.4 in Table 385. The RS attempting network entry may obtain the DCD TLV encodings sent by neighbouring RSs and MR-BS to select a desired access station to enter the MR network through it. The RS shall then proceed with the rest of the network entry procedure as defined in Figure XXX with the desired access station.

Change the table in subclause 11.1.3 as indicated:

Type	Length	Value	Scope
148	1	Version number of IEEE 802.16 supported on this channel. 1: Indicates conformance with IEEE Std 802.16-2001 2: Indicates conformance with IEEE Std 802.16c-2002 and its predecessors 3: Indicates conformance with IEEE Std 802.16a-2003 and its	PMP: DCD, RNG-REQ MESH: REG-REQ, REG-RSP

		predecessors 4: Indicates conformance with IEEE Std 802.16-2004 5: Indicates conformance with IEEE Std 802.16-2004 and IEEE Std 802.16e-2005 6: Indicates conformance with IEEE Std 802.16-2004, IEEE Std 802.16e-2005 and IEEE Std 802.16j-xxxx ~~5~~67-255: *Reserved*	

11.4   DCD management message encodings
[Insert the following entries into Table 385:]

Table 385 – DCD channel encoding (continued)

Name	Type (1 byte)	Length	Value
ETE Metric	62	1	Bit #0-2: hop count Bits #3-7: *reserved*

11.6 RNG-RSP Management Message Encoding
[Change Table 367 as indicated:]

Name	Type	Length	Value
RS network entry optimization	TBA	1	Bit #0: Omit neighbor station measurement report if set to '1'. Bit #1: Omit path selection phase if set to '1' Bit #2: Omit relay station operational parameter configuration if set to '1' Bit #3-7: *reserved*

[Insert a new subclause 11.8.3.7.20]

11.8.3.7.20 MR PHY feature support

This TLV indicates the MR PHY features supported by the RS and the MR-BS.

Type	Length	Value	Scope
Xx	1	Bit #0: Access zone preamble transmission support Bits #1-7: *Reserved*	SBC-REQ SBC-RSP

[Insert a new subclause 11.7.27]

11.7.27 MR MAC feature support

This TLV indicates the MR features supported by the RS and the MR-BS.

Type	Length	Value	Scope
Xx	1	Bit #0: RS scheduling support Bit #1: NBR-ADV generating Bit #2: Tunneling packet mode support Bit #3: Tunneling burst mode support Bit #4: RS mobility support Bit #5: Child RS network entry support Bit #6-7 : *Reserved*	REG-REQ REG-RSP

References

[1] Hart, M., "MAC version encoding TLV for .16j", IEEE C802.16j-06/139, IEEE 802.16 meeting #46, Dallas, November 2006.

[2] Hart, M. Y. Zhou, Sungjin Lee, etc., "RS network entry procedure", IEEE C802.16j-07/025r7, IEEE 802.16 meeting #48, Orlando, March 2007.

[3] Hang Zhang, Peiying Zhu, Mo-Han Fong, Wen Tong, etc., "RS Initial Network Entry and Re-entry", IEEE C802.16j-07/097r5, IEEE 802.16 meeting #48, Orlando, March 2007.

[4] Shyamal Ramachandran, Aparna Pandey, etc., "Routing Announcements for Network Entry Support", IEEE C802.16j-07/158r2, IEEE 802.16 meeting #48, Orlando, March 2007.