Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**RS Network Entry, Topology Establishment and Initialization for IEEE 802.16j**
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Re:	IEEE 802.16j-06/027: "Call for Technical Proposals regarding IEEE Project P802.16j"
Abstract	This contribution describes RS network entry, topology establishment and initialization for 802.16j
Purpose	Propose the RS network entry, topology establishment and initialization procedures for IEEE 802.16j specification
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RS Network Entry, Topology Establishment and Initialization

for IEEE 802.16j

I.   Introduction

According to IEEE 802.16j-06-016r1 [1], the specification shall define network entry process for RS. An RS can be associated with an MR-BS, an RS or multiple RSs, as suggested in IEEE 802.16j-06-015 [2]. In addition, the specification shall define a mechanism for MR-BS to control and manage RSs in the MR-cell. In this contribution, procedures for RS network entry, topology establishment and initialization are proposed to meet these requirements.

The basic principle of this proposal is as follows. For a new incoming RS, it doesn't have the knowledge of MR network topology initially. It shall behave like an MS to perform its network entry to obtain a temporal association (maybe associate to an RS or an MR-BS) and obtain authorization and registration with an MR-BS. However, this temporal association may not be the best choice in term of system performance due to lack of topology consideration (hop numbers, traffic load, etc.). Thus, in addition to the procedures for network entry and initialization, an RS topology establishment procedure is devised to find the best station to associate with and perform network re-entry if necessary so that a better network topology can be established.

.

1 **II. Proposed text**

2 --Start text proposal--

3 **6.3.9   Network entry and initialization [5]**

4 **6.3.9.16   Support for network entry and initialization in relay mode**

5 *[Insert the following text into this section]*

6

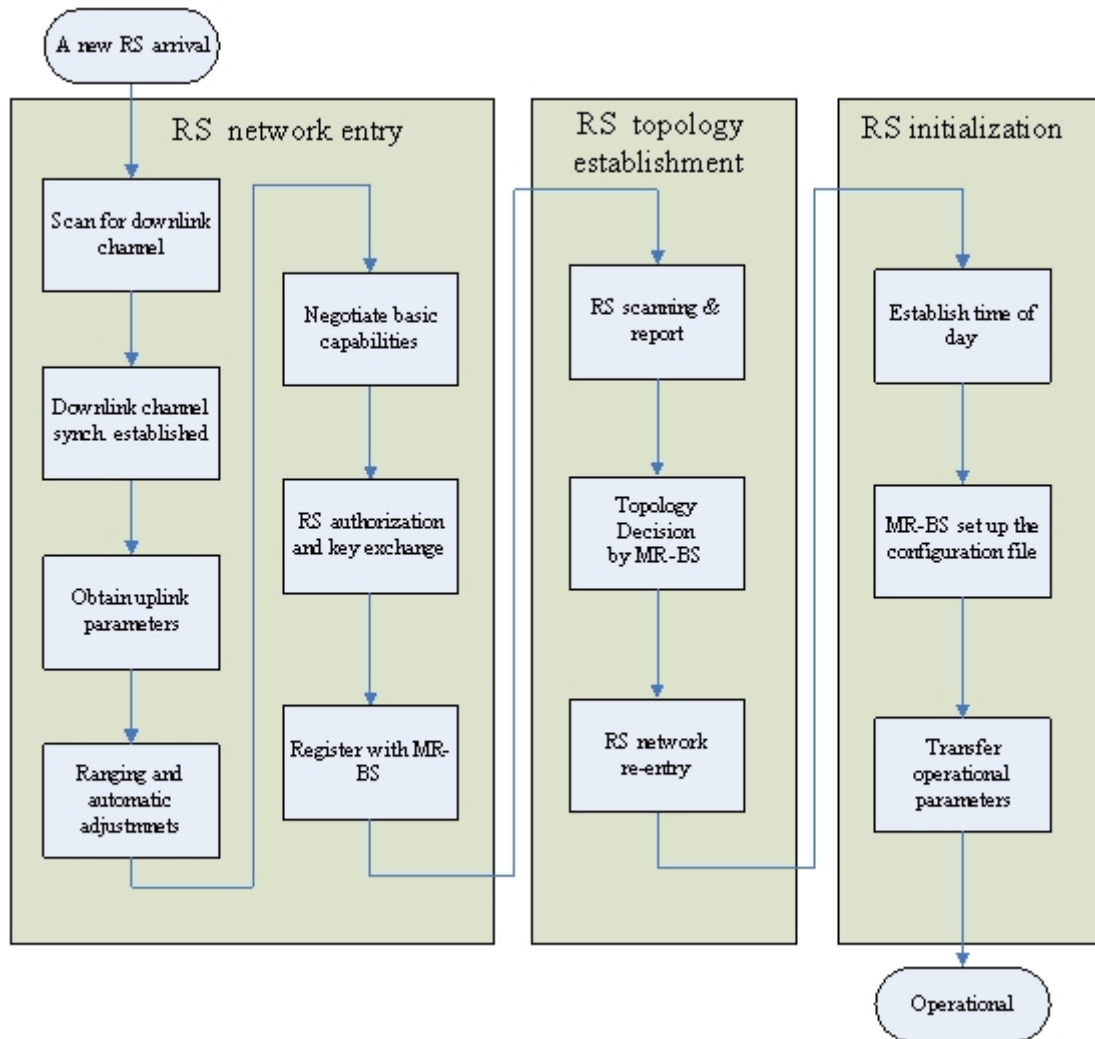7 The overall procedures of RS network entry, topology establishment, and initialization are shown in Figure

8 A.

9

10

11   Figure A, RS network entry, topology establishment and initialization

12

13 In addition to the network entry and initialization, an RS topology establishment process is needed to find

14 the best station to associate with and perform network re-entry if necessary so that a better network topology

15 can be established.

16   The procedure for RS network entry is the same as MS network entry which includes:

17   a.   Scan for overall downlink channel and establish synchronization

18   b.   Obtain DL and UL parameters

19   c.   Perform RS initial ranging

    d.   Negotiate basic capabilities

    e.   Authorize RS and perform key exchange

    f.   Perform registration with MR-BS

After RS network entry, the procedure for MR topology establishment is performed before the RS initialization. The procedure of RS topology establishment includes:

    a.   RS scanning and report (RS neighborhood discovery)

    b.   RS topology decision

    c.   Force RS to perform network re-entry, if necessary

After the establishment of the RS topology, the MR-BS will setup the corresponding RS configuration file and transfer the related operational parameters to the RS for its initialization.

6.3.9.16.1 RS scanning and report

After RS network entry, RS will trigger an RS scanning by transmitting an RLY_SCN-REQ message which indicates the candidate stations and scanning type. These candidates can be picked up during previous scanning results in network entry. MR-BS shall response with an RLY_SCN-RSP message to RS. After receiving this, RS will follow the indications to perform RS scanning and obtain the demanded metrics about recommended stations. An unsolicited RLY_SCN-REP message shall be transmitted to MR-BS for scanning report after scan duration. The flow is shown in Figure B.

6.3.9.16.2 RS topology decision

On MR-BS receiving the RLY_SCN-REP message, based on selection criteria, MR-BS may select a best target station for re-association. A RLY_TPY-IND message will be transmitted by MR-BS to notify the results and trigger the procedures of RS network re-entry.

6.3.9.16.3 RS network re-entry

If the selected target station during topology establishment is not the same as previous associated one, RS shall perform network entry again to associate with this new target.

6.3.9.16.4 MR-BS set up the RS configuration file

After topology establishment, the new network topology has been decided. A configuration file of this new RS includes its BSID, preamble index, frequency assignment, information of its access station (preamble index, BSID) and QoS information including hop count, relay path quality, and service level support will be recorded and maintained by MR-BS.

6.3.9.16.5 Transfer operational parameters

MR-BS will transfer the operational parameters to this incoming RS by RLY_CFG-IND message for providing data transmission with following subscribers. Besides, MOB_RS_NBR-REQ [4] will be

1   originated by MR-BS to notify the changes of network topology to corresponding RSs (including this

2   incoming RS) to facilitate their network topology advertisement.

3
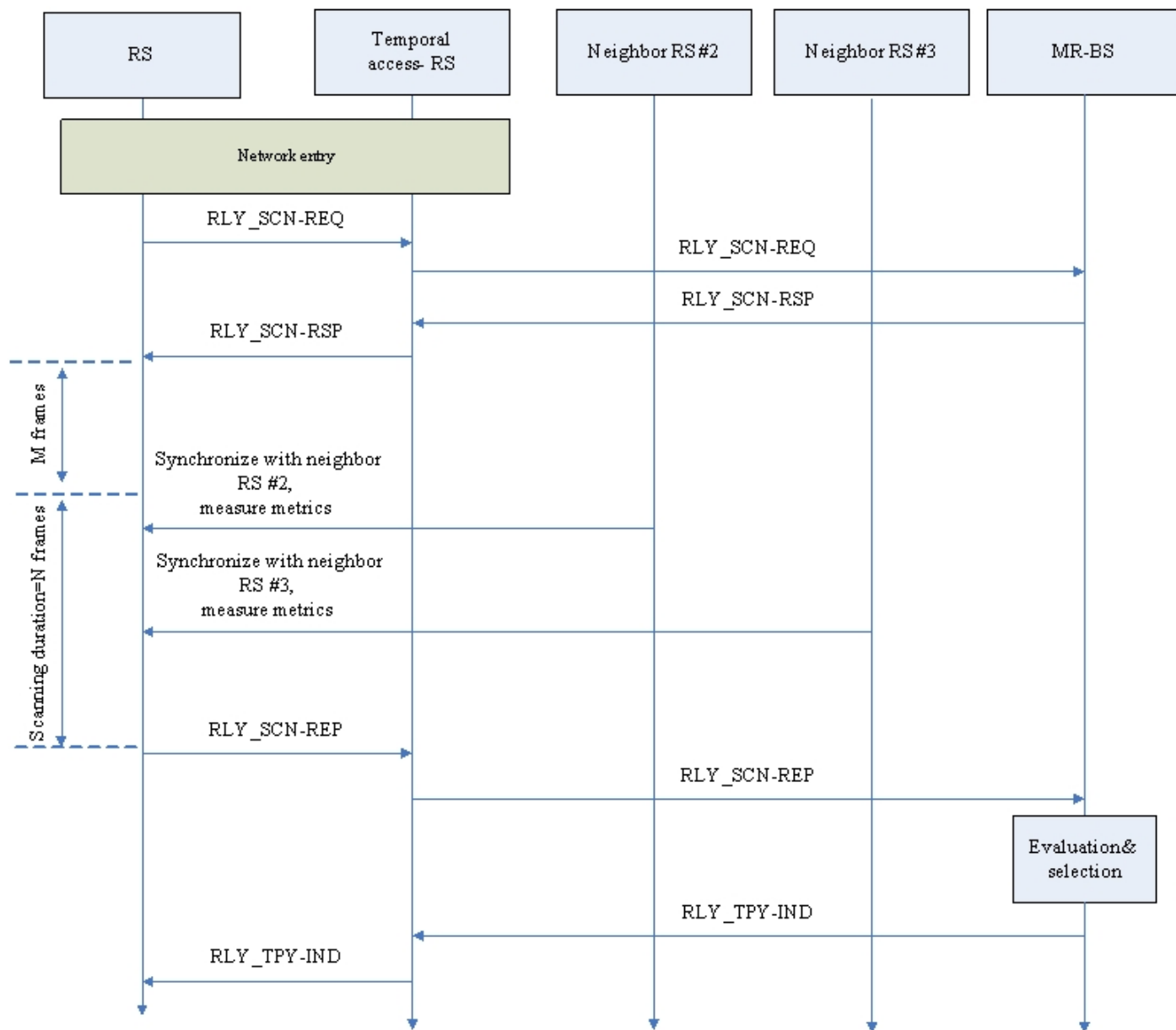
4

5   Figure B, RS scanning and report

6

7   **6.3.2.3   MAC management messages**

8   *[Insert the following text into this section]*

9   *Add the columns into Table 14 as indicated.*

10   **Table 14—MAC Management messages**

Type	Message name	Message description	Connection
69	RLY_SCN-REQ	Relaying mode RS scanning interval allocation request	Basic
70	RLY_SCN-RSP	Relaying mode RS scanning interval allocation response	Basic
71	RLY_SCN-REP	Relaying mode RS scanning result report message	Primary management
72	RLY_TPY-IND	Relaying mode topology indication message	Basic

| 73 | RLY_CFG-IND | Relaying mode configuration indication message | Basic |

1

2 Relaying mode RS scanning request (RLY_SCN-REQ) message

3 An RLY_SCN-REQ message is transmitted by an RS to trigger the neighborhood discovery and

4 determine their suitability as an association for attaching relaying network. The scanning type may be

5 scanning or association (three levels) as the same as MS scanning process.

6

7 An RS shall generate RLY_SCN-REQ messages in the format shown in Table A.

8

9   Table A—RLY_SCN-REQ message format

Syntax	Size	Notes
RLY_SCN-REQ_Message_format(){	—	—
Management Message Type=69	8 bits	—
Scan duration	8 bits	Units are in frames
Interleaving interval	8 bits	Units are frames
Scan Iteration	8 bits	In frames
N_Recommend_Station_Index	8 bits	Number of stations to be scanned or associated, which index that corresponds to the preamble index
For (j=0; j<N_Recommend_Station_Index; j++){	—	—
Preamble_Index/Subchannel Index	8 bits	This parameter defines the OFDMA PHY specific preamble
Scanning type	3 bits	0b000: Scanning without Association. 0b001: Scanning with Association level 0: association without coordination 0b010: Scanning with Association level 1: association with coordination. 0b011: Scanning with Association level 2: network assisted association 0b100–0b111: *Reserved*
}	—	—
Padding	variable	If needed for alignment to byte boundary
TLV encoded information	variable	—
}	—	—

10

11 Relaying mode RS scanning response (RLY_SCN-RSP) message

12 An RLY_SCN-RSP message shall be transmitted by the MR-BS in response to an RLY_SCN-REQ

13 message sent by an RS. An MR-BS may transmit RLY_SCN-RSP to trigger the RS scanning report with or

14 without scanning allocation. Four scanning type same as MS scanning may be used. The message shall be

15 transmitted on the Basic CID.

1

2   The format of the RLY_SCN-RSP message is depicted in Table B.

3

4   Table B—RLY_SCN-RSP message format

Syntax	Size	Notes
RLY_SCN-RSP_Message_format(){	—	—
Management Message Type=70	8 bits	—
Scan duration	8 bits	Units are in frames. When scan duration is set to zero, no scanning parameters are specified in the message. When RLY_SCN-RSP is sent in response to RLY_SCN-REQ, setting scan duration to zero to deny RLY_SCN-REQ.
Report mode	2 bits	0b00: No report 0b01: Periodic report 0b10: Event-triggered report 0b11: *Reserved*
Reserved	6 bits	Shall be set to zero
Report period	8 bits	Available when the value of Report Mode is set to 0b01. Report period in frames.
Report metric	8 bits	Bitmap indicating metrics on which the corresponding triggers are based: Bit 0: CINR mean Bit 1: RSSI mean Bit 2: Relative delay Bit 3: MR-BS RTD; this metric shall be only measured on MR-BS. Bits 4–7: *Reserved*; shall be set to zero.
If (Scan duration != 0) {		
Start frame	4 bit	—
Reserved	1 bits	Shall be set to zero
Interleaving interval	8 bits	Duration in frames
Scan iteration	8 bits	—
Padding	3 bits	Shall be set to zero
N_Recommended_Station_Index	8 bits	Number of stations to be scanned or associated, which index that corresponds to the preamble index
For (j=0; j<N_Recommend_Station_Index; j++){	—	—
Preamble_Index/Subchannel Index	8 bits	This parameter defines the OFDMA PHY specific preamble
Scanning type	3 bits	0b000: Scanning without Association. 0b001: Scanning with Association level 0: association without

		coordination
		0b010: Scanning with Association level 1: association with coordination.
		0b011: Scanning with Association level 2: network assisted association
		0b100–0b111: *Reserved*
If (Scanning type = = 0b010) or (Scanning type= = 0b011 {	—	—
Rendezvous time	8 bits	Units are frame
CDMA code	8 bits	From initial ranging codest
Transmission_opportunity offset	8 bits	Units are transmission opportunity
}	—	—
}	—	—
}	—	—
Padding	variable	If needed for alignment to byte boundary
TLV encoded information	variable	—
}	—	—

1

2 **Relaying mode RS scanning report (RLY_SCN-REP) message**

3   RS shall transmit an RLY_SCN-REP message to report the scanning results to MR-BS after scan
4 duration. The message shall be transmitted on the Primary Management CID.

5

6   The format of the RLY_SCN-REP message is depicted in Table C.

7

8   Table C—RLY_SCN-REP message format

Syntax	Size	Notes
RLY_SCN-REP_Message_format(){	—	—
Management Message Type=71	8 bits	—
Report metric	8 bits	Bitmap indicating metrics on which the corresponding triggers are based: Bit 0: CINR mean Bit 1: RSSI mean Bit 2: Relative delay Bit 3: MR-BS RTD; this metric shall be only measured on MR-BS. Bits 4–7: *Reserved*; shall be set to zero.
N_Recommend_Station_Index	8 bits	Number of stations to be scanned or associated, which index that corresponds to the preamble index
For (j=0; j<N_Recommend_Station_Index;	—	—

j++){		
Preamble_Index/Subchannel Index	8 bits	This parameter defines the OFDMA PHY specific preamble
If (Report metric[Bit 0]==1)	—	—
Station CINR mean	8 bits	—
If (Report metric[Bit 1]==1)	—	—
Station RSSI mean	8 bits	—
If (Report metric[Bit 2]==1)	—	—
Relative delay	8 bits	—
}	—	—
TLV encoded information	variable	Optional
}	—	—

1

2 **Relaying mode RS topology indication (RLY_TPY-IND) message**

3   An MR-BS shall transmit an RLY_TPY-IND message for indicating what the suitable access RS or

4 MR-BS is and trigger the network re-entry. The message shall be transmitted on the basic CID.

5

6   Table D—RLY_TPY-IND message format

Syntax	Size	Notes
RLY_TPY-IND_Message_format(){	—	—
Management Message Type=72	8 bits	—
Target_Station_ID	48 bits	—
Preamble_Index/Subchannel Index	8 bits	This parameter defines the OFDMA PHY specific preamble
HO process optimization	8 bits	HO Process Optimization is provided as part of this message is indicative only. HO process requirements may change at time of actual HO. For each Bit location, a value of '0' indicates the associated reentry management messages shall be required, a value of '1' indicates the reentry management message may be omitted. Regardless of the HO Process Optimization TLV settings, the target Station may send unsolicited SBC-RSP and/ or REG-RSP management messages: Bit #0: Omit SBC-REQ/RSP management messages during re-entry processing Bit #1: Omit PKM Authentication phase except TEK phase during current re-entry processing Bit #2: Omit PKM TEK creation phase during re-entry processing Bit #3: Omit REG-REQ/RSP management during current re-entry processing Bit #4: Omit Network Address Acquisition management messages during current re-entry processing

		Bit #5: Omit Time of Day Acquisition management messages during current reentry processing
		Bit #6: Omit TFTP management messages during current re-entry processing
		Bit #7: Full service and operational state transfer or sharing between serving station and target station (ARQ, timers, counters, MAC state machines, etc…)
Padding	variable	If needed for alignment to byte boundary
TLV encoded information	variable	—
}	—	—

1

2 **Relaying mode RS configuration indication (RLY_CFG-IND) message**

3   An MR-BS shall setup a RS configuration file to record and manage the PHY & MAC characteristics of

4 a new RS after finishing its RS topology establishment. An RS_CFG-IND message is also transmitted for

5 transferring these operational parameters. The message shall be transmitted on the basic CID.

6

7   Table E—RS_CFG-IND message format

Syntax	Size	Notes
RLY_CFG-IND_Message_format(){	—	—
Management Message Type=73	8 bits	—
Operator ID	24 bits	Unique ID assigned to the operator(MR-BS)
Fragmentation Index	4 bits	Indicates the current fragmentation index
Total Fragmentation	4 bits	Indicates the total number of fragmentations
Configured BSID	48 bits	Unique ID assigned to this new RS
PHY Profile ID	8 bits	Aggregated IDs of Co-located FA Indicator, FA Configuration Indicator, FFT size, Bandwidth, Operation Mode of the starting subchannelization of a frame, and Channel Number.
If (FA Index Indicator = =1){	—	—
FA index	8 bits	This field, Frequency Assignment Index, is present only the FA Index Indicator in PHY Profile ID is set.
}	—	—
If (BS EIRP Indicator = =1) {	—	—
RS EIRP	8 bits	Signed Integer from -128 to 127 in unit of dBm. This field is present only if the MR-BS EIRP indictor is set in PHY ProfileID.
}	—	—
Preamble Index/ Subchannel Index	8 bits	Index value 0b11111111 stands for Null case (RS doesn't need preamble)
Scheduling Service Supported	8 bits	Bitmap to indicate if Station supports a particular scheduling service. 1

		indicates support, 0 indicates not support:
		Bit #0: Unsolicited Grant Service (UGS)
		Bit #1: Real-time Polling Service (rtPS)
		Bit #2: Non-real-time Polling Service (nrtPS)
		Bit #3: Best Effort
		Bit #4: Extended real-time Polling Service (ertPS)
		If the value of bit 0 through bit 4 is 0b00000, it indicates no information on service available.
		Bits #5–7: *Reserved*; shall be set to zero.
DCD Configuration Change Count	4 bits	This represents the 4 LSBs of this Station current DCD configuration change count.
UCD Configuration Change Count	4 bits	This represents the 4 LSBs of this Station current UCD configuration change count.
TLV Encoded Neighbor information	variable	TLV specific
Padding	variable	If needed
}		

--End of text proposal--

References

[1] IEEE 802.16j-06/016r1, "Proposed Technical Requirements Guideline for IEEE 802.16 Relay TG".

[2] IEEE 802.16j-06/015, "Harmonized Contribution on 802.16j (Mobile Multihop Relay) Usage Models".

[3] IEEE Std. 802.16e-2004, "IEEE Standard for Local and metropolitan area networks, Part 16: Air Interface for Fixed Broadband Wireless Access Systems".

[4] IEEE C802.16j-06/166, "Network Topology Advertisement for IEEE 802.16j".

[5] IEEE 802.16j-06/017r2, "Table of Contents of Task Group Working Document".