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Re:	IEEE 802.16j-07/043: “IEEE 802.16j working group letter ballot #28”
Abstract	This contribution proposes sleep mode procedure for the transparent RS.
Purpose	To incorporate the proposed text into the P802.16j/D1
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RS Sleep Mode

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1 Introduction

A transparent RS only transfers the traffic between its subordinate MSs and the serving MR-BS. It's not necessary for the transparent RS to transmit preamble, FCH, and broadcast messages, such as MAPs, DCD and UCD. The sleep mode feature of a transparent RS is useful for providing power efficiency, especially for the mobile RS with battery power source or low-power fixed/nomadic RS powered by the solar power or battery. As a transparent RS enters the sleep mode, its power consumption can be reduced by turning off the transceiver and keeping CPU running at the lowest speed.

2 Spec Changes

This section contains the suggested text for the 802.16 specification changes.

Change Table 14 as indicated:

Type	Message name	Message description	Connection
~~67–255~~		~~Reserved~~	-
xx	RS_SLP-REQ	RS Sleep Request	Basic
xx	RS_SLP-RSP	RS Sleep Response	Basic
xx-255		Reserved	-

6.3.21.7 Relay support for MS sleep mode

6.3.21.7.3 RS Sleep mode

Transparent RS should support RS sleep mode. Under centralized scheduling, MR-BS may activate an RS getting into sleep mode after switching the MSs, which are attached to the RS and are in normal mode, to either itself or another transparent RS. The MR-BS should send an RS_SLP-RSP message to inform the transparent RS of the sleeping pattern which consists of listening and sleep windows. The sleeping patterns of an RS in sleep mode and its subordinate MSs in sleep mode shall be consistent.
Alternatively, a transparent RS can request the activation of RS sleep mode by sending an RS_SLP-REQ message to the serving MR-BS. Upon receiving the RS_SLP-REQ message, the MR-BS shall respond by sending an RS_SLP-RSP message to the RS to activate the RS sleep mode. When an RS is in sleep mode, the MR-BS can send an MOB_TRF-IND to awake the sleeping RS. Alternatively, when an RS in sleep mode needs to transmit data, it should perform bandwidth request process with its serving MR-BS, and awake from sleep mode.

6.3.2.3.97 RS_SLP-REQ message

A transparent RS supporting sleep mode uses the RS_SLP-REQ message to request activation of RS sleep mode. The RS_SLP-REQ message is sent from the RS to the MR-BS on the RS's basic CID.

Syntax	Size	Notes
RS_SLP-REQ_Message_format() {	-	-
Management message type = xx	8 bits	-
Number_of_descriptions	8 bits	
for (i = 0; i < Number_of_descriptions; i++) {		
RS_Operation	1 bit	Value=0 – Deactivate Value=1 – Activate
Reserved	7 bits	
if (RS_Operation = 1) {		
RS_start_frame_number	6 bits	
RS_initial-sleep_window	8 bits	
RS_listening-window	8 bits	
RS_final-sleep_window_base_	10 bits	
RS_final-sleep_window_exponent	3 bits	
RS_traffic_triggered_wakening_flag	1 bit	
Reserved	4 bits	
} Else{		
Description_ID	8 bits	
}		
}		
}		

Parameters shall be as follows:

Number_of_descriptions

The number of descriptions for RS sleep mode

RS_Operation

0= Deactivation of RS Sleep Mode

1= Activation of RS Sleep Mode

RS_start_frame_number

Start frame number for the sleep window.

RS_initial-sleep_window

Assigned Duration of RS listening window (measured in frames).

RS_listening-window

Assigned initial duration for the RS sleep window (measured in frames).

RS_final-sleep_window_base_

Assigned final value for the RS sleep interval (measured in frames).

RS_final-sleep_window_exponent

Assigned factor by which the final-sleep window base is multiplied in order to calculate the RS_final-sleep window. The following formula is used:

RS_final-sleep window = RS_final-sleep window base × $2^{(\text{RS\_final-sleep window exponent})}$

RS_traffic_triggered_wakening_flag

0 = RS shall be activated when it receives traffic.

1 = RS shall be activated only when it receives the MOB_TRF-IND message.

Description_ID

Assigned description identifier

6.3.2.3.98 RS_SLP-RSP message

The RS_SLP-RSP message shall be sent from MR-BS to an RS on the RS's basic CID in response to an RS_SLP-REQ message, or may be sent unsolicited.

Syntax	Size	Notes
RS_SLP-RSP_Message_format() {	-	-
Management message type = xx	8 bits	-
Number_of_descriptions	8 bits	
for (i = 0; i < Number_of_descriptions; i++) {		
Description_ID	8 bits	
RS_Operation	1 bit	Value=0 – Deactivate Value=1 – Activate
if (RS_Operation = 1) {		
RS_start_frame_number	6 bits	
RS_initial-sleep_window	8 bits	

RS_listening-window	8 bits	
RS_final-sleep_window_base_	10 bits	
RS_final-sleep_window_exponent	3 bits	
RS_traffic_triggered_wakening_flag	1 bit	
Support_Enabled-Action-Triggered	1 bit	
Reserved	8 bits	
SLPID	10 bits	
REQ-duration	8 bits	
} else{		
Reserved	7 bits	
}		
}		
}		

Parameters shall be as follows:

Number_of_descriptions
The number of descriptions for RS sleep mode
Description_ID
Assigned description identifier
RS_Operation
0= Deactivation of RS Sleep Mode
1= Activation of RS Sleep Mode
Support_Enabled-Action-Triggered
0 = RS supports MS Enabled-Action-Triggered actions
1 = RS does not support MS Enabled-Action-Triggered actions
RS_start_frame_number
Start frame number for the sleep window.
RS_direction
0b00 = Both
0b01 = Downlink direction only
0b10 = Uplink direction only
0b11 = Reserved
RS_traffic_triggered_wakening_flag
0 = RS shall be activated when it receives traffic.
1 = RS shall be activated only when it receives the MOB_TRF-IND message.
RS_initial-sleep_window

Assigned Duration of RS listening window (measured in frames).

RS_listening-window

Assigned initial duration for the RS sleep window (measured in frames).

RS_final-sleep_window_base_

Assigned final value for the RS sleep interval (measured in frames).

RS_final-sleep_window_exponent

Assigned factor by which the final-sleep window base is multiplied in order to calculate the RS_final-sleep window. The following formula is used:
RS_final-sleep window = RS_final-sleep window base × $2^{(\text{RS\_final-sleep window exponent})}$

Scheduling_type

0 = Centralized Scheduling
1 = Distributed Scheduling

SLPID

This is a number assigned by the MR-BS whenever an RS is instructed to enter sleep mode. This number shall be unique in the sense that it is assigned to a single RS that is instructed to enter sleep mode.

REQ-duration

Waiting value for the RS_SLP-REQ message re-transmission (measured in MAC frames): the RS may retransmit the RS_SLP-REQ message after the time duration (REQ-duration) provided in the message.

Change the subclause 6.3.2.3.46 MOB_TRF-IND (traffic indication) message

6.3.2.3.46 MOB_TRF-IND (traffic indication) message

[Insert the following text after the third paragraph of 6.3.2.3.46:]

For MR system, when a transparent RS enters sleep mode, the MR-BS shall assign a SLPID for the RS.

Change Table 342 as indicated:

10.1 Global values

Table 342—Parameters and constants

System	Name	Time reference	Minmum value	Default value	Maximum value
RS/MS	Listening_ Interval	The time duration during which the RS/MS, after waking up and synchronizing with the DL transmissions, can demodulate downlink transmissions and decide whether to stay awake or go back to sleep.	=	=	64 frames

Change the subclause 11.1.8.2 SLPID_Update

11.1.8.2 SLPID_Update

The SLPID_Update TLV specifies a new SLPID that replaces an old SLPID. This TLV may include multiple Old_New_SLPID values for the MSs or RSs negatively indicated in MOB_TRF-IND message.

***Change the subclause 11.7.15*:**

11.7.15 Sleep mode recovery time

The 'Sleep mode recovery time' field indicates the time required for an MS or an RS that is in a sleep mode to return to awake-mode. This parameter is optional and may be used by the MR-BS to determine sleep interval window sizes when initiating sleep mode with an MS or an RS.

Type	Length	Value	Scope
32	1	Number of frames required for the MS or the RS to switch from sleep mode to awake-mode	REG-REQ