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Re:	“IEEE 802.16n-11/0020,” in response to Call for Comments on 802.16n (GRIDMAN) AWD	
Abstract	Multicast power saving on IEEE 802.16n Amendment Draft Standard	
Purpose	To discuss and adopt the proposed text in the draft amendment document on 802.16n	
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Multicast Power Saving over IEEE 802.16n

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1. Introduction

IEEE 802.16.1a AWD [3] (i.e. over WirelessMAN-AAI[5]) describes the multicast power saving operation. This document provides a proposed multicast power saving over IEEE 802.16n[4] to be consistent with that over IEEE 802.16.1a.

2. References

- [1] IEEE 802.16n-10/0048r2, 802.16n System Requirement Document including SARM annex, July 2011.
- [2] IEEE 802.16n-11/0024, P802.16n Draft AWD, October 2011.
- [3] IEEE 802.16n-11/0025, P802.16.1a Draft AWD, October 2011.
- [4] IEEE P802.16Rev3/D2, IEEE Draft Standard for Local and metropolitan area networks; Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems,” October 2011.
- [5] IEEE P802.16.1TM/D2, [Draft] WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems, October 2011.

3. Proposed Text on the IEEE 802.16n Amendment Draft Standard

[-----Start of Text Proposal-----]

[Remedy1: Add the following text in 6.3.2.3 in the 802.16n AWD.]

6.3.2.3.10 DSA-REQ message

Insert the following text at the end of 6.3.2.3.10 DSA-REQ message:

When an MS commences multicast service, the following parameters shall be included in the DSA-REQ message.

Multicast Group Zone ID (see 11.13.48)

Indicates multicast group zone IDs for the connection that is associated with the service flow in DSA-REQ in HR-Network.

Multicast Group ID (see 11.13.yy)

Indicates multicast group for the connection that is associated with the service flow in DSA-REQ.

Multicast Indication cycle (see 11.13.yy+1)

Indicates multicast indication cycle for the multicast in HR-Network

6.3.2.3.11 DSA-RSP message

Insert the following text at the end of 6.3.2.3.11 DSA-RSP message:

When an MS commences multicast service, the BS shall include the following parameters in the DSA-RSP message.

Multicast Group Zone ID (see 11.13.48)

Indicates multicast group zone IDs for the connection that is associated with the service flow in DSA-RSP in HR-Network.

Multicast Group ID (see 11.13.yy)

Indicates multicast group for the connection that is associated with the service flow in DSA-RSP.

Multicast Indication cycle (see 11.13.yy+1)

Indicates multicast indication cycle for the multicast in HR-Network

6.3.2.3.13 DSC-REQ (DSC request) message

Insert the following text at the end of 6.3.2.3.13 DSA-REQ message:

In HR-Network, BS may include the following parameters for the purposes of multicast management in DSC-REQ message.

Multicast Group Zone ID (see 11.13.48)

Indicates multicast group zone IDs for the connection to overwrite that is associated with the service flow in DSC-REQ in HR-Network.

Multicast Group ID (see 11.13.yy)

Indicates multicast group for the connection to overwrite that is associated with the service flow in DSC-REQ.

Multicast Indication cycle (see 11.13.yy+1)

Indicates multicast indication cycle to overwrite for the multicast in HR-Network

[Remedy2: Insert the following new sections in the end of 6.3.2.3 in the 802.16n AWD:]

6.3.2.3.98.xz HR-MG-IND (High Reliable Multicast Group Indication) message

An HR-BS providing multicast service transmits HR-MG-IND message in the beginning of available interval in multicast indication cycle. This message indicates whether there is DL multicast traffic for a specific multicast group. There are two formats for the HR-MG-IND message, indicated by the indication type field. If the indication type is set to “0,” this message indicates the multicast traffic transmission offset directly. Otherwise, MGIND bitmap indicates a subgroup of multicast group and further information will be transmitted by HR-MT-IND described in 6.3.2.3.98.xz+1.

Table aaa - HR-MG-IND message format

<u>Syntax</u>	<u>Size (bit)</u>	<u>Notes</u>
HR-MG-IND message format () {	=	=
<u>Management Message Type = xx</u>	<u>8</u>	=
<u>Indication type</u>	<u>1</u>	<u>0b0: full MGID indication</u> <u>0b1: MGIND+MTIND indication</u>
if (Indication type == 0b0) {	=	=
<u>Num_MGID</u>	<u>5</u>	<u>Number of multicast group to indicate multicast traffic is transmitted.</u>
for(i=0;i<Num_MGID;i++){	=	=
<u>Multicast Group ID</u>	<u>12</u>	=
<u>Action Code</u>	<u>3</u>	<u>if bit0 = 1, perform network entry or exit sleep mode</u> <u>if bit1 = 1, perform ranging procedure with ranging purpose indication (bit#5) is set to HR multicast service flow update</u> <u>if bit2 = 1, receiving multicast traffic</u>
if (Action Code bit2 == 1) {		
<u>offset of multicast traffic</u>	<u>4</u>	<u>frame number offset in which the BS transmits multicast traffic</u>
}		
}	=	=
} else if (Indication type == 0b1) {	=	=

Table aaa - HR-MG-IND message format

<u>Syntax</u>	<u>Size (bit)</u>	<u>Notes</u>
<u>MGIND bitmap</u>	$M(=64)$	Indicates whether a corresponding subgroup of multicast group has multicast data to transmit, where the N -th bit of MGIND bitmap [MSB corresponds to $N=0$] corresponds to MGIDs in a subgroup ($2^{12 \times N/M}$ to $2^{12 \times (N+1)/M-1}$) 0: There is no multicast traffic for any of multicast groups in the corresponding multicast subgroup 1: There is multicast traffic for at least one multicast group in the corresponding multicast subgroup
<u>for(i=0;i<L;i++){</u>	=	L equals the number of bits in MGIND bitmap whos bit is set to 1.
<u>offset of HR-MT-IND message</u>	<u>2</u>	frame number offset in which the BS transmits HR-MT-IND message 0b00: [current + 1]th frame 0b01: [current + 2]th frame 0b10: [current + 3]th frame 0b11: [current + 4]th frame
<u>}</u>	=	=
<u>}</u>	=	=
<u>}</u>	=	=

6.3.2.3.98.xz+1 HR-MT-IND (High Reliable Multicast Traffic Indication) message

MT-IND message shall be transmitted at the offset indicated by HR-MG-IND message described in 6.3.2.3.98.xz. Based on the action code in HR-MT-IND message, HR-MSs may receive multicast traffic or perform network entry or exit sleep mode.

Table bbb - HR-MT-IND message format

<u>Syntax</u>	<u>Size (bit)</u>	<u>Notes</u>
HR-MT-IND message format () {	=	=
<u>Management Message Type = xx+1</u>	<u>8</u>	=

<u>Syntax</u>	<u>Size (bit)</u>	<u>Notes</u>
<u>for(i=0;i<L;i++){</u>	=	<u>L equals the number of bits in MGIND bitmap whose bit is set to 1 and whose offset is the current frame. The bits are ordered by the shortest MSB of MGIND bitmap.</u>
<u>MTIND bitmap</u>	<u>K(=64)</u>	<u>Indicates whether a corresponding multicast group has multicast data to transmit, where the Q-th bit of MTIND bitmap [MSB corresponds to Q = 0] corresponds to MGID in the subgroup (Q is the value of logK LSB of multicast group and MSB logM of multicast group is defined by MG-IND message).</u> <u>-</u> <u>0: There is no multicast traffic for the corresponding multicast group</u> <u>1: There is multicast traffic for the corresponding multicast group</u>
<u>for(j=0;j<P;j++){</u>	=	<u>P equals the number of bits in MTIND bitmap whose bit is set to 1.</u>
<u>Action code</u>	<u>3</u>	<u>if bit0 = 1, perform network entry or exit sleep mode</u> <u>if bit1 = 1, perform ranging procedure with ranging purpose indication (bit#5) is set to HR multicast service flow update</u> <u>if bit2 = 1, receiving multicast traffic</u>
<u>if (action code bit2 == 1) {</u>	=	=
<u>offset of multicast traffic</u>	<u>4</u>	<u>frame number offset in which the BS transmits multicast traffic</u>
<u>}</u>	=	=
<u>}</u>	=	=
<u>}</u>	=	=
<u>}</u>	=	=

[Remedy3: Insert the following row in line 20, page 32 (section 11.4.1) in the 802.16n AWD:]

<u>Multicast Indication cycle</u>	<u>xxx+1</u>	<u>1</u>	<p><u>Multicast Indication cycle indicates the start of multicast indication cycle in unit of 8 LSB of frame number.</u></p> <p><u>Multicast indication cycle is unique to HR multicast group zone and it consists of multicast available interval and multicast unavailable interval. 1st frame of multicast indication cycle is the multicast available interval and rest frames are the multicast unavailable interval.</u></p>	<u>All</u>
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[Remedy4: Insert the following row in line 8, page 34 (section 11.13) in the 802.16n AWD:]

<u>zz</u>	<u>Multicast Group ID</u>
<u>zz+1</u>	<u>Multicast Indication Cycle assignment</u>

[Remedy5: Insert the following new sections after 11.13.48 in line 1, page 35 (section 11.13) in the 802.16n AWD:]

11.13.yy Multicast Group Identifier Assignment parameter

The DSA-REQ/RSP message may contains the value of this parameter to specify a Multicast Group identifier. This parameter indicates a Multicast Group ID through which the connection or virtual connection for the associated service flow is valid.

<u>Type</u>	<u>Length</u>	<u>Value</u>	<u>Scope</u>
<u>[145/146].zz</u>	<u>1</u>	<u>Multicast group identifier.</u>	<u>DSA-REQ, DSA-RSP, DSC-REQ</u>

11.13.yy+1 Multicast Indication Cycle Assignment parameter

The DSA-REQ/RSP message may contains the value of multicast indication cycle to specify Multicast Indication Cycle. This parameter indicates the start of multicast indication cycle in unit of 8 LSB of frame number. Multicast Indication cycle is unique to multicast group zone and consists of multicast available interval and multicast unavailable interval. 1st frame of multicast indication cycle is the multicast available interval and rest frames are the multicast unavailable interval.

<u>Type</u>	<u>Length</u>	<u>Value</u>	<u>Scope</u>
[145/146].zz+1	1	<u>Multicast Indication Cycle in unit of 8 LSB of frame number.</u>	<u>DSA-REQ, DSA-RSP, DSC-REQ</u>

[Remedy6: Insert the following text in the end of 16.9.1.3 in the 802.16n AWD:]

HR-BS providing multicast service transmits multicast indication cycle using DCD and DSA/DSC messages. The multicast indication cycle is unique to HR multicast group zone and it consists of multicast available interval and multicast unavailable interval. Multicast available interval is the first frame of each multicast indication cycle. In the multicast available interval, the HR-BS providing multicast service transmits HR-MG-IND message described in 6.3.2.3.98.xz and HR-MT-IND message described in 6.3.2.3.98.xz+1 during multicast available interval of HR multicast group zone. HR-MG-IND and HR-MT-IND message are used to indicate

- multicast service establishment/change/release
- whether the multicast traffic is transmitted after those messages are transmitted
- to perform network entry or exit sleep mode to transmit multicast related message to change/release multicast service and update multicast security key.
- to perform multicast service flow update using ranging procedure

Multicast indication cycle included in DCD message is used for multicast service establishment.

During multicast service establishment/change using DSA/DSC message, new multicast indication cycle may be transmitted.

During multicast available interval, HR-BS transmits HR-MG-IND message in the beginning of available interval to indicate multicast traffic of one or more specific multicast groups will transmit. HR-MG-IND message includes an indication whether HR-MT-IND message will be transmitted. If the HR-MT-IND message is transmitted after transmitting HR-MG-IND using frame offset, MGIND bitmap indicates a multicast subgroup which is included in the HR-MT-IND message. Multicast group is divided into some subgroups (i.e., length of MGIND bitmap) and each subgroup has following number of multicast groups:

$$\text{Number of multicast group in a subgroup} = 2^{12}/M,$$

where M is the length of MGIND bitmap and N -th bit in MGIND bitmap indicates a subgroup of multicast groups from $2^{12} \times N/M$ to $2^{12} \times (N+1)/M - 1$.

HR-MT-IND message is transmitted in the offset included in HR-MG-IND message after transmitting HR-MG-IND message and it indicates whether multicast traffic of specific multicast

group will transmit. The multicast group is indicated based on the MGIND bitmap in HR-MG-IND message and MTIND bitmap in HR-MT-IND message.

N -th bit in MGIND bitmap indicates the value of $\log M$ MSB of Multicast Group ID and Q -th bit in MTIND bitmap indicates the value of $\log K$ LSB of Multicast Group ID. For the indicated Multicast Group ID, according to the action code, HR-MSs, member of the Multicast Group, perform network entry or receive multicast traffic.

[-----End of Text Proposal-----]