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Re:	This document accompanies a comment on IEEE 802.16e/D5a
Abstract	The document contains changes suggested for Scanning Request and Response message to improve Scanning procedure
Purpose	The contribution accompanies comment to be considered within the P802.16e/D5a Ballot Resolution Committee Recirculation
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Optimization of Scanning procedure

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1. Background

Section 6.3.20.1.2 "MSS Scanning of available BS" of 802.16e/D5a says:

"In the MOB_SCN-REQ MAC management message the MSS, and in the MOB_SCN-RSP MAC management message the BS shall indicate either Scanning, Scan type = 0, or Association, Scan type = 1, as the intended MSS activity during the Scanning Interval. If Scan type = 1, Association, then the MSS and BS may include, in their respective messages, one or more Association Test BSID. The BS may send over the backbone to the Association Test BS request to allocate non-contention based ranging opportunity, at the appropriate timing interval, for MSS to conduct Association ranging with the Association Test BS. When conducting initial ranging to Association Test BS, MSS shall use allocated non-contention based ranging opportunity, if available. Regardless of value of Scan type and the presence of one or more Association Test BSID, MSS may determine and perform any scanning or ranging or Association activities during Scanning Interval at its own discretion."

There are several problems with this procedure.

1. How they neighbor BS may predict when MSS arrives to their channel? Even MSS itself does not know precisely as worst case of DL synchronization latency is large: is it product of (# of frequencies to scan) x (# of GIs to try) x (# of preambles to try etc.) x (estimated # of frames to get synchronized to DL at proper frequency). For the first BS in the list of Test BSs it may be disputable, but certainly not for next BSs where latency of ranging is added by each previous BS.

2. Why should MSS request (and BS approve) for either scanning-only for all BSs or scanning-and-ranging for all BSs?

2. Addition: Problem with Fast Ranging

Fast Ranging IE (8.4.5.4.20) may be placed in the UL-MAP message by a BS to provide a non-contention based initial-ranging opportunity. Additional problem discovered during analysis of Association option is that Fast Ranging IE is not consistent with later updates on OFDMA UL subframe structure where allocations typically are not rectangular and not necessarily fit definitions of Ranging subchannel in 8.4.7.
This is why OFDMA UL-MAP IE format (Table 285) considers (CDMA) ranging allocation a special case. Such allocation (UIUC=12) is provided in terms of OFDMA Symbol offset + Subchannel offset + No. OFDMA Symbols + No. Subchannels rather than in terms of Duration (number of OFDMA slots). In both Network re-entry and Association initial transmission of MSS must be transmission of CDMA code, so Fast Ranging IE should provide allocation in same terms as regular IE for UIUC=12.

~~2.~~3. Suggested remedy for Scanning procedure

[Change Table 106g and following text]

Syntax	Size	Notes
MOB_SCN-REQ_Message_Format() {		
Management Message Type = 54	8 bits	
Scan duration	8 bits	Units are frames
~~Scan type~~	~~1 bit~~	~~0: Scanning~~ ~~1: Association~~
Reserved	3 bites	Shall be set to zero
~~If (Scan type = 0) {~~	~~8 bits~~	
Interleaving interval	8 bits	Units are frames
Scan Iteration	8 bits	
~~}~~		
~~Else {~~ N_Recommended_BS_ Scanning	4 bits	
For (j=0; j<N_Recommended_BS_ Scanning; j++) {		
~~Scan type~~	~~1 bit~~	~~0: Scanning~~ ~~1: Association~~
~~Reserved~~	~~7 bit~~	
~~Association~~ Recommended ~~Test~~ BS ID Scanning	48 bits	
}		
N_Recommended BS_Associations	4 bits	
For (j=0; j<N_Recommended_BS_Association; j++) {		
Recommended BS ID Association	48 bits	
}		
HMAC Tuple	21 bytes	
}		

The following parameters shall be included in the MOB_SCN-REQ message,

Scan duration
Duration (in units of frames) of the requested scanning period.

~~**Scan type**~~
~~Operation that a MSS intends during Scanning Interval (0) Scanning (1) Association.~~

HMAC Tuple (see 11.1.2)
The HMAC Tuple Attribute contains a keyed Mmessage digest (to guarantee the origin and integrity of the message).

~~If Scan type is set to '0', the following parameters shall be included in the MOB-SCN-REQ message:~~

Interleaving Interval
The period of MSS's Normal Operation which is interleaved between Scanning Durations.

Scan Iteration
The requested number of iterating scanning interval by an MSS

N_Recommended_BS_ Scanning
Number of BSs which the MSS plans to scan only

Recommended BS ID Scanning
BS IDs of those BSs the MSS plans to scan

~~If Scan type is set to '1', the following parameters may be included in the MOB-SCN-REQ message:~~

~~**Association Test BS ID**~~
N_Recommended_BS_ Association
Number of BSs which the MSS plans to scan and try association

Recommended BS ID Association
BS IDs of those BSs the MSS plans to scan and try association

~~Association Test~~ ~~Recommended~~This ~~BS ID~~ field may be included only if an MSS has a candidate available BS. It means that MSS calls Serving BS for assistance to make appointment with the Recommended BS for non-contention based ranging opportunity to perform association~~ to associate~~. ~~Multiple Association Test Recommended BS IDs may be included in the MOB-SCN-REQ message.~~

[Change Table 106h and following text]

Syntax	Size	Notes
MOB_SCN-RSP_Message_Format() {		
Management Message Type = 55	8 bits	
Scan duration	8 bits	Units are frames
if (Scan Duration ==0) {		
HMAC Tuple	21 bytes	
}		
else {		
Start frame	4 bits	
~~Scan type~~	~~1 bit~~	~~0: Scanning~~ ~~1: Association~~
~~reserved~~	~~7 bites~~	~~Shall be set to zero~~
~~If (Scan type = 0) {~~		
Interleaving interval	8 bits	Units are frames

Scan iteration	8 bits	
Report mode	2 bits	
Scan report period	8 bits	
Reserved	2 bits	
~~}~~		
~~Else {~~ N_Recommended_BS_Scanning	4 bits	
For (j=0; j<N_Recommended_BS_Scanning; j++) {		N_Recommended_BS can be derived from the known length of the MAC message
~~Association Test BS ID~~ Recommended BS ID Scanning	48 bits	
~~}~~		
}		
N_Recommended BS_Association	4 bits	
For (j=0; j<N_Recommended_BS_Associations; j++) {		
Recommended BS ID Association	48 bits	
Rendevouz_time	16 bits	
}	16 bits	
HMAC Tuple		
}		
}		

Scan duration
Duration (in units of frames) where the MSS may perform scanning or association for Available BS. If the BS sets this field to be zero to disapprove the MSS's request, all other parameters except HMAC Tuple shall be omitted in the message.

Start Frame
Measured from the frame in which this message was received. A value of zero means that ~~it~~ first Scanning Interval starts ~~will start~~ in the next frame. ~~If Scan type=1 and multiple Association Test BS IDs are included in MOB-SCN-RSP message. The MSS may perform Association with the first Association Test BS at Start Frame and sequentially perform Association with each following Association Test BS in the message.~~

~~**Start type**~~
~~0 : BS approval of requested/directed Scanning operation~~
~~1 : BS approval of requested/directed Association operation~~

~~The Scan type field in MOB-SCN-RSP message shall have the same value as Scan type in MOB-SCN-REQ.~~

~~If Scan type is set to '0', the following parameters shall be included in the MOB-SCN-REQ message:~~

Interleaving interval
The period interleaved between Scanning Intervals when MSS ~~may~~ shall perform Normal Operation.

Scan iteration
The number of iterating scanning intervals

Report mode
Action code for an MSS's report of CINR measurement:
00: The MSS measures channel quality of the Available BSs without reporting.
01: The MSS reports the result of the measurement to Serving BS periodically. The period of reporting is different from that of scanning.
10: The MSS reports the result of the measurement to Serving BS after each measurement.
11: reserved

Scan report period
The period of MSS's report of CINR measurement when the MSS is required to report the value periodically.

~~If Scan type is set to '1', the following parameters may be included in the MOB_SCN-REQ message,~~

N_Recommended_BS_ Scanning
Number of BSs which the BS recommends to scan only

Recommended BS ID Scanning
BS IDs of those BSs the BS recommends to scan

N_Recommended_BS_ Association
Number of BSs which the BS recommends to scan and try association

Recommended BS ID Association
BS IDs of those BSs the BS recommends to scan and try association
It means that BS makes for MSS an appointment with the Recommended BS for non-contention based ranging opportunity to perform association.

Rendezvous time
This is offset, measured in units of frame duration (of Serving BS), when the corresponding Recommended BS is expected to provide non-contention based ranging opportunity for the MSS. The offset is calculated from the frame where MOB_SCN-REQ message is transmitted. In case Scan type = 0 the parameter is not applicable and shall be encoded as 0. The Recommended BS is expected to provide non-contention based Ranging opportunity within 5 frames interval starting from the frame specified by Rendezvous time parameter.

~~**Association Test BS ID**~~ Recommended BS ID
~~Recommended Association Test BS~~ Recommended BS ID list for Association. ~~If multiple Association Test BS IDs are included in the message, the MSS may perform Association in ascending order of the sequence of Association Test BS ID presented in the message.~~ Serving BS may request, over the backbone, ~~Association Test BS~~ from Recommended BS allocation of non-contention based ~~initial~~ ranging opportunity for MSS Association

activity. When conducting initial ranging to ~~Association Test~~ Recommended BS, MSS shall use allocated non-contention based ~~initial~~ ranging opportunity, if available.

[Change in 6.3.20.1.2, p. 128 line 43]

In the MOB_SCN-REQ MAC management message the MSS, and in the MOB_SCN-RSP MAC management message the BS shall indicate either Scanning, Scan type = 0, or Association, Scan type = 1, as the intended MSS activity during the Scanning Interval. If Scan type = 1, Association, then the MSS and BS may include, in their respective messages, one or more ~~Association Test BSID~~ Recommended BS IDs. The BS may negotiate ~~send~~ over the backbone with ~~to~~ the ~~Association Test BS~~ Recommended BS ID ~~request to allocate~~ allocation of non-contention based ranging opportunity, at the appropriate timing interval, for MSS to conduct Association ranging with the ~~Association Test BS~~ Recommended BS ID. When conducting initial ranging to ~~Association Test BS~~ Recommended BS ID, MSS shall use allocated non-contention based ~~initial~~ ranging opportunity, if available. Regardless of value of Scan type and the presence of one or more ~~Association Test BSID~~ Recommended BS IDs, MSS may determine and perform any scanning or ranging or Association activities during Scanning Interval at its own discretion.

4. Suggested Remedy for Fast Ranging IE

[Change in Table 298g and in the following text, p. 276 line 59]

Syntax	Size	Notes
Fast_UL_Ranging_IE {		
Extended UIUC	4 bits	0x06
Length	4 bits	Length = 0x08 variable
HO ID indicator	1 bit	0: MAC Address is present 1: HO ID is present
padding		Shall be set to zero
if (HO ID indicator == 1) {		
HO ID	8 bits	
} else {		
MAC address	48 bits	MSS MAC address as provided on the RNG_REQ message on initial system entry
}		
UIUC	4 bits	UIUC ≠ 15. A four-bit code used to define the type of uplink access and the burst type associated with that access.
if (UIUC == 12) {		
OFDMA Symbol offset	8 bits	
Subchannel offset	7 bits	
No. OFDMA Symbols	7 bits	
No. Subchannels	7 bits	
Ranging Method	2 bits	0b00 - Initial Ranging over two symbols 0b01 - Initial Ranging over four symbols

		0b10 - BW Request/Periodic Ranging over one symbol 0b11 - BW Request/Periodic Ranging over three symbols
reserved	1 bit	Shall be set to zero
} else {		
Duration	10 bits	In OFDMA slots (see 8.4.3.1)
Repetition coding indication	2 bits	0b00 - No repetition coding 0b01 - Repetition coding of 2 used 0b10 - Repetition coding of 4 used 0b11 - Repetition coding of 6 used
}		
}		

CID

Basic CID of MSS to which ranging opportunity is allocated. In case UIUC = 12 allocation shall be used for CDMA code transmission as specified in 8.4.7

UIUC

UIUC used for the burst.

OFDMA Symbol offset

The offset of the OFDMA symbol in which the burst starts, the offset value is defined in units of OFDMA symbols and is relevant to the Allocation Start Time field given in the UL-MAP message.

Subchannel offset

The lowest index subchannel used for carrying the burst, starting from subchannel 0. When allocation of mini-subchannels is used this offset will always be even numbered and will point to the first subchannel of the couple splitted into mini-subhcnannels and used in the allocation.

No. OFDMA Symbols

The number of OFDMA symbols that are used to carry the uplink Burst.

No. subchannels

The number of subchannels with subsequent indices

Ranging Method

Specifies option of CDMA code transmission according to 8.4.7

Duration

Indicates the duration, in units of OFDMA slots, of the allocation.

Repetition coding indication

Indicates the repetition code used inside the allocated burst.

HO ID indicator

An indicator to indicate whether HO ID or MAC Address is being used to identify an MSS during HO.

HO ID

-- An identifier assigned to an MSS for use during initial ranging to the selected target BS.