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Re:	Sponsor Ballot 16
Abstract	A method of shortening the duration of scanning neighbor BSs
Purpose	To incorporate the changes here proposed into the 802.16e D4 draft.
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A method of shortening the duration of scanning neighbor BSs

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1 Introduction

The scanning function is getting more important since the handover schemes such as SHO/FBSS handover is added to IEEE 802.16 standards. In order to support the SHO/FBSS handover, scanning function is provided to MSS for reporting the records of arrival time difference between a serving BS and neighbor BSs, CINR of neighbor BSs, by using MOBHO_REQ/RSP messages. Also periodic neighbor BS scanning is possible without transmitting any extra SCN_REQ message. But these provisions can cause following problems.

A. Decrease of data throughput caused by oftenly repeated scanning.
B. Dissipation of resource such as a battery power, excessive usage of time for scanning a neighbor BS which has undesirable CINR when scanning all the neighbor BSs.
C. When applying SHO/FBSS, dissipation of BS's resources can occur when there are excessive number of BSs with acceptable CINR

More regard should be paid to the CINR and arrival time difference when handover between BSs is strongly required, because location of MSS is in the boundary area of neighboring BSs. Also, when the MSS is located in the boundary area of several BSs, the service quality tends to degrade, because there is much possibility that only low level modulation can be provided. In this situation, MSS may assign more time slots for scanning neighbor BSs in search for handover target BS would result in degradation of service quality.

The aim of scanning procedure is to find the target BS which can support the handover as fast as possible. The number of target BSs should not be excessive and should be managed in order to prevent the waste of resource of BS.

In more detail, a MSS requests MAX_duration upon transmitting a SCN_REQ message to scan neighbor BSs. After receiving the SCN_REQ message, a BS transmits a SCN_RSP message including the maximum number of BSs with acceptable CINR and A.T.D the MSS should look for during the scanning period. MSS can stop scanning either when maximum number of BSs with acceptable CINR and A.T.D or when there is no more neighboring BSs to scan, or when maximum scanning duration is over. After scanning is finished and target BS is chosen, MSS transmits HO_REQ message including target BSs and related information such as CINR, A.T.D.

Our scanning method is different from the existing scanning method since MSS participates in the decision of terminating scanning process. By reducing the time consumption of neighbor BS scanning and managing the maximum number of BS participating in SHO, BS resource dissipation that can be caused during SHO and service quality degradation of MSS in handover area can be prevented.

2 Proposed method for shortening the scanning duration

[Specific text changes to P802.16e/D5 document]

6.3.2.3.49 Scanning Interval Allocation Response (MOB_SCN-RSP) message

A MOB_SCN-RSP message shall be transmitted by the BS in response to an MOB_SCN-REQ message sent by an MSS. In addition, the BS may send an unsolicited MOB_SCN-RSP. The message shall be transmitted on the basic CID.
The format of the MOB_SCN-RSP message is depicted in Table 106h.

Table 106h—MOB-SCN-RSP Message Format

Syntax	Size	Notes
MOB-SCN-RSP_Message_Format(){		
Management Message Type = 50	12 bits	
Max Scan Duration	8 bits	In frames, expected maximum spent time when scanning all neighbor BSs
Strart Frame	4 bits	
Interleaving Interval	8 bits	
Scan Iteration	8 bits	
Report mode	2 bits	0b00 : no report 0b01 : periodic report 0b10 : event triggered report 0b11 : reserved
Reserved	6 bits	
CINR threshold	8bits	In dB, signed, 0.5step
Max BS selection	3bits	MSS terminates scanning if number of neighboring BS with acceptable A.T.D and CINR found is equal to this value.
Scan Report Period	8 bits	Available when the value of Scan Report is set to 01
HMAC Tuple	21 bytes	See 11.1.2
}		

The following parameters shall be included in the MOB_SCN-RSP message:

Scan duration
Duration (in units of frames) where the MSS may scan for neighbor BS.

Start Frame
Measured from the frame in which this message was received. A value of zero means that it will start in the next frame.

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

Scan iteration

The number of iterating scanning interval

Report mode

Action code for an MSS's report of CINR measurement:

00: The MSS measures channel quality of the neighbor 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*

Max target BS selection

This value is the maximum number of possible target BS that MSS should consider for handover. MSS terminates scanning if number of neighboring BS with acceptable A.T.D and CINR found is equal to this value.

Scan report period

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

HMAC Tuple (see 11.1.2)

HMAC Tuple Attribute contains a keyed Message digest (to guarantee the origin and integrity of the message).