Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Measurements for LBS in Idle Mode**
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Re:	IEEE 802.16Rev2/D4, Letter Ballot 26c Technical Comments
Abstract	Proposal to provide support for LBS measurements without requiring an MS in idle mode to perform a full network entry.
Purpose	Adopt proposed text changes for IEEE 802.16Rev2/D4 revision
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LBS support in Idle Mode

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Explanation

MSs can not receive MOB-SCN-REQ from BS while in idle mode. As a result, an MS in idle mode must be activated first before performing scanning operations for performing measurements and reporting the results. However, for LBS, measurement requests will be required often, particularly for tracking-type applications and it is preferred for the MS to stay in idle mode in a similar way as Location Update procedure. This proposal provides support for measurements for LBS without requiring an MS in idle mode to perform a full network entry. It is proposed that a BS begins a request for measurements for LBS by first paging an MS. The measurement request parameters are included in a RNG_RSP message and ~~T~~the measurement results are reported through the RNG-REQ message.

Proposed Text Changes

Modify Section 6.3.2.3.5 as follows:

6.3.2.3.5 RNG-REQ (ranging request) message

An RNG-REQ shall be transmitted by the SS at initialization and periodically to determine network delay and to request power and/or DL burst profile change. The format of the RNG-REQ message is shown in Table 42. The RNG-REQ message may be sent in initial ranging and data grant intervals.

[…]

The following TLV parameter shall be included in the RNG-REQ message when the MS is attempting to perform reentry, HO, ~~or~~ location update, or idle mode measurement reporting:

Ranging Purpose Indication

Presence of this item in the message indicates the following MS action:

Bit #0 is set to 1, in combination with a serving BSID, indicates that the MS is currently attempting to HO or reentry; or, in combination with a Paging Controller ID, indicates that the MS is attempting network reentry from idle mode to the BS.

If Bit #1 is set to 1, it indicates that the MS is initiating the idle mode location update process.

If Bit #2 is set to 1, it indicates that the MS is reporting results from measurements performed while in idle mode.

[…]

The following TLV parameter shall be included in RNG-REQ message when the MS is reporting measurement results performed while in idle mode:

Measurement REP

This TLV provides a report of the results of measurements performed by the MS while in idle mode.

[…]

Modify Section 6.3.2.3.6 as follows:

6.3.2.3.6 RNG-RSP (ranging response) message

An RNG-RSP shall be transmitted by the BS in response to a received RNG-REQ. In addition, it may also be transmitted asynchronously to send corrections based on measurements that have been made on other received data or MAC messages. As a result, the SS shall be prepared to receive a RNG-RSP at any time, not just following a RNG-REQ transmission. The format of the RNG-REQ message is shown in Table 43.

[…]

The following TLV parameter shall be included in RNG-RSP message to request that the MS perform measurements in idle mode according to the parameters of the TLV:

Measurement REQ

This TLV includes parameters that specify measurements to be performed by the MS in idle mode.

[…]

Modify Section 6.3.24.8.2.1 as follows:

6.3.24.8.2.1 Secure location update process

If the MS shares a valid security context with the target BS so that the MS may include a valid HMAC/ CMAC Tuple in the RNG-REQ, then the MS shall conduct initial ranging with the target BS by sending a RNG-REQ including Ranging Purpose Indication TLV with Bit #1 set to 1, Location Update Request and Paging Controller ID TLVs (11.1.9.2) and HMAC/CMAC Tuple. If the MBS Zone has changed, then the MS shall include MBS update TLV in RNG-REQ. If the target BS evaluates the HMAC/CMAC Tuple as valid and can supply a corresponding authenticating HMAC/CMAC Tuple, then the target BS shall reply with a RNG-RSP including the Location Update Response TLV and HMAC/CMAC Tuple completing the location update process. If the paging group has changed, then target BS shall include Paging Group ID TLV in the RNG-RSP. If the target BS responds with a successful Location Update Response = 0x00 (Success of Location Update), the target BS shall notify the paging controller via the backbone network of the MS new location information, the MS shall assume the Paging Group ID of the target BS, and the paging controller may send a message over the backbone network to inform the BS at which the MS entered idle mode that the MS has transitioned to a different Paging Group. If the MBS Zone has changed, then the BS shall include CID_Update TLV in RNG-RSP and shall include at least the SFID, Multicast CID, MBS Zone Identifier Assignment parameter, and may include MBS contents IDs, for any multi-BS-MBS service flow for which the MBS Zone has changed. If measurements to be performed in idle mode are being requested, the BS shall include the Measurement_REQ TLV in the RNG-RSP. If the target BS evaluates the HMAC/CMAC Tuple as invalid, cannot supply a corresponding authenticating HMAC/CMAC Tuple, or otherwise elects to direct the MS to use unsecure location update, then the target BS shall instruct the MS to continue network reentry using the unsecure location update process by inclusion of Location Update Response TLV in RNG-RSP with a value of 0x01 (Failure of Location Update).

Add Section 6.3.24.10 as follows:

6.3.24.10 Measurements in Idle mode procedure

When the BS transmits a RNG-RSP message that includes the Measurement_REQ TLV, the MS shall perform the requested measurements and shall report the results of the measurements in a RNG-REQ message that includes the Measurement_REP TLV. The measurement parameters contained in the Measurement_REQ and Measurement_REP TLVs shall be used in the same way as the MOB_SCN-RSP and MOB_SCN-REP message fields.

When the MS transmits a RNG_REQ message to report measurement results from an ongoing periodic measurement, if the MS shares a valid security context with the target BS so that the MS may include a valid HMAC/CMAC Tuple in the RNG-REQ, then the MS shall conduct initial ranging with the target BS by sending a RNG-REQ including Ranging Purpose Indication TLV with Bit #1 set to 1, (Location Update Request), Bit #2 set to 1, (Measurement Report), Paging Controller ID TLVs (11.1.9.2), and HMAC/CMAC Tuple. If the target BS evaluates the HMAC/CMAC Tuple as valid and can supply a corresponding authenticating HMAC/CMAC Tuple, then the target BS shall reply with a RNG-RSP including the Location Update Response TLV and HMAC/CMAC Tuple. If the target BS responds with a successful Location Update Response = 0x00 (Success of Location Update), the BS shall notify the network

of the measurement values.

If the target BS evaluates the HMAC/CMAC Tuple as invalid, cannot supply a corresponding authenticating HMAC/CMAC Tuple, or otherwise elects to direct the MS to full network entry, then the target BS shall instruct the MS to continue network reentry by including of Location Update Response TLV in RNG-RSP with a value of 0x01 (Failure of Location Update). When sending a RNG-REQ message for full network entry, the MS may include the Measurement_REP TLV.

Modify Section 11.5 as follows:

11.5 RNG-REQ management message encodings

The encodings in Table 569 are specific to the RNG-REQ message (6.3.2.3.5).

[…]

Name	Type(1 byte)	Length	Value(variable length)	PHY scope
Ranging Purpose Indication	6	1	Bit 0: HO indication (when this bit is set to 1 in combination with other included information elements indicates the MS is currently attempting to HO or network reentry from idle mode to the BS) Bit 1: Location update request (when this bit is set to 1, it indicates MS action of idle mode location update process) Bit 2: Idle mode measurement report Bits ~~2~~3-7: Reserved	-

[…]

Measurement REP	X	variable	Report of idle mode measurement results. See Table xx.	-

[…]

Table xx: Measurement REP parameters

Parameter	Length (bits)	Note
Report Mode	1	0: Event-triggered report 1: Periodic report
N_current_BSs	3	When FBSS/MDHO is supported, N_current_BSs is the number of BSs currently in the diversity set; When FBSS/MDHO is not supported or the MS has an empty diversity set, N_current_BSs is set to 1.
Use_Nbr_Bitmap_Index	1	Indicates if the bitmap index for MOB_NBR-ADV is used.
Use_Rsp_Bitmap_Index	1	Indicates if the bitmap index for RNG-RSP is used.
Reserved	2	
Report metric	8	Bitmap indicating presence of certain metrics (threshold values) on which the corresponding triggers are based: Bit 0: BS CINR mean Bit 1: BS RSSI mean Bit 2: Relative delay Bit 3: BS RTD; this metric shall be only measured between the serving BS/anchor BS and the reporting MS Bits 4–7: *Reserved*; shall be set to zero

If (Report metric[Bit 0] == 1)		-	
Preferred BS CINR mean		8	The BS CINR Mean parameter indicates the CINR measured by the MS from the particular BS. The value shall be interpreted as a signed byte with units of 0.5 dB. The measurement shall be performed on the subcarriers of the frame preamble that are active in the particular BS's segment and averaged over the measurement period.
If (Report metric[Bit 1] == 1)		-	
Preferred BS RSSI mean		8	The BS RSSI Mean parameter indicates the Received Signal Strength measured by the MS from the particular BS. The value shall be interpreted as an unsigned byte with units of 0.25 dB, e.g., 0x00 is interpreted as –103.75 dBm. An MS shall be able to report values in the range –103.75 dBm to –40 dBm. The measurement shall be performed on the frame preamble and averaged over the measurement period.
If ((Report metric[Bit 3] == 1)		-	
Preferred BS RTD		8	The BS RTD parameter indicates the round trip delay (RTD) measured by the MS from the preferred BS. RTD can be given by the latest time advance taken by MS. The value shall be interpreted as an unsigned byte with units of 1/Fs (see 10.3.4.3). This parameter shall be only measured on preferred BS.
}		-	
If(Use_Nbr_Bitmap_Index == 1){			
Configuration change count for MOB_NBR-ADV		8	Configuration Change Count value of referring MOB_NBR-ADV message
Nbr_Bitmap_Index	Up to the Number BSs in MOB_NBR-ADV		Bitmap index of BS into MOB_NBR-ADV message
For(each '1' in Nbr_Bitmap_Index){			
If(Report metric[Bit 0] == 1)		-	
BS CINR mean		8	The BS CINR Mean parameter indicates the CINR measured by the MS from the particular BS. The value shall be interpreted as a signed byte with units of 0.5 dB. The measurement shall be performed on the subcarriers of the frame preamble that are active in the particular BS's segment and averaged over the measurement period.
If(Report metric[Bit 1] == 1)		-	
BS RSSI mean		8	The BS RSSI Mean parameter indicates the Received Signal Strength measured by the MS from the particular BS. The value shall be interpreted as an unsigned byte with units of 0.25 dB, e.g., 0x00 is interpreted as –103.75 dBm. An MS shall be able to report values in the range –103.75 dBm to –40 dBm. The measurement shall be performed on the frame preamble and averaged over the measurement period.
If(Report metric[Bit 2] == 1)		-	
Relative delay		8	This parameter indicates the delay of the DL signals relative to the preferred BS, as measured by the MS for the particular BS. The value shall be interpreted as a signed integer in units of samples.
}			
}else {		-	
N_Neighbor_BS_Index		8	Number of neighboring BS that are included in MOB_NBR-ADV message.
If (N_Neighbor_BS_Index != 0){		-	
Configuration change count for MOB_NBR-ADV		8	Configuration Change Count value of referring MOB_NBR-ADV message
}		-	
For(j = 0; j < N_Neighbor_BS_Index; j++) {		-	
Neighbor_BS_Index		8	BS index corresponds to position of BS in MOB_NBR-ADV message

If(Report metric[Bit 0] == 1)		-	
BS CINR mean		8	The BS CINR Mean parameter indicates the CINR measured by the MS from the particular BS. The value shall be interpreted as a signed byte with units of 0.5 dB. The measurement shall be performed on the subcarriers of the frame preamble that are active in the particular BS's segment and averaged over the measurement period.
If(Report metric[Bit 1] == 1)		-	
BS RSSI mean		8	The BS RSSI Mean parameter indicates the Received Signal Strength measured by the MS from the particular BS. The value shall be interpreted as an unsigned byte with units of 0.25 dB, e.g., 0x00 is interpreted as –103.75 dBm. An MS shall be able to report values in the range –103.75 dBm to –40 dBm. The measurement shall be performed on the frame preamble and averaged over the measurement period.
If(Report metric[Bit 2] == 1)		-	
Relative delay		8	This parameter indicates the delay of the DL signals relative to the preferred BS, as measured by the MS for the particular BS. The value shall be interpreted as a signed integer in units of samples.
}		-	
}		-	
N_Neighbor_BS_Full		8	Number of neighboring BS that are using full 48 bits BS ID.
For(j = 0; j < N_Neighbor_BS_Full; j++) {		-	
Neighbor BSID		48	BS IDs of BSs that MS shall scan.
If(Report metric[Bit 0] == 1)		-	
BS CINR mean		8	The BS CINR Mean parameter indicates the CINR measured by the MS from the particular BS. The value shall be interpreted as a signed byte with units of 0.5 dB. The measurement shall be performed on the subcarriers of the frame preamble that are active in the particular BS's segment and averaged over the measurement period.
If(Report metric[Bit 1] == 1)		-	
BS RSSI mean		8	The BS RSSI Mean parameter indicates the Received Signal Strength measured by the MS from the particular BS. The value shall be interpreted as an unsigned byte with units of 0.25 dB, e.g., 0x00 is interpreted as –103.75 dBm. An MS shall be able to report values in the range –103.75 dBm to –40 dBm. The measurement shall be performed on the frame preamble and averaged over the measurement period.
If(Report metric[Bit 2] == 1)		-	
Relative delay		8	This parameter indicates the delay of the DL signals relative to the preferred BS, as measured by the MS for the particular BS. The value shall be interpreted as a signed integer in units of samples.
}		-	
If(Use_Rsp_Bitmap_Index == 1){			
Rsp_Seq_Num		1	1 bit sequence number for the corresponding RNG-RSP message
Rsp_Bitmap_Index	Up to the Number BSs in RNG-RSP		Bitmap index of BS into RNG-RSP message
For(each '1' in Rsp_Bitmap_Index){			
If(Report metric[Bit 0] == 1)		-	
BS CINR mean		8	The BS CINR Mean parameter indicates the CINR measured by the MS from the particular BS. The value shall be interpreted as a signed byte with units of 0.5 dB. The measurement shall be performed on the subcarriers of the frame preamble that are active in the particular BS's segment and averaged over the measurement period.
If(Report metric[Bit 1] == 1)		-	

BS RSSI mean	8	The BS RSSI Mean parameter indicates the Received Signal Strength measured by the MS from the particular BS. The value shall be interpreted as an unsigned byte with units of 0.25 dB, e.g., 0x00 is interpreted as –103.75 dBm. An MS shall be able to report values in the range –103.75 dBm to –40 dBm. The measurement shall be performed on the frame preamble and averaged over the measurement period.
If(Report metric[Bit 2] == 1)	-	
Relative delay	8	This parameter indicates the delay of the DL signals relative to the preferred BS, as measured by the MS for the particular BS. The value shall be interpreted as a signed integer in units of samples.
}		
}		

[…]

Modify Section 11.6 as follows:

11.6 RNG-RSP management message encodings

CID update encodings (11.7.10) and SAID update encodings (11.7.18) may be used in RNG-RSP for reestablishing connections. When CID update encodings or SAID update encodings are used in RNG-RSP, those will be included in the compound REG-RSP encodings TLV. When the compound SBC-RSP encodings and REG-RSP encodings are included in RNG-RSP for HO optimization, the target BS shall only include TLV fields which values are different from what are used in the serving BS. For the TLV fields that are not included in the compound SBC-RSP and REG-RSP encodings, the MS shall set the values according to what are used in the serving BS. The encodings in Table 572 are specific to the RNG-RSP message (6.3.2.3.6).

[…]

Name	Type (1 byte)	Length	Value(variable length)	PHY scope
Timing Adjust	1	4	Tx timing offset adjustment (signed 32-bit). The amount of time required to adjust SS transmission so the bursts will arrive at the expected time instance at the BS. Units are PHY-specific (see 10.3). The SS shall advance its burst transmission time if the value is negative and delay its burst transmission if the value is positive.	-

[…]

Measurement REQ	X	*variable*	Request idle mode measurements. See Table xy.	-

Table xy: Measurement REQ parameters

Parameter	Length (bits)	Note
Scan duration	8	In units of frames. When Scan Duration is set to zero, no scanning parameters are specified in the message.
Report mode	2	0b00: No report 0b01: Periodic report 0b10: Event-triggered report 0b11: One-time scan report

Reserved		4	Shall be set to zero.
Rsp_Seq_Num		1	1 bit sequence number for this message. Toggles after each transmission of this message
Use_Nbr_Bitmap_Index		1	Indicates whether bitmap index for MOB_NBR-ADV is used.
Report period		8	If Report mode is set to 0b01, this is the Report Period, in frames; otherwise this field is set to 0.
Report metric		8	Bitmap indicating metrics on which the corresponding triggers are based: Bit 0: BS CINR mean Bit 1: BS RSSI mean Bit 2: Relative delay Bit 3: BS RTD; this metric shall be only measured on serving BS/anchor BS. Bits 4–7: *Reserved*; shall be set to zero.
if (Scan Duration != 0) {			
Start frame		8	-
Interleaving interval		8	Duration in frames.
Scan iteration		8	-
If(Use_Nbr_Bitmap_Index == 1){			
Configuration change count for MOB_NBR-ADV		8	Configuration Change Count value of referring MOB_NBR-ADV message.
Nbr_Bitmap_Index	Up to the Number BSs in MOB_NBR-ADV		Bitmap index of BS into MOB_NBR-ADV message
For(each '1' in Nbr_Bitmap_Index)			
Scanning type		3	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 b100–0b111: *Reserved*
If (Scanning type == 0b010) OR (Scanning type == 0b011) {			
Rendezvous time		8	Units are frames.
CDMA_code		8	From initial ranging codeset.
Transmission_opportunity offset		8	Units are transmission opportunity.
}			
}			
} else {			
N_Recommended_BS_Index		8	Number of neighboring BS to be scanned or associated, which are using BS index that corresponds to the position of BS in MOB_NBR-ADV message. If both N_Recommended_BS_Index and N_Recommended_BS_Full are set to 0, the BS recommends the MS scan all neighbors listed in the MOB_NBR-ADV message. MS may scan a sub-set of the list.
If(N_Recommended_BS_Index != 0){			
Configuration change count for MOB_NBR-ADV		8	Configuration Change Count value of referring MOB_NBR-ADV message.
}			
For(j = 0; j < N_Recommended_BS_Index; j++){			
Neighbor_BS_Index		8	BS index corresponds to position of BS in MOB_NBR-ADV message.
Reserved		*1*	*Shall be set to zero.*
Scanning type		3	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 b100–0b111: *Reserved*
If (Scanning type == 0b010) OR (Scanning type == 0b011) {		
Rendezvous time	8	Units are frames.
CDMA_code	8	From initial ranging codeset.
Transmission_opportunity offset	8	Units are transmission opportunity.
}		
}		
}		
N_Recommended_BS_Full	8	Number of neighboring BS to be scanned or associated, which are using full 48 bits BS ID.
For(j = 0; j < N_Recommended_BS_Full; j++){		
Recommended BS ID	48	BS IDs of BSs that MS shall scan.
Reserved	*1*	*Shall be set to zero.*
Scanning type	3	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 b100–0b111: *Reserved*
If (Scanning type == 0b010) OR (Scanning type == 0b011) {		
Rendezvous time	8	Units are frames.
CDMA_code	8	From initial ranging codeset.
Transmission_opportunity offset	8	Units are transmission opportunity.
}		
}		
Padding	*variable*	
}		