Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Measurements for LBS in Idle Mode**
Date Submitted	**2008-07-01**
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Re:	IEEE 802.16Rev2/D5, Letter Ballot 26d 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/D5 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 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 43. 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 to initiate 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 #3 is set to 1, it indicates that the MS is initiating idle mode measurement reporting due to a pending measurement report resulting from an ongoing measurement request.

[…]

The following TLV parameter shall be included in RNG-REQ message to provide an idle mode measurement report:

Measurement REP

This TLV provides the idle mode measurement report from an ongoing measurement request.

[…]

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 44.

[…]

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

Measurement REQ

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

[…]

The following TLV parameters may be included in an unsolicited RNG-RSP message and whenever the RNG-RSP message is providing a dedicated ranging opportunity:

Rendezvous time
This is the offset, measured in units of frame duration, when the BS is expected to provide a non-contention-based ranging opportunity for the MS. The offset is calculated from the frame where RNG-RSP message is transmitted. The BS is expected to provide the non-contention based ranging opportunity at the frame specified by the rendezvous time parameter.

CDMA code
A unique code assigned to the MS, to be used for dedicated ranging. The code is from the initial ranging codeset.

Transmission Opportunity Offset
A unique transmission opportunity assigned to the MS, to be used for dedicated ranging, in units of symbol duration.

[…]

Modify Section 6.3.10.3.4 as follows:

6.3.10.3.4 Dedicated ranging and automatic adjustments

A dedicated ranging is an optional initial ranging which can be used to expedite the ranging process when the ranging is performed as an initial step of a certain procedure such as location determination, coordinated association during scanning, location update in idle mode, measurement reporting in idle mode, etc. For a dedicated ranging, BS will provide dedicated ranging information and allocate the dedicated ranging region at a pre-defined "rendezvous time", in terms of relative frame number. The BS will also assign:

[…]

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

A BS may request an MS to perform and report measurements in idle mode by transmitting a RNG-RSP message that includes the Measurement_REQ TLV and dedicated ranging information. 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. When accessing the network to send a measurement report, the MS shall use the dedicated ranging information provided in the RNG-RSP. The BS shall provide a CDMA Allocation for this RNG-REQ message that is sufficient for the size of the measurement report. 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 parameters.

When the MS transmits a RNG-REQ message to initiate idle mode measurement reporting due to a pending measurement report from an ongoing periodic measurement request, 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 #3 set to 1, (idle mode 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. In addition, if the target BS obtains ongoing idle mode measurement information for the MS, it shall include Location Update Response TLV in RNG-RSP with a value of 0x04 (Success of Location Update and Measurement Report Request) and dedicated ranging information for the MS. The MS shall provide the pending measurement report in a RNG-REQ message that includes the Measurement_REP TLV. When accessing the network to send the measurement report, the MS shall use the dedicated ranging information provided in the RNG-RSP. The BS shall provide a CDMA Allocation for this RNG-REQ message that is sufficient for the size of the measurement report based on the ongoing measurement information received from the network. If the target BS receives the idle mode measurement report, it shall notify the network of the measurement values.

Modify Section 11.5 as follows:

11.5 RNG-REQ management message encodings

The encodings in Table 573 are specific to the RNG-REQ message (6.3.2.3.5).

Table 573—RNG-REQ message encodings

Name	Type(1 byte)	Length	Value(variable length)	PHY scope
Requested Downlink Burst Profile	1	1	Bits 0–3: DIUC of the DL burst profile requested by the SS for DL traffic. Bits 4–7: 4 LSB of Configuration Change Count value of DCD defining the burst profile associated with DIUC.	All

[…]

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: Seamless HO indication (when this bit is set to 1 in combination with other included information elements indicates the MS is currently initiating ranging as part of the seamless HO procedure) Bit 3: Idle mode measurement report Bits ~~3~~4-7: 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
Use_Nbr_Bitmap_Index	1	Indicates if the bitmap index for MOB_NBR-ADV is used.
Use_Req_Bitmap_Index	1	Indicates if the bitmap index for Measurement REQ TLV is used.
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 preferred 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 preferred 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 preferred 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_Size		8	Size of Nbr_Bitmap_Index in bits, which may be less than or equal to the number of BSs in MOB_ NBR ADV.
Nbr_Bitmap_Index	Nbr_Bitmap_Size		Each bit position corresponds to a BS index of the corresponding 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_Req_Bitmap_Index == 1){		
Req_Seq_Num	1	One-bit sequence number for the corresponding Measurement REQ TLV.
Req_Bitmap_Size	8	Size of Req_Bitmap_Index in bits, which may be less than or equal to the number of BSs in the corresponding Measurement REQ TLV.
Req_Bitmap_Index	Req_Bitmap_Size	Bitmap of BS indexes from the corresponding Measurement REQ TLV.
For(each '1' in Req_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.
}		
Padding	*variable*	If needed for alignment to byte boundary.
}		

[…]

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 576 are specific to the RNG-RSP message (6.3.2.3.6).

[…]

Table 576—RNG-RSP message encodings

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.	-

[…]

Location Update Response	23	1	0x00= Success of Location Update 0x01= Failure of Location Update 0x02 = *Reserved* 0x03=Success of location update and DL traffic pending 0x04 = Success of location update and measurement report request 0x045~0xFF: *Reserved*	All

[…]

Measurement REQ	X	*variable*	Idle mode measurements request. 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
Req_Seq_Num	1	One-bit sequence number for this TLV that is incremented for each new instance.
Use_Nbr_Bitmap_Index	1	Indicates whether bitmap of BS indexes 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_Size	8	Size of Nbr_Bitmap_Index in bits, which may be less than or equal to the number of BSs in MOB_NBR ADV.
Nbr_Bitmap_Index	Nbr_Bitmap_Size	Each bit position corresponds to a BS index of the corresponding 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 N_Recommended_BS_Index, N_Recommended_BS_Full, and Use_Nbr_Bitmap_Index 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.

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.
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*	If needed for alignment to byte boundary.
}		