Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>	
Title	**LBS support in Idle Mode**	
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Source(s)	Wenliang Liang, Jia Lin, David Comstock Huawei Technologies Co., Ltd.	E-mail: van.liang@huawei.com, linjia@huawei.com, dcomstock@huawei.com *<http://standards.ieee.org/faqs/affiliationFAQ.html>
Re:	IEEE 802.16Rev2/D2, Letter Ballot 26a Technical Comments	
Abstract	Proposal to provide support for LBS measurements without requiring an MS in idle mode to perform a full network entry.	
Purpose	An MS must be activated out of idle mode to receive MOB-SCN-REQ or unsolicited RNG-RSP messages, which are required for measurements for LBS. However, the MS is allowed to perform ranging and send RNG-REQ message in idle mode. The purpose of this contribution is to avoid the idle mode entry/exit state switching while performing LBS measurements, by adding support for paging for the purpose LBS measurements and reporting measurement results in RNG-REQ message.	
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LBS support in Idle Mode

Wenliang Liang, Jia Lin, David Comstock
Huawei Technologies Co., Ltd.

Explanation

MSs can not receive MOB-SCN-REQ or unsolicited RNG-RSP messages from BS while in idle mode. As a result, an MS in idle mode must be activated first before performing LBS measurements. This proposal provides support for LBS measurements without requiring an MS in idle mode to perform a full network entry.

We propose that a BS can request LBS measurements by paging the MSs. According to this proposal, MSs can be paged to request a report of measured RTD values and then report the values through the RNG-REQ message. MSs can also be paged to request a report of measured TDOA parameters and then report the parameters through the RNG-REQ message. The D-TDOA parameters reported are for Relative Delay (RD). For U-TDOA, the parameters reported are for CINR and RSSI and are used to support the existing U-TDOA procedure such that the Preferred BS may use the CINR and RSSI measurements to select appropriate neighbor BSs, and then, in accordance with the U-TDOA procedure, the Preferred BS requests the selected BSs to allocate a dedicated ranging opportunity for the MS in order to measure the timing adjustment for that BS. The MS ranges sequentially with the Preferred BS and the neighbor BSs. The Preferred BS and the neighbor BSs measure the Timing Adjustments for the MS, the neighbor BSs report their timing adjustments to the Preferred BS, and the Preferred BS calculates the difference in propagation delay.

Proposed Text Changes

6.3.2.3.52 Modify Table152 as following:

Syntax	Size (bit)	Notes
MOB_PAG-ADV_Message_format(){		
Management Message Type = 61	8	
Num_Paging_Group_IDs	8	Number of Paging Group IDs in this message
for (i=0;i< Num_Paging_Group_IDs; i++) {		
Paging Group ID	16	
}		
Num_MACs	8	Number of MS MAC address
for (j=0;j< Num_MACs; j++) {		
MS MAC address hash	24	The hash is obtained by computing a CRC24 on the MS 48-bit MAC address. The polynomial for the calculation is 0x1864CFB
Action Code	2	Paging action instruction to MS 0b00 = No action required 0b01 = Perform ranging to

		establish location and acknowledge message 0b10 = Enter network 0b11 = Measure for LBS
if (Action code = 0b11;) {		
LBS measurement type:	2	0b00 = Perform RTD measurement 0b01 = Perform U-TDOA measurement 0b10 = Perform D-TDOA measurement 0b11 = Reserved
Reserved	4	
}		
else {		
Reserved	6	
}		
}	8	
Padding	*variable*	Padding bits to ensure octet aligned
TLV Encoding Information	*variable*	TLV-specific
}		

Page 242 Line 1 modify action code description:

0b00 = No action required

0b01 = Perform ranging to establish location and acknowledge message

0b10 = Enter network

0b11 = Measure for LBS ~~measurement~~

LBS measurement type:

0b00 = Perform RTD measurement
0b01 = Perform U-TDOA measurement
0b10 = Perform D-TDOA measurement
0b11 = Reserved

Page 463 Line 40 modify as following:

0b00 = No action required

0b01 = Perform ranging to establish location and acknowledge message

0b10 = Enter network

0b11 = Measure for LBS~~LBS measurement~~

If the action code is 0b11 (Measure for LBS), the LBS measurement type is also

included according to the following encoding:

0b00 = Perform RTD measurement
0b01 = Perform U-TDOA measurement
0b10 = Perform D-TDOA measurement
0b11 = Reserved

Page 463 Line 57 modify as following:

After transmitting the Broadcast Paging message with action code 0b01 (Perform Ranging), ~~or~~ 0b10 (Enter Network) or 0b11 (LBS measurement), if the BS does not receive RNG-REQ from the MS paged until the next MS paging listening interval, the BS shall retransmit the Broadcast Paging message.

Page 46~~73~~ Line ~~5465~~ add a ~~the~~new section 6.3.24.10

6.3.24.10 Idle mode LBS measurement procedure~~LBS paging description as following:~~

When the BS transmits the Broadcast Paging message with action code 0b11 (Measure for LBS), it will set the LBS measurement type to 0b00 (RTD measurement), 0b01 (U-TDOA measurement), or 0b10 (D-TDOA measurement). The MS will perform the requested measurements and transmit a RNG-REQ containing RTD, RD, or CINR/RSSI values for a set of scanned BSs, respectively.

After receiving the MOB-PAG-ADV message, an MS detects that the MAC-address-hash matches its own MAC-address-hash, and the action code is 0b11.

- If LBS measurement type is 0b00 (perform RTD measurement), the MS performs ranging against the scanned BSs. The selection of scanned BSs can be implementation dependent. After getting ranging RTD result, MS sends RNG-REQ with RTD values and the scanned BS IDs to the BS. Paging controller ID shall be contained in this RNG-REQ message. The BS can send the result to the identified paging controller.
- If LBS measurement type value is 0b01 (Perform U-TDOA measurement), the MS does ranging to Preferred BS. Meanwhile, MS scans BSs and measures CINR and RSSI of BSs. If MS gets BSID/BS_INDEX, CINR and RSSI of BSs, it will send RNG-REQ message to Preferred BS This RNG-REQ message contains BSID/BS_INDEX, CINR and RSSI of BSs. The network measures locations of MS in terms of information from RNG-REQ message.
- If LBS measurement value is 0b10 (Perform D-TDOA measurement), the MS does ranging to Preferred BS. Meanwhile, MS scans Neighbor BSs and calculates RD which is the time difference between DL signals of neighbor BSs and Preferred BS. If MS gets RDs of neighbor BSs, it will send RNG-REQ message to BS, this RNG-REQ message contains RDs of neighbor BSs, BSID/BS_INDEX of BSs. Network measures locations of MS in terms of information from RNG-REQ message.

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 #2, 3, or 4 set to 1, LBS for RTD measurement Parameters, LBS for RD measurement Parameters, or LBS for CINR/RSSI measurement Parameters and 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 LBS measurement Response TLV and HMAC/CMAC Tuple completing the LBS measurement process. If the target BS

responds with a successful LBS measurement Response =0x00 (Success of LBS measurement), 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 in order to use MOB_SCN messages for LBS measurement, then the target BS shall instruct the MS to continue network reentry by including the LBS measurement Response TLV in RNG-RSP with a value of 0x01 (Failure of LBS measurement).

Section 6.3.24.7.1 Page 464 Line 23 modify as follows:

In the event that an MS decodes a BS Broadcast Paging message that contains the MS own MS MAC address hash and action code 0b01 (Perform Ranging), the MS shall conduct and complete idle mode location update to establish location to the network and acknowledge message decoding. In the event that an MS decodes a BS Broadcast Paging message that contains the MS own MS MAC address hash and action code 0b011 (LBS Measurement), the MS shall conduct and complete LBS Measurement according to the LBS Measurement Type. In ~~both~~ these three cases for the OFDMA PHY, if a PHYspecific ranging code and transmission opportunity is assigned to the MS in the MOB_PAG-ADV message, the MS shall perform network reentry, ~~or~~ idle mode location update, or LBS measurement by transmitting the code at the transmission opportunity assigned in the MOB_PAG-ADV message on the dedicated ranging region assigned in the UL-MAP IE (UIUC = 12 and dedicated ranging indicator bit set to 1).

Section 6.3.24.7.1 Page 464 Line 43 modify as follows:

— In the case where RNG-RSP message with Success status is not received within the Page-Response window, the MS shall continue with the normal initial ranging procedure for network reentry from idle mode (6.3.22.10), ~~or~~ idle mode location update (6.3.24.8.2), or LBS measurement (6.3.24.10).

— In the case where no RNG-RSP message is received or no dedicated ranging region is assigned within the Page-Response window to the MS, the MS shall continue with the normal initial ranging procedure for network reentry from idle mode (6.3.24.9), ~~or~~ idle mode location update (6.3.24.8.2), or LBS measurement (6.3.24.10).

— In all other cases, the MS shall use normal network reentry, ~~or~~ idle mode location update procedure, as described in 6.3.24.8.2, or LBS measurement described in 6.3.24.10.

Section 6.3.2.3.5 Page 89 Line 50 modify as following:

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 LBS measurements (RTD measurement, U-TDOA measurement or D-TDOA measurement):

Ranging Purpose Indication

Presence of item in message indicates MS action as follows:

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

If Bit #1 is set to 1, indicates MS action of idle mode location update process.

If Bit #2 is set to 1, indicates performing RTD measurement.

If Bit #3 is set to 1, indicates performing U-TDOA measurement

If Bit #4 is set to 1, indicates performing D-TDOA measurement

Section 11.5 Table 550 Page 1077 Line 34 modify Ranging Purpose Indication as following:

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: RTD measurement (when this bit is set to 1, it indicates MS action of RTD measurement for LBS) Bit 3: U-TDOA measurement (when this bit is set to 1, it indicates MS action of U-TDOA measurement for LBS) Bit 4: D-TDOA measurement (when this bit is set to 1, it indicates MS action of D-TDOA measurement for LBS) Bits 5-7: Reserved	-

Section 6.3.2.3.5 Page 90 Line 1 modify as following:

The Paging Controller ID is a logical network identifier for the serving BS or other network entity retaining MS service and operational information and/or administering paging activity for the MS while in idle mode. If combined with ranging purpose indication Bit #2 set to 1, BS shall get RTD from the RNG-REQ and forward to the Paging Controller. If combined with ranging purpose indication Bit #3 set to 1, BS shall get U-TDOA parameters from the RNG-REQ and forward to the Paging Controller. If combined with ranging purpose indication Bit #4 set to 1, BS shall get D-TDOA parameters from the RNG-REQ and forward to the Paging Controller.

Section 6.3.2.3.5 Page 89 Line 58 add the descriptions as following:

The following TLV parameter shall be included in RNG-REQ message when MS is attempting to perform LBS for RTD measurement:

LBS for RTD measurement Parameters

A list of BS_ID/BS_INDEX and RTD pairs can be contained in this TLV. The number of elements in this list is defined by BS-RTD-number.

The following TLV parameter shall be included in RNG-REQ message when MS is attempting to perform LBS for U-TDOA measurement:

LBS for U-TDOA measurement Parameters

A list of BSID/BS_INDEX, CINR and RSSI pairs can be contained in this TLV. The number of elements in this list is defined by BS-CINR-RSSI-number.

The following TLV parameter shall be included in RNG-REQ message when MS is attempting to perform LBS for D-TDOA measurement:

LBS for D-TDOA measurement Parameters

A list of BSID/ BS_INDEX and RD pairs can be contained in this TLV. The number of elements in this list is defined by BS-RD-number.

Section 11.5 Table 550 Page 1078 Line 36 add three lines as following:

Name	Type(1 byte)	Length	Value(variable length)	PHY scope
LBS for RTD measurement Parameter	22	Variable	A compound TLV for a list of BSID/BS_INDEX and RTD pairs. Result of LBS for RTD measurement.	-
LBS for U-TDOA measurement Parameter	23	Variable	A compound TLV for a list of BSID/BS INDEX with CINR and RSSI pairs. Result of LBS for U-TDOA measurement.	-
LBS for D-TDOA measurement Parameter	24	Variable	A compound TLV for a list of BSID/BS_INDEX and RD pairs. Result of LBS for D-TDOA measurement.	-

Section 11.5 inserts two Tables defining the LBS for RTD measurement Parameter TLV as following:

The LBS for RTD measurement Parameters Value field is composed from a number of encapsulated TLV fields as specified in Table 551a

Table 551a– LBS for RTD measurement Parameters

Name	Type(1 byte)	Length	Value(variable length)	PHY scope
N_Recommend_BS_Index	1	1	Number of BS_INDEX	-
N_Recommend_BS_Full	2	1	Number of BS_ID	-
BS-RTD-Pair-List	3	variable	A list of BSID/BS_INDEX and RTD pairs.	-

The BSID-RTD-Pair List TLV Value field is composed from a number of encapsulated TLV fields as specified in Table 551a1

Table 551a1 - BSID-RTD-Pair List TLV

Name	Type(1 byte)	Length	Value(variable length)	PHY scope
BSID	1	48	Identifier of a scanned BS.	-
BS_INDEX	2	8	Index of a scanned BS	-
Round Trip Delay (RTD)	3	8	Round Trip delay of a scanned BS.	-

Notes: In one pair the BSID is only used when the MS can not get the BS index from the MOB_NBR-ADV message.

Section 11.5 inserts two Tables defining the LBS for U-TDOA measurement Parameter TLV as following:

The LBS for U-TDOA measurement Parameters Value field is composed from a number of encapsulated TLV fields as specified in Table 551b

Table 551b– LBS for U-TDOA measurement Parameters

Name	Type(1 byte)	Length	Value(variable length)	PHY scope
N_Recommend_BS_Index	1	1	Number of BS_INDEX	-
N_Recommend_BS_Full	2	1	Number of BS_ID	-
BS-CINR-RSSI-Pair-List	3	variable	A list of BSID/BS_INDEX with CINR and RSSI.	-

The BSID-CINR-RSSI-Pair-List TLV Value field is composed from a number of encapsulated TLV fields as specified in Table 551b1

Table 551b1 - BS-CINR-RSSI-Pair ListTLV

Name	Type(1 byte)	Length	Value(variable length)	PHY scope

BSID	1	48	Identifier of a scanned BS.	-
BS_INDEX	2	8	Index of a scanned BS	-
CINR	3	7	Carrier-to-interference-and-noise ratio of a scanned BS	-
RSSI	4	8	Receive signal strength indicator of a scanned BS	-

Notes：In one pair the BSID is only used when the MS can not get the BS index from the MOB_NBR-ADV message.

Section 11.5 inserts two Tables defining the LBS for D-TDOA measurement Parameter TLV as following:

The LBS for D-TDOA measurement Parameters Value field is composed from a number of encapsulated TLV fields as specified in Table 551c

Table 551c– LBS for D-TDOA measurement Parameters

Name	Type(1 byte)	Length	Value(variable length)	PHY scope
N_Recommend_BS_Index	1	1	Number of BS_INDEX	-
N_Recommend_BS_Full	2	1	Number of BS_ID	-
BS-RD-Pair-List	3	variable	A list of BSID/BS_INDEX and RD pairs.	-

The BSID-RD-Pair List TLV Value field is composed from a number of encapsulated TLV fields as specified in Table 551c1

Table 551c1 - BSID-RD-Pair List TLV

Name	Type(1 byte)	Length	Value(variable length)	PHY scope
BSID	1	48	Identifier of a scanned BS.	-
BS_INDEX	2	8	Index of a scanned BS	-
Relative Delay (RD)	3	8	Relative Delay of a scanned neighbor BS and Preferred BS.	-

Notes: In one pair the BSID is only used when the MS can not get the BS index from the MOB_NBR-ADV message.

Backward compatibility

Legacy mobile station will ignore this action code 0b11 and reserved bits. New mobile stations will interpret the action code 0b11 and reserved bits as LBS paging. BS shall know the version of the MS, activate legacy MSs before LBS, and page with action code 0b11 and reserved bits for new MSs.