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| Title | **Fixes in LBS_ADV TLVs** |
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| Source(s) | Lei Wang, Michael Wengler, Yair Bourlas, Wee Peng Goh<br><br>NextWave Broadband | Voice: [Telephone Number  (optional)]]<br>E-mail:<br>lwang@nextwave.com;<br>ybourlas@nextwave.com;<br>wgoh@nextwave.com;<br>mwengler@nexwave.com<br><br>*<http://standards.ieee.org/faqs/affiliationFAQ.html> |
| Re: | 802.16 Working Group Letter Ballot #26 |
| Abstract | This document proposes fixes in LBS_ADV TLVs. |
| Purpose | To be discussed and adopted by 802.16 Rev2. |
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# Fixes in LBS_ADV TLVs

*Lei Wang, Michael Wengler, Yair Bourlas, Wee Peng Goh,*

NextWave Broadband

## Problem statement

There are three issues with the LBS-ADV TLVs in the current Rev2/D1 spec:

1. Wrong section number for LBS-ADV TLV: it should be 11.21, as 11.20 has been occupied by another message's TLV;

2. The section title of LBS TLV does not follow the convention of the sub-section names of Section 11 in Rev2/D1; it should be "LBS_ADV message encodings"

3. In order to provide the accuracy required to support Emergency Services regulations, the LBS_ADV message need to provide more information about the BSs to enable MS positions to be derived. We propose to add the required information in the LBS_ADV TLVs.

## Suggested Changes in Rev2/D1

*In Rev2/D1, replace the contents from page 276 line 53 to page 276 line 59 by the following, where the new texts are marked by blue and underlined; the deleted texts are red with strikethrough:*

The LBS-ADV shall include the following TLV:

~~Device Coordinates (see 11.20)~~
~~The BS's coordinates.~~

**Base Station Information (see 11.21)**
The Base Stations location, timing, and transmit information.

*In Rev2/D1, replace the contents on pages 1306 line 1through 1306 line 5 by the following, where the new texts are marked by blue and underlined; the deleted texts are red with strikethrough:*

## 11.21 ~~11.20 Device Coordinates~~ LBS_ADV message encodings

This compound TLV is used for encoding the ~~coordinates of a device~~Base Station Information.

*In Rev2/D1, replace the contents on pages 1306 line 16 through 1307 line 41 by the following, where the new texts are marked by blue and underlined; the deleted texts are red with strikethrough:*

The Longitude, Latitude, and Altitude fields indicate the location of the first BS antenna in the LBS-ADV message.  The fields, ~~indicate the MS / BS location in~~ latitude, longitude, and altitude ~~that~~ are based on the LCI (Location Configuration Information) format as defined in RFC3825. Latitude and longitude are represented in 34 bits fixed-point 2s-complement number, consisting of 9 bits of integer and 25 of fraction. Altitude is represented in 30 bits fixed-point 2s-complement number with 22 bits of integer and 8 bits of fraction. Latitude and longitude should be normalized to within +/- 90 degrees and +/- 180 degrees, respectively. Each field also includes resolution bits that define the number of valid bits in the fixed-point value. Here are the definition of 2s-complement number.

- Positive numbers

- o Latitide - North
- o Longitude - East
- o Altitude - above ground

- Negative numbers
  - o Latitide – South
  - o Longitude - West
  - o Altitude - below ground

The Delta.Long, Delta.Lat, and Delta.Alt fields are used to indicate the positions of subsequent BS antennas described in this LBS-ADV message.  The scaling of these numbers allows other BS antennas within about +/- 13 km of the first BS antenna to be described.

The TX_Pwr field informs the mobile of how much preamble power is radiated from this BS antenna.  This information may be used by the mobile to aid in estimating the mobile's range from the BS based on RSSI.

The TX_Azimuth tells the mobile the direction from the BS antenna that this antenna radiates.  This information may be used by the mobile to aidin estimating the mobile's location relative to the BS.

The GPS_Week, GPS_Second, and GPS_Time_Acc fields may be used by the mobile to calibrate the mobile's own internal clock in reference to the GPS time standard.  This may be particularly valuable for determining GPS satellite signal search windows in mobiles equipped to detect GPS satellites.  GPS_Week and GPS_Second allow the mobile to use DL Frame arrival times as timing signals aligned with GPS time.  GPS_Time_Acc aids the mobile in estimating how much error with respect to GPS time it may have when using this calibration.

| Name | Type | Length | Value |
|------|------|--------|-------|
| Longitude | 45.1 | 5 | Bits # 0-5: longitude resolution<br>    1-34 - number of valid bits in fixed-point value of longitude value<br>    35 - LBS not supported<br>    Others - reserved<br>Bits # 6-14: longitude integer<br>Bits # 15-39: longitude fraction |
| Latitude | 45.2 | 5 | Bits # 0-5: latitude resolution<br>    1-34 - number of valid bits in fixed-point value of latitude value<br>    35 - LBS not supported<br>    Others - reserved<br>Bits # 6-14: latitude integer<br>Bits # 15-39: latitude fraction |
| Altitude | 45.3 | 5 | Bits # 0-3: altitude type<br>    1 - meters<br>    2 - floors<br>    Others - reserved<br>Bits # 4-9: altitude resolution<br>    1-30 - number of valid bits in fixed-point value of altitude value<br>    31 - LBS not supported<br>    Others - reserved<br>Bits # 10-31: altitude integer<br>Bits # 32-39: altitude fraction |
| Delta.Long | 45.4 | 2 | Bit #0-24: Delta Longitude signed integer in units of $2^{-17}$ degrees |
| Delta.Lat | 45.5 | 2 | Bit #0-24: Delta Longitude signed integer in units of $2^{-17}$ degrees |
| Delta.Alt | 45.6 | 2 | Bit #0-24: Delta Altitude signed integer in units of meters |

| | | | |
|---|---|---|---|
| TX_Pwr | 45.7 | 1 | EIRP of Transmitted Preamble in steps of 0.5 dB, ranging from -44 dBm (encoded 0x00) to +63.5 dBm (encoded 0xFF) |
| TX_Azimuth | 45.8 | 1 | Direction of TX Beam.  0xFF indicates omnidirectional transmit.  For directional antennas, center of beam direction heading expressed in units of 5 degrees per LSB.  For example, North: 0x00 or 0x48, antenna faces North, 0x12 antenna faces East, 0x24 antenna faces South, 0x36 antenna faces West.  Values from 0x49 through 0xFE are not allowed |
| GPS_Week | 45.9 | 1 | GPS_Week modulo 256 for the beginning of the frame in which this message started |
| GPS_Second | 45.10 | 6 | GPS Second, seconds transpired from the beginning of this GPS_Week until the beginning of the DL Frame in which this message started.<br>Bits #0-19: seconds transpired integer<br>Bits #20-48: seconds transpired fraction |
| GPS_Time_Ac c | 45.11 | 1 | For unsigned integer values 0x00-0x3F: Log2(TimeErr in ps).  For unknown accuracy in time error, 0xFF.  Values 0x40-0xFE not allowed. |