IEEE P802.11
Wireless LANs

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| P802.11ah LB200 some proposed resolutions for ~~Clause 4 and~~ ToD accuracy |
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Abstract

This document proposes resolutions for following comments of P802.11ah D1.0 LB200.

~~CID for Clause 4: 2540, 2541, 2542, 2593~~

CID for Time of Departure accuracy: 2543, 2544

~~Also, the proposed resolutions may be applicable to CID 1627, 1933, 2318, and 2607.~~

R0: Initial

R1: Revise the propsed resolutions for CID 2540, 2607 and 2544, add CID 2318

 Add discussions.

R2: Revise the propsed resolutions for CID 2540 according to the resolution of CID 1551 (14/0080r1).

R3: Remove resolution for Clause 4 as they were already resolved by other submissions (11-14/321r1, 11-14/0270r0, and 11-14/0375r1)

# Proposed resolutons for Time of Departure accuracy

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| **CID** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 2543 | 24.3.17 | A base document IEEE P802.11ac D5.0 defines 22.3.18.5 Time of Departure accuracy which is important for the Timing measurement specified in 10.24.5. The timing measurement is the base function for ranging (location) and time synchronization (IEEE Std 1588 and IEEE Std 802.1AS) and is important for Sensor STAs.It is necessary to specify the Time of Departure accuracy in 24.3.17. | Insert subclause 24.3.17.5 Time of Departure accuracy based on 22.3.18.5 of IEEE P802.11ac D5.0.Detailed proposed changes are provided in 11/13-1316. | Revise.Agree in principle.TGah editor to make changes shown in 11-13/1316r3 under the heading for CID 2543. |
| 2544 | 24.3.17 | Annex T.2 needs to be modified to support S1G STA. | Add following new modification to the subclause T.2 of the IEEE P802.11ac D5.0.----Change bullet l) in the 5th paragraph as follows:l) The Time Difference of Departure accuracy test is passed if both of the following conditions are met: 1) The RMS value of e is less than aTxPHYTxStartRMS when transmitting a VHT PPDU, a TVHT PPDU and an S1G PPDU, or aTxPmdTxStartRMS otherwise. 2) aTxPHYTxStartRMS when transmitting a VHT PPDU, a TVHT PPDU and an S1G PPDU or aTxPmdTxStartRMS otherwise is less than TIME\_OF\_DEPARTURE\_ACCURACY\_TEST\_THRESH, where the units of e, aTxPHYTxStartRMS when transmitting a VHT PPDU, a TVHT PPDU and an S1G PPDU or aTxPmdTxStartRMS otherwise, and TIME\_OF\_DEPARTURE\_ACCURACY\_TEST\_THRESH are properly accounted for.---Change the associated note of bullet l) in the 5th paragraph as follows:Replace the phrase "aTxPmdTxStartRFDelay when transmitting a non-VHT PPDU or aTxPHYTxStartRFDelay when transmitting a VHT PPDU"by"aTxPHYTxStartRFDelay when transmitting a VHT PPDU, a TVHT PPDU and an S1G PPDU or aTxPmdTxStartRFDelay otherwise" | Revise.Agree in principle.TGah editor to make changes shown in 11-13/1316r3 under the heading for CID 2544. |

### Discussion:

The Time of Depature (TOD) measurement is used for Location track procedures (10.24.4) and Timing measurement procedure (10.24.5), which are optionally supported by an S1G STA according to the submission for Annex B (11-14/587r0). The current S1G Capabilities Element (P802.11ah D1.3) does not provide capability information for the Location track procedures and the Timing measurement procedure. However, an S1G STA includes the Extended Capabilities element in an S1G Beacon frame that is transmitted at a TBTT, if Location track procedure or Timing measurement procedure is supported.

## Proposed resolution for CID 2543

*(Instruction to Editor) Insert a new subclause 24.3.16.5 as follows:*

### 24.3.16.5 Time of Departure accuracy

The Time of Departure accuracy test evaluates TIME\_OF\_DEPARTURE against aTxPHYTxStartRMS and aTxPHYTxStartRMS against TIME\_OF\_DEPARTURE\_ACCURACY\_TEST\_THRESH as defined in Annex T with the following test parameters:

* MULTICHANNEL\_SAMPLING\_RATE is:

1 × 106 (1+⎾ (fH - fL)/1 MHz⏋) sample/s, for a CH\_BANDWIDTH parameter equal to CBW1

2 × 106 (1+⎾ (fH - fL)/2 MHz⏋) sample/s, for a CH\_BANDWIDTH parameter equal to CBW2

4 × 106 (1+⎾ (fH - fL)/4 MHz⏋) sample/s, for a CH\_BANDWIDTH parameter equal to CBW4

8 × 106 (1+⎾ (fH - fL)/8 MHz⏋) sample/s, for a CH\_BANDWIDTH parameter equal to CBW8

16 × 106 (1+⎾ (fH - fL)/16 MHz⏋) sample/s, for a CH\_BANDWIDTH parameter equal to CBW16

where

fH is the nominal center frequency in Hz of the highest channel in the channel set

fL is the nominal center frequency in Hz of the lowest channel in the channel set, the channel set is the set of channels upon which frames providing measurements are transmitted.

⎾x⏋ equals the smallest integer equal to or larger than x.

* FIRST\_TRANSITION\_FIELD is STF.
* SECOND\_TRANSITION\_FIELD is LTF1.
* TRAINING\_FIELD is LTF1 windowed in a manner which should approximate the windowing described in 18.3.2.5 (Mathematical conventions in the signal descriptions) with TTR = 1000 ns.
* TIME\_OF\_DEPARTURE\_ACCURACY\_TEST\_THRESH is 1600ns for a CH\_BANDWIDTH parameter equal to CBW1 and 800 ns otherwise.

NOTE —The indicated windowing applies to the time of departure accuracy test equipment, and not the transmitter or receiver.

## Proposed resolution for CID 2544

*(Instruction to Editor) Insert new Annex T as follows;*

### Annex T Location and Time Difference accuracy test (informative)

**T.2 Time Difference of departure accuracy test**

*Change bullet l) and the associated note in the 5th paragraph as follows:*

1. The Time of Departure accuracy test is passed if both of the following conditions are met:
2. The RMS value of e is less than aTxPHYTxStartRMS when transmitting a VHT PPDU ~~and~~, a TVHT PPDU and an S1G PPDU, or aTxPmdTxStartRMS otherwise.
3. aTxPHYTxStartRMS when transmitting a VHT PPDU ~~and~~, a TVHT PPDU and an S1G PPDU, or aTxPmdTxStartRMS otherwise is less than TIME\_OF\_DEPARTURE\_ACCURACY\_TEST\_THRESH, where the units of e, aTxPHYTxStartRMS when transmitting a VHT PPDU ~~and~~, a TVHT PPDU and an S1G PPDU, or aTxPmdTxStartRMS otherwise, and TIME\_OF\_DEPARTURE\_ACCURACY\_TEST\_THRESH are properly accounted for.

NOTE 1—One possible implementation of a time of departure measurement system is a free-running oscillator clocking (a) the digital-to-analog converter(s) used to transmit the packet, (b) a 32-bit continuously counting counter and (c) a hardware finite state machine such that PMD\_TXSTART.request causes a transition within the finite state machine that in turn causes frame transmission at the DACs a fixed number of cycles later; where the time of departure is recorded as the value of the counter at that transition minus ~~aTxPmdTxStartRFDelay when transmitting a non-VHT PPDU or~~ aTxPHYTxStartRFDelay when transmitting a VHT PPDU and an S1G PPDU, or aTxPmdTxStartRMS otherwise (using TIME\_OF\_DEPARTURE\_ClockRate), where aTxPmdTxStartRFDelay or aTxPHYTxStartRFDelay can vary by channel. In this implementation, the principal source of time of departure error is short term oscillator imperfection (e.g., phase noise) and RF group delay variation across channels uncompensated by ~~aTxPmdTxStartRFDelay when transmitting a non-VHT PPDU or~~ aTxPHYTxStartRFDelay when transmitting a VHT PPDU and an S1G PPDU, or aTxPmdTxStartRMS otherwise.