IEEE P802.11  
Wireless LANs

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| CC28 CR VHTz Protocol Rewrite | | | | |
| Date: 2018-09-10 | | | | |
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**Abstract**

This submission proposes resolutions of comments received from TGaz CC28.

(The proposed change is based on TGaz Draft 0.4.1)

* CIDs: 405, 406, 407, 408, 413, 47, 48, 176, 409, 410, 411, 493, 415, 417, 414, 177, 49, 50, 178, 422, 423, 424, 426, 418, 419, 420, 421, 416, 179, 430, 428, 431, 432 (33 CIDs)

| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| --- | --- | --- | --- | --- | --- |
| 405 | 58 | 11.22.6.4.4.4 | "equalt to nonzero" | "nonzero" | Accepted |
| 406 | 58 | 11.22.6.4.4.4 | "protocoloperates" | Add space after "l" | Accepted |
| 407 | 59 | 11.22.6.4.4.1 | " the MaxToAAvailable value " -- where is this value defined? The field is the MaxToAAvailableExp | Clarify | Revised  Added explanation that the MaxToaAvailableExp indicates a time marked MaxToaAvailable in Fig. |
| 408 | 59 | 11.22.6.4.4.1 | "for which the responder retains the computed ToA value. " -- what does this mean? | Clarify | Revised  Removed sentence, kept normative behavior |
| 413 | 59 | 11.22.6.4.4.1 | Figure 11-xx is not referred to anywhere | Refer to figure in text | Accepted |
| 47 | 59 | 11.22.6.4.4.2 | NPDA and NDP PPDU format is defined in the previous and the paragraph after this statement. Should we define the LMR PDDU as SU PPDU (not ER SU PPDU?) explicitly or it's implicit anyway | As per comment | Revised  PPDU format defintions have been removed |
| 48 | 59 | 11.22.6.4.4.2 | Remove the phrase "operating at 2.4GHz and 5GHz bands" as VHTz is applicable to these bands anyway | As per comment | Revised  PPDU format defintions have been removed |
| 176 | 59 | 11.22.6.4.4.2 | Shouldn't the text here be mandatory behavior? | Change "use" to "shall use". | Revised  paragraph has been removed |
| 409 | 59 | 11.22.6.4.4.2 | Non-break space before units | Needed before GHz and us (which should be <micro>s), etc. | Revised  paragraph has been removed |
| 410 | 59 | 11.22.6.4.4.2 | This is a big lump of text | Split into bullets for the three (?) cases | Revised  paragraph has been removed |
| 411 | 59 | 11.22.6.4.4.2 | What happens for VHTz mode in other bands? | Clarify | Revised  paragraph has been removed |
| 493 | 59 | 11.22.6.4.4.2 | GI=0.8us is incorrect | change GI=0.8us to GI=1.6us everywhere | Revised  paragraph has been removed |
| 415 | 60 | 11.22.6.4.4.3 | This Figure 11-xx has a MinProcessingTime but this is not defined anywhere. Further, if the time to the next sounding sequence is more than this processing time, why can't the LMR be provided immediately after the first sounding sequence, as in the Figure 11-xx above? | Clarify | Revised  Figure 11-xx now uses “MinTimeBetweenMeasurements”, which is defined.  The LMR can only be provided if the ISTA is available (could be off channel), the only way for the ISTA to signal availability is to initiate another measurement. |
| 417 | 60 | 11.22.6.4.4.3 | This Figure 11-xx refers to an "Empty LMR" but this is not defined anywhere. What does an Empty LMR consist of? | Clarify | Accepted  Added clarification |
| 414 | 60 | 11.22.6.4.4.3 | There are 4 Figure 11-xxs in this subclause, but only one reference (to one of them) | Refer to all the figures in the text | Accepted  Added reference to Figures in relevant places |
| 177 | 60 | 11.22.6.4.4.3 | This should be in other subcaluse | Move the sentence to the general part of VHTz ranging description | Accepted  Moved paragraph as requested |
| 49 | 60 | 11.22.6.4.4.3 | Change "field in an initial Fine Timing Measurement frame has expired" | As per comment:  to "field in the most recent initial Fine Timing Measurement frame has elapsed".' | Accepted  Changed wording |
| 50 | 60 | 11.22.6.4.4.3 | Change "an initial Fine Timing Measurement frame with the MinToAReady field value equal to a nonzero" | As per comment:  to "the most recent transmitted initial Fine Timing Measurement frame with the MinToAReady field value equal to a nonzero" | Revised  Rewrote paragraph |
| 178 | 60 | 11.22.6.4.4.3 | The valid result may not be available, e.g. when the UL NDP is not received. | Fix the issue mentioned in the comment. | Revised  Changed wording to reflect the case where no valid ToA available |
| 422 | 60 | 11.22.6.4.4.3 | Again "equal to a nonzero" | "nonzero" | Revised  Rewrote paragraph |
| 423 | 60 | 11.22.6.4.4.3 | "may not" is ambiguous | Change to "is not required to" | Revised  Rewrote paragraph |
| 424 | 60 | 11.22.6.4.4.3 | What is a "valid" measurement result? How is it distinguished from an invalid one? Or does nothing get transmitted at all? | Clarify. Also at line 29 | Revised  Rewrote paragraph |
| 426 | 60 | 11.22.6.4.4.3 | "is negotiated and agreed on during negotiation" -- these are the same thing, in baseline conventions | Delete "and agreed on during negotiation" throughout | Accepted  Changed wording accordingly |
| 418 | 60 | 11.22.6.4.4.3 | "The direction(s) of LMR feedback(s) is (are) negotiated at service establishment." -- so can be ISTA-to-RSTA only (unlike HEz)? | Clarify | Revised  Rewrote/removed paragraph |
| 419 | 60 | 11.22.6.4.4.3 | "In both directions, LMR feedback is neither acknowledged" -- this follows from it being in Action No Ack frames | Delete, or change to a NOTE, referring to the use of Action No Ack frames | Accepted  Now refer to Acktion No Ack frame format |
| 420 | 60 | 11.22.6.4.4.3 | "LMR feedback is reported in the next sounding sequence. " but the Figures 11-xx indicate the LMR feedback is after the sounding sequence, not part of it | As it says in the comment | Accepted  Replaced sounding sequence with measurement exchange |
| 421 | 60 | 11.22.6.4.4.3 | What is the "sounding sequence" for VHTz? Is it the NDPA NDP NDP from Figure 11-xx in 11.22.6.4.4.2? | Clarify | Accepted  Added language that defines “Sounding sequence” |
| 416 | 60 | 11.22.6.4.4.3 | What is the point of having units "[ms]" if there are no numbers or other marks on the axis? | Delete in all cases | Revised  Removed units |
| 179 | 61 | 11.22.6.4.4.3 | This is not IEEE language. | Fix the issue mentioned in the comment. | Revised  Rewrote/removed paragraph |
| 430 | 61 | 11.22.6.4.4.3 | Spurious full stop | Delete one of them | Accepted  Fixed typo |
| 428 | 61 | 11.22.6.4.4.3 | "TOA and TOD format" -- what is this? | Change "format" to "reporting". Ditto line 14 | Revised  Rewrote/removed paragraph |
| 431 | 61 | 11.22.6.4.4.3 | Same comments re secured wording as for 11.22.6.4.3.4 | See comments on that subclause | Accepted  Changed wording accordingly |
| 432 | 61 | 11.22.6.4.4.3 | Same comments re secured wording as for 11.22.6.4.3.4 | See comments on that subclause | Accepted  Changed wording accordingly |
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***TGaz Editor: replace subclause 11.22.6.4.4 with the following revised text, changes relative to draft 0.5***

* + - * 1. 11.22.6.4.4 Measurement Phase in Non-TB Ranging

11.22.6.4.4.1 General

In Non-TB Ranging, the protocol operates in an ISTA centric scheduling FTM mode; whenever the medium is available, an ISTA may initiate a measurement. The RSTA can only limit the frequency with which the ISTA can initiate measurements, by setting a minimum time interval between subsequent range mesasurements.



**Figure 11-xx Non-TB Ranging measurement exchange sequence**

11.22.6.4.4.2 Non-TB Ranging Measurement Sounding Part

The measurement sounding part of the measurement exchange sequence in non-TB Ranging shall follow the sequence illustrated in Figure 11-xx. The NDP-A and UL/DL NDP frames refer to a Ranging NDP Announcement frame and Ranging NDP PPDUs respectively, whose frame formats are defined in 9.3.1.20 and 28.3.17, respectively. The measurement reporting part consists of an LMR frame, which is a Location Measurement Report as defined in 9.6.7.37.

For immediate feedback the LMR carries measurement results of this round, while for delayed feedback the LMR carries measurement results of the previous round (see 11.22.6.4.4.3).

An ISTA shall not initiate a new measurement exchange sequence until the minimum time interval between subsequent range measurements, specified in the MinTimeBetweenMeasurements field in the non-TB Ranging Specific subelement subfield in the Ranging Parameters field in an initial Fine Timing Measurement frame, has elapsed (see Figure 11-xy).

In the nn-TB mesurement exchange sequence, the ISTA shall transmit the NDP-A frame with the same bandwidth as the UL NDP to reserve the medium; the RSTA shall transmit the DL NDP with the same bandwidth as the NDP-A and UL NDP, while the LMR can be transmitted at a different bandwidth, according to the rules of multiple frame transmission in an EDCA TXOP (see 10.22.2.7), i.e., not exceeding the bandwidth of the NDP-A, UL NPD and DL NDP. The allowed bandwidths for the NDP-A and UL/DL NDP frames are specified in the Format and Bandwidth subfield of the Ranging Parameters field (see 9.4.2.246).

Accordingly:

* An ISTA transmitting a Ranging NDP-A frame shall not use a bandwidth wider than that indicated by an RSTA in the Ranging Parameters element, in the initial Fine Timing Measurement frame. The TA field of the Ranging NDP Announcement frame is a bandwidth signalling TA when the Ranging NDP Announcement frame is sent in a non-HT duplicate PPDU (see 10.7.6.6)
* An ISTA transmitting an UL NDP shall set the TXVECTOR parameter CH\_BANDWIDTH to the same value as the TXVECTOR parameter CH\_BANDWIDTH in the preceding Ranging NDP-A frame.
* An RSTA transmitting a DL NDP shall set the TXVECTOR parameter CH\_BANDWIDTH to the bandwidth of the Ranging NDP-A frame and/or the UL NDP frame; which are obtained from the RXVECTOR parameter CH\_BANDWIDTH of the Ranging NDP-A frame or UL NDP frame respectively. For the NDP-A frame, when not received in an HE/VHT/HT PPDU: from the RXVECTOR parameter CH\_BANDWIDTH\_IN\_NON\_HT when the Ranging NDP–A frame is received in a non-HT duplicate PPDU and is 20 MHz when the Ranging NDP-A frame is received in a non-HT PPDU.

11.22.6.4.4.3 Non-TB Ranging Measurement Reporting Part

In non-TB Ranging, the ranging protocol supports both immediate and delayed reporting. In delayed reporting, the TOA feedback corresponding to the current measurement exchange sequence is reported in the next measurement exchange, see Figures 11-xy and 11-xz. Delayed reporting is meant to give the RSTA enough processing time, in case some RSTA implementations cannot have the TOA measurements of the UL NDP ready in time to be included in the LMR of the same measurement exchange sequence. In this case, the LMR following the very first sounding sequence has no valid TOA to include, which in Figure 11-xy is termed an “Empty LMR” for illustrative purposes.



**Figure 11-xy Non-TB Ranging with immediate reporting**



**Figure 11-xz Non-TB Ranging with delayed reporting**

An RSTA indicates delayed reporting by setting the MinToaReady parameter in the non-TB Ranging Specific subelement in the Ranging Parameters field to a non-zero value. The RSTA then shall also set the MinTimeBetweenMeasurements to the same value as the MinToaReady parameter and set the MaxToaAvailableExp parameter in the non-TB Ranging Specific subelement to indicate a time MaxToaAvailable larger than MinToaReady as defined below:

MaxToaAvailable = 2^(MaxToaAvailableExp+8) milliseconds

An RSTA that indicated delayed reporting shall provide TOA feedback to the ISTA, if the ISTA initiates another measurement sequence after MinToaReady, but before MaxToaAvailable, see Figure 11-yx. This TOA feedback is carried in the LMR frame of this new measurement sequence and can be either valid or invalid as indicated by the invalid Measurement field in the LMR frame.



**Figure 11-yx Illustration of MinToaReady and MaxToaAvailable for delayed reporting**

If ISTA-to-RSTA LMR feedback is negotiated, the non-TB Ranging measurement exchange sequence shall follow the sequence shown in Figure 11-yy. After SIFS time of receiving the RSTA-to-ISTA LMR frame, the ISTA shall transmit the ISTA-to-RSTA LMR frame to the RSTA. The feedback type of ISTA-to-RSTA LMR could be either immediate or delayed.

LMR feedback is carried in Action No Ack frames (see 9.6.7.37) and are therefore neither acknowledged nor retransmitted.



**Figure 11-yy Non-TB Ranging neasurement exchange sequence with bidirectional LMR feedback**

The data rate or MCS used for transmitting the LMR frame is solely decided by the transmitter of the corresponding LMR frame. The bandwidth used to transmit the LMR frame shall not be wider than the bandwidth of the soliciting NDP-A.

If the PHY of an RSTA issues a PHY-RXEND.indication(*IntegrityCheckError*) primitive, the RSTA shall set the Invalid Measurement field in the RSTA-to-ISTA LMR frame carrying the TOA measured from the UL NDP to 1. Correspondingly, if ISTA-to-RSTA LMR was negotiated between the ISTA and RSTA and the PHY of the ISTA issues a PHY-RXEND.indication(*IntegrityCheckError*) primitive, the ISTA shall set the Invalid Measurement field in the ISTA-to-RSTA LMR carrying the TOA measured from the DL NDP to 1

If ISTA-to-RSTA LMR reporting was negotiated, then the ISTA shall include a CFO parameter in the ISTA-to-RSTA LMR (see 9.6.7.37 Location Measurement Report frame format). The ISTA shall estimate the CFO parameter based on the DL NDP from the RSTA. The RSTA may account for clock rate differences between ISTA and RSTA based on the CFO parameter included in the received ISTA-to-RSTA LMR. The mechanism by which t4 and t1 are adjusted by RSTA is implementation specific. The CFO parameter refers to the t1 and t4 indicated in the same ISTA-to-RSTA LMR instance.

If the Invalid Measurement field in RSTA-to-ISTA LMR or ISTA-to-RSTA LMR is set to 1, the RSTA or ISTA receiving the LMR should discard the TOA carried in the LMR.