IEEE P802.11
Wireless LANs

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| TGbd D0.3 Comment Resolutions for Section 32.3.6 Mathematical Description of Signals |
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Abstract

This submission proposes resolutions for comments received on Section 32.3.6 Mathematical description of signals in TGbd D0.3. The following is the list of CIDs:

* 140, 141, 142, 143
* 272, 273, 274, 275, 276, 277, 278

***CIDs for Clause 32.3.6.3***

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| **CID** | **Commenter** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 140 | Rui Cao | 32.3.6.3 | 39.09 | Update the reference of number of NGV-LTF to Table 32-11. | As in the comment. | AcceptSee changes in 11-20/0875r0  |
| 141 | Rui Cao | 32.3.6.3 | 40.27 | N\_Norm for NGV modulated fields need to be updated to N\_SS, as there is no N\_STS for NGV, and update the reference to NGV table. | change "N\_STS" to "N\_SS". Change "Table 27-15 " to "Table 32-7". | AcceptSee changes in 11-20/0875r0 |
| 142 | Rui Cao | 32.3.6.3 | 40.43 | Reference Table 21-10 title is not correct. | Change "NGV-SIG" to "VHT-SIGA". | AcceptSee changes in 11-20/0875r0 |
| 143 | Rui Cao | 32.3.6.3 | 41.25 | Typo in the row of NGV-LTF-2x for T\_GI. | Change "GI" to "T\_GI". | AcceptSee changes in 11-20/0875r0 |
| 272 | Yujin Noh | 32.3.6.3 | 39.09 | it does not provide additional information to refer to the table 21-13. remove from "and uses the same definition as in Table 21-13" | as in comment | AcceptSee changes in 11-20/0875r0 |
| 273 | Yujin Noh | 32.3.6.3 | 39.42 | In Equation (32-3), - t\_NGV-LTF should be + t\_NGV-LTF | as in comment | Accept See changes in 11-20/0875r0 |
| 274 | Yujin Noh | 32.3.6.3 | 39.43 | In Equation (32-3), - t\_NGV-Data should be + t\_NGV-Data | as in comment | Accept See changes in 11-20/0875r0 |
| 275 | Yujin Noh | 32.3.6.3 | 40.50 | m should be italic. | as in comment | AcceptSee changes in 11-20/0875r0 |
| 276 | Yujin Noh | 32.3.6.3 | 40.51 | K should be small italic k because it means indices. | as in comment | AcceptSee changes in 11-20/0875r0 |
| 277 | Yujin Noh | 32.3.6.3 | 41.03 | fill TBD | as in comment | RevisedSee changes in 11-20/0875r0 |
| 278 | Yujin Noh | 32.3.6.3 | 41.28 | GI should be T\_GI | as in comment | Accepted in CID 143See changes in 11-20/0875r0 |

*TGbd Editor: Please make the following changes (in red) in Section 32.3.6.3 of D0.3.*

* + 1. Mathematical description of signals

32.3.6.1 Notation

For a description of the conventions used for the mathematical description of the signals, see 17.3.2.5 (Mathematical conventions in the signal descriptions), and 21.3.7.1 (Notation).

32.3.6.2 Subcarrier indices in use

For description on subcarrier indices over which the signal is transmitted for non-NGV 10MHz PPDUs, see 19.3.7 (Mathematical description of signals).

For a 10 MHz NGV PPDU transmission, the 10 MHz is divided into 64 subcarriers. The signal is transmitted on subcarriers –28 to –1 and 1 to 28, with 0 being the center (DC) subcarrier.

For a 20 MHz NGV PPDU transmission, the 20 MHz is divided into 128 subcarriers. The signal is transmitted on subcarriers –58 to –2 and 2 to 58.

32.3.6.3 Transmitted signal

The transmitted signal is described in complex baseband signal notation. The actual transmitted signal is related to the complex baseband signal by the relation shown in Equation (32-1).

, (32-1)

where

 represents the complex baseband signal of transmit chain *iTX*;

 represents the center frequency of the PPDU.

The transmitted RF signal is derived by upconverting the complex baseband signal, which consists of several fields. The timing boundaries for the various fields are shown in Figure 32-8 (Timing boundaries for NGV PPDU fields) where *NNGV-LTF* is the number of NGV-LTF symbols as defined in Table 32-11(Number of NGV-LTFs required for different numbers of spatial streams).

L-STF

L-LTF

L-SIG

RL-SIG

NGV-SIG

RNGV-SIG

NGV-STF

Data Symbol

……

Data Symbol

NGV-LTF Symbol

……

NGV-LTF Symbol

Non-NGV portion

Pre-NGV modulated fields

NGV portion

NGV modulated fields

Midamble

……

Data Symbol

NGV LTF

Data

**Figure 32-8 – Timing boundaries for NGV PPDU fields**

The time offset, , determines the starting time of the corresponding field relative to the start of L-STF (*t* = 0).

The signal transmitted on transmit chain shall be as shown in Equation (32-2).

  (32-2)

where

Each field, , is defined as the summation of one or more subfields, where each subfield is defined to be an inverse discrete Fourier transform as specified in Equation (32-3).

 (32-3)

This general representation holds for all subfields. The total power of the time domain NGV modulated field signals summed over all transmit chains should not exceed the total power of the time domain pre-NGV modulated field signals summed over all transmit chains. For notational simplicity, the parameter BW is omitted from some bandwidth dependent terms.

In Equation (32-3) the following notations are used:

 Table 32-8 (Tone scaling factor and guard interval duration values for PHY fields) summarizes the various values of as a function of bandwidth.

 For pre-NGV modulated fields, . For NGV modulated fields, where is given in Table 32-7 (Frequently used parameters).

 is a windowing function. An example function, , is given in 17.3.2.5 (Mathematical conventions in the signal descriptions). is *TL-STF* for L-STF, *TL-LTF* for L-LTF, *TL-SIG* for L-SIG, *TRL-SIG* for RL-SIG, *TNGV-SIG* for NGV-SIG, *TRNGV-SIG* for RNGV-SIG*, TNGV-STF* for NGV-STF and *TNGV-LTF* for NGV-LTF. is *TSYM* for Data.

 is the spatial mapping matrix for the subcarrier *k*. For pre-NGV modulated fields, is a column vector with elements with element being , where represents the cyclic shift for transmitter chain whose values are given in Table 21-10 (Cyclic shift values for L-STF, L-LTF, L-SIG, and VHT-SIGA fields of the PPDU). For NGV modulated fields, is a matrix with rows and columns.

 is defined in 32.3.6.4 (Definition of tone rotation)

 is the subcarrier frequency spacing given in Table 32-6 (Timing-related constants).

 is the frequency domain symbol in subcarrier *k* of spatial stream *m*. Some of the within have a value of 0. Examples of such cases include the DC tones, guard tones on each side of the transmit spectrum, as well as the unmodulated tones of L-STF and NGV-STF fields. Note that the multiplication matrices and are included in the calculation of for the NGV-LTF field.

 is the guard interval duration used for each OFDM symbol in the field. For L-STF and NGV-STF, but it can be omitted from Equation (32-3) due to the periodic property of L-STF and NGV-STF over every 1.6 µs. For the L-SIG, RLSIG, NGV-SIG, RNGV-SIG, NGV-LTF and Data fields, is defined in the “Guard interval duration” column of Table 32-8 (Tone scaling factor and guard interval duration values for PHY fields).

 For pre-NGV modulated fields, . For NGV modulated fields, represents the cyclic shift per spatial stream, whose value is given in 21.3.8.3.2 (Cyclic shift for VHT modulated fields) for NSTS,*total* = 1 and 2, corresponding to NSS = 1 and 2 respectively.

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| Table 32-8 Tone scaling factor and guard interval duration values for PHY fields |
| Field |   | Guard interval duration |
| 10 MHz | 20 MHz |  |
| L-STF | 12 | 24 | - |
| L-LTF | 52 | 104 | *TGI2* |
| L-SIG | 52 | 104 | *TGI* |
| RL-SIG | 52 | 104 | *TGI* |
| NGV-SIG | 52 | 104 | *TGI* |
| RNGV-SIG | 52 | 104 | *TGI* |
| NGV-STF | 12 | 24 | *-* |
| NGV-LTF-1x  | 28 | 58 | *TGI* |
| NGV-LTF-2x | 56 | 114 | *TGI* |
| NGV-LTF-2x-Repeat | 56 | 114 | *TGI* |
| NGV-LTF-1x-Repeat | 28 | 58 | *TGI* |
| Data | 56 | 114 | *TGI* |