IEEE P802.11
Wireless LANs

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| Spec Change Related to GI and NGV-LTF |
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| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Rui Cao | NXP | 350 Holger Way, San Jose, CA 95134 |  | rui.cao\_2@nxp.com |
| Prashant Sharma |  | prashant.sharma@nxp.com |

Abstract

This submission contains modified spec text for the GI and NGV-LTF format. The changes are to be incorporated in P802.11bd D0.3. The changes are for Sec. 32.3.5 (Timing-related parameters), 32.3.6.3 (Transmitted signal) and Sec. 32.3.7.3.6 (NGV-LTF definition) in D0.2.

Revisions:

* Rev 0: Initial version of the document.

32. Next Generation V2X (NGV) PHY specification

* + 1. Timing-related parameters

Table 33-6 (Timing-related constants) defines the timing-related parameters for NGV format.

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| Table 33-6 Timing-related constants  |
| Parameter | CBW10 | CBW20 | Description |
| *NSD* | 52 | 108 | Number of complex data numbers per frequency segment |
| *NSP* | 4 | 6 | Number of pilot values per frequency segment |
| *NST* | 56 | 114 | Total number of subcarriers per frequency segment. See NOTE. |
| *NSR* | 28 | 58 | Highest data subcarrier index per frequency segment |
| *∆F,NGV* | 156.25 kHz | Subcarrier frequency spacing |
| *TDFT* | 6.4 µs | IDFT/DFT period |
| *TGI* | 1.6 µs = *TDFT* /4 | Guard interval duration |
| *TGI2* | 3.2 µs | Double guard interval |
| *TSYM,NGV* | 8 µs = *TDFT* + *TGI =* 1.25 *TDFT*  | symbol interval |
| *TL-STF,NGV* | 16 µs = 10 x *TDFT* /4 | Non-HT Short Training field duration |
| *TL-LTF,NGV* | 16 µs = 2 x *TDFT* + *TGI2* | Non-HT Long Training field duration |
| *TL-SIG,NGV* | 8 µs | Non-HT SIGNAL field duration |
| *TRL-SIG,NGV* | 8 µs | Repeated Non-HT SIGNAL field duration |
| *TNGV-SIG* | 8 µs | NGV Signal field duration |
| *TRNGV-SIG* | 8 µs | Repeated NGV Signal field duration |
| *TNGV-STF* | 8 µs | NGV Short Training field duration |
| *TNGV-LTF-2X* | 8 µs | Duration of each NGV-LTF-2x symbol |
| *TNGV-LTF-1X* |  4.8us | Duration of each NGV-LTF-1x symbol |
| *TNGV-LTF-2X-Repeat* | 14.4 µs | Duration of each repeated NGV-LTF-2x symbol |
| *TNGV-LTF* | *T*NGV-LTF-2X or *T*NGV-LTF-1X or *T*NGV-LTF-2X-Repeat depending upon the LTF format used | Duration of each OFDM symbol in NGV LTF field |
| *Nservice* | 16 | Number of bits in the SERVICE field |
| *Ntail* | 6 | Number of tail bits per BCC encoder |
| NOTE—*NST* = *NSD* + *NSP* |

**32.3.7.3.6 NGV-LTF definition**

The NGV Long Training field (NGV-LTF) field provides a means for the receiver to estimate the MIMO

channel between the set of constellation mapper outputs and the receive chains. The transmitter provides

training for NSTS space-time streams (spatial mapper inputs) used for the transmission of the PSDU(s). For

each tone, the MIMO channel that can be estimated is an NRX×NSTS matrix. An NGV transmission has a

preamble that contains NGV-LTF symbols, where the data tones of each NGV-LTF symbol are multiplied

by entries belonging to a matrix PNGV-LTF, to enable channel estimation at the receiver. The pilot tones of

each NGV-LTF symbol are multiplied by the entries of a matrix RNGV-LTF defined in the following text. The

multiplication of the pilot tones in the NGV-LTF symbol by the RNGV-LTF matrix instead of the PNGV-LTF

matrix allows receivers to track phase and frequency offset during MIMO channel estimation using the

NGV-LTF. The number of NGV-LTF symbols, NNGV-LTF, is a function of the number of space-time

streams, NSTS, as shown in Table 32-11 (Number of NGV-LTFs required for different numbers of spacetime

streams). As a result the NGV-LTF field consists of one or two symbols.

An NGV PPDU supports three NGV-LTF formats: NGV-LTF-1x, NGV-LTF-2x and repeated NGV-LTF-2x. NGV-LTF-2x is the default LTF format; NGV-LTF-1x is for high efficient transmission for one spatial stream case; and repeated NGV-LTF-2x is used for extended range case. When DCM

and BPSK modulation is applied to the NGV Data field of PPDU in 10 MHz, the NGV-LTF symbol will use repeated NGV-LTF-2x regardless of the LTF format bit in the NGV-SIG. Repeated NGV-LTF-2x is constructed by repeating the time domain symbol of

NGV-LTF-2x excluding GI and pre-append one cyclic prefix of duration 1.6us.

The duration of each NGV-LTF symbol excluding GI is TNGV-LTF, defined in Equation (32-17).

(32-17)

**32.3.6.3 Transmitted signal**

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| Table 32-8 Tone scaling factor and guard interval duration values for PHY fields |
| Field |  as a function of bandwidth  | 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* |
|  |  |  |  |
| Data | 56 | 114 | *TGI* |