IEEE P802.11
Wireless LANs

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| Draft Spec Text for Section 33.3.9 (Data field) |
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Abstract

This submission contains spec text for Sec. 33.3.9 (Data field) to be incorporated in P802.11bd D0.1. The text reflects the related passed motions recorded in 11-19/0514r10.

Revisions:

* Rev 0: Initial version of the document.

33. Next Generation V2X (NGV) PHY specification

* + 1. Data field

33.3.9.1 General

The number of OFDM symbols in the Data field is determined by the Length field in L-SIG (see Equation (33-x)), the preamble duration and the setting of the NGV-LTF and Midamble field in NGV-SIG (see 33.3.8 (NGV preamble)).

For LDPC encoding, the Data field shall consist of the SERVICE field, the PSDU, and the PHY pad bits.

The padding flow is as follows. The MAC delivers a PSDU that fills the available octets in the Data field of the PPDU. The PHY determines the number of pad bits to add and appends them to the PSDU. The number of pad bits added will always be 0 to 7. The PHY padding bits are calculated using Equation (33-x1).

 (33-x1)

where

 is defined in 33.4.3 (TXTIME and PSDU\_LENGTH calculation)

 is given by Equation (33-x3)

33.3.9.2 SERVICE field

The SERVICE field is as shown in Table 21-16 (SERVICE field).

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| Table 33-x1SERVICE field |
| Bits | Field | Description |
| B0-B6 | Scrambler Initialization | Set to 0 |
| B7-B15 | Reserved | Set to 0 |

33.3.9.3 Scrambler

The SERVICE, PSDU, and PHY pad parts of the Data field shall be scrambled by the scrambler defined in 17.3.5.5 (PHY DATA scrambler and descrambler). The Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification) TXVECTOR parameters CH\_BANDWIDTH\_IN\_NON\_HT and DYN\_BANDWIDTH\_IN\_NON\_HT are not present; therefore, the initial state of the scrambler is set to a pseudorandom nonzero seed.

33.3.9.4 Coding

33.3.9.4.1 General

The Data field shall be encoded using low-density parity check (LDPC) code defined in 33.3.10.2 (LDPC coding).

33.3.9.4.2 LDPC coding

For a NGV PPDU uses the same LDPC code and encoding process described in 21.3.10.5.4 (LDPC coding) to encode the Data field.

33.3.9.5 Stream parser

After coding and puncturing, the data bit streams at the output of the FEC encoders are processed in groups of *NCBPS* bits. Each of these groups is rearranged into *NSS* blocks of *NCBPSS* bits. This operation is referred to as *stream parsing* and is described in this subclause.

The number of bits assigned to a single axis (real or imaginary) of a constellation point in a spatial stream is denoted by Equation (33-x5).

 (33-x5)

The sum of these over all streams is

Consecutive blocks of *s* bits are assigned to different spatial streams in a round robin fashion.

Let

 (33-x6)

and

 (33-x7)

For the first bits of each OFDM symbol, S bits from the output of first encoder are divided among all spatial streams, *s* bits per stream. Then, bits from the output of next encoder are used, and so on. If is greater than , then for the last bits of each OFDM symbol, bits from the output of the first encoder are fed into spatial streams 1 to *M* (*s* bits per spatial stream), and then bits from the output of the next encoder are used for spatial stream to , and so on, where ( is the remainder resulting from the division of integer *z* by integer *t*.

The following equations are an equivalent description to the above procedure. Bit *i* at the output of encoder *j* is assigned to input bit *k* of spatial stream where

 (33-x8)

and

 (33-x9)

where

33.3.9.6 Constellation mapping

The mapping between bits at the output of the interleaver and complex constellation points for BPSK, QPSK, 16-QAM, and 64-QAM follows the rules defined in 17.3.5.8 (Subcarrier modulation mapping) and 256-QAM follows the rules defined in 21.3.10.9 (Costellation mapping).

33.3.9.7 LDPC tone mapping

The LDPC tone mapping shall be performed on all LDPC encoded streams as described in this subclause and using an LDPC tone-mapping distance parameter . is constant for each bandwidth and its value for different bandwidths is given in Table 33-x2 (LDPC tone mapping distance for each bandwidth).

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| Table 33-x2 LDPC tone mapping distance for each bandwidth |
| Parameter | 10 MHz | 20 MHz |
|  | 4 | 6 |

For a NGV PPDU transmission, the LDPC tone mapping for LDPC-coded streams is done by permuting the stream of complex numbers generated by the constellation mappers (see Equation (33-x10)) to obtain

 (33-x10)

where,

and

 (33-x11)

As a result of the LDPC tone mapping operation above, each two consecutively generated complex constellation numbers and will be transmitted on two data tones that are separated by at least other data tones. Note that the operation above is equivalent to block-interleaving the complex numbers for each i, n, and u using a matrix with rows and columns, where are written row-wise into the matrix, and are read column-wise from the matrix.

33.3.9.6 Pilot subcarriers

In a 10 MHz transmission, four pilot tones shall be inserted in TBD subcarriers. The pilot mapping for subcarrier *k* for symbol *n* shall be as specified in Equation (33-x12).

  (33-x12)

where,

 is given by the row of Table 19-19 (Pilot values for 20 MHz transmission)

In a 20 MHz transmission, six pilot tones shall be inserted in TBD subcarriers. The pilot mapping for subcarrier *k* for symbol *n* shall be as specified in Equation (33-x13).

(33-x13)

where

 is given by the *NSTS =* 1 row of Table 19-20 (Pilots values for 40 MHz transmission (excluding MCS 32))

The above pilot mapping shall be copied to all space-time streams before the space-time stream cyclic shifts are applied.

33.3.9.8 OFDM modulation

33.3.9.8.1 Transmission in NGV format

The time domain waveform of the Data field of a NGV PPDU from transmit chain *iTX*, 1  *iTX*  *NTX* shall be as defined in Equation (33-x14).

(33-x14)

where

*pn* is defined in 17.3.5.10 (OFDM modulation)

 is defined in 21.3.10.10 (Pilot subcarriers)

 is defined in Equation (21-14), Equation (21-15), Equation (21-16), and Equation (21-17)

 is the transmitted constellation at subcarrier *k*, space-time stream *m*, and Data field OFDM symbol *n* and is defined in Equation (21-96) to(#240) Equation (21-99)

 has the value given in Table 21-8 (Tone scaling factor and guard interval duration values for PHY fields)

 is given in Table 21-11 (Cyclic shift values for the NGV modulated fields of a PPDU)

 is the guard interval duration. .

In a 10 MHz NGV transmission,

 , (33-x15)

where

 is defined in Equation (21-49)

In a 20 MHz NGV transmission,

, (33-x16)

where

 is defined in Equation (21-51)

 is a spatial mapping/steering matrix with *NTX* rows and *NSTS* columns for subcarrier *k*. may be frequency dependent. Refer to the examples of listed in 19.3.11.11.2 (Spatial mapping) for examples of that could be used for NGV PPDU. Note that implementations are not restricted to the spatial mapping matrix examples listed in 19.3.11.11.2 (Spatial mapping) and the number of transmit chains *NTX* could be 1 or 2. The beamforming steering matrices are implementation specific.