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Wireless LANs

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| 30.6.4 Encoding of EDMG-Header-B for OFDM Mode |
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Abstract

This document proposes specification text for subclause 30.6.4 of the spec describing encoding and modulation method for EDMG-Header-B in OFDM mode, [1].

**30.6.4 Encoding of EDMG-Header-B**

The EDMG-Header-B shall be encoded as follows:

* Definitions:
* Let *b* = (b1, b2, …, b64), where b1, b2, …, b64 represent the input bits from the EDMG-Header-B
* Let *q* = (01, 02, …, 07, s1, s2, …, s57), where s1, s2, …, s57 represent the first 57 bits at the output of the scrambler with initial seed value (b1, b2, …, b7)
* Let:



where:

* s1, s2, …, sN represent the output of the scrambler with initial seed value (11, 12, …, 17)
* *iSTS* represents the space-time stream index number
* Steps:
* XOR each corresponding bit of vector *b* and vector *q* to generate vector *bq*
* Given an LDPC codeword (bq1, bq2, …, bq64, 01, 02, …, 0440, p1, p2, …, p168) generated as defined in 20.3.8, generate *c* = (c1, c2, c3) as:
* c1 = (bq1, bq2, …, bq64, p9, p10, …, p168)
* c2 = (bq1, bq2, …, bq64, p1, p2, …, p84, p93, p94, …, p168)
* c3 = (bq1, bq2, …, bq64, p1, p2, …, p160)
* Generate one codeword, *csiSTS*, for each space-time stream *iSTS* belonging to a STA addressed in the PPDU by XORing each corresponding bit of vector *c* and vector *siSTS* to generate *csiSTS*

Following encoding, the EDMG-Header-B shall be modulated as follows:

* For single channel transmission, each 672-bit codeword *csiSTS* is modulated using QPSK modulation described in 20.5.3.2.4.3 to the sequence (d0*iSTS*, d1*iSTS*, …, d335*iSTS*) which is assigned to the data subcarriers applying Static Tone Pairing (STP) mapping.
* The STP mapping assigns (d0*iSTS*, d1*iSTS*, …, d167*iSTS*) to the first half of OFDM signal spectrum and (d168*iSTS*, d169*iSTS*, …, d335*iSTS*) to the second half of the spectrum as defined in 20.5.3.2.4.6.
* For a PPDU transmitted over a *NCB* × 2.16 GHz channel, where 1 ≤ *NCB* ≤ 4, the resulting sequence for *iSTS*-th space-time stream is defined as follows:
* *D336*(*iSTS*, *:*) = [d0:335*iSTS*] for *NCB* = 1
* *D734*(*iSTS*, *:*) = [d0:167*iSTS*, d0:167*iSTS*, d0:30*iSTS*, d168:335*iSTS*, d168:335*iSTS*, d168:198*iSTS*] for *NCB* = 2
* *D1134*(*iSTS*, *:*) = [d0:167*iSTS*, d0:167*iSTS*, d0:167*iSTS*, d0:62*iSTS*, d168:335*iSTS*, d168:335*iSTS*, d168:335*iSTS*, d168:230*iSTS*] for *NCB* = 3
* *D1532*(*iSTS*, *:*) = [d0:167*iSTS*, d0:167*iSTS*, d0:167*iSTS*, d0:167*iSTS*, d0:93*iSTS*, d168:335*iSTS*, d168:335*iSTS*, d168:335*iSTS*, d168:335*iSTS*, d168:261*iSTS*] for *NCB* = 4

The *dm:niSTS* notation defines an array of vector *diSTS* elements starting with *m* (inclusive) and ending with *n* (inclusive) with step equal to 1.

The EDMG-Header-B is modulated to the zeroth OFDM symbol, *n* = 0. The EDMG-Header-B transmit waveform for *iTX*-th transmit chain in time domain shall be defined at the OFDM sampling rate *Fs* equal to *NCB*\*2.64 GHz, 1 ≤ *NCB* ≤ 4, and sample time duration *Ts* = 1/*Fs* ns as follows:



where:

*  is the total number of active tones
*  is the total number of space-time streams
*  is a guard interval duration, the same as for the data part, it can have short, normal or long duration
*  is the spatial mapping matrix per *k*-th subcarrier
*  is a matrix element from *m*-th row and *n*-th column
*  is window function applied to smooth the transitions between consecutive OFDM symbols, it’s definition is implementation specific
* The data sequence *D*(*iSTS*, *n* = 0, *k*) is defined by inserting zeros from –*NSR* to *NSR*, and then inserting data at the *Md*(*k*) tones defined in 30.6.1.6, *D*(*iSTS*, *n* = 0, *Md*(*k*)) = *DNSD*(*iSTS*, *k*), *k* = 0, 1, …, *NSD*-1, *DNSD*(*iSTS*, *k*) is defined above for different channel bonding factors
* The pilot sequence *P*(*iSTS*, *n* = 0, *k*) is defined in 30.6.1.5

***The rest of the document represents the informative part and not to be included into the spec draft.***

**Simulation results**

Figure 1 shows simulation results for PSDU and EDMG-Header-B PER vs SNR performance in frequency flat (AWGN) channel for *NCB* = 1. It is shown that the gap between the SNR corresponding to the lowest data MCS1 and EDMG-Header-B for PER = 10-2 level is equal to ~4.1 dB.

Figure 1: PER vs SNR performance in frequency flat (AWGN) channel for OFDM mode.

Figure 2 shows simulation results for PSDU and EDMG-Header-B PER vs SNR performance in IEEE 802.11ad #3 channel for *NCB* = 1. It is shown that the gap between the SNR corresponding to the lowest data MCS1 and EDMG-Header-B for PER = 10-2 level is equal to ~5.2 dB.

Figure 2: PER vs SNR performance in IEEE 802.11ad #3 channel for OFDM mode.

**SP:**

Do you agree to include the text proposed in (30 6 4 Encoding of EDMG-Header-B) and describing EDMG-Header-B encoding and modulation method to the spec draft?

**References:**

1. Draft P802.11ay\_D0.3