IEEE P802.11
Wireless LANs

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| Block interleaver and \pi/2 rotation clarification |
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Abstract

This document proposes editorial changes to the subclause 30.5.9.5.4 Block interleaver to clarify the order of the block interleaver and \pi/2 rotation operations.

*Editor: introduce changes as proposed below*

* + - * 1. Block interleaver

The block interleaver is defined for π/2-64-QAM and π/2-64-NUC modulations. The block interleaver performs modulated complex symbols interleaving inside a SC symbol block and its parameters depend on the *NSPB*, *NCB*, , , and  parameters.

The input to the interleaver for the ith spatial stream is a SC symbol block  of length *NSPB* × *NCB* and composed of 64-QAM or 64-NUC symbols (before application of π/2-rotation) , where *q* denotes the SC symbol block number, *q* = 0, 1, …, .

The output of the interleaver for the ith spatial stream is a permuted SC symbol block  of the same length defined as , where *idx* defines the array of permutation indexes.

The array of permutation indexes *idx* is constructed as follows:

* , where *i* = 0, 1, …, *Nx* – 1 and *j* = 0, 1, …, *Ny* – 1.
* 
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* 

The symbols of the output interleaver SC symbol block are then rotated by π/2 as defined in 20.6.3.2.4.5 and 30.5.9.5.5 to produce the π/2-64-QAM and π/2-64-NUC constellation points, respectively.

* + - 1. General

EDMG and non-EDMG SC PPDU transmissions can be generated using a transmitter consisting of the following blocks:

* Scrambler scrambles the data to reduce the probability of long sequences of 0s and 1s; see 20.3.9 (Scrambler).
* LDPC encoder encodes the data to enable error correction. It pads the data with zeros to get an integer number of codewords and SC symbol blocks; see 30.5.9.5.
* Stream parser divides the output of the LDPC encoder into the groups of bits that are sent to different mapping devices. The sequence of the bits sent to different mapping devices is called a spatial stream; see 30.5.9.4.
* Constellation mapper and π/2-rotation block map the sequence of bits in each stream to constellation points (complex numbers); see 30.5.9.5.
* Interleaver performs interleaving inside a SC symbol block; see 30.5.9.5.4.
* STBC encoder spreads constellation points from NSS spatial streams into NSTS space-time streams using a space-time block code. SC mode defines single STBC scheme with NSS = 1 and NSTS = 2; see 30.5.9.5.3.
* GI insertion prepends the SC symbol block with guard interval defined as a π/2-BPSK modulated Golay sequence; see 30.5.9.2.
* Preamble builder builds π/2-BPSK modulated Ga and Gb Golay sequences comprising the L-STF, L-CEF, EDMG-STF, and EDMG-CEF fields; see 30.10.
* Spatial mapper maps space-time streams to transmit chains. This may include one of the following, see 30.5.10.2:
* Direct mapping: constellation points from each space-time stream are mapped directly into the transmit chains.
* Indirect mapping: constellation points from each space-time stream are mapped to each transmit chain.
* Digital beamforming: each vector of constellation points from all of the space-time streams is multiplied by a matrix of steering vectors to produce the input to the transmit chains.
* Cyclic shift (CSD) insertion prevents the signal transmission from unintentional beamforming. A cyclic shift is specified per transmitter chain for non-EDMG duplicate PPDU transmission; see 30.5.3.3.1.
* Pulse shaping performs convolution of constellation points with shape filter impulse response with possible sampling rate change. For duplicate channel transmission, pulse shaping may include a relative time delay between the primary and secondary channels. The exact definition of shape filter impulse response is out of scope of this standard and is implementation specific.

30.5.3.3.2 EDMG portion of SU PPDU transmission

Figure 129 shows the transmitter blocks used to generate the EDMG portion of SU PPDU. The EDMG-STF and EDMG-CEF fields are generated using the Preamble builder block. The TRN field is generated using TRN builder block. The Data field of the PPDU is generated using the scrambler, LDPC encoder, constellation mapper, interleaver, and GI insertion blocks. If STBC encoder is applied, then a single spatial stream is mapped to two space-time streams as defined in 30.5.9.5.3. The NSTS space-time streams are further mapped to NTX transmit chains, where NSTS ≤ NTX.



Figure 129—Transmitter block diagram for EDMG portion of SU PPDU transmission

NOTE—Interleaver is applied to π/2-64-QAM and π/2-64-NUC modulations only. π/2-rotation is applied to the 64-QAM and 64-NUC symbols at the output of the interleaver block.

* + - * 1. EDMG portion of MU PPDU transmission

Figure 130 shows the transmitter blocks used to generate the EDMG portion of an MU PPDU. The EDMG-STF and EDMG-CEF fields are generated using the Preamble builder block. The TRN field is generated using TRN builder block. The EDMG-Header-B and Data field of the PPDU are generated using scrambler, LDPC encoder, constellation mapper, interleaver, and GI insertion blocks. The PPDU encoding uses seed value defined in EDMG-Header-B and has independent flow per user. However, transmitter keeps the common space-time streams numeration over all users. If STBC encoder is applied, then a single spatial stream is mapped to two space-time streams as defined in 30.5.9.5.3. The NSTS space-time streams are further mapped to NTX transmit chains, where NSTS ≤ NTX.



Figure 130—Transmitter block diagram for EDMG portion of an MU PPDU transmission

NOTE—Interleaver is applied to π/2-64-QAM and π/2-64-NUC modulations only. π/2-rotation is applied to the 64-QAM and 64-NUC symbols at the output of the interleaver block.

**References:**

1. Draft P802.11ay\_D1.0