IEEE P802.11
Wireless LANs

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| 11ad PHY related Fixes |
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Abstract

This submission proposes a resolution to several DMG PHY/BF comments on TGmc.

The discussion is in reference to Draft P802.11REVmc\_D3.0.

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| 3242 | 2393.18 | 21.4.4.2.2 | Common CCA requirement for all DMG PHY types | DMG CCA requirement is defined under the Control PHY section, but there should be one CCA requirement applicable to all DMG PHY types. |

***Proposed Resolution: Revised***

***Editor: modify the text at P2392L21:22 as follows:***

The start of a valid DMG control PHY transmission at a receive level greater than-68dBm shall cause CCA to indicate busy with a probability > 90% within 3 µs.

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| 3245 | 2427.49 | 21.10.2.2.6 | The usage of TRN-R and TRN-T terms in the DMG PHY text is inconsistent. These terms used to refer to a block of 29 Golay-128 sequences (in the form of (CE,T,T,T,T) or (CE,R,R,R,R)), with multiple TRN-R or TRN-T fields (plural) appended to the end of a DMG frame (after AGC fields, another plural). All figures capturing DMG packet structures in Section 21 (Figures 21-2, 21-8, 21-10, and 21-12) still refer to the training field at the end of the packet as "TRN-R/T subfields" (plural), consistent with the original definitions of TRN-R and TRN-T fields in draft versions of .11ad. Sections 21.10.2.2.6 and 21.10.2.2.7 however define TRN-R and TRN-T as the group of 29 Golay-128 sequences above, with each DMG packet carrying a maximum of 1 TRN-R/T field (singular), and each TRN-R/T field including multiple "TRN-Unit"s. | Decide on one definition of TRN-R and TRN-T and remove inconsistencies. Commenter's opinion is to revert to original definition where a DMG packet is appended with multiple TRN-R/T fields (and in the process remove the ill-defined "TRN-Unit") for two reasons: (1) to stay consistent with AGC fields (multiple) preceding these fields, and (2) to possibly allow a mix of TRN-R and TRN-T fields appendded to DMG packets in future extensions. Otherwise, (1) all references to TRN-R and TRN-T (including the figures mentioned) need to be examined, and (2) two versions of "TRN-Unit" needs to be defined as the "TRN-Unit" in TRN-R is not the same as the "TRN-Unit" in TRN-T, for example TRN-R-Unit and TRN-T-Unit (defined respectively as (CE, R, R, R, R), and (CE, T, T, T, T)). |

**Proposed Resolution: Revised**

Discussion

The Terms TRN-R/T field, subfields and unit are defined, and described in the following diagram



This diagram does not appear in the text. The term TRN field covers both TRN subfields and CE estimation field. The term TRN-Unit was defined because the number appears at the header actually refers to TRN-units and the “old” text was confusing.

The differences between TRN-T and TRN-R are not in the sequence structure – the sequences are the same. They are different in transmitter behaviour, the transmitter may change antenna pattern at the beginning of each TRN-T subfield.

**Proposed changes**:

***Editor: replace the text of 21.10.2.2.2 and figure 21-22 with the following text as follows:***

The TRN-LEN parameter in the TXVECTOR or RXVECTOR of a BRP packet shall be greater than zero. Moreover, if the PACKET-TYPE parameter in the RXVECOTR or TXVECTOR is equal to TRN-R-PACKET, then the BEAM\_TRACKING\_REQUEST parameter in the corresponding RXVECTOR or TXVECTOR shall be set to Beam tracking not requested.

Each BRP packet is composed of an STF, a CE field, and a data field followed by a training field containing

an AGC training field and a TRN field.



***Editor: Change the text in P2425L19-22 as follows:***

A value of 0 in the Packet Type field and a value of 0 in the Beam Tracking Request field indicates a BRP-RX packet.

A value of 1 in the Packet Type field indicates a BRP-TX packet.

***Editor: replace subclauses 21.10.2.2.6 and 21.10.2.2.7 and figures 21-23 and 21-24 with the following text and figures:***

**21.10.2.2.6** **Beam Refinement TRN field**

The TRN field enables transmitter and receiver AWV training. The TRN field has the form shown in Figure 1 - TRN field definition.



Figure 1 - TRN field definition

The TRN field is composed of N TRN-Units. Each TRN-Unit is composed of a CE subfield and 4 TRN

subfields. Each subfield CE matches the Channel Estimation field defined in 21.3.6.3 (Channel Estimation

field). The 4N subfields TRN1 through TRN4N each consist of the sequence [Ga128 –Gb128 Ga128 Gb128

Ga128]. The sequences Ga128 and Gb128 are defined in Table 21-24 (The sequence Ga128(n)) and Table 21-25 (The sequence Gb128(n)), respectively, in 21.11 (Golay sequences). The sequences are transmitted using rotated

π/2-BPSK modulation.

In a BRP-RX packet, all the TRN and CE subfields are transmitted using the same AWV as the preamble and data field of the packet. In a BRP-TX packet, the CE subfield shall be transmitted using the same AWV as the preamble and data field of the packet. In a BRP-TX packet, the transmitter may change AWV at the beginning of each TRN subfield. Any transmit signal transients that occur due to TX AWV configuration changes at the beginning of TRN subfields shall settle by the end of the first 64 samples of the subfield.

***Editor: change the description of PACKET-TYPE in P2375L34-41 as follows***

Enumerated Type:

— TRN-R-PACKET indicates either a packet whose data part is

followed by one or more TRN subfields, or a packet that is

requesting TRN subfields to beappended to a future response

packet.

— TRN-T-PACKET indicates a packet whose data part is followed by

one or more TRN subfields. The transmitter may change AWV configuration at the beginning of each TRN subfield

This parameter is reserved if TRN-LEN is 0.

***Editor: change the description of CHAN\_MEASUREMENT in P2376l18 as follows:***

Channel as measured during the reception of TRN subfields. Each

measurement includes 63 complex numbers.

***Editor: in figure 21-2 replace TRN-R/T with TRN.***

***Editor: in P2388L47 replace TRN-R/T with TRN including in figure 21-8.***

***Editor: replace TRN-R/T with TRN in figure 21-10.***

***Editor: replace TRN-R/T with TRN in figure 21-12.***

***Editor: change the description of Packet Type in P2407L16-26 as follows***

Corresponds to the TXVECTOR parameter PACKET-TYPE.

— Packet Type = 0 indicates either a PPDU whose data part is

followed by one or more TRN\ subfields (when the Beam

Tracking Request field is 0 orin Control PHY), or a PPDU

that contains a request for TRN\ subfields to be appended

to a future response PPDU (when the Beam Tracking

Request field is 1).

— Packet Type = 1 indicates a PPDU whose data part is followed by one or more TRN subfields.

The field is reserved when the Training Length field is 0.

***Editor: replace TRN-R/T with TRN including figure 21-18 and 21-20.***

***Editor: modify P2420L35-44 as follows:***

Transmission of the PSDU is completed with the transmission of the last bits of the (encoded) PSDU. If no TRN-T/R fields are specified inthe PHY-TXSTART.request primitive, the PHY shall issue a PHYTXEND.confirm primitive after the transmission of the last bits. If TRN units are requested in the PHY-TXSTART.request primitive, the transmission continues with the transmissionof AGC subfields and TRN units. The PHY issues the PHY-TXEND.confirm primitive to the MAC after the transmission of the last TRN unit. The packet transmission shall be completed, and the PHY entity shall enter the receive state (i.e., PHYTXSTART shall be disabled). Each PHY-TXEND.request primitive is acknowledged with a PHY-TXEND.confirm primitive from the PHY.

***Editor: in P2423L6 replace TRN-R/T with TRN.***

***Editor: modify the text in P2423L45-54 as follows:***

In the beam refinement procedure, BRP packets are used to train the receiver and transmitter antenna. There

are two types of BRP packets: BRP-RX packets and BRP-TX packets:

— BRP-RX packets are packets that have TRN training subfields appended to them. These packets enable receiver antenna weight vector training.

— BRP-TX packets are packets that have TRN training subfields appended to them. The transmitting STA may change antenna configuration at the beginning of each subfield. The receiving STA performs measurements on these subfields and sends feedback to the STA that transmits the BRP-TX packet.

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| 3246 | 2425.32 | 21.10.2.2.4 | Minimum number of single carier codewords (NCWmin) defined in this section for "BRP packets" is meant to be applicable to any 802.11ad frame that carries AGC and training fields, including non-BRP frames (see Figures 9-81 and 9-82 for example). It seems "BRP packet" in this section loosely refers to any packet with AGC and traning fields attached - as evident by the first paragraph in the previous section 21.10.2.2.3, which throws the term "BRP packet". | Suggest to (1) remove the confusing term "BRP packet" altogether throughout the 802.11ad text, (2) use "BRP frame" only when referring to the management frame defined in Section 8.6.22.3 , and (3) use an appropriate term such as "beam training DMG packet" for all frames that carrry AGC and training fields, BRP frame or not. Sections 21.10.2.2.3 and 21.10.2.2.4 need to be revised at minimum |

Proposed resolution: **Revised**

Discussion: the changes proposed for CID 3245 address this issue.

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| 3247 | 2425.44 | 21.10.2.2.4 | N\_CBPS is not defined and used for single-carrier PHY. There is a reference to N\_CBPS for low-power single-carrier, which probably is meant to be 1 for BPSK and 2 for QPSK modulations; the low-power single-carrier section (21.7) needs to define this parameter. | Remove the third column (with the header N\_CBPS) from Table 21-23, and add proper definition of N\_CBPS to the low-power single-carrier PHY section. |

Proposed resolution: **Reject**

Discussion: N\_CBPS is defined in table 21-5 as Number of coded bits per symbol. Nothing in the definition makes it specific to OFDM. It is assumed that the reader knows what a single carrier symbol is. The term is also used in table 21-18. It is not necessary to define this for low-power single carrier PHY as it is not used in 21.7.

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| 3248 | 2408.46 | 46 | 21.6.3.1.4 | N\_GI, which is also misspelled on the next page at line 12) is not defined. Similarly, "guard symbol" is undefined. In fact, "symbol" is undefined for DMG SC PHY. | Either define N\_GI (I suspect intention was 64) and guard symbols, or eliminte them. |

Proposed resolution: **Revised**

***Editor: Add a the following lines to table 21-4***

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| NGI | 64 |
| NSPB | 448 |

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| 3249 | 2382.54 | 21.3.6.1 | Preamble is common to OFDM and SC PHY | Retitle the figure to "SC and OFDM preamble" |

Proposed Resolution: **Reject**

Discussion:

The preamble of OFDM is not the same because there are different sequences in the channel estimation field.

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| 3250 | 2384.05 | 21.3.6.3 | Equations are not consistent with Figures 21-5 and 21-6 and the first paragraph of Section 21.3.6.3. | Change the last Gv512 in the equation on line 5 and the last Gu512 in the equation on line 8 to Gv128 (no waveform change). |

Proposed resolution: **Accept**

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| 3251 | 2391.14 | 21.4.3.3.3 | L\_FDCW definition is missing; also the word "additional" is extra (6 bytes of data is added to header, but not additional). | (1) Change "L\_FDCW is" to "L\_FDCW=6 as", and (2) remove "additional". |

Proposed resolution: **Revised**

***Editor: change P2391L13-16 as follows:***

length of the header (including header CRC), and LFDCW=6 is the length of the data added to the header in the first LDPC codeword in octets. Define the number of header and data bits in the first LDPC code

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| 3254 | 2408.49 | 21.6.3.1.4 | Reference to N\_CBPB in the entire Section 21.6.3.1.4 implies MCS-dependence, but header bytes always take two code blocks of 448 chip times. Also undefined are: symbols, guard symbols, and the N\_GI parameter. | First sentence needs to be changed to something like "The header is transmitted using two Single-Carrier code blocks of 448 symbols with N\_GI guard symbols."; ideal text should define what symbol is for single-carrier PHY (or remove it altogether and use chip time), have a constant such as N\_SPCB (symbols per code block)defined as 448 and put in a table together with N\_GI definition to 64, which is also missinng. |

Proposed Resolution: **Accept**

Discussion: N\_SPB is defined in the resolution to CID 3248

***Editor: change P2408L49-51 as follows***

The header is encoded using a two SC block of NSPB symbols with

NGI guard symbols. The bits are scrambled and encoded as follows:

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| 3257 | 2410.16 | 21.6.3.2.3.3 | [BRP, BRP-TX, BRP-RX usage] The minimum number of codewords N\_Cwmin is applicable to any .11ad frame that has training fields appended and not just BRP frames (e.g., in beam tracking). It seems the terms BRP-TX and BRP-RX have been defined to be able to refer to any .11ad frame that has TRN-T and TRN-R fields, but these terms (1) add confusion with the BRP frame, and (2) do not sufficiently capture that they can refer to any frame type/subtype with beam tracking. Note -- this is a general comment against all usages of BRP, BRP-TX and BRP-RX, including Section 21.10.2. | With the current nomenclature, "BRP packet" on lines 16 and 24 needs to be replaced with something like "BRP-TX or BRP-RX packet", but this is still not ideal for the reasons explained. Few options: (1) do not use any special name and refer to these packets as "packets with beam training fields", (2) coin a new term such as "beam-training packet (BTP)" to be independent of BRP frames. |

Propsed Resolution: **Revised**

Discussion: BRP packet definiton has been corrected as part of the resolution to CID3245

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| 3259 | 2423.28 | 21.10.2.1 | Also indicate packet modulation for receive sector sweep. | Change the section title to "Sector-level sweep", and change the text to "Packets transmitted during transmit sector sweep are DMG control PHY packets. Packets transmitted during receive sector sweep are DMG control PHY or DMG SC PHY packets." |

Proposed Resolution: **Accept**

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| 3260 | 2423.45 | 21.10.2.2 | [BRP, BRP-TX, BRP-RX usage] It seems the terms BRP-TX and BRP-RX have been defined to be able to refer to any .11ad frame that has TRN-T and TRN-R fields, but these terms (1) add confusion with the BRP frame, and (2) do not sufficiently capture that they can refer to any frame type/subtype with beam tracking. Note -- this is a general comment against all usages of BRP, BRP-TX and BRP-RX, including Section 21.10.2.2.3. | Few options: (1) do not use any special name and refer to these packets as "packets with beam training fields", (2) coin a new term such as "beam-training packet (BTP)" to be independent of BRP frames. |

Proposed Resolution: **Revised**

Discussion:

There is a difference between BRP-RX and BRP-TX, which is the behavior during the transmission of the training subfields (switching antenna patterns or not switching antenna patterns) – see **21.10.2.2.6**. In review of the spec, one place was found in which the distinction is not necessary.

***Editor: change P1238L17 as follows***

The BRPIFS shall be used by STAs between transmissions of BRP frames.