IEEE P802.11
Wireless LANs

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| Resolution of BRP TXSS-related CIDs III |
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Abstract

This submission proposes resolutions to BRP TXSS-related CIDs. The text used as reference is D1.1.

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| **CID** | **Clause** | **Page** | **Comment** | **Proposed change** |
| 1158 |  | 183.01 | The minimum font size for a figure is about 6 points. Smaller than this, and it is hard to read on the printed standard. The publication editor may object and require the figure to be re-drawn, which is not something you want to do at that stage in the project. | Please check that the font size (after any scaling) is no smaller than 6 points. If it is consider splitting the diagram into parts, or replacing repeated text with a key. |
| 1791 | 10.38.9.5.1 | 183.01 | Characters in Figure 105 are too small, and it is not easy to read. | Please make characters in Figure 105 larger. |

**Proposed resolution**: Revised

**Background:** *For reference, figure in question is below*



**Modifications:** *Replace Figure 118 with the following:*



*Modify the first paragraph (lines 1-21) of page 217 (and include two new figures) as follows*

As shown in Figure 118 ~~and as defined in 10.39.9.5.3~~, the setup phase consists of the transmission of a BRP frame that requests transmit training by the initiator followed by the transmission of a BRP frame that confirms the procedure by the responder. After receiving confirmation of the BRP TXSS request from the responder, the initiator performs an Initiator BRP TXSS. As shown in Figure 1 ~~defined in 10.39.9.5.2~~, in an Initiator BRP TXSS the initiator transmits *Ninit* + 1 EDMG BRP-TX packets consecutively *Rresp* + 1 times, and the same DMG antenna or set of DMG antennas is used by the responder when receiving the TRN field of all *Ninit* + 1 EDMG BRP-TX packets within one of the *Rresp* + 1 repetitions. The feedback sent by the responder within the Initiator BRP TXSS consists of a BRP frame with feedback of the measurements it performed during the reception of EDMG BRP-TX packets. If receive training of the responder is included in the procedure, the TRN field of the EDMG BRP-RX packet sent immediately after the Initiator BRP TXSS, as shown in Figure 118, is transmitted by the initiator and received by the responder using antenna configurations determined in the preceding Initiator BRP TXSS.



Figure 1 – Initiator BRP TXSS

In a Responder BRP TXSS, if present, the responder transmits *Nresp* + 1 EDMG BRP-TX packets consecutively *Rinit* + 1 times, and the same DMG antenna or set of DMG antennas is used by the initiator when receiving the TRN field of all *Nresp* +1 EDMG BRP-TX packets within one of the *Rinit* +1 repetitions. The Responder BRP TXSS procedure is shown in Figure 2. The feedback sent by the initiator within the Responder BRP TXSS consists of a BRP frame with feedback of the measurements it performed during the reception of EDMG BRP-TX packets transmitted by the responder. If receive training of the initiator is included in the procedure, the TRN field of the one or more EDMG BRP-RX packets sent immediately after the Responder BRP TXSS are transmitted by the responder and received by the initiator using antenna configurations determined in the preceding phases of the procedure. The BRP TXSS is concluded with the transmission of a BRP frame with acknowledgement.



Figure 2 – Responder BRP TXSS

*Modify the first paragraph (lines 3-6) of page 218 as follows*

BRP frames transmitted in a BRP TXSS ~~during the setup phase,~~ with feedback within an Initiator BRP TXSS, ~~and~~ with feedback within a Responder BRP TXSS, and with acknowledgement at the end of the procedure shall be transmitted and received with the same DMG antennas and AWVs used in the setup phase. Also, these frames shall not include a TRN field.

*Modify the fourth paragraph (lines 9-17) of page 221 as follows*

For EDMG BRP-TX packets used in a BRP TXSS, the AWV used in the transmission of the first P TRN subfields of each TRN-Unit, where P is the number of TRN subfields determined by the EDMG TRN-Unit P field within the EDMG-Header-A of the packet, depends on whether the DMG antenna used in the transmission of an EDMG BRP-TX packet changes at the beginning of the TRN field. As defined in X, if the TRN field of an EDMG BRP-TX packet is transmitted with the same DMG antenna as the remaining fields of the packet, the first P TRN subfields of each TRN-Unit shall be transmitted using the same AWV as the remaining fields of the packet. If the DMG antenna used in the transmission of an EDMG BRP-TX packet changes at the beginning of the TRN field, the AWV used in the transmission of the first P TRN subfields of each TRN-Unit shall be selected in an implementation dependent manner and should be the same for all TRN-Units.

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| **CID** | **Clause** | **Page** | **Comment** | **Proposed change** |
| 1794 | 10.38.9.5.2.2.1 | 186.02 | Characters in Figure 106 are too small, and it is not easy to read. | Please make characters in Figure 106 larger. |

**Proposed resolution**: Revised

**Modifications:** *Replace Figure 119 with the following one*



*Replace Figure 120 with the following one*



*Modify the last paragraph (lines 29-36) of page 219 as follows*

An example of a BRP TXSS is shown in Figure 119 for a scenario in which the initiator and the responder have ~~has~~ two DMG antennas, ~~the responder has three DMG antennas,~~ and both the initiator and responder use one DMG antenna when performing measurements. It is assumed in this example that the best AWV configuration identified in the Initiator BRP TXSS was obtained when the initiator used DMG antenna 0 and the responder used DMG antenna 1, and that the best AWV configuration identified in the Responder BRP TXSS was obtained when the responder used DMG antenna ~~2~~ 0 and the initiator used DMG antenna 0. If the responder in this example was capable of processing all of its antennas simultaneously, the duration of the BRP TXSS could be shortened as shown in Figure 120.

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| **CID** | **Clause** | **Page** | **Comment** | **Proposed change** |
| 1790 | 10.38.9.5.1 | 182.21 | There is a sentence "an optional receive training phase of the responder, an optional transmit training phase by the responder with feedback," in 182.21. However, in 185.15, there is a sentence "Receive training of the responder after the Initiator BRP TXSS is mandatory in SISO BRP TXSS". Also, in 191.8, there is a sentence "Responder BRP TXSS is mandatory in MIMO BRP TXSS". It seems that the sentence in 182.21 is a bit misleading. | It would be reader friendly if we insert a table showing which phase is mandatory and optional for SISO BRP TXSS and MIMO BRP TXSS. |

**Proposed resolution**: Revised

**Modifications:** *Modify lines 12 and 13 of page 216 as follows*

A BRP TXSS ~~is comprised of a~~ may include as many as six phases: ~~mandatory~~ setup phase, ~~a mandatory~~ transmit training phase by the initiator with feedback, referred to as Initiator BRP TXSS, ~~an optional~~ receive training phase of the responder, ~~an optional~~ transmit training phase by the responder with feedback, referred to as Responder BRP TXSS, ~~an optional~~ receive training phase of the initiator, and ~~a mandatory~~ acknowledgement phase. An example of BRP TXSS is shown in Figure 118 for the case when the procedure is comprised of all ~~mandatory and optional~~ six phases. In Figure 118 and in the remainder of 10.39.9.5, *Ninit* is the value of the TXSS-PACKETS subfield within the EDMG BRP Request element in the BRP frame sent by the initiator to start the BRP TXSS, *Rresp* is the value of the TXSS-REPEAT subfield within the EDMG BRP Request element in the BRP frame sent by the responder to confirm the procedure, *Nresp* is the value of the TXSS-PACKETS subfield within the EDMG BRP Request element in the BRP frame sent by the responder to confirm the procedure, and *Rinit* is the value of the TXSS-REPEAT subfield within the EDMG BRP Request element in the BRP frame sent by the initiator to start the BRP TXSS.

*In page 217, add the following paragraph after the one in lines 27-31*

A BRP TXSS shall include a setup phase, an Initiator BRP TXSS, and an acknowledgement phase. As defined in 10.39.9.5.2, receive training for responder, Responder BRP TXSS, and receive training for initiator are included in a BRP TXSS depending on whether the procedure is a SISO BRP TXSS or a MIMO BRP TXSS and, for a SISO BRP TXSS, on reciprocity characteristics of the initiator and the responder.

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| 1394 | 30.2.2 | 218.19 | TXVECTOR/RXVECTOR parameters necessary to support BRP TXSS must be defined. | Define TXVECTOR/RXVECTOR parameters to support BRP TXSS, if any. |

**Proposed resolution**: Revised

**Modifications:** *Add the following to**Table 32 (TXVECTOR and RXVECTOR parameters)*

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| **Parameter** | **Condition** | **Value** | **TXVECTOR** | **RXVECTOR** |
| BRP\_TXSS\_SETUP | FORMAT is EDMG | In the TXVECTOR, indicates a request for the setup phase of a BRP TXSS (see 10.39.9.5). In the RXVECTOR, indicates that a request for the setup phase of a BRP TXSS was received.Enumerated type:BRP\_TXSS\_SISO indicates a request for a SISO BRP TXSS or that a SISO BRP TXSS request was received.BRP\_TXSS\_MIMO indicates a request for a MIMO BRP TXSS or that a MIMO BRP TXSS request was received. | Y | Y |
| BRP\_TXSS\_EXECUTION | FORMAT is EDMG | In the TXVECTOR, indicates a BRP TXSS request (phases that follow the setup phase, as defined in 10.39.9.5). In the RXVECTOR, indicates that a BRP TXSS request (phases that follow the setup phase) was received.Enumerated type:1: Execute BRP TXSS (phases that follow the setup phase).0: Do not execute BRP TXSS | Y | Y |
| BRP\_TXSS\_PACKETS | FORMAT is EDMG | In the TXVECTOR, if BRP\_TXSS\_SETUP is equal to either BRP\_TXSS\_SISO or BRP\_TXSS\_MIMO, it indicates the number of packets (TXSS\_PACKETS) requested by the EDMG STA.In the RXVECTOR, if BRP\_TXSS\_SETUP is equal to either BRP\_TXSS\_SISO or BRP\_TXSS\_MIMO, it indicates the number of packets (TXSS\_PACKETS) requested by the peer EDMG STA.In the TXVECTOR, if BRP\_TXSS\_EXECUTION is equal to 1, it indicates the number of packets (TXSS\_PACKETS) requested by the peer EDMG STA.Value is an integer in the range 1 to 8. | Y | Y |
| BRP\_TXSS\_REPEAT | FORMAT is EDMG | In the TXVECTOR, if BRP\_TXSS\_SETUP is equal to either BRP\_TXSS\_SISO or BRP\_TXSS\_MIMO, it indicates the number of repetitions (TXSS\_REPEAT) requested by the EDMG STA.In the RXVECTOR, if BRP\_TXSS\_SETUP is equal to either BRP\_TXSS\_SISO or BRP\_TXSS\_MIMO, it indicates the number of repetitions (TXSS\_REPEAT) requested by the peer EDMG STA.In the TXVECTOR, if BRP\_TXSS\_EXECUTION is equal to 1, it indicates the number of repetitions (TXSS\_REPEAT) requested by the peer EDMG STA.Value is an integer in the range 1 to 8. | Y | Y |

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| **CID** | **Clause** | **Page** | **Comment** | **Proposed change** |
| 1364 | 10.38.9.5.1 | 183.25 | "As defined in 10.38.9.5.2, if the BRP frames used in a BRP TXSS are sent with a single transmit chain, the TRN field of EDMG BRP-TX and EDMG BRP-RX packets sent in the procedure may be transmitted with a different DMG antenna than the one used in the setup phase." - This is somewhat limitting - even if a device have several transmit chains, it may have to swtich between different antenna sets. | submission will be provided |

**Proposed resolution**: Revised

**Discussion:** The definition and functionality of MIMO BRP TXSS has been addressed/improved in the resolution of CIDs 1027, 1028, and 1795 in 18/0089r0. As is now better defined in the draft, MIMO BRP TXSS allows an EDMG STA to train *N* transmit chains simultaneously (TRN field is composed by orthogonal sequences). Also, it should be noted that 18/0089r0 enabled each EDMG STA to transmit more than one EDMG BRP-TX packet in its SLS, as well as the receiver to request the EDMG BRP-TX packets to be transmitted more than once. The modifications listed below complete the changes necessary to support a MIMO device that has more DMG antennas than transmit chains to train multiple sets of DMG antenna sets in a single MIMO BRP TXSS.

**Modifications:** *Change lines 22-26 in page 217 as follows*

~~As defined in 10.39.9.5.2, if the BRP frames used in a BRP TXSS are sent with a single transmit chain, the~~ The TRN field of EDMG BRP-TX and EDMG BRP-RX packets sent in ~~the procedure~~ a BRP TXSS may be transmitted with ~~a~~ different DMG ~~antenna~~ antennas than the ~~one~~ ones used in the setup phase. Also, the TRN field of EDMG BRP-TX and EDMG BRP-RX packets used in the procedure may be received with ~~a DMG antenna that is~~ DMG antennas that are not the same ~~one~~ ones used in the setup phase.

*Change 10.39.9.5.2.3 (MIMO BRP TXSS configuration) as follows*

Receive training of the responder and receive training of the initiator shall not be performed in a MIMO BRP TXSS procedure. The L-RX field within the EDMG BRP Request element in the BRP frames transmitted during the setup phase of a MIMO BRP TXSS shall be set to zero.

Responder BRP TXSS is mandatory in MIMO BRP TXSS.

An example of a MIMO BRP TXSS is shown in Figure 123.



Figure 123 - Example of MIMO BRP TXSS.

BRP frames sent in ~~the setup phase of~~ a MIMO BRP TXSS shall be transmitted by applying spatial expansion and mapping a single space-time stream to all N transmit chains to be trained in the procedure.The TRN field of EDMG BRP-TX packets sent in a MIMO BRP TXSS shall consist of N orthogonal waveforms, as defined in 30.9.2.

BRP frames transmitted in a MIMO BRP TXSS during the setup phase, with feedback within an Initiator BRP TXSS, with feedback within a Responder BRP TXSS, and with acknowledgement at the end of the procedure shall not include a TRN field.

In the setup phase of a MIMO BRP TXSS, if an implementation has not yet determined AWVs to use in some of its transmit chains (for example, if a station has been only using a single transmit chain before the setup phase), the AWVs used by such chains should be selected in an implementation dependent manner.

The DMG antennas and AWVs used in the transmission of all fields except for the TRN field of EDMG BRP-TX packets sent in the Initiator BRP TXSS, the Responder BRP TXSS, and with acknowledgement shall be the same ones used in the setup phase. The TRN field of EDMG BRP-TX packets sent in a MIMO BRP TXSS may be transmitted with a different set of DMG antennas than the one used in the transmission of the remaining fields of the same packet.

Similarly, the DMG antennas and AWVs used in the reception of all fields except for the TRN field of BRP frames sent in the Initiator BRP TXSS, the Responder BRP TXSS, and with acknowledgement shall be the same ones used in the setup phase. The TRN field of EDMG BRP-TX packets sent in a MIMO BRP TXSS may be received with a set of DMG antennas that is not the same one used in the reception of the remaining fields of the same packet.

~~BRP frames sent in the Initiator BRP TXSS, the Responder BRP TXSS, and with acknowledgement shall be transmitted using EDMG PPDUs by applying spatial expansion and mapping a single space-time stream to all N transmit chains to be trained in the procedure. The TRN field of EDMG BRP-TX packets used in MIMO BRP TXSS shall consist of N orthogonal waveforms, as defined in 30.9.2.~~

The Initiator BRP TXSS shall consist of the transmission of $N\_{init}$ + 1 EDMG BRP-TX packets consecutively repeated *Rresp* + 1 times by the initiator followed by the transmission of a BRP frame with feedback by the responder. The EDMG BRP-TX packets transmitted in an Initiator BRP TXSS shall be configured as follows:

* The TRN-Unit RX Pattern field in the EDMG-Header-A shall be set to 1;
* The EDMG-Header-A of the *ith* EDMG BRP-TX packet within each of the *Rresp* + 1 repetitions, where $1\leq i\leq N\_{init}+1$, shall have the same value for the fields EDMG TRN Length, EDMG TRN-Unit P, EDMG TRN-Unit M and EDMG TRN-Unit N; ~~and~~
* ~~The TRN subfields of the~~ *~~i~~~~th~~* ~~EDMG BRP-TX packet within each of the~~ *~~R~~~~resp~~* ~~+ 1 repetitions, where~~ $1\leq i\leq N\_{init}+1$~~, shall be transmitted using the same AWVs.~~
* The TRN subfields of the *ith* EDMG BRP-TX packet within each of the *Rresp* + 1 repetitions, where $1\leq i\leq N\_{init}+1$, shall be transmitted using the same set of DMG antennas and the same AWVs; and
* The set of DMG antennas used when transmitting the TRN field of the *Ninit* + 1 EDMG BRP-TX packets within one of the *Rresp* + 1 repetitions in an Initiator BRP TXSS should be different.

Similarly, the Responder BRP TXSS shall consist of the transmission of *Nresp* +1 EDMG BRP-TX packets consecutively repeated *Rinit* + 1 times by the responder followed by the transmission of a BRP frame with feedback by the initiator. The EDMG BRP-TX packets transmitted in a Responder BRP TXSS shall be configured as follows:

* The TRN-Unit RX Pattern field in the EDMG-Header-A shall be set to 1;
* The EDMG-Header-A of the *ith* EDMG BRP-TX packet within each of the *Rinit* + 1 repetitions, where $1\leq i\leq N\_{resp}+1$, shall have the same value for the fields EDMG TRN Length, EDMG TRN-Unit P, EDMG TRN-Unit M and EDMG TRN-Unit N; ~~and~~
* ~~The TRN subfields of the~~ *~~i~~~~th~~* ~~EDMG BRP-TX packet within each of the~~ *~~R~~~~init~~* ~~+ 1 repetitions, where~~ $1\leq i\leq N\_{resp}+1$~~, shall be transmitted using the same AWVs.~~
* The TRN subfields of the *ith* EDMG BRP-TX packet within each of the *Rinit* + 1 repetitions, where 1 ≤ *i ≤ Nresp* + 1, shall be transmitted using the same set of DMG antennas and the same AWVs; and
* The set of DMG antennas used when transmitting the TRN field of the *Nresp* + 1 EDMG BRP-TX packets within one of the *Rinit* + 1 repetitions in a Responder BRP TXSS should be different.

In both Initiator BRP TXSS and Responder BRP TXSS of a MIMO BRP TXSS, the set of DMG antennas used when receiving the TRN subfields of EDMG BRP-TX packets of different repetitions should be different.

~~The AWVs used in the transmission of all fields except for the TRN field of BRP frames sent in the Initiator BRP TXSS, the Responder BRP TXSS, and with acknowledgement shall be the same ones used in the setup phase. Similarly, the AWVs used in the reception of all fields except for the TRN field of BRP frames sent in the Initiator BRP TXSS, the Responder BRP TXSS, and with acknowledgement shall be the same ones used in the setup phase.~~

A STA that is part of a MIMO BRP TXSS shall provide feedback for each of the receive chains trained in the procedure, as defined in 10.38.9.5.4.

~~For EDMG BRP-TX packets transmitted in a MIMO BRP TXSS, the value of the TXVECTOR parameter EDMG\_TRN\_LEN shall be set to k, where k is the number of TRN-Units used in the transmit training.~~

The first TRN-Unit in an EDMG BRP packet used in a MIMO BRP TXSS may be used for the initiator and responder to switch one or more DMG antennas used and shall not be processed by the receiver. Therefore, for EDMG BRP-TX packets transmitted in a MIMO BRP TXSS, the value of the TXVECTOR parameter EDMG\_TRN\_LEN shall be set to k + 1, where k is the number of TRN-Units used for transmit training. The TRN subfields that comprise the first TRN-Unit in EDMG BRP-TX packets used as part of a MIMO BRP TXSS shall not be included in the TRN subfield and AWV feedback ID indexing procedures described in 30.9.2.2.5.

When transmitting an EDMG BRP-TX packet as part of a MIMO BRP TXSS, an EDMG STA may change the set of DMG antennas used in the transmission of its TRN field during the first TRN-Unit and shall not change DMG antennas during the remaining TRN-Units.

When receiving an EDMG BRP-TX packet as part of MIMO BRP TXSS, an EDMG STA may change the set of DMG antennas used in the reception of the TRN field during the first TRN-Unit and shall not change DMG antennas during the remaining TRN-Units.

For EDMG BRP-TX packets used in a MIMO BRP TXSS, the AWVs used in the transmission of the first P TRN subfields of each TRN-Unit depends on whether the set of DMG antennas used in the transmission of the EDMG BRP-TX packet changes at the beginning of the TRN field. If the TRN field of an EDMG BRP-TX packet is transmitted with the same set of DMG antennas as the remaining fields of the packet, the first P TRN subfields of each TRN-Unit shall be transmitted using the same DMG Antennas and AWVs as the remaining fields of the packet. If the set of DMG antennas used in the transmission of an EDMG BRP-TX packet changes at the beginning of the TRN field, the AWVs used in the transmission of the first P TRN subfields of each TRN-Unit are selected in an implementation dependent manner and should be the same for all TRN-Units.

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| **CID** | **Clause** | **Page** | **Comment** | **Proposed change** |
| 1365 | 10.38.9.5.2.2.2 | 187.20 | " that has the Antenna Pattern Reciprocity subfield in the DMG STA Capability Information field of the responder is equal to 1." - this text repeats many times in this subclause. It should be replaced with something shorter to make the text easier to read by humans | Define "A STA that has the Antenna Pattern Reciprocity subfield in the DMG STA Capability Information field of the respodner set to 1" as Antenna Pattern Reciprocal STA and replace throught this subclause - submission will be provided |
| 1366 | 10.38.9.5.2.2.2 | 187.25 | "DMG Antenna Reciprocity field in the DMG STA Capability informaiton set to 1" - repeats in the subclause - define a shorter term to make the text easier to read | Define: "A STA that has the DMG Antenna Reciprociy field in the the DMG STA Capability information field set to 1" as DMG Antenna Reciprocal STA and replace throughout the subclause - submission will be proviced |

**Proposed resolution:** Accepted