IEEE P802.11
Wireless LANs

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| Proposed pre-ballot changes related to 11ad text |
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Abstract

This submission contains corrections to inconsistencies and ambiguities found in the text of the 11ad amendment.

The goal of this submission is to correct these issues prior to ballot of 802.11REVmc D2.0.

**Introduction**

This submission contains corrections to inconsistencies and ambiguities found in the text of the 11ad amendment. All these corrections have been detected during implementation and interoperability testing of the 11ad amendment.

The proposed modifications are in reference to Draft P802.11REVmc\_D1.5.

Each set of proposed changes is preceded by a discussion text that describes the motivation for the following set of proposed changes. The discussion text is highlighted in yellow and is included for the sole purpose of understanding of the proposed changes, but is not meant to be included in the draft standard.

**Proposed text changes**

**6.**

**6.3**

**6.3.26**

**6.3.26.1**

*Discussion:*

* *Table 6-1 differentiates ADDTS for PTP TSPEC and DMG TSPEC contexts using “DMG STA” and “PCP”. This is confusing and may result in incorrect interpretation of ADDTS behaviour. E.g. that PCP does not transmit an ADDTS Request.*
* *The normative behavior (10.4) is different depending on the purpose of the ADDTS exchange (set up a new TS or set up an allocation (Service Period)). Therefore, we propose to reflect that in Table 6-1 by adding an additional row.*

*Change Table 6-1 as follows:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Primitive** | **Request** | **Confirm** | **Indication** | **Response** |
| ADDTS (in the context of establishing a TS) | DMG STANon-AP QoS STA | DMG STANon-AP QoS STA | ~~PCP~~DMG STAHC | ~~PCP~~DMG STAHC |
| ADDTS (in the context of requesting an allocation) | Non-PCP/non-AP DMG STA | Non-PCP/non-AP DMG STA | DMG PCP/AP | DMG PCP/AP |
| DELTS | DMG STANon-AP QoS STA~~PCP~~HC | DMG STANon-AP QoS STA~~PCP~~HC | DMG STANon-AP QoS STA~~PCP~~HC | - |

**6.3.26.3**

***6.3.26.3.2***

*Discussion: The Extended Schedule element in not included in DMG ADDTS Response frame variant however it is mentioned in the MLME-ADDTS.confirm primitive.*

*Change the primitive as follows*

MLME-ADDTS.confirm(

ResultCode,

DialogToken,

TSDelay,

TSPEC,

Schedule,

TCLAS,

TCLASProcessing,

EBR,

HigherLayerStreamID,

STAAddress,

~~Extended Schedule,~~

DMG TSPEC,

Multi-band,

U-PID,

MMS,

VendorSpecificInfo

)

*Delete the “*Extended Schedule*” row in the table*

**6.3.26.5**

***6.3.26.5.2***

*Discussion: The Extended Schedule element in not included in DMG ADDTS Response frame variant however it is mentioned in the MLME-ADDTS.response primitive.*

*Change the primitive as follows*

MLME-ADDTS.response(

ResultCode,

DialogToken,

STAAddress,

TSDelay,

TSPEC,

Schedule,

TCLAS,

TCLASProcessing,

EBR,

HigherLayerStreamID,

~~Extended Schedule,~~

DMG TSPEC,

Multi-band,

U-PID,

MMS,

VendorSpecificInfo

)

*Delete the “*Extended Schedule*” row in the table*

**6.5**

**6.5.9 PLME-DMGTESTMODE.request**

**6.5.9.2**

*Discussion: the length of a PHY packet is never 0.*

*Change the indicated row in the table*

|  |  |  |  |
| --- | --- | --- | --- |
| LENGTH | integer | ~~0~~1 – 262143 | Selects the number of payload octets to be transmitted in each PPDU~~packet~~. |

**8.**

**8.4**

**8.4.2**

**8.4.2.29 TSPEC element**

*Discussion: there is inconsistency of terminology between the statement that allows using the same TSID between two DMG STAs twice by reversing the roles of source and destination (P365, first paragraph) “*An additional 16 TSs may be created between the two DMG STAs by reversing the roles of source and destination.*” and how the indication of the downlink and uplink is used when the P2P TSPEC is created.*

*Change the last paragraph as follows*

The Reliability subfield in an ADDTS Request frame that has the Direction subfield set to downlink or in an ADDTS Response frame that has the Direction field set to uplink indicates the ~~receiver’s~~ expectation of the PER of the destination DMG station for this TS. The Reliability subfield in an ADDTS Request frame that has the Direction subfield set to uplink or in an ADDTS Response frame that has the Direction field set to downlink is reserved. The reliability information is provided by the SME using the MLMEADDTS.request primitive and MLME-ADDTS.response primitives. Together with the link margin (9.38) and other implementation-specific information, this value can be used by the transmitter source DMG station of this TS to estimate the MCS to be used for this particular TS.

**8.4.2.127 DMG Capabilities element**

***8.4.2.127.2 DMG STA Capability Information field***

*Discussion: need to make it clear that an implementation can adjust the value of the number of sectors to account for the LBIFS interframe space. This allows for a more flexible implementation.*

*Change the eigth and nineth paragraphs as follows*

The Total Number of Sectors field indicates the total number of transmit sectors the STA uses in a transmit sector sweep combined over all DMG antennas, including any LBIFS required for DMG antenna switching (see 9.36). The value of this field is in the range of 1 to 128, with the value being equal to the bit representation plus 1.

*Discussion: the last sentence in this paragraph is unnecessary (and incorrect since the number of transmitted frames is equal to the value of the RXSS Length field) since the behavior is already described in 9.36.*

The value represented by the RXSS Length field specifies the total number of receive sectors combined over all receive DMG antennas of the STA, including any LBIFS required for DMG antenna switching (see 9.36). The value represented by this field is in the range of 2 to 128 and is given by (RXSS Length+1)×2. ~~The maximum number of SSW frames transmitted during an RXSS is equal to the value of (RXSS Length+1)×2 times the total number of transmit DMG antennas of the peer device.~~

**8.4.2.129 DMG Beam Refinement element**

*Discussion: rephrasing of the text to improve clarity and remove ambiguity*

*Change the nineth paragraph as follows*

The BS-FBCK field specifies the index of the TRN-T field that was received with the best quality ~~sector that resulted in the best receive quality~~ in the last received BRP-TX PPDU~~packet~~, where the first TRN-T field in the PPDU is defined as having an index equal to 1. If the last received PPDU~~packet~~ was not a BRP-TX PPDU~~packet~~, this field is set to 0. The determination of ~~the~~ best quality ~~sector~~ is implementation dependent.

**8.4.2.153 Upper Layer Protocol Identification element**

*Discussion: The LLC Header Copy field is always present. So, the paragraph should only point to the table that has the length of the field.*

*Change the fourth paragraph as follows*

~~The LLC Header Copy field is not present if the value of the No-LLC field is 0; otherwise, it contains a copy of the LLC header field values if the value of the No-LLC field is 1. When the field is present, t~~The size of the LLC Header Copy field is specified in Table 8-219 (LLC Header Copy field size(11ad)).

**8.5**

**8.5.5 Beamforming Control field**

*Discussion: there are more fields that are reserved. Therefore, propose to generalize text.*

*Change the second paragraph as follows*

The Beamforming Training subfield is set to 1 to indicate that the source DMG STA intends to initiate beamforming training with the destination DMG STA at the start of the allocation and is set to 0 otherwise. If the Beamforming Training subfield is set to 0, ~~the IsInitiatorTXSS, IsResponderTXSS, and RXSS Length subfields are reserved~~ all other fields of the Beamforming Control field are reserved.

*Discussion: there is at least one TXSS within an SP. In other words, there are no back-to-back RXSSs.*

*Insert the following paragraph after the fourth paragraph*

When the Beamforming Control field is transmitted within an Extended Schedule element, either the IsInitiatorTXSS field or the IsResponderTXSS field is set to 0, but not both.

*Discussion: need to make it clear that an implementation can adjust the value of the number of sectors to account for the LBIFS interframe space. This allows for a more flexible implementation of multi-antenna systems.*

*Change the fifth paragraph as follows*

The RXSS Length subfield is valid only if at least one of IsInitiatorTXSS subfield or IsResponderTXSS subfield is equal to 0 and is reserved otherwise. The value represented by the RXSS Length subfield specifies the total number of receive sectors combined over all receive DMG antennas of the STA, including any LBIFS as necessary for DMG antenna switching. The value represented by this subfield is in the range of 2 to 128 and is given by (RXSS Length+1)×2. ~~The maximum number of SSW frames transmitted during an RXSS is equal to the value of (RXSS Length+1)×2 times the total number of transmit DMG antennas of the peer device.~~

*Discussion: need to make it clear that an implementation can adjust the value of the number of sectors to account for the LBIFS interframe space. This allows for a more flexible implementation of multi-antenna systems.*

*Change the last to last paragraph as follows*

When the BF Control field is transmitted in a Grant frame, the Total Number of Sectors subfield indicates the total number of sectors the initiator uses during the ISS, including any LBIFS required for DMG antenna switching (see 9.36). When the BF Control field is transmitted in a Grant ACK frame, the Total Number of Sectors subfield indicates the total number of sectors the responder uses during the RSS.

**8.5.6**

*Discussion: Undefined value for BeamLink Maintenance Value indicates the STA does not participate in beamformed link maintenance. This is irrespective of BeamLink isMaster. If it desires, the DMG STA supporting link maintenance may still keep its own counter.*

*Also, the result for when isMaster=1 but dot11BeamLink MaintenanceTime for the pair of STAs are not equal has not been defined.*

*Change Table 8-228 “The beamformed link maintenance negotiation” as follows:*

|  |  |  |  |
| --- | --- | --- | --- |
| BeamLink isMaster (DMG STA-A) | BeamLink isMaster (DMG STA-B) | dot11BeamLinkMaintenanceTime (DMG STA-A) vs. dot11BeamLinkMaintenanceTime (DMG STA-B) | Result |
| 0 | 0 | >= | dot11BeamLinkMaintenanceTime (DMG STA-A) |
| 1 | 0 | >, <, = | dot11BeamLinkMaintenanceTime (DMG STA-A) |
| 1 | 1 | >= | dot11BeamLinkMaintenanceTime (DMG STA-A) |
| 0 or 1 | 0 or 1 | If either dot11BeamLinkMaintenanceTime~~value~~ (DMG STA-A) or dot11BeamLinkMaintenanceTime (DMG STA-B)~~equals 0~~ is undefined | Undefined |

**8.6.3**

*Discussion:*

* *802.11-2012 enables delivery of RD and AC constraint when transmitting BAR by using of Control Wrapper, but 802.11ad does not provide the functionality. Propose to allow aggregation of BAR with QoS Null to provide the same functionality as 802.11-2012.*
* *In addition, propose to clean up the text and separate the DMG and non-DMG behavior.*

*Change the indicated row in (Table 8-367—A-MPDU contents in the data enabled immediate response context) as follows*

|  |  |  |
| --- | --- | --- |
| Data MPDUs sent under an HT-immediate Block Ack agreement or, in a DMG BSS, QoS Null MPDUs with Ack Policy set to No Acknowledgment | QoS Data MPDUs with the same TID, which corresponds to an HT-immediate Block Ack agreement~~, or in a DMG BSS QoS Null MPDUs with Ack Policy set to No Acknowledgment~~.These MPDUs all have the Ack Policy field equal to the same value, which is either Implicit Block Ack Request or Block Ack.In addition, in a DMG BSS, QoS Null MPDUs with Ack Policy set to No Acknowledgment. | Of these, at most one of the following is present in a non-DMG BSS:~~— QoS Null MPDU (in DMG BSS only) with Ack Policy set to No~~~~Acknowledgment~~— One or more QoS Data MPDUs with the Ack Policy field equal to Implicit Block Ack Request— A BlockAckReq frameOf these, at most one of the following is present in a DMG BSS:— One or more QoS Data MPDUs with the Ack Policy field equal to Implicit Block Ack Request— QoS Null MPDUs with Ack Policy set to No Acknowledgment— A BlockAckReq frame |
| Immediate BlockAckReq  | At most one BlockAckReq frame with a TID that corresponds to an HT-immediate Block Ack agreement. This is the last MPDU in the A-MPDU. It is not present if any QoS data frames for that TID are present. |

**9.**

**9.3**

**9.3.2**

**9.3.2.3**

***9.3.2.3.11 LBIFS***

*Discussion: defining LBIFS in terms of SIFS time is problematic, since it fundamentally depends on a SSW and SBIFS (note, LBIFS is used for the multi antenna case). Therefore, it is better and more accurate to redefine the LBIFS accordingly. In addition, need to include “%” towards the end of the paragraph.*

*Change the first paragraph as follows*

The LBIFS shall be used between transmissions employing different DMG antennas and when the recipient STA is expected to switch DMG antennas. LBIFS is equal to ~~6×aSIFStime~~ TXTIME(SSW) + 2×SBIFS. An implementation of a DMG STA shall not allow the space between frames that are separated by LBIFS time, as measured on the medium, to vary from the nominal LBIFS value by more than –0% or +10% of aSlotTime.

**9.3.2.11 NAV distribution**

*Discussion: this restriction is unnecessary and complicates implementation. Propose to remove it.*

*Delete the following paragraph (last one)*

~~A DMG STA shall not transmit a DMG DTS frame outside an SP.~~

**9.34**

**9.34.3**

*Discussion: a STA is always awake in the ATI (10.2.6). Therefore, the text is incorrect and needs to be removed.*

*Change the fourth paragraph as follows*

During each ATI the PCP/AP shall schedule transmissions to a non-PCP/non-AP STA if the non-PCP/non-AP STA Heartbeat field in the STA’s DMG Capabilities element within the Association Request frame of the last successful association attempt is 1 ~~and the non-PCP/non-AP STA is in the Awake state~~. If the non-PCP/non-AP STA does not respond to the frame transmitted by the PCP/AP, the PCP/AP shall use the DMG Control modulation class (9.7.7.1) at its next transmission attempt to the non-PCP/non-AP STA. The PCP/AP shall use the DMG Control modulation class for all subsequent transmissions to the non-PCP/non-AP STA until it receives a valid frame from the non-PCP/non-AP STA.

**9.34.4**

*Discussion: In a few places in 9.34, the phrase “shall not transmit” is confusing and may be interpreted as if a STA is not even supposed to respond to a received frame with an ACK, even though that is not the intention. Propose to change the text to improve clarify.*

*Change the first paragraph as follows*

During the DTI, a STA may initiate a ~~transmit~~ frame~~s~~ exchange (following the DMG channel access rules) if any of the following conditions are met:

1. During a CBAP for which the STA is identified or included as source or destination (9.34.6.3, 9.34.7, and 9.34.8)
2. During an SP for which the STA is identified as source or destination (9.34.6.2 and 9.34.7)

and shall not initiate a frame exchange ~~transmit~~ if none of these conditions are met. A STA initiating data transfer shall check that the transaction, including acknowledgments, completes before the end of the CBAP or SP in which it was initiated.

*Change the last paragraph as follows*

The DMG low-power SC PHY (21.7) may be used only within SPs that have the LP SC Used subfield within the Extended Schedule element equal to 1 and shall not be used otherwise. A STA supports the DMG low-power SC PHY if the Low-Power SC PHY Supported subfield within its DMG Capabilities element is 1. A STA that supports the DMG low-power SC PHY shall not initiate a frame exchange ~~transmit a PPDU~~ using the DMG low-power SC PHY unless the STAs identified in the RA field of all MPDUs contained within the PPDU support the DMG low-power SC PHY. A STA can use the procedure described in 10.29.1 to discover the capabilities of another STA.

**9.34.5**

*Change the second paragraph as follows*

A STA shall not initiate a frame exchange ~~transmit~~ within a CBAP unless at least one of the following conditions is met:

**9.34.6**

**9.34.6.1**

*Discussion: the Extended Schedule element is always used to communicate the schedule of a DTI; there is no other way. Likewise, the schedule of a DTI has to be announced through the Extended Schedule element.*

*Change the third, fourth and fifth paragraphs and insert a new one as follows*

The schedule of the DTI of a beacon interval shall be ~~is~~ communicated through the Extended Schedule element. The PCP/AP ~~shall~~ transmits the Extended Schedule element in either or both an Announce frame or a DMG Beacon frame. The Extended Schedule element shall contain the scheduling information of all allocations in the DTI. The same Allocation field shall not appear more than once in the Extended Schedule element transmitted in a beacon interval. The content of the Extended Schedule element communicated in a beacon interval shall not change if transmitted more than once in the beacon interval, except that if the STA transmitting the Extended Schedule element is a PCP with multiple DMG antennas then the value of the PCP Active field of CBAP allocations within the Extended Schedule element might change when this element is transmitted through different DMG antennas. The PCP/AP should schedule SPs for a STA such that the scheduled SPs do not overlap in time with the traffic scheduling constraints indicated by this STA in the TSCONST field of the associated DMG TSPEC element.

*Discussion: the following rules for pseudo-static should not be restricted to SPs only and also apply to CBAPs.*

When scheduling a nonpseudo-static ~~SP~~ allocation or changing the start time of an existing pseudo-static ~~SP~~ allocation that has a non-PCP/non-AP STA as a source DMG STA or as a destination DMG STA of the ~~SP~~ allocation, a PCP/AP shall set the start time of the ~~SP~~ allocation to no less than aMinAllocationDeliveryTime after the last Extended Schedule element containing this ~~SP~~ allocation is transmitted by the PCP/AP.

NOTE—This rule does not apply to the case when a PCP/AP schedules a new pseudo-static ~~SP~~ allocation.

*Discussion: this rule is to ease implementation complexity and ensure that the scheduler does not create a schedule for which a STA cannot abide due to, say, limited computation capabilities.*

When receiving an Extended Schedule element containing a new pseudo-static allocation in which it is expected to participate, a non-PCP/non-AP STA shall ignore the allocation if the value of the TSF at the time the frame containing the Extended Schedule element is received is greater than the value of the TSF at the start of the pseudo-static allocation. The value of the TSF at the start of the pseudo-static allocation is constructed using the value of the Allocation Start Time field within the Allocation field for the pseudo-static allocation.

**9.34.6.6**

***9.34.6.6.1***

*Discussion: improving readability.*

*Change the first paragraph as follows*

Communicating STA pairs of neighboring PBSS/infrastructure BSS might be granted SPs that potentially create interference for neighbor PBSS/infrastructure BSS STA pairs. SPs within a PBSS/infrastructure BSS can also experience such interference when spatial diversity conditions change. The intent of DMG Protected Period is to minimize such interference by allowing any pair of STAs to protect their SP and thereby limit the transmission of frames during the DMG Protected period to ~~not more than one pair of a set~~ not more than one pair of potentially interfering pairs of communicating stations.

**9.35**

**9.35.1**

*Discussion: improving readability.*

*Change the fourth paragraph as follows*

Decentralized clustering enabled PCPs/APs operating on the same channel may form a decentralized PCP/AP cluster. A PCP/AP cluster includes one S-PCP/S-AP and zero or more member PCPs/APs. ~~The MAC address of the S-PCP/S-AP shall be the Cluster ID of the decentralized PCP/AP cluster~~ The Cluster ID of the decentralized PCP/AP cluster shall be set to the MAC address of the S-PCP/S-AP. Centralized clustering enabled PCPs/APs operating on the same channel as a S-AP form a centralized PCP/AP cluster as described in 9.35.2.2. The Cluster ID of the centralized PCP/AP cluster shall be set to the MAC address of the S-AP.

**9.36**

**9.36.2**

**9.36.2.2**

***9.36.2.2.2***

*Discussion: need to specify that LBIFS is to be accounted for.*

*Change the fourth and fifth paragraphs as follows*

During an initiator TXSS, the Sector ID field in each BF frame shall be set to a value that uniquely identifies the transmit antenna sector employed when the BF frame is transmitted. The CDOWN field in each transmitted frame shall contain the total number of transmissions remaining until the end of the initiator TXSS, including any LBIFS if required, such that the last BF frame transmission of the initiator TXSS has the CDOWN field set to 0. Each transmitted BF frame shall be separated by a time interval equal to SBIFS, unless the allocation ends as described in 9.35.6. This is indicated in Figure 9-51.

*Discussion: the restriction specified in the last paragraph is not needed. Removing it allows more flexibility.*

If the initiator has more than one DMG antenna, the initiator transmits the BF frame through a number of sectors equal to the value of the last negotiated Total Number of Sectors field that was transmitted by the initiator to the responder. In each transmitted BF frame, the initiator shall set the Sector ID and DMG Antenna ID fields to uniquely identify the sector and the DMG Antenna ID, respectively, the initiator is using for the frame transmission and shall set the CDOWN field to the total number of transmissions remaining from all of the initiator’s DMG antennas. ~~The initiator shall transmit from its DMG antennas in increasing order of Antenna ID.~~

***9.36.2.2.3***

*Discussion: a TXSS has to be done before a RXSS so that the STA obtains the best transmit sector first.*

*Insert the following paragraph below the fourth paragraph*

If the initiator uses more than one transmit sector or more than one transmit DMG antenna to perform beamforming with the responder, the initiator shall perform an initiator TXSS with the responder before participating in an initiator RXSS with the responder.

*Discussion: there is no need to require transmission from each antenna. Using the best antenna and sector is enough and significantly improve efficiency.*

*Change the fifth and sixth paragraphs as follows*

During the initiator RXSS~~,~~ the initiator shall transmit from ~~each of the initiator’s DMG antennas~~ the DMG antenna and sector that were selected during the preceding TXSS with the responder the number of BF frames indicated by the responder in the last negotiated RXSS Length field transmitted by the responder. Each transmitted BF frame shall be transmitted with the same fixed antenna sector or pattern. The initiator shall set the Sector ID and DMG Antenna ID fields in each transmitted BF frame to a value that uniquely identifies the single sector through which the BF frame is transmitted. The initiator shall set the CDOWN field in each transmitted BF frame to contain the total number of transmissions remaining to the end of the initiator RXSS, such that the last BF frame transmission of the initiator RXSS has the CDOWN field set to 0. Each transmitted BF frame shall be separated by a time interval equal to SBIFS, except if the allocation ends as described in 9.36.6. This is indicated in Figure 9-51.

During an initiator RXSS, the responder should have its receive antenna array configured to sweep RXSS Length sectors, including any LBIFS if required, ~~for each of the initiator’s DMG antennas~~ while attempting to receive SSW frames from the initiator.

**9.36.2.3**

***9.36.2.3.2***

*Discussion: need to specify that LBIFS is to be accounted for.*

*Change the fourth paragraph as follows*

During a responder TXSS, the responder shall set the Sector ID and the DMG Antenna ID fields in each transmitted SSW frame to a value that uniquely identifies the sector through which the SSW frame is transmitted. The initial value of CDOWN is set to the total number of sectors in the responder (covering all DMG antennas) multiplied by the number of DMG antennas at the initiator minus one. The responder shall set the CDOWN field in each transmitted SSW frame to contain the total number of transmissions remaining to the end of the responder TXSS, including any LBIFS if required, such that the last SSW frame transmission of the responder TXSS has the CDOWN field set to 0. The responder shall transmit from its DMG antennas in increasing order of Antenna ID. Each transmitted SSW frame shall be separated by an interval of time equal to SBIFS. Transmissions are not separated by SBIFS if the allocation ends as described in 9.36.4 and 9.36.6 or if the end of an SSW slot is reached as described in 9.36.5 or when the responder completed a full sweep of all its transmit sectors and is ready to transmit to another DMG antenna of the initiator. In the latter case, the next transmission is separated from the previous transmission by LBIFS interval. This is indicated in Figure 9-52.

***9.36.2.3.3***

*Discussion: a TXSS has to be done before a RXSS so that the STA obtains the best transmit sector first.*

*Insert the following paragraph below the third paragraph*

If the responder chooses to use more than one transmit sector or more than one transmit DMG antenna to perform beamforming with the initiator, the responder shall perform a responder TXSS with the initiator before participating in a responder RXSS with the initiator.

*Discussion: need to specify that LBIFS is to be accounted for.*

*Change the sixth paragraph as follows*

At the start of a responder RXSS, the initiator should have its receive antenna array configured to sweep over RXSS Length sectors, including any LBIFS if required, ~~for each of the responder DMG antennas~~ when it attempts to receive frames from the responder until the completion of the responder RXSS.

**10.**

**10.1**

**10.1.2**

**10.1.2.1**

*Discussion: before network initialization, there is no DMG BSS. In this case, a rule is needed to specify how the TSF is generated so that synchronization can be achieved.*

*Insert the following paragraph at the end of this subclause*

Before network initialization (see 10.1.3.4), the value of the TSF timer is delivered by DMG Beacon frames generated at each BTI.

**10.1.3**

**10.1.3.3**

***10.1.3.3.1***

*Discussion: the last part of the last sentence of the following para is redundant. It is also confusing, since the beacon can be delayed. Therefore, propose to remove it and rely simply on the TBTT (which is well defined).*

*Change the fourth paragraph as follows*

A PCP and a DMG AP establish a series of Target Beacon Transmission Times (TBTTs) spaced dot11BeaconPeriod TUs apart. The period between two TBTTs is referred to as the beacon interval. The beacon interval length shall be no more than aMaxBIDuration. Time value zero of the TSF is defined to be a TBTT ~~with a DMG Beacon frame transmitted at the beginning of the beacon interval~~.

**10.1.4**

**10.1.4.3**

***10.1.4.3.2***

*Discussion: the scanning procedure for DMG requires corrections:*

* *In c(b), a DMG STA does not have to necessarily go to step (e), but can also perform BF as in step (d)*
* *In (g), the timer should only be reset/started once.*
* *In (h), the text is simply improved to improve readability.*

*Change the second paragraph as follows*

For each channel to be scanned:

1. Wait until the ProbeDelay time has expired or a PHYRxStart.indication has been received;
2. Perform the Basic Access procedure as defined in 9.3.4.2 if the STA is a non-DMG STA;
3. DMG STAs only:
	1. Start generation of DMG Beacon frames according to the rules described in 10.1.3.4, if the STA intends to transmit DMG Beacon frames with the Discovery Mode field set to 1.
	2. Otherwise, optionally proceed to step (e);
4. If a DMG Beacon frame is received, perform beamforming training with the peer STA as defined in 9.35.5;
5. Perform the Basic Access procedure as defined in 9.3.4.2 if the STA is a DMG STA;
6. Send a probe request to the broadcast destination address or, in the case of a DMG STA only~~,~~ :
	1. ~~(i) f~~Following the transmission of an SSW-Feedback frame send a Probe Request to the MAC address of the DMG STA addressed by the SSW-Feedback frame ~~or~~ and
	2. ~~(ii) o~~Optionally, following the reception of an SSW-Feedback frame send a Probe Request to the MAC address of the DMG STA that transmitted the SSW-Feedback frame.

~~i~~In all these cases the Probe Request is sent with the SSID and BSSID from the MLME-SCAN.request primitive. When transmitted by a DMG STA, the transmitted Probe Request frame includes the DMG Capabilities element. When the SSID List is present in the MLME-SCAN.request primitive, send one or more probe request, each with an SSID indicated in the SSID List and the BSSID from the MLME-SCAN.request primitive.;

1. Set to 0 and start a ProbeTimer if the STA is a non-DMG STA or, in case of a DMG STA set to 0 and start a ProbeTimer either immediately following the transmission of the first Probe Request on this channel or if no Probe Request is transmitted on this channel;
2. If PHY-CCA.indication (BUSY) has not been detected before the ProbeTimer reaches MinChannelTime and the STA is a non-DMG STA, then
	1. ~~If the STA is a non-DMG STA,~~ set the NAV to 0 and scan the next channel
	2. Otherwise, when ProbeTimer reaches MaxChannelTime, process all received probe responses;
3. Set the NAV to 0 and scan the next channel.

***10.1.4.3.3***

*Discussion: instead incorrectly duplicating text, it is preferred to refer to the subclause that has the correct procedure. Both paragraphs below should be corrected.*

*Change the third and fourth paragraphs as follows*

Only DMG STAs that are not members of a PBSS but that are performing active scan as defined in 10.1.4.3.2 ~~have transmitted at least one DMG Beacon frame with the Discovery Mode field set to 1~~, multi-band capable non-AP STAs for which the last received probe request included a Multi-band element, APs, PCPs, and STAs in an IBSS or in an MBSS respond to probe requests. A result of the procedures defined in this subclause is that in each infrastructure BSS, except in DMG BSSs, and IBSS, there is at least one STA that is awake at any given time to receive and respond to probe requests. In an MBSS, STAs might not be awake at any given time to respond to probe requests. In an infrastructure BSS or in an IBSS, a STA that sent a Beacon frame shall remain in the Awake state and shall respond to probe requests, subject to criteria in the next paragraph, until a Beacon frame with the current BSSID is received. If the STA is contained within an AP, it shall remain in the Awake state and always respond to probe requests, subject to criteria in the next paragraph. There may be more than one STA in an IBSS that responds to any given probe request, particularly in cases where more than one STA transmitted a Beacon/DMG Beacon frame following the most recent TBTT, either due to not receiving successfully a previous Beacon/DMG Beacon frame or due to collisions between beacon transmissions.

*Discussion: Regarding sending a response to a Probe Request with a Probe Response within the DMG, we should allow a device not to respond if beamforming has not been completed.*

In an infrastructure BSS or in an IBSS, STAs receiving Probe Request frames shall respond with a probe response when the SSID in the probe request is the wildcard SSID or matches the specific SSID of the STA or when the specific SSID of the STA is included in the SSID List element. Furthermore, a STA with dot11RadioMeasurementActivated true receiving a probe request with a DSSS Parameter Set element containing a Current Channel field value that is not the same as the value of dot11CurrentChannel shall not respond with a probe response. A DMG STA that is not member of a PBSS but that is performing active scan as defined in 10.1.4.3.2 ~~has transmitted at least one DMG Beacon with the Discovery Mode field set to 1~~, an AP, and a PCP shall respond to all probe requests meeting the above criteria if the transmit antenna of the DMG STA is trained to transmit to the STA from which a probe request is received from. In an IBSS, a STA that transmitted a Beacon or DMG Beacon frame since the last TBTT shall respond to group addressed Probe Request frames. A STA in an IBSS shall respond to Probe Request frames sent to the individual address of the STA.

**10.2**

**10.2.3**

**10.2.3.5**

*Discussion: this section is referred to in 10.2.6.2.4 (Power management mode operation of a non-PCP/non-AP STA with or without a wakeup schedule), but it has not been modified for DMG operation. Therefore, need to make such changes.*

*Change the second paragraph as follows*

The following rules describe operation of the ATIM and frame transmission to STAs in PS mode in a~~n~~ non-DMG IBSS and in a DMG BSS:

1. Following the reception or transmission of the Beacon frame in a non-DMG IBSS, during the ATIM Window, the STA shall transmit an individually addressed ATIM management frame to each STA for which it has one or more buffered individually addressed BUs. Following the BTI or ATI in a DMG BSS, during the Awake Window, the STA shall transmit an individually addressed ATIM management frame to each STA for which it has one or more buffered individually addressed BUs. If the STA has one or more buffered group addressed MSDUs (excluding those with a service class of StrictlyOrdered) or has one or more buffered group addressed MMPDUs, it shall transmit an appropriately addressed group addressed ATIM frame.
2. In a non-DMG IBSS, a~~All~~ STA~~s~~ shall use the backoff procedure defined in 9.3.4.3 for transmission of the first ATIM following the Beacon frame. In a DMG BSS, a STA shall use the backoff procedure defined in 9.3.4.3 for transmission of the first ATIM following the BTI or ATI. All remaining ATIMs shall be transmitted using the conventional DCF access procedure.
3. ATIM management frames shall be transmitted only during the ATIM Window/Awake Window.
4. A non-DMG STA shall transmit no frame types other than RTS, CTS, and ACK Control frames, Beacon and ATIM management frames and (QoS)Null data frames during the ATIM Window.
5. Individually addressed ATIM management frames shall be acknowledged. If no acknowledgment is received, the ATIM shall be retransmitted using either the DCF (for non-QoS STAs) or the EDCAF (for QoS STAs). Group addressed ATIM management frames shall not be acknowledged.
6. If a STA is unable to transmit an ATIM during the ATIM Window/Awake Window, for example due to contention with other STAs, the STA should retain the buffered BUs and attempt to transmit the ATIM during the next ATIM Window/Awake Window.
7. Immediately following the ATIM Window, a non-DMG STA shall begin transmission of any buffered group addressed frames for which an ATIM was previously transmitted. Following the transmission of any group addressed frames, any BUs addressed to STAs for which an acknowledgment for a previously transmitted ATIM frame was received shall be transmitted. All STAs shall use the backoff procedure defined in 9.3.4.3 for transmission of the first frame following the ATIM Window. All remaining frames shall be transmitted using either the DCF (for non-QoS STAs) or the EDCAF (for QoS STAs).
8. If a buffered BU is transmitted using fragmentation and if the BU has been partially transmitted when the next Beacon frame is sent in a non-DMG IBSS or when the next beacon interval begins in a DMG BSS, the STA shall retain the buffered BU and announce the remaining fragments by transmitting an ATIM during the next ATIM Window/Awake Window.
9. If a STA is unable to transmit a buffered BU during the beacon interval in which it was announced, for example due to contention with other STAs, the STA shall retain the buffered BU and announce the BU again by transmitting an ATIM during the next ATIM Window/Awake Window.
10. Following the transmission of all buffered BUs, a STA may transmit BUs without announcement to STAs that are known to be in the Awake state for the current beacon interval.
11. A STA may discard BUs buffered for later transmission to power-saving STAs if the STA determines that the BU has been buffered for an excessive amount of time or if other conditions internal to the STA implementation make it desirable to discard buffered BUs (e.g., buffer starvation). A BU should not be discarded that has been buffered for less than dot11BeaconPeriod. The algorithm to manage this buffering is beyond the scope of this standard.
12. A non-DMG STA may transmit individually addressed or group addressed Null data frames within the ATIM window to indicate the STA’s intent to change power management modes. The STA may transition into PS mode after acknowledgements have been successfully received for all individually addressed Null data frames or after the STA has transmitted group addressed Null data frames at least dot11BSSBroadcastNullCount times.

**10.2.5**

**10.2.5.2**

***10.2.5.2.4***

*Discussion: it is not any CBAP that has the Awake Window. Instead, there are specific conditions that must be met for the first CBAP to contain an Awake Window. Need to fix text.*

*Change the sixth paragraph as follows*

There might be one or more CBAPs in a beacon interval. An Awake window is present within the first CBAP of a beacon interval if the CBAP has the Destination AID field equal to the Broadcast AID and the Awake Window field in the Awake Window element (8.4.2.136) transmitted by the PCP/AP has a value that is nonzero. The Awake window starts from the beginning of the first CBAP and has a duration that is defined by the value of the Awake Window field in the Awake Window element. During the Awake window, a STA shall transmit only ATIM frames. A DMG STA in PS mode shall be in the Awake state during each Awake window that lies within each Awake BI for that STA.

**10.4**

**10.4.4**

**10.4.4.4**

*Discussion: instead of duplicating text, it is preferable to refer to the appropriate section that has all the rules.*

*Change the eigth paragraph as follows*

The HC/non-AP’s MLME transmits an ADDTS Response frame containing this TSPEC or DMG TSPEC and status. The encoding of the ResultCode values to Status Code field values is defined in Table 8-37. The PCP/AP shall transmit the ADDTS Response frame to the STAs identified as source and destination AID of the DMG TSPEC contained in the ADDTS Request frame if the ADDTS Request it is sent by a non-PCP/non-AP STA. If the ResultCode is SUCCESS, the PCP/AP shall announce the creation of the allocation by setting the Allocation ID field in the TSPEC element sent in the ADDTS Response frame to a nonzero value and also by ~~including the allocation schedule in the Extended Schedule element transmitted in the DMG Beacon frame or Announce frame~~ delivering the Extended Schedule element as defined in 9.34.6.

*Discussion: need to specify the condition that is based on the field value contained in the U-PID element.*

*In the last paragraph, insert “*with the No-LLC field equal to 1*” after “*U-PID element*”*

**10.4.8**

*Discussion: note is unnecessary.*

*Delete the third paragraph (i.e., delete the NOTE)*

**10.4.14**

*Discussion: series of changes to remove ambiguity clarify the text, use proper capitalization of field names and to recognize that an ADDTS Request frame can also be transmitted to a non-PCP STA.*

*Change the second paragraph as follows*

A non-AP DMG STA may add TSs to an existing allocation with a peer non-AP DMG STA. To do this, the non-AP DMG STA transmits an ADDTS Request frame to the peer ~~non-PCP/non-AP DMG~~ STA to include the additional TS. The ADDTS Request frame shall contain a PTP TSPEC with the Allocation ID field set to indicate the desired allocation to carry the additional TS. A TS with EDCA access policy does not need to be added to any CBAP allocation and can use any CBAP allocation as long as the source AID of the CBAP allocation matches the source AID of the TS, or the source AID of the CBAP allocation is equal to the broadcast AID, or the destination AID of the CBAP matches the destination AID of the TS.

*Change the last paragraph as follows*

If the DMG STA ~~asserts~~ sets the ~~d~~Direction field to a value equal to ~~D~~downlink in the PTP TSPEC included in the ADDTS Request frame, the parameters apply to the DMG STA as the destination DMG STA ~~receiving~~ ~~station~~ of that TS. For example, in this case, the Maximum MSDU Size field indicates that the DMG STA is not able to receive MSDUs longer than the value presented in the MSDU Size field. Similarly, if the ~~d~~Direction field indicates uplink, the parameters apply to the DMG STA as the source DMG STA of that TS. In this case, the DMG STA that issued the ADDTS Request frame does not send MSDUs longer than the value of the Maximum MSDU Size field.

**10.28**

**10.28.1**

*Discussion: need to refer to the subclause that specifies the negotiation procedures.*

*Change the third paragraph as follows*

The DMG STAs shall negotiate the value of dot11BeamLinkMaintenanceTime using the procedures specified in 9.36.6.2 or may leave it undefined as specified in 8.5.6 Beamformed Link Maintenance field.

**10.29**

**10.29.1**

*Discussion: the fifth paragraph should only apply if the STA supports the feature corresponding to the IE.*

*Change the fifth paragraph*

A STA shall include in the Information Response frame the elements requested by the originator STA that the STA transmitting the Information Response frame supports.

*Discussion: the current text in the second bullet does not list the full requirements. In particular, the STA has to be a non-PCP STA in order to qualify to respond with an Information Response frame with an empty payload.*

*In the sixth paragraph, replace the second bullet by “*TheSTA sending the Information Response frame is a non-PCP STA and is not the target STA*”*

**21.**

**21.2**

**21.2.2**

*Discussion: the length can never be zero.*

*Change the indicated row in Table 21-1 as follows*

|  |  |  |  |
| --- | --- | --- | --- |
| LENGTH | Indicates the number of octets in the PSDU in the range of ~~0~~1 to 262 143. ~~A value of zero indicates a packet in which no data part follows the header.~~ | Y | Y |

*Discussion: the normative text is correct, but the descriptions of the vectors are inconsistent with the normative text. Make them consistent.*

*Change the indicated row in Table 21-1 as follows*

|  |  |  |  |
| --- | --- | --- | --- |
| TRN-LEN | TRN-LEN indicates the length of the training field. Values are in the range of 0-16~~64 in multiples of 4. A value of N indicates that the AGC has 4×N AGC subfields and that the TRN-R/T field has 5×N subfields~~ (see 21.10.2.2.3). | Y | Y |

*Discussion: specify where the RSSI is measured and its components.*

*Change the indicated row in Table 21-1 as follows*

|  |  |  |  |
| --- | --- | --- | --- |
| RSSI | The allowed values for the RSSI parameter are in the range from 0 through RSSI maximum. This parameter is a measure by the PHY of the power observed at the input of the antennas plus the antenna gain, or equivalent antenna gain for a phased-array antenna, used to receive the current PPDU. RSSI shall be measured during the reception of the PLCP preamble. RSSI is intended to be used in a relative manner, and it shall be a monotonically increasing function of the received power. | N | Y |

*Discussion: need to improve the readability and clarity of the text.*

*Change the indicated row in Table 21-1 as follows*

|  |  |  |  |
| --- | --- | --- | --- |
| DTP\_INDICATOR | ~~Takes values 0 or 1 to indicate a DTP update~~ An update to the DTP tone map is indicated by changing the value of this parameter from 0 to 1 or from 1 to 0 (see 9.38) | Y | Y |

**21.3**

**21.3.2**

*Discussion: the details of the measurement BW are not specified.*

*Change the first paragraph as follows*

The transmitted spectrum shall adhere to the transmit spectrum mask shown in the Figure 21-1. The transmit spectrum shall have a 0 dBr (dB relative to the maximum spectral density of the signal) bandwidth not exceeding 1.88 GHz, -17 dBr at a 1.2 GHz offset, -22 dBr at a 2.7 GHz offset and -30dBr at a 3.06 GHz offset and above, inside the channels allowed for the regulatory domain in which the device is transmitting. The measurement shall be made using a 1 MHz resolution bandwidth and a 300 KHz video bandwidth ~~shall be set to 1 MHz~~.

**21.3.3**

*Discussion: this section is not needed, and was also removed from other PHYs.*

*Remove subclause 21.3.3.2 Transmit RF delay*

**21.3.5**

**21.3.5.1**

*Discussion: this change is simply to make the figure comply with the normative text and clearly indicate the presence of the AGC subfield.*

*Replace Figure 21-2 with the following figure, which shows the AGC field:*



**21.3.5.2**

*Discussion: the last sentence is confusing and unnecessary.*

*Change the first paragraph as follows*

The windowing function <equation> is used to smooth the transition between adjacent fields in the ~~packet~~ PPDU where OFDM modulation is employed. No windowing is applied to preamble fields or to SC modulated fields. ~~The windowing function is different from being equivalent to “1” only in the transition region.~~

**21.3.6**

**21.3.6.3**

*Discussion: the text can be improved to increase clarity and remove ambiguity.*

*Change the last paragraph as follows*

Note that sequences Gu512(n) and Gv512(n) are defined for 0≤n≤511. For other values of n, Gu512(n) and Gv512(n) ~~they~~ are set to 0.

**21.3.9**

*Discussion: fixing readability.*

*Change the last paragraph as follows*

For each PPDU, the transmitter shall select a nonzero seed value for the scrambler (bits x1 through x7). The seed value should be selected in a pseudo random fashion. The seed value is sent in the Scrambler Initialization field of the PLCP header. Each data bit in the data field of the PPDU is then XORed with the scrambler output (x4 XOR x7) and then the scrambler content is shifted once.

**21.3.10**

*Discussion: the first set of changes fix the inequality signs. The second set of changes specifies the requirements of RCPU measurement.*

*Change the first and second paragraphs as follows*

The RCPI is a measure of the received RF power in the selected channel as measured at the DMG Antenna output. This parameter shall be measured by the PHY of the received RF power in the channel measured over the preamble of the received frame. RCPI shall be a monotonically increasing~~,~~ logarithmic function of the received power level defined in dBm. The allowed values for the Received Channel Power Indicator (RCPI) parameter shall be an 8 bit value in the range from 0 to 220, with indicated values rounded to the nearest 0.5 dB as follows:

— 0: Power ~~<~~≤ –110 dBm

— 1: Power = –109.5 dBm

— 2: Power = –109.0 dBm

And so on up to:

— 220: Power ~~>~~≥ 0 dBm

— 221–254: reserved

— 255: Measurement not available

where RCPI = ~~int~~$\left⌊(Power in dBm+110)×2\right⌋$~~{(Power in dBm +110) × 2}~~ for 0 dBm > Power > –110 dBm

RCPI shall equal the received RF power with an accuracy of ± 5 dB ~~(~~with 95% confidence interval~~)~~ within the specified dynamic range of the receiver. The received RF power shall be determined assuming a receiver noise equivalent bandwidth equal to the channel width multiplied by 1.1. The relative error between RF power measurements made within a 1 second interval should be less than ± 1 dB.

**21.4**

**21.4.3**

**21.4.3.1**

***21.4.3.1.1***

*Discussion: the normative text in 21.4.3.1.2 specifies that the STF is comprised of 6400 samples, while Figure 21-9 indicates only 5120. Need to correct the figure to match the normative text.*

*In Figure 21-9, change “*5120*” by “*6400*”*

**21.4.3.2**

***21.4.3.2.1***

*Discussion: instead of having duplicate definitions for the same field (since the fields repeat across different PHYs), it is better to have the definition in a single place. Hence, the following definition is replaced by a reference.*

*Change the indicated row of Table 21-11 as follows*

|  |  |  |  |
| --- | --- | --- | --- |
| Packet Type  | 1 | 15  | ~~Corresponds to the TXVECTOR parameter PACKET-TYPE.~~* ~~Packet Type = 0 indicates either a packet whose data part is followed by one or more TRN-R subfields, or a packet that is requesting TRN-R subfields to be appended to a future response packet.~~
* ~~Packet Type = 1 indicates a packet whose data part is followed by one or more TRN-T subfields.~~

~~The field is reserved when the Training Length field is 0.~~As defined in Table 21-17 |

**21.5**

**21.5.3**

**21.5.3.1**

***21.5.3.1.1***

*Discussion: the text can be improved to increase clarity and remove ambiguity.*

*Change the indicated row of Table 21-13 as follows*

|  |  |  |  |
| --- | --- | --- | --- |
| Training Length | 5 | 32 | Corresponds to the TXVECTOR parameter TRN-LEN. If the Beam Tracking Request field is 0, the Training Length field indicates the length of the training field. The use of this field is defined in 21.10.2.2.3. A value of 0 indicates that no training field is present in this PPDU.If the Beam Tracking Request field is 1 and the Packet Type field is 1, the Training Length field indicates the length of the training field appended to this PPDU. If the Packet Type field is 0, the Training Length field indicates the length of the training field requested for receive training. |

**21.6**

**21.6.3**

**21.6.3.1**

***21.6.3.1.1***

*Discussion: the following table will contain all the PHY header field definitions. All other PHY header definitions refer to this table.*

*Change the indicated rows of Table 21-17 as follows*

|  |  |  |  |
| --- | --- | --- | --- |
| Packet Type | 1 | 31 | ~~See definition of Packet Type field in Table 21-11.~~Corresponds to the TXVECTOR parameter PACKET-TYPE.* Packet Type = 0 indicates either a PPDU whose data part is followed by one or more TRN-R subfields (when the Beam Tracking Request field is 0 or in Control PHY), or a PPDU that contains a request for TRN-R 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-T subfields.

The field is reserved when the Training Length field is 0. |
| Training Length | 5 | 32 | Corresponds to the TXVECTOR parameter TRN-LEN. If the Beam Tracking Request field is 0, the Training Length field indicates the length of the training field. The use of this field is defined in 21.10.2.2.3. A value of 0 indicates that no training field is present in this PPDU.If the Beam Tracking Request field is 1 and the Packet Type field is 1, the Training Length field indicates the length of the training field appended to this PPDU. If the Packet Type field is 0, the Training Length field indicates the length of the training field requested for receive training. |

**21.10**

**21.10.2**

**21.10.2.2**

***21.10.2.2.3***

*Discussion: the text can be improved to increase clarity and remove ambiguity.*

*Change the fourth paragraph as follows*

A value of N in the Training Length field indicates ~~that the~~ 4×N AGC ~~has 4N~~ subfields and that the TRN-R/T field has 5×N subfields.

**Annex B**

**B.4**

**B.4.26**

**B.4.26.1**

*Discussion: fixing mandatory status for DMG-M17.*

*Replace the contents of the 4th column entitled “*Status*” of DMG-M17 with “*CF25:M*”*

**Annex L**

*Discussion: the correct term is channel estimation, as it is used in the remaining of the standard.*

**L.5**

*Replace all occurrences of “*Channel Equalization*” with “*Channel Estimation*”*

**L.6**

*Replace all occurrences of “*Channel Equalization*” with “*Channel Estimation*”*

**L.7**

*Replace all occurrences of “*Channel Equalization*” with “*Channel Estimation*”*