IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 11-11-xxxx-00-00ad-Corrections to allocation and flow management | | | | |
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Abstract

This document resolves several issues around resource reservation in DBand. It provides corrections to TS operation to ensure robust and efficient operation of multiple Traffic Streams, with attention to bidirectional operation and efficiency, set up and deletion, and coexistence (e.g., multiple PAL streams and LAN traffic).

This document is provided as part of resolution to CID 3037.

**Background and problem statement**

The 802.11ad MAC and PHY, while part of the IEEE Wireless LAN standard, is well-equipped to address PAN appliations. Focusing on low-overhead relatively simple point-to-point scenarios, PAN applications hardly make use of IP protocol and instead on rely on MAC-level TID-based mux/demux for traffic streams. They make use of Service Periods and present a dynamic setup for Traffic Streams (TSs).



We propose several improvements and corrections around allocation model (TS addition and deletion). One important change is to decouple the lifetime of pseudo-static allocations (airtime allocations) from the flows (TSs or TSPECs) these allocations carry, i.e., allocations are allowed to persist independent of the flows they carry.

Another change is to address lack of semantics to describe type of pseudo-static allocation (SP, CBAP and possibly more). The proosed DBand TSPEC provides the necessary semantics.

Access policy for TSPECs in DBand is currently set to an undefined “DBand Channel Access”. Instead of a single DBand-specific access policy, we define multiple access policies in DBand that directly match OBand access policies, specifically, contention-based (EDCA), contention-free (Service Period Channel Access, or SPCA), and SPCA/EDCA Mixed Mode (SEMM) that allows flows using Service Periods to continue during CBAPs.



Allocation and flow decoupling has been made possible by managing allocations through a separate Allocation ID (instead of a TID/TSID bound to the allocation). In short, multiple TIDs can be attached to or detached from a single Allocation ID.



Allocation deletion rules have been defined, in particular, PCP/AP can delete/remove any allocation at any point in time, but non-PCP/non-AP stations are allowed to delete only allocations for which they they are a sourec or destination.



Clear definition of acess policies also clears the way to specify TID rules for each access policy, specifically, TID range of 0-7 for EDCA TSs and TID range of 8-15 for SPCA and SEMM TSs.



Examples of allocation and flow management are shown below.





Here is a summary of TID, TSID and UP rules. TSs with SEMM access policy keep their TID 8-15 when sent during a contention-based period (similar to HEMM TSs).



Here is an overview of the change to DBand TSPEC element. Each allocation is managed independent from the flows it carries, through an Allocation ID.



The allocation is refelected in the extended schedule element advertised by PCP/AP. Allocation ID uniquely identifies an airtime allocation for a given source and destination pair. A flow (TS) can be set up to use an allocation by specifying the Allocation ID in the TSPEC.



A few TS addition, deletion scenarios are shown below. Note how TSs can be added and deleted in any order. Also note CBAPs (with unicast source AID) can be allocated using DBand TSPECs, just like Service Periods.









And finally, a summary of proposed changes.



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## 3.3 Abbreviations and acronyms

*Editor instruction: insert the following abbreviations and acronyms:*

|  |  |
| --- | --- |
| SEMM  SPCA | SPCA, EDCA mixed mode  service period channel access |

### 4.3.7 QoS BSS: The QoS network

The third mechanism, designated the *service period* (SP) *access or service period* (SP) *channel access* (SPCA), is applicable only to the DBand and allows for the reservation of channel time with the PCP/AP. A STA based on its requirements requests the PCP/AP for SPs, which can be used for transmission to any other STA in the BSS. The request is initiated by the SME of the STA. The PCP/AP either accepts or rejects the request based on an admission control policy. If the request is accepted, the PCP/AP uses the Extended DBand Schedule element to schedule SPs for communication between the source and destination DBand STAs indicated within the request. Details of this mechanism are provided in 9.33.7.2 Service period (SP) allocation, 9.33.7.4 Pseudo-static allocations, 9.33.7.6 DBand Protected Period and 10.4.

### 6.3.26 TS management interface

#### 6.3.26.2 MLME-ADDTS.request

##### 6.3.26.2.2 Semantics of the service primitive

*Editor Instructions: Change the primitive as follows:*

MLME-ADDTS.request (

DialogToken,

TSPEC,

TCLAS,

TCLASProcessing,

ADDTSFailureTimeout,

STAAddress,

Extended DBand TSPEC,

Multi-band,

U-PID,

VendorSpecificInfo

)

*Editor Instructions: insert the following entries in the table:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| STAAddress | MACAddress |  | Specifies the MAC address of the peer STA. Only included in case this refers to the PTP TSPEC. |
| Extended DBand TSPEC | As defined in the frame format | As defined in 8.4.2.117 | Specifies the characteristics and QoS (scheduling) requirements of the DBand allocation of concern. |
| Multi-band | As defined in the frame format | As defined in 8.4.2.121 | Specifies the frequency band and channel number where the TSID is to be established. The parameter is absent if the TSID is intended to be established on the same frequency band and channel where the ADDTS Request is transmitted. |
| U-PID | As defined in the frame format | As defined in 8.4.2.133 | This parameter is optionally present and specifies the parameters of the LLC for the purpose of (de)multiplexing of frames associated with the TSID. |

#### 6.3.26.3 MLME-ADDTS.confirm

##### 6.3.26.3.2 Semantics of the service primitive

*Editor Instructions: Change the primitive as follows:*

MLME-ADDTS.confirm(

ResultCode,

DialogToken,

TSDelay,

TSPEC,

Schedule,

TCLAS,

TCLASProcessing,

STAAddress,

Extended Schedule,

Extended DBand TSPEC,

Multi-band,

U-PID,

VendorSpecificInfo

)

*Editor Instructions: change the table as indicated below:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| ResultCode | Enumeration | SUCCESS, INVALID\_PARAMETERS, REJECTED\_WITH\_SUGGESTED\_CHANGES, REJECTED\_FOR\_DELAY\_PERIOD, TIMEOUT, SUCCESS\_STA\_IN\_DOZE\_MODE, REJECT\_U-PID\_SETTING | Indicates the results of the corresponding MLMEADDTS.request primitive. |
| … | … | … | … |
| STAAddress | MACAddress |  | Specifies the MAC address of the peer STA. Only included in case this refers to the PTP TSPEC. |
| Extended Schedule | As defined in the frame format | As defined in 8.4.2.115 | Specifies the schedule information of the TS. |
| Extended DBand TSPEC | As defined in the frame format | As defined in 8.4.2.117 | Specifies the characteristics and QoS (scheduling) requirements of the DBand allocation of concern. |
| Multi-band | As defined in the frame format | As defined in 8.4.2.121 | Specifies the frequency band and channel number where the TSID is to be established. The parameter is absent if the TSID is intended to be established on the same frequency band and channel where the ADDTS Request is transmitted. |
| U-PID | As defined in the frame format | As defined in 8.4.2.133 | This present is optionally present and specifies the parameters of the LLC for the purpose of (de)multiplexing of frames associated with the TSID. |

For the ResultCode value of SUCCESS or SUCCESS\_STA\_IN\_DOZE\_MODE in the DBand, the Extended DBand TSPEC and the optional TCLAS parameters describe the characteristics of the allocation or TS that has been created (or modified); and the specified (nonzero) parameters exactly match those of the matching MLME-ADDTS.request primitive.

For other values of ResultCode in the DBand, no new allocation or TS has been created. In the case of REJECTED\_WITH\_SUGGESTED\_CHANGES or REJECT\_U-PID\_SETTING, the Extended DBand TSPEC, Multi-band and U-PID represent an alternative proposal by the peer STA. In such cases, an allocation or TS has not been created. If the suggested changes are acceptable to the STA, it is the responsibility of the STA to set up the allocation or TS with the suggested changes.

If this is the result of a modification of an existing allocation or TS, the status of that allocation or TS remains unchanged.

##### 6.3.26.3.3 When generated

*Editor instruction: in the second paragraph, replace* “HC” *by* “DBand STA/HC”

#### 6.3.26.4 MLME-ADDTS.indication

##### 6.3.26.4.1 Function

*Editor instruction: change the first paragraph as indicated*

This primitive reports to the DBand STA/HC’s SME the request for adding (or modifying) a TS.

##### 6.3.26.4.2 Semantics of the service primitive

*Editor Instructions: Change the primitive as follows:*

MLME-ADDTS.indication (

DialogToken,

STAAddress,

TSPEC,

TCLAS,

TCLASProcessing,

Extended DBand TSPEC,

Multi-band,

U-PID,

VendorSpecificInfo

)

*Editor Instructions: insert the following entries in the table:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Extended DBand TSPEC | As defined in the frame format | As defined in 8.4.2.117 | Specifies the characteristics and QoS (scheduling) requirements of the allocation of concern. |
| Multi-band | As defined in the frame format | As defined in 8.4.2.121 | Specifies the frequency band and channel number where the TSID is to be established. The parameter is absent if the TSID is intended to be established on the same frequency band and channel where the ADDTS Request is transmitted. |
| U-PID | As defined in the frame format | As defined in 8.4.2.133 | This present is optionally present and specifies the parameters of the LLC for the purpose of (de)multiplexing of frames associated with the TSID. |

##### 6.3.26.4.4 Effect of receipt

*Editor instruction: in the second paragraph, replace* “HC” *by* “DBand STA/HC”

#### 6.3.26.5 MLME-ADDTS.response

##### 6.3.26.5.2 Semantics of the service primitive

*Editor Instructions: Change the primitive as follows:*

MLME-ADDTS.response (

ResultCode,

DialogToken,

STAAddress,

TSDelay,

TSPEC,

Schedule,

TCLAS,

TCLASProcessing,

Extended Schedule,

Extended DBand TSPEC,

Multi-band,

U-PID,

VendorSpecificInfo

)

*Editor Instructions: change the table as indicated below:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| ResultCode | Enumeration | SUCCESS, INVALID\_PARAMETERS, REJECTED\_WITH\_SUGGESTED\_CHANGES, REJECTED\_FOR\_DELAY\_PERIOD, SUCCESS\_STA\_IN\_DOZE\_MODE, REJECT\_U-PID\_SETTING | Indicates the results of the corresponding MLMEADDTS.request primitive. |
| … | … | … | … |
| Extended Schedule | As defined in the frame format | As defined in 8.4.2.115 | Specifies the schedule information of the TS. |
| Extended DBand TSPEC | As defined in the frame format | As defined in 8.4.2.117 | Specifies the characteristics and requirements of the allocation of concern. |
| Multi-band | As defined in the frame format | As defined in 8.4.2.121 | Specifies the frequency band and channel number where the TSID is to be established. The parameter is absent if the TSID is intended to be established on the same frequency band and channel where the ADDTS Request is transmitted. |
| U-PID | As defined in the frame format | As defined in 8.4.2.133 | This present is optionally present and specifies the parameters of the LLC for the purpose of (de)multiplexing of frames associated with the TSID. |

*Editor Instructions: change the indicated paragraphs as follows:*

If the result code is SUCCESS in the OBand, the TSPEC and (optional) TCLAS parameters contain the values from the matching MLME-ADDTS-indication.

If the result code is SUCCESS or SUCCESS\_STA\_IN\_DOZE\_MODE in the DBand, the Extended DBand TSPEC and (optional) TCLAS parameters contain the values from the matching MLME-ADDTS-indication.

If the result code is REJECTED\_WITH\_SUGGESTED\_CHANGES in the OBand, the TSPEC and TCLAS parameters represent an alternative proposed TS. The TS, however, is not created. The TSID and direction values within the TSPEC are as in the matching MLME-ADDTS.indication primitive. The difference may lie in the QoS (e.g., minimum data rate, mean data rate, and delay bound) values, as a result of admission control performed at the SME of the HC on the TS requested to be added (or modified) by the STA. If sufficient bandwidth is not available, the QoS values may be reduced. In one extreme, the minimum data rate, mean data rate, and delay bound may be all set to 0, indicating that no QoS is to be provided to this TS.

If the result code is REJECTED\_WITH\_SUGGESTED\_CHANGES or REJECT\_U-PID\_SETTING in the DBand, the Extended DBand TSPEC, TCLAS, Multi-band and U-PID parameters represent an alternative proposal for the allocation or TS. The allocation or TS, however, has not been created. The allocation ID value within the Extended DBand TSPEC is as in the matching MLME-ADDTS.indication primitive. The difference may lie in the other parameter values, as a result of admission control performed at the SME of the peer STA on the allocation or TS requested to be added (or modified). If sufficient bandwidth is not available, the QoS values may be reduced.

##### 6.3.26.5.3 When generated

*Editor instruction: in the first paragraph, replace* “HC” *by* “DBand STA/HC”

##### 6.3.26.5.4 Effect of receipt

*Editor instruction: in the second paragraph, replace* “HC” *by* “DBand STA/HC”

#### 6.3.26.6 MLME-DELTS.request

##### 6.3.26.6.1 Function

*Editor instruction: change the second paragraph as indicated*

This primitive may be generated at either a DBand STA/non-AP STA or the PCP/HC.

##### 6.3.26.6.2 Semantics of the service primitive

*Editor Instructions: Change the primitive as follows:*

MLME-DELTS.request(

STAAddress,

TSInfo,

ReasonCode,

STAAddress,

DBand Allocation Info,

Multi-band,

VendorSpecificInfo

)

*Editor Instructions: insert the following entries in the table:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| STAAddress | MACAddress |  | Specifies the MAC address of the peer STA. Only included in case this refers to the PTP TSPEC. |
| DBand Allocation Info | As defined in the frame format | As defined in 8.4.2.117 | Specifies the DBand allocation to be deleted. |
| Multi-band | As defined in the frame format | As defined in 8.4.2.121 | Specifies the frequency band and channel number where the TS is to be deleted. The parameter is absent if the TS is intended to be deleted on the same frequency band and channel where the DELTS is transmitted. |

##### 6.3.26.6.4 Effect of receipt

*Editor Instructions: Change the second paragraph as follows:*

This primitive causes the local MAC entity to send out a DELTS frame containing the specified parameters. In the OBand, If this primitive was generated at the HC, the frame is sent to the specified STA’s MAC address. If this primitive was generated at the non-AP STA, the frame is sent to its HC. In the DBand, the frame is sent to the specified STA’s MAC address. In either case, the DELTS frame does not solicit a response from the recipient frame other than an acknowledgment to receipt of the frame.

#### 6.3.26.7 MLME-DELTS.indication

##### 6.3.26.7.1 Function

*Editor Instructions: Change the first paragraph as follows:*

This primitive reports the deletion of a TS by a specified peer MAC entity or deletion of the TS due to an inactivity timeout (PCP/HC only).

##### 6.3.26.7.2 Semantics of the service primitive

*Editor Instructions: Change the primitive as follows:*

MLME-DELTS.indication (

STAAddress,

TSInfo,

ReasonCode,

DBand Allocation Info,

Multi-band,

VendorSpecificInfo

)

*Editor Instructions: insert the following entries in the table:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| DBand Allocation Info | As defined in the frame format | As defined in 8.4.2.117 | Specifies the DBand allocation under consideration. |
| Multi-band | As defined in the frame format | As defined in 8.4.2.121 | Specifies the frequency band and channel number for the TS under consideration. The parameter is absent if the TS is intended to be deleted on the same frequency band and channel where the DELTS is transmitted. |

##### TID subfield



*Editor instruction: change (Table 8-5 – TID subfield) as follows*

|  |  |  |
| --- | --- | --- |
| **Access policy** | **Usage** | **Allowed values in bits 0-3 (TID subfield)** |
| EDCA | UP for either TC or TS, regardless of whether admission control is required | 0-7 |
| HCCA, SPCA | TSID | 8-15 |
| HEMM, SEMM | TSID, regardless of access mechanism used | 8-15 |

##### 8.2.4.5.11 RDG/More PPDU subfield

The RDG/More PPDU subfield of the QoS Control field for DBand frames is interpreted differently depending on whether it is transmitted by an RD initiator or an RD responder, as defined in Table 8-13 (RDG/More PPDU subfield values).

##### 8.2.4.5.12 AC Constraint subfield

The AC Constraint subfield of the QoS Control field for DBand frames indicates whether the mapped AC of an RD data frame is constrained to a single AC, as defined in Table 8-12 (AC Constraint subfield values).

*Editor instructions: add the following note after Table 8-12*

NOTE – The AC of the last data frame received from the RD initiator is determined directly from the TID of the received frame if TID is between 0 and 7 inclusive, or from the UP field of the TSPEC identified by the TID of the received frame if TID is between 8 and 15 inclusive.

#### Service period request (SPR)

The format of the SPR frame is shown in Figure 8.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Octets: | 2 | 2 | 6 | 6 | 5 | 2 | 4 |
|  | Frame Control | Duration | RA | TA | Dynamic Allocation Info | BF Control | FCS |

Figure 8 SPR frame

When sent in response to a Poll frame (see 9.33.8), the Duration field in the SPR frame is set to the value of the Duration field contained in the Poll frame, minus the value of the Response Offset field contained in the Poll frame multiplied by its unit as specified in 8.3.1.11, minus SIFS, minus the time taken to transmit the SPR frame. When not sent in response to a Poll frame (see 9.33.10 and 10.4.13) and transmitted within an SP or a TXOP allocation, the Duration field is set to the time left in the allocation excluding the SPR transmission time. In all other cases, the Duration field is set to 0.

The RA field contains the MAC address of the PCP or AP.

The TA field contains the MAC address of the STA transmitting the SP request.

The Dynamic Allocation Info field is defined in 8.4a.2 Dynamic Allocation Info field.

The BF Control field is defined in 8.4a.5 Beamforming Control field.

#### Grant

The format of the Grant frame is shown in Figure 9.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Octets: | 2 | 2 | 6 | 6 | 5 | 2 | 4 |
|  | Frame Control | Duration | RA | TA | Dynamic Allocation Info | BF Control | FCS |

Figure 9 Grant frame

For individually addressed Grant frames the Duration field in the Grant frame is set to cover the time to transmit the remaining Grant frame(s) if required, the related IFS (9.3.2.4 IFS) and the Allocation Duration carried in the Dynamic Allocation Info field. For broadcast Grant frames the Duration field is set to cover for the duration of all remaining Grant frames and the transmission of the following MPDU and its response frame, if required (including appropriate IFS values 9.3.2.4 IFS).

The RA field contains the MAC address of the STA receiving the SP grant.

The TA field contains the MAC address of the STA that has transmitted the Grant frame.

The Dynamic Allocation Info field is defined in 8.4a.2 Dynamic Allocation Info field.

The BF Control field is defined in 8.4a.5 Beamforming Control field.

#### Status Code field

*Editor instruction: change (Table 8-36 Status codes) as follows:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Status Code** | **Meaning** | **OBand** | **DBand** |
| 39 | The TS has not been created because the request cannot be honored; however, a suggested TSPEC/Extended DBand TSPEC is provided so that the initiating STA may attempt to set another allocation or TS with the suggested changes to the TSPEC/Extended DBand TSPEC | Yes | Yes |
| 47 | The TS or allocation has not been created; however, the PCP/HC may be capable of creating a TS or allocation, in response to a new request, after the time indicated by the TS Delay or Allocation Delay element | Yes | Yes |

#### TSPEC element

*Editor Instructions: insert at the end of the first paragraph*

Note that a PTP TSPEC is a TSPEC exchanged between two non-AP DBand STAs. The format of the PTP TSPEC is the same as the TSPEC.

*Editor Instructions: change the second paragraph as follows:*

The TSPEC allows a set of parameters more extensive than may be needed, or may be available, for any particular instance of parameterized QoS traffic. Unless indicated otherwise, fields that follow the TS Info field are set to 0 for any unspecified parameter values. STAs set the value of any parameters to unspecified if they have no information for setting that parameter. The DBand STA that responds with an ADDTS response frame and the HC ~~may~~ can change the value of parameters that have been set unspecified by the STA to any value that it deems appropriate, including leaving them unspecified.

*Editor Instructions: change (Figure 8-188—TS Info field) to replace the reserved subfield (B17-B23) as follows*

|  |  |  |
| --- | --- | --- |
| B17-B18 | B19 | B20-B23 |
| Reliability | A-MSDU subframe | Allocation ID |

*Editor Instructions: insert the following new paragraph after the list item ending with “*A bidirectional link request is equivalent to a downlink TS and an uplink TS, each with the same TSID and parameters.*”*

The combination of the TSID, source DBand STA AID, destination DBand STA AID and Direction subfields identifies the TS, in the context of the non-AP STA, to which the TSPEC applies. A non-AP STA as a source DBand STA can use the TSID subfield value for an uplink PTP TSPEC and at the same time the non-AP STA as a destination DBand STA can use the same TSID subfield value for a downlink PTP TSPEC.

*Editor instructions: change Table 8-105—Direction subfield encoding as follows:*

|  |  |  |
| --- | --- | --- |
| Bit 5 | Bit 6 | Usage |
| 0 | 0 | Uplink (MSDUs are sent from the non-AP STA to HC) and used in a PTP TSPEC when the ADDTS request frame is sent by the non-AP Source DBand STA) |
| 1 | 0 | Downlink (MSDUs are sent from the HC to the non-AP STA and used in a PTP TSPEC when the ADDTS request frame is sent by the non-AP Destination DBand STA) |

*Editor instructions: change (Table 8-106—Access Policy subfield) as follows*

|  |  |  |
| --- | --- | --- |
| Bit 7 | Bit 8 | Usage |
| 0 | 0 | Reserved |
| 1 | 0 | Contention-based channel access (EDCA) |
| 0 | 1 | Controlled channel access (HCCA in OBand, SPCA in DBand) |
| 1 | 1 | Controlled and contention-based channel access (HCCA, EDCA mixed mode (HEMM) in OBand; SPCA, EDCA mixed mode (SEMM) in DBand) |

*Editor instructions: change the indicated list item as follows*

* The Aggregation subfield is 1 bit in length. The Aggregation subfield is valid only when the access method is HCCA or SPCA or when the access method is EDCA and the Schedule subfield is set to 1. It
  + is set to 1 by a non-AP STA to indicate that an aggregate schedule is required. It is set to 1 by the AP if an aggregate schedule is being provided to the STA.It is set to 0 otherwise. In all other cases, the Aggregation subfield is reserved.

*Editor instructions: insert the following list items after the last list item*

* The reliability field is 2 bits in length and contains an expected reliability index. The reliability index refers to the PER of the PHY (PSDU Packet Error Rate as in 21.3.3.8). The relation between the reliability index and the PER is shown in Table 11.

Table 11 Reliability

|  |  |
| --- | --- |
| Reliability index | PER |
| 0 | Not specified |
| 1 | 10-3 |
| 2 | 10-4 |
| 3 | 10-5 |

When the reliability field is included in the ADDTS request frame and the direction is set to downlink, and when this field is included in the ADDTS response frame and the direction field is set to uplink, then the value in this field represents the receiver expectation of the PERper specific TSID. This information is provided by the SME using the MLME-ADDTS.request primitive and MLME-ADDTS.response primitives. Together with the Link Margin (9.37) and other implementation specific information, the value can be used by the transmitter to estimate the MCS to be used for this particular TS.

* The A-MSDU subframe field is 1 bit in length and contains a value that indicates the A-MSDU subframe structure to be used for this TS. The A-MSDU subframe field is set to 0 to indicate the standard A-MSDU subframe structure and set to 1 to indicate the short A-MSDU subframe structure.
  + The Allocation ID subfield is defined only for DBand, and is 4 bits in length. Traffic Streams with the same source DBand STA and destination DBand STA can share an allocation through TSPEC aggregation. The Allocation ID subfield is used as follows:When setting up a TS, the DBand STA that transmits an ADDTS Request frame containing a TSPEC or PTP TSPEC element sets the Allocation ID to a nonzero value to identify the allocation it requires to carry the TS. Alternatively, the same DBand STA sets the Allocation ID to zero to indicate any CBAP allocation with broadcast Source AID.
  + When setting up a TS, the DBand STA that transmits the ADDTS Response frame containing the TSPEC or PTP TSPEC element sets the Allocation ID to a nonzero value that identifies the allocation carrying the TS. Alternatively, the same DBand STA sets the Allocation ID to zero to indicate any CBAP allocation with broadcast Source AID and Destination AID.
  + When deleting a TS, the DBand STA that transmits the DELTS frame containing a TSPEC or PTP TSPEC element sets the Allocation ID to a nonzero value to identify the allocation that is carrying the TS to be deleted. Alternatively, the same DBand STA sets the Allocation ID to zero to indicate no allocation exists to carry the TS to be deleted.

#### Extended Schedule element

The Allocation Control field is defined in Figure 46.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0-B3 | B4-B6 |  | B7 | B8 | B9 | B10 | B11 | B12-B15 |
|  | Allocation ID | AllocationType |  | Pseudo-static | Truncatable | Extendable | PCP Active | LP SC Used | Reserved |
| Bits: | 4 | 3 |  | 1 | 1 | 1 | 1 | 1 | 4 |

Figure 46 Allocation Control field

The Allocation ID field, when set to a nonzero value, identifies an airtime allocation from Source AID to Destination AID. Except for CBAP allocations with broadcast Source AID and broadcast Destination AID, the tuple (Source AID, Destination AID, Allocation ID) uniquely identifies the allocation. For CBAP allocations with broadcast Source AID and broadcast Destination AID Allocation ID is zero.

The AllocationType field defines the channel access mechanism during the allocation, with possible values listed in Table xx.

Table xx AllocationType field description

| **Bit 4** | **Bit 5** | **Bit 6** | **Meaning** |
| --- | --- | --- | --- |
| 0 | 0 | 0 | SP allocation |
| 1 | 0 | 0 | CBAP allocation |
| All other combinations | | | Reserved |

#### Extended DBand TSPEC element

The Extended DBand TSPEC element is present in the ADDTS Request frame sent by a non-PCP/non-AP DBand STA, and contains the set of parameters needed to create an airtime allocation. The Extended DBand TSPEC element is also present in the ADDTS Response frame sent by a DBand PCP/AP, and reflects the parameters, possibly modified, by which the allocation was created. The format of the Extended DBand TSPEC element is shown in Figure 49.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element ID | Length | DBand Allocation Info | BF Control |
| Octets: | 1 | 1 | 3 | 2 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Allocation Period | Minimum Allocation | Maximum Allocation | Minimum Duration | TSCONST |
| Octets: | 2 | 2 | 2 | 2 | Variable |

Figure 49 Extended DBand TSPEC element format

The DBand Allocation Info field is formatted as shown in Figure 50.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0-B3 | B4-B6 | B7 | B8 | B9 | B10 | B11 | B12-B14 | B15-B22 | B23 |
|  | Allocation ID | AllocationType | Allocation Format | Pseudo-static | Truncatable | Extendable | LP SC Used | UP | Destination AID | Reserved |
| Bits: | 4 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 8 | 1 |

Figure 50 DBand Allocation Info field format

The Allocation ID field identifies an allocation if set to a nonzero value, and is used as follows:

* The DBand STA that transmits an ADDTS Request containing the Extended DBand TSPEC element sets the Allocation ID to a nonzero value to create a new allocation or modify an existing allocation.
* The DBand STA that transmits the ADDTS Response containing the Extended DBand TSPEC element sets the Allocation ID to a nonzero value to identify a created or modified allocation, or sets it to zero if creating or modifying the allocation failed.

The AllocationType field defines the channel access mechanism used during the allocation, with values listed in Table xx.

The Allocation Format field values are listed in Table 16.

Table 16 Allocation Format values

|  |  |
| --- | --- |
| **Allocation Format value** | **Description** |
| 0 | Isochronous allocation format |
| 1 | Asynchronous allocation format |

The Pseudo-static field is set to 1 for a pseudo-static allocation and set to 0 otherwise.

For an SP allocation, the Truncatable field is set to 1 if the STA expects to truncate the SP, as described in 9.33.9. If the STA does not expect to truncate the SP, the Truncatable field is set to 0. The field is reserved for CBAP allocations.

For an SP allocation, the Extendable field is set to 1 if the STA expects to extend the SP, as described in 9.33.10. If the STA does not expect to extend the SP, the Extendable field is set to 0. The field is reserved for CBAP allocations.

The LP SC Used field is defined in 8.4.2.115.

The UP field indicates the least-priority UP to be used for possible transport of MSDUs belonging to TCs with the same source and destination of the allocation.

The Destination AID field contains the AID of a STA that the requesting STA wishes to communicate with during the allocation.

The BF Control field is defined in 8.4a.5 Beamforming Control field.

The Allocation Period is specified as a fraction or multiple of the Beacon Interval as defined in Table 17.

Table 17 Allocation Period values

|  |  |  |
| --- | --- | --- |
| **B0-B14** | **B15** | **Meaning** |
| 0 | 0-1 | Reserved |
| 1-32767 | 0 | The allocation period is a multiple of the BI, i.e., allocation period = n x BI where n is the value represented by B0-B14 |
| 1-32767 | 1 | The allocation period is a fraction of the BI, i.e., allocation period = BI/n where n is the value represented by B0-B14. |

For isochronous allocation format, the Allocation Period, Minimum Allocation, Maximum Allocation and Minimum Duration fields are set as follows:

* The Allocation Period field indicates the period over which the allocation repeats.
* The Minimum Allocation field is set to the minimum acceptable allocation in microseconds in each allocation period.
* The Maximum Allocation field is set to the desired allocation in microseconds in each allocation period.
* The Minimum Duration specifies the minimum acceptable SP duration in microseconds making up the allocation.

For asynchronous allocation format, the Maximum Allocation field is reserved and the Allocation Period, Minimum Allocation and Minimum Duration fields are set as follows:

* The Allocation Period field indicates the period over which the minimum allocation applies. The Allocation Period is an integral multiple of the Beacon Interval.
* The Minimum Allocation field specifies the minimum allocation in microseconds that the STA expects within the allocation period.

The Minimum Duration field specifies the minimum acceptable SP duration in microseconds.

The Traffic Scheduling Constraint (TSCONST) field contains one or more constraint subfields as illustrated in Figure 51.

|  |  |
| --- | --- |
|  | One or more constraint subfields |
| Octets: | Variable |

Figure 51 Traffic scheduling constraint field format

#### Cluster Report element

The format of the Cluster Report element is shown in

|  |  |  |  |
| --- | --- | --- | --- |
|  | ECPAC Policy Element | Extended Schedule Element | Traffic Scheduling Constraint (TSCONST) |
| Octets: | 0, 13 or 17 | 0 or 17-n | Variable |

Figure 69. The Cluster Report element is included in management action frames, such as the Announce and the Information Response frames, transmitted to the PCP/AP of the BSS. Because the Length field supports only 255 octets of payload in an element, the STA can split the content of the Extended Schedule Element field, as described in 8.4.2.115, in different Cluster Report elements. The value of *n* in

|  |  |  |  |
| --- | --- | --- | --- |
|  | ECPAC Policy Element | Extended Schedule Element | Traffic Scheduling Constraint (TSCONST) |
| Octets: | 0, 13 or 17 | 0 or 17-n | Variable |

Figure 69 is equal to 255-(36 + sizeof(TSCONST field)).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Cluster report control | Reported BSSID | Reference Timestamp | PCP/AP Clustering Control |
| Octets: | 1 | 1 | 1 | 0 or 6 | 0 or 4 | 0 or 8 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | ECPAC Policy Element | Extended Schedule Element | Traffic Scheduling Constraint (TSCONST) |
| Octets: | 0, 13 or 17 | 0 or 17-n | Variable |

Figure 69 Cluster Report element

The Traffic Scheduling Constraint (TSCONST) field is defined in 8.4.2.117 and specifies periods of time with respect to the TBTT of the BI of the BSS the STA participates where the STA experiences poor channel conditions, such as due to interference.

### 8.4a.2 Dynamic Allocation Info field

The format of the Dynamic Allocation Info field is shown in Figure 79.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0-B3 | B4-B6 | B7-B14 | B15-B22 | B23-B38 | B39 |
|  | TID | AllocationType | Source AID | Destination AID | Allocation Duration | Reserved |
| Bits: | 4 | 3 | 8 | 8 | 16 | 1 |

Figure 79 Dynamic Allocation Info field format

The TID subfield in the Dynamic Allocation Info field identifies the TC or TS using the allocation.

NOTE – Unlike pseudo-static allocations, non-pseudo static allocations are not labeled with an Allocation ID, and are tied to a TID.

The AllocationType field is defined in 8.4.2.115.

The Source AID field identifies the STA that is the source of the allocation.

The Destination AID field identifies the STA that is the destination of the allocation.

When the Dynamic Allocation Info field is transmitted within an SPR frame, the Allocation Duration field contains the requested duration in microseconds. When the Dynamic Allocation Info field is transmitted within a Grant frame, the Allocation Duration field contains the granted duration of the allocation in microseconds (see 9.33.8, 9.33.9, 9.33.10).

## Action frame format details

### QoS Action frame details

#### 8.5.3.1 General

*Editor instruction: insert the following paragraph at the end of the subclause*

Two variants are defined for the ADDTS frames: a Basic ADDTS frame variant and an Extended DBand ADDTS frame variant. These variants use different TSPEC formats. The variant of the frame is indicated by the Element ID in the fourth field of the ADDTS Request frame body (Table 8-184) and sixth field of the ADDTS Response frame body (Table 8-185). The Element ID is the first octet of each of these fields. The encoding of the ADDTS frame variants is shown in Table 28 and Table 29.

Table 28 Encoding of the ADDTS Request variant

|  |  |
| --- | --- |
| **Element ID of fourth field of ADDTS Request frame** | **ADDTS Request frame variant** |
| 13 (TSPEC) | Basic ADDTS Request frame |
| 146 (extended DBand TSPEC) | Extended DBand ADDTS Request frame |

Table 29 Encoding of the ADDTS Response variant

|  |  |
| --- | --- |
| **Element ID of sixth field of ADDTS Response frame** | **ADDTS Response frame variant** |
| 13 (TSPEC) | Basic ADDTS Response frame |
| 146 (extended DBand TSPEC) | Extended DBand ADDTS Response frame |

Unless otherwise noted, in this specification the use of the term ADDTS Request/Response frame without the modifier “Extended DBand” always refers to the Basic ADDTS Request/Response frame variant.

*Editor instruction: change the heading of subclause as follows*

#### Basic and Extended DBand ADDTS Request frame formats

*Editor instruction: insert the following subclause heading before the first paragraph*

##### Basic ADDTS Request frame variant

*Editor instruction: rename Table 8-184 as “*Basic ADDTS Request frame variant*” and insert rows as follows:*

|  |  |
| --- | --- |
| Order | Information |
| n+6 | Multi-band (optional) |
| n+7 | Upper Layer Protocol Identification (U-PID) element (optional) |

*Editor instruction: insert at the end of the subclause*

When present in an ADDTS Request frame, the Multi-band element indicates the frequency band, operating class and channel number to which the ADDTS Request frame applies and contains band specific information.

When present in the ADDTS Request frame, the Upper Layer Protocol Identification (U-PID) element indicates the upper layer protocol associated with the TID/TSID specified within the TSPEC element contained in this frame. If a TSPEC element is not present in the frame, the U-PID element is not included in the frame.

*Editor instruction: insert the following subclause*

##### Extended DBand ADDTS Request frame variant

The Extended DBand ADDTS Request frame is used in a PBSS and in an infrastructure BSS operating in the DBand. The frame body of the Extended DBand ADDTS Request frame contains the information shown in Table 30.

Table 30 Extended DBand ADDTS Request frame variant

|  |  |
| --- | --- |
| Order | Information |
| 1 | Category |
| 2 | Action |
| 3 | Dialog Token |
| 4 | Extended DBand TSPEC |
| 5 | TSPEC (optional) |
| 6-n | TCLAS (optional) |
| n+1 | TCLAS Processing (optional) |
| n+2 | Multi-band (optional) |
| n+3 | Upper Layer Protocol Identification (U-PID) element (optional) |

The Dialog Token, Extended DBand TSPEC, and optional TSPEC, TCLAS, TCLAS Processing, Multi-band and U-PID fields of this frame are contained in an MLME-ADDTS.request primitive that causes the frame to be sent.

The Extended DBand TSPEC element contains parameters defining an allocation. The allocation is uniquely identified by the source DBand STA MAC Address, Allocation ID, and destination AID in the Extended DBand TSPEC element.

The optional TSPEC element defines a TS that can use the allocation should the allocation is created successfully.

The TCLAS element is optional and can be present only when a TSPEC element is present, and is used to identify the destination non-PCP/non-AP DBand STA of the ADDTS request frame. There can be one or more TCLAS elements in the Extended DBand ADDTS frame. The TCLAS Processing element is present when there is more than one TCLAS elements.

When present in an Extended DBand ADDTS Request frame, the Multi-band element indicates the frequency band, operating class and channel number for the TS identified by the optional TSPEC element contained in this frame.

When present in the Extended DBand ADDTS Request frame, the Upper Layer Protocol Identification (U-PID) element indicates the upper layer protocol associated with the TS identified by the optional TSPEC element contained in this frame.

*Editor instruction: change the heading of the subclause as follows*

#### Basic and Extended DBand ADDTS Response frame formats

*Editor instruction: insert the following subclause heading before the first paragraph*

##### Basic ADDTS Response frame variant

*Editor instruction: insert the following rows in Table 8-185—ADDTS Response frame body:*

|  |  |
| --- | --- |
| Order | Information |
| n+3 | Multi-band (optional) |
| n+4 | Upper Layer Protocol Identification (U-PID) element (optional) |

*Editor instruction: insert at the end of the subclause:*

When present in an ADDTS Response frame, the Multi-band element indicates the frequency band, operating class and channel number to which the ADDTS Response frame applies and contains band specific information.

When present in the ADDTS Response frame, the Upper Layer Protocol Identification (U-PID) element indicates the upper layer protocol associated with the TID/TSID specified within the TSPEC contained in this frame. If a TSPEC element is not present in the frame, the U-PID element is not included in the frame.

*Editor instruction: insert the following subclause*

##### Extended DBand ADDTS Response frame variant

The Extended DBand ADDTS Response frame is used in a PBSS and in an infrastructure BSS operating in the DBand. The frame body of the Extended DBand ADDTS Response contains the information shown in Table 31.

Table 31 Extended DBand ADDTS Response frame variant

|  |  |
| --- | --- |
| Order | Information |
| 1 | Category |
| 2 | Action |
| 3 | Dialog Token |
| 4 | Status code |
| 5 | Allocation Delay |
| 6 | Extended DBand TSPEC |
| 7 | TSPEC (optional) |
| 8-n | TCLAS (optional) |
| n+1 | TCLAS Processing (optional) |
| n+2 | Multi-band (optional) |
| n+3 | Upper Layer Protocol Identification (U-PID) element (optional) |

The Dialog Token, Allocation Delay, Extended DBand TSPEC, and optional TCLAS, TCLAS Processing, Multi-band and U-PID fields in this frame are contained in an MLME-ADDTS.response primitive that causes the frame to be sent. The Allocation Delay information element is present in an Extended DBand ADDTS Response frame only if the status code is set to 47 (8.4.1.9).

The TSPEC and all other optional fields associated with the TSPEC have the same definition as the fields with the same names in Extended DBand ADDTS Request frame.

#### DELTS frame format

*Editor instruction: change this subclause as indicated below*

The DELTS frame is used to delete a TS or allocation using the procedures defined in 10.4.9 (TS deletion).

Table 8-186 DELTS frame Action field format

|  |  |
| --- | --- |
| Order | Information |
| 1 | Category |
| 2 | Action |
| 3 | TS Info |
| 4 | Reason code |
| 5 | DBand Allocation Info (optional) |
| 6 | Multi-band (optional) |

The TS Info field, defined in 8.4.2.32 (TSPEC element), is always present, and either identifies an existing TS created using the TSPEC element, or all its fields are set to zero.. The DBand Allocation Info field, defined in 8.4.2.117 (Extended DBand TSPEC element), is present when deleting an existing allocation, or when the optional Multi-band field needs to be included. When deleting an allocation, DBand Allocation Info identifies an existing allocation created using the Extended DBand TSPEC element. When not deleting an allocation, all fields in the DBand Allocation Info field are set to zero.At least one of TS Info field or DBand Allocation Info field shall identify a valid TS or allocation.

A DELTS frame ~~may~~ can be sent from the HC or PCP to the source STA of that TS, or vice versa, to indicate an imperative request, to which no response is required from the recipient STA.

When present in an DELTS frame, the Multi-band element indicates the frequency band, operating class and channel number to which the DELTS frame applies.

#### 9.33.7.2 Service period (SP) allocation

The PCP/AP shall set the AllocationType subfield to zero in an Allocation field within an Extended Schedule element to indicate an SP allocation.

#### 9.33.7.3 Contention-based access period (CBAP) allocation

The PCP/AP shall set the AllocationType subfield to one, the Source AID subfield to the broadcast AID or to the AID of the source of the CBAP, and the Destination AID subfield to the broadcast AID in the Allocation field in an Extended Schedule element to indicate a CBAP allocation.

#### 9.33.7.6 DBand Protected Period

##### 9.33.7.6.1 Introduction

A DBand Protected Period can be created by the source DBand STA during an SP, and shall be created by the source DBand STA if at least one of the following conditions are met:

* The source DBand STA is the PCP/AP of the BSS, the ECPAC Policy Enforced subfield within the DBand Parameters field of the last DBand Beacon frame transmitted by the source DBand STA is set to 1 and the Protected Period Enforced field within the ECPAC Policy Detail field of the last ECPAC Policy element transmitted by the source DBand STA is set to 1;
* The source DBand STA is not the PCP/AP of the BSS, the ECPAC Policy Enforced subfield within the DBand Parameters field of the last DBand Beacon frame received by the source DBand STA from the PCP/AP of the BSS is set to 1 and the Protected Period Enforced field within the ECPAC Policy Detail field of the last ECPAC Policy element received by the source DBand STA from the PCP/AP of the BSS is set to 1.

##### 9.33.7.6.4 Interference report

The Allocation ID field of the Extended DBand TSPEC element shall identify the allocation during which the interference was detected. One ADDTS Request frame is generated and transmitted for each allocation during which interference is detected.

The TSCONST field of the Extended DBand TSPEC element may contain one or more Traffic Scheduling Constarint fields. Each Traffic Scheduling Constraint field provides information separately for each overlapping NAV event. The following NAV events should be reported:

### Dynamic allocation of service periods

#### 9.33.8.1 General

Dynamic allocation of service periods is employed to allocate channel time during scheduled SPs and CBAPs. The procedure includes an optional Polling Period (PP) phase and a Grant Period (GP) phase.

Service periods allocated using this mechanism do not persist beyond a beacon interval. Persistent allocations are created using the allocation mechanisms described in 10.4.

Any MAC entity of an MA-STA that belongs to an EL cluster identified by the Source AID and Destination AID that are equal to, respectively, the Source AID and Destination AID of the Dynamic Allocation Info field in the Grant frame may transmit during the allocation, if the MA-STA sent a MMAE to the peer STA and the BeamLink cluster field within the MMAE is 1.

#### 9.33.8.3 Grant period (GP)

A PCP/AP that intends to dynamically allocate an SP within the DTT shall commence a GP at a time instant indicated by at least one of the following:

* SIFS interval following the end of a PP if the PP is present
* anytime during a scheduled SP for which the source AID and destination AID are set to the broadcast AID if a PP does not precede the GP, excluding any time that has been allocated dynamically
* anytime during a TXOP within a scheduled CBAP for which the destination AID is set to the broadcast AID, excluding any time that has been allocated dynamically
* anytime during the relinquished channel time following an SP truncation if a PP does not precede the GP, excluding any time that has been allocated dynamically.

The PCP/AP shall not transmit a frame during a GP if any portion of that frame would extend beyond the end of the originally scheduled SP or CBAP, or beyond the end of an immediately following SP if that SP has the broadcast AID as both source and destination AID, whichever is later.

A non-PCP/non-AP STA may switch to Doze state if it does not receive a Grant frame from the PCP/AP within dot11MinPPDuration from the start of the scheduled SP for which the source AID and destination AID are set to the broadcast AID.

To commence the GP, the PCP/AP shall transmit one or more Grant frames to notify the source DBand STA and destination DBand STA about a dynamically allocated service period. The PCP/AP should transmit the last Grant frame within a GP to the source of the dynamically allocated SP if the source of the dynamically allocated SP is not the PCP/AP. In each transmitted Grant frame, the PCP/AP shall set the Duration field within the Grant frame to a time that does not overlap in time with another SP which has either the source AID or destination AID different than the broadcast AID. In addition, the source AID and destination AID fields shall respectively be set to the source and destination of the dynamically allocated SP, the AllocationType field set to indicate the channel access mechanism during the allocation, and the Allocation Duration field set to a value that is not greater than the result of the subtraction of the duration of all remaining Grant frame transmissions, if any, plus all appropriate IFSs (9.3.2.4 IFS) from the value of the Duration field. An allocation that is indicated in this manner begins at the time that is equal to the PHY-TXEND.indication of the Grant frame plus the value from the Duration field of the Grant frame minus the value of the Allocation Duration field of the Grant frame, and continues for the time indicated in the Allocation Duration field of the Grant frame.

The Dynamic Allocation Info fields within Grant frames transmitted as part of the same GP shall be the same.

NOTE – This means the PCP/AP can create only one allocation per GP.

### Dynamic truncation of service period

An STA truncates an SP to release the remaining time in the SP. The STA can use the DBandCF-End frame to truncate the SP at the peer STA, to reset NAV in third party STAs and to return to the PCP/AP the time left in the SP, thus allowing the PCP/AP to grant any portion of the released time as part of an SP to any other STA or to allocate any portion of it as a CBAP. The STA can use the Grant frame to release any part of the time left in the SP as a CBAP.

#### STA Beamforming after A-BFT

To schedule time in the DTT for BRP execution with the responder, the initiator shall transmit a Grant frame to the responder in one of the following aMinBTIPeriod BIs beginning with the BI in which the SLS phase with the responder was last completed. In the Grant frame, the initiator shall set the RA field to the MAC address of the responder and the TA field to the MAC address of the initiator. In the Dynamic Allocation Info field of the Grant frame, the AllocationType field shall be set to indicate SP, the source AID field shall be set to the AID of the initiator, the destination AID field shall be set to the broadcast AID and the Allocation Duration field shall be set to the expected duration of the BRP phase.

If the initiator receives at least one ScS frame from a responder within an A-BFT but did not transmit an ScS-Feedback frame to the responder within that A-BFT, the initiator may schedule time in the DTT for the responder to complete the RSS. To do that, the initiator shall transmit a Grant frame to the responder before the next A-BFT. In the Grant frame, the initiator shall set the RA field to the MAC address of the responder and the TA field to the MAC address of the initiator. In the Dynamic Allocation Info field of the Grant frame, the AllocationType field shall be set to indicate SP, the source AID field shall be set to the broadcast AID, the destination AID field shall be set to the AID of the initiator and the Allocation Duration field shall be set to cover for at least the remaining duration of the RSS.

## TS operation

### Introduction

*Editor instruction: insert the following pargraph as the new first paragraph*

There are three types of traffic specifications: the TSPEC, the Extended DBand TSPEC and the PTP TSPEC.

*Editor instruction: insert the following pargraphs after the first paragraph*

The Extended DBand TSPEC (8.4.2.117) describes an allocation within a PBSS or an infrastructure BSS operating in the DBand. The purpose of the Extended DBand TSPEC is to create or modify an allocation for the transmission of frames between DBand STAs that are members of a PBSS or an infrastructure BSS operating in the DBand (9.33.7).

When transmitted between members of a PBSS or members of an infrastructure BSS operating in DBand, the TSPEC defined in 8.4.2.32 is used to create or modify a TS between the members. When transmitted between members of a PBSS, or between a non-AP members of an infrastructure BSS operating in the DBand, the TSPEC is referred to as a PTP TSPEC.

In DBand, a TSPEC includes TS parameters such as maximum MSDU size, delay bound , and optionally the allocation carrying the TS. A single allocation can carry multiple TSs. Each TS is carried in one allocation, except when

* the TS has an access policy of EDCA, where it can use all CBAP allocations with broadcast Source AID, as well as all CBAP allocations with a unicast Source AID matching the TS source STA, or
* the TS has an access policy of SEMM, where it can use exactly one SP allocation, as well as all CBAP allocations with broadcast Source AID, and all CBAP allocations with a unicast Source AID matching the TS source STA.

*Editor instruction: change the second pargraph as follows*

A TS can have one or more TCLAS (within the discretion of the STA that sets up the stream) associated with it. The DBand STA/AP uses the parameters in the TCLAS elements to identify the MSDUs belonging to a TS so that they can be delivered with the QoS parameters that have been set up for that TS.

*Editor instruction: change the fourth pargraph as follows*

TSPEC, PTP TSPEC, optional TCLAS, and optional EBR elements are transported on the air by the ADDTS Request frame and the ADDTS Response frame, and across the MLME SAP by the MLME-ADDTS primitives. In addition, a TS could be created if a STA sends a resource request to a~~n~~ PCP/AP prior to initiating a transition to that PCP/AP, as part of performing FST (10.34 Multi-band Operation), or in the Reassociation Request frame to that PCP/AP.

Extended DBand TSPEC is transported over the air within the Extended DBand ADDTS and across the MLME SAP by the MLME-ADDTS primitives.

*Editor instruction: insert the following paragraphs below the fifth paragraph and change the existing sixth paragraph*

Following a successful negotiation of an Extended DBand TSPEC in a PBSS or in a DBand infrastructure BSS, a new alocation is created, or an existing allocation is modified. Within a PBSS or infrastructure BSS, each allocation is uniquely identified by a combination of Allocation ID, source AID and destination AID.

Following a successful negotiation of a PTP TSPEC or a TSPEC in DBand, the frames corresponding to the PTP TSPEC or TSPEC are indentified within the DBand STA by the combination of TSID, requesting non-AP DBand STA address, responding non-AP DBand STA address, direction.

It is always the responsibility of the non-AP STA to initiate the creation of a TS regardless of its direction. An STA that is not a DBand STA shall not transmit a PTP TSPEC or an Extended DBand TSPEC. A non-AP DBand STA that is not the source of a specific TS shall not initiate the exchange of a TSPEC to the AP DBand STA or PCP DBand STA to create that TS. Any non-AP DBand STA can issue a PTP TSPEC to any other non-AP DBand STA to create a TS.

*Editor instruction: starting from the eigth paragraph, change the subclause as indicated below*

In the case of traffic relayed by a PCP/AP, the sending and receiving non-PCP/non-AP STAs may both create individual TSs for the traffic. In an infrastructure BSS, any traffic classifier created for the downlink TS applies equally regardless of whether the source is in the same BSS or reached through the DS.

In an infrastructure BSS in the OBand, a non-AP STA may simultaneously support up to eight TSs from the HC to itself and up to eight TSs from itself to other STAs, including the HC. The actual number it supports may be less due to implementation restrictions.

In an infrastructure BSS in the OBand, an HC may simultaneously support up to eight downlink TSs and up to eight uplink TSs per associated STA. The actual number it supports may be less due to implementation restrictions.

Within a DBand BSS there may be up to sixteen TSs from a source DBand STA to a destination DBand STA. An additional sixteen TSs may be created between the two DBand STAs by reversing the roles of source and destination. The actual number supported in any direction may be less due to implementation restrictions in either the source or destination DBand STA.

In OBand, the traffic admitted in the context of a TSPEC can be sent using EDCA or HCCA or HEMM. This depends on the access policy set in the TS Info field in the TSPEC. A TSPEC request may be set so that both HCCA and EDCA mechanisms (i.e., HEMM) are used.

In DBand, the traffic admitted in the context of a PTP TSPEC or TSPEC is sent according to the access policy set in the TS Info field of the PTP TSPEC or TSPEC. Specifically, the traffic is sent during one or more CBAP allocations if the access policy is EDCA, during an SP allocation if the access policy is SPCA, and during one SP allocation as well as zero or more CBAP allocations if the access policy is SEMM.

A DBand STA transmitting an Extended DBand TSPEC shall set the LP SC Used subfield within the Extended DBand TSPEC to 1 to indicate that the low power SC PHY described in 21.7 will be used during the allocation. All TSs sent during the allocation shall use the low power SC PHY. The DBand STA shall set the LP SC Used subfield to 1 only if the DBand STA identified in the Destination AID field within the Extended DBand TSPEC supports the low power SC PHY (8.4.2.111.2 DBand STA Capability Information field). In all other cases, the LP SC Used subfield shall be set to 0.

### TSPEC Construction

*Editor instruction: change the first paragraph as follows*

Extended DBand TSPECs and TSPECs are constructed at the SME, from application requirements supplied via the SME, and with information specific to the MAC layer. Except as described in this subclause, there are no normative requirements on how any TSPEC is to be generated. However, N.3.2 (TSPEC construction), describes parameter choice for the TSPEC. There are no normative requirements on how any Extended DBand TSPEC is to be generated.

### TS Lifecycle

*Editor instruction: insert the following paragrap below the third paragraph*

Unless stated otherwise, in the DBand the owner of an SP is the source DBand STA for that SP and the owner of a TXOP is the TXOP holder. A STA that owns an SP or a TXOP is said to have the ownership of the SP or the TXOP, respectively. The rules applicable to an SP or TXOP owner are defined in 9.33 and 10.4.

*Editor instruction: starting with the fourth paragraph, change this subclause as follows*

Following a successful TS setup initiated by the non-AP STA, the TS becomes active, and either the non-AP STA or the HC may transmit QoS data frames using this TSID (according to the Direction field). In the case of EDCA, the TID contains the UP value.

While the TS is active, the parameters of the TSPEC characterizing the TS, or parameters of the Extended DBand TSPEC characterizing the alloaction carrying the TS can be renegotiated, when the renegotiation is initiated by the non-AP STA. This negotiation can succeed, resulting in a change to the TSPEC or Extended DBand TSPEC, or can fail, resulting in no change to the TSPEC or Extended DBand TSPEC.

An active TS becomes inactive following a TS deletion process initiated at either non-AP STA or HC. It also becomes inactive following a TS timeout detected at the HC, or if the HC within an AP when dot11SSPNInterfaceActivated is true determines as defined in 10.24.5 (Interworking procedures: interactions with SSPN) that the non-AP STA’s TS has exceeded the transmitted MSDU limit for the access category in which the TS was admitted. In the DBand, a TS timeout is detected at a non-AP STA and causes the TS deletion process to be initiated at the non-AP STA. When an active TS becomes inactive, all the resources allocated for the TS are released.

An active TS may become suspended if no activity is detected for a duration of a suspension interval. Upon detection of activity, the TS may be reinstated. While the TS is in the suspended state, the HC shall not reclaim the resources assigned to the TS. In the DBand, a TS in which both the source and destination are non-PCP/non-AP STAs shall not be suspended.

### TS Setup

*Editor instructions: in Figure10-8, replace “*HC*” by “*HC/non-AP STA*”*

*Editor instruction: starting from the second paragraph, change the subclause as follows*

The non-AP STA SME decides that a TS needs to be created. How it does this, and how it selects the TSPEC or Extended DBand TSPEC parameters, is beyond the scope of this standard. The SME generates an MLME-ADDTS.request primitive containing a TSPEC or Extended DBand TSPEC. A TSPEC or Extended DBand TSPEC may also be generated autonomously by the MAC without any initiation by the SME. However, if a TSPEC or Extended DBand TSPEC is generated subsequently by the SME and the responding MLME-ADDTS.confirm primitive contains ResultCode=SUCCESS, the TSPEC or Extended DBand TSPEC containing the same TSID generated autonomously by the MAC shall be overridden. If one or more TSPECs or Extended DBand TSPEC s are initiated by the SME, the autonomous TSPEC or Extended DBand TSPEC shall be terminated.

The STA’s MLME transmits the TSPEC or Extended DBand TSPEC in an ADDTS Request frame to the HC/non-AP STA and starts a response timer called *ADDTS timer* of duration dot11ADDTSResponseTimeout. If the non-AP STA expects to enter power save mode, it shall include its Wakeup Schedule element in the ADDTS Request frame variant and in the Extended DBand ADDTS Request frame variant.

The HC’s/non-AP’s MLME receives this management frame and generates an MLME-ADDTS.indication primitive to its SME containing the TSPEC or Extended DBand TSPEC.

The SME in the HC/non-AP STA decides whether to admit the TSPEC or Extended DBand TSPEC with its associated TCLAS element(s) (if present) and TCLAS processing element (if present), as specified, refuse the TSPEC or Extended DBand TSPEC, or not admit but suggest an alternative TSPEC or TCLAS element(s) or TCLAS processing element or Extended DBand TSPEC.

If the TSPEC or Extended DBand TSPEC is received from a non-AP STA by an AP when dot11SSPNInterfaceActivated is true, the HC shall use the permissions stored in dot11InterworkingEntry for that STA in the decision to admit or deny the request (see 10.24.5.3 (Reporting and session control with SSPN)). The SME then generates an MLME-ADDTS.response primitive containing the TSPEC or Extended DBand TSPEC, zero or more TCLAS element(s) (only if present in the request) and TCLAS processing element (only if present in the request) and a ResultCode value. The contents of the TSPEC or Extended DBand TSPEC and Status fields contain values specified in 6.3.26.5.2 (Semantics of the service primitive). The SME may include fewer TCLAS elements in the MLME-ADDTS.response primitive than were present in the request; when the SME’s response includes a single TCLAS element, it shall not include a TCLAS processing element. If the SME changes a TCLAS element’s Classifier Type field in the MLME-ADDTS.response primitive but is unable to suggest a value for the Classifier Mask field, it shall set that field to zero. If the SME changes a TCLAS element’s Classifier Type field or Classifier Mask field in the MLME-ADDTS.response primitive but is unable to suggest values for one or more Classifier Parameter subfields, it shall set those subfields to zero.

*Editor instruction: insert the following paragraph below the sixth paragraph*

If the Extended DBand TSPEC is admitted, the PCP/AP shall set the ResultCode to SUCCESS\_STA\_IN\_DOZE\_MODE if the STA identified by destination AID is in power save mode, and shall include in the ADDTS Response frame the Wakeup Schedule element of the destination DBand STA if one is established. In this case, the PCP/AP should defer including the TS schedule in the Extended Schedule element until both source DBand STA and destination DBand STA are in active mode.

*Editor instruction: change the 7th, 8th and 9th paragraphs as follows*

The HC’s/non-AP’s MLME transmits an ADDTS Response frame containing this TSPEC or Extended DBand TSPEC and status. The encoding of the ResultCode values to Status Code field values is defined in Table 8-36. The PCP/AP shall transmit the ADDTS Response frame to the STAs identified as source and destination AID of the Extended DBand 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 returning the nonzero Allocation ID in the TSPEC element returned in the ADDTS Response frame, and also by including the allocation schedule in the Extended Schedule element transmitted in the DBand Beacon frame or Announce frame.

The non-AP STA MAC receives this management frame and cancels its ADDTS timer. It generates an MLME-ADDTS.confirm primitive to its SME containing the TSPEC or Extended DBand TSPEC and status.

The non-AP STA SME decides whether the response meets its needs. How it does this is beyond the scope of this standard. A SME receiving a modified TCLAS element having a Classifier Mask field equal to zero or Classifier Parameter subfields equal to zero should regard these values as meaning that no suggested value has been provided by the HC.

* If the result code is SUCCESS, the TS enters into an active state.
* If the result code is REJECTED\_WITH\_SUGGESTED\_BSS\_TRANSITION, the non-AP STA may try to transition to other BSSs. In case that the non-AP STA is recommended to transition to other BSSs, it should do so according to the process defined in 10.23.6 (BSS transition management for network load balancing). Once the transition is completed, it should proceed with a TS setup process with the new HC.
* Otherwise, the whole process can be repeated using the same TSID and direction and a modified TSPEC or Extended DBand TSPEC until the non-AP STA SME decides that the granted medium time is adequate or inadequate and cannot be improved.

The above rules also apply to the negotiation of the PTP TSPEC and to the negotiation of the Extended DBand TSPEC.

*Editor instruction: insert the following below the 10th paragraph and change the 11th paragraph as follows*

When a request for the modification of the TS parameters is accepted by a non-AP STA, it shall reset the inactivity interval timers.

If the HC/PCP grants medium time for an ADDTS Request frame with the Ack Policy subfield set to Block Ack and the Direction field set to either downlink or bidirectional, then it shall initiate a Block Ack negotiation by sending an ADDBA Request frame to the non-AP STA that originated the ADDTS Request frame. If a STA in the OBand is granted medium time for an ADDTS Request frame with the Ack Policy subfield equal to Block Ack and the Direction field equal to other than downlink, then it shall initiate a Block Ack negotiation by sending an ADDBA Request frame to the recipient of the TS.

*Editor instruction: Insert after the last paragraph:*

A STA may include a U-PID element in ADDTS Request and ADDTS Response frames transmitted by the STA. The U-PID element is used to indicate the protocol responsible for handling MSDUs corresponding to the TID indicated within the frame carrying the U-PID element. If a U-PID element is not included in an ADDTS Request frame, MSDUs corresponding to the TID contain an LLC protocol header used for upper layer protocol selection. A U-PID element shall not be included in an ADDTS Response frame if a U-PID element was not included in the corresponding ADDTS Request frame. If a U-PID element was included in an ADDTS Request frame, the value of the LLC header copy field within the U-PID element included in the ADDTS Response frame with a Status Code of success and that is transmitted in response to the received ADDTS Request frame shall be the same as the LLC header copy field contained in the ADDTS Request frame. The STA shall set the Status Code field to 89 (Reject because of U-PID setting) in the ADDTS Response frame if it rejects the ADDTS Request frame due to the setting of the U-PID element received within the ADDTS Request frame.

### Failed TS Setup

*Editor instruction: change the first two paragraphs as follows*

There are two possible types of failed TS setup:

a) The transmission of ADDTS Request frame failed.

b) No ADDTS Response frame is received from the HC/non-AP STA (e.g., because of delay due to congestion or because the response frame cannot be transmitted).

Figure 10-9 (Failed TS setup detected within non-AP STA’s MLME) summarizes the remaining two cases. The MLME shall issue an MLME-ADDTS.confirm primitive, with a result code of TIMEOUT. In either case and for a BSS in the OBand, if the request is not for an existing TS, the MLME shall send a DELTS to the HC specifying the TSID and direction of the failed request just in case the HC had received the request and it was the response that was lost. In both cases and for a BSS in the DBand, if the request is not for an existing allocation or TS, the MLME shall send a DELTS to the non-AP STA, specifying the Allocation ID or TSID and destination DBand STA of the failed request just in case the PCP/AP had received the request and it was the response that was lost.

*Editor instruction: In Figure 10-9, replace “*HC*” by “*HC/non-AP STA*”*

### Data Transfer

*Editor instruction: change the first paragraph as indicated below*

After the setup of a TSPEC or PTP TSPEC MSDUs are classified above the MAC and are sent to the MAC through the MAC\_SAP using the service primitive MA-UNITDATA.request with the priority parameter encoded to the TSID.

*Editor instruction: insert the following paragraphs after the first paragraph*

In the DBand, MSDUs are transmitted using QoS data frames. During eachCBAP allocation, the MAC delivers MSDUs based on the priority of the transmitted QoS data frames. The MAC can transmit all MSDUs having a TSID with an associated TSPEC with an access policy of EDCA or SEMM, provided that the CBAP allocation source is the same as the MSDU source, or the CBAP allocation source is set to broadcast address.

NOTE - MSDUs having a TSID with no associated TSPEC are not transmitted.

During each SP allocation, the MAC delivers MSDUs whose TSIDs identify TSPECs that have been set up to use the SP allocation. Relative prioritization of multiple TSPECs mapped to the same SP allocation is an implementation topic and outside the standard scope.

When an MSDU arrives from the MAC\_SAP with a TSID for which there is no associated TSPEC, the MSDUs shall be sent using EDCA with the access category AC\_BE.

### TS Deletion

*Editor instruction: change this subclause as indicated below*

There are two types of TS deletion: non-PCP/non-AP STA-initiated and HC/PCP-initiated. In both cases, the SME entity above the MAC generates an MLME-DELTS.request primitive specifying either the allocation or TS to be deleted and the reason for deleting the allocation or TS. In OBand, or in DBand when deleting a TS, receiving an MLME-DELTS.request primitive causes the MAC to send a DELTS Action frame.

In DBand, an SP or CBAP allocation can be deleted at any point in time. A PCP/AP can delete any allocation. A non-PCP/non-AP STA can delete only allocations that were created using the STA address as Source AID or Destination AID. Deleting an allocation also triggers deletion of any TS that is dependent on that allocation, specifically:

* Deleting an SP allocation also triggers deletion of any TS with access policy SPCA or SEMM using the allocation
* Deleting a CBAP allocation with unicast Source AID also triggers deletion of any TS with access policy EDCA using the allocation
* Deleting a CBAP allocation with broadcast Source AID also triggers deletion of any TS with access policy EDCA using the allocation, provided there is no other CBAP allocation the TS could use

In DBand, receiving an MLME-DELTS.request for an allocation causes the MAC to send a DELTS Action frame to PCP/AP. If the allocation Destination AID is unicast, PCP/AP shall send a DELTS Action frame to the allocation Destination AID. PCP/AP shall also remove the scheduling information corresponding to the allocation and contained in the Extended Schedule Elemenet

Receiving an MLME-DELTS.request for a TS causes the DBand MAC to send a DELTS Action frame to the STA at the other end of the TS.

The encoding of ReasonCode values to Reason Code field (see 8.4.1.7) values is defined in Table 8-35.

When deleting an allocation or TS, the allocation or TS is considered inactive within the initiating MAC when the ACK frame to the Action frame is received. No Action frame response is generated.

Figure 10-10 shows the case of TS deletion initiated by the non-PCP/non-AP STA and the case of TS deletion initiated by the HC/PCP.

*Editor instruction: In Figure 10-10, replace “*HC*” by “*HC/non-AP STA*”*

An HC should not delete a TSPEC without a request from the SME except due to inactivity (see 10.4.10) or an HC service change that precludes the HC from continuing to meet the requirements of the TSPEC.

All TSPECs or Extended DBand TSPEC s that have been set up shall be deleted upon disassociation and reassociation. Reassociation causes the non-PCP/non-AP STA and PCP/AP to clear their state, and the non-PCP/non-AP will have to reinitiate the setup.

*Editor instruction: insert the following subclauses*

### DBand Allocation Formats

#### General

A DBand STA manages allocations and TSs as described in subclauses 10.4.1 through 10.4.14. Using the Extended DBand TSPECelement, a DBand STA can define two types of allocation scheduling: isochronous and asynchronous. It should establish an isochronous allocation if it needs periodic access to the channel and does not expect to change the amount of time allocated frequently. It should establish an asynchronous allocation if it expects to make requests for channel time and wishes to reserve a minimum amount of channel time to satisfy for those requests when they occur.

#### Isochronous allocations

In order to request the setup of an isochronous allocation, a DBand STA shall set the Allocation Format field in the Extended DBand TSPEC element to zero.

Following successful admittance of an Extended DBand TSPEC with isochronous allocation, the PCP/AP should allocate time in the BI to meet the periodicity and minimum allocation requirements specified in the Extended DBand TSPEC element.

Referring to fields in the Extended DBand TSPEC element, the PCP/AP should ensure that over each Allocation Period, the sum of the time allocations is at least the Minimum Allocation. In addition, the PCP/AP should ensure that each individual allocation has a minimum duration of at least Minimum Duration. See 8.4.2.117, 9.33.7 and 9.33.7.4 Pseudo-static allocations.

NOTE – With an isochronous Extended DBand TSPEC, the allocation period defines the period over which the channel time allocation repeats. The scheduler ought to ensure that at least the minimum allocation is made within each allocation period. The allocation may be composed of multiple SPs. The scheduler will also ensure that each SP making up the allocation is no shorter than the minimum SP duration. The scheduler is free to position the SPs that make up the allocation anywhere in the allocation period. The scheduler may allocate up to the maximum allocation each allocation period if resources permit.

#### Asynchronous allocations

A DBand STA uses the SPR frame to request channel time for asynchronous traffic.

For each TID, source DBand STA and destination DBand STA tuple, the PCP/AP can maintain the amount of outstanding channel time that needs to be allocated. Each time it receives an SPR frame the amount of outstanding channel time is set to the value received in the SPR frame from the source DBand STA for the identified TID and destination DBand STA. The amount of outstanding channel time is decreased by the amount allocated when channel time is schedule for that TID, source DBand STA and destination DBand STA tuple.

A DBand STA may also use an Extended DBand TSPEC to reserve resources for asynchronous traffic. In this case, the STA shall set the Allocation Format field in the Extended DBand TSPEC element to one. The PCP/AP should admit an asynchronous Extended DBand TSPEC only if it is able to meet the minimum allocation requirements specified in the Extended DBand TSPEC element.

NOTE – With an asynchronous Extended DBand TSPEC, the DBand STA registers the minimum allocation it expects within the allocation period while an SP request is in effect that is greater than the minimum allocation specified. In addition, the STA expects that each allocation will be at least Minimum Duration microseconds in duration, provided the outstanding SP request is at least that much. In admitting an Extended DBand TSPEC, the PCP/AP ought to ensure that there are sufficient resources available to meet the TSPEC requirements.

### PTP TS Operation

The ADDTS Request frame containing the PTP TSPEC may be sent to the peer non-AP DBand STA directly or through PCP/AP DBand STA.

A non-AP DBand STA may add TSs to an existing allocation. To do this, the non-AP DBand STA transmits an ADDTS Request frame to peer non-PCP/non-AP DBand STA to include the additional TS. The ADDTS request frame shall contain a PTP TSPEC with Allocation ID identifying 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 CBAP allocation source matches the TS source or CBAP allocation source is set to broadcast.

A non-AP DBand STA transmits an ADDTS request frame to a peer non-AP DBand STA to add a TS to an existing allocation, and to possibly communicate traffic-specific parameters such as A-MSDU subframe and Maximum MSDU Size with the peer non-AP DBand STA. The non-AP DBand STA may transmit the ADDTS request frame directly to the peer DBand STA, or to PCP/AP DBand STA. In the latter case, the ADDTS request frame shall contain a TCLAS element with the classifier type set to Ethernet parameters and the Source Address field shall contain the address of the DBand STA that sends the ADDTS Request frame and the Destination Address field shall contain the address of the peer DBand STA, which will be used by PCP/AP to forward to the peer DBand STA.

The non-AP DBand STA and the non-PCP DBand STA shall not request adding a TS to an allocation whose source DBand STA and destination DBand STA differ from the source DBand STA and destination DBand STA indicated in the ADDTS request frame.

The PCP/AP DBand STA shall forward the received ADDTS Request frame to the DBand STA with Address equal to the Destination Address field of the Classifier. If an ADDTS Response frame is received by the PCP/AP DBand STA in response to the forwarded ADDTS Request frame, then the PCP/AP DBand STA shall forward the ADDTS Response frame to the DBand STA with Address equal to the Source Address field of the Classifier. The PCP/AP DBand STA shall not change the content of the information elements included in the ADDTS Request and ADDTS Response frames.

If the DBand STA asserts the direction field to a value equal to Downlink in the PTP TSPEC included in the ADDTS Request frame, the parameters apply to the DBand STA as the receiving station. For example, in this case, the Maximum MSDU Size field indicates that the DBand STA is not able to receive MSDUs longer then the value presented in the MSDU Size field. Similarly, if the direction field indicates uplink, the DBand STA that issued the ADDTS Request frame will never send MSDUs longer than the value of the Maximum MSDU Size field.

#### FST TS switching

The rules defined below apply when the ADDTS frames or the Extended DBand ADDTS frames are used to switch TS. When the ADDTS frames and the Extended DBand ADDTS frames are used then the ADDTS requester and the ADDTS responder provide the functions defined for the ADDBA Originator and the ADDBA Recipient respectively.