IEEE P802.11
Wireless LANs

|  |
| --- |
| Miscellaneous 6 GHz channelization CIDs |
| Date: 2020-05-25 |
| Author(s): |
| Name | Company | Address | Phone | email |
| Thomas Derham | Broadcom |  |  | thomas.derham@broadcom.com |
| Laurent Cariou | Intel |  |  | laurent.cariou@intel.com |
| Youhan Kim | Qualcomm |  |  | youhank@qti.qualcomm.com |
|  |  |  |  |  |

Abstract

This submission present proposed resolution for some miscellaneous CIDs relating to 6 GHz channelization: 24036, 24558, 24559.

Note that resolutions for the following CIDs, which also relate to 6 GHz channelization, are proposed in a separate submission 20/646: 24047, 24049, 24050, 24052, 24053, 24213, 24255, 24256, 24547.

Changelog:

r0 – initial contribution

r1 – various fixes, 1st presentation (blue markup)

r2 – updates based on received comments, including updated representation of PSD limits, 2nd presentation (red markup)

r3 – additional updates, including clarified text in 11.7.5 (TPE in Beacons/Probes), clarification of TPE PSD representations, clarifications in Annex of limits indicated by SP/AFC APs

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 24036 | Ecclesine, Peter | 771 | E.1 | This comment is a placeholder for a comment in an 802.11ax recirculation ballot. I accept the Editorial note for now, but if before final draft recirculation a regulatory administration issues a 6 GHz band rule prohibiting active scanning in a 6 GHz band, then Annex D and the E.4 Global Table Behavior Limits Set have to indicate a behavior for 6 GHz active scanning prohibited, like the existing DFS\_50\_10\_Behavior in 5 GHz bands. | Change Table D-2 Behavior Limits to add a behavior for 6 GHz Active Scanning Prohibited, and add 6 GHz Active Scanning Prohibited to bands/channels in Annex E tables where 6 GHz Active Scanning Prohibited is true in some regulatory domains. | **Reject**No regulatory administration has issued a rule that prohibits active scanning in 6 GHz band, therefore no change to Table D-2 or Annex E is required. |
| 24558 | Asterjadhi, Alfred | 158 | 9.4.2 | Check whether Country IE and Supported Operating Class IE need updated with the addition of 6 GHz band. If they need update then please do so. Also check if other IEs may need similar updates | As in comment. | **Revised**See discussion.Editor to adopt changes in this document 20/0822r0 |
| 24559 | Asterjadhi, Alfred | 771 | E.1 | Only Table E-4 is updated to include 6 Ghz channels. Check if other tables in clause E need to be updated as well. | As in comment. | **Reject**All 6 GHz devices are required to support global operating class table. The proposal in 20/646 is intended to be used across multiple regulatory domains. There is no need to add operating classes to nonglobal tables. Note that many 6 GHz/11ax features require signaling using global operating classes only.  |

**Discussion for CID #24558:**

No needed updates have been identified for the Supported Operating Classes element. This element supports signaling of the newly defined 6 GHz Operating Classes without modification.

Regarding Country element, since all 6 GHz APs have dot11OperatingClassesRequired equal to true (see 26.17.2.1), the Country element is present in Beacon and Probe Response frames, and the Triplet field in Country element will contain Operating/Subband Sequence fields which indicate the Operating Class (in Operating Triplet) that corresponds to the channel numbers (in Subband Triplet). Modifications are proposed as follows:

* Explicitly disallow inclusion of Subband Triplet fields prior to Operating/subband sequences in 6 GHz band, since they do not contain an OpClass and the channel numbers alone are ambiguous
* To align with 5 GHz rules (see 10.22.3), for 6 GHz explicitly disallow inclusion of Subband Triplet fields with Operating/Subband Sequence fields if they indicate channel spacing >=40 MHz. (Note: Inclusion of Subband Triplet fields within Operating/Subband Sequence fields is still allowed for 20 MHz channel spacing since it allows AP to indicate which channels it supports)
* Specify that the Maximum Transmit Power Level field is reserved within an Operating/Subband Sequence field for 6 GHz band. Since 6 GHz regulatory rules in some countries specify both PSD-EIRP and total EIRP regulatory limits, and different limits for different client device categories, this single field is insufficient to carry full maximum power level regulatory information. Note even if no Subband Triplet Sequence fields are included, the Operating/Subband Sequence field might be used to indicate a Coverage Class. (Also see TPE discussion below for signaling of power limits.)

Regarding Transmit Power Envelope (TPE) element, this is used by an AP to indicate to STAs a (Local) Maximum Transmit Power; one usage of which is to meet mitigation requirements for a channel in a given regulatory domain (see 10.22.4 and 11.7.5). While the concept of a mitigation requirement is specific to certain bands and regulatory rules, the indicated power limits can be used to indicate (regulatory) power limits for any band. All 6 GHz HE STAs support the TPE element because they have both dot11VHTOptionImplemented and dot11SpectrumManagementRequired equal to true (see 26.17.2.1). At least one regulatory authority is defining 6 GHz regulatory limits for client devices that are based not only on (total) EIRP but also on EIRP PSD (Power Spectral Density) in dBm/MHz, and also in some cases depend on the client device category/type. To enable signaling of these limits using TPE element, the following modifications are proposed:

* Add a “unit interpretation” of PSD-EIRP (in dBm/MHz), in addition to the currently defined unit interpretation of (total) EIRP in dBm.
	+ Note that, with respect to the note in Table 9-275a (previously 9-277), an EIRP PSD limit cannot be unambiguously converted to an EIRP value per 20/40/80/160 MHz transmission bandwidth, since the regulatory PSD limit applies separately to every 1 MHz of transmission, and transmissions do not in general have flat PSD across the nominal bandwidth (e.g. due to tone boosting, narrowband-RU OFDMA transmissions, etc).
* For PSD-EIRP interpretation(s), define a new field format for indicating transmit power limits. Instead of advertising limits for each PPDU bandwidth, for PSD-based limits it is more appropriate to advertise limits for each 20 MHz channel within the bandwidth of the BSS. This is particularly relevant for AFC-based regulatory limits where different mitigations might apply to different parts of the BSS bandwidth in order to protect incumbents. This field format allows indications over partial BSS bandwidths (e.g. just primary 20 within an 80 MHz BSS), and efficiently compresses to a single value for cases where the PSD limit is the same across each 20 MHz channel (e.g. fixed PSD limit for LPI operation).
* Add “[unit] interpretation” definitions corresponding to regulatory client transmit power limits. This ensures that a client can clearly differentiate between regulatory client limits and local transmit power limits (which might be chosen by the network operator for other reasons such as OBSS interference mitigation). These new interpretations replace the regulatory limits provided in Country element for legacy bands. Mandatory requirements to advertise these regulatory limits are specified.
* Define a Maximum Transmit Power Category subfield (in previously reserved bits) which contains a value indicating the (client device) category for which the limits apply, with country-specific interpretation (see below)
* Update description of inclusion of TPE element in Beacons/Probes so that multiple TPE elements can be included with unique combinations of the unit interpretation and (client) category, as needed
* Rename the Local Maximum Transmit Power Unit Interpretation subfield and Local Maximum Transmit Power for X MHz subfields through the standard, to represent the broader interpretation of these fields due to above additions

In addition, in order to address regulatory rules in which all transmissions in a 6 GHz channel (including short signaling such as probe requests) might require the STA to have received indication/confirmation of an AP operating in that channel (and corresponding regulatory power limits), the following modifications are proposed to optimize in-band discovery using active scan prior to a beacon or probe response having been received from the 6 GHz AP:

* If a 6 GHz AP sends FILS Discovery frames, require a TPE element to be included indicating local/regulatory? power limit
* If an (2.4 / 5 GHz) AP that is co-located with a 6 GHz AP sends RNR, require inclusion of a “20 MHz PSD” field which is a minimal indication of the lowest local/regulatory? power limit in the primary 20 MHz
* Since RNR might include report of multiple APs, intention is to only indicate minimal power limit information (sufficient to send a 20 MHz probe request), to avoid beacon/probe bloat

A new subclause in Annex E.2.7 (for Band-specific Operating requirements in 6 GHz) is proposed to be added, based on the published FCC rules. This specifies the following requirements, related to the above signaling, when operating in the US:

* Use of EIRP-PSD interpretations in TPE for Default client category in Beacons, Probes and FILS-DF by 6 GHz APs
* For LPI APs, inclusion of a 2nd TPE element in Beacon and Probe Responses with EISP-PSD interpretation for Subordinate Device category. (Note the regulatory limit for Subordinate Device clients, when associated with an LPI AP, is higher than for regular clients with an LPI AP)
* Allowance for a Fixed Client to ignore TPE limits from an AP it has identified as an SP AP (see below) (note: this is because a Fixed Client, when associated with an SP AP, is allowed to use regulatory limits it has determined itself by querying an AFC database)
* Note: The intention of this subclause is to ensure signaling is provided to enable client devices to meet regulatory rules when operating in the US (e.g. when regulatory hints such as Country string indicate US). It does not attempt to interpret FCC regulations for exactly how client devices are required to use that signaling when determining a local maximum transmit power – this is consistent with baseline in 10.22.4

Finally, a new “Regulatory Info” subfield is added in HE Operation element (included in Beacons and Probe Responses), in which an AP indicates country-specific regulatory information (interpretation depends on Country String in Country element). In the US case, this subfield indicated an “AP type”, interpreted per a table in Annex E.2.7.1. Specifically, this can be used by a Fixed Client STA to determine if the AP is an SP AP (in which case it can use its own AFC-derived power limits instead of the TPE limits – see above). It is expected there may be other use cases for this indication in other regulatory domains.

Note: For some AP types defined in FCC rules (and potentially other regulatory rules), the regulatory limits for client devices are fixed values. Therefore, it could be argued that indication of the AP type alone (without explicit signaling of those limits) is sufficient. However, one advantage of explicit signaling of power limits (in TPE element) is forward compatibility of client devices with new AP types that might be defined in the future. For example, if some APs were only to advertise their AP type without explicit power limit indication, and a new AP type (such as VLP AP) were to be defined in the future with different (fixed or variable) power limits that might be lower than LPI or SP power limits, an existing STA in the field that does not recognize the indicated AP type would have no way to determine the regulatory limit. The motivation for indicating an AP type (in US case) **in addition to** explicit power limits is to cover use cases such as Fixed Client where a STA that **does** understand the AP type is allowed to ignore the TPE information and use its own AFC-derived limits instead. It also provides some additional protocol flexibility to handle regulatory rules in other countries and/or changes/additions to existing rules in the future.

In addition, two small issues with the recently added 6 GHz Operating Classes and channels have been found and are proposed to be resolved as part of this comment:

* Upper range of n\_ch should be 233 (not 253) in 27.3.23.2
* For 20 MHz operating classes, the channels should be specified in the “Channel set” column (instead of the “Channel center frequency index” column), since various signaling used in 6 GHz defines a “Channel Number” field that references the Channel Set column for the primary operating channel

**Proposed changes for CID #24558**:

9.3.3.2 Beacon frame format

***Instruction to Editor: Make changes as follows:***

|  |
| --- |
| Table 9-34 - Beacon frame body  |
| Order | Information | Notes |
| 58 | Transmit Power Envelope element | One Transmit Power Envelope element is present for each distinct combination of values of the Maximum Transmit Power Interpretation subfield and Maximum Transmit Power Category subfield that is supported for the BSS if both of the following conditions are met:* dot11VHTOptionImplemented or dot11ExtendedSpectrumManagementImplemented is true;
* Either dot11SpectrumManagementRequired is true or dot11RadioMeasurementActivated is true.

Otherwise, this element is not present.NOTE – In a 6 GHz HE AP, both dot11VHTOptionImplemented (see 26.17.1) and dot11SpectrumManagementRequired (see 26.17.2.1) are true. |

9.3.3.10 Probe Response frame format

***Instruction to Editor: Make changes as follows:***

|  |
| --- |
| Table 9-41 - Probe Response frame body  |
| Order | Information | Notes |
| 60 | Transmit Power Envelope element | One Transmit Power Envelope element is present for each distinct combination of values of the Maximum Transmit Power Interpretation subfield and Maximum Transmit Power Category subfield that is supported for the BSS if both of the following conditions are met:* dot11VHTOptionImplemented or dot11ExtendedSpectrumManagementImplemented is true;
* Either dot11SpectrumManagementRequired is true or dot11RadioMeasurementActivated is true.

Otherwise, this element is not present.NOTE – In a 6 GHz HE AP, both dot11VHTOptionImplemented (see 26.17.1) and dot11SpectrumManagementRequired (see 26.17.2.1) are true. |

***Instruction to Editor: Add the following text to TGax D6.1:***

9.4.2.8 Country element

The Country element contains the information required to allow a STA to identify the regulatory domain in which the STA is located and to configure its PHY for operation in that regulatory domain. The format of this element is as shown in Figure 9-162 (Country element format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Country String | Triplet | Padding (if needed) |
| Octets: | 1 | 1 | 3 | *Q×*3 | 0 or 1 |
| Figure 9-162 Country element format |

The Element ID and Length fields are defined in 9.4.2.1 (General). The length of the element is variable, as the element contains the variable length Triplet field.

The Country String field is 3 octets in length. The AP and mesh STA set this field to the value contained in dot11CountryString before transmission in a Beacon or Probe Response frame. Upon reception of this element, a STA sets the dot11CountryString to the value contained in this field. The three octets of the Country String have additional structure as defined by dot11CountryString (see Annex C).

If dot11OperatingClassesRequired is false, then the Triplet field is a single Subband Triplet Sequence field, as shown in Figure 9-163 (Subband Triplet Sequence format), that is composed of *Q* Subband Triplet fields, where *Q* is one or more. The format of the Subband Triplet field is shown in Figure 9-164 (Subband Triplet field format).

|  |  |
| --- | --- |
|  | One or more |
|  | Subband Triplet |
| Octets: | 3 |
| Figure 9-163 - Subband Triplet Sequence format |

|  |  |  |  |
| --- | --- | --- | --- |
|  | First Channel Number | Number of Channels | Maximum Transmit Power Level |
| Octets: | 1 | 1 | 1 |
| Figure 9-164 Subband Triplet field format |

If dot11OperatingClassesRequired is true, then the Triplet field is composed of zero or more Subband Triplet fields followed by one or more Operating/Subband Sequences, as shown in Figure 9-165 (Triplet field format if dot11OperatingClassRequired is true). When the Country element is included in a frame transmitted in the 6 GHz band, the Triplet field is composed of zero subband Triplet fields, and only has one or more Operating/subband Sequences. Each Operating/Subband Sequence is composed of one Operating Triplet field followed by one Subband Triplet Sequence field, as shown in Figure 9-166 (Format of m-th Operating/Subband Sequence field). Each Subband Triplet Sequence field is composed of zero or more Subband Triplet fields. If dot11OperatingClassesRequired is true, the number of triplets in the Triplet field is , where *N* is the total number of Subband Triplet fields and *M* is the total number of Operating/Subband Sequences contained in Country element and *P(m)* is the number of Subband Triplet fields making up Operating/Subband Sequence field *m*.

|  |  |  |
| --- | --- | --- |
|  | Zero or more | One or more indexed by  |
|  | Subband Triplet | Operating/Subband Sequence |
| Octets: | 3 | 3 |
| Figure 9-165 - Triplet field format if dot11OperatingClassRequired is true |

|  |  |  |
| --- | --- | --- |
|  | Operating Triplet | Subband Triplet Sequence made up of P(m) Subband Triplet fields, where  |
|  | Operating Extension Identifier | Operating Class | Coverage Class |
| Octets: | 1 | 1 | 1 | (#4055)3 *× P(m)* |
| Figure 9-166 - Format of *m*-th Operating/Subband Sequence field |

The number *Q* of Subband fields or Operating triplet fields in the element is determined by the Length field.

An operating class for an 80+80 MHz channel width is expressed by two consecutive Operating/Subband Sequences, where the first Operating/Subband Sequence field contains an Operating Triplet field indicating an 80 MHz channel spacing with an 80+ behavior limit and the second Operating/Subband Sequence field contains an Operating Triplet field indicating an 80 MHz channel spacing without an 80+ behavior limit.

Operating/Subband Sequence fields that contain an Operating Class field for which the Channel spacing (MHz) column in the appropriate table in Annex E equals 80 or 160 contain zero Subband Triplet fields.

NOTE 1—Any Operating Triplet field indicating 80 MHz, 160 MHz, and 80+80 MHz can be omitted from the Country element (see 10.22.3 (Operation with operating classes)).

NOTE 2—The Transmit Power Envelope element is always used for TPC for 80 MHz, 160 MHz, or 80+80 MHz operating classes instead of Subband Triplet fields (see 11.39.1 (Basic VHT BSS functionality)).

An Operating/Subband Sequence field contains zero Subband Triplet fields if all the following conditions are true:

* The Operating Class table number indicated in the Country String field is Table E-4 (see dot11CountryString in Annex C).
* The Channel starting frequency (GHz) column in Table E-4 is greater than or equal to 5.925 and less than or equal to 7.125 for the Operating class indicated in the Operating Class field.
* The Channel spacing (MHz) column in Table E-4 is greater than or equal to 40 MHz for the Operating class indicated in the Operating Class field.

NOTE 3—Any Operating Triplet field for an Operating Class for which the Channel starting frequency (GHz) column in Table E-4 is greater than or equal to 5.925 and less than or equal to 7.125 can be omitted from the Country element (see 10.22.3 (Operation with operating classes)).

NOTE 4—The Transmit Power Envelope element is always used for TPC for operating classes in the 6 GHz band instead of Subband Triplet fields (see 26.15.8 (Additional rules for PPDUs sent in the 6 GHz band)).

The first octet in each Subband Triplet field or Operating Triplet field contains an unsigned integer and identifies the type of field. If the integer has a value less than or equal to 200, then the field is a Subband Triplet field. If the integer has a value of 201 or greater, then the field is an Operating Triplet field.

The minimum length of the element is 8 octets.

The First Channel Number field indicates the lowest channel number in the Subband Triplet field. No channel is indicated by more than one pair of First Channel Number and Number of Channels fields within a Subband Triplet Sequence field. [For example, the (First Channel Number, Number of Channels) pairs (2,4) and (5,2) in 2.4 GHz each indicate channel 5, therefore are not used within the same Subband Triplet Sequence field.] The First Channel Numbers are monotonically increasing within a Subband Triplet Sequence field. The First Channel Number and the Number of Channels pairs in a Country element are used to describe channels only in the band on which the frame containing the element is transmitted.

The Number of Channels subfield of the subelement is 1 octet in length. Outside the 2.4 GHz band, the channel numbers that are included in a group of channels are separated by the BSS bandwidth. For Subband Triplet fields that are not within an Operating/Subband Sequence field, the BSS bandwidth is 20 MHz. For Subband Triplet fields that are within an Operating/Subband Sequence field, the BSS bandwidth is as indicated by the operating class in the same Operating/Subband Sequence field. In the 2.4 GHz band, the channel numbers that are included in a group of channels are separated by 5 MHz (for both 20 and 40 MHz BSS bandwidth), except that channel 14 is treated as if it were 5 MHz above channel 13.

NOTE—For example, the channels 1 to 11 in the 2.4 GHz band can be represented using one Subband Triplet subfield with First Channel Number = 1 and Number of Channels = 11. The channels 36, 40, 44 and 48 with 20 MHz BSS bandwidth in the 5 GHz band can be represented using one Subband Triplet subfield with First Channel Number = 36 and Number of Channels = 4. The six channels 183, 184, 185, 187, 188 and 189 (but not 186) with 10 MHz BSS bandwidth can be represented using three Subband Triplet subfields: one with First Channel Number = 183 and Number of Channels = 4, one with First Channel Number = 184 and Number of Channels = 1 and one with First Channel Number = 188 and Number of Channels = 1.

The Maximum Transmit Power Level field is a signed number and is 1 octet in length. The Maximum Transmit Power Level field indi-cates the maximum power, in dBm, allowed to be transmitted. As the method of measurement for maximum transmit power level differs by regulatory domain, the value in this field is interpreted according to the regulations applicable for the domain identified by the Country String.

The Maximum Transmit Power Level field is reserved if it is within an Operating/Subband Sequence field with the Operating class for which the Channel starting frequency (GHz) column in Table E-4 is greater than or equal to 5.925 and less than or equal to 7.125.

NOTE – Maximum transmit power information for channels in the 6 GHz band is conveyed using the Transmit Power Envelope element (see 10.22.4).

An operating class is an index into a set of values for radio equipment sets of rules. The Operating Class field is 1 octet in length.

A coverage class is an index into a set of values for aAirPropagationTime. The Coverage Class field is reserved in a DMG BSS. The Coverage Class field is 1 octet in length.

The Coverage Class field of the Operating Triplet field specifies the aAirPropagationTime characteristic used in BSS operation, as shown in Table 9-97 (Coverage Class field parameters). The characteristic aAirPropagationTime describes variations in actual propagation time that are accounted for in a BSS and, together with maximum transmit power level, allow control of BSS diameter.

|  |
| --- |
| Table 9-97 - Coverage Class field parameters  |
| Coverage class value | aAirPropagationTime (µs) |
| 0–31 | , where *n* is the value of the coverage class |
| 32–255 | Reserved |

The Padding field is 0 or 1 octet in length. The Padding field is used to add, if needed, a single octet (with the value 0) to the Country element so that its length is evenly divisible by 2.

9.4.2.161 Transmit Power Envelope element

***Instruction to Editor: Make changes as follows:***

The Transmit Power Envelope element conveys the local or regulatory client maximum transmit powers for various transmission bandwidths or channels within the bandwidth of a BSS. The format of the Transmit Power Envelope element is shown in Figure 9-616 (Transmit Power Envelope element format).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Transmit Power Information | Maximum Transmit Power  |  |  |  |
| Octets: | 1 | 1 | 1 | Variable |  |  |  |
| Figure 9-616 - Transmit Power Envelope element format |

The Element ID and Length fields are defined in 9.4.2.1 (General).

The format of the Transmit Power Information field is defined in Figure 9-617 (Transmit Power Information field format(#2607)).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B2 | B3 B5 | B6 B7 |
|  | Maximum Transmit Power Count | Maximum Transmit Power Interpretation | Maximum Transmit Power Category |
| Bits: | 3 | 3 | 2 |
| Figure 9-617 - Transmit Power Information field format(#2607) |

The Maximum Transmit Power Interpretation subfield indicates the contents of the Maximum Transmit Power field and interpretation of the Maximum Transmit Power Count field, and is defined in Table 9-275a.

|  |
| --- |
| Table 9-275a - Definition of Maximum Transmit Power Interpretation subfield |
| Value | Interpretation of the Maximum Transmit Power field |
| 0 | Local EIRP |
| 1 | Local EIRP PSD (Power Spectral Density)  |
| 2 | Regulatory Client EIRP |
| 3 | Regulatory Client EIRP PSD (Power Spectral Density) |
| 4–7 | Reserved |
| NOTE—This table is expected to be updated only if regulatory domains mandate the use of transmit power control with limits that cannot be converted into one of the currently defined interpretations. |

The Maximum Transmit Power Category subfield indicates a category for which the maximum transmit powers apply. A value of 0 indicates the default category; the interpretation of other values depends on the country; see E.2.7 (6 GHz band) for 6 GHz operation for specific countries. In bands other than the 6 GHz band, this subfield is reserved.

When the Maximum Transmit Power Interpretation subfield is 0 or 2 (EIRP), the Maximum Transmit Power Count subfield indicates the number of Maximum Transmit Power For *X* MHz fields (where *X* = 20, 40, 80, or 160/80+80) minus 1 in the Maximum Transmit Power field of the Transmit Power Envelope element, as shown in Table 9-276.

|  |
| --- |
| Table 9-276 - Meaning of Maximum Transmit Power Count subfield when Maximum Transmit Power Interpretation subfield is 0 or 2 |
| Value | Field(s) present |
| 0 | Maximum Transmit Power For 20 MHz. |
| 1 | Maximum Transmit Power For 20 MHz and Maximum Transmit Power For 40 MHz. |
| 2 | Maximum Transmit Power For 20 MHz, Maximum Transmit Power For 40 MHz, and Maximum Transmit Power For 80 MHz. |
| 3 | Maximum Transmit Power For 20 MHz, Maximum Transmit Power For 40 MHz, Maximum Transmit Power For 80 MHz, and Maximum Transmit Power For 160/80+80 MHz.For TVHT STAs, reserved. |
| 4–7 | Reserved |

|  |
| --- |
|  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |

When the Maximum Transmit Power Interpretation subfield in the Transmit Power Envelope element is 0 or 2 (EIRP), the format of the Maximum Transmit Power field is defined in Figure 9-617a.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Maximum Transmit Power For 20 MHz | Maximum Transmit Power For 40 MHz | Maximum Transmit Power For 80 MHz | Maximum Transmit Power For 160/80+80 MHz |
| Octets: | 1 | 0 or 1 | 0 or 1 | 0 or 1 |

**Figure 9-617a –Maximum Transmit Power field format when Maximum Transmit Power Interpretation subfield is 0 or 2**

Maximum Transmit Power For *X* MHz fields (where *X* = 20, 40, 80, or 160/80+80) define the maximum transmit power limit of *X* MHz PPDUs, except for an HE TB PPDU where *X* MHz is the bandwidth of the pre-HE modulated fields of the HE TB PPDU transmitted by a STA. Each Maximum Transmit Power For *X* MHz field is encoded as an 8-bit 2s complement signed integer in the range –64 dBm to 63 dBm with a 0.5 dB step. Setting this field to 63.5 dBm indicates 63.5 dBm or higher (i.e., no local maximum transmit power constraint).

In frames transmitted by a TVHT STA the Maximum Transmit Power for 20 MHz field indicates the Local Maximum Transmit Power for TVHT\_W bandwidth; the Maximum Transmit Power for 40 MHz field indicates the Local Maximum Transmit Power for TVHT\_2W or TVHT\_W+W bandwidth; the Maximum Transmit Power for 80 MHz field indicates the Local Maximum Transmit Power for TVHT\_4W or TVHT\_2W+2W bandwidth; the Maximum Transmit Power for 160/80+80 MHz field is not included in the Transmit Power Envelope element.

When the Maximum Transmit Power Interpretation subfield in the Transmit Power Envelope element is 1 or 3 (EIRP PSD), the Maximum Transmit Power field is defined as shown in Figure 9-617b. The Maximum Transmit Power Count subfield determines the value of an integer N as defined in Table 9-276b which specifies the format and interpretation of the Maximum Transmit Power field as described below.

|  |
| --- |
| Table 9-276b - Meaning of Maximum Transmit Power Count subfield when Maximum Transmit Power Interpretation subfield is 1 or 3 |
| Value | N |
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
| 3 | 4 |
| 4 | 8 |
| 5–7 | Reserved |

If *N* is 0, then the Maximum Transmit Power field has one octet (Maximum Transmit PSD #1), and represents the maximum transmit PSD for a PPDU of any bandwidth within the BSS bandwidth.

If *N* is greater than 0, then the Maximum Transmit Power field has *N* octets, with *N* representing the number of 20 MHz channels for which a maximum transmit PSD is indicated. The *X*-th octet (*X* = integer ranging from 1 to *N*) of the Maximum Transmit Power field is the Maximum Transmit PSD #*X* subfield, which indicates the maximum transmit PSD for the *X*-th 20 MHz channel.

When the BSS bandwidth is 20, 40, 80 or 160 MHz, *N* is less than or equal to 1, 2, 4 or 8, respectively. The Maximum Transmit PSD #1~*N* subfields correspond to 20 MHz channels from lowest to highest frequency, respectively, within the indicated bandwidth. If *N* is equal to 1, 2, 4 or 8 for 20, 40, 80 or 160 MHz BSS bandwidth, respectively, the indicated bandwidth is the BSS bandwidth. If *N* is greater than 0 and less than 2, 4 or 8 for 40, 80 or 160 MHz BSS bandwidth, respectively, then the indicated bandwidth is the primary 20 MHz, primary 40 MHz or primary 80 MHz channel for *N* equal to 1, 2 or 4, respectively.

When the BSS bandwidth is 80+80 MHz, *N* is less than or equal to 8. If N is equal to 8 and the BSS bandwidth is 80+80 MHz, the Maximum Transmit PSD #1~4 subfields correspond to the 20 MHz channels from lowest to highest frequency, respectively, within the 80 MHz segment lower in frequency; the Maximum Transmit PSD #5~8 subfields correspond to the 20 MHz channels from lowest to highest frequency, respectively, within the 80 MHz segment higher in frequency. If *N* is greater than 0 and less than 8 for 80+80 MHz BSS bandwidth, then the bandwidth indicated by the Maximum Transmit PSD #1~*N* subfields is the primary 20 MHz, primary 40 MHz or primary 80 MHz channel for *N* equal to 1, 2 or 4, respectively. In this case, the Maximum Transmit PSD #1~*N* subfields correspond to 20 MHz channels from lowest to highest frequency, respectively, within the indicated bandwidth.

NOTE – A STA might receive a Transmit Power Envelope element with *N* greater than 8 in a 160 or 80+80 MHz BSS. In this case, the Maximum Transmit PSD #1~8 subfields indicate the maximum transmit PSD for the 20 MHz channels within the 160 or 80+80 MHz BSS bandwidth, and the Maximum Transmit PSD #*X* subfields for which *X* > 8 are ignored by the STA. See 10.22.4 (Operation with the Transmit Power Envelope element).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Maximum Transmit PSD #1 | Maximum Transmit PSD #2 | …. | Maximum Transmit PSD #*N* |
| Octets: | 1 | 0 or 1 |  | 0 or 1 |

**Figure 9-617b –Maximum Transmit Power field format when Maximum Transmit Power Interpretation subfield is 1 or 3**

The Maximum Transmit PSD #*X* subfield is encoded as an 8-bit 2s complement signed integer. The value -128 indicates that the corresponding 20 MHz channel cannot be used for transmission. The value of +127 indicates that no maximum PSD limit is specified for the corresponding 20 MHz channel. For all other values Y of the subfield (i.e. -127 to +126, inclusive), the maximum transmit PSD in the corresponding 20 MHz channel is *Y*/2 dBm/MHz (i.e. ranging from -63.5 to +63 dBm/MHz).

NOTE – If the Maximum Transmit Power Count subfield is 0, then the Maximum Transmit PSD #0 subfield applies to all 20 MHz channels within the BSS bandwidth.

* Reduced Neighbor Report element
* Neighbor AP Information field

Change the 4th paragraph as follows:

The Filtered Neighbor AP subfield is 1 bit in length. When included in an individually addressed Probe Response frame, it is set to 1 if the SSID corresponding to every AP in this Neighbor AP Information field matches the SSID in the corresponding Probe Request frame. When included in a Beacon, broadcast Probe Response or FILS Discovery frame transmitted by a non-TVHT AP, it is set to 1 if the SSID corresponding to every AP in this Neighbor AP Information field matches the SSID of the transmitting AP’s BSS. It is set to 0 otherwise.

Change the 6th paragraph as follows:

The TBTT Information Length subfield is 1 octet in length and indicates the length of each TBTT Information field included in the TBTT Information Set field of the Neighbor AP Information field. ~~When~~ If the TBTT Information Field Type subfield is ~~set to~~ 0, the TBTT Information Length subfield:

* contains the length in octets of each TBTT Information field that is included in the TBTT Information Set field of the Neighbor AP Information field
* is set to 1, 2, 5, 6, 7, 8, 9, ~~or~~ 11, or 12; other values are reserved.
* indicates the TBTT Information field contents as shown in Table 9-273 (TBTT Information field content).

Change Table 9-281 (TBTT Information field contents) as follows:

|  |
| --- |
| * TBTT Information field contents
 |
| TBTT Information Length subfield value | TBTT Information field contents |
| 1 | The Neighbor AP TBTT Offset subfield |
| 2 | The Neighbor AP TBTT Offset subfield and the BSS Parameters subfield  |
| 5 | The Neighbor AP TBTT Offset subfield and the Short-SSID subfield |
| 6 | The Neighbor AP TBTT Offset subfield, the Short-SSID subfield, and the BSS Parameters subfield |
| 7 | The Neighbor AP TBTT Offset subfield and the BSSID subfield |
| 8 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, and the BSS Parameters subfield |
| 9 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the BSS Parameters subfield, and the 20 MHz PSD subfield |
| 11 | The Neighbor AP TBTT Offset subfield, the BSSID subfield andthe Short-SSID subfield |
| 12 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield and the BSS Parameters subfield |
| 0, ~~2~~3–4, ~~6, 8–10, 12–255~~10 | Reserved |
| 13 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield, the BSS Parameters subfield and the 20 MHz PSD subfield |
| 14–255 | Reserved, but the first 13 octets of the field are the same as for TBTT Information Length |

Change 9-632 (TBTT Information field format) as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Neighbor AP TBTT Offset | BSSID (optional) | Short-SSID (optional) | BSS parameters | 20 MHz PSD |
| Octets:  | 1 | 0 or 6 | 0 or 4 | 0 or 1 | 0 or 1 |
| * TBTT Information field format
 |  |

Change the 3rd to last paragraph as follows:

~~The Neighbor AP TBTT Offset subfield is 1 octet in length and indicates the offset in TUs, rounded down to nearest TU, to the next TBTT of an AP from the immediately prior TBTT of the AP that transmits this element. The value 254 indicates an offset of 254 TUs or higher. The value 255 indicates an unknown offset value.~~

The Neighbor AP TBTT Offset subfield indicates the offset in TUs, rounded down to nearest TU, to the following:

* The next TBTT of the reported AP from the immediately prior TBTT of the AP that transmits this element if the reported AP is not part of a multiple BSSID set or is the transmitted BSSID of a multiple BSSID set.
* The next TBTT of the transmitted BSSID of the multiple BSSID set of the reported AP from the immediately prior TBTT of the AP that transmits this element if the reported AP is part of a multiple BSSID set and is a nontransmitted BSSID.

The value 254 indicates an offset of 254 TUs or higher. The value 255 indicates an unknown offset value.

Insert at the end of this subclause:

The format of the BSS Parameters subfield is defined in Figure 9-632a (BSS Parameters subfield format).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|  | OCT Recommended | Same SSID | Multiple BSSID | Transmitted BSSID | Member Of ESS With 2.4/5 GHz Co-Located AP | Unsolicited Probe Responses Active | Co-Located AP | Reserved |
| Bits:  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| * BSS Parameters subfield format
 |

The OCT Recommended subfield is set to 1 to indicate that OCT is recommended to exchange MMPDUs with the AP identified in the TBTT Information field (see 11.32.5 (On-channel Tunneling (OCT) operation)), through over-the-air transmissions with the AP sending the Reduced Neighbor Report element. It is set to 0 otherwise.

The Same SSID subfield is set to 1 to indicate that the reported AP has the same SSID as the reporting AP. It is set to 0 otherwise.

The Multiple BSSID subfield is set to 1 to indicate that the reported AP is part of a multiple BSSID set. It is set to 0 otherwise.

The Transmitted BSSID subfield is set to 1 to indicate that the reported AP is a transmitted BSSID. It is set to 0 it the reported AP is a nontransmitted BSSID. It is reserved if the Multiple BSSID subfield is set to 0.

The Member Of ESS With 2.4/5 GHz Co-Located AP subfield is set to 1 if the reported AP is part of an ESS where each AP in the ESS and operating in the same band as the reported AP (irrespective of the operating channel in that band) that might be detected by a STA receiving this frame has dot11MemberOfColocated6GHzESSOptionActivated equal to true and also has a corresponding AP operating in the 2.4 GHz or 5 GHz bands that is in the same co-located AP set as that AP. It is set to 0 otherwise or if the reporting AP does not have that information. It is reserved if the reported AP is operating in the 2.4 GHz or 5 GHz bands.

NOTE 1—This subfield indicates that the reported AP is part of an ESS that has no 6 GHz-only APs that might be detected by a STA receiving this frame. This means that all APs operating in the 6 GHz band that are part of that ESS that might be detected by a STA receiving this frame can be discovered in the 2.4 GHz and/or 5 GHz bands.

NOTE 2—An AP might be detected by a STA if the STA and the AP are on the same channel and in range.

The Unsolicited Probe Responses Active subfield is set to 1 if the reported AP is part of an ESS where all the APs that operate in the same channel as the reported AP and that might be detected by a STA receiving this frame have dot11UnsolicitedProbeResponseOptionActivated equal to true and are transmitting unsolicited Probe Response frames every 20 TUs or less (see 26.17.2.3 (Scanning in the 6 GHz band)). It is set to 0 otherwise or if the reporting AP does not have that information.

The Co-Located AP subfield is set to 1 if every AP in this Neighbor AP Information field is in the same co-located AP set as the transmitting AP. It is set to 0 otherwise.

The 20 MHz PSD subfield is one octet in length and, when present, indicates a maximum transmit power for the Default category, with unit interpretation of PSD EIRP in dBm/MHz (see 9.4.2.161 Transmit Power Envelope element and 11.7.5 Specification of Regulatory and Local Maximum Transmit Power Levels), corresponding to the primary 20 MHz channel of the reported AP.

NOTE – For example, suppose the reported AP transmits one Transmit Power Envelope element in Beacon and Probe Response frames, with Maximum Transmit power For 20 MHz of 20 dBm (EIRP). Then, the 20 MHz PSD subfield indicates the equivalent PSD limit of 7 dBm/MHz.

* HE Operation element

***Instruction to Editor: Make changes as follows:***

The operation of HE STAs in an HE BSS is controlled by the following:

* the HT Operation element and the HE Operation element if operating in the 2.4 GHz band
* the HT Operation element, VHT Operation element (if present) and the HE Operation element if operating in the 5 GHz band
* The HE Operation element if operating in the 6 GHz band

The format of the HE Operation element is defined in Figure 9-788h (HE Operation element format).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |
|  | Element ID | Length | Element ID Extension | HE Operation Parameters | BSS Color Information | Basic HE-MCS And NSS Set | VHT Operation Information | Max Co-Hosted BSSID Indicator | 6 GHz Operation Information |
| Octets: | 1 | 1 | 1 | 3 | 1 | 2 | 0 or 3 | 0 or 1 | 0 or 5 |
| * HE Operation element format
 |

The Element ID, Length, and Element ID Extension fields are defined in 9.4.2.1 (General).

The format of the HE Operation Parameters field is defined in Figure 9-788i (HE Operation Parameters field format).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0       B2 | B3 | B4      B13 | B14 | B15 | B16 | B17 | B18     B23 |
|  | Default PE Duration | TWT Required | TXOP Duration RTS Threshold | VHT Operation Information Present | Co-Hosted BSS | ER SU Disable | 6 GHz Operation Information Present | Reserved |
| Bits: | 3 | 1 | 10 | 1 | 1 | 1 | 1 | 6 |
| * HE Operation Parameters field format
 |

The Default PE Duration subfield indicates the PE field duration in units of 4 µs for an HE TB PPDU that is solicited with a TRS Control subfield and its use is defined in 26.5.2.3 (Non-AP STA behavior for UL MU operation). Values 5-7 of the Default PE Duration subfield are reserved.

The TWT Required subfield is set to 1 to indicate that the AP requires its associated non-AP HE STAs that have declared support for TWT by setting any one of TWT Requester Support or TWT Responder Support or Broadcast TWT Support subfield in HE Capabilities element that it transmits to 1 to operate in the role of either TWT requesting STA by following the rules in 26.8.2 (Individual TWT agreements), or TWT scheduled STA by following the rules in 26.8.3 (Broadcast TWT operation) and set to 0 otherwise.

The TXOP Duration RTS Threshold subfield enables an HE AP to manage RTS/CTS usage by non-AP HE STAs that are associated with it (see 26.2.1 (TXOP duration-based RTS/CTS)). The TXOP Duration RTS Threshold subfield contains the TXOP duration RTS threshold in units of 32 µs, which enables the use of RTS/CTS except for the value 1023. The value 1023 indicates that TXOP duration-based RTS is disabled. The value of 0 is allowed in Beacon and Probe Response frames and indicates that the previously announced TXOP duration RTS threshold remains in effect. In all other frames, the value of 0 is reserved.

The VHT Operation Information Present subfield is set to 1 to indicate that the VHT Operation Information field is present in the HE Operation element and set to 0 otherwise. The VHT Operation Information Present subfield is set as defined in 26.17 (HE BSS operation).

The Co-Hosted BSS subfield is set to 1 to indicate that the AP transmitting this element shares the same operating class, channel and antenna connectors with at least one other AP that is providing its BSS information by transmitting Beacon and Probe Response frames. Otherwise the subfield is set to 0. An AP operating in the 6 GHz band, a TDLS STA, an IBSS STA, a mesh STA, or an AP with dot11MultiBSSImplemented equal to true sets the subfield to 0.

The ER SU Disable subfield indicates whether 242-tone HE ER SU PPDU reception by the AP is disabled or enabled. The ER SU Disable subfield is set to 1 to indicate that it is disabled and set to 0 to indicate that it is enabled.

The 6 GHz Operation Information Present field is set to 1 to indicate that the 6 GHz Operation Information field is present and set to 0, otherwise. The 6 GHz Operation Information Present field is set to 1 by an AP operating in the 6 GHz band.

The BSS Color Information field is defined in Figure 9-788j (BSS Color Information field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0         B5 | B6 | B7 |
|  | BSS Color | Partial BSS Color | BSS Color Disabled |
| Bits: | 6 | 1 | 1 |
| * BSS Color Information field format
 |

The BSS Color subfield is an unsigned integer whose value is the BSS Color of the BSS corresponding to the AP, IBSS STA, mesh STA or TDLS STA that transmitted this element and is set as defined in 26.17.3 (BSS color).

The Partial BSS Color subfield is set to 1 to indicate that an AID assignment rule based on the BSS color as defined in 26.17.4 (AID assignment) is applied for the BSS. Otherwise, the Partial BSS Color subfield is set to 0.

The BSS Color Disabled subfield is set to 1 to disable the use of color for the BSS as described in 26.17.3.3 (Disabling BSS color); otherwise it is set to 0.

The Basic HE-MCS And NSS Set field indicates the HE-MCSs for each number of spatial streams in HE PPDUs that are supported by all HE STAs in the BSS (including IBSS and MBSS) in transmit and receive. The Basic HE-MCS And NSS Set field is defined in Figure 9-788e (Rx HE-MCS Map subfield, Tx HE-MCS Map subfield and Basic HE-MCS And NSS Set field format).

The format of the VHT Operation Information field is defined in Figure 9-564 (VHT Operation Information field) and its subfields are defined in Table 9-252 (VHT Operation Information subfields). The VHT Operation Information field is present if the VHT Operation Info Present field is 1; otherwise not present.

The Max Co-Hosted BSSID Indicator field contains a value assigned to *n*, where 2*n* is the maximum number of BSSIDs in the co-hosted BSSID set as defined in 26.17.7 (Co-hosted BSSID set). This field is present if the Co-Hosted BSS subfield in HE Operation Parameters field is 1 and is not present otherwise.

NOTE—The Max Co-Hosted BSSID Indicator field does not provide the exact number or the identity of each co-hosted BSSID.

The 6 GHz Operation Information field provides channel and bandwidth information related to 6 GHz operation (see 27.3.23.2 (Channel allocation in the 6 GHz band)). The format of the 6 GHz Operation Information field is defined in Figure 9-788k (6 GHz Operation Information field format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  | Primary Channel | Control | Channel Center Frequency Segment 0 | Channel Center Frequency Segment 1 | Minimum Rate |
| Octets: | 1 | 1 | 1 | 1 | 1 |
| * 6 GHz Operation Information field format
 |

The Primary Channel field indicates the channel number of the primary channel in the 6 GHz band.

The Control field is defined in Figure 9-788l (Control field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0         B1 | B2 | B3 B5 | B6    B7 |
|  | Channel Width | Duplicate Beacon | Regulatory Info | Reserved |
| Bits: | 2 | 1 | 3 | 2 |
|  | Figure 9-788I - Control field format |

The Channel Width field indicates the BSS channel width and is set to 0 for 20 MHz, 1 for 40 MHz, 2 for 80 MHz, and 3 for 80+80 or 160 MHz.

The Duplicate Beacon subfield is set to 1 if the AP transmits Beacon frames in non-HT duplicate PPDU with a TXVECTOR parameter CH\_BANDWIDTH value that is up to the BSS bandwidth and is set to 0 otherwise.

The Regulatory Info subfield carries information related to regulatory rules specific to the country in which the BSS is operating in, which is identified by the Country String field in the Country element. The interpretation of the Regulatory Info subfield is in Annex E.2.7. If Annex E.2.7 does not list information for the country in which the BSS is operating in, then the Regulatory Info subfield is reserved.

The Channel Center Frequency Segment 0 field indicates the channel center frequency index for the 20 MHz, 40 MHz, or 80 MHz, or 80+80 MHz channel on which the BSS operates in the 6 GHz band. If the BSS channel width is 80+80 MHz or 160 MHz then the Channel Center Frequency Segment 0 field indicates the channel center frequency index of the primary 80 MHz.

The Channel Center Frequency Segment 1 field indicates the channel center frequency index of the 160 MHz channel on which the BSS operates in the 6 GHz band. If the channel width is 80+80 MHz then it indicates the channel center frequency index of the secondary 80 MHz.

The Minimum Rate field indicates the minimum rate, in units of 1 Mb/s, that the non-AP STA is allowed to use for sending PPDUs (see 26.15.4.3 (Additional rate selection constraints for HE PPDUs)), where the rate is obtained with an *NSS*(#24396) that is less than or equal to 3 and an MCS that is less than or equal to 3.

* FILS Discovery frame format

***Instruction to Editor: Make changes as follows:***

|  |
| --- |
| * FILS Discovery frame format
 |
| Order | Information | Notes |
| 4 | Reduced Neighbor Report element | The Reduced Neighbor Report element is optionally present if dot11FILSActivated, dot11HEOptionImplemented or dot11HE6GOptionImplemented is true, otherwise it is not present.(#24017) |
| 5 | FILS Indication element | The FILS Indication element is optionally present if dot11FILSActivated is true, otherwise it is not present. |
| 6 | Roaming Consortium element | The Roaming Consortium element is optionally present if dot11FILSActivated is true, otherwise it is not present. |
| 7 | TIM element | The TIM element is optionally present if dot11HEOptionImplemented is true, otherwise it is not present. |
| 8 | TWT element | The TWT element is optionally present if dot11HEOptionImplemented is true, otherwise it is not present. If present, the Broadcast field of the TWT element is 1 |
| 9 | OPS element | The OPS element is optionally present if dot11HEOptionImplemented is true, otherwise it is not present. |
| 10 | Transmit Power Envelope element | One Transmit Power Envelope element is optionally present for each distinct combination of values of the Maximum Transmit Power Interpretationsubfield and Maximum Transmit Power Category subfield that is supported for the BSS if both of the followingconditions are met:— dot11VHTOptionImplemented ordot11ExtendedSpectrumManagementImplemented is true;— Either dot11SpectrumManagementRequired is true ordot11RadioMeasurementActivated is true.NOTE – In a 6 GHz HE AP, both dot11VHTOptionImplemented (see 26.17.1) and dot11SpectrumManagementRequired (see 26.17.2.1) are true. |

***Instruction to Editor: Add the following sentence to the end of the subclause:***

The Transmit Power Envelope element is defined in 9.4.2.161 (Transmit Power Envelope element).

10.22.3 Operation with operating classes

***Instruction to Editor: Make changes as follows:***

The following, and only the following, are extended spectrum management capable: a VHT STA, an HE STA and a STA that has dot11ExtendedSpectrumManagementImplemented true. A non-VHT STA or non-HE STA that has dot11ExtendedSpectrumManagementImplemented true shall indicate that it is extended spectrum management capable using the Extended Spectrum Management Capable field of the Extended Capabilities element.

When communicating with a STA that supports global operating classes, all requests and Action and Action No Ack frames that convey elements containing operating classes shall use global operating class values.

When dot11OperatingClassesImplemented is true, the following statements apply:

* When dot11OperatingClassesRequired is false, or where operating classes domain information is not present in a STA, that STA is not required to change its operation in response to an element that contains an operating class.
* When dot11OperatingClassesRequired is true, or where operating classes domain information is present in a STA, the STA shall indicate current operating class information in the Country element and Supported Operating Classes element, except for the following cases:
* A VHT STA may omit from the Country element any Operating Triplet field for an Operating Class for which the Channel spacing (MHz) column indicates 80 MHz or wider and for which the Behavior limits set column in the applicable table in Annex E contains only a blank entry or either or both of “80+” and “UseEirpForVHTTxPowEnv.”
* An HE STA may omit from the Country element any Operating Triplet field for an Operating Class for which the Channel starting frequency (GHz) column in Table E-4 is greater than or equal to 5.925 and less than or equal to 7.125.
* When dot11OperatingClassesRequired and dot11ExtendedChannelSwitchActivated are true and a STA is capable of operating as specified in more than one operating class, the STA shall include the Supported Operating Classes element in Association frames and Reassociation frames.
* When dot11OperatingClassesRequired is true, or where operating classes domain information is present and the STA parsing a Country element finds an invalid First Channel Number field or Operating Class field with a value that is reserved, the STA shall ignore the remainder of the Country element and shall parse any remaining management frame body for additional elements.
* When dot11OperatingClassesRequired is true and the STA supports one or more global operating classes, or where global operating classes domain information is present in a STA, the STA shall indicate current operating class information in the Country element and Supported Operating Classes element using the country string for the global operating classes, except for the following cases:
* A VHT STA may omit from the Country element any Operating Triplet field for an Operating Class for which the Channel spacing (MHz) column indicates 80 MHz or wider and for which the Behavior limits set column in the applicable table in Annex E contains only a blank entry or either or both of “80+” and “UseEirpForVHTTxPowEnv.”
* An HE STA may omit from the Country element any Operating Triplet field for an Operating Class for which the Channel starting frequency (GHz) column in Table E-4 is greater than or equal to 5.925 and less than or equal to 7.125.

10.22.4 Operation with the Transmit Power Envelope element

***Instruction to Editor: Make changes as follows:***

A STA that is not operating in the 6 GHz band and is extended spectrum management capable and that has dot11SpectrumManagementRequired or dot11RadioMeasurementActivated equal to true shall determine a local maximum transmit power from a Transmit Power Envelope element for which the Maximum Transmit Power Interpretation subfield indicates EIRP.

A STA that is operating in the 6 GHz band shall determine local and regulatory client maximum transmit powers from Transmit Power Envelope element(s) according to local regulations known at the STA (see Annex E.2.7). A STA shall ignore Transmit Power Envelope element(s) indicating Transmit Power Category values that the STA is unable to interpret for the current country.

NOTE – The Default category value (0) is applicable to, and so can be interpreted for, all countries – see 11.7.5 (Specification of regulatory and local maximum transmit power levels). An AP in the 6 GHz band has dot11SpectrumManagementRequired equal to true, and so transmits a Country element in Beacon and Probe Response frames.

A STA that sends two or more Transmit Power Envelope elements in a frame shall order the elements by increasing values of their Maximum Transmit Power Interpretation subfields.

A STA that sends two or more Transmit Power Envelope elements in a frame with the same value in the Maximum Transmit Power Interpretation subfield shall order the elements by increasing values of their Maximum Transmit Power Category subfields.

NOTE – The Maximum Transmit Power Category subfield is reserved except in the 6 GHz band.

If a STA that is extended spectrum management capable finds an unknown value in the Maximum Transmit Power Interpretation subfield in a Transmit Power Envelope element, then the STA shall ignore that and subsequent Transmit Power Envelope elements.

A STA that receives two or more Transmit Power Envelope elements in the same frame with known values in their Maximum Transmit Power Interpretation subfields shall process all of the elements according to the local regulations known at the STA.

NOTE—If a STA receives two Transmit Power Envelope elements, each with a known value in the Maximum Transmit Power Interpretation subfield, then the expected possibilities are as follows:

* The STA complies with either element (shared spectrum),
* The STA complies with both elements (tightened regulations), or
* The STA complies with the second element (changed regulations).

If a STA receives a Transmit Power Envelope element with the Local Maximum Transmit Power Interpretation subfield equal to 1 or 3 (EIRP PSD) and the Maximum Transmit Power Count subfield greater than 8 from an AP whose BSS bandwidth is 160 or 80+80 MHz, then the STA shall use the Maximum Transmit PSD #1~8 subfields to determine the maximum transmit PSD for each 20 MHz channel within the 160 MHz or 80+80 MHz BSS bandwidth. The STA should ignore the Maximum Transmit PSD #*X* subfields with *X* > 8.

NOTE – This might occur when the AP supports PHY mode(s) unknown to the STA, and the actual BSS bandwidth is wider than 160 or 80+80 MHz.

* Specification of regulatory and local maximum transmit power levels

***Instruction to Editor: Make changes as follows:***

A STA shall determine a regulatory maximum transmit power for the current channel by selecting the minimum of the following:

* Any regulatory maximum transmit power received in a Country element from the AP in its BSS, PCP in its PBSS, another STA in its IBSS, or a neighbor peer mesh STA in its MBSS
* If the STA is extended spectrum management capable, any regulatory client maximum transmit power received in a Transmit Power Envelope element from the AP in its BSS, another STA in its IBSS, or a neighbor peer mesh STA in its MBSS
* Any regulatory maximum transmit power for the channel in the current regulatory domain known by the STA from other sources

A STA shall determine a local maximum transmit power for the current channel by selecting the minimum of the following:

* Unless the STA is extended spectrum management capable and has received a Transmit Power Envelope element for a channel width of 20 MHz and 40 MHz, any local maximum transmit power received in the combination of a Country element and a Power Constraint element from the AP in its BSS, PCP in its PBSS, another STA in its IBSS, or a neighbor peer mesh STA in its MBSS
* If the STA is extended spectrum management capable, any local maximum transmit power received in a Transmit Power Envelope element from the AP in its BSS, another STA in its IBSS, or a neighbor peer mesh STA in its MBSS
* Any local maximum transmit power for the channel in the current regulatory domain known by the STA from other sources

NOTE – A STA might receive a maximum transmit power in a Transmit Power Envelope element from the AP in its BSS, another STA in its IBSS, or a neighbor peer mesh STA in its MBSS in various management frames – including Beacon frames, Probe Response frames, FILS Discovery frames and (prior to a channel switch) New Transmit Power Envelope elements (in Channel Switch Wrapper element, Future Channel Guidance element, Channel Switch Announcement element/frame or Extended Channel Switch Announcement element/frame). Other sources from which a STA might receive a maximum transmit power for a channel include Reduced Neighbor Report elements (20 MHz PSD subfield) sent by a (co-located) AP. If this information is received by a STA, any requirements on its usage depend on local regulations known at the STA (see Annex E.2).

NOTE – The determination of a maximum transmit power from Transmit Power Envelope element(s) is specified in 10.22.4 (Operation with the Transmit Power Envelope element).

The Local Power Constraint field of any transmitted Power Constraint element and each Maximum Transmit Power For *X* MHz field (where *X* = 20, 40, 80, or 160/80+80) in the Transmit Power Envelope element shall each be set to its respective value that allows the mitigation requirements to be satisfied in the current channel.

NOTE 1—The local maximum transmit power for the channel needs to meet the mitigation requirements for the channel in the current regulatory domain. The conservative approach is to set the local maximum transmit power level equal to the regulatory maximum transmit power level minus the mitigation requirement. However, it might be possible to satisfy the mitigation requirement using a higher local maximum transmit power level. A lower local maximum transmit power level might be used for other purposes (e.g., range control, reduction of interference).

The regulatory and local maximum transmit powers may change in a STA during the life of an infrastructure BSS and an MBSS. However, network stability needs to be considered when deciding how often or by how much these maximums are changed. The regulatory and local maximum transmit powers shall not change during the life of an IBSS.

An AP, IBSS STA, or mesh STA that is not operating in the 6 GHz band shall advertise the regulatory maximum transmit power for that STA’s operating channel in Beacon frames and Probe Response frames using a Country element. An AP, IBSS STA or mesh STA shall advertise the local maximum transmit power for that STA’s operating channel in Beacon frames and Probe Response frames using the combination of a Country element and a Power Constraint element.

If an AP, IBSS STA, or mesh STA that is not operating in the 6 GHz band is extended spectrum management capable, it shall advertise the local maximum transmit power for that STA’s operating channel in Beacon frames and Probe Response frames using one Transmit Power Envelope element for each distinct value of the Maximum Transmit Power Interpretation subfield that is supported by the BSS, IBSS, or MBSS, respectively. Each Transmit Power Envelope element shall include a local power constraint for all channel widths supported by the BSS.

If an AP, IBSS STA, or mesh STA is operating in the 6 GHz band, it shall include Transmit Power Envelope element(s) in Beacon and Probe Response frames as follows:

* For each distinct combination of values of the Maximum Transmit Power Interpretation subfield and Maximum Transmit Power Category subfield that are supported by the BSS, IBSS, or MBSS, respectively, one Transmit Power Envelope element is included that indicates the regulatory client maximum transmit power for the STA’s operating channel
* At a minimum, a regulatory client maximum transmit power is indicated where the Maximum Transmit Power Category subfield is set to 0 (Default). If different regulatory limits apply to different categories, the value of the limit advertised for Default category shall be the minimum of those limits.

NOTE – This requirement ensures that a STA, even if it does not know how to interpret the Regulatory Info subfield (in HE Operation element) and/or non-default values of the Maximum Transmit Power Category subfield (in Transmit Power Envelope element) for the current country, can determine a regulatory client maximum transmit power for use with the AP. This default value might be lower than the actual regulatory client maximum transmit power for specific categories.

NOTE – The regulatory client maximum transmit power is the regulatory limit for client devices such as non-AP STAs, which might be different from the regulatory limit for APs.

* If a local maximum transmit power is different from (lower than) a regulatory client maximum transmit power for the same combination of values of the Maximum Transmit Power Interpretation subfield and Maximum Transmit Power Category subfield, a Transmit Power Envelope element is included that indicates that local maximum transmit power.
* Each Transmit Power Envelope element that is included indicates a power constraint for all channel widths supported by the BSS (if an EIRP constraint is advertised) or for all 20 MHz channels within the bandwidth of the BSS (if an EIRP PSD constraint is advertised).

NOTE 1 – STAs operating in the 6 GHz band are extended spectrum management capable (see 10.22.3 Operation with operating classes).NOTE 2 – If a Transmit Power Envelope element in Beacon and Probe Response frames in the 6 GHz band indicates EIRP PSD limits, the value of N (see Table 9-276b) is either equal to 0, or equal to the BSS bandwidth in MHz divided by 20 (1, 2, 4 or 8 for 20, 40, 80 or 160/80+80 MHz BSS bandwidth, respectively).

3 , IBSS STA, or mesh STAindicating maximum transmitit sends Transmit Power Envelope elements indicating maximum transmit PSD and those values of STAs in the BSS

STAs that are extended spectrum management capable and have dot11RadioMeasurementActivated equal to true should be able to reduce their EIRP to 0 dBm.

(#4063)NOTE 2—When the local maximum transmit power is set by an AP for radio resource management, a typical low value for the local power constraint is 0 dBm. A STA that cannot reduce its transmit power to this level or below will not be able to associate to the AP.

The PCP in a PBSS shall advertise both the regulatory maximum transmit power and the local maximum transmit power for its operating channel in Announce and Probe Response frames (using a Country element for the regulatory maximum and a combination of a Country element and a Power Constraint element for the local maximum). In addition, it should advertise both regulatory and local maximum transmit power in DMG Beacon frames.

When dot11SpectrumManagementRequired is false and dot11RadioMeasurementActivated is true, an AP or a PCP may include a Power Constraint element and a Transmit Power Envelope element in Beacon, DMG Beacon, Announce, and Probe Response frames.

11.7.6 Transmit power selection

***Instruction to Editor: Make changes as follows:***

A STA may select any transmit power for transmissions in a channel within the following constraints:

— A STA shall determine a regulatory maximum transmit power and a local maximum transmit power for a channel in the current regulatory domain before transmitting in the channel.

— An AP shall use a transmit power less than or equal to the regulatory maximum transmit power level for the channel. The AP shall also meet any regulatory mitigation requirement.

— A non-AP STA shall use a transmit power less than or equal to the minimum of the local maximum transmit power level and regulatory client maximum transmit power for the channel.

11.46.2.1 FILS Discovery frame transmission

***Instruction to Editor: Make changes as follows:***

Change the 3rd and 4th paragraph as follows:

If an AP transmits a FILS Discovery frame as a non-HT duplicate PPDU in an 80+80 MHz channel bandwidth, the Channel Center Frequency Segment 1 field shall be present in the FILS Discovery frame and shall be set to the channel center frequency of the frequency segment 1 for an 80+80 MHz VHT or HE operating channel.

A FILS AP should transmit FILS Discovery frame(s) in every beacon interval. The interval between the transmission of a Beacon frame and a subsequent FILS Discovery frame shall be no less than the interval indicated in dot11FILSFDFrameBeaconMinimumInterval. The transmission interval between subsequent FILS Discovery frames by an AP in a beacon interval shall be no less than the interval indicated in dot11FILSFDFrameBeaconMinimumInterval. If dot11FILSFDFrameBeaconMaximumInteval is not equal to 0, and if a Beacon frame, broadcast Probe Response frame or FD frame has not been transmitted by an AP for a period that is equal to dot11FILSFDFrameBeaconMaximumInterval, that AP shall queue for transmission a FD frame, broadcast Probe Response frame or a Beacon frame unless the next TBTT is within a duration indicated by the value of dot11FILSFDFrameBeaconMinimumInterval.

Insert the following at the end of the subclause:

The Address 1 field of the FILS Discovery frame shall be set to the broadcast address.

For the APs in a multiple BSSID set, only the AP corresponding to the transmitted BSSID may transmit a FILS Discovery frame; other APs corresponding to nontransmitted BSSIDs shall not transmit a FILS Discovery frame. If dot11MultiBSSIDImplemented is true, then the following applies to the fields in the FILS Discovery frame:

* The SSID or Short SSID field shall be set to the SSID or short SSID, respectively, of the transmitted BSSID
* The FILS Capability field shall be present and the Multiple BSSIDs Presence Indicator subfield shall be set to 1

A 6 GHz AP that is sending FILS Discovery frames shall include at least one Transmit Power Envelope element, where the Maximum Transmit Power Category subfield is set to 0 (Default), including a transmit power limit for at least 20 MHz bandwidth (for EIRP) or at least the AP’s primary 20 MHz channel (for EIRP PSD).

NOTE 1 – The AP is not required to include local power constraints for bandwidths greater than 20 MHz in FILS Discovery frames, even if they are supported by the BSS. Therefore, when a Transmit Power Envelope element in a FILS Discovery frame indicates EIRP PSD limits, the value of *N* (see Table 9-276b) can take any valid value equal to or less than the BSS bandwidth in MHz divided by 20.

NOTE 2 – A Transmit Power Envelope element sent in a FILS Discovery frame by a 6 GHz AP can be used by a STA to determine a local transmit power limit for 20 MHz PPDUs corresponding to the 6 GHz AP prior to having received a Beacon or Probe Response frame from that AP. A STA might, for example, determine a local transmit power limit based on this information when sending a Probe Request frame with 20 MHz PPDU bandwidth during active scan on the 6 GHz AP’s channel.

* Reduced neighbor report

Change the last paragraph of the subclause as follows:

***Instruction to Editor: Make changes as follows:***

A STA that receives a Neighbor AP Information field with a recognized TBTT Information Field Type subfield but an unrecognized TBTT Information Length subfield ~~shall ignore that Neighbor AP Information field and continue to process remaining Neighbor AP Information fields.~~has two possible ways of processing the received information: (1) ignore that Neighbor AP Information field and continue to process the subsequent Neighbor AP Information fields or (2) process the first 13 octets of each TBTT Information field of the Neighbor AP Information field as if the TBTT Information Length subfield had value 13, ignore the remaining TBTT Information Length minus 13 octets of each TBTT Information field of the Neighbor AP Information field, and continue to process the subsequent Neighbor AP Information fields. If the unrecognized TBTT Information Length value is less than or equal to 13, the STA shall follow the alternative (1). If the unrecognized TBTT Information Length value is greater than 13, an HE STA shall follow the alternative (2) and a non-HE STA shall follow either the alternative (1) or (2).

If an AP that operates in the 2.4 GHz or 5 GHz band advertises a 6 GHz AP in Reduced Neighbor Report elements that is in the same co-located AP set as itself, the AP shall include the 20 MHz PSD subfield in the TBTT Information field corresponding to that 6 GHz AP.

a20 MHz PSD in a TBTT Information fieldshall bethe primary channel is equal to the minimum of the maximum transmit sindicatedll

NOTE 1 – Country-specific operating requirements that relate to use of Reduced Neighbor Report element are defined in Annex E.2.

NOTE 2 – A 20 MHz PSD subfield in a Reduced Neighbor Report element sent in Beacon and Probe Response frames by an AP that is in the same co-located AP set as a 6 GHz AP, can be used by a STA to determine a local transmit power limit for 20 MHz PPDUs corresponding to a 6 GHz AP prior to having received a Beacon or Probe Response frame from that AP. The value in the 20 MHz PSD subfield can be used by any STA, although for some categories it may result in determination of a lower transmit power limit than would be determined by (subsequent) reception of a Transmit Power Envelope element. A STA might, for example, determine a transmit power limit based on this information when sending a Probe Request frame with 20 MHz PPDU bandwidth during active scan on the 6 GHz AP’s channel.

27.3.23.2 Channel allocation in the 6 GHz band

***Instruction to Editor: Make changes as follows:***

Channel center frequencies are defined at every integer multiple of 5 MHz above the channel starting frequency. The relationship between center frequency and channel number is given in Equation (27-135).

Channel center frequency = Channel starting frequency + 5 × *nch* (MHz) (27-135)

where

*nch* = 1, …, 233

Channel starting frequency is defined as dot11ChannelStartingFactor × 500 kHz

For example, a channel center frequency of 5.955 GHz is indicated by dot11ChannelStartingFactor = 11 900 and *nch* = 1. A channel center frequency of 5.935 GHz is indicated by dot11ChannelStartingFactor = 11 850 and *nch* = 2.

# Annex E

* Country information and operating classes

***Instruction to Editor: Make changes as follows:***

Insert the following rows and update the “reserved” row appropriately in Table E-4:

|  |
| --- |
| * Global operating classes
 |
| Operating class | Nonglobal operating class(es) | Channel starting frequency (GHz) | Channel spacing (MHz) | Channel set | Channel center frequency index | Behavior limits set |
| 131 |  | 5.950 | 20 | 1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41, 45, 49, 53, 57, 61, 65, 69, 73, 77, 81, 85, 89, 93, 97, 101, 105, 109, 113, 117, 121, 125, 129, 133, 137, 141, 145, 149, 153, 157, 161, 165, 169, 173, 177, 181, 185, 189, 193, 197, 201, 205, 209, 213, 217, 221, 225, 229, 233 | — |  |
| 132 |  | 5.950 | 40 | — | 3, 11, 19, 27, 35, 43, 51, 59, 67, 75, 83, 91, 99, 107, 115, 123, 131, 139, 147, 155, 163, 171, 179, 187, 195, 203, 211, 219, 227 |  |
| 133 |  | 5.950 | 80 | — | 7, 23, 39, 55, 71, 87, 103, 119, 135, 151, 167, 183, 199, 215 |  |
| 134 |  | 5.950 | 160 | — | 15, 47, 79, 111, 143, 175, 207 |  |
| 135 |  | 5.950 | 80 | — | 7, 23, 39, 55, 71, 87, 103, 119, 135, 151, 167, 183, 199, 215 | 80+ |
| 136 |  | 5.925 | 20 | — | 2 |  |

***Instruction to Editor: Add the following subclause:***

## E.2 Band-specific operating requirements

### E.2.7 6 GHz band

### E.2.7.1 6 GHz band in the US

In the United States, when operating in the 6 GHz band, the Country String field in the Country element is set to (in hexadecimal) 0x55, 0x53, 0x04.

NOTE – The first two octets indicate the US. The third octet indicates that Table E-4 (Global Operating Classes) is in use (see Annex C).

The Regulatory Info subfield in the Control field of the 6 GHz Operation Information field of the HE Operation element is interpreted as shown in Table XX-1 when operating in the 6 GHz band in the United States.

|  |
| --- |
| Table XX-1 - Interpretation of the Regulatory Info subfield in the United States |
| Value | Interpretation |
| 0 | Indoor Access Point |
| 1 | Standard Power Access Point |
| 2-7 | Reserved |

The Maximum Transmit Power Category subfield of the Transmit Power Envelope element is interpreted as shown in Table XX-2 when operating in the 6 GHz band in the United States.

An AP that is an Indoor Access Point per regulatory rules shall send at least two Transmit Power Envelope elements in Beacon and Probe Response frames as follows:

* Maximum Transmit Power Category subfield = Default; Unit interpretation = Regulatory Client EIRP PSD
* Maximum Transmit Power Category subfield = Subordinate Device; Unit interpretation = Regulatory Client EIRP PSD

An AP that is a Standard Power Access Point per regulatory rules shall send at least one Transmit Power Envelope element in Beacon and Probe Response frames as follows:

* Maximum Transmit Power Category subfield = Default; Unit interpretation = Regulatory Client EIRP PSD

A regulatory client EIRP PSD value advertised by an AP that is a Standard Power Access Point shall be set to the highest value that meets the authorized client transmit power limits for the corresponding category obtained from the AP’s AFC system and any other client PSD regulatory rules for the corresponding 20 MHz channel.

If the regulatory client EIRP PSD values advertised by an AP that is a Standard Power Access Point are insufficient to ensure that regulatory client limits on total EIRP are always met for all transmission bandwidths within the bandwidth of the AP’s BSS, the AP shall also send a Transmit Power Envelope element in Beacon and Probe Response frames as follows:

* Maximum Transmit Power Category subfield = Default; Unit interpretation = Regulatory Client EIRP

NOTE – In the case of regulatory rules where the maximum transmit power for client devices is lower than the maximum transmit power for Access Points, the regulatory client maximum transmit power advertised by the AP for client devices might be lower than the regulatory client maximum transmit power the AP is authorized to use for its own transmissions.

If a non-AP STA that is a Subordinate Device per regulatory rules receives Transmit Power Envelope elements with Maximum Transmit Power Category subfields indicating Subordinate Device, it may ignore any other received Transmit Power Envelope elements that indicate other values in the Maximum Transmit Power Category subfield.

A non-AP STA that is a Fixed Client Device per regulatory rules may ignore any received Transmit Power Envelope elements it receives from an AP that it has identified (from interpretation of the Regulatory Info field in the HE Operation element) as a Standard Power Access Point.

NOTE – A non-AP STA that is a Fixed Client per regulatory rules must ensure it abides by regulatory limits it has obtained from an AFC system.

|  |
| --- |
| Table XX-2 - Interpretation of the Maximum Transmit Power Category subfield in the United States |
| Value | Interpretation |
| 0 | Default |
| 1 | Subordinate Device |
| 2-3 | Reserved |

***Instruction to Editor: Copy the text at the following locations in REVmd D3.3 to TGax D6.1, and change “Local Maximum Transmit Power Unit Interpretation” to “Maximum Transmit Power Interpretation”.***

***P1355L13***

***P1369L41***

***P1515L26***

***P1539L16***

***P1597L36***

***P2266L44***

***P2266L51***

***P2267L11***

***P2267L34***

***P2267L50***

***P2501L8***

***P2501L10***

***P2535L52***

***P2535L54***

***P4371L30***

***Instruction to Editor: Copy the text at the following locations in REVmd D3.3 to TGax D6.1, and change “Local Maximum Transmit Power For” (X MHz) to “Maximum Transmit Power For” (X MHz).***

***P2266L45***

***P2266L46***

***P2267L12***

***P2267L13***

**Reference:**

[1] IEEE P802.11ax™/D6.1, May 2020