IEEE P802.11
Wireless LANs

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| CR for 6GHz - Discovery |
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Abstract

This document provides CR for CIDs 15121, 15825, 15651.

1. **Introduction**

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. The introduction and the explanation of the proposed changes are not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

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| **CID** | **Clause Number(C)** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 15121 | 27.16.1 | 369 | Spec needs to provide rules on how a non-AP STA discovers and associates with a 6GHz BSS. Need details on how 6GHz BSS presence and configuration is advertised in 5/2.4G | As in comment | Revised – agree with the commenter. Apply the changes as proposed in doc 1227r9. |
| 15825 | 27 | 253 | 802.11ax now enables support for 6GHz band. Most devices will soon become tri-band devices. The discovery of APs and corresponding scanning time will increase and impact overhead in the channel and power/time consumption on STAs side. Full discovery of 6GHz APs should be enabled by simply scanning 2.4 and 5GHz bands only as today. This can simply be achieved by defining a multi-band collocated device that has multiple APs in different bands, and by imposing rules so that a discovery message (neighbor report, multiband element) is included in the 2.4 and 5GHz APs to describe the collocated AP at 6GHz | Define a Multiband collocated AP, that is part of a Multiband collocated device. And define rules to enable full discovery at 2.4 and 5GHz of collocated 6GHz APs. | Revised – agree with the commenter. Apply the changes as proposed in doc 1227r9. |
| 15651 |  |  | 6GHz AP Discovery: Add the ability for a STA operating in 2.4/5GHz BSS to discover a 6GHz HE AP. | As in the comment | Revised –Agree in principle with the comment. Proposed resolution is to include RNR in 2.4/5GHz beacons and probes.TGax editor to make the changes shown in 11-18/1227r9. |

1. Discussion

**Objectives of this contribution**

802.11ax voted to extend the scope of the project to operation up to 7.125GHz, in order to enable 802.11ax operation in the 6GHz band, which spans from 5935MHz to 7125MHz.

It is expected that all APs operating at 6GHz, except soft APs, will be multi-band collocated devices operating at 6GHz and at 2.4 and/or 5 GHz. Scanning more than 1.2GHz of spectrum is very demanding time-wise and energy-wise. In order to reduce this impact on resource overhead at 6GHz and energy and time consumption on STA side, we propose to enure that all 6GHz APs (that are collocated with another AP in the lower band) can be discovered by scanning the lower bands (2.4 and 5GHz) only, as it is done today. This is the basic concept that is covered by this document.

All this can be very simply done by:

* we can mandate that the APs collocated in the lower bands (2.4 or 5GHz) include aa reduced neighbour report describing the 6GHz collocated AP.

The objective is that a STA that scans 2.4 and 5GHz will have all the information it requires to decide if it wants/can associated with one of the 6GHz APs. It should then get as much information as it would get by sending a probe request to the 6GHz AP. When it wants to associate with the 6GHz AP, it only needs to send one frame: association request.

This submission describes a discovery mechanism for 2.4, 5 and 6 GHz that allows:

* Detection of the operating channels of the BSSs that are available for the association
* Detecting the BSSs that are collocated with the reporting device, i.e. operating in the same device that has transmitted the discovery information.
	+ BSS Transition Management signalling is enhanced to be able to transition to collocated 6 GHz BSSs
* Providing the information that the AP supports OCT, a mechanism already defined in the spec: Tunneling between the reporting device and the AP in 6 GHz to tunnel probe request/response, association and authentication frames that are transmitted over-the-air to the AP in lower band and tunnelled to the AP at 6GHz.
	+ The mechanisms reduce scanning, authentication and association signalling overhead at 6 GHz band, but they do not intend to replace the direct scanning, authentication and association at 6GHz band.

2. **Proposed changes**

***11ax Editor: Modify 9.4.2.170 Neighbor AP information field element as follows:***

* Neighbor AP Information field

The Neighbor AP Information field specifies TBTT and other information related to a group of neighbor APs on one channel. See Figure 9-622 (Neighbor AP Information field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | TBTT Information Header | Operating Class | Channel Number | TBTT Information Set |
| Octets: | 2 | 1 | 1 | variable |
| * Neighbor AP Information field format
 |

The format of TBTT Information Header subfield is defined in Figure 9-623 (TBTT Information Header subfield).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 | B3 | B4 B7 | B8 B15 |
|  | TBTT Information Field Type | Filtered Neighbor AP | Co-Located AP | TBTT Information Count | TBTT Information Length |
| Bits: | 2 | 1 | 1 | 4 | 8 |
| * TBTT Information Header subfield
 |

The TBTT Information Field Type subfield is 2 bits in length and identifies, together with the TBTT Information Length subfield, the format of the TBTT Information field. It is set to 0.(#1533)(#1535). (11ai)Values 1, 2, and 3 are reserved.(#1533)

The Filtered Neighbor AP subfield is 1 bit in length. (11ai)When included in a Probe Response frame, it is set to 1 if the SSID corresponding to every AP(#341) in this Neighbor AP Information field matches the SSID in the (11ai)corresponding Probe Request frame. (11ai)When included in a Beacon or FILS Discovery frame transmitted by a non-TVHT AP, it is set to 1 if the SSID corresponding to every AP(#341) in this Neighbor AP Information field matches the SSID of the transmitting AP’s BSS. It is set to 0 otherwise.(11ai)(#1533)

The Co-Located AP subfield is 1 bit in length and is set to 1 if every AP in this Neighbor AP Information field is co-located with the transmitting AP. It is set to 0 otherwise, or if the information is unknown.

(#1533)The TBTT Information Count subfield is 4 bits in length and contains the number of TBTT Information fields included in the TBTT Information Set field of the Neighbor AP Information field, minus one. For example, a value of 0 indicates that one TBTT Information field is included.

(#1533)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(#342) the Neighbor AP Information field. When 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(#342) the Neighbor AP Information field
* is set to 1, 5, 7, 8, 11, or 12; other values are reserved.(11ai)
* indicates the TBTT Information field contents as shown in Table 9-273 (TBTT Information field content(11ai)).

(#1533)A TVHT AP sets the TBTT Information Length subfield to 1.

(11ai)The TBTT Information Length subfield is interpreted as shown in Table 9-283 (TBTT Information field(11ai) contents(#1533)).

|  |
| --- |
| * TBTT Information field(11ai) contents(#1533)
 |
| TBTT Information Length subfield value | TBTT Information field contents |
| 1 | The Neighbor AP TBTT Offset subfield |
| 5 | The Neighbor AP TBTT Offset subfield and the Short-SSID 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 |
| 11 | The Neighbor AP TBTT Offset subfield, the BSSID subfield and the Short-SSID subfield |
| 12 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield and the BSS Parameters subfield |
| 0, 2–4, 6, 8–10, 12–255 | Reserved |

The Operating Class field is 1 octet in length and indicates a channel starting frequency that, together with the Channel Number field, indicates the primary channel of the BSSs of the APs in this Neighbor AP Information field. Values of Operating Class are shown in Table E-4 (Global operating classes), of which operating classes that, together with the channel number, indicate the primary channel is valid (see 11.49 (Reduced neighbor report(#1533))).

NOTE—The Operating Class field and Channel Number tuple indicate the primary channel in order to assist with passive scanning.

The Channel Number field is 1 octet in length and indicates the last known primary channel of the APs in this Neighbor AP Information field. Channel Number is defined within an Operating Class as shown in Table E-4 (Global operating classes).

The TBTT Information Set field contains one or more TBTT Information fields. The TBTT Information field is defined in Figure 9-624 (TBTT Information field (11ai)format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Neighbor AP TBTT Offset | BSSID (optional)(#15)(11ai) | Short-SSID (optional)(#15)(11ai) | BSS Parameters |
| Octets: | 1 | 0 or 6 | 0 or 4 | 0 or 1 |
| * TBTT Information field (11ai)format
 |  |

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 BSSID is defined in 9.2.4.3.4 (BSSID field).(11ai)

The Short-SSID subfield is calculated as given in 9.4.2.170.3 (Calculating the Short-SSID(11ai)).(11ai)

The format of BSS Parameters subfield is defined in Figure 9-xxx (BSS Parameters subfield).

|  |  |  |
| --- | --- | --- |
|  | B0 | B1 B7 |
|  | OCT Supported | Reserved |
| Bits: | 1 | 7 |
| * BSS Parameters subfield format
 |

The OCT Supported subfield is set to 1 to indicate that the OCT procedure described in 11.31.5 (On-channel Tunneling (OCT) operation) can be used to exchange management frames with the AP described in this TBTT Information field through over-the-air transmissions with the AP sending the Reduced Neighbor Report. It is set to 0 otherwise.

**TGax Editor: *Insert this subclause as follows:***

**27.16.1a.1 Out of band discovery of 6 GHz BSS***(#15651, 15832, 15023)*

An AP that operates in the 2.4 or 5 GHz band and that is co-located with one or more APs operating at 6GHz, shall include in Beacon and Probe Response frames that it transmits a Reduced Neighbor Report element with the Co-Located AP subfield in the TBTT Information Header subfield set to 1 to provide at least the channel(s) and operating class(es) of the co-located AP(s) in the 6 GHz band.

Note – The Reduced Neighbor Report can also contain information on APs that are not co-located.

If the OCT Supported subfield is set to 1 in the Neighbor AP Information field describing an HE AP operation in the 6GHz band in the Reduced Neighbor Report element, then a non-AP STA that supports operation in the 6 GHz band may use the OCT procedure described in 11.31.5 (On-channel Tunneling (OCT) operation) to perform active scanning, authentication and/or association to the 6GHz AP through over-the-air transmissions with the AP that sent the Reduced Neighbor Report element and that is operating in the 2.4, 5 or 6GHz band.

**TGax Editor: *Modify this subclause as follows:***

11.32.5 On-Channel Tunneling (OCT) operation:

A STA supports the OCT if the OCT Not Supported subfield within the STA's Multi-band element is 0 or if the OCT Supported subfield in a Neighbor AP Information field of the STA's Reduced Neighbor Report element is 1. A STA should not perform OCT with a peer STA that does not support the OCT. A STA that does not support the OCT shall ignore a received OCT MMPDU.