IEEE P802.11
Wireless LANs

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| CR for 6GHz AP Discovery |
| Date: 2019-01-14 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Ming Gan | Huawei |  |  | ming.gan@huawei.com |
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Abstract

This document provides CR for CIDs 15121, 15825, 15651, 15023.

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 11-18/0077 r0. |
| 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 11-18/0077 r0 |
| 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 11-18/0077 r0. |
| 15023 |  | 134.01 | Add a bit to indicate that the reported neighbor is a co-located BSS. This will be useful for discovery of a co-located ER BSS or 6GHz BSS | As in comment | Revised –Agree in principle with the comment.Apply the changes as proposed in doc 11-18/0077 r0. |
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1. Discussion

This contribution proposes to use only Reduced Neighbor Report (compromised solution) in beacons and probe responses.

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 | Reserved | 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) (#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, or 11; 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 |
| 11 | The Neighbor AP TBTT Offset subfield, the BSSID subfield and the Short-SSID 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) |
| 1 | 0 or 6 | 0 or 4 |
| * 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 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 |
| 11 | The Neighbor AP TBTT Offset subfield, the BSSID subfield and the Short-SSID subfield |
| 8 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, and the BSS Parameters subfield |
| 12 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield and the BSS Parameters subfield |
| 0, 2–4, 6, 9–10, 13–255 | 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)).

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 | B1 | B2 B7 |
|  | Multiple BSSID | Transmitted BSSID | Reserved |
| Bits: | 1 | 1 | 6 |
|  | **Figure 9-xxx BSS Parameters subfield format** |

Multiple BSSID subfield is set to 1 to indicate the AP reported in the Neighbor AP Information field is a member of a multiple BSSID set with two or more members, and set to 0 to indicate the AP reported in the Neighbor AP Information field is not a member of a multiple BSSID set with two or more members.

If Multiple BSSID subfield is 1, the Transmitted BSSID subfield is set to 1 to indicate the AP reported in the Neighbor AP Information field has transmitted BSSID, and set to 0 to indicate the AP reported in the Neighbor AP Information field has non-transmitted BSSID,.

If Multiple BSSID subfield is 0, the Transmitted BSSID subfield is reserved

If Multiple BSSID subfield is 1and the Transmitted BSSID subfield is set to 0, Neighbor AP TBTT Offset is set to the TBTT offset of transmitted BSSID of the same Multiple BSSID set as the reported non-transmitted BSSID in the RNR element.

The Neighbor AP Information field for an AP that has transmitted BSSID shall be included in the RNR element if the AP is in in Multiple BSSID set. The The Neighbor AP Information field for an AP that has non-transmitted BSSID may be included in the RNR element if the AP is in Multiple BSSID set.

Discussion: BSSID is necessity for 6GHz AP discovery, a clarification following the description of the MAC address field in Multiband element is provided as followsBSSID is not present in TBTT Information field in RNR element if the reported AP carried in Neighbor AP Information field of the RNR element hg

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

**27.16.1a.1 Discovery of 6 GHz BSS**

**Discussion: Co-located AP indication is not useful when providing the info of 6GHz AP through 2.4/5GHz, it should be transparent to STA. In this case, the STA still can do in-band or out-band association based on the received information in RNR.**

An AP that operates in the 2.4 or 5 GHz band and that is in the device which contains 6GHz AP, shall include in Beacon and Probe Response frames that it transmits a Reduced Neighbor Report element to provide at least the channel(s) and operating class(es) of the AP(s) in the 6 GHz band.

An AP that operates in the 2.4 or 5 GHz band and that is in the device which does not contain 6GHz AP, may include in Beacon and Probe Response frames that it transmits a Reduced Neighbor Report element to provide at least the channel(s) and operating class(es) of the AP(s) in the 6 GHz band.

If an AP operating on a 6 GHz band has one or more co-located APs operating on the 2.4 and/or the 5 GHz band, then at least one of the co-located APs operating on the 2.4 and/or 5GHz band shall include, in beacon frames and probe response frames, a TBTT Information field in a Reduced Neighbor Report element with the BSSID field and the Short SSID field set to the BSSID and Short SSID of the transmitted BSSID of the same Multiple BSSID set as the co-located AP operating in the 6 GHz band.

**However, if we need OCT support indication in RNR element, then Co-located AP indication is necessary because OCT is used in the device which has more than one STAs (Note: this is not the part of this contribution)27.16.1a.1 Discovery of 6 GHz BSS (New)**

If an AP operating on a 2.4 or 5 GHz channel has one or more co-located APs operating at 6 GHz with the same SSID, then Beacon frames and Probe Response frames transmitted by the AP or by the transmitted BSSID of the same Multiple BSSID set as the AP shall include, at a minimum, for each of these co-located APs, a TBTT Information field in a Reduced Neighbor Report element with the BSSID field set to the BSSID of the co-located AP, and with either the Short SSID field set to the Short SSID of the co-located AP or the Same SSID subfield in the BSS Parameters subfield is set to 1, except if the AP transmits an individually addressed Probe Response frame to a STA that does not support operating in the 6 GHz band. (No change)

If an AP operating on a 2.4 or 5 GHz channel has a co-located AP operating at 6 GHz with a different SSID which is not in Multiple BSSID Set, and no other co-located AP operating on a 2.4 or 5 GHz channel is indicating the 6 GHz AP in a Reduced Neighbor Report of the Beacon and Probe Response frames they transmit, then Beacon and Probe Response frames transmitted by the AP (or by the transmitted BSSID of the same Multiple BSSID set as the AP) shall include a TBTT Information field in a Reduced Neighbor Report element with the BSSID field and the Short SSID field set to the BSSID and Short SSID of the co-located AP, except if the AP transmits an individually addressed Probe Response frame to a STA that does not support operating in the 6 GHz band or  if the AP does not intend to be discovered by STAs. (Change with red text)

If an AP operating on a 6 GHz band has one or more co-located APs operating on the 2.4 and/or the 5 GHz band and the AP operating on a 6 GHz channel is in Multiple BSSIS set, then at least one of the co-located APs operating on the 2.4 and/or 5GHz band shall include, in beacon frames and probe response frames, a TBTT Information field in a Reduced Neighbor Report element with the BSSID field and the Short SSID field set to the BSSID and Short SSID of the transmitted BSSID of the same Multiple BSSID set as the co-located AP operating in the 6 GHz band, and may include, in beacon frames and probe response frames, a TBTT Information field in a Reduced Neighbor Report element with the BSSID field and the Short SSID field set to the BSSID and Short SSID of the non-transmitted BSSID of the same Multiple BSSID set as the co-located AP operating in the 6 GHz band.

If an AP operating on a 2.4 or 5 GHz channel does not have a co-located AP operating at 6 GHz, then Beacon and Probe Response frames transmitted by the AP (or by the transmitted BSSID of the same Multiple BSSID set as the AP) may include a TBTT Information field in a Reduced Neighbor Report element with the BSSID field and the Short SSID field set to the BSSID and Short SSID of the reported AP operating at 6 GHz, except if the AP transmits an individually addressed Probe Response frame to a STA that does not support operating in the 6 GHz band or if the AP does not intend to be discovered by STAs.

**27.16.1a.2 Out of band discovery of 6 GHz BSS**

If the OCT Supported subfield is set to 1 and Co-located AP 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.