IEEE P802.11
Wireless LANs

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| CR for 6GHz – Active Scanning Part II  |
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Abstract

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

R1: Added All APs in ESSs fields. Editorial changes.

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.***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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 19/95r1. |
| 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 19/95r1. |
| 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 19/95r1 distan2.4, distan2.4,. |

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.

Many of the APs that host BSSs at 6 GHz are multi-band devices, i.e. they the APs colocate BSSs at multiple bands, like 2.4, 5 and 6 GHz bands. Also, other bands are getting more popular.

The non-AP STAs will likely initiate their scanning operation at 2.4 or 5 GHz band. The APs at these channels include to the RNR elements they transmit information of the BSSs at 6 GHz, so that scanning STA knows the channels in the 6 GHz that are worth of scanning.

Active scanning should have means to indicate more precisely the information on other BSSs that the responding AP includes to Reduced Neighbor Report element that is included to Probe Response. For instance, a STA should have means to:

* Indicate the bands from which it is interested to get BSSID and Short SSIDs of the BSSs
* Indicate whether the STA desires to receive information of BSSs that match with the SSIDs and Short SSIDs specified on Probe Request
* Indicate whether the STA desires to receive information of Co-located APs only

HE APs should have means to indicate whether they have included information of all co-located BSSs to the RNR elements of the frame.

3- **Proposed changes**

* Neighbor AP Information field

**TGax Editor: *Add the All Co-located APs Present field to the clause and add the paragraph after the description of the Unsolicited Probe Responses Active subfield.***

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|  | OCT Recommended | Same SSID | Nontransmitted BSSID | ESS With All Co-located 6 GHz APs | Unsolicited Probe Responses Active | All Co-located APs Present | All APs in ESSs Present | Reserved |
| Bits | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  | * BSS Parameters subfield format
 |

The All Co-Located APs Present subfield set to 1 indicates that the RNR elements in the frame that carries this subfield include Neighbor AP Information field containing the operating classes and the channel numbers of all co-located APs. Otherwise, the subfield is set to 0. *(#15651, 15832, 15023)*

The All APs in ESSs Present subfield set to 1 indicates that the Multiple BSSID elements and the RNR elements in the frame that carries this subfield include BSSIDs and SSIDs or Short SSIDs for all APs in ESS that match with the SSIDs or the Short SSIDs included in the frame and are within one-hop of 5 or 6 GHz radio distance from the STA that transmits the frame. Otherwise, the subfield is set to 0. *(#15651, 15832, 15023)*

**9.4.2.177 FILS Request Parameters element**

**TGax Editor: *Add the RNR Criteria field to the FILS Request Parameters as shown below.***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element Id | Length | Element ID Extension  | Parameter Control Bitmap  | Max Channel time  |
| Octets: | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |
|  | FILS Criteria  | Max Delay Limit  | Minimum Data Rate  | RCPI Limit  | OUI Response Criteria  | RNR Criteria |
| Octets: | 0 or 1  | 0 or 1  | 0 or 3 | 0 or 1  | 0 or 2 | 0 or 2  |

**Figure 9-XXX–FILS Request Parameters element format**

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5 | B6 – B7 |
|  | FILS Criteria Present | Max Delay Limit Present | Minimum Data Rate Present | RCPI Limit Present | OUI Response Criteria Present | RNR Criteria Present | Reserved |
| Bits: | 1 | 1 | 1 | 1 | 1 | 1 | 2 |

**Figure 9-636—Parameter Control Bitmap field**

Bits 0 to 5 of the Parameter Control Bitmap field correspond to the Parameter fields that are conditionally present in the element. A value of 1 in a bit indicates the corresponding parameter is present, and a value of 0 indicates the corresponding parameter is not present.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 – B8 | B9 – B12 | B13 | B14 | B15 |
|  | Band Requested Bitmap | Reserved | All APs in ESSs Requested | Matching SSID Only | Co-Located APs Only |
| Bits: | 9 | 4 | 1 | 1 | 1 |

**Figure 9-XX1–RNR Criteria field format** *(#15651, 15832, 15023)*

The Band Requested Bitmap subfield defines a band specific criterion. Starting from bit zero, each bit position of the Band Requested Bitmap subfield corresponds, respectively, to the band identified by values of the Band ID field (see 9.4.1.45). That is, bit zero corresponds to Band ID field value zero, bit one corresponds to Band ID field value one, and so on. If a value of the Band ID field is reserved, the corresponding bit position, if it exists, of the Band Requested Bitmap subfield is also reserved. Each bit position of the Band Requested Bitmap subfield is set to 1 to request that the Short SSID and BSSID of APs operating in the band corresponding to the bit position are included in the RNR element of the Probe Response transmitted as a response to the Probe Request that carried the RNR Criteria field. Each bit position of the Band Requested Bitmap subfield is set to 0 to indicate that the scanning STA is not interested to receive information on APs operating in the band corresponding to the bit position.

The All BSSs in ESSs Requested subfield is set to 1 to request that Multiple BSSID elements and RNR elements of the Probe Response frame include all the BSSIDs and Short SSIDs of all APs of the ESSs matching to the SSIDs and Short SSIDs of the Probe Request frame. Otherwise, the subfield is set to 0.

The Matching SSIDs Only subfield is set to 1 to request that RNR elements of the Probe Response frame include only APs whose SSID matches with one of the requested SSIDs or Short SSIDs. Otherwise, the subfield is set to 0.

The Co-Located APs Only subfield is set to 1 to request that RNR elements of the Probe Response frame include only co-located APs. The subfield is set to 0 to request that information of one or more neighbor APs are included to RNR elements of the Probe Response.

**TGax Editor: *Insert the following paragraph to the end of the subclause:***

**27.16.1a.1 Out of band discovery of 6 GHz BSS**

An AP shall set the All Co-Located APs Present subfield of the BSS Parameters subfield of the TBTT Information Set field of the RNR elements it transmits to 1, if the RNR elements of the transmitted frame include the operating classes and the channel numbers of all co-located APs. Otherwise, the AP shall set the subfield to 0. *(#15651, 15832, 15023)*

An AP shall set the All APs in ESSs Present subfield of the BSS Parameters subfield of the TBTT Information Set field of the RNR elements it transmits to 1, if the Multiple BSSID elements and RNR elements of the transmitted frame include the BSSIDs and the SSIDs or Short SSIDs of all APs belonging to the ESSs identified by the SSIDs and Short SSIDs included in the frame within a continuous coverage area of 2.4 GHz, 5 GHz or 6 GHz radios around the AP. Otherwise, the AP shall set the subfield to 0. *(#15651, 15832, 15023)*

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

27.16.1a.1.2 Scanning behavior for non-AP STA

A STA shall follow the rules defined in 11.1.4.3.2(Scanning behavior for non-AP STA) with the addition of the following rules: *(#15651, 15832, 15023)*

* May set a bit in the Band Requested Bitmap subfield of the RNR Criteria field of the FILS Request Parameters element of a Probe Request frame specify a band specific criterion for APs to be included to the RNR element. Each bit is set to 1 to request that the frame, transmitted as a response to the Probe Request frame with the RNR Criteria field, should include one or more RNR elements containing the Short SSID and the BSSID of APs operating in the respective band. The bit is set to 0 to indicate that information of the APs operating in the band is not requested to be added in the RNR elements of the Probe Response frame.
* May set a All APs in ESSs Requested subfield of RNR Criteria field of a FILS Request Parameters element of a Probe Request frame to 1 to request that Multiple BSSID elements and RNR elements of the Probe Response frame should include BSSIDs, SSIDs or Short SSIDs of all APs in the ESSs identified by the SSIDs and Short SSIDs in the Probe Request. Otherwise, the subfield is set to 0.
* May set a Matching SSIDs Only subfield of an RNR Criteria field of a FILS Request Parameters element of a Probe Request frame to 1 to request that Multiple BSSID elements and RNR elements of the Probe Response frame should include information of APs that match with an SSID or a Short SSID included in the Probe Request frame and set to 0 otherwise.
* May set the Co-Located APs Only subfield of an RNR Criteria field of a FILS Request Parameters element to 1 to indicate that the RNR elements of the Probe Response frame, that is transmitted as a response to the Probe Request frame, include information of the co-located APs only. The subfield is set to 0 to request that information of one or more neighbor APs are included in RNR elements of the Probe Response frame.

**TGax Editor: *Insert the following subclause:***

**27.16.1a.3a HE AP active scanning rules to include RNR elements in Probe Response** *(#15651, 15832, 15023)*

An HE AP that receives a Probe Request shall follow the rules defined in 11.1.4.3.4(Criteria for sending a response) to determine whether it responds to a received Probe Request frame. If the HE AP responds to a Probe Request frame that contains an RNR Criteria field of the FILS Request Parameters element, then the rules specified in this clause specify the information included in RNR elements of the Probe Response frame.

If an HE AP receives a Probe Request that contains at least one bit in the Band Requested Bitmap subfield in the RNR Criteria field of the FILS Request Parameters element set to 1, then, for each bit that is set to 1, the AP should include in RNR elements of the Probe Response, that it transmits as a response to the Probe Request, the Short SSIDs and the BSSIDs of the APs operating at the respective band and the AP desires to be discoverable. If a bit is set to 0 the AP should not include any information of the APs operating in the respective band. If all bits in the Band Requested Bitmap subfield are set to 0, the AP should include in RNR elements of the Probe Response only information of the APs operating in the channel in which the Probe Request was received.

If an HE AP receives a Probe Request that contains All APs in ESSs Requested subfield of RNR Criteria field of a FILS Request Parameters element set to 1, then the AP should include to the Multiple BSSID element and RNR ekements the BSSID and the SSID or the Short SSID of all APs, within a one-hop 5 or 6 GHz radio distance from the HE AP, that belong to the ESSs identified by the SSIDs and/or the Short SSIDs in the received Probe Request frame. If at least one such AP is not included, or the AP has no knowledge of the APs in the the ESS, then the AP shall set the subfield to 0.

If an HE AP receives a Probe Request that contains Matching SSIDs Only subfield of the RNR Criteria field of the FILS Request element set to 1, then the AP should only include to the RNR element of the Probe Response frame, that it transmits as a response to the Probe Request, information of APs whose SSID match with an SSID or Short SSID included in the Probe Request. If the subfield is set to 0, the AP should include to the RNR element of the Probe Response frame information of the APs whose SSID match and information of one or more APs whose SSID does not match with the SSID or the Short SSID included in the Probe Request.

NOTE– The Filtered Neighbor AP subfield of the TBTT Information Header subfield is set to 1 if the SSIDs of included APs in this RNR element match with the SSID or the Short SSID of the corresponding Probe Request frame.

If an HE AP receives a Probe Request that contains Co-located APs Only subfield of the RNR Criteria field of the FILS Request element set to 1, then the RNR element of the Probe Response frame, that is transmitted as a response to the Probe Request, should only include information of the co-located APs. If the value is set to 0, then the RNR element of the Probe Response should include information of the co-located APs and one or more neighbor APs.

To provide information for other scanning STAs, an AP may include RNR elements containing the BSSID and/or the Short SSID of BSSs on the Co-located APs at a band on which the respective subfield in the Band Specific RNR Criteriafield is set to 0. Similarly, an AP may not include all APs of the ESSs to the Probe Request frame it transmits, even if this is requested by a received Probe Request frame.