IEEE P802.11
Wireless LANs

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| CR for 6GHz |
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Abstract

This document provides CR for CIDs related to 6GHz policy.

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** |
| 15826 | 27 | 253 | 6GHz APs will be multi-band APs operating also at 2.4/5GHz. Most STAs will also be tri-band capable. Load balancing/traffic steering between bands is the most powerful tool to limit the load at 6GHz and ensure QoS, high throughput or low latency. BTM requests, neighbor reports that are in the spec right now provide most of the tools to enable efficient load balancing. What is however missing is the description of the policy that a multi-band collocated AP is applying across it's different bands to inform the STAs of which traffic is recommended in which band, and to enable a very simple admission control per band. A policy should then be defined for a multi-band collocated AP, and this would define how a STA should operate with this AP, before association and after association. This policy could say that there are no restrictions (default for main deployments) or would enable specific modes where a realistic admission control for the 6GHz band is in place and where associaiton at 6GHz is allowed only after receiving a BTM request for instance, or is allowed only through pre-association at 6GHz through the collocated APs at 2.4 and 5GHz. | Define a multi-band collocated AP operation policy, which defines different modes for how to interact with this AP across different bands, before and after association (for instance association allowed only after receiving BTM request)... If this element is not included, interaction with the 6GHz AP should be exactly the same as today: no restrictions. | Revised – agree with the commenter. Apply the changes as proposed in doc 1229r0. |

1. **Proposed changes**

**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.

For these multi-band collocated APs, load balancing and steering STAs and traffic on the different bands is the most powerful tool in order to ensure that only a limit set of STAs, or specific traffic/applications are allowed in a particular band, while the other STAs/traffic is handled in other bands. Limiting the access in one band with admission control is the most powerful tool to control the load of the channel and ensure QoS, low latency, or full efficiency for high throughput is ensured. In the meantime, other bands/APs are used to support all other traffic.

To enable this efficient load balancing/STA steering in multi-band collocated APs, and especially for the 6GHz band, we have most of the tools today in the 802.11 spec:

* BSS transition management frames to ask STAs to change band and go to a collocated AP
* Ability for an AP to reject association and propose redirection to another collocated AP

What is missing is the definition of the policy that a multi-band collocated device with multiple APs in different bands is applying across all its bands/APs.

* Informing STAs about the policy that the APs are applying: what traffic is expected in a particular band so that STAs don’t try and associate to the AP at 6GHz if they intend to do a very different type of traffic
* Specific rules or recommendations for STAs to follow when trying to associate:
	+ Recommanded to do active scanning and/or pre-association at 6GHz, or on the contrary at 2.4/5GHz, depending on the load of the different bands
* Specific rules or recommendations for STAs to follow if the AP decides to operate with a specific mode with admission control:
	+ basic default mode should be no restrictions and no extra rules on STAs.
	+ One or several modes should be defined to support AP-controlled BSS transitions and multi-band admission control: define rules that association to an AP at 6GHz only after having received a BTM request, while association at 2.4/5GHz is always possible. We define the point of entry AP as the AP on which no restrictions for association apply and admission controlled AP the AP on which restriction applies.
		- Basically STAs shoul not try to associate just to get an association reject

**Proposal**

For the discovery of collocated APs, as discussed in doc 1227, we need to define a multi-band collocated device that is made of several collocated APs operating on different bands.

In this document, we propose to define a Multi-band operation policy element:

* This is describing different possible modes that the AP operates on regarding association across multiple bands
* If this element is present in neighbour report from a collocated or non collocated AP, depending on the modes, some restrictions can apply: for instance, association at 2.4/5GHz allowed all the time. Association at 6GHz only after receiving BTM request.
* If this element is not present in neighbour report from a collocated or non collocated AP, no restrictions apply (default behavior).

And the rules for HE STAs, when receiving this policy element. Note that we may want to look into other policies.

***11ax Editor: Define a new subclause 9.4.2.xxx Multi-band operation policy element***

9.4.2.xxx Multi-band operation policy element

(#6144)The format of the Multi-band operation policy is defined in Figure xxxx (Multi-band operation policy element).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | Association procedure mode | Post-association Traffic policy |
| Octets: | 1 | 1 | 1 | 1 | 1 |

**Figure xxxx - Multi-band operation policy element**

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

The Association procedure mode subfield is defined in Table xxx – Association procedure mode subfield encoding and is used to define which association procedure mode is used by the multi-band collocated AP. Each association procedure mode has rules for pre-association exchanges.

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| Table xxx – Association procedure mode subfield encoding |
| Association procedure mode subfield value | Description |
| 0 | No restrictions - Default mode |
| 1 | Admission control through any BTM request or FST request |
| 2 | Admission control through BTM request or FST request received from the point of entry AP of the Multi-band collocated concurrent device |
| 3 | Admission control through the point of entry AP of the Multi-band collocated concurrent device with OCT and Multi-band RSNA |
| 5-7 | Reserved |

The Post-association Traffic Policy subfield is defined in Table xxx – Post-association Traffic Policy subfield encoding and is used to define which traffic is admitted to the multi-band collocated AP.

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| Table xxx – Post-association traffic Policy subfield encoding |
| Traffic Policy subfield bit value | Description |
| B0 | All traffic – Default mode |
| B1 | AC-VO Voice |
| B2 | AC-VI Video |
| B3 | TSN |
| B4-B7 | Reserved |

***11ax Editor: Define a new subclause 9.4.2.xxy Multi-band collocated AP description element***

9.4.2.xxy Multi-band collocated AP description element

The Multi-band collocated AP description element is used to describe an AP that is part of a Multi-band collocated concurrent device. (#6144)The format of the Multi-band collocated AP description element is defined in Figure xxxx - collocated AP description element).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | Element ID | Length | Element ID Extension | Multi-band collocated AP description |
| Octets: | 1 | 1 | 1 | 1 |
| Figure xxxx - Multi-band collocated AP description element |

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

The Multi-band collocated AP description field is defined in Figure xxxxx - Multi-band collocated AP description field format.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0          B1 | B2 | B3 | B4 B7 |
|  | APID | Point of entry AP | Access controlled AP | Reserved |
| Bits: | 3 | 1 | 1 | 1 |
| Figure xxxx - Multi-band collocated AP description field |

The APID field is encoded with a value representing the ID of the AP that is part of a Multi-band collocated concurrent device. This ID is unique in the Multi-band collocated concurrent device.

The point of entry AP field is set to 1 to indicate that the AP that is part of a Multi-band collocated concurrent device is a point of entry AP, for Multiband admission control procedure defined in xxx, and set to 0 otherwise.

The Access controlled AP field is set to 1 to indicate that the AP that is part of a Multi-band collocated concurrent device is an Access controlled AP, for Multiband admission control procedure defined in xxx.

***11ax Editor: Modify 27.16.1 Basic HE BSS operation as follows***

27.16.1 Basic HE BSS operation

27.16.1.1 Basic HE BSS operation in the 6GHz band

A multi-band device that has an HE AP operating in the 6GHz band and one or more APs operating in the 2.4 and 5GHz band may regulate association procedure across the APs by including a Multi-band policy element in beacons, probe response, (re)association frames, and in neighbor reports describing the APs.

If the AP does not include a Multi-band policy element in beacons, probe response, or if a neighbor AP does not include a Multi-band policy element in the neighbor report it transmits to describe the AP, non-associated HE STAs have no restrictions to access the channel for sending pre-association traffic to the AP, other than the restrictions defined by regulation.

If a Multi-band collocated AP operating in the 6GHz band is regulating operation with a Multi-band collocated operation policy element, the following rules shall apply.

* If the Association procedure mode subfield is set to 0, non-associated STAs can transmit any pre-association frames to the Multi-band collocated AP, except for probe request frame with wildcard SSID.
* If the Association procedure mode subfield is set to 1, the non-AP STA should not send (re)authentication or (re)association frames to the Multi-band collocated AP, unless it received a BTM request frame or an FST request frame from a neighbor AP, which may be an AP that is part of the Multi-band device with the Multi-band collocated AP or any other neighbor AP with the same SSID as the Multi-band collocated AP. The non-AP STA may send a (re)authentication or (re)association frames to the point of entry AP that is part of the same Multi-band device as the Multi-band collocated AP.
* If the Association procedure mode subfield is set to 2, the non-AP STA should not send (re)authentication or (re)association frames to the Multi-band collocated AP, unless it received a BTM request frame or an FST request frame from a point of entry AP that is part of the same Multi-band device as the Multi-band collocated AP. The non-AP STA may send a (re)authentication or (re)association frames to the point of entry AP that is part of the same Multi-band device as the Multi-band collocated AP.
* If the Association procedure mode subfield is set to 3, the non-AP STA should not send (re)authentication or (re)association frames to the Multi-band collocated AP in the operating channel of the HE AP. If the Multi-band device is non transparent, the non-AP STA that operates at 6GHz may send (re)authentication or (re)association frames to the Multi-band collocated AP operating at 6GHz using the OCT protocol using an over-the-air transmission between the collocated non-AP STA that operates in the channel of the point of entry AP and the point of entry AP. If the Multi-band collocated concurrent device is transparent, the collocated non-AP STA that operates in the channel of the point of entry AP may send (re)authentication or (re)association frames directly to the point of entry AP, and the STA becomes naturally associated with the 6GHz multi-band collocated AP. If the multi-band collocated AP is multi-band RSNA-capable, the non-AP STA may establish a multi-band RSNA with the multi-band collocated AP for the 6GHz band using the collocated non-AP STA operating in the point of entry AP.

# Post-association Traffic Policy for admission control

If B0 of the Post-association Traffic Policy subfield is not set to 1, the non-AP STA should send (re)authentication or (re)association frames to the HE AP only if it intends to do traffic for which the related bit is set to 1 in the Post-association Traffic Policy subfield, otherwise, it should send (re)authentication or (re)association frames to the other APs that are part of the same Multi-band collocated concurrent device.