IEEE P802.11
Wireless LANs

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| Comment resolutions for 27.16.1 related to 6 Ghz band |
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Abstract

This submission proposes resolutions for multiple comments related to TGax D3.0 with the following CIDs (2 CIDs):

* 15122, 15829

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Incorporated feedback received during offline discussions. The changes are not highlighted because the REV 0 has not been presented yet.
* Rev 2: Editorial re-organization to reduce overhead. Technical content same as Rev 1.
* Rev 3: No changes to the document.
* Rev 4: Minor editorial changes to the document based on the presentation. Changes in green.

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. This introduction is 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** | **Commenter** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 15122 | Abhishek Patil | 369.47 | Define 6GHz access rules in compliance with regulatory requirements | As in comment | Revised –Agree in principle with the comment. Proposed resolution is to provide operation details on how the non-AP STA can discover a 6 GHz AP, by either using passive scanning or active scanning in the 6 GHz band when certain conditions are satisfied. The access is expected to always be compliant with regulatory requirements. Added notes mentioning regulatory restrictions as a reason that channels might not be available due to them.TGax editor to make the changes shown in 11-18/1471r4 under all headings that include CID 15122. |
| 15829 | Laurent Cariou | 369.47 | An HE BSS can operate at 6GHz. The description is missing in this subclause. | Specify how a STA determines channelization when operating at 6GHz | Revised –Agree in principle with the comment. Proposed resolution is to provide operation details on how the non-AP STA can discover and associate with a 6 GHz AP, by either using passive scanning or active scanning, in the 6 GHz band when certain conditions are satisfied.TGax editor to make the changes shown in 11-18/1471r4 under all headings that include CID 15829. |

**Discussion:** *Proposed resolution defines discovery rules for 6 GHz band, inline with discussions in 11-18/1624r0 and additional improvements based on offline discussions and feedback. The concept can be divided in three main parts:*

**Definition of two classes of channels:**

* *Preferred Scanning Channel (PSC)* – A channel where the STA can send a probe request when scanning without having knowledge of an AP in that channel following IEEE802.11ai/OCE-like rules.
* *Non-Preferred Scanning Channel (non-PSC)* – A channel where the STA can send probe request when scanning only if the STA has knowledge of an AP in that channel.
* *One channel every four channels is a PSC****.***

**Proposed AP behavior:**

* Fast passive scanning as a mandatory mode for 6 GHz-only APs; while dual band APs are not required since their presence is advertised via RNR or ANQP in the lower band (please refer to 11-18/1227r9 for details). Fast passive scanning performed via:
	+ Generation of FILS Discovery frames every 20 TUs (very short frames (i.e., short airtime usage (e.g., <100us)) that provide partial information (BSSID, Short SSID and some other information) or generation of unsolicited Probe Response frames every 20 TU (longer frames that provide full information).
	+ FD frames and Probe Responses are transmitted at a mandatory rate and may be included in the broadcast RU of a DL MU PPDU. In addition, provided explicit rules for the single BSSID and the multi-BSSID case.
* Recommends that a 6 GHz-only AP sets up the BSS with a primary channel that coincides with a preferred scanning channel (4x reduction of the discovery times of these APs due to 1 in 4 channels assigned as PSCs)

**Proposed STA behavior:**

* Add explicit rules to limit blind probing in the 6 GHz band to avoid probe storming
	+ Broadcast Probe Requests with wildcard BSSID & wildcard SSID are not allowed
	+ Broadcast Probe Requests to an AP that is already discovered during the scanning phase (RXed Probe Response or Beacon) are not allowed. Likewise, for a non-transmitted BSSID if the profile has already been received. And similarly, if the AP is discovered via RNR or NR IE and that IE had the 20 TU Probe Responses Active set to 1 (see 1227r9)
	+ Limit broadcast Probe Requests with wildcard BSSID in A3 to no more than one and no more than 3 broadcast Probe Requests with non-wildcard BSSID in A3 for a 20 TU interval.
	+ A STA that scans a preferred scanning channel may transmit a broadcast Probe Request frame after discovering it (e.g., via FILS Discovery frame in 6 GHz, or RNR IE, and NR IE in the lower bands). If no AP is discovered, then the STA is free to send the broadcast Probe Request after expiration of the 20 TUs.
	+ A STA that scans a non-preferred scanning channel may transmit a broadcast Probe Request frame only after discovering an AP in that channel.
	+ The STA is free to send a directed Probe Request frame to an AP if it has discovered it via discovery mechanism that are out of scope of the standard.
* HE BSS operation
	+ 1. Basic HE BSS functionality

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 15122, 15829):***

An HE STA shall follow the rules defined in 11.40 (VHT BSS operation) for channel selection, determining scanning requirements, channel switching, NAV assertion and antenna indication when operating in 5 GHz unless explicitly stated otherwise in Clause 27. An HE STA shall follow the rules defined in 27.16.1a (HE BSS functionality in 6 GHz band) for scanning.*(#15122, 15829)*

**TGax Editor: *Insert a new subclause as follows (#CID 15122, 15829):***

27.16.1a.1 Scanning in the 6 GHz band

27.16.1a.1.1 Fast passive scanning

An AP operating in the 6 GHz band that is not co-located with an AP that operates in at least one of 2.4 GHz band or 5 GHz band is defined as a 6 GHz-only AP.

A 6 GHz AP that has dot11MultiBSSIDActivated equal to true and that corresponds to the transmitted BSSID or that has dot11MultiBSSIDImplemented equal to false shall schedule for transmission FILS Discovery frames as described in 11.47.2.1 (FILS Discovery frame transmission), except that:

* The FILS Discovery frames may be included in the broadcast RU of a transmitted DL HE MU PPDU, wherein the broadcast RU, identified by the STA ID field equal to 2045, does not exceed a 242-tone RU, which is located within the primary 20 MHz channel and is subject to the rules defined in 28.3.2.8,
* The transmission of FILS Discovery frames may be omitted if a BSSID, and SSID (or short SSID) indication of the AP is advertised in a Reduced Neighbor Report element in Beacon and Probe Response frames transmitted on a 2.4 GHz or 5 GHz channel by a co-located AP, or if a broadcast Probe Response or a Beacon frame is scheduled for transmission instead of the FILS Discovery frame, or if the AP is a 6 GHz-only AP that does not intend to be discovered by STAs

A 6 GHz AP that has dot11MultiBSSIDImplemented equal to true and that corresponds to the transmitted BSSID or that has dot11MultiBSSIDImplemented equal to false may send unsolicited Probe Response frames to the broadcast address. The Probe Response frame shall be transmitted at a mandatory PHY rate and may be included in the broadcast RU of a transmitted DL HE MU PPDU, wherein the broadcast RU, identified by the STA ID field equal to 2045, does not exceed 242-tone RU, which is located within the primary 20 MHz channel and is subject to the rules defined in 28.3.2.8.

A 6 GHz AP that transmits FILS Discovery frames or broadcast Probe Response frames in HE SU PPDU shall set the TXVECTOR parameter CH\_BANDWIDTH to 20 MHz and shall set the Primary Channel Indicator subfield in FILS Discovery frames it transmits in the 6 GHz band to 0.

An AP that corresponds to a nontransmitted BSSID shall not schedule for transmission FILS Discovery frames or unsolicited broadcast Probe Response frames. A 6 GHz AP shall set dot11FILSFDFrameBeaconMaximumInterval to a nonzero value that is less than or equal to 20 TUs. An AP that has dot11MultiBSSIDImplemented equal to true and that corresponds to the transmitted BSSID shall set the Multiple BSSID Presence Indicator subfield to 1 in FILS Discovery frames it transmits.

A 6 GHz-only AP should set up the BSS with a primary 20 MHz channel that coincides with a *Preferred Scanning Channel* (see 27.16.1a.1.2).

NOTE—An AP initiates a BSS with a primary channel that coincides with a PSC in order to assist STAs that are scanning the 6 GHz band to discover the BSS. The AP might subsequently switch its operating channel to a non-PSC channel (e.g., using a CSA mechanism) if it does not expect additional (not yet associated) STAs will need to discover the BSS.

When a 6 GHz AP sends a Probe Response frame in response to a Probe Request frame with the broadcast destination address, the response shall be sent to the broadcast destination address.27.16.1a.1.2 Scanning behavior for non-AP STA

A subset of the 20 MHz channels in the 6 GHz band, with channel center frequency, indexed as *ch\_a* *=* *channel starting frequency +* 5 × 16 × *(n-1)*, where *n* varies between 1 to 15, are defined as *Preferred Scanning Channels (PSC)*.NOTE—Not all *PSCs* might be available in a certain location due to regulatory restrictions.

A HE non-AP STA that is actively scanning a channel in the 6 GHz band shall operate as defined in 11.1.4.3.2 with the addition of the following rules:

* Shall not transmit a Probe Request frame to the broadcast destination address with Address 3 field set to the wildcard BSSID and the SSID set to the wildcard SSID
* Shall not send a Probe Request frame with Address 3 field (BSSID) set to the BSSID of an AP from which it has already received a Probe Response or a Beacon frame since the start of its scanning on that channel,
* Shall not send a Probe Request frame with Address 3 field (BSSID) set to the BSSID of a nontransmitted BSSID if it has already received the nontransmitted BSSID profile for that BSSID via a Beacon frame or Probe Response frame sent by the transmitted BSSID since the start of its scanning on that channel,Shall not send a Probe Request frame with SSID and/or Address 3 field set to the SSID and/or BSSID, respectively, of an AP for which it has received, a Reduced Neighbor Report, or Neighbor Report element with the 20 TU Probe Responses Active subfield corresponding to that AP set to 1 and that indicates that the AP is operating in that channel until the FILS Probe Timer reaches dot11FILSProbeDelay.
* Shall not transmit more than one Probe Request frame to the broadcast destination address with Address 3 field set to the wildcard BSSID and shall not transmit more than three Probe Request frames to the broadcast destination address with Address 3 field set to a non-wildcard BSSID during each 20 480 *us* period scanning the channel
* Shall set the dot11FILSProbeDelay to a value equal to or greater than 20 480 *us*
* If the STA is scanning a channel, then:
	+ If the STA has received a FILS Discovery frame indicating that an AP is operating in that channel, or if the STA has received a Reduced Neighbor Report, or Neighbor Report element indicating that an AP is operating in that channel then the STA may, subject to the other rules in this clause, send a Probe Request frame in that channel with SSID set to the SSID of that AP as per step d) of 11.1.4.3.2 without waiting for the FILS Probe Timer to reach dot11FILSProbeDelay,
	+ Else, if the STA has discovered the presence of an AP in that channel through means that are out of scope of the standard, then the STA may send a Probe Request frame to the broadcast destination address with Address 3 field set to the BSSID of that AP without waiting for the FILS Probe Timer to reach dot11FILSProbeDelay,
	+ Else, if the FILS Probe Timer reaches dot11FILSProbeDelay and the channel is a *PSC*, then the STA may, subject to the other rules in this clause, send a Probe Request as per step d) of 11.1.4.3.2,
	+ Else, the STA shall not send a Probe Request frame to the broadcast destination address.

NOTE—When a STA performs active scan on receipt of the MLME-SCAN.request primitive with ScanType parameter indicating an active scan, it always sends Probe Request frames to the broadcast destination address (see 11.1.4.3.2). The Address 3 field (BSSID), set per the MLME-SCAN.request primitive, is either a specific BSSID or the wildcard BSSID, and determines the scope of potential respondees. The STA might send individually addressed Probe Request frames to an AP for reasons other than active scan even if it has already received a FILS Discovery, Probe Response or Beacon frame from that AP.*(#15122, 15829)*