Comments to the Draft 6GHz KDB Guidance on Network Association

Submitted by Broadcom Inc., Hewlett Packard Enterprise, Intel Corp., and Qualcomm Inc.

September 25, 2020

Introduction

On September 9, 2020, representative of our three companies met with FCC OET Labs and discussed the Issue of 6GHz Network Association within the framework of 6GHz KDB Guidance process. This request is a follow up to the meeting as an action item identified during the call.

We are proposing clarification on the rules regarding transmission of signals during network discovery and association in the 6 GHz band.

We make reference to the following extracts of the 6 GHz R&O and Draft KDB Guidance:

- 6GHz R&O: "In all cases, an exception exists for transmitting brief messages to an access point when attempting to join its network after detecting a signal that confirms that an access point is operating on a particular channel".
- 6GHz Draft KDB Guidance: "A client, after passively scanning to determine if a low power indoor access point is available, may then initiate a request to associate and establish a connection. After being associated with a low power indoor access point, the indoor client can only initiate transmission with that access point".

List of Clarification Areas as Related to the KDB Guidance

Items as referenced in the 6GHz R&O § 15.407 (d) (5)

(1) What is the scope of "brief messages to an access point"?
(2) What constitutes "a signal that confirms that an access point is operating on a particular channel"?
(3) What is the transmit power limit for these "brief messages"?

(1) What is the scope of "brief messages to an access point"?

Background Information

IEEE 802.11 standard defines multiple types of signals that might be sent before a client device is associated, such as:

- Probe Request frames: primarily to discover access points that are within coverage, and the capabilities/policies of those Access Points (APs)
- Action frames (e.g. GAS/ANQP): primarily to query information about networks/services/capabilities available from an AP

- Authentication frames: establishment of security keys, etc
- Association Request frames: initiate association with the AP

In many cases, these frame transmissions target a single AP. Note this does not mean that all frames are sent "unicast" to the AP. For example, in some cases it is required for initial frame exchanges (such as Probe Request frames) to be sent "broadcast" to avoid unwanted overhead from the unicast ack/retry mechanism if the AP and client cannot reliably communicate.

Note: Even if the client has already received a broadcast frame (e.g. beacon) from an AP, it is not necessarily the case that reliable communication is possible due to uplink/downlink power imbalance, local interference, change of link quality in mobility, etc.

However, Probe Request frames contain filtering criteria that determine which AP(s) potentially respond. The transmission of a "broadcast" Probe Request frame that specifies the BSSID of a specific AP effectively targets a single AP, since (at most) only that AP would respond

In certain cases, these frame transmissions target more than one AP. 802.11ax standard disallows broadcast transmission of Probe Request frames that specify both SSID and BSSID filtering criteria as "wildcard" in 6 GHz band, in order to avoid airtime overhead where many APs from various networks on the channel might respond.

However, under certain conditions, 802.11 allows to specify wildcard BSSID as long as a non-wildcard SSID (network name) is specified – this is important for time-sensitive roaming scenarios in particular. Therefore, the transmission could solicit a response from more than one AP if there are multiple APs that are (a) in coverage of the client device, and (b) operating on the same primary channel, and (c) part of the same network.

These frame transmissions are short duration and their potential impact is minimal. In particular, typical implementations minimize the IEs present in Probe Request frames due to client privacy initiatives (against passive tracking)

Request for Clarification #1

Please confirm that "brief messages to an access point" can, in this context, be interpreted as any brief messages that are sent on a 6 GHz channel as a necessary part of network discovery and association, when the client device is not associated with any AP on that channel, irrespective of the exact type of message. Please consider providing clarification that the same rules apply irrespective of whether the message is sent unicast, multicast or broadcast, or any relevant filtering criteria for the potential respondees to that message.

(2) What constitutes "a signal that confirms an access point is operating on a particular channel"?

Background Information

IEEE 802.11ax standard defines multiple types of signal that confirm operation of an AP on a particular channel. These include:

- Beacon frames: Broadcast signals sent by the AP on the channel of operation, which include various capabilities and parameters of the AP

- Probe Response frames: (Broadcast) signals, usually (but not always) sent in response to a Probe Request from the client, sent by the AP on the channel of operation, with similar content as a Beacon frame
- FILS Discovery frames: Very short broadcast signals, sent by certain types of APs on the channel of operation in between consecutive Beacon frames to assist fast passive discovery, which include basic information on the AP such as its BSSID, SSID and time of the next Beacon frame
- Reduced Neighbor Report element: Included (typically) in Beacon and Probe Response frames sent by multi-band (so-called "co-located") APs in other bands (e.g. 2.4 and/or 5 GHz channels) to assist fast out-of-band discovery, which include basic information on the AP such as its BSSID, SSID and its operating channel in 6 GHz band

In particular, Reduced Neighbor Report elements are an important part of efficient 6 GHz discovery, by allowing initial discovery of multi-band 6 GHz APs to be performed using scanning in 2.4/5 GHz, which helps minimize airtime overhead in 6 GHz and facilitates fast discovery across all 6 GHz channels.

While Beacon and Probe Response frames carry explicit information about the type of AP transmitting the signal (aka the AP's equipment class), FILS Discovery frames and Reduced Neighbor Report elements only carry the transmit power limit that applies to client devices transmitting to the corresponding AP.

Further details on the signaling design in IEEE 802.11ax to support operation in 6 GHz band can be found in [1].

Request for Clarification #2

Please confirm that all of the above signals can be considered to constitute "a signal that confirms an access point is operating on a particular channel", irrespective of the actual channel/band on which that signal is sent. In addition, we propose a clarification that a client device can send a brief message to an access point for which a confirmation signal has been received, at a known transmit power limit (see next section), without necessarily knowing a-priori the AP's equipment class.

(3) What is the transmit power limit for these "brief messages"?

Background Information

In order to support client transmit power limits that are specific to each access point in 6 GHz band, each of the signals defined in IEEE 802.11ax standard that confirm operation of an AP (as described on the previous slide) include an indication of the client transmit power limit associated with that 6 GHz AP. Therefore, for example, if a client device scans 2.4/5 GHz band and receives a Reduced Neighbor Report element from a multi-band AP, it will know the client transmit power limit associated with that AP's operation in 6 GHz band, without necessarily having received a Beacon or Probe Response frame on the 6 GHz channel itself.

Request for Clarification #3

Please confirm that the transmit power limit that applies to transmission of these "brief messages" is the same as the client transmit power limit that would apply if the client device becomes associated with the corresponding AP.

We propose the a clarification that, if the client device intends to transmit a "brief message" on a 6 GHz channel that targets more than one AP, and the STA has received (in-band and/or out-of-band) signals

that confirm operation of more than one of those targeted APs, then the STA can choose to use any of the transmit power limits (as indicated in the received confirmation signals) that pertain to those targeted APs.

References:

[1] IEEE Std 802.11ax™/D7.0 subclauses 11.7, 11.49, 11.53 and Annex E.2. Contact dstanley@ieee.org to request access.