IEEE P802.11
Wireless LANs

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| CR for Reduced Neighbor Report  |
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| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Jarkko Kneckt | Apple | Cupertino, CA |  | jkneckt@apple.com |
| Guoqing Li | Apple |  |  |  |
| Chris Hartman | Apple |  |  |  |

Abstract

 This submission provides comment resolutions to four CIDs: 20253, 20255, 20264 and 20265.

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** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 20253 | 9.4.2.170.2 | 152 | Enable in active scanning the scanning non-AP STA to request information that is included to the Reduced Neighbor Report. For example, a non-AP STA should be capable to indicate the bands in which it is interested to operate and request AP information on these bands to be added to the Reduced Neighbor Report elements. | Please create a new Reduced Neighbor Report Criteria element that may be included to the Probe Request frames. This element can request the bands from which the AP information should be added to the Reduced Neighbor Report element. | Revised. Agree in principle with the comment. The scanning STAs benefit, if they get knowledge whether AP has provided channels in which an AP operates in the band. TGax editor to make changes as shown in 11-19/488r0 that are marked with CID 20253 that create Reduced Neighbor Report Parameters element and add Requested Band Bitmap to the element.  |
| 20255 | 9.4.2.170.2 | 152 | Allow a non-AP STA to request whether only the co-located APs are included in the Reduced Neighbor Report or whether to include neighbor AP information to the Reduced Neighbor Report. | Please create a new Reduced Neighbor Report Criteria element that may be included to the Probe Request frames. This element can request to include only co-located AP information or to include neighbor AP information to the Reduced Neighbor Report included to the Probe Response frames. | Revised. The responding AP may have reasons to include non co-located BSS in the Reduced Neighbor Report. For instance, the Co-located BSS may be congested, and the other BSS may have more resources available. However, the STAs benefit, if they get knowledge that AP has provided all co-located APs. TGax editor to make changes as shown in 11-19/488r0 that are marked with CID 20253 that create Reduced Neighbor Report Parameters element and include All Co-located APs field to the element that is included to Probe Response, Beacon or FILS Discovery frame.  |
| 20264 | 9.4.2.170.2 | 152 | A STA should be capable to request that Reduced Neighbor Report contains AP information only on the SSIDs that are included in the Probe Request frame. The guidance helps to reduce the size of the Neighbor Report element and to provide essential information for the scanning STA. | Please create a new Reduced Neighbor Report Criteria element that may be included to the Probe Request frames. This element can request to include information of APs that match with the SSIDs included to the Probe Request frame to the Reduced Neighbor Report in the Probe Response frames that are transmitted as a response to the Probe Request. | Revised. Agree in principle with the comment. TGax editor to make changes as shown in 11-19/488r0 that are marked with CID 20264 that create Reduced Neighbor Report Parameters element and add Any SSID field to the element. |
| 20265 | 9.4.2.170.2 | 152 | A STA should be capable to request that Reduced Neighbor Report contains information of All APs in the ESS from which the STA may receive a Beacon. Information of all APs ensures that the STA knows all available APs and can select the best AP. | Please create a new Reduced Neighbor Report Criteria element that may be included to the Probe Request frames. This element can request to include information of all APs in the ESS that are within a coverage that the requesting STA could receive a beacon from them to the Reduced Neighbor Report in the Probe Response frames that are transmitted as a response to the Probe Request. | Revised. Agree in principle with the comment. TGax editor to make changes as shown in 11-19/488r0 that are marked with CID 20265 that create Reduced Neighbor Report Parameters element and add All APs Requested field to the element. |

1. Discussion

Currently, WLAN radio may operate in 8 bands, as listed in 9.41.45(band id field). Some bands, like the 6 GHz band, have very large number of available channels. It will take long time to scan through all available channels which causes high power consumption to the battery powered device.

Currently, a scanning STA can transmit a probe request frame and specify SSIDs or AP capabilities that the responding AP must have in order to respond to the probe request frame. The response rules to probe request controls which responses the scanning STA gets from the scanned channel.

The BSSs should assist the scanning STA to select the next scanned channel wisely to reduce the total scanning time. Scanning STAs likely start scanning on already widely used 2.4 or 5 GHz bands. APs in these bands should provide hints to the scanning STA and let the scanning STA know the bands and the channels of the APs that the STA seeks to find. This will reduce scanning and the interference caused by scanning in the currently less used bands. For instance, scanning traffic in sub 1 GHz, TVWS and 6 GHz bands can be minimized and APs operating in 45 GHz or 60 GHz can be discovered fast.

The Reduced Neighbor Report (RNR) elements have key role to distribute information of the available BSSs. The APs can include Reduced Neighbor Reports to Beacon, Probe Response and FILS Dicovery frames. Unfortunately, the STAs are not able to request the bands from which the information is included to the RNR and the STAs are not able to indicate are they looking after APs in the large coverage area or APs from any SSID. These indications add more information to the RNR in broadcast Probe Response, Beacon and FILS Discovery frames. Thus, the information serves all scanning STAs and the number of transmitted scanning frames may be reduced.

When scanning devices request the information that is added, the AP reduce the size of the Reduced Neighbor Reports that it typically transmits. The scanning STA should be able to request the responding APs to include the following information to the Reduced Neighbor Reports they transmit:

* The bands in which the scanning STA desires to operate. The STA may be capable to operate in multiple bands and it may look for a radio with specific performance level, or a band in which it does not have multi-radio co-existence issues.
* To get information of all APs that operate in the coverage of the responding AP.
* To get response from APs whose SSID does not match with a Short SSID or an SSID in the Probe Request. If a band does not allow to use a wildcard SSID, the STA may need to specify whether it desires to receive information of all BSSs or only on the limited set of BSSs.

The Reduced Neighbor Report should provide more complete information to the scanning devices. The scanning STA can avoid rescanning the APs, if it knows that it has received information of all co-located APs or got a complete information on a specific band.

3- **Proposed changes**

**9.4.2.1 General**

**TGax Editor: *Include the Reduced Neighbor Report Parameters to the Table 9-95 above the Reserved Element.***

**Table 9-95—Element IDs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | Element ID | Element ID Extension | Extensible | **Fragmentable** |
| Reduced Neighbor Report Parameters (see 9.4.2XXX(Reduced Neighbor Report Parameters element))  | 255 | ANA | Yes | No |
| Reserved | 255 | 56 - 255 |  |  |

**9.4.2.XXX Reduced Neighbor Report Parameters element**

**TGax Editor: *Add the element as shown below.***

This element is placed in a Probe Request frame to request information of the Reduced Neighbor Report element, or this element is placed in Probe Response, FILS Discovery and Beacon frames to characterize information that is included in the Reduced Neighbor Report elements of the frame that carries this element.

 (#20253, #20264)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element Id | Length | Element ID Extension  | Reduced Neighbor Report Parameters |
| Octets: | 1 | 1 | 1 | 2 |

**Figure 9-XX1–** **Reduced Neighbor Report Parameters element**

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 – B13 | B14 | B15 |
|  | Requested Band Bitmap | All APs Requested | Any SSID  |
| Bits: | 14 | 1 | 1 |

**Figure 9-XX2–Reduced Neighbor Report Parameters field format when attached to a Probe Request frame**

The Requested Band Bitmap subfield requests information of APs that operates in the specific band to the Reduced Neighbor Report element that is transmitted as a response to the frame that contains this subfield. Starting from bit zero, each bit position of the Requested Band Bitmap subfield corresponds, respectively, to the band identified by values of the Band ID field, see 9.4.1.45(Band ID field). If a value of the Band ID field is reserved, the corresponding bit position, if it exists, of the Requested Band Bitmap subfield is also reserved. Each bit position of the Requested Band Bitmap subfield is set to 1 to request that information related to APs operating in the band corresponding to the bit position are included in the Reduced Neighbor Report element of the frame transmitted as a response to the Probe Request frame that carried the Reduced Neighbor Report Criteria field. Each bit position of the Requested Band Bitmap subfield is set to 0 to indicate no preference whether information on APs operating in the band corresponding to the bit position is included to the Reduced Neighbor Report elements. (#20253)

The All APs Requested subfield is set to 1 to request that Reduced Neighbor Report elements of the frame, transmitted as a response to the Probe Request frame carrying this subfield, include information of all APs within the coverage of the requested AP, that operate in a requested band and whose SSID matches to one of the SSIDs and Short SSIDs in the Probe Request frame. Otherwise, the subfield is set to 0. (#20265)

The Any SSID subfield is set to 1 to request that Reduced Neighbor Report elements of the frame, transmitted as a response to the Probe Request frame carrying this subfield, include information on APs operating in a requested band and whose SSID matches or does not match with an SSID or a Short SSID that is included to the Probe Request. Otherwise, the subfield is set to 0. (#20264)

|  |  |  |
| --- | --- | --- |
| B0 – B13 | B14 | B15 |
| Complete BandBitmap | Reserved | All Co-located APs |
| 14 | 1 | 1 |

**Figure 9-XX3– Reduced Neighbor Report Parameters field format when present in Probe Response, Beacon or FILS Discovery frame**

The Complete Band bitmap defines a band specific indication. Starting from bit zero, each bit position of the Requested Band Bitmap subfield corresponds, respectively, to the band identified by values of the Band ID field, see 9.4.1.45(Band ID field). If a value of the Band ID field is reserved, the corresponding bit position, if it exists, of the Requested Band Bitmap subfield is also reserved. Each bit position of the Requested Band Bitmap subfield is set to 1 to indicate that the reporting AP has knowledge of APs in the respective channel and the reporting AP has provided information of all co-located and neighboring APs in the band that the responding AP knows to operate within its coverage. The field is set to 0 if the reporting AP does not know any AP operating in the respective band or if the reporting AP has not provided all operating classes and channels where it knows that an AP operates. (#20253)

The All Co-located APs subfield set to 1 indicates that the Neighbor AP Information fields of the Reduced Neighbor Report elements in the frame include the operating classes and the channel numbers of all co-located APs that have a primary channel on a different channel than the channel in which this subfield is transmitted. Otherwise, the subfield is set to 0. (#20255)

**TGax Editor: *Append the following text at the end of the subclause:***

**1.1.4.3.2 Active scanning procedure for a non-DMG STA**

A STA may set a bit in the Band Requested Bitmap subfield of the Reduced Neighbor Report Parameters field of the Reduced Neighbor Report Parameters element of a Probe Request frame to specify certain APs to be included to the Reduced Neighbor Report element, as defined in 9.4.2.XXX(Reduced Neighbor Report Parameters element).

**TGax Editor: *Add the following new subclause:***

**26.17.2.4.1 AP rule for the content of the reduced neighbor report**

An HE AP that receives a Probe Request frame shall follow the rules defined in 11.1.4.3.4(Criteria for sending a response) to determine whether it responds to the received Probe Request frame. If the HE AP responds to the Probe Request frame that contains a Reduced Neighbor Report Parameters element, then the responding AP shall include the co-located AP information as described in 11.1.4.3.4(Criteria for sending a response) and in 26.17.2.4(Out of the band discovery at 6 GHz). The responding AP follows the rules specified in this clause to include information of other APs to the Reduced Neighbor Report elements that are included in the frame that is transmitted as a response to the Probe Request frame.

An AP with dot11ColocatedRNRImplemented set to true may include the Reduced Neighbor Report Parameters element to Probe Response, FILS Discovery and Beacon frames it transmits.

If an HE AP receives a Probe Request frame that contains at least one bit in the Band Requested Bitmap subfield in the Reduced Neighbor Report Parameters field of the Reduced Neighbor Report Parameters element set to 1, then, for each bit that is set to 1, the AP should include in Reduced Neighbor Report elements of the frame, that it transmits as a response to the Probe Request frame, information of SSIDs and the BSSIDs of the APs that the responding AP desires to be discoverable, are within the coverage of the responding AP and operate at the respective band. If a bit is set to 0 the responding AP does not have any recommendation whether to include information of APs operating in the respective band to the Reduced Neighbor Report. (#20253)

If an HE AP receives a Probe Request frame that contains All APs Requested subfield of Reduced Neighbor Report Parameters field of a Reduced Neighbor Report Parameters element set to 1, then the AP should include to Reduced Neighbor Report elements of the frame that it transmits as a response to the Probe Request frame, information of the BSSIDs and the SSIDs of all APs the responding AP knows to operate within its coverage and whose SSID match with an SSID or a Short SSIDs included in the received Probe Request frame. (#20265)

If an HE AP receives a Probe Request frame that contains Any SSIDs subfield of the Reduced Neighbor Report Parameters field of the Reduced Neighbor Report Parameters element set to 1, then the responding AP should include to the Reduced Neighbor Report elements of the frame, that it transmits as a response to the Probe Request frame, information of APs whose SSID match with an SSID or a Short SSID included in the received Probe Request frame and information of one or more APs whose SSID does not match an SSID or a Short SSID included in the Probe Request frame. If the subfield is set to 0 the responding AP does not have any preference for the SSIDs it can include to the Reduced Neighbor Report element. (#20264)

An HE AP that transmits a Reduced Neighbor Report element shall set a bit in the Complete Band Bitmap, if the transmitting AP has included all operating classes and the channels of the APs the transmitting AP knows to operate in its coverage in the band identified by the position of the bit in the bitmap as described in 9.4.2.XXX(Reduced Neighbor Report Parameters element). The bit is set to 0 if the AP does not know any AP that operates in the band or if the AP has not included all operating classes and channels of the APs in the band that the transmitting AP knows to operate within its coverage. (#20255)

An HE AP that transmits a Reduced Neighbor Report element shall set the All Co-Located APs Present subfield of the Reduced Neighbor Report Parameters field of the Reduced Neighbor Report Parameters element to 1, if the operating classes and the channel numbers of all co-located APs are present in the Neighbor AP Information fields of the Reduced Neighbor Report elements in the frame that carries this subfield. Otherwise, the AP shall set the subfield to 0. (#20253)