IEEE P802.11
Wireless LANs

|  |
| --- |
| 802.11Multiple BSSID Support in RNR |
| Date: 2019-05-02 |
| Author(s): |
| Name | Company | Address | Phone | email |
| Thomas Derham | Broadcom | 16340 W Bernardo Dr, San Diego CA 92127 |  | thomas.derham@broadcom.com |
| Abhishek Patil | Qualcomm Inc |  |  | appatil@qti.qualcomm.com |
|  |  |  |  |  |

**Abstract**

This document proposes resolution for CID 2696 by introducing a new field type in the Reduced Neighbor Report element to efficiently support indication of BSSs in a Multiple BSSID set.

R0 – initial draft

R1 – added missing co-author

R2 – small fix from REVmd review comment

R3 – Clarify TBTT Information length value for type=1

R4 – Fix a couple of change annotations

R5 – Editorial fixes from REVmd review comments

**Discussion**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 2696 | 9.4.2.170 | 1336 | 53 | Reduced Neighbor Report should support a structure to efficiently allow representation of a Multiple BSSID set | Define new TBTT Information Field Type value and structure which efficiently represents the Transmitted BSSID and its TBTT offset, and partial/complete indices/ShortSSIDs for all BSSs in the set |

The Reduced Neighbor Report element may be transmitted by APs in Beacon, Probe Response or FILS Discovery frames. It provides information about neighboring APs that can be useful to non-AP STAs, particularly to assist with pre-association discovery of APs in the local area. For example, during a scanning procedure, information received in RNR elements early on during the scan can be used to optimize the remainder of the scan, e.g. which channels to prioritize according to information that candidate APs for association exists on certain channels.

The current RNR format is not well optimized when reporting several BSSs in a Multiple BSSID Set. For example:

* the TBTT is repeated for each BSS (even though it is identical for all of them)
* the BSSID (when present) is a full 6 octets per BSS (even though it could be more efficiently indicated with just the BSSID of the transmitted BSSID and the indices of the nontransmitted BSSIDs)
* the ShortSSID (when present) is indicated for every reported BSS in the set, even though it may only be desirable to indicate it only for certain BSSs in the set (e.g. production BSSs in an enterprise)

Such optimizations would be particularly beneficial given that the RNR may be transmitted frequently in Beacon and/or FILS Discovery frames, for which it is important to minimize signaling airtime overhead.

This contribution proposes a new TBTT Information Field Type that is designed to optimize for Multiple BSSID reporting.

It is noted that the definition of fields in RNR element has been expanded multiple times from its original inception in 11af amendment, including by 11ai and subsequent REVmd resolutions (as noted in 17/906r4). In this document, if in a Neighbor AP Information field the TBTT Information Field Type field is set to 1 (a previously reserved value) instead of 0, there are several changes to the structure and parsing of that Neighbor AP Information field - the TBTT Information Count field is replaced by other fields, the contents/structure of the TBTT Information field(s) in the TBTT Information Set is different, and the Opclass/ChanNum fields might be absent (depending on value of other fields).

Note that baseline text requires TVHT STAs to always set TBTT Info Length=1, and this proposal also requires TVHT STAs to always set TBTT Info Field Type=0 (which is the only allowed value in baseline) to avoid interop issues with other TVHT STAs.

In addition, note that addition in REVmd from 2018 (11.50) requires all STAs - both TVHT and non-TVHT - to ignore the remainder of an RNR element if it starts to parse a Neighbor AP Information field with unrecognized TBTT Info Field Type (i.e. non-zero for legacy STAs). This proposal specifies that any Neighbor AP Information fields with TBTT Info Field Type=1 are placed after any Neighbor AP Information fields with TBTT Info Field Type = 0, so that legacy STAs adhering to this rule will ignore them.

Proposed resolution: Revise by making following modifications:

***Instruct the editor to make the following modifications:***

* Reduced Neighbor Report element
* General (Ed)

The Reduced Neighbor Report element contains channel and other information related to neighbor APs. The format of the Reduced Neighbor Report element is shown in Figure 9-622 (Reduced Neighbor Report element format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Element ID | Length | Neighbor AP Information Fields |
| Octets: | 1 | 1 | variable |
| * Reduced Neighbor Report element format
 |

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

The Neighbor AP Information Fields field contains one or more of the Neighbor AP Information field described in 9.4.2.170.2 (Neighbor AP Information field).

* Neighbor AP Information field

The Neighbor AP Information field specifies TBTT and other information related to a group of neighbor APs on one channel. See Figure 9-623 (Neighbor AP Information field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | TBTT Information Header | Operating Class (optional) | Channel Number (optional) | TBTT Information Set |
| Octets: | 2 | 0 or 1 | 0 or 1 | variable |
| * Neighbor AP Information field format
 |

The format of TBTT Information Header subfield when bits B0-B1 are equal to 0 is defined in Figure 9-624 (TBTT Information Header subfield).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 | B3 | B4 B7 | B8 B15 |
|  | TBTT Information Field Type | Filtered Neighbor AP | Reserved | TBTT Information Count | TBTT Information Length |
| Bits: | 2 | 1 | 1 | 4 | 8 |
| * TBTT Information Header subfield format when TBTT Information Field Type is equal to 0
 |

The TBTT Information Field Type subfield identifies, together with the TBTT Information Length subfield, the format of the TBTT Information field. It is set to 0 or 1. Values ~~1,~~ 2 and 3 are reserved.

If a Reduced Neighbor Report element contains multiple Neighbor AP Information fields with a mixture of TBTT Information Field Type values, the Neighbor AP Information fields with TBTT Information Field Type set to 1 are placed after all the Neighbor AP Information fields with TBTT Information Field Type set to 0.

The Filtered Neighbor AP subfield is 1 bit in length. When included in a Probe Response frame, it is set to 1 if the SSID corresponding to every AP in this Neighbor AP Information field matches the SSID in the corresponding Probe Request frame. When included in a Beacon or FILS Discovery frame transmitted by a non-TVHT AP, it is set to 1 if the SSID corresponding to every AP in this Neighbor AP Information field matches the SSID of the transmitting AP’s BSS. It is set to 0 otherwise

The TBTT Information Count subfield is 4 bits in length and contains the number of TBTT Information fields included in the TBTT Information Set field of the Neighbor AP Information field, minus one. For example, a value of 0 indicates that one TBTT Information field is included.

The TBTT Information Length subfield indicates the length of each TBTT Information field included in the TBTT Information Set field of the Neighbor AP Information field. When the TBTT Information Field Type subfield is set to 0 or 1, the TBTT Information Length subfield:

* contains the length in octets of each TBTT Information field (if any) that is included in the TBTT Information Set field of the Neighbor AP Information field
* is set to 1, 5, 7 or 11 if TBTT Information Field Type subfield is set to 0, or if the TBTT Information Field Type subfield is 1 and the Transmitted BSSID AP subfield is 0; other values are reserved.
* is set to 0 if the TBTT Information Field Type subfield is set to 1 and the Transmitted BSSID AP subfield is 1
* indicates the TBTT Information field contents as shown in Table 9-273 (TBTT Information field content).

A TVHT AP sets the TBTT Information Length subfield to 1 and the TBTT Information Field Type subfield to 0.

|  |
| --- |
| * TBTT Information field(11ai) contents(#1533)
 |
| TBTT Information Length subfield value | TBTT Information field contents |
| 0 | TBTT Information field is not present |
| 1 | The Neighbor AP TBTT Offset subfield |
| 5 | The Neighbor AP TBTT Offset subfield and the Short-SSID subfield  |
| 7 | The Neighbor AP TBTT Offset subfield and the BSSID subfield |
| 11 | The Neighbor AP TBTT Offset subfield, the BSSID subfield and the Short-SSID subfield |
| ~~0,~~ 2–4, 6, 8–10, 12–255 | Reserved |

The format of TBTT Information Header subfield when bits B0-B1 are equal to 1 is defined in Figure 9-624a (TBTT Information Header subfield).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 | B3 | B4 |  B5 | B6 B7 | B8B15 |
|  | TBTT Information Field Type | Filtered Neighbor AP | Co-Located AP | Transmitted BSSID AP | Co-Channel AP | Reserved | TBTT Information Length |
| Bits: | 2 | 1 | 1 | 1 | 1 | 2 | 8 |
|  |  | Figure 9-624a -- TBTT Information Header subfield format when TBTT Information Field Type is equal to 1 |

  When the TBTT Information Field Type subfield is set to 1, it indicates that that all the APs indicated in the TBTT Information Set field are members of the same multiple BSSID set (i.e., the APs have dot11MultiBSSIDActivated equal to true).

The Co-Located AP subfield is set to 1 if every AP in this Neighbor AP Information field is co-located with the transmitting AP. It is set to 0 otherwise, or if the information is unknown.

The Transmitted BSSID AP subfield is set to 1 if the transmitted BSSID of the multiple BSSID set indicated in the TBTT Information Set field is equal to the BSSID of the transmitting AP (i.e. the AP sending this Reduced Neighbor Report element); it is set to 0 otherwise. When the Transmitted BSSID AP subfield is set to 1, the Co-Channel AP and Co-Located AP subfields are set to 1.

The Co-Channel AP subfield is 1 bit in length and is set to 1 if the last known primary channel of every AP in this Neighbor AP Information field is equal to the primary channel of the transmitting AP (i.e. the AP sending this Reduced Neighbor Report element); it is set to 0 otherwise.

The Operating Class field is 1 octet in length and is present if the TBTT Information Field Type is 0, or if the TBTT Information Field Type is 1 and the Co-channel subfield is 0; otherwise it is absent. It indicates a channel starting frequency that, together with the Channel Number field, indicates the primary channel of the BSSs of the APs in this Neighbor AP Information field. Values of Operating Class are shown in Table E-4 (Global operating classes), of which operating classes that, together with the channel number, indicate the primary channel is valid (see 11.50 (Reduced neighbor report)).

NOTE—The Operating Class field and Channel Number tuple indicate the primary channel in order to assist with passive scanning.

The Channel Number field is 1 octet in length and is present if the TBTT Information Field Type subfield is 0, or if the TBTT Information Field Type subfield is 1 and the Co-channel subfield is 0; otherwise it is absent. It indicates the last known primary channel of the APs in this Neighbor AP Information field. Channel Number is defined within an Operating Class as shown in Table E-4 (Global operating classes).

When the TBTT Information Field Type subfield is 0, the ~~The~~ TBTT Information Set field contains one or more TBTT Information fields. The TBTT Information field is defined in Figure 9-625 (TBTT Information field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Neighbor AP TBTT Offset | BSSID (optional)(#15)(11ai) | Short-SSID (optional)(#15)(11ai) |
| Octets: | 1 | 0 or 6 | 0 or 4 |
| * TBTT Information field format
 |

 The Neighbor AP TBTT Offset subfield is 1 octet in length and indicates the offset in TUs, rounded down to nearest TU, to the next TBTT of an AP from the immediately prior TBTT of the AP that transmits this element. The value 254 indicates an offset of 254 TUs or higher. The value 255 indicates an unknown offset value.

The BSSID is defined in 9.2.4.3.4 (BSSID field).(11ai)

The Short-SSID subfield is calculated as given in 9.4.2.170.3 (Calculating the Short-SSID(11ai)).(11ai)

When the TBTT Information Field Type subfield is 1 and the Transmitted BSSID AP subfield is 0, the TBTT Information Set field contains one TBTT Information field carrying information on the transmitted BSSID of the multiple BSSID set, followed by one Nontransmitted BSSID Information field.

When the TBTT Information Field Type subfield is 1 and the Transmitted BSSID AP subfield is 1, the TBTT Information Set field contains one Nontransmitted BSSID Information field.

The Nontransmitted BSSID Information field is defined in Figure 9-625a.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Nontransmitted BSSID Control | Nontransmitted BSSID Bitmap(optional) | Nontransmitted BSSID Count (optional) | Short-SSID List |
| Octets: | 1 | Variable | 0 or 1 | Variable |

Figure 9-625a– Nontransmitted BSSID Information field format

The Nontransmitted BSSID Control subfield is defined in Figure 9-625b (Nontransmitted BSSID Control subfield).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 B3 | B4 | B5 | B6 | B7 |
|  | MaxBSSID | Nontransmitted Same SSID | Nontransmitted BSSID Bitmap Present | Nontransmitted BSSID Count Present | Nontransmitted Short SSIDs Present |
| Bits: | 4 | 1 | 1 | 1 | 1 |

Figure 9-625b– Nontransmitted BSSID Control subfield format

The MaxBSSID subfield is 4 bits in length and is equal to a value *n* minus 1, where *n* (1<=*n*<=8) is the value carried in the MaxBSSID Indicator field of the Multiple BSSID element (9.4.2.45) advertised by the transmitted BSSID of this Multiple BSSID set. For example, a value of 0 indicates that the MaxBSSID Indicator value for the multiple BSSID set is 1.

The Nontransmitted Same SSID subfield is 1 bit in length, and is set to 1 if any of the Nontransmitted BSSIDs in this Multiple BSSID set have an SSID equal to the SSID of the reporting AP’s BSS; it is set to 0 otherwise.

The Nontransmitted BSSID Bitmap Present subfield is 1 bit in length. It is set to 1 if the Nontransmitted BSSID Bitmap subfield is present; otherwise it is is set to 0.

The Nontransmitted BSSID Count Present subfield is 1 bit in length. It is set to 1 if the Nontransmitted BSSID Count subfield is present; otherwise it is set to 0.

The Nontransmitted Short SSIDs Present subfield is 1 bit in length. It is set to 1 if the Short SSIDs List field is present in the Nontransmitted BSSIDs Information field, else it is set to 0.

The Nontransmitted BSSID Bitmap field is defined in Figure 9-625c – BSSID Bitmap field. The Bitmap subfield of the Nontransmitted BSSID Bitmap field has a length of 2n bits where *n* is equal to the value of the MaxBSSID subfield plus 1, and is present when the Nontransmitted BSSID Bitmap Present subfield is 1; otherwise it is absent. Bit position 0 is reserved. The remainder of the bits represents one of 2n – 1 possible BSSID Index values (see 9.4.2.74 (Multiple BSSID-Index element)) in the multiple BSSID set. A value of 1 at bit position k indicates that a Nontransmitted BSSID with BSSID Index k is a member of the indicated Multiple BSSID set. Otherwise the bit is set to 0. The Pad subfield of the Nontransmitted BSSID Bitmap field contains additional bits set to 0 to make the total number of bits in the Nontransmitted BSSID Bitmap field equal to an integer number of octets.

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  | Bitmap | Pad |
| Bits: | variable | 0, 4 or 6 |
| Figure 9-625c - BSSID Bitmap field |

The Nontransmitted BSSID Count field is present when the Nontransmitted BSSID Count subfield is 1; otherwise it is absent. The Nontransmitted BSSID Count field indicates the number of Nontransmitted BSSIDs in the Multiple BSSID set.

The Short SSID List field is defined in Figure 9-625b (Short SSID List field).

|  |  |  |
| --- | --- | --- |
|  | Short SSID Count | Short SSIDs |
| Octets: | 1 | variable |

Figure 9-625d– Short SSID List field format

The Short SSID Count field indicates the number of short SSIDs indicated in the Short SSIDs field.

The Short SSIDs field contains one more Short SSID subfields, each calculated as given in 9.4.2.170.3 (Calculating the Short-SSID). The Short SSIDs field indicates a (partial or complete) list of the short SSIDs of nontransmitted BSSIDs in the multiple BSSID set.