IEEE P802.11  
Wireless LANs

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | CR Spatial Reuse Group Management CID 12044 12304 | | | | | | Date: 2017-12-05 | | | | | | Author(s): | | | | | | Name | Affiliation | Address | Phone | email | | Matthew Fischer | Broadcom |  |  | [Matthew.fischer@broadcom.com](mailto:Matthew.fischer@broadcom.com) | | Thomas Derham | Broadcom |  |  | [thomas.derham@broadcom.com](mailto:thomas.derham@broadcom.com) | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

Abstract

Comment resolution with proposed changes to TGax D2.0for CIDs relating to Spatial Reuse Group.

The CID list is:

12044, 12304

The proposed changes on this document are based on TGax Draft 2.0.

**REVISION NOTES:**

**R0**:

Initial

**R1**:

27.9.2.5 – added the adjective “receiving” to clarify which AP is being refered to – the receiving AP is the one that receives an authorize message and can use the authorize message to set a color bit only when the receiving AP is named either through an included BSSID value or by being a member of an indicated SSID value or network ID value

Updated doc references

**END OF REVISION NOTES**

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.***

**CIDs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 12044 | Jarkko Kneckt | 156.56 | 9.4.2.243 | The SRG OBSS PD Min Offset can allow associated STAs to transmit with full transmission power even when they detect WLAN signal from an SRG BSS at -62 dBm energy. The spatial reuse is targetted to organise higher transmission density by lowering the transmission power when the sensitivity requirement is relaxed. An ill behaving AP can get benefit by misconfiguring SRG OBSS PD MIN value. In this case the non-AP STAs may transmit with full transmission power during the transmissions of the SRG OBSSs. The 802.11 should ensure fairness between STAs and not allow such behaviour. In worst case, this operation may be used against the WLAN, for instance  It may be difficult to explain to the FCC and other regulators why WLAN allows such interfering transmissions and why it cannot control WLAN BSSs and STAs. Lack of control may prevent WLAN use in new spectrum and cause changes in the current regulation. | Please delete all instances of the SRG OBSS PD Min Offset and its use in the spec. Please allow only to control the OBSS PD MaxOffset[CL1] . | Revise – Tgax editor to make changes found in 11-18-0225r1 under the heading of CID 12044. |
| 12304 | Laurent Cariou | 27.9.2 | 290.25 | OBSS\_PD based spatial reuse operation is defining specific rules and equations when applied to an SRG (SR group). In some managed environments, the definition and settlement of SRG can be done in a proprietary way within an ESS. In less managed environments, such SRG formation would require a specific protocol and specific frame exchanges. The spec should define such protocol to extend the usability of the SRG OBSS\_PD SR mode | Define the protocol and frame exchanges needed to establish an SRG among neighboring APs. | Revise – Tgax editor to make changes found in 11-18-0225r1 under the heading of CID 12304. |

**Discussion:**

The Spatial Reuse Group (SRG) concept applies to OBSS\_PD Spatial Reuse. An AP determines an SRG that applies to its own transmissions, and SRGs that apply to transmissions by associated STAs in its BSS.

In 11ax D2.0, an AP can indicate SRG parameters in the Spatial Reuse Parameter Set element to its associated STAs, and those associated STAs use the indicated SRG PD\_Min, SRG PD\_Max, SRG BSS Color Bitmap and SRG Partial BSSID Bitmap. The bitmaps indicate the group of (O)BSSs that constitute the SRG for the recipient associated STA. The associated STAs use the indicated SRG PD\_Min/Max values when conditions are met for OBSS\_PD Spatial Reuse on reception of a PPDU that matches an indicated BSS Color or Partial BSSID in the bitmaps.

SRG is expected to be used primarily in planned networks – that is, where the deployer either knows (e.g. for professionally-installed APs in stadiums or enterprises), or can reasonably estimate (e.g. based on residential address for self-installed APs) the physical locations of all the APs that are operating BSS within a given SRG. Knowledge of the AP location and configurability of operating parameters enables the deployer to determine SRG PD\_Max and PD\_Min values that optimize aggregate capacity within the network. For example, in deployments where the APs are densely deployed and the SINR distribution of links to associated STAs is high, substantial gains in aggregate capacity may be achieved by each AP in the network determining its same-network co-channel neighbors to be in its SRG, and increasing SRG PD\_Min and/or PD\_Max to values higher than the non-SRG values. These gains occur because the resulting increase of transmit opportunities more than outweighs the impact of SINR compression due to increased mutual interference in a high SINR operating regime. (See 11-15/1039r0.)

The use of SRG means that interference caused to other OBSS that are not part of the (SRG enabled) network is not increased, hence enabling these capacity gains to be achieved without causing coexistence issues or unfairness with respect to other independent network deployments - unlike existing proprietary solutions to this use case which may desense reception of signals from all other BSS, irrespective of their source.

One commenter notes in CID 12044 that, because the mechanism by which an SRG is determined is not currently defined, an “ill-behaving AP” could set its SRG bitmaps to include BSS that the deployer is not managing and is therefore not in a position to determine the interference impact of a higher SRG PD\_Max. It is noted that this comment applies both to transmissions by the associated STAs (which receive the SRG bitmaps from their AP) and the AP’s own transmissions, and that the current text does not clearly define how an SRG is to be determined for the AP’s own transmissions.

Another commenter in CID 12304 notes that a mechanism by which the AP of one BSS could authorize the AP of another BSS to add the first BSS to its SRG(s) without centralized management could be beneficial; this may be the case for example in lightly-managed residential networks, where the APs in each of multiple neighboring residences may be provided by the same operator (e.g. fixed-line service provider) with lightweight remote management, but for scalability reasons may not be under full joint control, and may be operating independent data networks (e.g. home network of each residence).

The proposed solution to address all of the above comments is as follows:

* Define messaging and rules by which an AP is allowed to add BSS Colors and Partial BSSIDs to an SRG that it defines
  + The authors of this document gave some consideration to simply defining rules on the AP’s SME, however these would have involved concepts (e.g. “APs in a managed network”) which are out-of-scope of 802.11, and may not be sufficiently well defined to ensure correct implementation. Therefore, the proposed approach is based on explicit 802.11 messaging between APs, whereby the AP of an OBSS authorizes a second AP to add the BSS Color and Partial BSSID of the OBSS to the SRG(s) determined by the second AP. In the absence of (or revokation of) such authorization, or when certain other conditions are met, the rules prevent an AP from adding the corresponding BSS Color or Partial BSSID to its SRG(s)
  + The proposed solution targets scalable SRG authorization in large managed networks, and can also be used for opportunitic SRG authorization between unmanaged or lightly-managed APs.
  + An SRG Authorization element is defined which can be sent (unsolicitied) broadcast in Beacon and Probe Response frames, or unicast in a Public Action frame
  + An SRG Authorization element can carry a “Denied” status code in order to revoke a previous authorization
  + An SRG Authorization element specifies the scope of the APs (OBSS) to which the authorization applies. It is noted that, particularly in managed networks, it is convenient for a single SRG Authorization element to authorize multiple APs (OBSS) operated by a physical managed network, which may or may not all be in the same ESS. On the other hand, in some cases such as opportunistic authorization, it might be more typical for an AP to authorize a single neighboring AP (OBSS). Therefore, the SRG Authorization element contains one or more SRG Scope subelements, each of which defines one of three possible scopes as follows:
    - BSSID (authorizing a single neighboring BSS)
    - SSID (authorizing all BSS in a specified ESS)
    - SRG Network ID (authorizing all BSS in a specified SRG Network – see below)
  + Note: While the SRG authorization message is sent between APs in unauthenticated frames (Beacon, Probe Response or Public Action), and therefore it is theoretically possible than an attacker could send spoofed SRG Authorization elements, the risk and consequences of such attack are low and if an AP discovers that it has been added to an SRG, it can revoke the membership. If the attacker persists, then this amounts to an unauthorized addition and effectively, a form of denial of service.
* Define a mechanism by which an AP, which may be considering to send an SRG Authorization element, can make that determination based on knowledge of the APs it would be authorizing
  + The decision by an AP to authorize an OBSS will typically be made based on knowledge of the interference impact on itself such authorization might cause. As mentioned earlier, in some cases this knowledge will be known a-priori, e.g. due to RF planning, while in other cases it may not. In any case, it is useful that an AP can identify the APs that it would be authorizing, e.g. to confirm interference assumptions based on Beacon RSSI measurements.
  + With respect to the three possible scopes of an SRG authorization defined above:
    - BSSID – already indicated in Beacon and Probe Response frames
    - SSID – already indicated in Beacon and Probe Response frames (hidden SSIDs may not be indicated in Beacon frames, but are indicated in responses to directed probe requests)
    - SRG Network ID – in order that an OBSS is to be authorized by an SRG Authorization element specifying an SRG Network ID, the AP of the OBSS is itself required to transmit an SRG Authorization element in Beacon and Probe Response frames indicating the same SRG Network ID. Note: by requiring an AP that would be authorized by an SRG Network ID to broadcast the same SRG Network ID itself, this avoids the possibility for an “ill-behaving AP” to pretend to be part of an SRG Network in order to modify its PD threshold without authorizing other BSS advertising the same SRG Network ID to do the same
* Add text to specify that the rules for determining SRG vs non-SRG PPDU apply both to APs and non-AP STAs. Per existing 11ax draft, in the non-AP STA case, determination is based on the SRG bitmaps in the Spatial Reuse Parameters element received from the STA’s AP. The new text specifies that, in the AP case, determination is based on the same rules (i.e. AP may determine that a BSS Color or Partial BSSID is in the SRG for its own transmissions if the same criteria are met as for inclusion in the SRGs it provides to its associated STAs)

Three possible use cases are described as follows:

1. A stadium deploys a large number of RF-planned APs, all operating in the same ESS. All APs are configured (by their WLAN Controller) to advertise SRG Authorization element in Beacon and Probe Response frames, indicating the SSID. Therefore, each AP authorizes all other APs in the ESS to add its BSS to their SRGs
2. An enterprise deploys RF-planned physical Access Points across a campus, each operating multiple APs with different SSIDs corresponding to different corporate VLANs. All APs (across all ESS operated by the network) are configured (by their WLAN Controller) to advertise SRG Authorization element in Beacon and Probe Response frames. The enterprise’s network IT professionals performed an RF survey which indicates that, due to the shape of the campus, two partially-overlapping spatial reuse regions should be defined. An SRG Network ID is defined for each region. The APs in each region advertise the corresponding SRG Network ID in order to authorize all the other APs in the same region (across all the deployed ESSs) to add the AP’s BSS to their SRGs. In the overlapping region, each AP advertises the SRG Network IDs of both regions, authorizing all APs throughout the network (i.e. in either region) to add the AP’s BSS to their SRGs.
3. A fixed-line operator provides its customers with 802.11 home gateways and remotely manages them. In general, the home gateways operate both a home network SSID (different for each customer) and a “homespot” SSID (common across all participating customers). The APs are not professionally installed however, on average, the BSS have characteristic RF parameters due to wall attenuation between residences, location of associated STAs, etc. The operator configures the APs on each home gateway to discover their neighbors and evaluate the Beacon RSSI and other parameters pertaining to those neighbors, and decide whether or not to send an SRG Authorization element in order to allow (some of) those neighbors to add the AP to the SRG they define. The SRG Authorization element contains the BSSID(s) of the neighboring APs that the AP decides to authorize.

**Proposed Changes to Draft Text of TGax D2.0:**

**CID 12044, 12304**

***TGax editor: modify TGax D2.0 subclause 9.3.3 as follows:***

* Management frames
* Beacon frame format

Insert the following new rows into Table 9-27 (Beacon frame body):

|  |  |  |
| --- | --- | --- |
| * Beacon frame body | | |
| **Order** | **Information** | **Notes** |
| 83 | SRGAuthorization | The SRG Authorization element is optionally present |

* Probe Response frame format

Insert the following new rows into Table 9-34 (Probe Response frame body):

|  |  |  |
| --- | --- | --- |
| * Probe Response frame body | | |
| **Order** | **Information** | **Notes** |
| 100 | SRGAuthorization | The SRG Authorization element is optionally present |

***TGax editor: modify TGax D2.0 subclause 9.4.2 as follows:***

Insert the following new rows into Table 9-77 (Element IDs):

|  |  |  |  |
| --- | --- | --- | --- |
| SRG Authorization(#5163) | 255 | <ANA> | Yes |

***Add the following section:***

* + - 1. SRG Authorization element(#5163)

The format of the SRG Authorization element is shown in Figure 9-XXX (SRG Authorization element format).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | |  | |  |  |
|  | Element ID | Length | | Element ID Extension | | SRG Authorization Control | SRG Scope |
| Octets: | 1 | 1 | | 1 | | 1 | Variable |
| Figure 9-XXX - SRG Authorization element format | | |  | |

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

The SRG Authorization Control field is defined in Figure 9-yXX (SRG Authorziation Control field format)

|  |  |  |
| --- | --- | --- |
|  | B0 | B1 B7 |
|  | Status Code | Reserved |
| Bits: | 1 | 7 |

**Figure 9-yXX SRG Authorization Control field format**

The Status Code field is set to 1 to indicate that the AP(s) of the BSS(s) indicated in the SRG Scope field are authorized to add the BSS of the AP transmitting the element to their SRG(s). The Status Code field is set to 0 to indicate that a previous authorization of the AP(s) indicated in the SRG Scope field is revoked.

The SRG Scope field contains one or more SRG Scope subelements, per the Table 9-zXX.

**Table 9-zXX SRG Scope subelements**

|  |  |
| --- | --- |
| SRG Scope subelement | Subelement ID |
| SRG BSSID | 0 |
| SRG SSID | 1 |
| SRG Network ID | 2 |
| Reserved | 3-255 |

The SRG BSSID subelement indicates the BSSID of a BSS that is in the scope of the SRG authorization. The format of the SRG BSSID subelement is shown in Figure 9-yyx (SRG BSSID Subelement format).

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | Subelement ID | Length | BSSID |
| Octets: | 1 | 1 | 6 |

**Figure 9-yyX SRG BSSID Subelement format**

The SRG SSID subelement indicates the SSID of an ESS that is in the scope of the SRG authorization. The SSID field contains a valid SSID with non-zero length. All APs operating a BSS in the specified ESS are in scope of the SRG authorization. The format of the SRG SSID subelement is shown in Figure 9-yy7 (SRG SSID Subelement format).

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | Subelement ID | Length | SSID |
| Octets: | 1 | 1 | 1-32 |

**Figure 9-yy7 SRG SSID Subelement format**

The SRG Network ID subelement indicates an SRG Network ID. All APs operating a BSS that are broadcasting an SRG Authorization Element in Beacon and Probe Response frames indicating Status Code = 1 and containing an SRG Network ID matching the SRG Network ID in this element are in scope of the SRG authorization. The format of the SRG Network ID subelement is shown in Figure 9-yy8 (SRG Network ID Subelement format).

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | Subelement ID | Length | SRG Network ID |
| Octets: | 1 | 1 | 6 |

**Figure 9-yy8 SRG Network ID Subelement format**

The use of the SRG Authorization element is described in 11.48 (Spatial Reuse Group operations).

***TGax editor: modify TGax D2.0 subclause 9.6.8 as follows:***

* Public Action details

***Add the following section:***

* + - 1. SRG Authorization frame

An SRG Authorization frame is sent to authorize the APs of BSS indicated in the SRG Scope to add the transmitting AP’s BSS to the SRGs they determine. The format is shown in Table 9-235XX SRG Authorization frame format.

|  |  |  |
| --- | --- | --- |
| * SRG Authorization frame format | | |
| Order | Information | Notes |
| 1 | Category |  |
| 2 | Public Action |  |
| 3 | Dialog Token |  |
| 4 | SRG Authorization element |  |
| 5 | HE Operation | The HE Operation element is present when dot11HEOptionImplemented  is true; otherwise it is not present. |

***TGax editor: modify TGax D2.0 subclause 9.6.29 as follows:***

* Protected HE Action frame details(#4911)

***Modify the following section:***

* Protected HE Action field

A Protected HE Action field, in the octet immediately after the Category field, differentiates the Protected HE Action frame formats. The Protected HE Action field values associated with each frame format within the HE category are defined in Table 9-421z (HE Action field values).

|  |  |
| --- | --- |
| * Protected HE Action field values | |
| Value | Meaning |
| 0 | HE BSS Color Change Announcement |
| 1 | HE Spatial Reuse Parameter Set |
| 2-255 | Reserved |

***Add the following section:***

* + - 1. HE Spatial Reuse Parameter Set frame format

The HE Spatial Reuse Parameter Set frame is an Action or Action No ACK frame of category Protected HE. The Action field of an HE Spatial Reuse Parameter Set frame contains the information shown in Table XXX.

|  |  |
| --- | --- |
| Table XXX: HE Spatial Reuse Parameter Set frame Action field format | |
| Order | Information |
| 1 | Category |
| 2 | Protected HE Action(#4911) |
| 3 | Spatial Reuse Parameter Set element (see 9.4.2.243 (Spatial Reuse Parameter Set element))(#4911) |

The Category field is defined in Table 9-47 (Category values).

The Protected HE Action field is defined in Table 9-421z (Protected HE Action field values).(#4911)

The Spatial Reuse Parameter Set element as defined in 9.4.2.243 (Spatial Reuse Parameter Set element) is always present in the frame.

No Vendor-Specific elements are present in the(#5350) HE Spatial Reuse Parameter Set frame.

***TGax editor: add TGax D2.0 subclause 11.48 as follows:***

***Add the following new text after subclause 27.9.2.4* OBSS\_PD-based spatial reuse backoff procedure*, as shown:***

* + - 1. Spatial Reuse Group operations

An HE AP may define a Spatial Reuse Group (SRG) that applies to OBSS\_PD Spatial Reuse operation by an associated STA in the AP’s BSS, in accordance with clause 27.2.3, and indicate the SRG to the associated STA using the SRG BSS Color Bitmap and SRG Partial BSSID Bitmap fields in a Spatial Reuse Parameter Set element. An AP may additionally define an SRG for its own use, without transmitting information to indicate the composition of that SRG.

An HE AP that transmits a Spatial Reuse Parameter Set element with the value of 1 in the SRG Information Present subfield, may set the bit in the SRG BSS Color Bitmap field or SRG Partial BSSID Bitmap field that corresponds to a given BSS Color or Partial BSSID to 1 if and only if all the following criteria are true, otherwise it shall set the bit to 0:

* The AP has received an SRG Authorization element that meets all of the following criteria:
  + The element is contained in a frame that contains an HE Operation element that matches the BSS Color (for SRG BSS Color) or is contained in an MPDU with TA that matches the Partial BSSID (for SRG Partial BSSID)
  + The SRG Scope field matches the BSSID of the receiving AP, or matches the SSID advertised by the receiving AP, or matches an SRG Network ID contained in SRG Authorization elements transmitted by the receiving AP in Beacon and Probe Response frames
  + The Status Code field is equal to 1 (Authorized)
* No subsequent SRG Authorization element has been received in an MPDU with the same TA which has Status Code field value equal to 0 (Revoked) and its SRG Scope field matching the BSSID, SSID or a SRG Network ID of the AP
* The AP has not detected a BSS Color clash (for SRG BSS Color) or Partial BSSID clash (for SRG Partial BSSID) for the BSS corresponding to this BSS Color or Partial BSSID within the previous 10 seconds.
  + A BSS Color clash is detected if, subsequent to receiving an authorizing SRG Authorization element, an MPDU is received where all the following conditions apply:
    - The MPDU contains an HE Operation element that matches the BSS Color, or is contained in an HE PPDU that matches the BSS Color
    - Address 3 (BSSID) of the MPDU does not match the TA of a previously received SRG Authorization element that was the basis for setting the BSS Color bit to 1
  + a Partial BSSID clash is detected if, subsequent to receiving an authorizing SRG Authorization element, an MPDU is received where all the following conditions apply:
    - Address 3 (BSSID) of the MPDU matches the Partial BSSID
    - Address 3 (BSSID) of the MDPU does not match the TA of a previously received SRG Authorization element that was the basis for setting the Partial BSSID bit to 1

If an HE AP transmits a Spatial Reuse Parameter Set element with the value of 1 in the SRG Information Present subfield, the AP shall subsequently monitor the above criteria corresponding to bits set to 1 in the SRG BSS Color Bitmap and SRG Partial BSSID Bitmap fields in the element. If the criteria for setting a bit to 1 are no longer met (i.e. a BSS Color or Partial BSSID clash was detected corresponding to a bit set to 1, or a Revoked status code in an SRG Authorization element was received that matches a bit set to 1, or a BSS Color Change Announcement element was received corresponding to a bit set to 1), the AP shall transmit an updated Spatial Reuse Parameter Set element to the associated STAs to which the previously transmitted element was addressed.

An HE AP may define a Spatial Reuse Group (SRG) that applies to OBSS\_PD Spatial Reuse operation for its own transmissions, in accordance with clause 27.2.3. An HE AP may consider a BSS Color or Partial BSSID to be part of the SRG that applies to its own transmissions if and only if all the above criteria are true.

An AP may indicate SRG authorization by transmitting an SRG Authorization element in an SRG Authorization frame or in Beacon and Probe Response frames.

SRG Authorization elements are received directly (from one AP to another) or, if transmitted in Beacon and Probe Response frames. via associated STAs that support the Beacon request capability (as indicated by the Beacon Passive Measurement Capability Enabled bit or the Beacon Active Measurement Capability Enabled bit being set in the RM Enabled Capabilities element in the (Re)Association frame).

Note: While the OBSS\_PD Spatial Reuse transmission is defined only for HE STAs, any AP (regardless of HE capability) may transmit an SRG Authorization element in order to authorize receiving HE APs to include the AP’s BSS in their SRGs.

***TGax editor: modify TGax D2.0 subclause 27.2.3 as follows:***

* SRG and non-SRG frame determination(#8111)

*Modify the following paragraph:*

An HE non-AP STA that has received a Spatial Reuse Parameter Set element from its associated AP with a value of 1 in the SRG Information Present subfield shall use information provided in the most recently received Spatial Reuse Parameter Set element to identify BSSs that are members of the STA's SRG to determine whether or not a received inter-BSS PPDU is an SRG PPDU.

*Modify the following paragraph:*

Otherwise, the PPDU is not determined to be an SRG PPDU. An HE non-AP STA that has not received a Spatial Reuse Parameter Set element from its associated AP with a value of 1 in the SRG Information Present subfield shall not classify any received PPDUs as an SRG PPDU.

*Add the following paragraph at the end of this section:*

An HE AP that has determined an SRG for its own transmissions per the rules in Clause 11.48 shall use that SRG to determine whether or not a received inter-BSS PPDU is an SRG PPDU.

A received HE PPDU that is an inter-BSS PPDU is an SRG PPDU if the numerical value of the BSS\_COLOR parameter of the RXVECTOR is equal to a BSS Color in the SRG. A received VHT PPDU that is an inter-BSS PPDU is an SRG PPDU if the GROUP\_ID parameter of the RXVECTOR has a value of 0 and the numerical value of PARTIAL\_AID[0:5] of the RXVECTOR is equal to a Partial BSSID in the SRG.

A received PPDU that is an inter-BSS PPDU is an SRG PPDU if BSSID information from an MPDU of the PPDU is correctly received and the numerical value of BSSID[39:44] is equal to a Partial BSSID in the SRG.(#8111)

Otherwise, the PPDU is not determined to be an SRG PPDU. An HE AP that has not determined an SRG for its own transmissions shall not classify any received PPDUs as an SRG PPDU.

***TGax editor: modify TGax D2.0 subclause 27.9.2 as follows:***

* OBSS\_PD-based spatial reuse operation
* General

***TGax editor: Modify the following paragraph, beginning at line 64 of page 290 (D2.0):***

(#8111)If the PHY of a STA issues a PHY-CCA.indication with a value equal to BUSY followed by a PHY-RXSTART.indication due to a PPDU reception then the STA's MAC sublayer may a) issue a PHY-CCARESET.request primitive before the end of the PPDU(#9728) and b) not update its NAV timers based on frames carried in the PPDU if all the following conditions are met:

* The received PPDU is an Inter-BSS PPDU (see 27.2.2 (Intra-BSS and inter-BSS frame determination))
* The received PPDU is an SRG PPDU (see 27.2.3 (SRG and non-SRG frame determination)
* ~~The most recently received Spatial Reuse Parameter Set element from the AP associated with the STA had the SRG Information Present subfield equal to 1 or the STA is an AP and its most recently transmitted Spatial Reuse Parameter Set element had the SRG Information Present subfield equal to 1~~
* The RXVECTOR parameter RSSI\_LEGACY in the PHY-RXSTART.indication primitive, which defines the received power level measured from the legacy portion of the PPDU is below the SRG OBSS\_PD level defined in 27.9.2.2 (Adjustment of OBSS\_PD and transmit power)
* The PPDU is not one of the following:
* A non-HE PPDU that carries a frame where the RA field is equal to the STA MAC address
* A non-HE PPDU that carries a Public Action frame
* A non-HE PPDU that carries an NDP Announcement frame or an FTM frame
* An NDP
* Adjustment of OBSS\_PD and transmit power

***TGax editor: Modify the following tables:***

|  |  |  |  |
| --- | --- | --- | --- |
| * Determining Non-SRG OBSS PD Min and Non-SRG OBSS PD Max values | | | |
| OBSS\_PD SR Disallowed | Non-SRG Offset Present | Value of Non-SRG OBSS PD Min | Value of Non-SRG OBSS PD Max |
| Spatial Reuse Parameter Set element not received | Spatial Reuse Parameter Set element not received | 82 | Non-AP STA: 62  AP: 82 + dot11NonSRGAPOBSSPDMaxOffset |
| 0 | 0 | 82 | 62 |
| 0 | 1 | 82 | 82 + Non-SRG OBSS PD Max Offset |
| 1 | Don’t care | 82 | -82 |

|  |  |  |
| --- | --- | --- |
| * Determining SRG OBSS PD Min and SRG OBSS PD Max values | | |
| SRG Information Present | Value of SRG OBSS PD Min | Value of SRG OBSS PD Max |
| Spatial Reuse Parameter Set element not received | Non-AP STA: N/A  see NOTE  AP: 82 + dot11SRGAPOBSSPDMinOffset | Non-AP STA: N/A  see NOTE  AP: 82 + dot11SRGAPOBSSPDMaxOffset |
| 0 | N/A  see NOTE | N/A  see NOTE |
| 1 | 82 + SRG OBSS PD Min Offset | 82 + SRG OBSS PD Max Offset |
| NOTE—When SRG Information is not present, a non-AP STA cannot determine a PPDU to be SRG and so will not use SRG OBSS PD Min or SRG OBSS PD Max values. | | |

**C.3 MIB Detail**

***TGax editor: Add the following to Dot11HEStationConfigEntry:***

dot11NonSRGAPOBSSPDMaxOffset Unsigned32,

dot11SRGAPOBSSPDMinOffset Unsigned32,

dot11SRGAPOBSSPDMaxOffset Unsigned32

***TGax editor: Add the following:***

dot11NonSRGAPOBSSPDMaxOffset

OBJECT-TYPE SYNTAX Unsigned32 (0..1023)

UNITS "dB"

MAX-ACCESS read-write

STATUS current

DESCRIPTION "This is a control variable. It is written by an external management entity. Changes take effect as soon as practical in the implementation. This attribute indicates the PD\_Max Offset to be used by the AP for non-SRG OBSS\_PD operation."

DEFVAL { 0 } ::= { dot11HEStationConfigEntry TBD}

dot11SRGAPOBSSPDMaxOffset

OBJECT-TYPE SYNTAX Unsigned32 (0..1023)

UNITS "dB"

MAX-ACCESS read-write

STATUS current

DESCRIPTION "This is a control variable. It is written by an external management entity. Changes take effect as soon as practical in the implementation. This attribute indicates the PD\_Max Offset to be used by the AP for SRG OBSS\_PD operation."

DEFVAL { 0 } ::= { dot11HEStationConfigEntry TBD}

dot11SRGAPOBSSPDMinOffset

OBJECT-TYPE SYNTAX Unsigned32 (0..1023)

UNITS "dB"

MAX-ACCESS read-write

STATUS current

DESCRIPTION "This is a control variable. It is written by an external management entity. Changes take effect as soon as practical in the implementation. This attribute indicates the PD\_Min Offset to be used by the AP for SRG OBSS\_PD operation."

DEFVAL { 0 } ::= { dot11HEStationConfigEntry TBD}