IEEE P802.11  
Wireless LANs

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | CR Spatial Reuse Group Management CID 12044 12304 | | | | | | Date: 2018-03-02 | | | | | | 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) | | Laurent Cariou | Intel |  |  | [laurent.cariou@intel.com](mailto:laurent.cariou@intel.com) | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

Abstract

Comment resolution with proposed changes to TGax D2.3 for CIDs relating to Spatial Reuse Group.

The CID list is:

12044, 12304

The proposed changes on this document are based on TGax Draft 2.3.

**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

**R2**:

Removed SRG Network ID. Authorization is granted based on matching BSSID or SSID only

Clarified language to make clear that the scheme does not allow one AP to send an Authorization element which could cause other APs to add arbitrary OBSS (other than the BSS of the sending AP) to their SRGs

Added Max/Min thresholds, and AP vs AP+STAs flag, associated with an authorization.

**R3**:

Accepted revision marks that were simply changes from R1 to R2 and not changes to the draft.

The following changes have been made:

* Removed SRGAuthorization element and its insertion into various management frames
* Removed SRG Authorization Public Action frame
* Removed 27.2.3 SRG PPDU determination changes – very similar changes exist in 11-18-0026
* Removed 27.9.2.3 paragraph allowing an AP to use a different SRG than what it tells its associated STAs to use, because the same allowance is being made in the changes in 27.2.3 in doc 11-18-0026

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 11-18-0225r3 |
| 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 11-18-0225r3 |

**Discussion:**

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

In 11ax D2.3, 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 OBSSs 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).

A proposed solution to address all of the above comments and that could be expected to receive a 75% vote could not be identified and therefore, this document only includes some changes to clarify some of the operation of the functionality currently defined within D2.3

**Proposed Changes to Draft Text of TGax D2.3:**

**CID 12044, 12304**

***TGax editor: modify TGax D2.3 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 |

***TGax editor: insert a new editing instruction and subclause 9.6.29.3 as shown:***

***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: modify TGax D2.3 subclause 27.9.2.3 as follows:***

27.9.2.3 General Operation with SRG OBSS\_PD level

***Add the following new text at the end of Section 27.9.2.3 General Operation with SRG OBSS\_PD level:***

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 and indicate that SRG to the associated STA using the Spatial Reuse Parameter Set element by setting the SRG Information Present field to 1 and including the SRG OBSS PD Min Offset, SRG OBSS Max Offset, SRG BSS Color Bitmap and SRG Partial BSSID Bitmap fields.

***TGax editor: modify TGax D2.3 subclause 27.9.2.4 as follows:***

27.9.2.4 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. | | |

***TGax editor: Modify C.3 MIB Detail as shown:***

**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}