IEEE P802.11
Wireless LANs

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| Proposed Text Changes for OBSS\_PD-based SR parameters |
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Abstract

This document provides proposals for spec changes for OBSS\_PD-based SR mode.

1. **Revision notes**

R6: slight modifications to the optionally present fields of the SRP element, i.e. rewording for readability without technical change

 Change “ESS” to “ESS ” in a few places (i.e. just a spacing issue) (later changed all ESS to SRG)

 Expanded the description of how to determine if a PPDU is inter-ESS – i.e. used language that discusses the use of the bitmap, as opposed to just saying “use the bitmap”

 Changed OBSSPD to OBSS\_PD everywhere, since that seems to be the term that has more momentum in the TGax community

R7: update the “not received at all” language to reflect updated language fom 11-16-1223r6

 Removed default value statements for TXPwr\_ref and OBSS\_PDmin and OBSS\_PDmax because these are duplicates of changes that appear already in 11-16-1223r6 which should precede the changes in this document

R8: add a note to the editing instructions to point out that subclause 25.9.3 becomes 25.9.2.1 after the application of changes found in 11-16-1223r6

R9:

In 25.9.2:

Merged condition for ESS OBSS PD use of ESS Info present = 1 and PPDU is an intra-ESS PPDU

Merged condition for ESS OBSS PD use of ESS Info present = 1 and PPDU is an inter-ESS PPDU

(Note that the R10 revision changes ESS to SRG)

R10:

Because the AP might be selective about which colors to include, the set of colors and/or partial BSSID values might not be the same as the ESS which the STA belongs to – so ESS is replacaed with SRG = Spatial Reuse Group

Added a definition of the term SRG

Changed ESS to SRG

R11:

Changed occurrences of addSRG to address

R12:

Changed occurrences of wirelSRG to wireless

In 25.9.2 changed the first paragraph, which used to be the only paragraph in the draft descsribing how to discard an OBSS PPDU, and was using only inter-BSS identification – in earlier revisions, this paragraph included a new condition such that the OBSS PPDU discard could only be performed if no SRG parameters were received – that condition has now been removed, effectively making the use of the SRG list optional by a receiver – i.e. if a non-AP STA receives an SR P IE with SRG present, then it may decide to continue to only apply an inter-BSS test based on the associated BSS color

Added NDPA to 25.11a list of PPDUs that have SRP disallowed set in the HE PHY SRP field

25.9.2 – added NDPA to the list of non-HT PPDUs to which SR cannot be applied

R13:

25.9.3 SRG OBSS\_PDmin offset and SRG OBSS\_PDmax offset values transmitted by the AP in SR info elements language updated to fix errors, i.e. offset vs absolute value

Fixed a couple more places where SRG should be “ess”, e.g. within the title page in the word “wireless” and within the R10 revision notes, where a couple of instances of SRG should remain as ESS, and within R6 and R9 revision notes, which reference an earlier version of the document that did not yet contain the term SRG

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.***

1. **Explanation of the proposed changes**
	1. **OBSS\_PD-based SR parameters**

The spec defines a spatial reuse mode that we call OBSS\_PD-based SR, and which is defined in 25.9.2 and 25.9.3.

In the SFD, we agreed that the TxPower and OBSS\_PD can be adjusted based on a proportional rule.

An 11ax STA regards a valid OBSS PPDU as not having been received at all (e.g., should not update its NAV), except that the medium condition shall indicate BUSY during the period of time that is taken by the receiving STA to validate that the PPDU is from an Inter-BSS, but not longer than the time indicated as the length of the PPDU payload if the RXPWR of the received PPDU is below the OBSS\_PD threshold and TBD conditions are met, noting that the OBSS\_PD threshold is accompanied by a TXPWR value following adjustment rules:



[SR Motion 4, September 17, 2015, see [137], modified with SR Motion 7, March 2016, see 16/414r0]

This document proposes to fill TBDs in the spec:

* Default parameters for this proportional rule
* how to set/adjust the different values in this proportional rule.

**Default parameters:**

This document proposes default parameters that are conservative:

* + OBSS\_Pdmin\_default = -82dBm for 20MHz
	+ OBSS\_Pdmax\_default = -62dBm for 20MHz
	+ PWRref = 21dBm for non-AP STAs or AP STAs with 1 and 2 SSs, 25dBm for AP STAs of 3 SSs or more

**how to set/adjust the different values in this proportional rule.**

An SRG may provide SRG OBSS\_PDmin and OBSS\_PDmax values that apply to intra-SRG PPDUs

* OBSS\_PDmin\_default <= OBSS\_PDmin <= ED threshold
* OBSS\_PDmin <= OBSS\_PDmax

Default OBSS\_PDmin and default OBSS\_PDmax values apply to inter-BSS PPDUs that are not intra-SRG PPDUs

* 1. **Allowing/disallowing SR modes:**

In the specification framework 11-15-0132-17-00ax, we have the following sentence:

Include the “SR\_allowed” signaling in HE-SIGA to indicate whether SR operation is allowed or not.

* use a value of Spatial Reuse field to indicate SR is disallowed
* The conditions to disallow SR are TBD

[SR Motion 6, March 2016, see 16/382r0]

We have 2 spatial reuse modes currently defined in the SFD:

* OBSS\_PD-based SR: which uses OBSS\_PD levels as defined in 25.9.2 and 25.9.3, and which don’t use information in SIG-A.
* SRP-based SR: defined in the SFD and which uses information in SIG-A SR field.

We propose:

* that the “SR disallowed” entry set in SR field in HE-SIGA only disallows SRP-based SR

We propose also that:

– non-AP STAs set “SR disallowed” entry in Spatial Reuse field when AP requests.

– non-AP STAs set “SR disallowed” entry in Spatial Reuse field in frame with NDP or FTM.

1. **Proposed changes**

3. Definitions, acronyms, and abbreviations

3.4 Abbreviations and acronyms

**TGax Editor: *Add the following in the appropriate location within subclause 3.4 Abbreviations and acronyms:***

SRG Spatial Reuse Group

***TGax editor: Add a new line for spatial reuse parameter set element in Table 9-76—Element IDs.***

***TGax editor: Insert a new subclause (Spatial reuse parameter set element) in 9.4.2***

**9.4.2.x Spatial reuse parameter set element**

The Spatial Reuse Parameter Set element provides information needed by STAs for proper operation when operating with OBSS\_PD-based spatial reuse as defined in section 25.9.2. The format of the Spatial Reuse Parameter Set element is defined in Figure 9-ax6b (Spatial Reuse Parameter Set element).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension  | SR Control | SRG OBSS\_PDmin\_offset | SRG OBSS\_PDmax\_offset | SRG BSS Color Bitmap | SRG Partial BSSID Bitmap |
| Octets: | 1 | 1 | 1 | 1 | 0 or 1 | 0 or 1 | 0 or 8 | 0 or 8 |

 **Figure 9-ax6b- Spatial Reuse parameter set element**

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

The SR Control field is defined in Figure 9-ax6c (SR Control field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | SRP disallowed | SRG Information Present | Reserved |
| Bits: | 1 | 1 | 6 |

**Figure 9-ax6c SR Control field format**

The SRP disallowed subfield in the SR Control field indicates whether SRP-based SR is allowed or not at non-AP STAs that are associated with the AP that transmitted this element. SRP-based SR is disallowed when the SRP Disallowed subfield has the value 1. SRP-based SR is allowed when the SRP Disallowed subfield has the value 0.

The SRG Information Present subfield indicates if the SRG OBSS\_PDmin\_offset field, SRG OBSS\_PDmax\_offset field, SRG BSS Color Bitmap and SRG Partial BSSID subfields are present; When the SRG Information Present subfield has the value 1, then these subfields are present. When the SRG Information Present subfield has the value 0, then these subfields are not present.

The SRG OBSS\_PDmin\_offset subfield is present when the value of the SRG Information Present subfield is equal to 1; Otherwise the SRG OBSS\_PDmin\_offset subfield is not present. The SRG OBSS\_PDmin\_offset field contains an unsigned integer which is added to the value -82 dBm to generate the value of the SRG OBSS\_PDmin parameter.

The SRG OBSS\_PDmax\_offset subfield is present when the value of the SRG Information Present subfield is equal to 1; Otherwise the SRG OBSS\_PDmax\_offset subfield is not present. The SRG OBSS\_PDmax\_offset field contains an unsigned integer which is added to the value -82 dBm to generate the value of the SRG OBSS\_PDmax parameter.

The SRG BSS Color Bitmap subfield is present when the value of the SRG Information Present subfield is equal to 1; Otherwise the SRG BSS Color Bitmap subfield is not present. The SRG BSS Color Bitmap subfield is a bitmap that indicates which BSS Color values are used by members of the SRG of which the transmitting STA is a member. Each bit of the bitmap corresponds to one of the 63 available BSS Colors, where the lowest numbered bit corresponds to BSS Color value 0 and the highest numbered bit corresponds to BSS Color value 63. A BSS Color value is used by at least one BSS that is a member of the same SRG of the transmitting STA if the corresponding bit of the bitmap is set to 1. If a bit in the bitmap is set to 0, then no BSS in the same SRG of the transmitting STA uses the corresponding BSS Color value.

The SRG Partial BSSID Bitmap subfield is present when the value of the SRG Information Present subfield is equal to 1; Otherwise the SRG Partial BSSID Bitmap subfield is not present. The SRG Partial BSSID Bitmap subfield is a bitmap that indicates which Partial BSSID values are used by members of the SRG of which the transmitting STA is a member. Each bit of the bitmap corresponds to one of the 2^6 possible values of BSSID[39:44], where the lowest numbered bit corresponds to Partial BSSID value 0 and the highest numbered bit corresponds to Partial BSSID value 63. A Partial BSSID value is used by at least one BSS that is a member of the same SRG of the transmitting STA if the corresponding bit of the bitmap is set to 1. If a bit in the bitmap is set to 0, then no BSS in the same SRG of the transmitting STA uses the corresponding Partial BSSID value.

***TGax editor: Add the following text to section 25.2.1***

An HE STA shall use information provided in the Spatial Reuse Information element which identifies BSS that are members of the STA’s SRG to determine whether a received inter-BSS PPDU is an inter-SRG PPDU. If BSS Color information is present in a PPDU, the PPDU is an inter-SRG PPDU if the bit corresponding to the BSS Color of the PPPDU in the SRG BSS Color Bitmap is 0. If Partial BSSID information is present in a PPDU, the PPDU is an inter-SRG PPDU if the bit corresponding to the SRG Partial BSSID Bitmap is 0. If a PPDU is not determined to be inter-SRG, then it shall be assumed to be intra-SRG.

***TGax editor: Add the underlined text to section 25.9.2***

**25.9.2 Color code based CCA rules**

If the RXVECTOR parameter SPATIAL\_REUSE is set to SR disallowed entry, then SRP-based SR is disallowed.

***TGax editor: Modify the text as shown within 25.9.2***

If the PHY of a STA issues a PHY-CCA.indication with a value equal to BUSY followed by an RXSTART.indication due to a PPDU reception then the STA’s MAC sublayer may a) issue a PHY-CCARESET.request primitive 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 25.2.1)
* The received power level measured from the legacy portion of the PPDU is below the Default OBSS\_PD level (defined in 25.9.2.1)
* The PPDU is other than:
	+ a non-HT PPDU that carries a public action frame where the frame is individually addressed and the frame’s RA matches the receiving STA’s MAC address
	+ a non-HT PPDU that carries a public action frame where the frame is group addressed
	+ a non-HT PPDU that carries an NDPA

***TGax editor: Add the following text to 25.9.2***

If the PHY of a STA issues a PHY-CCA.indication with a value equal to BUSY followed by an RXSTART.indication due to a PPDU reception then the STA’s MAC sublayer may a) issue a PHY-CCARESET.request primitive 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 25.2.1)
* The STA received a Spatial Reuse Parameters information element from its associated AP with the SRG Information Present subfield equal to 1 and the received PPDU is an Intra-SRG PPDU (see 25.2.1)
* The received power level measured from the legacy portion of the PPDU is below the SRG OBSS\_PD level (defined in 25.9.2.1)
* The PPDU is other than:
	+ a non-HT PPDU that carries a public action frame where the frame is individually addressed and the frame’s RA matches the receiving STA’s MAC address
	+ a non-HT PPDU that carries a public action frame where the frame is group addressed
	+ a non-HT PPDU that carries an NDPA

If the PHY of a STA issues a PHY-CCA.indication with a value equal to BUSY followed by an RXSTART.indication due to a PPDU reception then the STA’s MAC sublayer may a) issue a PHY-CCARESET.request primitive 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 25.2.1)
* The STA received a Spatial Reuse Parameters information element from its associated AP with the SRG Information Present subfield equal to 1 and the received PPDU is an Inter-SRG PPDU (see 25.2.1)
* The received power level measured from the legacy portion of the PPDU is below the Default OBSS\_PD level (defined in 25.9.2.1)
* The PPDU is other than:
	+ a non-HT PPDU that carries a public action frame where the frame is individually addressed and the frame’s RA matches the receiving STA’s MAC address
	+ a non-HT PPDU that carries a public action frame where the frame is group addressed
	+ a non-HT PPDU that carries an NDPA

**25.9.3 Adaptive CCA and transmit power control**

***TGax editor: Add the following to section 25.9.3 (renumbered to 25.9.2.1 after application of 11-16-1223r6 the proposed changes of which the editor should apply first)***

An AP may define SRG OBSS\_PDmin and SRG OBSS\_PDmax values that are used by its associated STAs to derive SRG OBSS\_PD level for intra-SRG PPDUs. STAs which receive a Spatial Reuse Parameter IE from their associated AP shall maintain two OBSS\_PDlevel parameters, each calculated according to the Allowable OBSS\_PD level equation above. One of the parameters is the Default OBSS\_PD level parameter, calculated using Default OBSS\_PDmin and Default OBSS\_PDmax in place of OBSS\_PDmin and OBSS\_PDmax, respectively. The other parameter is the SRG OBSS\_PD level parameter, calculated using SRG OBSS\_PDmin and SRG OBSS\_PDmax in place of OBSS\_PDmin and OBSS\_PDmax, respectively. STAs which do not receive a Spatial Reuse Parameter IE from their associated AP, or a Spatial Reuse information element with a value of 0 in the SRG Information Present subfield shall maintain one OBSS\_PDlevel parameter calculated according to the Allowable OBSS\_PD level equation above. The parameter maintained by such STAs is the Default OBSS\_PD level parameter, calculated using Default OBSS\_PDmin and Default OBSS\_PDmax in place of OBSS\_PDmin and OBSS\_PDmax, respectively.

The AP shall respect the following constraints:

* OBSS\_PDmin\_default <= SRG OBSS\_PDmin <= -62dBm
* SRG OBSS\_PDmin <= SRG OBSS\_PDmax

An AP shall set the value of SRG OBSS\_PDmin offset and the value of SRG OBSS\_PDmax offset equal to SRG OBSS\_PDmin minus -82 dBm and SRG OBSS\_PDmax minus -82 dBm, respectively, in transmitted Spatial Reuse information elements.

A non-AP STA shall set the value of Default OBSS\_PDmin and the value of Default OBSS\_PDmax equal to OBSS\_PDmin\_default and OBSS\_PDmax\_default, respectively.

A non-AP STA that receives a Spatial Reuse parameter set element with the SRG Information Present subfield equal to 1 from its associated AP shall set SRG OBSS\_PDmin to the value of the SRG OBSS\_PDmin offset subfield offset plus -82 dBm.

A non-AP STA that receives a Spatial Reuse parameter set element with the SRG Information Present subfield equal to 1 from its associated AP shall set SRG OBSS\_PDmax to the value of the SRG OBSS\_PDmax offset subfield offset plus -82 dBm.

A non-AP STA that does not receive a Spatial Reuse parameter set element with the SRG Information Present subfield from its associated AP or that receives a Spatial Reuse parameter set element with the SRG Information Present subfield equal to 0 from its associated AP shall set SRG OBSS\_PDmin to the value of SRG OBSS\_PDmin\_default.

A non-AP STA that does not receive a Spatial Reuse parameter set element with the SRG Information Present subfield from its associated AP or that receives a Spatial Reuse parameter set element with the SRG Information Present subfield equal to 0 from its associated AP shall set SRG OBSS\_PDmax to the value of SRG OBSS\_PDmax\_default.

The Spatial reuse parameter set element can be included in beacons, probe responses, authentication responses, and association responses.

***TGax Editor: Insert the following subclause, 25.11a, after 25.11***

**25.11a TXVECTOR parameters SPATIAL\_REUSE for** **an HE PPDU**

A STA shall set the TXVECTOR parameter SPATIAL\_REUSE to “SR disallowed” entry if one of the following conditions is met:

* An NDPA, NDP or FTM frame is carried in the HE PPDU.
* The STA is a HE non-AP STA that received the Spatial reuse parameter set element from its associated AP, and the “SR disallowed” subfield in the “SRP-based SR parameters” field of the Spatial Reuse parameter set element is set to 1