IEEE P802.11  
Wireless LANs

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| CR for OBSS\_PD | | | | |
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| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Laurent Cariou |  |  |  | laurent.cariou@intel.com |

Abstract

This document provides CR for CIDs:

15175, 15652, 16411, 17077, 17001, 16124, 15716

R2: modify the definitions based on editorial comment in November

R3: Add a fix to section 27.10.2.5

R4: revise wording of fix to 27.10.2.5

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(C)** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 15175 | 27.9.2.2 | 338.25 | The settings and where this values are allowed or not allowed is still very confusing. Suggest to have a table that mentions where certain settings of this SPATIAL REUSE are allowed and were they are not. | As in comment. | Revised – A table is difficult to define as the conditions are hard to define in a few words and is not needed. References are defined in sections 27.9 and 27.11.6 and section 27.11.6 is reorganized to group conditions per SPATIAL\_REUSE values. Apply the changes as proposed in 1866r4. |
| 15652 | 27.9.2.4 | 340.08 | In many papers and analyses it has been clearly shown that there are problems with the solely TPC method and in reality it is difficult to see why any device would employ it as it puts the device at an immediate disadvantage. It may sound good that reducing the power makes you less of an interferer, but if you reduce the power, you reduce the SNIR of the wanted transmission, hence you decrease the MCS , you have a good possibility of not being successful, you slow down the network, but, most importantly, any legacy device or indeed DL traffic is liable to cause significant problems. In addition there are no rules for the OBSS-PD level and the TX transmission power making it impossible to simulkate or indeed know what an individual device may do. I would point at several independent studies that look at DSC and TPC. DSC is beneficial to the 11ax devices whereas TPC is beneficial to legacy devices. It makes no sense that we have TPC and not DSC. We need to add the DSC formula at which point we could sensibly work at devising a scheme that works. | As described in 18/0617r2, in Figure 9-589cx (P172) "Spatial Reuse Parameter Set element" add "OBSS\_PD Margin" field. In Figure 9-589cy (P172) add "OBSS PD Margin Present" subfield.At end of 9.4.2.241 P 173.50) Add following: "The OBSS PD Margin subfield is present when the value of the OBSS PD Margin Present subfield is equal to 1; otherwise the OBSS PD Margin subfield is not present. The OBSS PD Margin field contains an unsigned integer which indicates the value of the OBSS PD Margin, in dBs." At P342.28, after Table 27.11 add following: "The AP may include an OBSS PD Margin subfield in the Spatial Reuse Parameter Set element in order to recommend a STA to adjust its OBSS\_PD level in accordance with Equation 27-X. OBSS\_PDlevel = RSSI\_beacon - OBSS PD Margin, with OBSS\_PDmin ΓëñOBSS\_PDlevelΓëñOBSS\_PDmax (27-X) A STA may monitor the beacons transmitted by the AP to which it is associated and measure the received signal strength of the beacons, RSSI\_beacon. The received signal strength of the beacon frames may be averaged over time so as to account for the mobility of a STA. The value of OBSS PD Margin is then subtracted from the time averaged received signal strength of the beacons, RSSI\_beacon, using equation 27-X, to provide an interim value for OBSS\_PDlevel." | Reject – The proposed changes in contribution 1531 and 617 didn’t reach sufficient support. Propose to reject this comment. The selection of the operating point for OBSS\_PD level and transmit power is left to the STA’s implementation choice. Depending on the scenarios, there could be many alternative ways to set this operating point. |
| 16411 | 27.9 | 337.30 | With the current Class B accuracy requirements on the absolute transmit power (+/-9dB), all these "nice" equations of the OBSS PD-based spatial reuse can lead to really weird decision since tx power assumed can be wrong up to +9dB. With the current Class B accuracy requirements on the RSSI measurement accuracy, SRP-based spatial reuse operation may also lead to strange results (-/+ 5dB margin).  I can understand that using Matlab-like simulation tool, SR may give an improvement in certain scenarios (since power is set in an absolute manner), but when loose requirements are authorized for a STA which lead to bad reference values to be used to transmit over an existing transmission, then I think that it will not go well in the field.  For instance OBSS PD-based has a dynamic of 20 dB, and a class B can be wrong on its measurement with a 18 dB window (9 dB on both direction) ... decision will be done on values which are highly uncertain (not by 3 dB, but potentially much more than that).  Since this specification seems to allow low-cost devices with very loose requirement in terms of measurements which are essential to spatial reuse operation, I would prefer such devices to be forbidden of using these spatial reuse methods unless their requirements are tighten. | Due to their extremely weak requirements on tx accuracy and RSSI measurement accuracy, Class B STAs shall not be allowed to use spatial reuse operation on other STAs (both OBSS PD-based and SRP-based SR), no matter what the later signal in their transmissions. | Reject – Not enough details on the resolution. There were some debate and some other proposals were suggested, but without a conclusive outcome. |
| 17077 | 3.2 | 39.01 | "OBSS PD SR opportunity" is defined but not used. | Explain its meaning or usage in 27.9.2 and clarify the difference to "OBSS PD SR transmit power restriction period" in 27.9.2.5. If it is identical with OBSS PD SR transmit power restriction period, align the terminology. | Revised – agree with the commenter, this is not used, and can be removed. Apply the changes as proposed in doc 1866r4. |
| 17001 | 3.2 |  | There should be the definition of Spatial Reuse Group (SRG) in subclause 3.2. | As in the comment. | Revised – Agree with the commenter. Add a definition in 3.2 and apply the changes as defined in doc 1866r4. |
| 16124 |  |  | "HESIGA\_Spatial\_reuse\_value15\_allowed" is a very odd and unclear (what is value 15) field name? | Change to "SRP And Non-SRG OBSS\_PD Allowed" throughout (per CID 12655's resolution) | Reject – The meaning of this bit is that it allows the associated STA to set the HE-SIGA SR value to value 15 or not. The proposed change would not be clearer. |
| 15716 | 29.9.2.5 | 350.43 | This clause describes the case that a STA ignores an OBSS PPDU following procedure of 27.9.2.2 or 27.9.2.3 and not able to transmit within the received inter-BSS PPDU duration. The STA starts an OBSS PD SR transmit power restriction period may not be able to gain TXOP for a long duration (e.g., receive intra-BSS PPDUs), the OBSS PD SR transmit power restriction period should not be applicable anymore after some duration. Please change to "This OBSS PD(#11726) SR transmit power restriction period shall be terminated at the end of the TXOPthat the STA gains once its backoff reaches zero." to "This OBSS PD(#11726) SR transmit power restriction period shall be terminated at the end of the TXOP that the STA gains once its backoff reaches zero or exceeds max TXOP limit." | as described | Rejected – this has been discussed in length. It was decided this way as the TxOP duration is not always known, to incite STAs to not change too frequently their transmit power and to keep the spec simple. Propose to keep current rules. |

1. **Proposed changes**

***11ax Editor: Modify clause 27.9.1 General as below***

* Spatial reuse operation
* General

The objective of HE spatial reuse operation is to allow the medium to be reused more often between OBSSs in dense deployment scenarios, for instance by the early identification of signals from overlapping basic service sets (OBSSs) and interference management.

There are two independent spatial reuse modes, one called OBSS PD-based spatial reuse(#11726) and the other called SRP-based spatial reuse.

An HE AP participating in spatial reuse may request an associated non-AP HE STA to gather information regarding the neighborhood by sending a Beacon request (see 9.4.2.21.7 (Beacon request)) by following the procedure described in 11.11 (Radio measurement procedures). An HE AP shall not set a measurement mode in a Beacon request to an associated STA to a mode for which the STA has not explicitly indicated support via the RM Enabled Capabilities element (see 9.4.2.45 (RM Enabled Capabilities element)). An HE AP that sends a Beacon request for this purpose(#11770):

* May request that the non-AP HE STA gather information of BSSs matching a particular BSSID and/or SSID
* May request that the non-AP HE STA generate a report only for the channel the requesting AP is operating on or is considering switching to
* Shall request that the non-AP HE STA include the HE Operation element of neighboring HE APs in order to help determine the BSS Color information of the neighboring APs

non-AP HE STA that performs spatial reuse operation shall respond to a Beacon request from its associated AP with a Beacon report as described in 11.11 (Radio measurement procedures).

***11ax Editor: Modify subclause 3.2 Definitions specific to IEEE 802.11 as described below***

**3.2 Definitions specific to IEEE 802.11**

**overlapping basic service set (OBSS) packet detect (PD) spatial reuse (SR) transmit power restriction period:** A time period that starts when a station (STA) regards an OBSS physical layer (PHY) protocol data unit (PPDU) as not received at all under OBSS PD SR conditions, and that ends at the end of the transmission opportunity (TXOP) that the STA gains once its backoff reaches zero.

(#17077)

**spatial reuse group (SRG)**: A group of basic service set (BSS) identified by their BSS colors or partial basic service set identifiers (BSSIDs) for overlapping basic service set packet detect (OBSS\_PD)-based spatial reuse operation with SRG OBSS PD level. (#17001)

* SPATIAL\_REUSE

The contents of the Spatial Reuse field are carried in the TXVECTOR parameter SPATIAL\_REUSE for an HE PPDU indicating spatial reuse information. Subclauses 27.9.2 (OBSS PD-based spatial reuse operation) and 27.9.3 (SRP-based spatial reuse operation) describe the behavior of STAs upon reception of an HE PPDU with different SPATIAL\_REUSE values. This subclause describes the conditions for a STA to set the SPATIAL\_REUSE parameter to its different values.

For a PPDU with a value of HE\_TB for the TXVECTOR parameter FORMAT, the SPATIAL\_REUSE parameter contains an array of four values. The first value in the array is the SPATIAL\_REUSE parameter that applies to the lowest frequency 20 MHz subband, the second value in the array applies to the second lowest frequency 20 MHz subband, the third value in the array applies to the third lowest frequency 20 MHz subband and the fourth value in the array applies to the highest frequency 20 MHz subband if(#15401) the CH\_BANDWIDTH parameter has the value of CBW20, CBW40 or CBW80. The first value in the array applies to the lowest frequency 40 MHz subband, the second value in the array applies to the second lowest frequency 40 MHz subband, the third value in the array applies to the third lowest frequency 40 MHz subband and the fourth value in the array applies to the highest frequency 40 MHz subband if(#15402) the CH\_BANDWIDTH parameter has the value of CBW160 or CBW80+80. If(#15403) the SPATIAL\_REUSE parameter is an array, each value in the array shall individually conform to the rules in this subclause.

An HE STA that transmits an HE TB PPDU determines the value of the TXVECTOR parameter SPATIAL\_REUSE according to 27.5.3.3 (STA behavior for UL MU operation).

An HE AP with dot11HESRPOptionImplemented set to true that transmits an HE SU PPDU, HE ER SU PPDU, or HE MU PPDU may set the TXVECTOR parameter SPATIAL\_REUSE to SRP\_DISALLOW to disallow(#16518) OBSS STAs from performing SRP-based SR transmission during the duration of the corresponding PPDU. .

An HE STA with dot11HESRPOptionImplemented set to false may set the TXVECTOR parameter SPATIAL\_REUSE to SRP\_DISALLOW for any PPDU that is not an HE TB PPDU, an HE NDP PPDU, a PPDU containing an HE NDP Announcement frame, or a PPDU containing a response to an HE NDP Announcement frame.

A STA shall set the TXVECTOR parameter SPATIAL\_REUSE of an HE PPDU to SRP\_DISALLOW or, if permitted by the other rules in this subclause, to SRP\_AND\_NON\_SRG\_OBSS\_PD\_PROHIBITED, if the STA is a non-AP HE STA and the SRP Disallowed subfield of the SR Control field of the most recently received Spatial Reuse Parameter Set element from its associated AP is equal to 1.

An AP with dot11HESRPOptionImplemented set to true that transmits an HE ER SU PPDU should set the TXVECTOR parameter SPATIAL\_REUSE to SRP\_DISALLOW. A non-AP STA with dot11HESRPOptionImplemented set to true that transmits an HE SU PPDU, HE ER SU PPDU or HE MU PPDU may set the TXVECTOR parameter SPATIAL\_REUSE, when permitted by other conditions, to SRP\_AND\_NON\_SRG\_OBSS\_PD\_PROHIBITED if(#15404) the HESIGA\_Spatial\_reuse\_value15\_allowed subfield of the SR Control field of the most recently received Spatial Reuse Parameter Set element from its associated AP is equal to 1. Otherwise, the non-AP STA shall set it to SRP\_DISALLOW. An HE STA shall set the TXVECTOR parameter SPATIAL\_REUSE to SRP\_AND\_NON\_SRG\_OBSS\_PD\_PROHIBITED for an HE NDP PPDU. An HE STA shall set the TXVECTOR parameter SPATIAL\_REUSE to SRP\_AND\_NON\_SRG\_OBSS\_PD\_PROHIBITED for a PPDU containing an FTM or NDP Announcement frame and in any frame that is transmitted as a response to an FTM or NDP Announcement frame.

An HE AP that transmits an HE SU PPDU or an HE ER SU PPDU that contains a Trigger frame should set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DELAY.

An HE STA that transmits an HE SU PPDU or HE ER SU PPDU shall not set the TXVECTOR parameter SPATIAL\_REUSE to SR\_RESTRICTED. An HE AP that transmits an HE MU PPDU that contains a Trigger frame should set the TXVECTOR parameter SPATIAL\_REUSE to SR\_RESTRICTED.

An HE STA that transmits a PPDU that does not contain a Trigger frame shall not set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DELAY or SR\_RESTRICTED.

***11ax Editor: Modify subclause 27.10.2.5 OBSS PD SR transmit power restriction as described below***

* OBSS PD SR transmit power restriction period

If a STA ignores an inter-BSS PPDU following the procedure in 27.10.2.3 (General operation with SRG OBSS PD level), using a chosen SRG OBSS PD level, or following the procedure in 27.10.2.2 (General operation with non-SRG OBSS PD level) using a chosen non-SRG OBSS PD level, then the STA shall start an OBSS PD SR transmit power restriction period. This OBSS PD SR transmit power restriction period shall be terminated at the end of the TXOP that the STA gains once its backoff reaches zero.

If a STA starts an OBSS PD SR transmit power restriction period with a chosen non-SRG OBSS PD level, the STA’s transmit power as measured at the output of the antenna connector shall be equal or lower than the *TX\_PWRmax*, calculated with this chosen non-SRG OBSS PD level with Equation (27-6), with the appropriate non-SRG parameters according to Table 27-10 (Non-SRG OBSS PD Min and Non-SRG OBSS PD Max values for non-AP STAs), for the transmissions of any PPDU that is not carrying a frame that is allowed to be sent without regard to the busy/idle state of the medium until the end of the OBSS PD SR transmit power restriction period.

If a STA starts an OBSS PD SR transmit power restriction period with a chosen SRG OBSS PD level, the STA’s transmit power as measured at the output of the antenna connector, shall be equal or lower than the *TX\_PWRmax*, calculated with this chosen SRG OBSS PD level with Equation (27-6), with the appropriate SRG parameters according to Table 27-11 (Determining SRG OBSS PD Min and SRG OBSS PD Max values), for the transmissions of any PPDU that is not carrying a response frame that is allowed to be sent without regard to the busy/idle state of the medium until the end of the OBSS PD SR transmit power restriction period.

Note: Examples of frames that are transmitted without regard to the busy/idle state of the medium include but are not limited to an HE TB PPDU that is a response to a Trigger fram with the CS Required subfield set to 0 and an Ack or Block Ack frame sent as an immediate response.