IEEE P802.11
Wireless LANs

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| CR for 27.9.2.2 spatial reuse |
| Date: 2017-02-28 |
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Abstract

This document provides CR for CIDs related to OBSS\_PD SR.

3198, 3199, 3200, 5204, 5205, 5207, 5208, 5484, 5489, 5494, 5495, 5496, 5497, 5499, 5500, 5501, 5502, 5503, 5690, 5691, 5870, 7122, 7123, 7129, 7406, 7612, 8073, 8104, 8232, 8239, 9315,9540, 9944, 9946, 9947, 10031, 10032, 7125, 3197, 5689, 9541, 3222, 3196, 6025, 7823, 8233

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** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 3198 | 27.9.1 | 191.62 | 27.9.1 | The relationship between OBSS\_PD\_min with OBSS\_PD\_min\_default is not established. The spec needs to clarify what is the relationship between OBSS\_PD\_min with OBSS\_PD\_min\_default. | As in the comment | Revised – this clarification has been made with the proposed changes in doc 947r21 |
| 3199 | 27.9.1 | 191.62 | 27.9.1 | The relationship between OBSS\_PD\_max with OBSS\_PD\_max\_default is not established. The spec needs to clarify what is the relationship between OBSS\_PD\_max with OBSS\_PD\_max\_default. | As in the comment | Revised – this clarification has been made with the proposed changes in doc 947r21 |
| 3200 | 27.9.1 | 191.01 | 27.9.1 | It is not clear from this clause whether the STA or the AP decides the value of OBSS\_PD\_min/OBSS\_PD\_max. Figure 27.6 shows the relationship of OBSS\_PD\_min and OBSS\_PD\_max relatively and it does not establish the values of OBSS\_PD\_min/OBSS\_PD\_max. The text later introduces OBSS\_PD\_min\_default/OBSS\_PD\_max\_default, but it does not clarify states whether and how an AP or a STA decides on OBSS\_PD\_min/OBSS\_PD\_max values. | Clarify whetehr and how a STA or an AP should choose the OBSS\_PD\_min/OBSS\_PD\_max values. State whether a non-AP STA shall obtain operating OBSS\_PD\_min and OBSS\_PD\_max from its associated AP. | Revised – this clarification has been made with the proposed changes in doc 947r21 |
| 5204 | 27.9.2.2 | 191.62 | 27.9.2.2 | what does "default" mean? Does that mean a user or vendor can change these values to something else? Define what is meant by "OBSS\_PD\_min\_default" and "OBSS\_PD\_max\_default". Or in otherwords, how are these variables and values used. | as in comment | Revised – this clarification has been made with the proposed changes in doc 947r21 |
| 5205 | 27.9.2.2 | 191.62 | 27.9.2.2 | Can the STA set OBSS\_PD\_min or OBSS\_PD\_max to an arbitray value, e.g. -50dBm? Please clarify | Define that OBSS\_PD\_min and OBSS\_PD\_max are set by the non-AP STAs to the default values only in the absense of direction from the AP.Perhaps define that APs always set OBSS\_PD\_min and OBSS\_PD\_max to default value. | Revised – this clarification has been made with the proposed changes in doc 947r21 |
| 5207 | 27.9.2.2 | 192.11 | 27.9.2.2 | The unconstrained condition needs to be changed to "if OBSS\_PD\_Level <= OBSS\_PD\_min" | as in comment | Revised – make the changes proposed by this comment by implementing the text changes proposed in doc xxxrx |
| 5208 | 27.9.2.2 | 192.18 | 27.9.2.2 | For proper management of an ESS to achieve our goal of high efficiency, the AP needs to be able to dictate the non-AP STA's transmit power level to lower levels than what may be calculated by TXPWR\_max. This is especially important in dense environments. Furthermore, we need this capability even beyond the context of SR and UL MU, e.g. tx power levels when transmitting SU PPDU | define such a protocol. |  |
| 5484 | 27.9.2.1 | 190.26 | 27.9.2.1 | "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 OBSS\_PD level (defined in 27.9.2.2 (Adjustment of OBSS\_PD and transmit power))" But 27.9.2.2 does not define any level for OBSS\_PD. It just says between -62 and -82 dBm. Furthermore is appears to complicate matters by providing a formula to change it with TXPWR. As we have no idea what OBSS\_PD is, this statement cited here is unusable. Nowhere can I find an actual definition of OBSS\_PD. | (I would prefer that this scheme were deleted but I will have to settle for) Add a definition of OBSS\_PD and refer to that. | Revised - the clarification of OBSS\_PDlevel has been made with the proposed changes in doc 947r21. The clarification can be further enhanced by clarifying that OBSS\_PD and TxPower can be changed but shall respect the proportional rule. Make such clarification by implementing the text changes from doc xxxrx. |
| 5489 | 27.9.2.2 | 191.07 | 27.9.2.2 | "Allowable OBSS\_PDlevel", not sure what the "allowable" is supposed to mean. Is this the rule for OBSS\_PDlevel, or the rule for OBSS\_PD or is it a new term OBSS\_PDlevel? Please clarify. | Clarify as poer comment or delete "Allowable" | Revised – agree with the commenter. Remove the mention to “allowable” and modify the text to express the equation as the condition to respect when selection OBSS\_PDlevel value, |
| 5494 | 27.9.2.2 | 192.03 | 27.9.2.2 | "A STA can select an OBSS\_PDlevel during its operation under SR mode." No idea what SR mode is supposed to mean, what is it? Is it given permission? This gets important when we consider the next sentence on L7. Also, which is much more important, this says a STA can effectively select any OBSS\_PD level. No explaination as to how to go about it, this is the path to anarchy, the whole point about SR is that rules are needed to stop some STAs from simply ignoring all other STAs. As the opening sentence says that adjusting the TX PWR is a 'may', then this can be interpreted, correctly, that OBSS\_PD applies to any inter\_BSS packet, so haviug no rule for setting the effective CCA level is a huge omission. DSC has defined exactly how to do it. In addition, there is no need to set the effective CCA threshold for inter-BSS packets, it makes no difference. | What is SR mode? Adopt text in 16/1063 | Revised – agree that SR mode is not clear. Clarify the text, by defining an OBSS\_PD SR opportunity and using this along the description of the protocol, as defined in the proposed changes in doc xxxrx. |
| 5495 | 27.9.2.2 | 192.03 | 27.9.2.2 | "This level can be dynamically adjusted or can be static". No explaination or help is given for setting this very important parameter. The only method that has been examined is DSC. There has been general agreement that the effective CCA can be set relative to the range of the STA from its AP, and DSC has been well researched on this. We cannot just leave this value setting open as that will not allow any testin or simulation to take place and simply lewaves the whole SR process up in the air. | Adopt text in 16/1064 |  |
| 5496 | 27.9.2.2 | 192.11 | 27.9.2.2 | Equation 27-1 . The first line says that TXPRmax is unconstrained if OBSS\_PDlevel=OBSS\_PDmin. Surely it should be =< ? | Change = to =< | Revised – agree with the commenter. Change the sign as in the proposed text in doc xxxrx. |
| 5497 | 27.9.2.2 | 191.62 | 27.9.2.2 | OBSS\_PDmin\_default = -82 dBm and OBSS\_PDmax\_default = -62 dBm. Are you defining new parameters or just providing simple default values. These terms do not appear in the equation so this is wrong and should simply be a statement that these values can be used a defaults. | Replace with "Recommended value for OBSS\_PDmin is -82dBm and for OBSS\_PDmax = -62 dBm." | Revised – this clarification has been made with the proposed changes in doc 947r21 |
| 5499 | 27.9.2.2 | 192.16 | 27.9.2.2 | "If a STA regards an inter-BSS PPDU as not having been received at all using a specific OBSS\_PDlevel," This is not the description of the OBSS\_PD idea as per P190L19-34. Surely this is supposed to refer to the reception of an inter-BSS packet at a signal strength less than OBSS\_PDlevel. Actually this has nothing to do with what follows as the TXPWR is set by the OBSS\_PD value selection irrespective if there is a packet received or not. If the STA selects a particular OBSS\_PD then it sets the TXPWR accordingly. | Delete cited text | Revised – this portion of the spec is useful to define during how long the TxPower constraints applies. It is however true that it is equivalent to the equation defined below, but written in a form of text case. Clarify the text as in the proposed changes in doc xxxrx. |
| 5500 | 27.9.2.2 | 192.16 | 27.9.2.2 | "If a STA regards an inter-BSS PPDU as not having been received at all using a specific OBSS\_PDlevel, the STA's power as measured at the output of the antenna connector, shall be equal or lower than the TXPWRmax, calculated with this specific OBSS\_PDlevel with Equation (27-1)," Does the STA only adjust TXPWR when receiving an inter\_BSS packet? That does not agree with teh rule as per P191L5-7 and equation 27-1 where it seems to say that if the TA chooses a particular OBSS\_PD level, then the TXPWR is always set accordingly - nothing to do with reception. OR is this not the case? - very confusing. | Reword as "The STA's power as measured at the output of the antenna connector, shall be equal or lower than the TXPWRmax, calculated with the chosen OBSS\_Pdlevel, as per Equation (27-1)." | Revised – change specific with chosen as proposed by the commenter, and as included in the changes proposed in doc xxxrx. |
| 5501 | 27.9.2.2 | 192.19 | 27.9.2.2 | "for the transmissions of any PPDU (including UL TB PPDU) until the end of the TXOP that the STA gains once its backoff reaches zero. The STA may increase the OBSS\_PDlevel during the backoff procedure, its maximum transmit power being adjusted as defined above." All this is not required. The STA must use a maximum TXPWR once it chooses its OBSS\_PD level. No need to describe the actions for a transmit power. | Delete cited text. This complete sentence L16-22 should read "The STA's power as measured at the output of the antenna connector, shall be equal or lower than the TXPWRmax, calculated with the chosen OBSS\_Pdlevel, as per Equation (27-1)." | Revised – modify the text to avoid redundancies, as proposed in the proposed changes in doc xxxrx |
| 5502 | 27.9.2.2 | 192.22 | 27.9.2.2 | "The minimum OBSS\_PDlevel used by the STA shall be above the received signal strength of the inter-BSS PPDU, which means that the maximum TXPWRmax shall be calculated with OBSS\_PDlevel equal to the received signal strength of the inter-BSS PPDU, with Equation (27-1)." Again, the actual signal level has nothjing to do with this 'scheme'. The STA choses an OBSS\_PD and thus sets its max TXPWR, that's it. I don't like it, but that that is what is previously described. It does not vary its TXPWR based upon the received signal strength. | Delete cited text. | Rejected – this part describes the set of rules in case the STA wants to dynamically adjust OBSS\_PDlevel and TxPower during an OBSS\_PD SR opportunity. It may also choose to have static parameters. |
| 5503 | 27.9.2.2 | 191.01 | 27.9.2.2 | This clause is confusing in that on one hand it seems to say that a STA selects an OBSS\_PD level (no indication of how) and then sets its TXPWR accordingly. It does not make it clear whether this is a mandatory link between the TXPWR and OBSS\_PD. If not mandatory I can't see why any STA would ever do it as by so doing it opens itself up to interference from STAs which do not do it. If it is mandatory then again I can't see why any STA would ever implement it - but they want to, go ahead. At the end of the clause it seems to be talking about only setting the TXPWR when receiving an inter-OBSS packet, but this does not make sense as the TXPWR is fixed by the selection as an OBSS\_PD level. If this scheme is to be kept, (and I would argue that it should not be), then at least make it clear what it actually is and how it is to be implemented. | Clarify what the scheme is or delete the scheme. | Revised – clarify the procedure and the rules as in the proposed text changes in doc xxxrx. |
| 5690 | 27.9.2.2 | 192.23 | 27.9.2.2 | "the minimum OBSS\_Pdlevel...", the wording of this sentence is confusing. Isnt that the min of this value is -82? | Clarify | Revised – agree in principle. Change minimum OBSS\_PDlevel by minimum chosen OBSS\_PD level. |
| 5691 | 27.9.2.2 | 191.62 | 27.9.2.2 | If there is a default value for OBSS\_Pdmin and max, does it mean the STA can alter these values to be different from the default values? Who set these values then? AP or the STA can altler these min and max values on its own? It's better to have AP set these values, but I do not see AP broadcasting such values. | Clarify | Revised – this clarification has been made with the proposed changes in doc 947r21 |
| 5870 | 27.9.2.1 | 192.03 | 27.9.2.1 | A STA can select an OBSS\_PDlevel during its operation under SR mode. This level can be dynamicallyadjusted or can be static." Can OBSS\_PDlevel be adjusted lower (from a higher level) once countdown starts ? This can allow a STA to transmit at a higher transmit power in the end | Add a restriction that OBSS\_PDlevel shall not be adjusted lower once backoff has started with a higher OBSS\_PDlevel. | Revised – agree with the commenter. Add the rules for adjusting OBSS\_PDlevel during the OBSS\_PD SR opportunity. Makes the changes as proposed in doc xxxrx |
| 7122 | 27.9.2.2 | 191.07 | 27.9.2.2 | There is no definitions for OBSS\_PDmin, OBSS\_Pdmax (and OBSS\_PDmin\_default, OBSS\_PDmax\_default in Line 62) | Define them | Revised – this clarification has been made with the proposed changes in doc 947r21 |
| 7123 | 27.9.2.2 | 191.07 | 27.9.2.2 | This formula and Figure 27-6 mean that there is no lower limit of allowable OBSS\_PD level. However, the lower limit of OBSS\_PD should exist and may be defined as OBSS\_PDmin. | Specify the minimum value (OBSS\_PDmin) for allowable OBSS\_PD level. | Rejected – a STA is allowed to choose an OBSS\_PD value lower than OBSS\_PDmin if it desires. It is not advantageous, but it can. |
| 7129 | 27.9.2.2 | 192.22 | 27.9.2.2 | "The minimum OBSS\_PDlevel used by the STA shall be above the received signalstrength of the inter-BSS PPDU"It is unclear why the minimum OBSS\_PD level (OBSS\_PDmin) shall be above the received signal strength of the inter-BSS PPDU. | Clarify the reason or modify the condition | Revised - this clarification has been made with the proposed changes in doc 947r21 |
| 7406 | 27.9.2.2 | 192.15 | 27.9.2.2 | The current spec defines a rule that the TxPower constraints can not be increased until the SR STA accesses the channel and ends its TxOP, even if other OBSS\_PPDUs are received. This should be clarified in better wording | Same as comment | Revised – agree with the comment. Make the changes as in the proposed text in doc xxxrx. |
| 7612 | 27.9.2.2 | 192.22 | 27.9.2.2 | The sentence is wrong. Here is an example, suppose the STA which sets OBSS PD level to -76 dbm, it receives the signal strength of inter-BSS PPDU is -72dbm, and the STA set NAV and assumes medium busy. Per "The minimum OBSS\_PDlevel used by the STA shall be above the received signal strength of the inter-BSS PPDU, which means that the maximum TXPWRmax shall be calculated with OBSS\_PDlevel equal to the received signal strength of the inter-BSS PPDU, with Equation (27-1).", the OBSS PD level is changed to -72dbm and TX Power is changed to TX Power Ref- (-72+82). | Update the sentence or deletre it. | Revised – clarify the spec text so that this constraints only applies when the STA decides to “not receive the OBSS PPDU at all” |
| 8073 | 27.9.2.2 | 191.00 | 27.9.2.2 | While obvious, I think that it should be stated that OBSS\_PDmin is lower or equal to OBSS\_PDmax. | As in comment. | Revised - this clarification has been made with the proposed changes in doc 947r21  |
| 8104 | 27.9.2.2 | 191.03 | 27.9.2.2 | If the OBSS\_PD is at a certain level and an OBSS PPDU is discarded based on that level, then is there any requirement of the STA that discarded that PPDU to hold its transmit power at or below the value associated with the OBSS\_PD level that it used to discard the PPDU, for the duration of the discarded PPDU? | Add text to clarify any rules regarding holding TX power at a certain level for a duration related to the duration of a discarded PPDU. | Revised – agree with the commenter. Clarify the rules with the definition of OBSS\_PD SR opportunity. Adopt the proposed changes in doc xxxrx. |
| 8232 | 27.9.1 | 190.14 | 27.9.1 | Is OBSS\_PD defined any where? If not then it needs to be addred to the definitions and abbreviations clauses | as in comment | Revised – add a definition as in the proposed changes in doc xxxrx. |
| 8239 | 27.9.2.2 | 192.16 | 27.9.2.2 | It is not clear what is the condition for the STA to consider an inter-BSS PPDU as not having been received | introduce the condition | Revised - this clarification has been made with the proposed changes in doc 947r21 |
| 9315 | 27.9.2.2 | 191.00 | 27.9.2.2 | The TXPWR can be a short term value and can be any value during CS as nothing will be transmitted. So adjusting the OBSS\_PD level by the TXPWR seems not to be the right direction. It seems better to unify the mechanism to adjust the TXPWRmax by the OBSS\_PD level. | Unify the mechanism to adjust the TXPWRmax by the OBSS\_PD level, not adjusting the OBSS\_PD level by the TXPWR. | Revised – it is implementation specific in which order these are adjusted. The spec just precises the relationship between the two levels and the rules to respect. Clarify by adopting the proposed changes in doc xxxrx. |
| 9540 | 27.9.2.2 | 191.07 | 27.9.2.2 | OBSS\_PD\_{level}, OBSS\_PD\_{max}, OBSS\_PD\_{min}, TXPWR\_{ref} not defined. | Define them before they apprear. | Revised – clarify as in the proposed changes in doc xxxrx. |
| 9944 | 27.9.2.2 | 191.62 | 27.9.2.2 | There's no description on OBSS\_PD\_{min/max\_default}. Please clarifiy these variables. | As in the comment. |  |
| 9946 | 27.9.2.2 | 192.11 | 27.9.2.2 | TXPWR\_max is unconstraind if OBSS\_PD\_level is equal to or less than OMBSS\_PD\_min. | Change the condition for unconstrained case of equation 27-1 as "if OBSS\_PD\_{level} <= OBSS\_PD\_{min}". | Revised – agree with the commenter. Make the change as in the proposed text changes in doc xxxrx. |
| 9947 | 27.9.2.2 | 192.20 | 27.9.2.2 | If a STA regards an inter-BSS PPDU as not having been received at all using a specific transmission power and resumes backoff process, it is not clear if the STA is allowed to increase the transmission power. If the increase of the transmission power is allowed, the STA may use the lowest transmission power during the backoff process to have more chance of SR transmission and then increases the transmission power right before the backoff reaches zero. This may give unfair competition and shall not be allowed. Further clarification is needed. | As in the comment. | Revised – clarify the rules to respect during the OBSS\_PD SR opportunity, by adopting the changes in doc xxxrx. |
| 10031 | 27.9.2.2 | 191.62 | 27.9.2.2 | How OBSS\_PDmin\_default is used is not defined. | Specify how this value is used. | Revised – this clarification has been made with the proposed changes in doc 947r21 |
| 10032 | 27.9.2.2 | 191.62 | 27.9.2.2 | "OBSS\_PDmin\_default = -82 dBm and OBSS\_PDmax\_default = -62 dBm." Second entry in this equation does not make sense. | Rewrite the second entry of this equation. | Rejected – this is correct. |
| 7125 | 27.9.2.2 | 192.03 | 27.9.2.2 | There is no definition for "SR mode" (also in Line 7) | Define "SR mode" or add explanations. | Revised – agree that SR mode is not clear. Clarify the text, by defining an OBSS\_PD SR opportunity and using this along the description of the protocol, as defined in the proposed changes in doc xxxrx |
| 3197 | 27.9.1 | 192.04 |  | SR mode is not defined: "A STA can select an OBSS\_PDlevel during its operation under SR mode." Also in P192L7. | Revise or define SR mode. | Revised – agree that SR mode is not clear. Clarify the text, by defining an OBSS\_PD SR opportunity and using this along the description of the protocol, as defined in the proposed changes in doc xxxrx |
| 5689 | 27.9.2.2 | 192.03 |  | SR mode is not defined. It is better to define the mode in the beginning of this section. | Define what exactly is SR mode. For example, " a mode that a STA operates in a PD level that is differnet from legacy PD threshold on OBSS PPDUs" | Revised – Clarify the text, by removing SR mode, defining an OBSS\_PD SR opportunity and using this along the description of the protocol, as defined in the proposed changes in doc xxxrx |
| 9541 | 27.9.2.2 | 192.07 |  | """If a STA chooses a specific OBSS\_PD\_{level} during its operation under SR mode, ...""SR mode undefined." | Define SR mode. | Revised – Clarify the text, by removing SR mode, defining an OBSS\_PD SR opportunity and using this along the description of the protocol, as defined in the proposed changes in doc xxxrx |

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| 3222 | 190.30 | 27.9.2.1 | There should be an exception for response frames (e.g. CTS, ACK, and BA etc) here. Otherwise a STA ignores an OBSS TXOP whose intended recipient happens to be nearby, e.g. within -62dBm or -72dBm reach. This causes significant interference to the OBSS recipient which could have been ignored if response frames where excluded from OBSS-PD rule. | Suggest to add exceptions for any response frame such as CTS, ACK, BA etc. The exception could be similar to the currently-listed exceptions for Public Action frames. |  |
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| 3196 | 190.22 | 27.9.1  | In "... not update its NAV timers based on frames carried in the PPDU ...", for consistency, it should be stated that the STA may not update its NAV based on TXOP field in the HE SIG-A if present | As in the comment | Rejected – may not update its NAV is valid for all possible NAV updates, be there with TxOP field in HE-SIG-A or with MAC frame. |
| 6025 | 190.36 | 27.9.2.1 | The spatial reuse rules are not easy-to-understand. Is the reuse allowed only for the PPDU duration when HE MU PPDU is transmitted and in all other cases the channel may be considered as IDLE and there is no limitation of the duration when the spatial reuse may be performed? | Please clarify. | Revised – clarify the rules for the transmission of the SR PPDU by defining an OBSS\_PD SR opportunity, as in the proposed changes in doc xxxrx. |
| 7823 | 190.24 | 27.9.2.1 | Inconsistency in basic NAV operation. At P150L36, P151L1 and P151L28, a frame (matching the other criteria) that is "cannot be identified as intra-BSS or inter-BSS" will update the basic NAV. But at P190L24, does not include the "cannot be determined" case. | Add "or cannot be identified as intra-BSS or inter-BSS" to the first bullet. | Rejected – the SR operation only applies to PPDUs that can be identified as inter-BSS. If they can not be classified, then the SR conditions are not met and SR is not possible. |
| 8233 | 190.24 | 27.9.1 | The rules starting on line 24 are not clear. Does it mean that both of the NAV timers are not going to be updated if the PPDU is an inter-BSS PPDU? It seems there is a contradiction with the rules for updating the two NAV timers | Clarify | Rejected – The rules in SR are orthogonal to the 2 NAV timers. SR simply allows to not update the NAV if specific conditions are met. If those conditions are not met, the 2 NAV rules apply. |
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1. **Proposed changes**

***11ax Editor: Modify 3.2 Definitions specific to IEEE 802.11 as follows:***

3. Definitions, acronyms, and abbreviations

**3.2 Definitions specific to IEEE 802.11**

**SRP PPDU:** a PPDU that does not contain a Trigger and is received with an RXVECTOR parameter Spatial Reuse value other than SR\_DELAY, SR\_DISALLOW, SR\_RESTRICTED, or reserved, or a PPDU that does contain a Trigger and is received with an RXVECTOR parameter Spatial Reuse value other than SR\_DELAY, SR\_DISALLOW or SR\_RESTRICTED

**SR PPDU:** a PPDU that is transmitted during a spatial reuse opportunity

**OBSS PD SR PPDU:** a PPDU that is transmitted during a spatial reuse opportunity that was determined using the OBSS\_PD threshold

OBSS PD SR opportunity: A time period that starts when a STA regards an OBSS PPDU as not received at all with the OBSS\_PD SR procedure, and that ends at the end of the TXOP that the STA gains once its backoff reaches zero. During this periods, the STA follows specific rules, as defined in 27.9.2.2.

***11ax Editor: Modify 3.4 Abbreviations and acronyms as follows:***

3.4 Abbreviations and acronyms

SR Spatial Reuse

SRG Spatial Reuse Group

OBSS\_PD Packet detection level used for spatial reuse procedure when receiving a PPDU that was classified as an inter-BSS PPDU.

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| **Order** | **Information** | **Notes** |
| <ANA> | Spatial Reuse Parameter Set | The Spatial Reuse Parameter Set element is optionally present if dot11HighEfficiencyOptionImplemented is true |

**9.4.2 Elements**

**9.4.2.1 General**

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| --- | --- | --- | --- |
| **Element** | **Element ID**  | **Element ID Extension** | **Extensible** |
| Spatial Reuse Parameter Set element (see 9.4.2.x Spatial reuse parameter set element) | 255 | <ANA> | Yes |

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

The Spatial Reuse Parameter Set element provides information needed by STAs when performing OBSS\_PD-based spatial reuse as defined in 27.9.2 (OBSS\_PD-based spatial reuse). The format of the Spatial Reuse Parameter Set element is defined in Figure 9-ax6b (Spatial Reuse Parameter Set element).

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension  | SR Control | NON SRG OBSS PD MAX OFFSET | SRG OBSS PD MIN OFFSET | SRG OBSS PD MAX OFFSET | SRG BSS Color Bitmap | SRG Partial BSSID Bitmap |
| Octets: | 1 | 1 | 1 | 1 | 0 or 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 | OBSS\_PD SR Disallowed | NON SRG Offset Present | SRG Information Present | Reserved |
| Bits: | 1 | 1 | 1 | 1 | 4 |

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

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

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

The NON SRG Offset Present subfield indicates whether the NON SRG OBSS PD MAX Offset subfield is present in the element. When this bit is set to 1, the NON SRG OBSS PD MAX Offset subfield is present. When this bit is set to 0, the NON SRG OBSS PD MAX Offset subfield is not present.

The SRG Information Present subfield indicates whether the SRG OBSS PD MIN Offset, SRG OBSS PD MAX Offset, SRG BSS Color Bitmap and SRG Partial BSSID Bitmap subfields are present in the element. When this bit is set to 1, the SRG OBSS PD MIN Offset, SRG OBSS PD MAX Offset, SRG BSS Color Bitmap and SRG Partial BSSID Bitmap subfields are present. When this bit is set to 0, the SRG OBSS PD MIN Offset, SRG OBSS PD MAX Offset, SRG BSS Color Bitmap and SRG Partial BSSID Bitmap subfields are not present.

The NON SRG OBSS PD MAX Offset subfield is present when the value of the NON SRG Offset Present subfield is equal to 1; Otherwise the NON SRG OBSS PD MAX Offset subfield is not present. The NON SRG OBSS PD MAX Offset field contains an unsigned integer which is added to the value -82 dBm to generate the value of the NON SRG OBSS PD MAX parameter.

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

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

**27.2.1 Intra-BSS and inter-BSS frame determination**

**27.2.1a SRG and non-SRG frame determination**

An HE 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 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. If BSS Color information is present in a PPDU, the PPDU is determined to be an SRG PPDU if the bit corresponding to the BSS Color of the PPDU in the SRG BSS Color Bitmap is 1. If Partial BSSID information is present in a PPDU, the PPDU is determined to be an SRG PPDU if the bit corresponding to the Partial BSSID of the PPDU in the SRG Partial BSSID Bitmap is 1. If Partial BSSID information is not present in a PPDU and BSSID information is correctly received, the Partial BSSID can be calculated and the PPDU is determined to be an SRG PPDU if the bit corresponding to the Partial BSSID of the PPDU in the SRG Partial BSSID Bitmap is 1. Otherwise, the PPDU is not determined to be an SRG PPDU. An HE 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.

**27.9.2 OBSS\_PD-based spatial reuse operation**

**27.9.2.1 General**

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 PHYCCARESET. 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 27.2.1 (Intra-BSS and inter-BSS frame detection))

— 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 NON 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-HT PPDU that carries an individually addressed Public Action frame where the RA field is equal to the STA MAC address

• A non-HT PPDU that carries a group addressed Public Action frame

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 PHYCCARESET. 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 27.2.1 (Intra-BSS and inter-BSS frame detection))

* The received PPDU is an SRG PPDU (see 27.2.1a 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-HT PPDU that carries an individually addressed Public Action frame where the RA field is equal to the STA MAC address

• A non-HT PPDU that carries a group addressed Public Action frame

A non-HT PPDU that carries an NDPA

The PHYCCARESET.request primitive shall be issued at the end of the PPDU if the PPDU is HE SU PPDU or HE extended range SU PPDU and the RXVECTOR parameter SPATIAL\_REUSE indicates SR\_DELAY.

If the PHYCCARESET.request primitive is issued before the end of the PPDU, and a TXOP is initiated within the duration of the PPDU, then the TXOP shall be limited to the duration of the PPDU if the PPDU is HE MU PPDU and the RXVECTOR parameter SPATIAL\_REUSE indicates SR\_RESTRICTED.

If the inter-BSS frame is carried in an HE extended range SU PPDU (where power of the L-STF/L-LTF symbols is boosted 3 dB), the received power measured based on the legacy preamble and captured in the RXVECTOR parameter RSSI\_LEGACY in the PHY-RXSTART.indication primitive shall be decreased by 3 dB to compensate for the power boost factor when compared to the OBSS PD level.

***11ax Editor: Modify 27.9.2.2 Adjustment of OBSS\_PD and transmit power as follows:***

**27.9.2.2 Adjustment of OBSS\_PD and transmit power**

Adjusting the OBSS\_PD level and transmit power can improve the system level performance and the utilization of the spectrum. When using OBSS\_PD-based spatial reuse, an HE STA is allowed to adjust the OBSS\_PD level in conjunction with its transmit power and shall respect the following condition:



The adjustment rule is illustrated in Figure 27-6 (Illustration of the adjustment rules for OBSS\_PD and TX\_PWR).

|  |
| --- |
|  |
| * Illustration of the adjustment rules for OBSS\_PD and TX\_PWR
 |

The *OBSS\_PDlevel* is applicable to the start of a 20 MHz PPDU received on the primary 20 MHz channel. The *OBSS\_PDlevel*(40 MHz) which is applicable to the start of a 40 MHz PPDU received on the primary 40 MHz channel, the *OBSS\_PDlevel*(80 MHz) which is applicable to the start of a 80 MHz PPDU received on the primary 80 MHz channel and the *OBSS\_PDlevel*(160 MHz or 80+80 MHz) which is applicable to the start of a 160 MHz or 80+80 MHz PPDU, can be derived by the following equations:

* *OBSS\_PDlevel*(40 MHz)= *OBSS\_PDlevel* + 3 dB
* *OBSS\_PDlevel*(80 MHz)= *OBSS\_PDlevel* + 6 dB
* *OBSS\_PDlevel*(160 MHz or 80+80 MHz) = *OBSS\_PDlevel* + 9 dB

*TXPWRref* = 21 dBm for non-AP STAs.

*TXPWRref* = 21 dBm for an AP with the Highest NSS Supported M1 subfield in the Tx Rx HE MCS Support field of its HE Capabilities element field equal to or less than 1.

*TXPWRref* = 25 dBm for an AP with the Highest NSS Supported M1 subfield in the Tx Rx HE MCS Support field of its HE Capabilities element field equal to or greater than 2.

*TXPWR* is the STA transmission power in dBm at the antenna connector.

NOTE—considering the antenna connector definition section 3.1.

An AP may define SRG OBSS PD MIN Offset and SRG OBSS PD MAX Offset values that are used by its associated STAs and by the AP to derive an SRG OBSS\_PD level for determining reception behaviour for inter-BSS PPDUs that are determined to be SRG PPDUs. An AP may define a NON SRG OBSS PD MAX Offset value that is used by its associated STAs and by the AP to derive a NON SRG OBSS\_PD level for determining reception behaviour for inter-BSS PPDUs that are not determined to be SRG PPDUs. The values of SRG OBSS PD MIN Offset, SRG OBSS PD MAX Offset and NON SRG OBSS PD MAX Offset are transmitted to associated STAs within the Spatial Reuse Parameter Set element.

An AP transmitting a Spatial Reuse Parameter Set element shall respect the following constraints:

* -82dBm <= -82 + SRG OBSS PD MIN Offset dBm <= -62dBm
* SRG OBSS PD MIN Offset <= SRG OBSS PD MAX Offset
* SRG OBSS PD MAX Offset + -82 dBm <= -62 dBm
* NON SRG OBSS PD MAX Offset <= SRG OBSS PD MAX Offset
* NON SRG OBSS PD MAX Offset + -82 dBm <= -62 dBm

HE STAs shall maintain a NON SRG OBSS\_PD level, with its value selected by respecting the OBSS\_PD level condition above but with NON SRG OBSS PD MIN and NON SRG OBSS PD MAX in place of OBSS\_PDmin and OBSS\_PDmax, respectively, where NON SRG OBSS PD MIN and NON SRG OBSS PD MAX are determined according to Table 25-xyz

**Table 25-xyz 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 | -62 |
| 0 | 0 | -82 | -62 |
| 0 | 1 | -82 | -82 + NON SRG OBSS PD MAX Offset |
| 1 | Don’t care | -82 | -82 |

HE STAs shall maintain a SRG OBSS\_PD level, with its value selected by respecting of the OBSS\_PD level condition above but with SRG OBSS PD MIN and SRG OBSS PD MAX in place of OBSS\_PDmin and OBSS\_PDmax, respectively, where SRG OBSS PD MIN and SRG OBSS PD MAX are determined according to Table 25-yyz

**Table 25-yyz Determining SRG OBSS\_PD\_MIN and SRG OBSS\_PD\_MAX values**

|  |  |  |  |
| --- | --- | --- | --- |
| **OBSS\_PD SR Disallowed** | **SRG Information Present** | **Value of SRG OBSS\_PD\_MIN** | **Value of SRG OBSS\_PD\_MAX** |
| Spatial Reuse Parameter Set element not received | Spatial Reuse Parameter Set element not received | N/A\* | N/A\* |
| Don’t care | 0 | N/A\* | N/A\* |
| Don’t care | 1 | -82 + SRG OBSS PD MIN Offset | -82 + SRG OBSS PD MAX Offset |
|  |  |  |  |
| \*Note: When SRG Information is not present, a STA cannot determine a PPDU to be SRG and so will not use SRG OBSS\_PD\_MIN or SRG OBSS\_PD\_MAX values. |

STAs which receive a Spatial Reuse Parameter Set information element from their associated AP that has a value of 1 in the SRP Disallowed subfield shall not perform SRP-based SR transmissions.

The Spatial Reuse Parameter Set element is optionally present in Beacons, Probe Responses and (Re)Association responses.

***11ax Editor: Add a new subsection 27.9.2.2a OBSS\_PD SR opportunity as follows:***

**27.9.2.2a OBSS\_PD SR opportunity**

If a STA ignores an inter-BSS PPDU following the procedure in 27.9.2.1, using a chosen SRG OBSS\_PDlevel, or a chosen NON SRG OBSS\_PDlevel it starts an OBSS\_PD SR opportunity. This OBSS\_PD SR opportunity is terminated at the end of the TXOP that the STA gains once its backoff reaches zero.

If a STA starts an OBSS\_PD SR opportunity with a chosen NON SRG OBSS\_PDlevel, the STA’s power as measured at the output of the antenna connector, shall be equal or lower than the *TXPWRmax*, calculated with this chosen NON SRG *OBSS\_PDlevel* with Equation (27-1), with the appropriate NON SRG parameters according to table **25-xyz**, for the transmissions of any PPDU (including UL TB PPDU) until the end of the OBSS\_PD SR opportunity. If a STA starts an OBSS\_PD SR opportunity with a chosen SRG OBSS\_PDlevel, the STA’s power as measured at the output of the antenna connector, shall be equal or lower than the *TXPWRmax*, calculated with this chosen SRG *OBSS\_PDlevel* with Equation (27-1), with the appropriate SRG parameters according to table **25-xyz**, for the transmissions of any PPDU (including UL TB PPDU) until the end of the OBSS\_PD SR opportunity.

Multiple ongoing OBSS\_PD SR opportunities can overlap in time. All ongoing OBSS\_PD SR opportunities end at the same time.

  (#5207, #5496)

NOTE1 – Equation (27-1) is equivalent to the condition defined in Equation XXX

The STA shall not decrease the chosen SRG OBSS\_PDlevel during an OBSS\_PD SR opportunity. The STA may increase the chosen SRG *OBSS\_PDlevel* during the OBSS\_PD SR opportunity. The STA shall not decrease the chosen NON SRG OBSS\_PDlevel during an OBSS\_PD SR opportunity. The STA may increase the chosen NON SRG *OBSS\_PDlevel* during the OBSS\_PD SR opportunity.

The STA’s power shall therefore always be equal or lower than the TXPWRmax, calculated with the lowest OBSS\_PDlevel used since the beginning of oldest ongoing OBSS\_PD SR opportunity, and until the end of the OBSS\_PD SR opportunity.

The minimum chosen SRG *OBSS\_PDlevel* used by the STA shall be above the highest received signal strength among all the inter-BSS PPDU that were ignored to start an OBSS\_PD SR opportunity, since the beginning of the oldest ongoing OBSS\_PD SR opportunity. Similarly, the minimum chosen NON SRG *OBSS\_PDlevel* used by the STA shall be above the highest received signal strength among all the inter-BSS PPDU that were ignored to start an OBSS\_PD SR opportunity, since the beginning of the oldest ongoing OBSS\_PD SR opportunity.

The maximum *TXPWRmax* used by the STA in the OBSS\_PD SR opportunity shall therefore be the minimum between:

* the SRG TXPWRmax calculated with SRG *OBSS\_PDlevel* equal to the highest received signal strength among all the inter-BSS PPDU that were ignored to start an OBSS\_PD SR opportunity since the beginning of the oldest ongoing OBSS\_PD SR opportunity, with Equation (27-1), with the appropriate SRG parameters according to table **25-xyz**.
* and the NON SRG TXPWRmax calculated with NON SRG *OBSS\_PDlevel* equal to the highest received signal strength among all the inter-BSS PPDU that were ignored to start an OBSS\_PD SR opportunity since the beginning of the oldest ongoing OBSS\_PD SR opportunity, with Equation (27-1) with the appropriate NON SRG parameters according to table **25-xyz**,



Figure xxx – Example of OBSS\_PD SR operation

***11ax Editor: Rename subsection 27.9.2.2a Transmission of an OBSS\_PD-based SR PPDU to 27.9.2.2b Transmission of an OBSS\_PD-based SR PPDU as follows:***

**27.9.2.2b Transmission of an OBSS\_PD-based SR PPDU**

Provided that other conditions are fulfilled to allow the transmission of an OBSS\_PD-based SR PPDU, a STA may transmit the PPDU only if one of the following conditions is met:

1. the medium was idle for PIFS preceding the received OBSS PPDU that was discarded based on OBSS\_PDlevel
2. a PHY-CCA.indication transition from BUSY to IDLE occurred within the PIFS time immediately preceding the received OBSS PPDU and the transition corresponded to the end of a PPDU that did not contain a CTS
3. a PHY-CCA.indication transition from BUSY to IDLE occurred within the PIFS time immediately preceding the received OBSS PPDU and the transition corresponded to the end of a PPDU that contained a CTS and a PHY-CCA.indication transition from BUSY to IDLE occurred within the PIFS time immediately preceding the received CTS and that transition corresponded to the end of a PPDU that contained an RTS

**27.11.6 SPATIAL\_REUSE**

A STA shall set the TXVECTOR parameter SPATIAL\_REUSE of an HE PPDU to SR\_DISALLOW if the STA is an HE non-AP STA and the SR 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