IEEE P802.11
Wireless LANs

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| CR for OBSS\_PD |
| Date: 2018-07-09 |
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Abstract

This document provides CR for CIDs:

15898 16499 15702 15704 15653 15655 15738 15656 15739 15740 17127 15847 15741 15175 15742 15699 17133 17076 15176 16757 17134 15652 15657 15744 16758 17131 16037 16226 16464 15581 15589 15591 16512 16761 16762 16513 17014 15761 16515 16514 16516 15745 15746 15781 15709 15713 15714 15715 16759 16760 16411 16935 16936

R1:

Add 16759, 16760, 16411

Resolution added for 1713116758: check with Robert

New proposed resolution for 15781 as discussed on the floor.

Transfer 15707 to Mat’s document

New proposed resolution for 17134

New proposed resolution for 15657, for 15713, for 16516

R3:

New revision for 16516, 15657, 16512, 15176

R4:

#16936 added from Mat’s doc for harmonization

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** |
| 15898 | 9.4.2.241 | 173.29 | make it clear that the bit related to BSS color 0 is reserved. | As in the comment | Revised – agree with the comment. Apply the changes as in doc 1495r3. |
| 16499 | 9.4.2.241 | 173.32 | "Each bit of the bitmap corresponds to one of the 63 available BSS Colors, wherethe lowest numbered bit corresponds to BSS Color value 0 and the highest numbered bit corresponds to BSSColor value 63." There are 64 numbers from 0 to 63. | change to "one of 64 available colors" | Revised – agree with the comment. Apply the changes as in doc 1495r3. |
| 15702 | 9.4.2.241 | 180.33 | "Each bit of the bitmap corresponds to one of the 63 available BSS Colors, wherethe lowest numbered bit corresponds to BSS Color value 0 and the highest numbered bit corresponds to BSS Color value 63." The first part of the statement indicates 63 available BSS colors but the second part of statement indicate 64 available values. The first and second parts are not consistent. | Please clarify. | Revised – agree with the comment. Apply the changes as in doc 1495r3. |
| 15704 | 9.4.2.241 | 180.33 | Is there any restrictions of AP setting BSS color map? For example, AP can set all BSS colors, excluding its own BSS color, in the bit map to 1, to include all OBSS to SRG. | Please clarify. | Revised – There are restrictions with regards to BSS Color value 0. The BSS Color corresponding to the one used by the AP sending this element should also not be considered. This is defined in the 27.2.2, so no need to write something specific in this subclause. Apply the changes as proposed in doc 1495r3.  |
| 15653 | 27.9.1 | 337.35 | "The objective of HE spatial reuse operation is to allow the medium to be reused more often between OBSSs in dense deployment scenarios by the early identification of signals from overlapping basic service sets (OBSSs) and interference management." It is debatable whether" early identification of signals" and "interference management" are the best or only methods. This effectively limits the methods. | Delete "by the early identification of signals from overlapping basic service sets (OBSSs) and interference management." | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 15655 | 27.9.1 | 337.60 | "An HE AP may use information from Beacon reports from associated STAs to make decisions related to spatial reuse. The exact algorithm is beyond the scope of this specification." If the algorithm is beyond this specification, this does not add anything at all. It does not tell one how it can aid spatial reuse in any way, and it is very debatable whether it would aid it at all. Is there a simulation that shows how this is useful? Is it just another "sounds a good idea, but the more one looks at it, the less useful it seems"? Delete this stuff entirely. | Delete from P337.43 to 337.65 | Revised – agree with the commenter. Delete last sentence as proposed in doc 1495r3. |
| 15738 | 27.9.1 | 337.64 | A non-AP HE STA should be able to reject the HE AP's Beacon measurement request. The Beacon measurements especially on other than primary channel consume transmission time and power of a STA. This may degrade real time service delay performance and cause poor QoS nad QoE. | delete the lines 64 & 65. | Reject – The spec in 11.11 already defines ways for the STA to report Incapability or rejection of measurements. See 9.4.2.22. |
| 15656 | 27.9.2.1 | 338.06 | "The first type is defined in 27.9.2.2 (General operation with non-SRG OBSS PD level), and allows a STA, under specific conditions, to ignore an inter-BSS PPDU using a Non-SRG OBSS PD level. The second type is defined in 27.9.2.2 (General operation with non-SRG OBSS PD level) and allows a STA, under specific conditions, to ignore inter- BSS PPDUs that are identified as being SRG PPDUs, using an SRG OBSS PD level." Hmm, something is wrong, we have two identical references with different descriptions? I suspect that the "second type" is probably 27.9.2.3 | Correct the reference. | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 15739 | 27.9.2.1 | 338.06 | The introdution of the SRG and non-SRG groups should describe more clearly what are these groups, why they are needed and how BSSs or devices are classified to the groups. | Please described the SRG and non-SRG differences more clearly. It is not enough to say that they have different operations. | Revised – The current sentences define already the difference with regards to what inter-BSS PPDUs can or can’t be ignored (whether they are SRG PPDU or not). What is missing is the values of OBSS PD min. Apply the changes as proposed in doc 1495r3. |
| 15740 | 27.9.2.1 | 338.06 | The SRG and non-SRG operatons are similar. The difference between them should be described more precisely. | Please described the SRG and non-SRG differences more precisely. It is not enough to say that they have different operations. | Revised – The current sentences define already the difference with regards to what inter-BSS PPDUs can or can’t be ignored (whether they are SRG PPDU or not). What is missing is the values of OBSS PD min. Apply the changes as proposed in doc 1495r3. |
| 17127 | 27.9.2.1 | 338.09 | The second type is defined in 27.9.2.3 instead of 27.9.2.2, please correct it. | as in comment | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 15847 | 27.9.2.1 | 338.11 | "Within a single beacon interval" does not seem to be relevant here. The 2 modes can be used simultaneously, depending on the classification of the frames they receive, but disregards of a beacon interval. | Remove: "within a single beacon interval" | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 15741 | 27.9.2.2 | 338.23 | The devices have temptation to set the SRP\_AND\_NON\_SRG\_OBSS\_PD\_PROHIBITED value at the end of the beacon period, because there is no penalty for doing it, i.e. the time when reuse cannot be used for non-SRG transmissions is only to the next TBTT. This may cause variation when STAs allow the reuse. When reuse is allowance varies, then the interfernce level varies as well. In order to minimize interference level variation for more precise link adaptation, the interference level should not vary. Also there should not be easy benefits for denying other STAs to use the SRG at transmissions at the end of the beacon period. | increase the time when a STA cannot use spatial reuse after transmitting a frame with SRP\_AND\_NON\_SRG\_OBSS\_PD\_PROHIBITED. Set allow the spatial reuse only after the following beacon period, i.e. after two beacon transmissions, or alternatively calculate the duration of one beacon period from the time when the frame with SRP\_AND\_NON\_SRG\_OBSS\_PD\_PROHIBITED was transmitted. | Revised – We can extend the rule to the current beacon interval and the previous beacon interval. Apply the changes as proposed in 1495r3. |
| 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. |  |
| 15742 | 27.9.2.2 | 338.36 | It is unclear why RTS needs to be mentioned in the spatial reuse rules. If CTS is received, then it will deny the spatial reuse. The complicated sentences on possible RTS reception before the CTS frame are not needed. The sentence does not enable any special operation when RTS is received. | Delete the sentence starting:"or the received..." | Rejected – RTS is mentioned here because there is a special case where OBSS\_PD is allowed when receiving both RTS and CTS. |
| 15699 | 27.9.2.2 | 338.38 | The CCA indication transition should be after receiving CTS, not preceding it | Change the text:"BUSY to IDLE occurred within the PIFS time immediately preceding the received CTS"To:"BUSY to IDLE occurred within the PIFS time immediately after the received CTS" | Rejected – the condition is that the STA received a CTS and that an RTS was also received right before that CTS. This is why the transition is during the PIFS immediately preceding, |
| 17133 | 27.9.2.2 General operation with non-SRG OBSS PD le | 338.52 | Non-SRG OBSS PD provides opportunity for a STA's MAC sublayer to issue a PHY-CCARESET. request primitive "before the end of the PPDU", but the last condition requires identification of a frame type carried in the PPDU that can be done only after the end of the PPDU. Therefore a PHY-CCARESET. request primitive is never issued before the end of the PPDU. The same comment is applied to PP339L37. | Remove the last comdition. | Rejected – the last condition is important to disable OBSS\_PD for specific frames. It is true that a) send CCAReset is anyway not possible but b) ignore NAV is possible. |
| 17076 | 27.9.2.2 | 338.55 | Approved CR to remove "group addressed" (CID 9716) is not reflected in "A non-HE PPDU that carries a group addressed Public Action frame".The CR is in 11-17/941r2 and database 11-17/0010r14, approved in July 2017, CR Motion #320. | Remove "group addressed" | Revised – apply the changes as proposed in 1495r3 |
| 15176 | 27.9.2.2 | 339.05 | Not clear to me what the VHT PPDU has to do here. Please clarify. | As in comment. | Reject – The sentence is clear. No changes are needed. – |
| 16757 | 27.9.2.3 | 339.26 | "before the end of the PPDU". I could actually be at the end of the PPDU (see SR\_DELAY) | Correct statement | Reject – CCAreset is always send at the end of the PPDU, what is different here is that under certain conditions, it is possible to do this before the end. In the case of SR\_delay, this is an exception where this is not possible, and this exception is stated later in this subclause. |
| 17134 | 27.9.2.1 General | 339.52 | In order to allow efficient use of SR resource, STA should be allowed to subtract the time it took to determine that the received PPDU is an inter-BSS PPDU from its BO timer.This is especially important to effectively utilize the SR resource, because by the time the BO expires in many cases the OBSS PPDU would be already be finished.Simple substraction of the time from BO timer could allow multiple zero hiting BO counters which cause collision, therefore CW shall not be decremented but only AIFS shall be decremented. In adittion, AC priority should be considered, then maxisimum substraction time shall not exceed AIFS of AC\_VO. | Add "If the PHYCCARESET.request primitive is issued before the end of the PPDU, the Backoff counter of the STA may be decremented by the time it took from the beginning of the PPDU until the PHYCCARESET.request primitive was issued or AIFS[AC\_VO], whichever is smaller. | Reject – Making such changes would complicate the procedure as several other corner cases would need to be covered by the rules.  |
| 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." |  |
| 15657 | 27.9.2.4 | 340.08 | For a typical non-AP STA, with TXPWR 15dBm, Equation 27-4 can result in that STA using an OBSS PD level of -76dBm, all the time. Taken further this means that all 11ax non-AP STAs will use -76dBm OBSS PD or CCA. Is this the real intent? I can sort of see that because an AP is typically 21dBm an AP must reduce its OBSS PD to -76dBm so as to make the DL and UL symmetrical, but why? How much evaluation has gone into checking that -76dBm default is OK and does not jeopodize legacy STAs? | Add a NOTE or text to justify the 21dBm. Something like: "NOTE: The TXPWRref of 21 dBm corresponds to a typical AP transmit power. Using this reference level allows a non-AP STA with a maximum transmit power of 15dBm to use an OBSS PD level of -76 dBm." | Revised – add a note to explain the reason for having 2 levels. |
| 15744 | 27.9.2.4 | 340.15 | The Allowable OBSS\_PDlevel should be changed to Allowed OBSS\_PDlevel and TX\_PWR, because the area of allowed parameter values is pointed, not only the Y-axis value. | Please change Allowable\_OBSS\_PDlevel to allowed OBSS\_PDlevel and TX\_PWR. Alternatively define what is meant with Allowable OBSS\_PDLevel in the normative text. | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 16758 | 27.9.2.4 | 340.17 | Figure 27-9 looks like a 8-bit graphic. Quality of the Figure needs to be improved. | See comment | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 17131 | 27.9.2.4 | 340.42 | When the OBSS-PD spatial reuse is applied to bandwidth larger than 20MHz, the OBSS\_PDlevel is increased. In the proceudre, the mid-packet detection is not considered. In order to maximize the gain of spatial reuse, the mid-packet detection in secondary channel need to be considered. | as in comment | Reject – this is already described in the CCA section. |
| 16037 | 27.9.2.4 | 340.49 | " the Highest NSS Supported M1 subfield in the Supported HE-MCS andNSS Set field of its HE Capabilities element field" -- there is no such subfield | Delete lines 49 to 55 in the referenced page, and delete "for non-AP STAs" in the line above | Revised – agree with the commenter. The same behaviour should be by using the support for transmitting 3 SSs or not. Apply the changes as proposed in doc 1495r3. |
| 16226 | 27.9.2.4 | 340.49 | "the Highest NSS Supported M1 subfield in the Supported HE-MCS and NSS Set field" -- no such subfield | Change "with the Highest NSS Supported M1 subfield in the Supported HE-MCS andNSS Set field of its HE Capabilities element field equal to or less than 1." to "that does not support more than two spatial streams.". At line 54 change " with the Highest NSS Supported M1 subfield in the Supported HE-MCS andNSS Set field of its HE Capabilities element field equal to or greater than 2." to "that supports more than two spatial streams.". At line 47 change "non-AP STAs" to "a non-AP STA" | Revised – agree with the commenter. The same behaviour should be by using the support for transmitting 3 SSs or not. Apply the changes as proposed in doc 1495r3. |
| 16464 | 27.9.2.4 | 340.49 | What is Highest NSS Supported M1 subfield? | Please clarify it. | Revised – agree with the commenter. The same behaviour should be by using the support for transmitting 3 SSs or not. Apply the changes as proposed in doc 1495r3. |
| 15581 | 27.9.2.4 | 340.57 | When MIMO transmission is applied, it's not clear how the OBSS\_PD rules should should be applied. Consider redefining TXPWR to be "the combined transmit power at the antenna connectors of all the transmit antennas" | As in comment | Reject – The sentence uses the “antenna connector”, whose definition clarifies that it’s the output of all antennas in a multi-antenna STA. |
| 15589 | 27.9.2.4 | 340.57 | We should consider high antenna gain systems when considering spatial reuse. | Consider changing "TXPWR is the STA transmission power in dBm at the output of the antenna connector" to "TXPWR is the STA transmission power in dBm at the output of the antenna connector assuming 0dBi antenna gain. If a different antena gain is used, TXPWR should be adjusted accordingly" | Revised –The spec already considers this in the definition of antenna connectors. Apply the changes as in doc 1495r3. |
| 15591 | 27.9.2.4 | 340.57 | When MIMO transmission is applied, it's not clear how the OBSS\_PD rules should be applied. Consider redefining TXPWR to be "the combined transmit power at the antenna connectors of all the transmit antennas" | As in comment | Revised – output of the antenna connector is defined for both SISO and MIMO. The only clarification that is needed regards the antenna gain. Apply the changes as in doc 1495r3. |
| 16512 | 27.9.2.4 | 340.57 | "TXPWR is the STA transmission power in dBm at the output of the antenna connector." Where is TXPWR derived from ? | Have note stating from (11.8.6, 11.8.7) for normal PPDUs and from (see 28.3.14.2 (Power pre-correction)) for HE TB PPDUs | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 16761 | 27.9.2.4 | 341.09 | Why "+ -82 dBm" | Replace with "- 82 dBm" | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 16762 | 27.9.2.4 | 341.10 | Why "+ -82 dBm" | Replace with "- 82 dBm" | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 16513 | 27.9.2.4 | 341.13 | "HE STAs shall maintain a non-SRG OBSS PD level, with its value selected by respecting the OBSS PDlevel condition in Equation (27-4) ...". Pg 340 line 4 indicates that it "may". | Clarify relationship between the two sentences | Revised – Modify P340L4 to resolve ambiguity. Apply the changes as proposed in doc 1495r3.  |
| 17014 | 27.9.2.4 | 341.21 | Table 27-10 should be revised.(1) The second row should be merged into the first row.(2) The "Value of Non-SRG OBSS PD Max" on the last row will be -62. | As in the comment. | Reject – For (1), row 1 and 2 are clearer if they are separated, even if they lead to the same values. For (2), the max value has to be set to -82 in this case as this row corresponds to the case where OBSS\_PD SR is disallowed. |
| 15761 | 27.9.2.2 | 341.39 | One condition for the non-SRG OBSS PD spatial reuse is that the "non-SRG OBSS PD SR Disallowed" field of the "spatial reuse parameter set" is zero.But in table 27-10 (Determining Non-SRG OBSS PD Min and Non-SRG OBSS PD Max values), page 341:The first column and last row define a value for non-SRG OBSS PD Min and non-SRG OBSS PD Max when the "non-SRG OBSS PD SR Disallowed" is high.- Why these 2 values are defined if we can't use the non-SRG OBSS PD spatial reuse ?- Maybe this mean that we can use non-SRG OBSS PD spatial reuse when disallowed but only with these two restrictive values ? | Remove the last row. | Reject – by setting the values in the last row to -82dBm, OBSS\_PD SR is effectively disallowed. |
| 16515 | 27.9.2.4 | 341.40 | Entry in table says "Don't care". Who defines this? Is it based on a capability of the STA? is it based on signaling from the AP? | Clarify meaning and signaling of "Don't care" | Revised – Clarify the meaning by saying that this field can be any values. Apply the changes as proposed in doc 1495r3. |
| 16514 | 27.9.2.4 | 341.43 | "HE STAs shall maintain a SRG OBSS PD level, with its value selected by respecting the OBSS PD levelcondition in Equation (27-4) but with SRG...". Pg 340 line 4 indicates that it "may". | Clarify relationship between the two sentences | Revised – Modify P340L4 to resolve ambiguity. Apply the changes as proposed in doc 1495r3.  |
| 16516 | 27.9.2.5 | 342.34 | 27.9.2.5 OBSS PD SR transmit power restriction period. The TXPWR\_max seems to be a a function of the OBSS\_PD\_level (eqn 27-5) which in turn in is a function of the TXPWR (eqn 27-4). The final transmit power depends on the TXPWR max. Can you please clarify this relationship with an example in the specification? | Clarify that STA gets orignal TXPWR, estimates OBSS\_PD then gets TXPWR\_max then transmits. Identify where STA gets original TXPWR (11.8.6/11.8.7/28.3.14.2) | Revised – add a note to clarify that the STA can derive OBSS\_PD level from transmit power, or derive max transmit power level from OBSS\_PD level. Apply the changes as proposed in doc 1495r3.  |
| 15745 | 27.9.2.5 | 342.40 | If a STA is AP, does the transmit power restriction restrict the transmission power that the STA can signal for UL transmissions in a trigger frame that it transmits? | Please clarify. | Reject – the power restriction period is for the STA only (in this example for the AP). So if the AP sends a trigger for other STAs, these other STAs will be responsible for respecting or not the NAV from ongoing transmissions.  |
| 15746 | 27.9.2.5 | 342.65 | Unclear which is the entity that can have multiple restriction periods. | Please change to:" a STA may have multiple ongoing OBSS PD SR transmit power restriction periods that overlap in time". | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 15781 | 27.9.2.6 | 344.26 | This section is missing some important details. "If an HE STA ignores an inter-BSS PPDU ... it may resume EDCAF procedures", but (for good reason) the preamble detect part of the EDCAF procedures only applies "in an otherwise idle channel". The inter-BSS PPDU may be ignored, but does that mean the channel is "idle" for purposes of the EDCAF procedures? There are some difficulties whether the answer is "yes" or "no". If "yes" (channel idle, preamble detect applies), then the HE STA must be able to detect any new PPDU at -82dBm or higher within aCCATime, with probability 90%. Are we sure that this is possible? The 90% requirement is tied to the assumption that the channel is idle, and that the -82dBm preamble is affected only by the effective noise floor, -95dBm or so; matters may be quite different when there's also an ongoing PPDU at -81dBm. If the answer is "no" (channel is not idle, so only energy detect applies), then the requirement should be achievable; but in that case it seems likely we will experience more collisions (new STAs keep piling on until -62dBm is exceeded for all the rest). And that interpretation seems at odds with the extended description in the immediately preceding section, which envisions multiple inter-BSS PPDUs piled up on one another. The draft should spell out which is the correct interpretation, and what is then required, and not leave implementers to guess. The proposed change provides one way of doing this. [NOTE--For some purposes it can be important to know if a device is a compliant implementation, i.e., strictly follows the letter of all applicable rules, so we should not impose a requirement that we are not sure can be met. The proposed change addresses this by retaining preamble detect for the resumed EDCAF procedures, but with a "should" instead of a "shall". Unfortunately the preamble detect operation would then operate on an "honor code" basis. Feel free to develop a better solution.] | Add at the end of the subclause "For purposes of the resumed EDCAF procedures, the channel shall not be considered "otherwise idle" for the signaled duration of the inter-BSS PPDU"; for purposes of the resumed EDCAF procedures, the HE STA should detect the beginning of a PPDU at a received power level of -82dBm or greater within aCCATime with probability at least 90%." | Reject – the issue raised here is not specific to spatial reuse operation. The CCA rules are defined as a test in a scenario where the channel is idle. When not in such scenario of idle channel, the spec does not define any tests for it. |
| 15707 | 27.9.2.2 | 347.12 | There are three instances of spatial reuse based on received power level. 1. P347.12 "the received signal strength measured based on the non-HE portion of the HE PPDU preamble and captured in the RXVECTOR parameter RSSI\_LEGACY", 2.P348.2 "the received signal strength measured based on the non-HE portion of the HE PPDU preamble", 3. P354.14 "The value of RPL is the received power level of the legacy portion of the SRP PPDU". Use a consistent description/name for the received power level in three instances. | Use a consistent description/name for the received power level in three instances cited. | Revised – agree with the commenter. Apply the changes as proposed in doc 1495r3. |
| 15709 | 27.9.2.4 | 349.15 | Please clarify TX\_PWR in the case of a MIMO transmision "TXPWR is the STA transmission power in dBm at the output of the antenna connector." | Please clarify. | Reject – the definition of antenna connector is clarifying this point already in the specification. |
| 15713 | 27.9.2.4 | 349.55 | "Not applicable if theSpatial Reuse ParameterSet element is notreceived" for the case of AP, it shall be "Not applicable if theSpatial Reuse ParameterSet element is nottransmitted." | Please include conditions for AP as well | Revised – agree with the commenter. Clarify that the table is only for a non-AP STA. Apply the changes as proposed in doc 1495r3. |
| 15714 | 27.9.2.4 | 351.60 | Change "OBSS\_PDmax ΓëÑOBSS\_PDlevel >OBSS\_Pdmin" to " OBSS\_PDlevel > OBSS\_Pdmin" because first part of condition is already specified in Equation 27-4, no need to repeat here. | as described | Reject – there is redundancy indeed, but this helps the understanding. |
| 15715 | 27.9.2.5 | 352.61 | In Example shown in Figure 27-10, please clarify that a STA might choose to maintain the same OBSS\_PDlevel with the same TX\_PWRmax1 and not ignore the PPDU from D1. Same situation as receiving PPDU from S1' and D1'. | as described | Revised – agree with the commenter. Add some words about this in the example description. Apply the changes as proposed in doc 1495r3. |
| 16759 | 27.9.4 | 340.50 | "Highest NSS Supported M1 subfield in the Supported HE-MCS and NSS Set field of its HE Capabilities element field". There is no Highest NSS Supported M1 subfield. | Update text | Revised – agree with the commenter. The same behaviour should be by using the support for transmitting 3 SSs or not. Apply the changes as proposed in doc 1495r3. |
| 16760 | 27.9.4 | 340.53 | "Highest NSS Supported M1 subfield in the Supported HE-MCS and NSS Set field of its HE Capabilities element field". There is no Highest NSS Supported M1 subfield. | Update text | Revised – agree with the commenter. The same behaviour should be by using the support for transmitting 3 SSs or not. Apply the changes as proposed in doc 1495r3. |
| 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. | Revised – Propose to forbid Class B devices to use spatial reuse. Apply the changes as proposed 1495r4 |
| 16936 | 27.2.3 | 255.07 | The sentences "Each HE STAshall set the value of SRG OBSS PD Min and SRG OBSS PD Max offsets to dot11SRGAPOBSSPDMin-Offset and dot11SRGAPOBSSPDMaxOffset, respectively. An HE AP may transmit SRG OBSS PD Minand SRG OBSS PD Max offset values that are different from the ones that it uses." don't seem to be long in the section of SRG PPDU identification, but rather in the spatial reuse section. | move the sentences to the spatial reuse section | Revise – TGax editor to make changes as shown in 11-18/1495r4 that are marked with CID 16936, which removes the sentences from this subclause and moves one to the spatial reuse subclause, noting that the other sentence is redundant to existing information in the SR sublcause. |
| 16935 | 27.2.3 | 255.05 | The sentence "An HE AP may use an SRG that is different from that which ithas transmitted to other STAs in Spatial Reuse Parameter Set elements to identify BSSs that are members ofthe AP's SRG to determine whether or not a received inter- BSS PPDU is an SRG PPDU." is very difficult to understand. Please rewrite in a more clear way. | Suggest to replace "An HE AP may use an SRG that is different from that which ithas transmitted to other STAs in Spatial Reuse Parameter Set elements to identify BSSs that are members of the AP's SRG to determine whether or not a received inter- BSS PPDU is an SRG PPDU." with "An HE AP may use an SRG different than that which it includes in Spatial Reuse Parameter Set elements transmitted to other STAs to determine whether a received inter- BSS PPDU is an SRG PPDU." | Revise – TGax editor to make changes as shown in 11-18/1410r1 that are marked with CID 16935, which makes a modification nearly identical to the one requested by the commenter. |

1. **Proposed changes**

***11ax Editor: Modify clause 9.4.2.241 Spatial reuse Parameter set element as below***

* Spatial Reuse Parameter Set element

The Spatial Reuse Parameter Set element provides information needed by STAs when performing OBSS PD-based spatial reuse(#11726) as defined in 27.9.2 (OBSS PD-based spatial reuse operation) and SRP-based spatial reuse as defined in 27.9.3 (SRP-based spatial reuse operation)(#14226). The format of the Spatial Reuse Parameter Set element is defined in Figure 9-589cx (Spatial Reuse Parameter Set element).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |
|  | 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 |
| * 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 9-589cy (SR Control field format).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5         B7 |
|  | SRP Disallowed | Non-SRG OBSS PD SR Disallowed(#11726) | Non-SRG Offset Present | SRG Information Present | HESIGA\_Spatial\_reuse\_value15\_allowed | Reserved |
| Bits: | 1 | 1 | 1 | 1 | 1 | 3 |
| * 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 SRP Disallowed subfield also affects the value of the SPATIAL\_REUSE parameter of the TXVECTOR as described in 27.11.6 (SPATIAL\_REUSE).(#11548)

The Non-SRG OBSS PD SR Disallowed subfield(#11726) in the SR Control field indicates whether non-SRG OBSS PD SR transmissions(#11726) are allowed or not at non-AP STAs that are associated with the AP that transmitted this element. Non-SRG OBSS PD SR transmissions(#11726) are disallowed when the Non-SRG OBSS PD SR Disallowed subfield(#11549)(#11726) has the value 1. Non-SRG OBSS PD SR transmissions(#11726) are allowed when the Non-SRG OBSS PD SR Disallowed subfield(#11726) 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(#12706), 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 HESIGA\_Spatial\_reuse\_value15\_allowed subfield in the SR Control field indicates whether non-AP STAs that are associated with the AP that transmitted this element may set the TXVECTOR parameter SPATIAL\_REUSE to SRP\_AND\_NON\_SRG\_OBSS\_PD\_PROHIBITED.(#11470, #12606, #14227) The subfield has the value of 0 or 1 and the interpretation of each of these values is described in 27.11.6 (SPATIAL\_REUSE).(#11550)

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(#12707) is not present. The SRG OBSS PD Max Offset subfield(#12707) 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 64 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 bit in the bitmap that corresponds to the BSS color value 0 is reserved. (#15898, #16499, #15702)

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 26 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.

**27.2.3 SRG PPDU identification**

***TGax editor: modify the text as shown:***

A non-AP 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. An HE AP may use an SRG that is different from that the one which it transmits to other STAs in Spatial Reuse Parameter Set elements to determine whether or not a received inter- BSS PPDU is an SRG PPDU. **(#16935) (#16936)**

***11ax Editor: Modify clause 27.9 Spatial reuse operation 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

 (#15655)A 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).

Class B device as defined in 28.3.14.3 (Pre correction accuracy requirements) shall not operate with the procedures defined in this subclause. (#16411)

* OBSS PD-based spatial reuse(#11726) operation
* General

OBSS PD-based spatial reuse(#11726) operation comprises two types of operation. The first type is defined in 27.9.2.2 (General operation with non-SRG OBSS PD level), and allows a STA, under specific conditions, to ignore an inter-BSS PPDU using a Non-SRG OBSS PD level(#11726). The second type is defined in 27.9.2.3 (General operation with SRG OBSS PD level) and allows a STA, under specific conditions, to ignore inter-BSS PPDUs that are identified as being SRG PPDUs, using an SRG OBSS PD level(#11726). (#15656, #17127) In addition to these differences between the two types, Non-SRG OBSS PD Min offset is fixed and defined in the specification while the SRG OBSS PD Min offset can be defined by the AP. (#15739, #15740) A STA may operate using one of the two modes or neither mode, or both modes simultaneously. (#15847)

* General operation with non-SRG OBSS PD level(#11726)

If the PHY of a STA issues a PHY-CCA.indication with a value equal to BUSY followed by a PHY-RXSTART.indication due to a PPDU reception then the STA’s MAC sublayer may a) issue a PHY-CCARESET.request primitive before the end of the PPDU and not update its basic NAV timer based on the PPDU or may b) not update its basic NAV timer based on the PPDU if all the following conditions are met:(#13062)

* The STA has not set the TXVECTOR parameter SPATIAL\_REUSE to the value SRP\_AND\_NON\_SRG\_OBSS\_PD\_PROHIBITED in any HE PPDU it has transmitted in the current beacon period and in the previous beacon period. (#15741)
* The most recently received Spatial Reuse Parameter Set element from its associated AP had the Non-SRG OBSS PD SR Disallowed subfield(#11726) equal to 0 or the non-AP STA has not received a Spatial Reuse Parameter Set element from its associated AP or the STA is an AP and its most recently transmitted Spatial Reuse Parameter Set element had the Non-SRG OBSS PD SR Disallowed subfield(#11726) equal to 0 or the STA is an AP and has not transmitted a Spatial Reuse Parameter Set element.(#12429)
* The received PPDU is an inter-BSS PPDU (see 27.2.2 (Intra-BSS and inter-BSS frame determination)) and the received PPDU is not a non-HT PPDU carrying a response frame (Ack, BlockAck or CTS frame), or the received PPDU contains 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 an inter-BSS PPDU that contained an RTS that was ignored following this procedure.
* The SPATIAL\_REUSE subfield in the HE-SIG-A (if present) of the received PPDU is not set to SRP\_ AND\_NON\_SRG\_OBSS\_PD\_PROHIBITED.
* The received signal strength level measured, which is measured from the L-STF, L-LTF or L-SIG of the PPDU and which is used to determine PHY-CCA.indication,(#12716) is below the non-SRG OBSS PD level(#11726). The non-SRG OBSS PD level(#11726) is defined in 27.9.2.4 (Adjustment of OBSS PD and transmit power). If the STA has dot11HESRPOptionImplemented set to true, it also follows the rules defined in 27.9.4 (Interaction of OBSS PD and SRP-based spatial reuse) to determine Non-SRG OBSS PD level(#11726).(#12188)
* The PPDU is not one of the following:
* A non-HE PPDU that carries a frame where the RA field is equal to the STA MAC address
* A non-HE PPDU that carries a Public Action frame (#17076)
* A non-HE PPDU that carries an NDP Announcement frame or FTM frame
* An NDP

If the inter-BSS frame is carried in an HE ER SU PPDU (where power of the L-STF/L-LTF symbols is boosted 3 dB), the received signal strength measured based on the non-HE portion of the HE PPDU 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.

The PHY-CCARESET.request primitive shall be issued at the end of the PPDU if the PPDU is an HE SU PPDU or an HE ER SU PPDU and the RXVECTOR parameter SPATIAL\_REUSE indicates SR\_DELAY.

NOTE—If an AP wants to get the protection equivalent to SR\_DELAY, when transmitting a Trigger frame in non-HE format, it might not transmit the Trigger frame in a VHT PPDU, but in a non-HT or in an HT PPDU with the TXVECTOR parameter AGGREGATION set to 0.(#11736)

If the PHY-CCARESET.request primitive is issued before the end of the received PPDU, and a TXOP is initiated within the duration of the received PPDU, then the TXOP and the duration of the transmitted PPDU within that TXOP shall be limited to the duration of the received PPDU if the received PPDU is an HE MU PPDU and the RXVECTOR parameter SPATIAL\_REUSE indicates SR\_RESTRICTED.(#14278)

NOTE—The restriction, in addition to the TXOP limit, of the PPDU duration within the TXOP is included in the above paragraph related to SR\_RESTRICTED as there are conditions where the TXOP limit can be exceeded (see 10.22.2.8 TXOP limits).(#14278)

A STA that ignores a PPDU following the procedure described in this subclause is deemed to perform non-SRG OBSS PD-based spatial reuse.

* General operation with SRG OBSS PD level(#11726)

If the PHY of a STA issues a PHY-CCA.indication with a value equal to BUSY followed by a PHY-RXSTART.indication due to a PPDU reception then the STA's MAC sublayer may a) issue a PHY-CCARESET.request primitive before the end of the PPDU and not update its basic NAV timer based on the PPDU or may b) not update its basic NAV timer based on the PPDU if all the following conditions are met:(#13062)(#13931)

* The received PPDU is an SRG PPDU (see 27.2.3 (SRG PPDU identification)
* The received signal strength level, which is measured from the L-STF, L-LTF or L-SIG of the PPDU and which is used to determine PHY-CCA.indication,(#12716) is below the SRG OBSS PD level(#11726). The SRG OBSS PD level(#11726) is defined in 27.9.2.4 (Adjustment of OBSS PD and transmit power). If the STA has dot11HESRPOptionImplemented set to true, it also follows the rules defined in 27.9.4 (Interaction of OBSS PD and SRP-based spatial reuse) to determine SRG OBSS PD level(#11726).(#12189)
* The PPDU is not one of the following:
* A non-HE PPDU that carries a frame where the RA field is equal to the STA MAC address
* A non-HE PPDU that carries a Public Action frame(#12080) (#17076)
* A non-HE PPDU that carries an NDP Announcement frame or an FTM frame
* An NDP

If the inter-BSS frame is carried in an HE ER SU PPDU (where power of the L-STF/L-LTF symbols is boosted 3 dB), the received signal strength measured based on the non-HE portion of the HE PPDU preamble shall be decreased by 3 dB to compensate for the power boost factor when compared to the OBSS PD level.

The PHY-CCARESET.request primitive shall be issued at the end of the PPDU if the PPDU is an HE SU PPDU or an HE ER SU PPDU and the RXVECTOR parameter SPATIAL\_REUSE indicates SR\_DELAY.

NOTE—If an AP wants to get the protection equivalent to SR\_DELAY, when transmitting a Trigger frame(#14290) in non-HE format, it might not transmit the Trigger frame(#14290) in a VHT PPDU, but in a non-HT or in an HT PPDU with the TXVECTOR parameter AGGREGATION set to 0.(#11736)

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

NOTE—The restriction, in addition to the TXOP limit, of the PPDU duration within the TXOP is included in the above paragraph related to SR\_RESTRICTED as there are conditions where the TXOP limit can be exceeded (see 10.22.2.8 TXOP limits).

* Adjustment of OBSS PD(#11726) and transmit power

When using OBSS PD-based spatial reuse(#11726), an HE STA shall maintain an OBSS\_PD level and may adjust this OBSS PD level(#11726) in conjunction with its transmit power and this adjustment shall be made in accordance with Equation (27-4). (#16513, #16514)(#11774, #11776)

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The adjustment rule is illustrated in Figure 27-9 (Illustration of the adjustment rules for OBSS PD and TX\_PWR).

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| --- |
|  |
|  |
| * Illustration of the adjustment rules for OBSS PD(#11726) and TX\_PWR (#15744, #16758)
 |

The value of the *OBSS\_PDlevel* is applicable to the start of a 20 MHz PPDU received on the primary 20 MHz channel. If the bandwidth of the received PPDU differs from 20 MHz, then the value of the *OBSS\_PDlevel* is increased by 10 log (bandwidth/20 MHz), using the bandwidth in MHz indicated by the value of RXVECTOR parameter CH\_BANDWIDTH or CH\_BANDWIDTH\_IN\_NON\_HT when present.(#13932)

*TXPWRref* = 21 dBm for non-AP STAs.

*TXPWRref* = 21 dBm for an AP with the Max HE-MCS For 3 SS subfield in the Tx HE-MCS Map ≤ 80 MHz subfield in the Supported HE-MCS and NSS Set field of its HE Capabilities element field set to a value equal to 3.

*TXPWRref* = 25 dBm for an AP with the Max HE-MCS For 3 SS subfield in the Tx HE-MCS Map ≤ 80 MHz subfield in the Supported HE-MCS and NSS Set field of its HE Capabilities element field set to a value not equal to 3. (#16037, #16226, #16464)

*TXPWR* is the STA transmission power in dBm at the output of the antenna connector, which is set following the rules defined in subclause 11.8.6 (Transmit power selection) and, for transmission of HE TB PPDU, following also the rules defined in subclause 28.3.14.2 (Power pre-correction) (#16512)

Note – The TxPWRref is 4 dB higher for APs with more than 2 spatial streams as those APs typically have higher transmit power than other devices, and as the OBSS\_PD procedure is based on a relative reduction of power. (#15657)

An AP may define SRG OBSS PD Min Offset and SRG OBSS PD Max Offset values that are used by its associated STAs to derive an SRG OBSS PD level(#11726) for determining reception behavior 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 to derive a non-SRG OBSS PD level(#11726) for determining reception behavior 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:

* 82 dBm  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
* (#11938)Non-SRG OBSS PD Max Offset 82 dBm  62 dBm

HE STAs shall maintain a non-SRG OBSS PD level(#11726), with its value selected by respecting the OBSS PD level(#11726) condition in Equation (27-4) but with Non-SRG OBSS PD Min and Non-SRG OBSS PD Max in place of OBSS\_PDmin and OBSS\_PDmax, respectively. Non-AP HE STAs shall determine Non-SRG OBSS PD Min and Non-SRG OBSS PD Max according to Table 27-10 (Determining Non-SRG OBSS PD Min and Non-SRG OBSS PD Max values). HE APs shall set Non-SRG OBSS PD Min and Non-SRG OBSS PD Max to -82 dBm and to -82 dBm + dot11NonSRGAPOBSSPDMaxOffset respectively. (#15713, #16936)

|  |
| --- |
| * Determining Non-SRG OBSS PD Min and Non-SRG OBSS PD Max values(#14283, #11555) by Non-AP STAs
 |
| Non-SRG OBSS PD SR Disallowed field in Spatial Reuse Parameter Set element | Non-SRG Offset Present field in Spatial Reuse Parameter Set element | Value of Non-SRG OBSS PD Min | Value of Non-SRG OBSS PD Max |
| Not applicable if the Spatial Reuse Parameter Set element is not received.  | Not applicable if the Spatial Reuse Parameter Set element is not received.  | 82 | 62 |
| 0 | 0 | 82 | 62 |
| 0 | 1 | 82 | 82 + Non-SRG OBSS PD Max Offset |
| 1 | N/A | 82 | -82 |

HE STAs shall maintain a SRG OBSS PD level(#11726), with its value selected by respecting the OBSS PD level(#11726) condition in Equation (27-4) but with SRG OBSS PD Min and SRG OBSS PD Max in place of OBSS\_PDmin and OBSS\_PDmax, respectively. Non-AP HE STAs shall determine SRG OBSS PD Min and SRG OBSS PD Max according to Table 27-11 (Determining SRG OBSS PD Min and SRG OBSS PD Max values). HE APs shall set SRG OBSS PD Min and SRG OBSS PD Max to -82dBm + dot11SRGAPOBSSPDMinOffset and -82dBm + dot11SRGAPOBSSPDMaxOffset. HE APs may transmit SRG OBSS PD Min and SRG OBSS PD Max offset values that are different from the ones that it uses. **(#16936)**

 (#16936)

|  |
| --- |
| * Determining SRG OBSS PD Min and SRG OBSS PD Max values
 |
| SRG Information Present field in Spatial Reuse Parameter Set element | Value of SRG OBSS PD Min | Value of SRG OBSS PD Max |
| Not applicable if the Spatial Reuse Parameter Set element is not received | N/Asee NOTE | N/Asee NOTE |
| 0 | N/Asee NOTE | N/Asee NOTE |
| 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. |

(#14284)The Spatial Reuse Parameter Set element is optionally present in Beacons, Probe Responses and (Re)Association responses.

* OBSS PD(#11726) SR transmit power restriction period

If a STA ignores an inter-BSS PPDU following the procedure in 27.9.2.3 (General operation with SRG OBSS PD level), using a chosen SRG OBSS PD level(#11726), or following the procedure in 27.9.2.2 (General operation with non-SRG OBSS PD level) using a chosen non-SRG OBSS PD level(#11726), then the STA(#11780) shall start an OBSS PD(#11726) SR transmit power restriction period. 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.

If a STA starts an OBSS PD(#11726) SR transmit power restriction period with a chosen non-SRG OBSS PD level(#11726), the STA’s transmit 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 PD level(#11726) with Equation (27-5), with the appropriate non-SRG parameters according to Table 27-10 (Determining Non-SRG OBSS PD Min and Non-SRG OBSS PD Max values), for the transmissions of any PPDU (including an HE TB PPDU, except when the HE TB PPDU is triggered by a Trigger frame having the CS Required subfield set to 0) until the end of the OBSS PD(#11726) SR transmit power restriction period.

If a STA starts an OBSS PD(#11726) SR transmit power restriction period with a chosen SRG OBSS PD level(#11726), the STA’s transmit power as measured at the output of the antenna connector, shall be equal or lower than the *TXPWRmax*, calculated with this chosen SRG OBSS PD level(#11726) with Equation (27-5), 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 (including an HE TB PPDU, except when the HE TB PPDU is a response to a Trigger frame with CS Required subfield equal to 0) until the end of the OBSS PD(#11726) SR transmit power restriction period.(17/1852r8)

A STA may have multiple ongoing OBSS PD(#11726) SR transmit power restriction periods that overlap in time. (#15746)

(#11812)NOTE 1—The STA’s transmit power is always equal or lower than the minimum *TXPWRmax* among all *TXPWRmax* from ongoing OBSS PD(#11726) SR transmit power restriction periods.

*

NOTE 2—Equation (27-5) is equivalent to the condition defined in Equation (27-4). The STA can derive its OBSS\_PD level value from its transmit power or can derive its TXPWRmax from the chosen OBSS\_PD level. (#16516)

NOTE 3—Anytime, even if *TXPWRmax* is unconstrained, the STA has to respect the transmit power restrictions defined by 11.8.6 Transmit power selection.

An example of OBSS PD(#11726) SR operation is shown in Figure 27-10 (Example of OBSS PD SR operation).

|  |
| --- |
|  |
| * Example of OBSS PD(#11726) SR operation(#12070)
 |

In this example:

* STA SR S2 receives the PPDU from S1 and, when it classifies it as inter-BSS PPDU, ignores it using OBSS PD-based spatial reuse(#11726) with non-SRG OBSS PD(#11726), starts the OBSS PD(#11726) SR transmit power restriction period 1 with TX\_PWRmax 1 and decrements its backoff counter until the reception of the PPDU from D1.
* When it classifies the PPDU from D1 as inter-BSS PPDU, it ignores it if it chooses to do so using OBSS PD-based spatial reuse(#11726) with non-SRG OBSS PD(#11726), starts the OBSS PD(#11726) SR transmit power restriction period 2 with TX\_PWRmax 2 and decrements its backoff counter until the reception of the PPDU from S1''. (#15715)
* It defers during the TxOP S1'' set by the intra-BSS PPDU from S1'' which belongs to its own BSS. At the end of the TxOP S1'', it resumes its backoff decrement until the reception of the PPDU from S1'.
* When it classifies the PPDU from S1' as SRG PPDU, it ignores it if it chooses to do so using OBSS PD-based spatial reuse(#11726) with SRG OBSS PD(#11726), starts the OBSS PD(#11726) SR transmit power restriction period 3 with TX\_PWRmax 3 and decrements its backoff counter until it reaches zero, as it does not receive the PPDU from D1'. (#15715)
* It starts transmitting a PPDU with a TX\_PWRmax equal to min(TX\_PWRmax 1, TX\_PWRmax 2, TX\_PWRmax 3) and respect this transmit power restriction until the end of the SR TXOP.(#13065, #13420)
* OBSS PD-based spatial reuse(#11726) backoff procedure

If an HE STA ignores an inter-BSS PPDU following the procedure in 27.9.2.2 (General operation with non-SRG OBSS PD level), the HE STA may resume EDCAF procedures after the PHY-CCARESET.request primitive is sent, provided that the medium condition is not otherwise indicated as BUSY.

***11ax Editor: Modify the following sentence in clause 27.9.3.2 SRP-based spatial reuse initiation as below***

**27.9.3.2 SRP-based spatial reuse initiation**

[…]

The value of RPL is the received power level of the legacy portion of the SRP PPDU, normalized to 20MHz bandwidth.

[…]

**TGax Editor: *Add two new MIB variables in C.3 MIB Detail within the dot11StationConfigEntry group as shown:***

**C.3 MIB Detail**

dot11SRGAPOBSSPDMinOffset OBJECT-TYPE **(#16936)**

SYNTAX Integer

UNITS “dBm”

MAX-ACCESS read-only

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 SRG OBSS PD Min Offset for an AP."

DEFVAL { 0 }

::= { dot11StationConfigEntry <XX>}

dot11SRGAPOBSSPDMaxOffset OBJECT-TYPE **(#16936)**

SYNTAX Integer

UNITS “dBm”

MAX-ACCESS read-only

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 SRG OBSS PD Max Offset for an AP."

DEFVAL { 0 }

::= { dot11StationConfigEntry <XX>}