IEEE P802.11
Wireless LANs

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| SRP-Based SR for HE Trigger-based PPDU – 27.9.3 |
| Date: 2017-02-23 |
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Abstract

This submission proposes resolutions for comments:

6178, 5043, 5873, 5940, 7117, 7174, 5385, 9508, 10040, 10039, 10080, 8094

5941, 7611, 5485, 5504, 8069, 8234, 7908, 8118

6760, 6020, 7116, 3195, 5482, 5680, 10194, 9760, 8068, 8231, 9730

8087, 8091, 8092

6115, 6127, 6143, 6142, 6842, 5872, 5871, 6845, 5942, 6843, 6844, 3600, 4997, 5259, 5260, 5261, 9462, 9180, 9181, 9183, 9208, 9209, 9210, 10043, 10041, 10415, 10414, 10413, 10412, 10409, 10407, 10406, 10306, 10305, 8568, 8920, 8907, 8908, 8914, 8909

From the letter ballot of TGax D1.0.

These comments are mostly on the topic of SRP Spatial Reuse.

The proposed changes on this document are based on TGax Draft 1.1.

**REVISION NOTES:**

**R0**:

initial

**R1:**

27.9.3

TSRP\_PPDU does not contain a common info field, reworded to reference HE PHY Header RXVECTOR field

SRP decision window is no longer applicable for DSRP\_PPDU

**27.9.3.4 SRP\_PPDU-based spatial reuse backoff procedure**

Added “plus interference”

25.12a TXVECTOR parameter SPATIAL\_REUSE

Added a definition for “Required SNR for the MCS to be used” which includes a “should”

**R2:**

Made header numbering consistent

27.9.3.1 DSRP

Changed the ignore condition to only if the color matches and the rxstart occurred within the timeout window

27.9.3.2 TSRP

Qualified the condition of a frame preceding the TSRP with a color match

Added the case when the preceding frame does not match the color of the TSRP

Use the review tab and change to “final showing markup” to see all changes

**R3:**

**27.9.3.4 SRP\_PPDU-based spatial reuse backoff procedure**

Time limit should be earliest, not shortest of durations

**25.12a TXVECTOR parameter SPATIAL\_REUSE**

Allow SR\_DISALLOW in any ppdu

**R4:**

ADD CID 64 and 2911

**R5:**

**27.9.3.3 SRP\_PPDU-based spatial reuse backoff procedure**

Expand the TX Power restriction for TX Power to ALL PPDUs transmitted during the SRP opportunity. For example, a CTS or BA or other response PPDU.

**25.12a TXVECTOR parameter SPATIAL\_REUSE**

Remove the last sentence regarding a requirement to set SRP to SR\_DISALLOW – it applied to HE SU and HE ER PPDU which are not included in SRP operation

**R6:**

**25.12a TXVECTOR parameter SPATIAL\_REUSE**

Fixed this subclause to correctly refer to Trigger-based PPDU and to state that transmitters of Trigger-based PPDUs fill in SRP field of SIGA by using Trigger Common info SR field information

Modified condition for non-trigger PPDU TXVEC SR parameter value setting

**R7:**

**Fix resolution box document references – they had said 1476r4 – now updated to 1476r7**

Fix CID number of first CID – it was 944, it is now 994

**R8:**

Add SRP types:

ULSRP\_PPDU = Uplink SRP PPDU and associated opportunity description

DLSRP\_PPDU = Downlink SRP PPDU and associated opportunity description – SRP opportunity limited to use by an AP

Update text to D1.0

Add A-control for SRP condition indication – i.e. “this is an SR PPDU so you need to check SRP before you can send your acknowledgement” - plus associated rules for the recipient of such a PPDU, plus an HE Cap bit to indicate that a STA supports this functionality and therefore is a suitable candidate for reception of an SR PPDU

Add language to 27.9.3.5 SRP\_PPDU-based spatial reuse backoff procedure

Add new subclause 27.9.4 which clarifies the intereaction of SRP and OBSS\_PD

**R9:**

27.9.2.1 – the text that was shown here is deleted (not all of this subclause was deleted, but only two paragraphs of the subclause) – this subclause refers to OBSS\_PD operation, and therefore, should not mention the SRP parameter value in a received PPDU – that is SRP operation. Similar language to that which is now deleted does exist in 27.9.3, but not exactly similar, since some of the language in the stricken 27.9.2.1 was simply incorrect.

**R10:**

27.9.3 – added SR\_DELAY into a few term definitions – see next change for explanation

27.11.6 – added: An HE STA that transmits a PPDU that contains a Trigger MPDU should set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DELAY. – note that the effect of using the value SR\_DELAY is to communicate to a receiver that the MPDU inside of the PPDU contains a trigger which then contains a common info field which contains explicit SRP parameter values for the upcoming trigger-based PPDU that follows this PPDU. By using SR\_DELAY, the trigger transmitter can help to avoid having a trigger PPDU being discarded due to OBSS PD which would then jeopardize the reception of the following trigger-based PPDU(s)

28.3.10.7.2 – HE SIGA parameter table entry – modified SR\_DELAY language as per above comment

28.3.10.7.2 – HE SIGA supplemental table of SRP parameter values – changed RESERVED value 15 to be SR\_DELAY

27.9.4 – adjusted the language to include SR\_DELAY and fixed an error in the last paragraph

Various cleanup, e.g. bad references to 25. Instead of 27., 2.a and 2.b swapped, extra mention of common info field in TSRP\_PPDU case

27.9.3.3 ULSRP\_PPDU – allow use of minimum receiver sensitivity if no beacon record exists

**R11:**

27.11.6 – added the following sentence:

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

**R12:**

27.11.6 – removed redundant text on SRP Field contents, changed “AP” to STA

**R13:**

27.9.3 – add the sentence: An AP sending a trigger frame shall not set the SR field in the Common Info field of the trigger frame to SR\_DELAY

**R14:**

27.11.6 – modify the SRP parameter equation – the one that was here was a copy of the value for the Trigger common info field, but needs to be modified for the non-Trigger case

**R15:**

**27.9.3.2 TSRP\_PPDU** – add an allowance to ignore a NAV set by the PPDU preceding the TSRP\_PPDU if the color matches

**27.11.6 SPATIAL\_REUSE –** revert to D1.0 concept of allowing SR\_RESTRICTED only for a Trigger

Table 28-16 – slight change to wording of SR\_DELAY and addition of SR\_RESTRICTED – now says that SR\_DELAY and SR\_RESTRICTED indicate that a Trigger is present

**R16:**

Add CID table with proposed resolutions

Add CID indications within text.

**27.9.1 -** Modification to this subclause is new – the text restricts transmission of SR PPDU to SR Responder capable STA.

Table 28-19 Spatial Reuse subfield encoding – change the -26 dBm value to SR\_RESTRICTED and change the -26 dBm value from = to >=

**R17:**

Add CIDs from Ron

Table 28-19 – modify the text below the table to correspond to the changes in the table (i.e. >= -26 changes to >= -29)

**DLSRP\_PPDU definition:** added limitation of one user for MU case

**27.9.3.2 TSRP\_PPDU-based spatial reuse initiation:** item 3.a changed “minimum receive sensitivity” to max energy detected as shown:

R16 language:

* 1. equal to the minimum receiver sensitivity of the STA, normalized to 20MHz if condition 2.a. is true

R17 language:

* 1. equal to the maximum level of the energy received by the STA during the SRP Decision Window using an averaging window of 4 usec, normalized to 20MHz if condition 2.a. is true

**27.9.3.3 ULSRP\_PPDU-based spatial reuse initiation:** added condition 2 – which allows ULSRP-based SRP transmission if the medium is IDLE or BUSY with a same color PPDU or CTS/BA/ACK preceding the ULSRP\_PPDU (language very parallel to the TSRP\_PPDU case)

**27.9.3.4 DLSRP\_PPDU-based spatial reuse initiation:** changed from idle must be sensed with NAV=0 preceding the DLSRP\_PPDU to must detect CTS, BA or ACK immediately preceding the DLSRP\_PPDU – this leads to a change of the interference path power calculation from using:

the highest receive power level of all same color PPDU observed in previous 500 ms of wake state time

to:

the received power level of the received CTS

**27.11.6 Spatial Reuse parameter of TXVECTOR** –

1) added a paragraph near the top of the subclause to note how the spatial reuse parameter works when it is an array for the trigger-based PPDU

2) modified text in SRP\_VALUE calculation section to clarify, but no technical change made, also added a diagram

**28.3.10.7.2 Content** – fixed table entries for SIGA Spatial Reuse fields – technical changes are all for clarification, with no real change in the unstated intent of the previous language

**28.3.10.7.2 Content – Table 28-19** (Spatial reuse subfield encoding, i.e. in SIGA) – changes to this table are new based on the addition of the set of CIDs from Ron P.

**28.3.10.7.2 Content – Table 28-19a** – the introduction of this table is new based on the addition of the set of CIDs from Ron P.

**28.3.10.7.2 Content –** added an instruction to delete all of the text below Table 28-19 since it is redundant to text in the MAC subclause that describes what values should be placed into the SPATIAL\_REUSE TXVECTOR parameter

**9.3.1.23 Trigger Frame format -** Removed BSS color addition to trigger frame common info field

**R18:**

Updated all CID resolution references from r16 to r18

**27.9.3.2 TSRP\_PPDU-based spatial reuse initiation:** item 2.b – removed the following qualifier:

and the RXVECTOR parameter BSS\_COLOR of the preceding PPDU that caused the BUSY to IDLE transition is the same as the RXVECTOR parameter BSS\_COLOR of the TSRP\_PPDU and the direction of the preceding PPDU is the opposite of the direction of the TSRP\_PPDU

The reason for removing this qualifier is that the probability of some non-sequential PPDU appearing at this time is low and the color requirement cannot be met when the trigger is present but is sent using legacy format and this is a valuable SRP opportunity that should not be ignored.

**R19:**

Updated all CID resolution references from r18 to r19

**REMOVED three of four cases so that only remaining case is DSRP\_PPDU**

**27.9.4 Interactin of OBSS\_PD and SRP-based spatial reuse**: (note that many subclauses are renumbered from r18) Added language to require SRP attempt if capable of SRP when SRP field in SIGA has value SR\_DELAY or SR\_RESTRICTED – this ensures that an SRP STA attempts to decode trigger frame SRP information instead of applying OBSS PD to the trigger frame as follows:

An HE STA with dot11HESRPOptionImplemented set to true that receives a PPDU that is identified as an Inter-BSS PPDU with a value equal to SR\_DELAY or SR\_RESTRICTED for the RXVECTOR parameter SPATIAL\_REUSE shall use a value of negative infinity for the OBSS\_PDlevel as it applies to this PPDU and shall use a value equal to the receive power of this PPDU minus 1 dB for the ED level for the duration of this PPDU.

**END OF REVISION NOTES**

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

**CIDs, by group**

**SRP DETAILS**

Each of these comments asks for a detailed description of behaviour for transmitters and receivers of the SRP field.

8118 moved to SR\_DELAY group

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| 6178 | Jin-Sam Kwak | 190.01 | 27.9 | We have the Spatial Reuse field in the HE-SIG-A and the well utilization of the field would be helpful. | Please define the SRP-based Spatial Reuse operation. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5043 | Chunyu Hu | 190.01 | 27.9 | The MAC operation of the SRP mechanism is not described. | Provide a description of the MAC protocol for the SRP spatial reuse parameter. Expect a submission detailing a set of proposed changes. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5873 | James June Wang | 192.27 | 27.9 | Missing description of SRP-based SR Operation (27.9.3) | Add description of SRP-based SR operation (27.9.3) | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5940 | James Yee | 274.07 | 28.3.10.7.2 | The spec provided two reference sections (27.9 and 27.11.6) for "SRP-based spatial reuse" but nothing about "SRP-based spatial reuse" can be found there. The definition of "SRP-based spatial reuse" is not clear | Please clarify. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 7117 | Junichi Iwatani | 190.13 | 27.9.1 | SRP-based spatial reuse (mentioned in 28.3.10.7.2) should be explained in 27.9.1 General and a new subclause (27.9.3) | as in comment | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 7174 | kaiying Lv | 190.01 | 27.9 | SRP-based spatial reuse operation needs to be described in details. | Please clarify it | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5385 | Geonjung Ko | 190.01 | 27.9 | Although the Spatial Reuse field is in the HE-SIG-A, the spec does not define the related operation. | The SRP-based Spatial Reuse operation should be defined. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 9508 | Yasuhiko Inoue | 81.40 | 9.4.2.218.3 | SRP-based SR Support:SRP-based SR is not defined. | Define the SRP-based SR in clause 3.2 and provide text in 27.9. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10040 | yujin noh | 274.12 | 28.3.10.7.2 | clarify SRP-based spatial reuse operation with a new sub-clause as 27.9.3. | As in the comment. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10039 | yujin noh | 274.06 | 28.3.10.7.2 | clarify SRP-based spatial reuse operation with a new sub-clause as 27.9.3. | As in the comment. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10080 | yujin noh | 190.01 | 27.9 | specify SRP-based SR mechanism with a new subclause 27.9.3. | As in the comment. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8094 | Matthew Fischer | 190.01 | 27.9 | The MAC operation of the SRP mechanism is not described. | Provide a description of the MAC protocol for the SRP spatial reuse parameter. Expect a submission detailing a set of proposed changes. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |

**SR DELAY**

Each of these comments asks for a detailed description of the use of the SR\_DELAY, SR\_DISALLOW, SR\_RESRTICTED and reserved values of the TXVECTOR/RXVECTOR parameter SPATIAL\_REUSE.

8118 reclassifed to belong to SR DELAY group

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| 5941 | James Yee | 274.12 | 28.3.10.7.2 | It is not clear what exactly the behavior of "SR\_Delay" is and more information should be provided in 27.9.2.1 and 27.11a. | Please clarify. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 7611 | Liwen Chu | 190.53 | 27.9.2.1 | Change "SR delay entry" to SR\_Delay | As in comment | Revise – generally agree with comment, text in question was deleted by adoption of changes in 11-16-0947r21 for CID 8111. |
| 5485 | Graham Smith | 190.37 | 27.9.2.1 | "...RXVECTOR parameter SPATIAL\_REUSE indicates SR\_Delay." What is SR\_Delay? At P274L13 it mentions it but then refers to this cited section and I note that "This section needs further development". Yes it does indeed, SR\_Delay needs to either dropped or defined. | I dread to say but whatever SR\_Delay is it needs to be explained.... or dropped. I just hope this is not another complicated scheme purely designed to avoid DSC. Delete cited text. | Revise – generally agree with idea that SR\_DELAY use was not sufficiently described, TGax editor shall incorporate changes in 11-16-1476r19, noting that the SR\_DELAY use as defined by those changes is used to identify the SRP PPDU type and the behaviors associated with each type. |
| 5504 | Graham Smith | 198.22 | 27.11.6 | "Spatial Reuse field is carried in the TXVECTOR parameter SPATIAL\_REUSE of an HE PPDU and indicates spatial reuse information (See 27.9.2 (OBSS\_PD-based spatial reuse operation))." I see no mention of SPATIAL\_REUSE in 27.9.2. Also SR\_Delay setting is sort of mentioned but not described anywhere, same with SR\_Restricted entry. It looks like this text precedes the acceptanceor description of the feature. Delete. | Delete 27.11.6 | Revise – agree that use of the Spatial Reuse field of the TXVECTOR was not well defined, rather than deleting the subclause, another subclause is added with the adoption of 11-16-1476r19 that defines behaviour associated with this field. TGax editor shall incorporate changes in 11-16-1476r19. |
| 8069 | Massinissa Lalam | 190.00 | 27.9.2.1 | "SR\_Delay" and "SR\_Restricted" values are not defined in this subclause. Please define them. | As in comment. | Revise – generally agree with comment, noting that the description of the use of SR\_RESTRICTED is both here and in the OBSS\_PD subclause, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8234 | Osama Aboulmagd | 190.37 | 27.9.1 | the term SR\_Delay seems to be introduced for the first time in this subclause without proper definition | define the term | Reject – it’s not a term, it’s a value of a parameter, defined elsewhere. |
| 7908 | Mark RISON | 190.52 | 27.9.2.1 | "carrying the SR delay entry" -- it is not clear what is meant by carrying an entry | Change to "not indicating SR\_Disallowed"; also at lines 55 and 56 | Revise – language changed or deteled, matching the spirit of the comment. TGax editor shall incorporate changes in 11-16-1476r19 |
| 8118 | Matthew Fischer | 274.06 | 28.3.10.7.2 | The Spatial Reuse field says that there are values SR\_DISALLOWED and SR\_DELAY and 14 other values and points to 27.9.2.1 General (within OBSS\_PD Spatial Reuse) and to what should be 27.11.6 Setting TXVECTOR parameters for an HE PPDU SPATIAL\_REUSE - but the table 28-19 Spatial Reuse subfield encoding indicates only SR\_DISALLOW, 14 numerical values and one reserved value. The table and the text in the various subclauses need to be reconciled. | As stated in the comment | Revise – generally agree with comment, noting that the description of the use of SR\_RESTRICTED is both here and in the OBSS\_PD subclause, TGax editor shall incorporate changes in 11-16-1476r19 |

**SR PPDU SR Mode**

Each of these comments asks for a description of SR PPDU and SR mode.

The SR mode comments are removed and sent to the owner of the OBSS\_PD thresholds CID group. Those comments were: 7125, 3197, 5689, 9541

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| 6760 | John Coffey | 190.11 | 27.9.1 | Use of undefined term: apparently when conditions are right for an "SR PPDU", an HE STA may go ahead and transmit an "SR PPDU". But what is an "SR PPDU"? The term appears nowhere in the draft except for this sentence. | Provide a definition for SR PPDU. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 6020 | Jarkko Kneckt | 190.10 | 27.9.1 | The SR PPDU is not defined. The following clauses do not use the term SR PPDU so the general introduction and the actual description text do not match. | Clarify the general spatial reuse operation. specify the term SR PPDU if ti is used by spatial reuse definition or delete the term. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 7116 | Junichi Iwatani | 190.11 | 27.9.1 | There is no definition for "SR PPDU" | Define "SR PPDU" or modify explanations | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 3195 | Ahmadreza Hedayat | 190.11 | 27.9.1 | SR PPDU is not defined: "When the conditions specified in 27.9 (Spatial reuse operation) are met that allow the transmission of an SR PPDU, an HE STA may transmit an SR PPDU to either an HE STA or a non-HE STA." | Define SR PPDU. Or change SR PPDU to PPDU since there seems "SR" indicates no attributes of the PPDU and rather the channel access method for which the PPDU is being sent. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5482 | Graham Smith | 190.10 | 27.9.1 | "When the conditions specified in 27.9 (Spatial reuse operation) are met that allow the transmission of an SR PPDU, an HE STA may transmit an SR PPDU to either an HE STA or a non-HE STA." What is an SR PPDU, it is only mentioned in this sentence. Delete, does not make sense. | Delete cited text | Revise – generally disagree with proposed resolution, but do agree with comment, rather than deleting, a definition of SR PPDU is provided. TGax editor shall incorporate changes in 11-16-1476r19 |
| 5680 | Guoqing Li | 190.12 | 27.9.1 | What is SR PPDU? The HE PHY does not define such an PPDU format. Seems to me, SR PPDU is a PPDU that can be initaited simultaneously using the SR mechiasm defined here which is otherwise not possible using legacy sensing mechanism. If so, this needs to be clarified since there is such PHY PPDU format called SR PPDU. | Either define SR PPDU, or clarify using different terminology. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10194 | Yusuke Asai | 190.11 | 27.9.1 | There is no definition of "SR PPDU." | Define it on Subclause 3.2 or delete it. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 9760 | Yoshio Urabe | 190.11 | 27.9.2.1 | SR PPDU' is not defined. | Define 'SR PPDU' in Section 3 | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8068 | Massinissa Lalam | 190.11 | 27.9.1 | An "SR PPDU" is not defined in the draft. Please consider replacing "When the conditions specified in 27.9 (Spatial reuse operation) are met that allow the transmission of an SR PPDU, an HE STA may transmit an SR PPDU to either an HE STA or a non-HE STA." with "When the conditions specified in 27.9 (Spatial reuse operation) are met that allow the transmission of a PPDU, an HE STA may transmit this PPDU, defined as Spatial Reuse (SR) PPDU, to either an HE STA or a non-HE STA." | As in comment. | Revise – generally agree with comment, but the resolution is to define the SR PPDU. TGax editor shall incorporate changes in 11-16-1476r19 |
| 8231 | Osama Aboulmagd | 190.11 | 27.9.1 | what does "SR PPDU" mean? | clarify | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 9730 | Yongho Seok | 190.11 | 27.9.1 | "When the conditions specified in 27.9 (Spatial reuse operation) are met that allow the transmission of an SR PPDU, an HE STA may transmit an SR PPDU to either an HE STA or a non-HE STA."What is a definition of a SR PPDU?Also, it is saying that an HE STA can transmit a SR PPDU to all STA (an HE STA or a non-HE STA). Such rule is not needed. | Delete the second paragraph of 27.9.1. | Revise – generally agree with comment about definition of SR PPDU, adding a definition of SR PPDU. The restriction as noted is not quite correct, modified to restrict to STA that are capable of acting as SR Responder. TGax editor shall incorporate changes in 11-16-1476r19 |

**From Laurent C.**

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| 8087 | Matthew Fischer | 190.1 | 27.9 | SRP is incomplete - need a control on the ACK response to an SR transmission - if the DATA frame was transmitted under SRP conditions, then the ACK should also obey the SRP conditions - but the ACK transmitter needs to know if the DATA frame was transmitted under SRP conditions because for a non-SRP generated DATA frame, the ACK has no conditions, and we do not want to impose new conditions on ACKing that were not in the baseline, except for the new case of a DATA frame sent under SRP conditions | Add a way for an SR transmitter using SRP to indicate to the recipient that its ACK must be conditionalized on SRP conditions - use A-control to tell the recipient that the DATA frame was transmitted under SRP conditions | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8091 | Matthew Fischer | 190.31 | 27.9.2.1 | What about the ACK that is transmitted in response to the SR PPDU? Does it have to obey any OBSS\_PD transmit power rules? | Add a restriction on the tx power of the response transmitter, such that the tx power has to be limited to whatever tx power is "in force" where "in force" means that if a STA has discarded an OBSS PPDU using OBSS\_PD and is counting backoff before transmitting an SR PPDU, then that tx power is "in force" for the duration of the OBSS PPDU that was discarded and if a reception occurs before the backoff countdown expires, then the response to that reception is restricted in its transmit power. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8092 | Matthew Fischer | 190.3 | 27.9.1 | What about the response transmission to a PPDU that was transmitted due to a spatial reuse opportunity? That response transmission should be restricted, such that it too, must ensure that it will not interfere with an ongoing exchange, using whatever SR technique is avilable at the response transmitter STA, with a preference for SRP if enabled and a fallback to OBSS\_PD if SRP is not enabled. Since a normal response is allowed to ignore all CCA indications, the responder needs to be able to tell the difference between a normal eliciting PPDU/MPDU and one an eliciting PPDU that was transmitted using SR of some sort. | Provide an indication within MPDUs of whether the MPDU was transmitted during an SR opportunity or not, and add a restriction on the response transmission to that SR PPDU transmission such that the response must examine the medium condition before responding and obey transmit power restrictions that might be in force due to ongoing SR conditions, e.g. OBSS\_PD based transmit power restriction. Expect a submission that details such changes. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |

**From Ron P.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 6115 | Jian Yu | 274.06 | 28.3.10.7.2 | Further develop the spatial reuse field, same for page 274, L6 and page 276 L40 | As in comment | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 6127 | Jing Ma | 86.18 | 9.4.2.218.3 | Clarify SRP-based SR operation described here which is supposed to indicated by this subfield. SRP-based SR operation description is not clear in the draft. | as the comment | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 6143 | Jing Ma |  | 28.3.10 | Clarify SRP-based spatial reuse operation. There are some indication bits in frames which are defined to set or disallow SRP-based spatial reuse operation, but SRP-based SR operation description is not clear in the draft. | as the comment | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 6142 | Jing Ma | 274.06 | 28.3.10.7.2 | Clarify SRP-based spatial reuse operation which is supposed to be disallowed by Spatial Reuse bits here. SRP-based SR operation description is not clear in the draft. | as the comment | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 6842 | John Coffey | 274.06 | 28.3.10.7.2 | Technical term used with incomplete or missing description: "SRP-based spatial reuse". The reference given is 27.9 but I don't find it there. | Either provide a definition for SRP-based spatial reuse or delete all mention of it from the draft. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5872 | James June Wang | 276.40 | 28.3.10.7.2 | In Spatial Reuse field, value 1 to 14 are missing | Use Set to value 1 to 14 corresponding to SRP value (see Table 28-19 (Spatial Reuse subfield encoding)) forSRP-based SR operation. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5871 | James June Wang | 274.06 | 28.3.10.7.2 | values 1 to 14 are missing in table for Spatial reuse | Use Set to value 1 to 14 corresponding to SRP value (see Table 28-19 (Spatial Reuse subfield encoding)) forSRP-based SR operation. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 6845 | John Coffey | 274.10 | 28.3.10.7.2 | "NOTE--This part needs further development." Well, yes! As an aside (though I think a relevant one) why does it need more development at this late stage? It must be connected with the complexity of the spatial reuse problem, which is on a vastly diffreent scale to the regular modes we consider. Adding a new 1024-QAM MCS or another power-save mode mostly affects individual links and so any problems are largely contained. Not so with spatial reuse, where everything affects everything else. A faulty spatial reuse mode or implementation could have disastrous consequences for other devices and BSSs, including the legacy installed base. We would be far better off to give this problem the respect it deserves by creating a new Task Group within 802.11 to consider it carefully, properly, and comprehensively. It can't be shoehorned into 802.11ax at this late stage. That's an aside because a letter ballot comment resolution can't properly consider that action, and a resolution can only cover what 11ax should so. So see proposed resolution. | Delete spatial reuse, of whatever variety, and all references to it in the draft. | Revise – agree with the part of the comment that notes that some behaviour is not defined, but disagree with the commenter’s proposed resolution and instead, propose an alternative solution which is in line with the vast majority of proposed resolutions from dozens of other commenters on the same topic, which resolution is to provide descriptive behavioural text to resolve the lack of completeness in the current draft, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5942 | James Yee | 282.29 | 28.3.10.7.2 | Definition of SRP, TX PWRAP and Acceptable Receiver Interference levelAP are not provided. | Please clarify. | Revise – generally agree with comment, except that the resolution is to move the text to 27.11.6 (SPATIAL\_REUSE) where the terms are now defined as suggested, TGax editor shall incorporate changes in 11-16-1476r19 |
| 6843 | John Coffey | 274.06 | 28.3.10.7.2 | Apparently there are two spatial reuse modes, OBSS\_PD and SRP-based. ("Apparently", because both are underdefined.) It is widely understood that having multiple different modes to accomplish the same objective is the kiss of death for all of them: cf. especially the 802.11n experience with beamforming. Having multiple modes works against the principles of standardization, reduces the chances of any one mode succeeding, and by tying up scarce Task Group resources delays the entire technology. | Either merge all spatial reuse functions into a single, unified, \*standardized\* mode, or delete them all from the draft. | Revise – the two modes of SR are distinct because of the difference in implementation complexity required and the varying estimations of the potential gains to be achieved by each of the mechanisms. The group has a long history of including multiple options and variations of a feature within an amendment based on the understanding that no individual has yet been identified who possesses the ability to foretell the future with enough accuracy to allow the one, true, correct, best variation of a feature to be selected while discarding all others, despite the fancy simulation tools and brilliant mathematical analysis that is usually performed to support each proposed variation and prove that it is the one true solution that will bring about world peace or higher throughput or whatever the PAR describes as the mission of this august body. Rather than merge or delete, the proposed resolution of this comment is to provide a more thorough description of the SRP SR mechanism. TGax editor shall incorporate changes in 11-16-1476r19 |
| 6844 | John Coffey | 274.06 | 28.3.10.7.2 | "Set to SR Disallowed to disallow SRP-based spatial reuse". Why restrict the disallowing only to SRP-based spatial reuse? The draft would be vastly improved if all spatial reuse can be disallowed, on a packet-by-packet basis. All types of spatial reuse, very much including OBSS\_PD, have the potential to make matters worse at the victim transmitter, yet the current draft allows only the interferer to make the decision about whether to use one form of spatial reuse. (Incidentally, if we won't even insist on protection of our own transmissions, we have no standing whatsoever to object to LAA, LTE-U, WiLDEbeeste, and all the others from talking all over Wi-Fi. Honour code for one, honour code for all.) What is the downside and why is this straightforward step resisted? There may be a fear that devices "set and forget" the switchoff bit. But in fact vendors are intensely competitive about performance, and if there are real gains to be achieved by switching the bit on and off, vendors have every incentive to find and use them | Delete "SRP-based". | Reject – the current sentence reflects the current super-majority opinion of the group. The AP of a BSS can disable the use of OBSS\_PD based SR within its BSS. |
| 3600 | Albert Petrick | 276.44 | 28.3.10.7.2 | Table 28-17 referencing B11-B14 Spatial Reuse suggests the need for more development. This is a place holder e.g., TBD. | Delete note in Table 28-17: NOTE: this part needs further development. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 4997 | Brian Hart | 274.10 | 28.3.10.7.2 | "This part needs further development" | This is a trivial rewording of "TBD" and so this draft should not have been submitted for LB. Continue to refine the draft to remove all TBDs and rewordings of TB | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5259 | Dorothy Stanley | 274.06 | 28.3.10.7.2 | What is the integer value or bit sequence for SR Disallowed? | as in comment | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5260 | Dorothy Stanley | 274.12 | 28.3.10.7.2 | What is the integer value or bit sequence for SR\_Delay? | as in comment | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 5261 | Dorothy Stanley | 276.46 | 28.3.10.7.2 | What is the integer value or bit sequence for SR\_Restricted? | as in comment | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 9462 | Xiaofei Wang | 274.10 | 28.3.10.7.2 | This note is another form of TBD and should not be in Draft 1.0. Either provide detailed procedures for SRP or remove entirely. | provide detailed procedure for SRP or remove entirely. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 9180 | SUNGEUN LEE | 274.07 | 28.3.10.7.2 | Specify the SRP-based spatial reuse methodology refered in Spatial Reuse field | Specify SRP-based spatial reuse for clarifying the meaning of SR Disallowed in Spatial Reuse field | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 9181 | SUNGEUN LEE | 274.10 | 28.3.10.7.2 | Complete Spatial Reuse field definition and usage for HE SU and HE extended range SU PPDUs | Complete Spatial Reuse field definition and usage for HE SU and HE extended range SU PPDUs and remove 'NOTE-This part needs further development' | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 9183 | SUNGEUN LEE | 276.44 | 28.3.10.7.2 | Complete Spatial Reuse field definition and usage for HE MU PPDU. | Complete Spatial Reuse field definition and usage for HE MU PPDU and remove 'NOTE-This part needs further development' | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 9208 | Thomas Handte | 274.10 | 28.3.10.7.2 | Signaling for spatial reuse needs further development | Specify signaling for spatial reuse. Equivalent specification as in Table 28-19 may be appropriate | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 9209 | Thomas Handte | 276.40 | 28.3.10.7.2 | Signaling for spatial reuse needs further development | Specify signaling for spatial reuse. Equivalent specification as in Table 28-19 may be appropriate | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 9210 | Thomas Handte | 279.23 | 28.3.10.7.2 | Spatial reuse fields labelled with 2, 3, and 4. In some BW setups, all or some of the fields have an identical and redundant value. | Consider declaring fields as reserved. This would affect spatial reuse fields 2, 3, and 4 and Note 1 | Revise – it seems difficult to justify declaring the fields as reserved for some cases, since doing so would only serve to allow a future use and that future use would be BW dependent. The description of the fields does need improvement. TGax editor shall incorporate changes in 11-16-1476r19 |
| 10043 | yujin noh | 276.41 | 28.3.10.7.2 | defind the rest values except for SR Disallowed and SR\_Restricted. | As in the comment. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10041 | yujin noh | 274.06 | 28.3.10.7.2 | defind the rest values except for SR Disallowed and SR\_Delay. | As in the comment. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10415 | Oghenekome Oteri | 280.46 | 28.3.10.7.2 | Set to value 1 to 14 corresponding to SRP value (seeTable 28-19 (Spatial Reuse subfield encoding)) forSRP-based SR operation. | Detailed description of SRP based SR needed  | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10414 | Oghenekome Oteri | 280.21 | 28.3.10.7.2 | Set to value 1 to 14 corresponding to SRP value (seeTable 28-19 (Spatial Reuse subfield encoding)) forSRP-based SR operation. | Detailed description of SRP based SR needed  | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10413 | Oghenekome Oteri | 279.40 | 28.3.10.7.2 | Set to value 1 to 14 corresponding to SRP value (seeTable 28-19 (Spatial Reuse subfield encoding)) forSRP-based SR operation. | Detailed description of SRP based SR needed  | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10412 | Oghenekome Oteri | 279.40 | 28.3.10.7.2 | Set to value 1 to 14 corresponding to SRP value (seeTable 28-19 (Spatial Reuse subfield encoding)) forSRP-based SR operation. | Detailed description of SRP based SR needed  | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10409 | Oghenekome Oteri | 276.47 | 28.3.10.7.2 | 27.11a(TXVECTOR parameters SPATIAL\_REUSE for anHE PPDU)). | wrong reference: 27.11.6 | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10407 | Oghenekome Oteri | 274.13 | 28.3.10.7.2 | 27.11a(TXVECTOR parameters SPATIAL\_REUSE for anHE PPDU)). | wrong reference: 27.11.6 | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10406 | Oghenekome Oteri | 274.10 | 28.3.10.7.2 | NOTE—This part needs further development. | Finalize SR schemes | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10306 | Yusuke Tanaka | 282.29 | 28.3.10.7.2 | The equation to define SRP is incorrect from the aspect of dBm unit. | Change SRP definition as follows."SRP is the sum of the value of TX PWRAP and the value of Acceptable Receiver Interference levelAP."Remove "dBm" from Table 28-19. | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 10305 | Yusuke Tanaka | 281.49 | 28.3.10.7.2 | Table 28-19 defines the Spatial Reuse subfield encoding but no procedures of SR operation based on SRP is defined in this spec. | Define procedures of SR operation based on SRP, which should include Tx power controlling not only for a Data frame and but Control frames (e.g. RTS/CTS/CF-End). | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8568 | ron porat | 274.06 | 28.3.10.7 | Spatial Reuse Field value definition lacks detail | Propose to adopt document 1476r8 to complete the definition of the SRP based spatial reuse feature | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8920 | Sigurd Schelstraete | 281.53 | 28.3.10.7.2 | The unit of SRP in Table 28-19 can not be dBm, given that it is a sum of two values expressed in dBm (which is similar to power squared in the linear domain) | Remove "dBm" from the rows of the Table | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8907 | Sigurd Schelstraete | 274.06 | 28.3.10.7.2 | What is the value of "SR Disallowed"? | Clarify | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8908 | Sigurd Schelstraete | 274.10 | 28.3.10.7.2 | "NOTE--This part needs further development." indicates that this feature is not sufficiently mature. | Consider decoupling SR from the remainder of the document. | Revise – not certain exactly what the proposed resolution means, but rather than “decoupling” the group describes in detail the behaviour for SRP-based spatial reuse in several new subclauses and modifies existing ones that mention SRP to provide a complete description of the SRP-based spatial reuse feature, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8914 | Sigurd Schelstraete | 276.46 | 28.3.10.7.2 | What is the value of "SR\_Restricted"? | Clarify | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |
| 8909 | Sigurd Schelstraete | 274.13 | 28.3.10.7.2 | What is the value of "SR\_Delay"? | Clarify | Revise – generally agree with comment, TGax editor shall incorporate changes in 11-16-1476r19 |

**Discussion:**

See the CID table.

**Proposed Changes to Draft Text of TGax D1.1:**

**3.2 Definitions specific to IEEE 802.11**

***TGax editor: insert the following definitions into subclause 3.2 Definitions specific to IEEE 802.11:***

**DSRP\_PPDU (Delayed SRP\_PPDU)**: a PPDU that contains a valid Trigger MPDU and that has a value other than SR\_DISALLOW in the Common Info Field SPATIAL\_REUSE. (Delayed SRP PPDU). **(#6178)(#5043)(#5873)(#5940)(#7117)(#7174)(#5385)(#9508)(#10040)(#10039)(#10080)(#8094)**

**SR\_PPDU:** a PPDU transmitted during an SRP Opportunity by an HE STA when SRP conditions for SRP-based spatial reuse operation are satisfied. **(#6760)(#6020)(#7116)(#3195)(#5482)(#5680)(#10194)(#9760)(#8068)(#8231)(#9730)**

***TGax editor: change subclause 3.2 Definitions specific to IEEE 802.11 as shown:***

**SRP PPDU:** a PPDU that is a DSRP\_PPDU(#9508)

***TGax editor: insert a new subclause 27.9.3 SRP-based spatial reuse operation and dependent subclauses as follows:***

**27.9.3 SRP-based spatial reuse operation**

**(#6178)(#5043)(#5873)(#5940)(#7117)(#7174)(#5385)(#9508)(#10040)(#10039)(#10080)**

**(#8094)(#5504)(#6845)(#6115)(#6127)(#6143)(#6142)(#6842)(#6843)(#4997) (#9462) (#9180)**

**(#9183)(#9209)(#10412) (#10413) (#10414) (#10415)(#10406)(#10305)(#8568)(\*8914)(#8909)**

SRP-based SR Opportunities are identified from the value of the RXVECTOR parameter SPATIAL\_REUSE and/or the contents of a Trigger MPDU. An HE STA is allowed to initiate an SR transmission during an SRP-based SR Opportunity using an adjusted transmit power level for the duration of an ongoing PPDU when certain conditions, designed to avoid interfering with the reception of the ongoing PPDU at the recipient are met. When the RXVECTOR parameter SPATIAL\_REUSE of the ongoing PPDU has the value SR\_DISALLOW, no SRP-based SR transmission is allowed for the duration of that PPDU.

An HE-STA supporting SRP-based SR operation indicates support for SRP-based SR operation by setting the SRP-based SR Support subfield to 1 in the HE PHY Capabilities Information field of the HE Capabilities element (Table 9-262aa).

An AP sending a trigger frame may set the SR field in the Common Info field of the trigger frame to SR\_DISALLOW to forbid OBSS STAs from performing SRP-based SR transmission during the ensuing uplink SRP\_PPDU duration. An AP sending a trigger frame shall not set the SR field in the Common Info field of the trigger frame to SR\_DELAY.

**27.9.3.1 DSRP\_PPDU-based spatial reuse initiation**

An HE STA identifies a DSRP\_PPDU SRP Opportunity when the following two conditions are met:

1. The STA receives a PHY-RXSTART.indication corresponding to the reception of a DSRP\_PPDU that is identified as an Inter-BSS PPDU (see 27.2.1 Intra-BSS and inter-BSS frame detection)
2. An SR\_PPDU is queued for transmission and the intended transmit power of the SR\_PPDU, after normalization to 20MHz bandwidth (i.e., the transmit power in dBm minus the value, in dB of the intended transmit bandwidth divided by 20MHz), is below the value of SRP minus RPL, where SRP is the value obtained from Table 26-19 (Spatial Reuse subfield encoding) based on the value of the Spatial Reuse information of the common info field of the Trigger MPDU of the DSRP\_PPDU and the value of RPL is the received power level of the legacy portion of the DSRP\_PPDU, normalized to 20MHz bandwidth.

A STA that identifies an SRP Opportunity due to the receipt of a DSRP\_PPDU may eschew the NAV update operations normally executed based on the receipt of the RXVECTOR parameter TXOP\_DURATION and the Trigger MPDU DUR field value. See Figure 25 – srp1 DSRP\_PPDU Spatial Reuse. A STA that identifies an SRP Opportunity due to the receipt of a DSRP\_PPDU may ignore the PHY-RXSTART.indication and the associated HE trigger-based PPDU(s) that are triggered by the Trigger MPDU of the DSRP\_PPDU and that occurs within aSIFSTime + aRxPHYStartDelay + 2 x aSlotTime of the end of the last symbol on the air of the PPDU that contained the Trigger MPDU, provided that the RXVECTOR BSS\_COLOR matches the BSS\_COLOR of the DSRP\_PPDU. A STA that identifies an SRP Opportunity due to the receipt of a DSRP\_PPDU shall not transmit an SR PPDU that terminates beyond the PPDU duration of the HE trigger-based PPDU that is triggered by the Trigger MPDU of the DSRP\_PPDU.

Duration from Common Info field

DSRP\_PPDU

HE Trigger-based PPDU

**Figure 25 – srp1 – DSRP\_PPDU Spatial Reuse**

**27.9.3.2 SRP\_PPDU-based spatial reuse backoff procedure**

If an HE STA identifies an SRP Opportunity as allowed in 27.9.3.1 (DSRP\_PPDU-based spatial reuse initiation above, the HE STA may continue the countdown of an existing backoff procedure provided that the medium condition is not otherwise indicated as BUSY. If the HE STA receives another SRP\_PPDU during the back-off procedure, it shall suspend its back-off and subsequently, if an SRP Opportunity is identified based on the new SRP\_PPDU, the STA may resume its back-off procedure. The TXOP that the HE STA gains once its backoff reaches zero shall not extend beyond the SRP Opportunity Endpoint which is the earliest ending of all of the durations of all of the SRP\_PPDUs that were used to confirm the SRP Opportunity and all of the durations indicated in the common info fields of Trigger frames within all DSRP\_PPDUs that were used to confirm the SRP Opportunity.

If the HE-STA is already executing its backoff procedure employing OBSS\_PDlevel as a threshold for determination of an IDLE medium condition prior to the reception of an SRP\_PPDU, the intended transmit power of the next SR\_PPDU in the transmission queue as measured at the output of the antenna connector shall be equal to or lower than the TXPWRmax, calculated with this specific OBSS\_PDlevel using Equation (25-1).

After a STA has identified the start of an SRP Opportunity, and until the SRP Opportunity Endpoint is reached, the transmission of any PPDU by the STA shall be limited by the transmit power restrictions identified in 27.9.3 (SRP-based spatial reuse operation).

**27.9.3.3 Spatial Reuse field of Trigger frame**

An AP with dot11HESRPOptionImplemented set to true that transmits a trigger frame may determine the value of the Spatial Reuse field value of the Common Info field of the trigger frame in each 20MHz bandwidth for 20MHz, 40MHz, 80 MHz PPDU or in each 40MHz bandwidth for 80+80 or 160 MHz PPDU by selecting the row in Table 28-19 (Spatial Reuse subfield encoding) that has a numerical value in the column labeled “Meaning” that is the highest value that is equal to or below the value of the computed MAC parameter SRP\_INPUT as follows:

* SRP\_INPUT = TXPWRAP + Acceptable Receiver Interference LevelAP
* where
	+ The TXPWRAP is the transmit power in dBm at the output of the antenna connector normalized to 20MHz bandwidth (i.e., transmit power in dBm minus transmit bandwidth divided by 20MHz bandwidth in dB) of the AP sending the trigger frame.
	+ Acceptable Receiver Interference LevelAP is a value in dBm normalized to a 20MHz bandwidth (i.e., minus transmit bandwidth divided by 20MHz bandwidth in dB) for each 20MHz transmit bandwidth for 20MHz, 40MHz, and 80MHz PPDU or in each of the 40MHz transmit bandwidths for an 80+80MHz or 160 MHz PPDU and should be set to the ambient noise plus interference power level observed at the AP immediately prior to the transmission of the trigger frame plus the SNR margin value which yields a 10% PER for all of the intended MCS(s) in the ensuing uplink HE trigger-based PPDU, minus a safety margin value not to exceed 5 dB as determined by the AP.

An AP with dot11HESRPOptionImplemented set to true that transmits a trigger frame may set the value of the Spatial Reuse field value of the Common Info field of the trigger frame in each 20MHz bandwidth for 20MHz, 40MHz, 80 MHz PPDU or in each 40MHz bandwidth for 80+80 or 160 MHz PPDU to SR\_DISALLOW.

An AP with dot11HESRPOptionImplemented set to false that transmits a trigger frame shall set the value of the Spatial Reuse field value of the Common Info field of the trigger frame in each 20MHz bandwidth for 20MHz, 40MHz, 80 MHz PPDU or in each 40MHz bandwidth for 80+80 or 160 MHz PPDU to SR\_DISALLOW.

**27.9.3.4 SR\_PPDU transmission requirements**

An HE STA that identifies an SRP Opportunity shall not transmit a PPDU during the SRP Opportunity that elicits a response transmission from a STA from which it has not received an HE Capabilities element with the SR Responder field equal to 1. An HE STA that identifies an SRP Opportunity and transmits a PPDU that elicits a response transmission during that SRP Opportunity shall include an A-control field with the SR\_PPDU Indication subfield value set to 1 in each MPDU of the PPDU that it transmits that contains an A-control field. **(#8087)(#8091)(\*8092)**

**27.9.3.5 SR\_PPDU reception and response transmission requirements**

An HE STA that receives a PPDU which contains at least one MPDU with an SR\_PPDU Indication subfield value equal to 1 shall not transmit a response PPDU elicited by the received PPDU if all outstanding SRP and OBSS\_PD transmit power requirements are not met by the response transmission. **(#8087)(#8091)(\*8092)**

***TGax editor: insert a new subclause 27.9.4 Interaction of OBSS\_PD and SRP-based spatial reuse and the associated text as follows:***

**27.9.4 Interaction of OBSS\_PD and SRP-based spatial reuse**

An HE STA with dot11HESRPOptionImplemented set to true that receives a PPDU that is identified as an Inter-BSS PPDU with a value other than SR\_DISALLOW for the RXVECTOR parameter SPATIAL\_REUSE and fails to identify an SRP Opportunity based on the receipt of the PPDU shall use a value of -82 dBm/20 MHz or lower for the OBSS\_PDlevel as it applies to this PPDU.

An HE STA with dot11HESRPOptionImplemented set to true that receives a PPDU that is identified as an Inter-BSS PPDU with a value other than SR\_DISALLOW or SR\_DELAY for the RXVECTOR parameter SPATIAL\_REUSE and identifies an SRP Opportunity based on the receipt of the PPDU may use a value of positive infinity or lower for the OBSS\_PDlevel as it applies to this PPDU and may use a value equal to the receive power of this PPDU plus 1 dB for the ED level for the duration of this PPDU.

An HE STA with dot11HESRPOptionImplemented set to true that receives a PPDU that is identified as an Inter-BSS PPDU with a value other than SR\_DISALLOW in the Common Info Field SPATIAL\_REUSE of a Trigger MPDU and fails to identify an SRP Opportunity based on the receipt of the PPDU shall use a value of -82 dBm/20 MHz or lower for the OBSS\_PDlevel as it applies to the Trigger-based PPDU that is elicited by the Trigger MPDU.

An HE STA with dot11HESRPOptionImplemented set to true that receives a PPDU that is identified as an Inter-BSS PPDU with a value other than SR\_DISALLOW or SR\_DELAY in the Common Info Field SPATIAL\_REUSE of a Trigger MPDU and identifies an SRP Opportunity based on the receipt of the PPDU may use a value of positive infinity or lower for the OBSS\_PDlevel as it applies to the Trigger-based PPDU that is elicited by the Trigger MPDU.

An HE STA with dot11HESRPOptionImplemented set to true that receives a PPDU that is identified as an Inter-BSS PPDU with a value equal to SR\_DELAY or SR\_RESTRICTED for the RXVECTOR parameter SPATIAL\_REUSE shall use a value of negative infinity for the OBSS\_PDlevel as it applies to this PPDU and shall use a value equal to the receive power of this PPDU minus 1 dB for the ED level for the duration of this PPDU.

***TGax editor: modify 9.2.4.6.4.1 General as shown and change all references of the Reverse Direction Protocol A-Control field in the draft to Command Control Indication:***

**9.2.4.6.4.1 General**

|  |  |  |  |
| --- | --- | --- | --- |
| **Control ID value** | **Meaning** | **Length of the Control Information subfield (bits)** | **Content of the Control Information subfield** |
| 0 | UL MU response scheduling | 26 | See 9.2.4.6.4.2 (UL MU response scheduling) |
| 1 | Operating mode | 12 | See 9.2.4.6.4.3 (Operating Mode) |
| 2 | HE link adaptation | 16 | See 9.2.4.6.4.4 (HE link adaptation) |
| 3 | Buffer Status Report (BSR) | 26 | See 9.2.4.6.4.5 (Buffer Status Report) |
| 4 | UL Power Headroom | 8 | See 9.2.4.6.4.6 (UL power headroom) |
| 5 | Bandwidth Query Report (BQR) | 10 | See 9.2.4.6.4.7 (Bandwidth Query Report (BQR)) |
| 6 | Command Control Indication | 8 | See 9.2.4.6.4.8 (Command Control Indication) |
| 7-15 |  |  |  |

**9.2.4.6.4.2 UL MU response scheduling**

**9.2.4.6.4.8 Control Command Indication**

***TGax editor: change B2 “reserved” of Figure 9-15i Control Information subfield format when Control ID subfield value is 6 to “SR\_PPDU Indication” and modify the text of the subclause as shown:***

,

The Control Information subfield, when the Control ID subfield is 6, contains the Control Command Indication field. The format of the Control Command Indication field is shown in Figure 9-15i (Control Information subfield format when the Control ID subfield is 6) **(#8087)(#8091)(\*8092)**

The AC Constraint subfield of the RDP field indicates whether the mapped AC of an RD Data frame is constrained to a single AC, and is defined in Table 9-10 (AC Constraint subfield values), except that a value of 1 indicates that the response from an HE STA contains Data frames from the same AC or higher AC as defined in 10.28.4 (Rules for RD responder).

The RDG/More PPDU subfield is defined in Table 9-11 (RDG/More PPDU subfield values).

The SR\_PPDU Indication subfield is defined in 9.2.4.6.4.2 (UL MU response scheduling). **(#8087)(#8091)(\*8092)**

**9.4.2.218.2 HE MAC Capabilities Information field**

***TGax editor: change one of the “reserved” bits of Figure 9-589ck HE MAC Capabilities Information field format to “SR Responder” and insert the following new row into the appropriate location within Table 9-262z Subfields of the HE MAC Capabilities Information field:***

**(#8087)(#8091)(\*8092)**

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| SR Responder | Indicates support by the STA for the role of SR Responder. | Set to 1 if the STA supports the role of SR Responder.Set to 0 otherwise. |

***TGax Editor: In TGa D1.0, modify subclause 27.9.1 General as shown:***

**27.9.1 General**

When the conditions specified in 27.9 (Spatial reuse operation) are met that allow the transmission of an SR PPDU, an HE STA may transmit an SR PPDU to a STA that has indicated support for the role of SR Responder.**(#9730) (#8087)(#8091)(\*8092)**

***TGax Editor: In TGa D1.0, modify subclause 27.9.2.1 General as shown:***

**27.9.2.1 General**

***TGax Editor: In TGa D1.0, modify subclause 27.11.6 SPATIAL\_REUSE as shown:***

**27.11.6 SPATIAL\_REUSE**

The contents of the Spatial Reuse field are carried in the TXVECTOR parameter SPATIAL\_REUSE for an HE PPDU indicating spatial reuse information (See 27.9.3 SRP-based spatial reuse operation). **(#5941)(#7611)(#5485)(#5504)(#7908)(#5942)(#9210)(#10043)**

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

An AP with dot11HESRPOptionImplemented set to true that transmits an HE ER PPDU should set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DISALLOW.

A non-AP STA with dot11HESRPOptionImplemented set to true that transmits an HE SU PPDU, HE ER PPDU or HE MU PPDU should set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DISALLOW.

An HE STA that transmits an HE Trigger-based PPDU determines the value of the TXVECTOR parameter SPATIAL\_REUSE according to 27.5.2.3 (STA behavior).

An HE AP with dot11HESRPOptionImplemented set to true may set the TXVECTOR parameter SPATIAL\_REUSE of an MSDU, A-MPDU or MMPDU to the value SR\_DISALLOW to forbid OBSS STAs from performing SRP-based SR transmission during the duration of the corresponding HE SU, HE ER, or HE MU PPDU.

An HE STA shall set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DISALLOW for an NDP PPDU.

An HE STA shall set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DISALLOW for a PPDU containing an FTM or NDPA.

An HE STA that transmits an HE SU PPDU or an HE extended range SU PPDU that contains a Trigger MPDU should set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DELAY or SR\_RESTRICTED.

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

An HE STA with dot11HESRPOptionImplemented set to false may set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DISALLOW for any PPDU that is not an an HE Trigger-based PPDU or an NDP PPDU or a PPDU containing an FTM or NDPA.

An HE STA with dot11HESRPOptionImplemented set to true that transmits an HE PPDU and that has not set the value of the TXVECTOR parameter SPATIAL\_REUSE according to the rules listed above may determine the value of the SPATIAL\_REUSE parameter in each 20MHz bandwidth for 20MHz, 40MHz, 80 MHz PPDU or in each 40MHz bandwidth for 80+80 or 160 MHz PPDU by selecting the row in Table 28-19 (Spatial Reuse subfield encoding) that has a numerical value in the column labeled “Meaning” that is the highest value that is equal to or below the value of the computed MAC parameter SRP\_VALUE as follows:

* SRP\_VALUE = TXPWRTX\_STA + Acceptable Target Interference Level
* where
	+ TX\_STA = STA transmitting the HE PPDU
	+ RX\_STA = STA that is the intended recipient of the HE PPDU
	+ TXPWRTX\_STA is the transmit power in dBm at the output of the antenna connector normalized to 20MHz bandwidth (i.e., transmit power in dBm minus transmit bandwidth divided by 20MHz bandwidth in dB) of TX\_STA, which is the STA sending the frame.
	+ Acceptable Target Interference Level is a value in dBm normalized to a 20MHz bandwidth (i.e., minus transmit bandwidth divided by 20MHz bandwidth in dB) for each 20MHz transmit bandwidth for 20MHz, 40MHz, and 80MHz PPDU or in each of the 40MHz transmit bandwidths for an 80+80MHz or 160 MHz PPDU and should be set to the RSSIRX\_STA\_at\_TX\_STA plus the relative constellation error value from table 28-45 (Allowed relative constellation error versus constellation size and coding rate) which corresponds to the modulation and coding of the HE PPDU, minus a safety margin value not to exceed 5 dB
	+ RSSIRX\_STA\_at\_TX\_STA is the received power measured by TX\_STA of the most recently received PPDU that was transmitted by RX\_STA

Figure 27-6a (SR Illustration) provides an example to show the relationships between TX\_STA, RX\_STA, and SR Initiator and an SR Responder.

TX\_STA

RX\_STA

STA3 (SR initiator)

on-going frame

Transmission

STA4 (SR responder)

RSSI

Space Loss

**Figure 27-6a SR Illustration**

**28.2.2 TXVECTOR and RXVECTOR parameters**

**TGax Editor: *Modify the row shown in Table 28-1 TXVECTOR and RXVECTOR parameters as shown, noting that the header row is shown for convenience only:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Condition** | **Value** | **TXVECTOR** | **RXVECTOR** |
| SPATIAL\_REUSE | FORMAT is HE\_SU, HE\_MU, HE\_EXT\_SU or HE\_TRIG | Indicates the spatial reuse parameter value. There is one value of the parameter present for each of an HE SU PPDU, HE extended range SU PPDU and HE MU PPDU. There are one to four values of the parameter present for an HE triggerbased PPDU, with the number of values depending on the bandwidth of the PPDU. See the Spatial Reuse field definition in 28.3.10.7.2 (Content).See 27.5.2.3 (STA behaviour) and 27.11.6 (SPATIAL\_REUSE). | Y | Y |

**28.3.10.7.2 Content**

**TGax Editor: *Modify the row shown in Table 28-16 HE-SIG-A field of an HE SU PPDU and HE extended range SU PPDU as shown:***

**Table 28-16—HE-SIG-A field of an HE SU PPDU and HE extended range SU PPDU**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| HE-SIG-A1 | B15-B18 | Spatial Reuse | 4 | Indicates whether or not spatial reuse is allowed during the transmission of this PPDU, and if allowed, indicates a value that is used to determine a limit on the transmit power of a spatial reuse transmission.Set to the value of the SPATIAL\_REUSE parameter of the TXVECTOR, which contains a value from Table 28-19 Spatial Reuse subfield encoding for an HE MU PPDU, HE SU PPDU or HE extended range SU PPDU, see 27.11.6 (SPATIAL\_REUSE).Set to SR\_DISALLOW to prohibit SRP-based spatial reuse during this PPDU. For the interpretation of other values see 27.11.6 (SPATIAL\_REUSE) and 27.9 (Spatial reuse operation).**(#4997)(#9462)(#9181) (#9209)(#10043) (#10041) (#10406)(#10412)** |

**TGax Editor: *Modify the row shown in Table 28-17 HE-SIG-A field of an HE MU PPDU***

**Table 28-17—HE-SIG-A field of an HE MU PPDU**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| HE-SIG-A1 | B11-B14 | Spatial Reuse | 4 | Indicates whether or not spatial reuse is allowed during the transmission of this PPDU, and if allowed, indicates a value that is used to determine a limit on the transmit power of a spatial reuse transmission.Set to the value of the SPATIAL\_REUSE parameter of the TXVECTOR, which contains a value from Table 28-19 Spatial Reuse subfield encoding for an HE MU PPDU, HE SU PPDU or HE extended range SU PPDU, see 27.11.6 (SPATIAL\_REUSE).Set to SR\_DISALLOW to prohibit SRP-based spatial reuse during this PPDU. For the interpretation of other values see 27.11.6 (SPATIAL\_REUSE) and 27.9 (Spatial reuse operation).**(#10407)**~~NOTE—This part needs further development.~~ **(#3600) (#4997)****(#9183) (#10043) (#10041)(#8908)****(#10413)** |

**TGax Editor: *Modify the rows shown in Table 28-18 HE-SIG-A field of an HE trigger-based PPDU***

**Table 28-18—HE-SIG-A field of an HE trigger-based PPDU**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| HE-SIG-A1 | B7-B10 | Spatial Reuse 1 | 4 | Indicates whether or not spatial reuse is allowed in a subband of the PPDU during the transmission of this PPDU, and if allowed, indicates a value that is used to determine a limit on the transmit power of a spatial reuse transmission.**(#5872)(#5871) (#10043) (#10041)**If the Bandwidth field indicates 20 MHz, 40 MHz, or 80 MHz:This Spatial Reuse field applies to the first 20 MHz subband (see NOTE 1)If the Bandwidth field indicates 160/80+80 MHz:This Spatial Reuse field applies to the first 40 MHz subband of the 160 MHz operating band. (see NOTE 1)Set to the value of the SPATIAL\_REUSE(1) parameter of the TXVECTOR, which contains a value from Table 28-19a Spatial Reuse subfield encoding for an HE trigger-based PPDU, see 27.11.6 (SPATIAL\_REUSE).Set to SR\_DISALLOW to prohibit SRP-based spatial reuse during this PPDU. For the interpretation of other values see 27.11.6 (SPATIAL\_REUSE) and 27.9 (Spatial reuse operation).**(#10409)(#8907)(#10414)** |
| HE-SIG-A1 | B11-B14 | Spatial Reuse 2 | 4 | Indicates whether or not spatial reuse is allowed in a subband of the PPDU during the transmission of this PPDU, and if allowed, indicates a value that is used to determine a limit on the transmit power of a spatial reuse transmission. **(#5872)(#5871)**If the Bandwidth field indicates 20 MHz, 40 MHz, or 80 MHz:This Spatial Reuse field applies to the second 20 MHz subband (see NOTE 1)When the STA operating width is 20 MHz, this field is set to the same value as the Spatial Reuse 1 field.When the STA operating width is 40 MHz and the STA is operating in a 2.4 GHz band, this field is set to the same value as the Spatial Reuse 1 fieldIf the Bandwidth field indicates 160/80+80 MHz:This Spatial Reuse field applies to the second 40 MHz subband of the 160 MHz operating band. (see NOTE 1)Set to the value of the SPATIAL\_REUSE(2) parameter of the TXVECTOR, which contains a value from Table 28-19a Spatial Reuse subfield encoding for an HE trigger-based PPDU, see 27.11.6 (SPATIAL\_REUSE).Set to SR\_DISALLOW to prohibit SRP-based spatial reuse during this PPDU. For the interpretation of other values see 27.11.6 (SPATIAL\_REUSE) and 27.9 (Spatial reuse operation).**(#10415)** |
| HE-SIG-A1 | B15-B18 | Spatial Reuse 3 | 4 | Indicates whether or not spatial reuse is allowed in a subband of the PPDU during the transmission of this PPDU, and if allowed, indicates a value that is used to determine a limit on the transmit power of a spatial reuse transmission. **(#5872)(#5871)**If the Bandwidth field indicates 20 MHz, 40 MHz, or 80 MHz:This Spatial Reuse field applies to the third 20 MHz subband (see NOTE 1) When operating in 20 MHz or 40 MHz, this field is set to the same value as the Spatial Reuse 1 field.If the Bandwidth field indicates 160/80+80 MHz:This Spatial Reuse field applies to the third 40 MHz subband of the 160 MHz operating band. (see NOTE 1)When operating in 80+80 MHz, this field is set to the same value as the Spatial Reuse 1 field.Set to the value of the SPATIAL\_REUSE(3) parameter of the TXVECTOR, which contains a value from Table 28-19a Spatial Reuse subfield encoding for an HE trigger-based PPDU, see 27.11.6 (SPATIAL\_REUSE).Set to SR\_DISALLOW to prohibit SRP-based spatial reuse during this PPDU. For the interpretation of other values see 27.11.6 (SPATIAL\_REUSE) and 27.9 (Spatial reuse operation). |
| HE-SIG-A1 | B19-B22 | Spatial Reuse 4 | 4 | Indicates whether or not spatial reuse is allowed in a subband of the PPDU during the transmission of this PPDU, and if allowed, indicates a value that is used to determine a limit on the transmit power of a spatial reuse transmission. **(#5872)(#5871)**If the Bandwidth field indicates 20 MHz, 40 MHz or 80 MHz:This Spatial Reuse field applies to the fourth 20 MHz subband (see NOTE 1)When operating in 20 MHz, this field is set to the same value as the Spatial Reuse 1 field.When operating in 40 MHz, this field is set to the same value as the Spatial Reuse 2 field.If the Bandwidth field indicates 160/80+80 MHz:This Spatial Reuse field applies to the fourth 40 MHz subband of the 160 MHz operating band. (see NOTE 1)When operating in 80+80 MHz, this field is set to the same value as the Spatial Reuse 2 fieldSet to the value of the SPATIAL\_REUSE(4) parameter of the TXVECTOR, which contains a value from Table 28-19a Spatial Reuse subfield encoding for an HE trigger-based PPDU, see 27.11.6 (SPATIAL\_REUSE).Set to SR\_DISALLOW to prohibit SRP-based spatial reuse during this PPDU. For the interpretation of other values see 27.11.6 (SPATIAL\_REUSE) and 27.9 (Spatial reuse operation). |

**TGax Editor: *Modify the caption and the rows shown in Table 28-19 Spatial Reuse subfield encoding:***

**Table 28-19—Spatial Reuse subfield encoding for an HE MU PPDU, HE SU PPDU or HE extended range SU PPDU**

|  |  |
| --- | --- |
| **Value** | **Meaning** |
| 0 | SR\_DISALLOW**(#5259)(#10043)** |
| 1 | SRP = - 80 dB(**#5872)(#5871)(#10306)(#8920)** |
| 2 | SRP = - 74 dB |
| 3 | SRP = - 68 dB |
| 4 | SRP = - 62 dB |
| 5 | SRP = - 56 dB |
| 6 | SRP = - 50 dB |
| 7 | SRP = - 47 dB |
| 8 | SRP = - 44 dB |
| 9 | SRP = - 41 dB |
| 10 | SRP = - 38 dB |
| 11 | SRP = - 35 dB |
| 12 | SRP = - 32 dB |
| 13 | SRP >= -29 dB |
| 14 | SR\_RESTRICTED**(#8069)(#8118)(#5261)** |
| 15 | SR\_DELAY**(#8069)(#8118)(#5260)** |

**TGax Editor: *Insert the following table to appear immediately after Table 28-19 Spatial Reuse subfield encoding, before any following text:***

**Table 28-19a—Spatial Reuse subfield encoding for an HE trigger-based PPDU**

|  |  |
| --- | --- |
| **Value** | **Meaning** |
| 0 | SR\_DISALLOW |
| 1 | SRP = - 80 dB |
| 2 | SRP = - 74 dB |
| 3 | SRP = - 68 dB |
| 4 | SRP = - 62 dB |
| 5 | SRP = - 56 dB |
| 6 | SRP = - 50 dB |
| 7 | SRP = - 47 dB |
| 8 | SRP = - 44 dB |
| 9 | SRP = - 41 dB |
| 10 | SRP = - 38 dB |
| 11 | SRP = - 35 dB |
| 12 | SRP = - 32 dB |
| 13 | SRP = -29 dB |
| 14 | SRP >= -26 dBm |
| 15 | Reserved |

**TGax Editor: *Delete the text beneath Table 28-19 Spatial Reuse subfield encoding as shown:***

**TGax Editor: *Add a new MIB variable in C.3 MIB Detail within the dot11HEStationConfigEntry group as shown:***

**C.3 MIB Detail**

dot11HESRPOptionImplemented OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable. Its value is determined by device capabilities.

This attribute, when true, indicates that the STA implementation is capable of transmitting Spatial Reuse Parameters in HE PPDUs. The capability is disabled, otherwise"

DEFVAL { false }

::= { dot11HEStationConfigEntry <XX>}

**End of proposed changes.**