IEEE P802.11
Wireless LANs

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| SRP-Based SR for HE Trigger-based PPDU – 25.9.3 |
| Date: 2016-10-06 |
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Abstract

This submission proposes resolutions for comment CID 944 related to TGax D0.1.:

NOTE- The proposed changes on this document are based on TGax Draft 0.5.

**REVISION NOTES:**

R0: initial

**R1:**

25.9.3

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SRP decision window is no longer applicable for DSRP\_PPDU

**25.9.3.4 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

25.9.3.1 DSRP

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

25.9.3.2 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:**

**25.9.3.4 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:**

**25.9.3.3 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

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.***

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| **CID** | **Commenter** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 944 | kaiying Lv | 63 | spatial reuse operation should be further defined | Comment resolution and supporting PPT will be provided | Revised – Agree in principle with the comment. TGax editor makes changes as shown in specified in 11-16/1476r4. |
| 64 |  |  | "A STA should revise the NAV depending on TBD conditions at the recipient of the ongoing OBSS frame." Specify how a HE STA can obtain the knowledge of the condition of an ongoing OBSS frame at the OBSS recipient STA. | As in the comment. | Revised – Agree in principle with the comment. TGax editor makes changes as shown in specified in 11-16/1476r4. |
| 2911 |  |  | If the detected inter-BSS frame is a Trigger Frame from an AP, the STA shall wait until the solicited UL transmission has started, otherwise the STAs solicited for transmission may sense the channel as busy and do not transmit. | If the detected inter-BSS frame is a Trigger Frame and the CS Required subfiled in the TF is set to 1, a STA should revise the NAV to the end of the TF plus SIFS duration. | Revised – Agree in principle with the comment. TGax editor makes changes as shown in specified in 11-16/1476r4. |

A motion [SR Motion 8, May 2016, DCN11-16-699r0] related to SRP-based SR Operation for HE trigger-Based PPDU is not fully defined.

SR Motion 8 [May 2016, DCN11-16-699r0]

* Add the following 4 bit SR field (in SIG A) for HE Trigger-Based PPDU
* One TBD value for SR Disallow Flag, (under TBD restrictions)
* One TBD value is reserved
* Remaining 14 values for SRP
	+ SRP = TX PWRAP + Acceptable Receiver Interference LevelAP
	+ SR STA shall back-off its TX power based on
	+ TX PWRSR STA < SRP –RSSItrigger frame@SR STA”

This document intends to provide clarification and definition of the SRP-based SR operation for HE trigger-Based PPDU.

***Instruct the editor to include 25.9.3 SRP-based spatial reuse operation and the associated text as follows:***

**25.9.3 SRP-based spatial reuse operation**

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 PPDU at the recipient are met. When the RXVECTOR parameter SPATIAL\_REUSE has the value SR\_DISALLOWED, no SRP-based SR transmission is allowed for the duration of the received PPDU.

An HE-STA supporting SRP-based SR operation indicates it supports SRP-based SR operation by setting SRP-based SR Support subfield to 1 in HE PHY Capabilities Information field of the HE Capabilities element (Table 9-262aa). An HE-STA not supporting SRP-based SR operation ignores the RXVECTOR parameter SPATIAL\_REUSE.

A DSRP\_PPDU is 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).

A TSRP\_PPDU is a PPDU that is an HE Trigger based PPDU and that has a value other than SR\_DISALLOW, in the RXVECTOR parameter SPATIAL\_REUSE. (Trigger-based SRP PPDU).

An SRP\_PPDU is a PPDU that is at least one of a DSRP\_PPDU or TSRP\_PPDU.

An SR\_PPDU is a PPDU transmitted during an SRP Opportunity by an HE STA when SRP conditions for SRP-based spatial reuse operation are satisfied.

The SRP Decision Window is a period of time with a duration equal to aSIFSTime + aRxPHYStartDelay + (2 x aSlotTime) that ends at the time of receipt of the PHY-RXSTART.indication of a TSRP\_PPDU.

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

An HE STA identifies a DSRP\_PPDU SRP Opportunity when the following 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 25.2.1 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 + 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 indicated in 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**

**25.9.3.2 TSRP\_PPDU-based spatial reuse initiation**

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

1. The STA receives a PHY-RXSTART.indication corresponding to the reception of a TSRP\_PPDU that is identified as an Inter-BSS PPDU (see 25.2.1 Intra-BSS and inter-BSS frame detection)
2. Condition a or b is met:
	1. The TSRP\_ PPDU is an HE Trigger-based PPDU and there was no PHY-CCA.indication transition from BUSY to IDLE within the SRP Decision Window corresponding to the TSRP\_PPDU
	2. The TSRP\_ PPDU is an HE Trigger-based PPDU and at least one PHY-CCA.indication transition from BUSY to IDLE occurred within the SRP Decision Window corresponding to the TSRP\_PPDU 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
3. 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 parameter of the RXVECTOR of the TSRP\_PPDU if present, or from the MAC Trigger common info field, if present, and the value of RPL is:
	1. equal to the minimum receiver sensitivity of the STA, normalized to 20MHz if condition 2.a. is true
	2. the received power level of the PPDU that preceded the TSRP\_PPDU as identified in condition 2.b., normalized to 20 MHz if condition 2.b. above is true

A STA that identifies an SRP Opportunity due to the receipt of a TSRP\_PPDU may issue a PHYCCARESET.request primitive at the time of the receipt of the PHY-RXSTART.indication and if condition 2.b. is true, follows the normal NAV update procedure with TXOP\_DURATION parameter information from the received RXVECTOR, if any. If condition 2.a is true, the STA 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. A STA that identifies an SRP Opportunity due to the receipt of a TSRP\_PPDU shall not transmit an SR PPDU that terminates beyond the duration indicated in the L-SIG length field of the TSRP\_PPDU.

Note – The RXVECTOR TXOP\_DURATION NAV update is performed at time that corresponds to the end of the duration indicated in the L-SIG length field of the received TSRP\_PPDU.

Duration from LSIG

TSRP\_PPDU (HE trigger based PPDU)

**Idle**

Figure 25-srp2 – Condition 2.a TSRP\_PPDU with preceding IDLE

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

If an HE STA identifies an SRP Opportunity as allowed in either 25.9.3.1 (DSRP\_PPDU-based spatial reuse initiation) or 25.9.3.2 (TSRP\_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 25.9.3 (SRP-based spatial reuse operation).

An AP with dot11HESRPOptionImplemented set to true that transmits a trigger frame may determine the value of the Spatial Reuse field value to be placed into 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 26-19 (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 to be placed into 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\_DISALLOWED.

An AP with dot11HESRPOptionImplemented set to false that transmits a trigger frame shall set the value of the Spatial Reuse field value to be placed into 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\_DISALLOWED.

***Instruct the editor to include the following new subclause in the TGax draft:***

**25.12a TXVECTOR parameter SPATIAL\_REUSE**

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 that transmits an HE SU or HE ER PPDU carrying a trigger frame may set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DELAY or SR\_DISALLOW. An AP that transmits an HE MU PPDU carrying a trigger frame may set the TXVECTOR parameter SPATIAL\_REUSE to SR\_RESTRICTED or SR\_DISALLOW.

An HE STA with dot11HESRPOptionImplemented set to true that transmits an HE SU, HE ER or HE MU PPDU may determine the value of the TXVECTOR parameter SPATIAL\_REUSE by selecting the row in Table 26-19 (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 = TXPWR + RSSIfrom intended receiver – Required SNR for the MCS to be used.
* Where,
	+ TXPWR is the transmit power in dBm at the output of the antenna connector normalized to 20MHz bandwidth (i.e., the transmit power in dBm minus the transmit bandwidth divided by 20MHz bandwidth in dB) of the HE STA sending an HE SU, HE ER, or HE MU PPDU
	+ RSSIfrom intended receiver is the received power level, normalized to the 20MHz bandwidth (i.e., the received power in dBm minus the receive bandwidth divided by 20MHz bandwidth in dB) measured from the legacy portion of the mostly recently received PPDU from the intended recipient within the last 100 ms prior to the transmission of the PPDU.
	+ Required SNR for the MCS should be the SNR margin value which yields a 10% PER for the intended MCS(s) for the PPDU, minus a safety margin value not to exceed 5 dB as determined by the AP

An AP 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 AP shall set the TXVECTOR parameter SPATIAL\_REUSE to SR\_DISALLOW of an NDP PPDU.

**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.**