IEEE P802.11
Wireless LANs

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| Proposed Text Changes for OBSS\_PD-based SR parameters |
| Date: 2016-09-12 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Laurent Cariou |  |  |  | laurent.cariou@intel.com |
| Robert Stacey | Intel | 2111 NE 25th Ave, Hillsboro OR 97124, USA | +1-503-724-893 | robert.stacey@intel.com |
| Shahrnaz Azizi |  |  |  | shahrnaz.azizi@intel.com |
| Po-Kai Huang |  |  |  | po-kai.huang@intel.com |
| Qinghua Li |  |  |  | quinghua.li@intel.com |
| Xiaogang Chen |  |  |  | xiaogang.c.chen@intel.com |
| Chitto Ghosh |  |  |  | chittabrata.ghosh@intel.com |
| Yaron Alpert |  |  |  | yaron.alpert@intel.com |
| Assaf Gurevitz |  |  |  | assaf.gurevitz@intel.com |
| Ilan Sutskover |  |  |  | ilan.sutskover@intel.com |
| Feng Jiang |  |  |  | feng1.jiang@intel.com |
| Minho Cheong | Newracom | 9008 Research Dr.Irvine, CA 92618 |  | minho.cheong@newracom.com |
| Reza Hedayat |  | reza.hedayat@newracom.com |
| Young Hoon Kwon |  | younghoon.kwon@newracom.com |
| Yongho Seok |  | yongho.seok@newracom.com |
| Daewon Lee |  | daewon.lee@newracom.com |
| Yujin Noh |  | yujin.noh@newracom.com |
| Ron Porat | Broadcom |  |  | rporat@broadcom.com |
| Sriram Venkateswaran |  |  |  |
| Matthew Fischer |  |  | mfischer@broadcom.com |
| Zhou Lan |  |  |  |
| Leo Montreuil |  |  |  |
| Andrew Blanksby |  |  |  |
| Vinko Erceg |  |  |  |
| Thomas Derham |  |  |  |
| Mingyue Ji |  |  |  |
| Robert Stacey | Intel | 2111 NE 25th Ave, Hillsboro OR 97124, USA | +1-503-724-893 | robert.stacey@intel.com |
| Shahrnaz Azizi |  | shahrnaz.azizi@intel.com |
| Po-Kai Huang |  | po-kai.huang@intel.com |
| Qinghua Li |  | quinghua.li@intel.com |
| Xiaogang Chen |  | xiaogang.c.chen@intel.com |
| Chitto Ghosh |  | chittabrata.ghosh@intel.com |
| Laurent Cariou |  | laurent.cariou@intel.com |
| Yaron Alpert |  | yaron.alpert@intel.com |
| Assaf Gurevitz |  | assaf.gurevitz@intel.com |
| Ilan Sutskover |  | ilan.sutskover@intel.com |
| Feng Jiang |  | feng1.jiang@intel.com |
| Hongyuan Zhang | Marvell | 5488 Marvell Lane,Santa Clara, CA, 95054 | 408-222-2500 | hongyuan@marvell.com |
| Lei Wang |  | Leileiw@marvell.com |
| Liwen Chu |  | liwenchu@marvell.com |
| Jinjing Jiang |  | jinjing@marvell.com |
| Yan Zhang |  | yzhang@marvell.com |
| Rui Cao |  | ruicao@marvell.com |
| Sudhir Srinivasa |  | sudhirs@marvell.com |
| Bo Yu |  | boyu@marvell.com |
| Saga Tamhane |  | sagar@marvell.com |
| Mao Yu |  | my@marvel..com |
| Xiayu Zheng |  | xzheng@marvell.com |
| Christian Berger |  | crberger@marvell.com |
| Niranjan Grandhe |  | ngrandhe@marvell.com |
| Hui-Ling Lou |  | hlou@marvell.com |
| Alice Chen | Qualcomm | 5775 Morehouse Dr. San Diego, CA, USA |  | alicel@qti.qualcomm.com |
| Albert Van Zelst | Straatweg 66-S Breukelen, 3621 BR Netherlands |  | allert@qti.qualcomm.com |
| Alfred Asterjadhi | 5775 Morehouse Dr. San Diego, CA, USA |  | aasterja@qti.qualcomm.com |
| Bin Tian | 5775 Morehouse Dr. San Diego, CA, USA |  | btian@qti.qualcomm.com |
| Carlos Aldana | 1700 Technology Drive San Jose, CA 95110, USA |  | caldana@qca.qualcomm.com |
| George Cherian | 5775 Morehouse Dr. San Diego, CA, USA |  | gcherian@qti.qualcomm.com |
| Gwendolyn Barriac | 5775 Morehouse Dr. San Diego, CA, USA |  | gbarriac@qti.qualcomm.com |
| Hemanth Sampath | 5775 Morehouse Dr. San Diego, CA, USA |  | hsampath@qti.qualcomm.com |
| Lin Yang | 5775 Morehouse Dr. San Diego, CA, USA |  | linyang@qti.qualcomm.com |
| Lochan Verma | 5775 Morehouse Dr. San Diego, CA USA |  | lverma@qti.qualcomm.com |
| Menzo Wentink | Straatweg 66-S Breukelen, 3621 BR Netherlands |  | mwentink@qti.qualcomm.com |
| Naveen Kakani | 2100 Lakeside BoulevardSuite 475, RichardsonTX 75082, USA |  | nkakani@qti.qualcomm.com |
| Raja Banerjea | 1060 Rincon Circle San JoseCA 95131, USA |  | rajab@qit.qualcomm.com |
| Richard Van Nee | Straatweg 66-S Breukelen, 3621 BR Netherlands |  | rvannee@qti.qualcomm.com |
| Rolf De Vegt | Qualcomm | 1700 Technology Drive San Jose, CA 95110, USA |  | rolfv@qca.qualcomm.com |
| Sameer Vermani | 5775 Morehouse Dr. San Diego, CA, USA |  | svverman@qti.qualcomm.com |
| Simone Merlin | 5775 Morehouse Dr. San Diego, CA, USA |  | smerlin@qti.qualcomm.com |
| Tevfik Yucek | 1700 Technology Drive San Jose, CA 95110, USA |  | tyucek@qca.qualcomm.com |
| VK Jones | 1700 Technology Drive San Jose, CA 95110, USA |  | vkjones@qca.qualcomm.com |
| Youhan Kim | 1700 Technology Drive San Jose, CA 95110, USA |  | youhank@qca.qualcomm.com |
| Jianhan Liu | MediatekUSA | 2860 Junction Ave, San Jose, CA 95134, USA | +1-408-526-1899 | jianhan.Liu@mediatek.com |
| Thomas Pare |  |  | thomas.pare@mediatek.com |
| ChaoChun Wang |  |  | chaochun.wang@mediatek.com |
| James Wang |  |  | james.wang@mediatek.com |
| Tianyu Wu |  |  | tianyu.wu@mediatek.com |
| Russell Huang |  |  | russell.huang@mediatek.com |
| James Yee | Mediatek | No. 1 Dusing 1st Road, Hsinchu, Taiwan | +886-3-567-0766 | james.yee@mediatek.com |
| Frank Hsu |  |  | frank.hsu@mediatek.com |
| Joonsuk Kim | Apple |  |  | joonsuk@apple.com |
| Aon Mujtaba |  |  | mujtaba@apple.com |
| Guoqing Li |  |  | guoqing\_li@apple.com |
| Eric Wong |  |  | ericwong@apple.com |
| Chris Hartman |  |  | chartman@apple.com |
| Jarkko Kneckt |  |  | jkneckt@apple.com |
| David X. Yang | Huawei | F1-17, Huawei Base, Bantian, Shenzhen |  | david.yangxun@huawei.com |
| Jiayin Zhang | 5B-N8, No.2222 Xinjinqiao Road, Pudong, Shanghai | +86-18601656691 | zhangjiayin@huawei.com |
| Jun Luo | 5B-N8, No.2222 Xinjinqiao Road, Pudong, Shanghai |  | jun.l@huawei.com |
| Yi Luo | F1-17, Huawei Base, Bantian, Shenzhen | +86-18665891036 | Roy.luoyi@huawei.com |
| Yingpei Lin | 5B-N8, No.2222 Xinjinqiao Road, Pudong, Shanghai |  | linyingpei@huawei.com |
| Jiyong Pang | 5B-N8, No.2222 Xinjinqiao Road, Pudong, Shanghai |  | pangjiyong@huawei.com |
| Zhigang Rong | 10180 Telesis Court, Suite 365, San Diego, CA  92121 NA |  | zhigang.rong@huawei.com |
| Jian Yu | F1-17, Huawei Base, Bantian, Shenzhen |  | ross.yujian@huawei.com |
| Ming Gan | F1-17, Huawei Base, Bantian, Shenzhen |  | ming.gan@huawei.com |
| Yuchen Guo | F1-17, Huawei Base, Bantian, Shenzhen |  | guoyuchen@huawei.com |
| Yunsong Yang | 10180 Telesis Court, Suite 365, San Diego, CA  92121 NA |  | yangyunsong@huawei.com |
| Junghoon Suh | 303 Terry Fox, Suite 400 Kanata, Ottawa, Canada |  | Junghoon.Suh@huawei.com |
| Peter Loc |  |  | peterloc@iwirelesstech.com |
| Edward Au | 303 Terry Fox, Suite 400 Kanata, Ottawa, Canada |  | edward.ks.au@huawei.com |
| Teyan Chen | F1-17, Huawei Base, Bantian, Shenzhen |  | chenteyan@huawei.com |
| Yunbo Li | F1-17, Huawei Base, Bantian, Shenzhen |  | liyunbo@huawei.com |
| David X. Yang | Huawei | F1-17, Huawei Base, Bantian, Shenzhen |  | david.yangxun@huawei.com |
| Jiayin Zhang | 5B-N8, No.2222 Xinjinqiao Road, Pudong, Shanghai | +86-18601656691 | zhangjiayin@huawei.com |
| Jun Luo | 5B-N8, No.2222 Xinjinqiao Road, Pudong, Shanghai |  | jun.l@huawei.com |
| Yi Luo | F1-17, Huawei Base, Bantian, Shenzhen | +86-18665891036 | Roy.luoyi@huawei.com |
| Yingpei Lin | 5B-N8, No.2222 Xinjinqiao Road, Pudong, Shanghai |  | linyingpei@huawei.com |
| Jiyong Pang | 5B-N8, No.2222 Xinjinqiao Road, Pudong, Shanghai |  | pangjiyong@huawei.com |
| Zhigang Rong | 10180 Telesis Court, Suite 365, San Diego, CA  92121 NA |  | zhigang.rong@huawei.com |
| Jian Yu | F1-17, Huawei Base, Bantian, Shenzhen |  | ross.yujian@huawei.com |
| Ming Gan | F1-17, Huawei Base, Bantian, Shenzhen |  | ming.gan@huawei.com |
| Yuchen Guo | F1-17, Huawei Base, Bantian, Shenzhen |  | guoyuchen@huawei.com |
| Yunsong Yang | 10180 Telesis Court, Suite 365, San Diego, CA  92121 NA |  | yangyunsong@huawei.com |
| Junghoon Suh | 303 Terry Fox, Suite 400 Kanata, Ottawa, Canada |  | Junghoon.Suh@huawei.com |
| Peter Loc |  |  | peterloc@iwirelesstech.com |
| Edward Au | 303 Terry Fox, Suite 400 Kanata, Ottawa, Canada |  | edward.ks.au@huawei.com |
| Teyan Chen | F1-17, Huawei Base, Bantian, Shenzhen |  | chenteyan@huawei.com |
| Yunbo Li | F1-17, Huawei Base, Bantian, Shenzhen |  | liyunbo@huawei.com |
| Jinmin Kim | LG Electronics | 19, Yangjae-daero 11gil, Seocho-gu, Seoul 137-130, Korea |  | Jinmin1230.kim@lge.com |
| Kiseon Ryu |  |  | kiseon.ryu@lge.com |
| Jinyoung Chun |  |  | jiny.chun@lge.com |
| Jinsoo Choi |  |  | js.choi@lge.com |
| Jeongki Kim |  |  | jeongki.kim@lge.com |
| Dongguk Lim |  |  | dongguk.lim@lge.com |
| Suhwook Kim |  |  | suhwook.kim@lge.com |
| Eunsung Park |  |  | esung.park@lge.com |
| JayH Park |  |  | Hyunh.park@lge.com |
| HanGyu Cho |  |  | hg.cho@lge.com |
| Bo Sun | ZTE | #9 Wuxingduan, Xifeng Rd., Xi'an, China |  | sun.bo1@zte.com.cn |
| Kaiying Lv |  |  | lv.kaiying@zte.com.cn |
| Yonggang Fang |  |  | yfang@ztetx.com |
| Ke Yao |  |  | yao.ke5@zte.com.cn |
| Weimin Xing |  |  | xing.weimin@zte.com.cn |
| Brian Hart | Cisco Systems | 170 W Tasman Dr, San Jose, CA 95134 |  | brianh@cisco.com |
| Pooya Monajemi |  |  | pmonajem@cisco.com |
| Fei Tong | Samsung | Innovation Park, Cambridge CB4 0DS (U.K.) | +44 1223 434633 | f.tong@samsung.com |
| Hyunjeong Kang | Maetan 3-dong; Yongtong-GuSuwon; South Korea | +82-31-279-9028 | hyunjeong.kang@samsung.com |
| Kaushik Josiam | 1301, E. Lookout Dr, Richardson TX 75070 | (972) 761 7437 | k.josiam@samsung.com |
| Mark Rison | Innovation Park, Cambridge CB4 0DS (U.K.) | +44 1223 434600 | m.rison@samsung.com |
| Rakesh Taori | 1301, E. Lookout Dr, Richardson TX 75070 | (972) 761 7470 | rakesh.taori@samsung.com |
| Sanghyun Chang | Maetan 3-dong; Yongtong-GuSuwon; South Korea | +82-10-8864-1751 | s29.chang@samsung.com |
| Yasushi Takatori | NTT | 1-1 Hikari-no-oka, Yokosuka, Kanagawa 239-0847 Japan | +81 46 859 3135 | takatori.yasushi@lab.ntt.co.jp |
| Yasuhiko Inoue | +81 46 859 5097 | inoue.yasuhiko@lab.ntt.co.jp |
| Shoko Shinohara | +81 46 859 5107 | Shinohara.shoko@lab.ntt.co.jp |
| Yusuke Asai | +81 46 859 3494 | asai.yusuke@lab.ntt.co.jp |
| Koichi Ishihara | +81 46 859 4233 | ishihara.koichi@lab.ntt.co.jp |
| Junichi Iwatani | +81 46 859 4222 | Iwatani.junichi@lab.ntt.co.jp |
| Akira Yamada | NTT DOCOMO | 3-6, Hikarinooka, Yokosuka-shi, Kanagawa, 239-8536, Japan | +81 46 840  3759 | yamadaakira@nttdocomo.com |
| Masahito Mori | Sony Corp. |  |  | Masahito.Mori@jp.sony.com |
| Yusuke Tanaka |  |  | YusukeC.Tanaka@jp.sony.com |
| Yuichi Morioka |  |  | Yuichi.Morioka@jp.sony.com |
| Kazuyuki Sakoda |  |  | Kazuyuki.Sakoda@am.sony.com |
| William Carney |  |  | William.Carney@am.sony.com |
| Sigurd Schelstraete | Quantenna |  |  | Sigurd@quantenna.com |
| Huizhao Wang |  |  | hwang@quantenna.com |
| Narendar Madhavan | Toshiba |  |  | narendar.madhavan@toshiba.co.jp |
| Masahiro Sekiya |  |  |  |
| Toshihisa Nabetani |  |  |  |
| Tsuguhide Aoki |  |  |  |
| Tomoko Adachi |  |  |  |
| Kentaro Taniguchi |  |  |  |
| Daisuke Taki |  |  |  |
| Koji Horisaki |  |  |  |
| David Halls |  |  |  |
| Filippo Tosato |  |  |  |
| Zubeir Bocus |  |  |  |
| Fengming Cao |  |  |  |

Abstract

This document provides proposals for spec changes for OBSS\_PD-based SR mode.

1. **Revision notes**

R6: slight modifications to the optionally present fields of the SRP element, i.e. rewording for readability without technical change

 Change “ESS” to “ESS or HESS” in a few places

 Expanded the description of how to determine if a PPDU is inter-ESS – i.e. used language that discusses the use of the bitmap, as opposed to just saying “use the bitmap”

 Changed OBSSPD to OBSS\_PD everywhere, since that seems to be the term that has more momentum in the TGax community

R7: update the “not received at all” language to reflect updated language fom 11-16-1223r6

 Removed default value statements for TXPwr\_ref and OBSS\_PDmin and OBSS\_PDmax because these are duplicates of changes that appear already in 11-16-1223r6 which should precede the changes in this document

R8: add a note to the editing instructions to point out that subclause 25.9.3 becomes 25.9.2.1 after the application of changes found in 11-16-1223r6

R9:

In 25.9.2:

Merged condition for ESS OBSS PD use of ESS Info present = 1 and PPDU is an intra-ESS PPDU

Merged condition for ESS OBSS PD use of ESS Info present = 1 and PPDU is an inter-ESS PPDU

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.***

1. **Explanation of the proposed changes**
	1. **OBSS\_PD-based SR parameters**

The spec defines a spatial reuse mode that we call OBSS\_PD-based SR, and which is defined in 25.9.2 and 25.9.3.

In the SFD, we agreed that the TxPower and OBSS\_PD can be adjusted based on a proportional rule.

An 11ax STA regards a valid OBSS PPDU as not having been received at all (e.g., should not update its NAV), except that the medium condition shall indicate BUSY during the period of time that is taken by the receiving STA to validate that the PPDU is from an Inter-BSS, but not longer than the time indicated as the length of the PPDU payload if the RXPWR of the received PPDU is below the OBSS\_PD threshold and TBD conditions are met, noting that the OBSS\_PD threshold is accompanied by a TXPWR value following adjustment rules:



[SR Motion 4, September 17, 2015, see [137], modified with SR Motion 7, March 2016, see 16/414r0]

This document proposes to fill TBDs in the spec:

* Default parameters for this proportional rule
* how to set/adjust the different values in this proportional rule.

**Default parameters:**

This document proposes default parameters that are conservative:

* + OBSS\_Pdmin\_default = -82dBm for 20MHz
	+ OBSS\_Pdmax\_default = -62dBm for 20MHz
	+ PWRref = 21dBm for non-AP STAs or AP STAs with 1 and 2 SSs, 25dBm for AP STAs of 3 SSs or more

**how to set/adjust the different values in this proportional rule.**

An ESS may provide ESS OBSS\_PDmin and OBSS\_PDmax values that apply to intra-ESS PPDUs

* OBSS\_PDmin\_default <= OBSS\_PDmin <= ED threshold
* OBSS\_PDmin <= OBSS\_PDmax

Default OBSS\_PDmin and default OBSS\_PDmax values apply to inter-BSS PPDUs that are not intra-ESS PPDUs

* 1. **Allowing/disallowing SR modes:**

In the specification framework 11-15-0132-17-00ax, we have the following sentence:

Include the “SR\_allowed” signaling in HE-SIGA to indicate whether SR operation is allowed or not.

* use a value of Spatial Reuse field to indicate SR is disallowed
* The conditions to disallow SR are TBD

[SR Motion 6, March 2016, see 16/382r0]

We have 2 spatial reuse modes currently defined in the SFD:

* OBSS\_PD-based SR: which uses OBSS\_PD levels as defined in 25.9.2 and 25.9.3, and which don’t use information in SIG-A.
* SRP-based SR: defined in the SFD and which uses information in SIG-A SR field.

We propose:

* that the “SR disallowed” entry set in SR field in HE-SIGA only disallows SRP-based SR

We propose also that:

– non-AP STAs set “SR disallowed” entry in Spatial Reuse field when AP requests.

– non-AP STAs set “SR disallowed” entry in Spatial Reuse field in frame with NDP or FTM.

1. **Proposed changes**

***TGax editor: Add a new line for spatial reuse parameter set element in Table 9-76—Element IDs.***

***TGax editor: Insert a new subclause (Spatial reuse parameter set element) in 9.4.2***

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

The Spatial Reuse Parameter Set element provides information needed by STAs for proper operation when operating with OBSS\_PD-based spatial reuse as defined in section 25.9.2. The format of the Spatial Reuse Parameter Set element is defined in Figure 9-ax6b (Spatial Reuse Parameter Set element).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension  | SR Control | ESS OBSS\_PDmin\_offset | ESS OBSS\_PDmax\_offset | ESS BSS Color Bitmap | ESS Partial BSSID Bitmap |
| Octets: | 1 | 1 | 1 | 1 | 0 or 1 | 0 or 1 | 0 or 8 | 0 or 8 |

 **Figure 9-ax6b- Spatial Reuse parameter set element**

The Element ID, Element ID extension and Length fields are defined in 9.4.2.1 (General).

The SR Control field is defined in Figure 9-ax6c (SR Control field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | SRP disallowed | ESS Information Present | Reserved |
| Bits: | 1 | 1 | 6 |

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

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

The ESS Information Present subfield indicates if the ESS OBSS\_PDmin\_offset field, ESS OBSS\_PDmax\_offset field, ESS BSS Color Bitmap and ESS Partial BSSID subfields are present; When the ESS Information Present subfield has the value 1, then these subfields are present. When the ESS Information Present subfield has the value 0, then these subfields are not present.

The ESS OBSS\_PDmin\_offset subfield is present when the value of the ESS Information Present subfield is equal to 1; Otherwise the ESS OBSS\_PDmin\_offset subfield is not present. The ESS OBSS\_PDmin\_offset field contains an unsigned integer which is added to the value -82 dBm to generate the value of the ESS OBSS\_PDmin parameter.

The ESS OBSS\_PDmax\_offset subfield is present when the value of the ESS Information Present subfield is equal to 1; Otherwise the ESS OBSS\_PDmax\_offset subfield is not present. The ESS OBSS\_PDmax\_offset field contains an unsigned integer which is added to the value -82 dBm to generate the value of the ESS OBSS\_PDmax parameter.

The ESS BSS Color Bitmap subfield is present when the value of the ESS Information Present subfield is equal to 1; Otherwise the ESS BSS Color Bitmap subfield is not present. The ESS BSS Color Bitmap subfield is a bitmap that indicates which BSS Color values are used by members of the ESS or HESS of which the transmitting STA is a member. Each bit of the bitmap corresponds to one of the 63 available BSS Colors, where the lowest numbered bit corresponds to BSS Color value 0 and the highest numbered bit corresponds to BSS Color value 63. A BSS Color value is used by at least one BSS that is a member of the same ESS or HESS 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 ESS or HESS of the transmitting STA uses the corresponding BSS Color value.

The ESS Partial BSSID Bitmap subfield is present when the value of the ESS Information Present subfield is equal to 1; Otherwise the ESS Partial BSSID Bitmap subfield is not present. The ESS Partial BSSID Bitmap subfield is a bitmap that indicates which Partial BSSID values are used by members of the ESS or HESS of which the transmitting STA is a member. Each bit of the bitmap corresponds to one of the 2^6 possible values of BSSID[39:44], where the lowest numbered bit corresponds to Partial BSSID value 0 and the highest numbered bit corresponds to Partial BSSID value 63. A Partial BSSID value is used by at least one BSS that is a member of the same ESS or HESS 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 ESS or HESS of the transmitting STA uses the corresponding Partial BSSID value.

***TGax editor: Add the following text to section 25.2.1***

An HE STA shall use information provided in the Spatial Reuse Information element which identifies BSS that are members of the STA’s ESS or HESS to determine whether a received inter-BSS PPDU is an inter-ESS PPDU. If BSS Color information is present in a PPDU, the PPDU is an inter-ESS PPDU if the bit corresponding to the BSS Color of the PPPDU in the ESS BSS Color Bitmap is 0. If Partial BSSID information is present in a PPDU, the PPDU is an inter-ESS PPDU if the bit corresponding to the ESS Partial BSSID Bitmap is 0. If a PPDU is not determined to be inter-ESS, then it shall be assumed to be intra-ESS.

***TGax editor: Add the underlined text to section 25.9.2***

**25.9.2 Color code based CCA rules**

If the RXVECTOR parameter SPATIAL\_REUSE is set to SR disallowed entry, then SRP-based SR is disallowed.

***TGax editor: Modify the text as shown within 25.9.2***

If the PHY of a STA issues a PHY-CCA.indication with a value equal to BUSY followed by an RXSTART.indication due to a PPDU reception then the STA’s MAC sublayer may a) issue a PHY-CCARESET.request primitive and b) not update its NAV timers based on frames carried in the PPDU if all the following conditions are met:

* The received PPDU is an Inter-BSS PPDU (see 25.2.1)
* The STA that received a Spatial Reuse Parameters information element from its associated AP with the ESS Information Present subfield equal to 0
* The received power level measured from the legacy portion of the PPDU is below the Default OBSS\_PD level (defined in 25.9.2.1)
* The PPDU is other than:
	+ a non-HT PPDU that carries a public action frame where the frame is individually addressed and the frame’s RA matches the receiving STA’s MAC address
	+ a non-HT PPDU that carries a public action frame where the frame is group addressed

***TGax editor: Add the following text to 25.9.2***

If the PHY of a STA issues a PHY-CCA.indication with a value equal to BUSY followed by an RXSTART.indication due to a PPDU reception then the STA’s MAC sublayer may a) issue a PHY-CCARESET.request primitive and b) not update its NAV timers based on frames carried in the PPDU if all the following conditions are met:

* The received PPDU is an Inter-BSS PPDU (see 25.2.1)
* The STA that received a Spatial Reuse Parameters information element from its associated AP with the ESS Information Present subfield equal to 1 and the received PPDU is an Intra-ESS PPDU (see 25.2.1)
* The received power level measured from the legacy portion of the PPDU is below the ESS OBSS\_PD level (defined in 25.9.2.1)
* The PPDU is other than:
	+ a non-HT PPDU that carries a public action frame where the frame is individually addressed and the frame’s RA matches the receiving STA’s MAC address
	+ a non-HT PPDU that carries a public action frame where the frame is group addressed

If the PHY of a STA issues a PHY-CCA.indication with a value equal to BUSY followed by an RXSTART.indication due to a PPDU reception then the STA’s MAC sublayer may a) issue a PHY-CCARESET.request primitive and b) not update its NAV timers based on frames carried in the PPDU if all the following conditions are met:

* The received PPDU is an Inter-BSS PPDU (see 25.2.1)
* The STA that received a Spatial Reuse Parameters information element from its associated AP with the ESS Information Present subfield equal to 1 and the received PPDU is an Inter-ESS PPDU (see 25.2.1)
* The received power level measured from the legacy portion of the PPDU is below the Default OBSS\_PD level (defined in 25.9.2.1)
* The PPDU is other than:
	+ a non-HT PPDU that carries a public action frame where the frame is individually addressed and the frame’s RA matches the receiving STA’s MAC address
	+ a non-HT PPDU that carries a public action frame where the frame is group addressed

**25.9.3 Adaptive CCA and transmit power control**

***TGax editor: Add the following to section 25.9.3 (renumbered to 25.9.2.1 after application of 11-16-1223r6 the proposed changes of which the editor should apply first)***

An AP may define ESS OBSS\_PDmin and ESS OBSS\_PDmax values that are used by its associated STAs to derive ESS OBSS\_PD level for intra-ESS PPDUs. STAs which receive a Spatial Reuse Parameter IE from their associated AP shall maintain two OBSS\_PDlevel parameters, each calculated according to the Allowable OBSS\_PD level equation above. One of the parameters is the Default OBSS\_PD level parameter, calculated using Default OBSS\_PDmin and Default OBSS\_PDmax in place of OBSS\_PDmin and OBSS\_PDmax, respectively. The other parameter is the ESS OBSS\_PD level parameter, calculated using ESS OBSS\_PDmin and ESS OBSS\_PDmax in place of OBSS\_PDmin and OBSS\_PDmax, respectively. STAs which do not receive a Spatial Reuse Parameter IE from their associated AP, or a Spatial Reuse information element with a value of 0 in the ESS Information Present subfield shall maintain one OBSS\_PDlevel parameter calculated according to the Allowable OBSS\_PD level equation above. The parameter maintained by such STAs is the Default OBSS\_PD level parameter, calculated using Default OBSS\_PDmin and Default OBSS\_PDmax in place of OBSS\_PDmin and OBSS\_PDmax, respectively.

The AP shall respect the following constraints:

* OBSS\_PDmin\_default <= ESS OBSS\_PDmin <= -62dBm
* ESS OBSS\_PDmin <= ESS OBSS\_PDmax

An AP shall set the value of ESS OBSS\_PDmin offset and the value of ESS OBSS\_PDmax equal to OBSS\_PDmin minus -82 dBm and OBSS\_PDmax\_default minus -82 dBm, respectively, in transmitted Spatial Reuse information elements.

A non-AP STA shall set the value of Default OBSS\_PDmin and the value of Default OBSS\_PDmax equal to OBSS\_PDmin\_default and OBSS\_PDmax\_default, respectively.

A non-AP STA shall set the ESS OBSS\_PDmin and ESS OBSS\_PDmax based on the Spatial Reuse parameter set element received from its associated AP. If the non-AP STA does not receive OBSS\_PDmin and OBSS\_PDmax values from its associated AP, then the STA shall set the ESS OBSS\_PDmin and ESS OBSS\_PDmax to OBSS\_PDmin\_default and OBSS\_PDmax\_default, respectively.

The Spatial reuse parameter set element can be included in beacons, probe responses, authentication responses, and association responses.

***TGax Editor: Insert the following subclause, 25.11a, after 25.11***

**25.11a TXVECTOR parameters SPATIAL\_REUSE for** **an HE PPDU**

A STA shall set the TXVECTOR parameter SPATIAL\_REUSE to “SR disallowed” entry if one of the following conditions is met:

* NDP or FTM frame is carried in the HE PPDU.
* The STA is a HE non-AP STA that received the Spatial reuse parameter set element from its associated AP, and the “SR disallowed” subfield in the “SRP-based SR parameters” field of the Spatial Reuse parameter set element is set to 1

**26.3.9.7 HE-SIG-A**

**26.3.9.7.2 Content**

***TGax editor: Change the following text in Table 26-15***

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| --- |
| Table 26 15 - Fields in the HE-SIG-A for an HE SU PPDU and HE extended range SU PPDU |
| Two Parts of HE-SIG-A | Bit | Field | Number of bits | Description |
|  | TBD | Spatial Reuse | TBD | ~~“SR\_allowed” signaling indicates whether SR operation is allowed or not. A value of Spatial Reuse field is used to indicate SR is disallowed. The conditions to disallow SR are TBD. Multiple SR fields (>=2) are signaled, where each SR field corresponds to a different subband of the PPDU. Other details are TBD.~~~~Notes: this part needs further development.(#2169)~~Set to SR disallowed Entry to disallow SRP-based spatial reuse (see 25.9.2 (Color code based CCA rules) and 25.11a (TXVECTOR parameters SPATIAL\_REUSE for an HE PPDU)).\ |

***TGax editor: Change the following text in Table 26-16***

|  |
| --- |
| Table 26 16 - Fields in the HE-SIG-A for a HE MU PPDU |
| Two Parts of HE-SIG-A | Bit | Field | Number of bits | Description |
|  | TBD | Spatial Reuse | TBD | ~~“SR\_allowed” signaling indicates whether SR operation is allowed or not. A value of Spatial Reuse field is used to indicate SR is disallowed. The conditions to disallow SR are TBD. Multiple SR fields (>=2) are signaled, where each SR field corresponds to a different subband of the PPDU. Other details are TBD.~~~~Notes: this part needs further development.(#2169)~~Set to SR disallowed Entry to disallow SRP-based spatial reuse (see 25.9.2 (Color code based CCA rules) and 25.11a (TXVECTOR parameters SPATIAL\_REUSE for an HE PPDU)). |

***TGax editor: Change the following text in Table 26-17***

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| --- |
| Table 26-17 Fields in the HE-SIG-A for an HE trigger-based PPDU  |
| Two Parts of HE-SIG-A | Bit | Field | Number of bits | Description |
|  | TBD | Spatial Reuse | TBD | ~~“SR\_allowed” signaling indicates whether SR operation is allowed or not. A value of Spatial Reuse field is used to indicate SR is disallowed. The conditions to disallow SR are TBD. Multiple SR fields (>=2) are signaled, where each SR field corresponds to a different subband of the PPDU. Other details are TBD.~~~~Notes: this part needs further development.(#2169)~~Set to SR disallowed Entry to disallow SRP-based spatial reuse (see 25.9.2 (Color code based CCA rules) and 25.11a (TXVECTOR parameters SPATIAL\_REUSE for an HE PPDU)). |