IEEE P802.11
Wireless LANs

|  |
| --- |
| TGah D0.1 CC9 – Resolution for CID 205, 433 |
| Date: 2013-09-18 |
| Author(s): |
| Name | Affiliation | Address | Phone | Email |
| Eugene Baik | Qualcomm | **5775 Morehouse Dr.** **San Diego, CA 92121** | (858)658-2568 | eugeneb@qti.qualcomm.com |
|  |  |  |  |  |

Abstract

This document provides a resolution to CIDs 205 and 433 by providing text for the missing section for CCA in Draft 0.1 of the TGah specification.

# Introduction

In CC9, CIDs 205 and 433 addressed the fact that Draft 0.1 of the specification was missing the CCA section of text. This contribution resolves those identical CIDs by providing proposed text for the CCA section, 24.3.19.5 and modifications to Section 9.19.2

Note to the TGah editor:

Also see document 11-13-xxxxr0 by Matthew Fisher for additional related text to PAID, Partial BSSID modifications for resolution of CID 205, 433.

Also see document 11-13-1118r2 by Minho Cheong for additional related text in Annex E for resolution of CID 205, 433.

# Proposed Resolution

[Note to TGah Editor: Please insert the following text starting at Section 24.3.19.5]

**24.3.19.5 CCA sensitivity**

**24.3.19.5.1 General**

The thresholds in this subclause are compared with the signal level at each receiving antenna.

**24.3.19.5.2 Type 1 and Type 2 channelization for CCA levels**

In S1G operation, the CCA sensitivity levels are defined such that they are dependent and specific to country channelization and channel location within the frequency band. For S1G channelizations in all regions of the world, there are to be two classifications for channels and CCA levels, defined as Type 1 and Type 2.

For BSS set up on channels classified as using Type 1, the AP and non-AP STA devices are required to use what are referred to in this section as Type 1 CCA levels when performing their CCA procedures. Likewise, if the BSS is set up on channels classified as Type 2, the AP and non-AP STA devices are required to use CCA levels specific to Type 2 channels. The Type 1 and Type 2 channel classification for different operating classes in different regions of the world are denoted by “CCA Level Classification” in Table E-1 through Table E-4 in Annex E.

Generally speaking, Type 1 channels have CCA levels set to favor protection of ongoing transmissions and range of devices, relative to Type 2 channels. Type 2 channels have CCA levels set to favor higher bandwidth and data rate transmissions, and to allow for higher reuse within the total network across different BSSs (relative to Type 1 channels). To achieve this, Type 2 channel CCA levels (i.e. thresholds) are set to be equal to or higher than Type 1channel CCA levels.

Because of differences in CCA levels and its system implications, it is generally advantageous for BSSs intending to service devices requiring higher levels of channel and transmission protection to set up on Type 1 channels, and for BSSs expected to service devices with higher bandwidth and data rate transmissions to set up on Type 2 channels if the region/country has both Type 1 and Type 2 channels available.

**24.3.19.5.3 CCA sensitivity for operating classes requiring CCA-ED**

For the operating classes requiring CCA-Energy Detect (CCA-ED), CCA shall also detect a medium busy condition when CCA-ED detects a channel busy condition.

For improved spectrum sharing, CCA-ED is required in some bands. The behavior class indicating CCA-ED is given in Table E-1 through Table E-4 (Behavior limit sets). The operating classes requiring the corresponding CCA-ED behavior class are given in Annex E. A STA that is operating within an operating class that requires CCA-ED shall operate with CCA-ED. The CCA-ED is not required for license-exempt operation in any band.

There is no distinction between Type 1 and Type 2 channel CCA levels for CCA-Energy Detect threshold levels, and all channels will use the same set of values: CCA-ED shall indicate a channel busy condition when the received signal strength exceeds the CCA-ED threshold of -75 dBm for the primary 1MHz, -72dBm for the primary 2 MHz channel and the secondary 2 MHz channels, -69 dBm for the secondary 4 MHz channel, and -66 dBm for the secondary 8 MHz channel. The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5 (CCA-ED threshold).

NOTE—The requirement to issue a CCA signal busy as stated in 24.3.19.5.4 (CCA sensitivity for signals occupying the primary 2 MHz and/or Primary 1MHz channel) and 24.3.19.5.5 (CCA sensitivity for signals not occupying the primary 2 MHz channel) is a mandatory energy detect requirement on all Clause 24 receivers. Support for CCA-ED is an additional requirement that relates specifically to the sensitivities described in D.2.5 (CCA-ED threshold).

**24.3.19.5.4 CCA sensitivity for signals occupying the Primary 2MHz and/or Primary 1MHz channel**

In S1G operation, the CCA sensitivity levels a device must obey when detecting the start of S1G PPDUs are based on whether the occupied Primary channel in question is classified as Type 1 or Type 2.

For devices operating in Type 1 channels, the PHY shall issue a PHY-CCA.indication(BUSY, {primary2}) if one of the conditions listed in Table 1: Conditions for CCA BUSY on the Primary 2 MHz in Type 1 Channelization is met in an otherwise idle 1 MHz, 2 MHz, 4 MHz, 8 MHz, 16 MHz operating channel width. With >90% probability, the PHY shall detect the start of a PPDU that occupies at least the primary 2 MHz channel under the conditions listed in Table 1: Conditions for CCA BUSY on the Primary 2 MHz in Type 1 Channelization within a period of aCCATime (see 24.4.4 (PHY characteristics)) and hold the CCA signal busy (PHY\_CCA.indicate(BUSY, channel-list)) for the duration of the PPDU.

**Table 1: Conditions for CCA BUSY on the Primary 2 MHz in Type 1 Channelization**

|  |  |
| --- | --- |
| **Operating Channel Width** | **Conditions** |
| 1 MHz, 2 MHz, 4 MHz, 8 MHz,16 MHz | The start of a 1 MHz S1G PPDU in the primary 1 MHz channel at or above –98 dBm.The start of a 2 MHz S1G PPDU in the primary 2 MHz channel at or above –92 dBm. |
| 4 MHz, 8 MHz, 16 MHz | The start of a 4 MHz S1G PPDU in the primary 4 MHz channel at or above –89 dBm. |
| 8 MHz, 16 MHz | The start of an 8 MHz S1G PPDU in the primary 8 MHz channel at or above –86 dBm. |
| 16 MHz | The start of a 16 MHz S1G PPDU at or above –83 dBm. |

For devices operating in Type 2 channels the PHY shall issue a PHY-CCA.indication(BUSY, {primary2}) if one of the conditions listed in Table 2: Conditions for CCA BUSY on the Primary 2 MHz in Type 2 Channelization is met in an otherwise idle 1 MHz, 2 MHz, 4 MHz, 8 MHz, 16 MHz operating channel width. With >90% probability, the PHY shall detect the start of a PPDU that occupies at least the primary 2 MHz channel under the conditions listed in Table 2: Conditions for CCA BUSY on the Primary 2 MHz in Type 2 Channelization within a period of aCCATime (see 24.4.4 (PHY characteristics)) and hold the CCA signal busy (PHY\_CCA.indicate(BUSY, channel-list)) for the duration of the PPDU.

**Table 2: Conditions for CCA BUSY on the Primary 2 MHz in Type 2 Channelization**

|  |  |
| --- | --- |
| **Operating Channel Width** | **Conditions** |
| 1 MHz, 2 MHz, 4 MHz, 8 MHz,16 MHz | The start of a 1 MHz S1G PPDU in the primary 1 MHz channel at or above –89 dBm.The start of a 2 MHz S1G PPDU in the primary 2 MHz channel at or above –89 dBm. |
| 4 MHz, 8 MHz, 16 MHz | The start of a 4 MHz S1G PPDU in the primary 4 MHz channel at or above –86 dBm. |
| 8 MHz, 16 MHz | The start of an 8 MHz S1G PPDU in the primary 8 MHz channel at or above –83 dBm. |
| 16 MHz | The start of a 16 MHz S1G PPDU at or above –80 dBm. |

**24.3.19.5.4.1 CCA sensitivity for devices in Type 2 channels implementing intended 8 or 16 MHz transmit channel width channel access procedure**

For devices operating in Type 2 channels, if the device intends to transmit an 8 or 16 MHz channel width PPDU and the device implements the procedure and rules for high intended BW transmission channel access described in 9.19.2.8a EDCA channel access in a S1G BSS, the PHY shall issue a PHY-CCA.indication(BUSY, {primary2}) if one of the conditions listed in Table 2a: Conditions for CCA BUSY on the Primary 2 MHz in Type 2 Channelization for 8/16MHz intended transmit channel width is met in an otherwise idle 1 MHz, 2 MHz, 4 MHz, 8 MHz, 16 MHz operating channel width. With >90% probability, the PHY shall detect the start of a PPDU that occupies at least the primary 2 MHz channel under the conditions listed in Table 2a: Conditions for CCA BUSY on the Primary 2 MHz in Type 2 Channelization for 8/16MHz intended transmit channel width within a period of aCCATime (see 24.4.4 (PHY characteristics)) and hold the CCA signal busy (PHY\_CCA.indicate(BUSY, channel-list)) for the duration of the PPDU.

Additionally, when a STA detects a PPDU with its PAID or BSSID of its own, the PHY shall issue a PHY-CCA.indication(BUSY, {primary2}) for the protected duration of the PPDU. When the conditions listed in Table 2a results in a TXOP, a dynamic bandwidth operation which results in a channel width that is narrower than the intended channel width used during the back-off may be ignored.

**Table 2a: Conditions for CCA BUSY on the Primary 2 MHz in Type 2 Channelization for 8/16MHz intended channel width**

|  |  |
| --- | --- |
| **Operating Channel Width** | **Conditions** |
| 8 MHz,16 MHz | The start of a 1 MHz S1G PPDU in the primary 1 MHz channel at or above –86 dBm.The start of a 2 MHz S1G PPDU in the primary 2 MHz channel at or above –86 dBm. |
| 8 MHz, 16 MHz | The start of a 4 MHz S1G PPDU in the primary 4 MHz channel at or above –83 dBm. |
| 8 MHz, 16 MHz | The start of an 8 MHz S1G PPDU in the primary 8 MHz channel at or above –80 dBm. |
| 16 MHz | The start of a 16 MHz S1G PPDU at or above –77 dBm. |

**24.3.19.5.5 CCA sensitivity for signals not occupying the primary 2MHz channel**

In S1G operation, the CCA sensitivity levels for detecting signals in the Secondary channels may be classified separately for Type 1 or Type 2 channels.

The PHY shall issue a PHY-CCA.indication(BUSY, {secondary2}) if the conditions for issuing PHY-CCA.indication(BUSY, {primary2}) are not present and one of the following conditions are present in an otherwise idle 4 MHz, 8 MHz, 16 MHz operating channel width:

— For both Type 1 and Type 2 channels, any signal within the secondary 2 MHz channel at or above a threshold of –72dBm within a period of aCCATime after the signal arrives at the receiver's antenna(s); then the PHY shall not issue a PHY-CCA.indication(BUSY,{secondary4}), PHY-CCA.indication(BUSY,{secondary8}) or PHY-CCA.indication(IDLE) while the threshold continues to be exceeded.

— For Type 1 channels, a 2 MHz S1G PPDU detected in the secondary 2 MHz channel at or above – 86 dBm with >90% probability within a period aCCAMidTime (see 24.4.4 (PHY characteristics)).

— For Type 2 channels, a 2 MHz S1G PPDU detected in the secondary 2 MHz channel at or above – 82 dBm with >90% probability within a period aCCAMidTime (see 24.4.4 (PHY characteristics)).

The PHY shall issue a PHY-CCA.indication(BUSY, {secondary4}) if the conditions for issuing PHY-CCA.indication(BUSY, {primary2}) and PHY-CCA.indication(BUSY, {secondary2}) are not present and one of the following conditions are present in an otherwise idle 8 MHz, 16 MHz operating channel width:

— For both Type 1 and Type 2 channels, any signal within the secondary 4 MHz channel at or above a threshold of – 69 dBm within a period of aCCATime after the signal arrives at the receiver's antenna(s); then the PHY shall not issue a PHY-CCA.indication(BUSY, {secondary8}) or PHY-CCA.indication(IDLE) while the threshold continues to be exceeded.

— For Type 1 channels:

* A 4 MHz S1G PPDU detected in the secondary 4 MHz channel at or above – 86 dBm with >90% probability within a period aCCAMidTime (see 24.4.4 (PHY characteristics)).
* A 2 MHz S1G PPDU detected in any 2 MHz sub-channel of the secondary 4 MHz channel at or above – 86 dBm with >90% probability within a period aCCAMidTime

— For Type 2 channels:

* A 4 MHz S1G PPDU detected in the secondary 4 MHz channel at or above – 82 dBm with >90% probability within a period aCCAMidTime (see 24.4.4 (PHY characteristics)).
* A 2 MHz S1G PPDU detected in any 2 MHz sub-channel of the secondary 4 MHz channel at or above – 82 dBm with >90% probability within a period aCCAMidTime

The PHY shall issue a PHY-CCA.indication(BUSY, {secondary8}) if the conditions for PHY-CCA.indication(BUSY, {primary2}), PHY-CCA.indication(BUSY, {secondary2}) and PHY-CCA.indication(BUSY,{secondary4}) are not present and one of the following conditions are present in an otherwise idle 160 MHz operating channel width:

— For both Type 1 and Type 2 channels, any signal within the secondary 8 MHz channel at or above – 66 dBm.

— For Type 1 channels:

* An 8 MHz S1G PPDU detected in the secondary 8 MHz channel at or above – 83 dBm with >90% probability within a period aCCAMidTime (see 24.4.4 (PHY characteristics)).
* A 4 MHz S1G PPDU detected in any 4 MHz sub-channel of the secondary 8 MHz channel at or above – 86 dBm with >90% probability within a period aCCAMidTime.
* A 2 MHz S1G PPDU detected in any 2 MHz sub-channel of the secondary 8 MHz channel at or above – 86 dBm with >90% probability within a period aCCAMidTime.

— For Type 2 channels:

* An 8 MHz S1G PPDU detected in the secondary 8 MHz channel at or above – 79 dBm with >90% probability within a period aCCAMidTime (see 24.4.4 (PHY characteristics)).
* A 4 MHz S1G PPDU detected in any 4 MHz sub-channel of the secondary 8 MHz channel at or above – 82 dBm with >90% probability within a period aCCAMidTime.
* A 2 MHz S1G PPDU detected in any 2 MHz sub-channel of the secondary 8 MHz channel at or above – 82 dBm with >90% probability within a period aCCAMidTime.

[Note to TGah Editor: Please make the following edits to sections 9.19.2.4 and 9.19.2.8a

**9.19.2.4 Multiple frame transmission in an EDCA TXOP**

***Insert the following paragraph at the end of the subclause 9.19.2.4:***

When both TXOP holder and TXOP responder indicate the OBSS mitigation support in the OBSS

mitigation support subfield of the S1G Capabilities element, the TXOP holder shall set the TXVECTOR

parameter CH\_BANDWIDTH of a S1G PPDU to be the same or narrower than RXVECTOR parameter

CH\_BANDWIDTH of the last received (duplicated) >= 2MHz NDP ACK frame in the same TXOP. (#833,75, 247)

If a S1G STA intending to transmit 8 or 16 MHz channel width invokes a backoff procedure at the primary 2MHz channel for >= 2MHz PPDU transmission using the channel busy conditions as defined in 24.3.19.5.4.1, a dynamic bandwidth operation which results in a TXVECTOR parameter CH\_BANDWIDTH of a S1G PPDU that is narrower than the intended channel width used during the back-off may be ignored.

**9.19.2.8a EDCA channel access in a S1G BSS(#866)**

If an S1G STA ~~(e.g., offloading STA)~~ invokes a backoff procedure at the primary 2MHz channel for >=

2MHz PPDU transmission using the CCA conditions defined in 24.3.19.5.4 and the S1G STA is permitted to begin a TXOP (as defined in 9.19.2.3 (Obtaining an EDCA TXOP)) and the S1G STA has at least one MSDU pending for transmission for the AC of the permitted TXOP, the S1G STA shall perform exactly one of the following steps:

a) Transmit a 16 MHz mask PPDU if the secondary 2MHz channel, the secondary 4 MHz channel and the secondary 8 MHz channel were idle during an interval of PIFS immediately preceding the start of the TXOP

b) Transmit an 8 MHz mask PPDU on the primary 8 MHz channel if both the secondary 2 MHz

channel and the secondary 4 MHz channel were idle during an interval of PIFS immediately

preceding the start of the TXOP

c) Transmit a 4 MHz mask PPDU on the primary 4 MHz channel if the secondary 2 MHz channel was idle during an interval of PIFS immediately preceding the start of the TXOP

d) Transmit a 2 MHz mask PPDU on the primary 2 MHz channel

If an S1G STA intending to transmit at 8 or 16 MHz channel width invokes a backoff procedure at the primary 2MHz channel for >= 2MHz PPDU transmission using the intended 8 or 16 MHz transmit channel width CCA conditions as defined in 24.3.19.5.4.1 and the S1G STA is permitted to begin a TXOP (as defined in 9.19.2.3(Obtaining an EDCA TXOP)) and the S1G STA has at least one MSDU pending for transmission for the AC of the permitted TXOP, the S1G STA shall perform exactly one of the following steps:

a) Transmit a 16 MHz mask PPDU if the secondary 2MHz channel, the secondary 4 MHz channel and the secondary 8 MHz channel were idle during an interval of PIFS immediately preceding the start of the TXOP

b) Transmit an 8 MHz mask PPDU on the primary 8 MHz channel if both the secondary 2 MHz

channel and the secondary 4 MHz channel were idle during an interval of PIFS immediately

preceding the start of the TXOP

c) Invoke a new backoff procedure if the secondary 2MHz and/or the secondary 4MHz channel were busy.