IEEE P802.11
Wireless LANs

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| Comment Resolutions for 32.3.10 (Receiver Specification) |
| Date: 2020-08-27 |
| Author(s): |
| Name | Affiliation | Address | Phone | Email |
| Rui Cao | NXP | 350 Holger Way, San Jose,CA |  | rui.cao\_2@nxp.com |

Abstract

This submission proposes resolution to the CID 344 received on subsection 32.3.10 (Receiver specification) in TGbd D0.3.

* r0: initial version
* r1: add receiver specification for BPSK with DCM modulation.
* r2: adjust the sensitivity and adjacent channel rejection level for BPSK with DCM modulation.
* r3: specify assumptions for receiver minimum input sensitivity

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| 344 | 32.3.10 | 60.01 | add more information in this subclause such as "Receiver minimum input sensitivity", "Adjacent channel rejection", "Nonadjacent channel rejection", "Receiver maximum input level" and etc. | as in comment | Revised.Agreed in general.Add individual subclauses for "Receiver minimum input sensitivity", "Adjacent channel rejection", "Nonadjacent channel rejection", "Receiver maximum input level" and etc.See changes in 11-20/1230r3. |

*TGbd Editor: Please make the following changes in Section 32.3.10 of D0.3.*

32.3.10 Receiver specification

For tests in this subclause, the input levels are measured at the antenna connector and are referenced as the average power per receive antenna. The number of spatial streams under test shall be equal to the number of utilized transmitting STA antenna (output) ports and also equal to the number of utilized Device Under Test input ports. Each output port of the transmitting STA shall be connected through a cable to one input port of the Device Under Test.

32.3.10.1 Receiver minimum input sensitivity

The packet error ratio (PER) shall be less than 10% for a PSDU with the rate dependent input levels listed in Table 32-x (Receiver minimum input level sensitivity). A noise figure of 10 dB and an implementation loss of 5 dB are assumed. The PSDU length shall be 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations. The test in this subclause and the minimum sensitivity levels specified in Table 32-x (Receiver minimum input level sensitivity) apply 1.6 us GI, NGV-LTF-2x, LDPC and NGV PPDUs.

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| Table 32-x Receiver minimum input level sensitivity  |
| Modulation | Rate (R) | Minimum sensitivity (10 MHz PPDU) (dBm) | Minimum sensitivity (20 MHz PPDU) (dBm) |
| BPSK with DCM | 1/2 | -88 | -82 |
| BPSK | 1/2 | -85 | -82 |
| QPSK | 1/2 | -82 | -79 |
| QPSK | 3/4 | -80 | -77 |
| 16-QAM | 1/2  | -77 | -74 |
| 16-QAM | 3/4  | -73 | -70 |
| 64-QAM | 2/3 | -69 | -66 |
| 64-QAM | 3/4 | -68 | -65 |
| 64-QAM | 5/6 | -67 | -64 |
| 256-QAM | 3/4 | -62 | -59 |
| 256-QAM | 5/6 | -60 | -57 |

32.3.10.2 Adjacent channel rejection

Adjacent channel rejection for W MHz channels (where W is 10, or 20) shall be measured by setting the desired signal’s strength 3 dB above the rate-dependent sensitivity specified in 32-x (Receiver minimum input level sensitivity) and raising the power of the interfering signal of W MHz bandwidth until 10% PER is caused for a PSDU length of 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations. The difference in power between the signals in the interfering channel and the desired channel is the corresponding adjacent channel rejection. The center frequency of the adjacent channel shall be placed W MHz away from the center frequency of the desired signal.

The interfering signal in the adjacent channel shall be a signal compliant with the NGV PHY, unsynchronized with the signal in the channel under test, and shall have a minimum duty cycle of 50%. The corresponding rejection shall be no less than specified in Table 32-x (Minimum required adjacent and nonadjacent channel rejection levels).

An optional enhanced performance specification is provided for systems requiring improved immunity to out-of-channel interfering emissions. If a STA has dot11ACRType equal to 2, the adjacent channel rejection shall be no less than specified in Table 32-x (Optional enhanced minimum required adjacent and nonadjacent channel rejection level). The interfering signal in the adjacent channel shall be a signal compliant with the NGV PHY, using class C transmit mask for 10MHz channel and C2 transmit mask for 20MHz channel (see D.2.2 (Transmit power levels)), unsynchronized with the signal in the channel under test. The corresponding minimum receiver sensitivities for each modulation and coding rate are the same as in Table 32-x (Receiver minimum input level sensitivity).

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| Table 32-x Minimum required adjacent and nonadjacent channel rejection level  |
| Modulation | Rate (R) | Adjacent channel rejection (dB)10 MHz/20 MHz Channel | Nonadjacent channel rejection (dB)10 MHz/20 MHz Channel |
| BPSK with DCM | 1/2 | 19 (10MHz), 16 (20MHz) | 35 (10MHz), 32 (20MHz) |
| BPSK | 1/2 | 16 | 32 |
| QPSK | 1/2 | 13 | 29 |
| QPSK | 3/4 | 11 | 27 |
| 16-QAM | 1/2  | 8 | 24 |
| 16-QAM | 3/4  | 4 | 20 |
| 64-QAM | 2/3 | 0 | 16 |
| 64-QAM | 3/4 | -1 | 15 |
| 64-QAM | 5/6 | -2 | 14 |
| 256-QAM | 3/4 | -7 | 9 |
| 256-QAM | 5/6 | -9 | 7 |

32.3.10.3 Nonadjacent channel rejection

Nonadjacent channel rejection for W MHz channels (where W is 10 or 20) shall be measured by setting the desired signal’s strength 3 dB above the rate-dependent sensitivity specified in Table 32-x (Receiver minimum input level sensitivity), and raising the power of the interfering signal of W MHz bandwidth until a 10% PER occurs for a PSDU length of 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations. The difference in power between the signals in the interfering channel and the desired channel is the corresponding nonadjacent channel rejection. The nonadjacent channel rejection shall be met with any nonadjacent channels located at least 2×W MHz away from the center frequency of the desired signal.

The interfering signal in the nonadjacent channel shall be a signal compliant with the NGV PHY, unsynchronized with the signal in the channel under test, and shall have a minimum duty cycle of 50%. The corresponding rejection shall be no less than specified in Table 32-x (Minimum required adjacent and nonadjacent channel rejection levels).

An optional enhanced performance specification is provided for systems requiring improved immunity to out-of-channel interfering emissions. If a STA has dot11ACRType equal to 2, the nonadjacent channel rejection shall be no less than specified in Table 32-x (Optional enhanced minimum required adjacent and nonadjacent channel rejection level). The interfering signal in the nonadjacent channel shall be a signal compliant with the NGV PHY, using class C transmit mask for 10MHz channel and C2 transmit mask for 20MHz channel (see D.2.2 (Transmit power levels)), unsynchronized with the signal in the channel under test. The corresponding minimum receiver sensitivities for each modulation and coding rate are the same as in Table 32-x (Receiver minimum input level sensitivity).

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| Table 32-x Optional enhanced minimum required adjacent and nonadjacent channel rejection level  |
| Modulation | Rate (R) | Adjacent channel rejection (dB)10 MHz/20 MHz Channel | Nonadjacent channel rejection (dB)10 MHz/20 MHz Channel |
| BPSK with DCM | 1/2 | 31 (10MHz), 28 (20MHz) | 45 (10MHz), 42 (20MHz) |
| BPSK | 1/2 | 28 | 42 |
| QPSK | 1/2 | 27 | 41 |
| QPSK | 3/4 | 25 | 39 |
| 16-QAM | 1/2  | 23 | 37 |
| 16-QAM | 3/4  | 20 | 34 |
| 64-QAM | 2/3 | 16 | 30 |
| 64-QAM | 3/4 | 12 | 26 |
| 64-QAM | 5/6 | 11 | 25 |
| 256-QAM | 3/4 | 6 | 20 |
| 256-QAM | 5/6 | 4 | 22 |

32.3.10.4 Receiver maximum input level

The receiver shall provide a maximum PER of 10% at a PSDU length of 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations, for a maximum input level of –30 dBm, measured at each antenna for any baseband NGV modulation.

32.3.10.5 CCA sensitivity

32.3.10.5.1 General

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

32.3.10.5.2 CCA sensitivity for signals occupying the primary 10 MHz channel

The PHY shall issue a PHY-CCA.indication(BUSY, {primary}) primitive if one of the conditions listed in Table 32-x (Conditions for CCA BUSY on the primary 10 MHz) is met in an otherwise idle 20 MHz operating channel width. With >90% probability, the PHY shall detect the start of a PPDU that occupies at least the primary 10 MHz channel under the conditions listed in Table 32-x (Conditions for CCA BUSY on the primary 10 MHz) within a period of aCCATime (see 32.4.4 (NGV PHY)) and hold the CCA signal busy (PHY-CCA.indication(BUSY, channel-list) primitive) for the duration of the PPDU.

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| Table 32-x Conditions for CCA BUSY on the primary 10MHz  |
| Operating channel width | Conditions |
| 10MHz, or 20MHz | The start of a NON\_NGV 10MHz PPDU in the primary 10 MHz channel as defined in 17.3.10.6 (CCA requirements).The start of a 10 MHz NGV PPDU in the primary 10 MHz channel at or above –85 dBm. |
| 20MHz | The start of a 20 MHz non-NGV duplicate or 20MHz NGV PPDU at or above –82 dBm. |

The receiver shall issue a PHY-CCA.indication(BUSY, {primary}) primitive for any signal that exceeds a threshold equal to 20 dB above the minimum modulation and coding rate sensitivity (–85 + 20 = –65 dBm) in the primary 10 MHz channel within a period of aCCATime after the signal arrives at the receiver’s antenna(s); then the receiver shall not issue a PHY-CCA.indication(BUSY,{secondary}) or PHYCCA.indication(IDLE) primitive while the threshold continues to be exceeded.

32.3.10.5.3 CCA sensitivity for signals not occupying the primary 10 MHz channel

The PHY shall issue a PHY-CCA.indication(BUSY, {secondary}) primitive if the conditions for issuing PHY-CCA.indication(BUSY, {primary}) primitive are not present and one of the following conditions are present in an otherwise idle 20 MHz operating channel width:

* Any signal within the secondary 10 MHz channel at or above a threshold of –65 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(IDLE) primitive while the threshold continues to be exceeded.
* A 10MHz NON\_NGV, or NGV PPDU detected in the secondary 10 MHz channel at or above –85 dBm with >90% probability within a period aCCAMidTime (see 32.4.4 (NGV PHY)).