IEEE P802.11  
Wireless LANs

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| Comment Resolution for Section 32.3.11 (Receiver Specification) | | | | |
| Date: 2020-12-29 | | | | |
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Abstract

This submission proposes resolutions for comments received on Section 32.3.11 (Receiver Specification) in TGbd D1.0. The following is the list of 24 CIDs:

* 1005, 1090, 1091, 1092, 1111, 1185, 1186, 1187, 1188, 1189, 1190, 1191, 1192, 1194, 1547, 1590, 1591, 1592, 1596, 1597, 1678, 1679, 1680, 1786

Revisions:

* r0: initial version
* r1: update resolution to CIDs 1590, 1591, 1592, 1547
* r2: update reference link and resolution to CID 1194, 1187, 1188, 1190, 1191 and 1192

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 1194 | 32.3.11 | 80.13 | "For tests in this subclause": this is not a test spec. The language should be recrafted to set normative requirements. | Change "For tests in this subclause, the input levels are measured" to "For requirements in this subclause, input levels refer to those", and change " Each output port of the transmitting STA shall be connected through a cable to one input port of the Device Under Test" to something else. | Revised.  Agreed in principle. Modified the text related “test” to clarify the requirement, similar as in 11ax draft.  The proposed change related to “port connection” has no clear description. No change is made.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1090 | 32.3.11.1 | 80.24 | Remove "A noise figure of 10 dB and an implementation loss of 5 dB are assumed".There is no clear definition of implemenation loss,.e.g. what's the baseline performance without implementation loss | as in the comment | Accepted.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1185 | 32.3.11.1 | 80.24 | Why include the sentence "A noise figure of 10 dB and an implementation loss of 5 dB are assumed"? These details make no difference to the normative requirements in this section. (Similar sentences are still in the spec for the HR (Clause 17) and ERP (Clause 18) PHYs, but those sections were written around 1999 and 2001 respectively. There is no similar sentence in later text: see 19.3.19.1, for example.)should be defined in 32.3 (PHY MIB) with NGV PHY MIB attributes | Delete the sentence "A noise figure of 10 dB and an implementation loss of 5 dB are assumed." | Accepted.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx)  Note: this is the same comment as CID 1090. |
| 1187 | 32.3.11.1 | 80.25 | "The PSDU length shall be 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations." Why is it necessary to single out DCM in this way? It would simplify the draft to specify a single value for all modulations. The values throughout the table are very conservative and so unifying the specified PSDU length will cause no material hardship. | Change ""The PSDU length shall be 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations" to "The PSDU length shall be 4096 octets" | Rejected.  The maximum allowed PPDU duration is limted by the aPPDUMaxTime. PSDU length of 4096 octets already hit the aPPDUMaxTime for BPSK. So the PSDU length of DCM can not be defined as 4096 octets. It is defined to be 2048 octets as NDBPS for BPSK-DCM is half of BPSK. |
| 1005 | 32.3.11.1 | 80.28 | It is not clear if the receiver minimum input sensitivity test "applies" to all the conditions being met ( 1.6 us GI, NGV-LTF-2x, LDPC and NGV PPDUs). | Clarify text. Change "sensitivity) apply" to "sensitivity) applies to PPDUs that meet all the following conditions:" bulletize text -1.6 us GI is used -NGV-LTF-2x is used - LDPC is used - PPDUs are NGV PPDUs. | Revised.  Agree with the commenter. Modify the text according to 11ax Draft.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1188 | 32.3.11.1 | 80.39 | In Table 32-14, the minimum sensitivity for BPSK with DCM in 20 MHz is -82 dBm, the same as for BPSK. Everywhere else in this table (apart from one obvious typo, which is the subject of a separate comment), a lower rate mode has a lower minimum sensitivity. What is the reason for DCM in 20 MHz to depart from this pattern? | In Table 32-14, for BPSK with DCM in 20 MHz, change "-82" to "-85". | Rejected.  20MHz NGV PPDU does not have power boost on L-STF and L-LTF, so the performance of DCM may be preamble limited. So the minimum sensitivity requirement is set to be the same as MCS0. Similar definition is used in 802.11ax draft. |
| 1786 | 32.3.11.1 | 80.39 | Why is the min. RX sensitivity for BPSK w/ DCM the same as BPSK w/o DCM? | Change the min. sensitivity for 20 MHz PPDU using BPSK with PPDU from -82 to -85 (dBm). | Rejected.  20MHz NGV PPDU does not have power boost on L-STF and L-LTF, so the performance of DCM may be preamble limited. So the minimum sensitivity requirement is set to be the same as MCS0. Similar definition is used in 802.11ax draft.  Note: this is the same comment as CID 1188. |
| 1111 | 3.2.3.11.1 | 80.43 | QPSK minimum sensitivity value for 20 MHz PPDU in table 32-14 is incorrect. | QPSK 1/2 minimum sensitivity for 20 MHz PPDU should be -79, not -97 dBm | Accepted.  This is a typo from previous comment resolution implementation.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1189 | 32.3.11.1 | 80.43 | In Table 32-14, the minimum sensitivity for QPSK rate 1/2 in 20 MHz is -97 dBm. This is rather startling: 15 dB more sensitive than BPSK rate 1/2 in the same bandwidth. It must be a transposition of digits (Table 17-18 specifies -79 dBm). | In Table 32-14, for QPSK rate 1/2 in 20 MHz, change "-97" to "-79". | Accepted.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx)  Note: this is the same comment as CID1111. |
| 1678 | 32.3.11.1 | 80.43 | Table 32-14 specifies a minimum sensitivity for QPSK, R=1/2, 20 MHz PPDU of -97 dBm, wich is 9 dB better than for BPSK with DCM, R=1/2 | Replace "-97" with "-79" for QPSK, R=1,2, 20 MHz PPDU | Accepted.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx)  Note: this is the same comment as CID1111. |
| 1590 | 32.3.11.1 | 80.58 | The cell corresponding to 256QAM, 5/6, and 10 MHz should be N/A. | As in the comment. | Accepted.    TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1190 | 32.3.11.2 | 81.2 | "for a PSDU length of 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations". Why is it necessary to single out DCM in this way? It would simplify the draft to specifiy a single value for all modulations. | Change "for a PSDU length of 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations" to "for a PSDU length of 4096 octets". | Rejected.    The maximum allowed PPDU duration is limted by the aPPDUMaxTime. PSDU length of 4096 octets already hit the aPPDUMaxTime for BPSK. So the PSDU length of DCM can not be defined as 4096 octets. It is defined to be 2048 octets as NDBPS for BPSK-DCM is half of BPSK.  Note: this is similar comment as CID 1187. |
| 1591 | 32.3.11.2 | 81.52 | The cells corresponding to 256QAM, 5/6 should specify for (20 MHz) only. | As in the comment. | Revised.    TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1191 | 32.3.11.3 | 81.62 | "for a PSDU length of 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations". Why is it necessary to single out DCM in this way? It would simplify the draft to specifiy a single value for all modulations. | Change "for a PSDU length of 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations" to "for a PSDU length of 4096 octets" | Rejected.  The maximum allowed PPDU duration is limted by the aPPDUMaxTime. PSDU length of 4096 octets already hit the aPPDUMaxTime for BPSK. So the PSDU length of DCM can not be defined as 4096 octets. It is defined to be 2048 octets as NDBPS for BPSK-DCM is half of BPSK.  Note: this is similar comment as CID 1187. |
| 1592 | 32.3.11.3 | 82.49 | The cells corresponding to 256QAM, 5/6 should specify for (20 MHz) only. | As in the comment. | Revised.    TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1679 | 32.3.11.3 | 82.49 | In Table 32-16 the nonadjacent channel rejection requirement for 256QAM, R=5/6 is 2 dB more stringent than for 256QAM, R=3/4 | Replace "22" with "18" for 256QAM, R=5/6 in the nonadjacent channel rejection column | Accepted.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1680 | 32.3.11.4 | 82.53 | Since the receiver minimum input sentivity is specified in 32.3.11.1, this subclause read "Receiver maximum input level" | Replace "minimum" with "maximum" | Accepted.  This is a typo from previous comment resolution implementation.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1192 | 32.3.11.4 | 82.55 | "at a PSDU length of 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations". Why is it necessary to single out DCM in this way? It would simplify the draft to specifiy a single value for all modulations. | Change ""at a PSDU length of 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations" to "at a PSDU length of 4096 octets". | Rejected.    The maximum allowed PPDU duration is limted by the aPPDUMaxTime. PSDU length of 4096 octets already hit the aPPDUMaxTime for BPSK. So the PSDU length of DCM can not be defined as 4096 octets. It is defined to be 2048 octets as NDBPS for BPSK-DCM is half of BPSK.  Note: this is similar comment as CID 1187. |
| 1547 | 32.3.11.5.2 | 83.13 | 802.11REVmd has changed the CCA definition for wider bandwidth OFDM by defining the CCA sesitivity on primary channel. Suggest to make the same change for NGV, i.e. set CCA BUSY if power in primary 10MHz is -85dBm or above. | As in the comment. | Revised.  Agree with the commenter. In 802.11REVmd D5.0, the definition of the CCA requirement for signal occupying primary 10 MHz is changed to only base on the power measured on the primary 10MHz. Make the changes according to the latest update in 802.11REVmd D5.0.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1091 | 32.3.11.5.2 | 83.5 | "in an otherwise idle 20 MHz operating channel width." should be changed to "in an otherwise idle 10 or 20 MHz operating channel width" | as in comment | Revised.  Agree with the commenter. Made the change to accommodate that.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1596 | 32.3.11.5.2 | 83.8 | aCCATime cannot be found in Clause 32.4.4. | Please clarify and fix as needed. | Revised.  This is the reference style used in 802.11REVmd. Clause 32.4.4 refers to Clause 17.4.4 for the aCCATime definition. I agree with the commenter that it is more straightforward to directly refer it to Clause 17.4.4.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1092 | 32.3.11.5.2 | 83.20 | In Table 32-17, "20 MHz non-NGV duplicate of 20 MHz NGV PPDU". Should it be " 20 MHz non-NGV duplicate or 20 MHz NGV PPDU"? | as in comment | Revised.  Agree with the commenter. This is a typo from previous comment resolution implementation.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1597 | 32.3.11.5.2 | 83.19 | The first line of Conditions is an incomplete sentence. | Please complete the sentence and requirement. | Revised.  Agreed with the comment. The text is rewritten, and the issue does not exist.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |
| 1186 | 32.3.11.5.2 | 83.26 | "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)". The minimum modulation and coding rate sensitivity in the primary 10 MHz channel is -88 dBm, not -85: see Table 32-14, p. 80. In any case, providing a derivation or explanation of this sort does not affect the normative requirements. Such notes were common 20 years ago, but have generally been phased out snce then. | Change "a threshold equal to 20 dB above the minimum modulation and coding rate sensitivity (-85 + 20 = -65 dBm)" to "-65 dBm". | Revised.  Agreed in principle. Rewrite the text to accommodate the comment.  TGbd Editor: Please see the changes in [https://mentor.ieee.org/802.11/dcn/20/11-20-1990-03-00bd-comment-resolution-for-receiver-specification.docx](https://mentor.ieee.org/802.11/dcn/20/11-20-1990-02-00bd-comment-resolution-for-receiver-specification.docx) |

*TGbd Editor: Please make the following changes in Section 32.3.11 of D1.0.*

32.3.11 Receiver specification

For receiver minimum input sensitivity, adjacent channel rejection, nonadjacent channel rejection, receiver maximum input level and CCA sensitivity requirements described in this subclause, (#1194) 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.

(#1005) For requirements on receiver minimum input sensitivity in 32.3.10.1 (Receiver minimum input sensitivity), adjacent channel rejection in 32.3.11.2 (Adjacent channel rejection) and nonadjacent channel rejection in 32.3.11.3 (Nonadjacent channel rejection) apply to PPDUs that meet all the following conditions:

* 1.6 us GI is used
* NGV-LTF-2x is used
* LDPC is used
* The PPDU is an NGV PPDU

32.3.11.1 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 32-14 (Receiver minimum input level sensitivity). (#1090, #1185) The PSDU length shall be 2048 octets for BPSK modulation with DCM or 4096 octets for all other modulations. (#1005)

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| Table 32-14 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 (#1111, #1189, #1678) |
| 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 | NA (#1590) | -57 |

32.3.10.2 Adjacent channel rejection

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| Table 32-15 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 (10 MHz), 16 (20 MHz) | 35 (10 MHz), 32 (20 MHz) |
| 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 (only applies to 20 MHz) (#1591) | 7 |

32.3.11.3 Nonadjacent channel rejection

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| Table 32-16 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 (10 MHz), 28 (20 MHz) | 45 (10 MHz), 42 (20 MHz) |
| 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 (only applies to 20 MHz) (#1592) | 18 (#1679) |

32.3.11.4 Receiver maximum input level (#1680)

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.

32.3.11.5.2 CCA sensitivity for signals occupying the primary 10 MHz channel



(#1547, #1091, #1092, #1597) An NGV STA with a W MHz operating channel width shall detect, with >90% probability, the start of a PPDU that occupies at least the primary 10 MHz channel in an otherwise idle W MHz operating channel width, and issue a PHY CCA.indication(BUSY, {primary}) primitive within a period of aCCATime (see 17.4.4 (OFDM PHY)) (#1596) if one of the following conditions is met:

— The start of a NON\_NGV\_10 PPDU as defined in Clause 17.3.10.6 (CCA requirements).

— The start of a 20 MHz non-NGV duplicate or NGV PPDU (#1092) for which the power measured within the primary 10 MHz channel is above –85 dBm.

The CCA signal shall be held busy (PHY-CCA.indication(BUSY, {primary}) primitive) for the duration of the PPDU.

The receiver shall issue a PHY-CCA.indication(BUSY, {primary}) primitive for any signal that exceeds a threshold of –65 dBm (#1186) 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.