IEEE P802.11  
Wireless LANs

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | CID 4615 | | | | | | Date: 2021-09-18 | | | | | | Author(s): | | | | | | Name | Affiliation | Address | Phone | email | | Brian Hart | Cisco Systems |  |  | [brianh@cisco.com](mailto:brianh@cisco.com) | | Eldad Perahia | HPE |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

Abstract

This submission proposes resolutions for the following comments from comment collection on P802.11be D1.0:

4615

The baseline used in this document is D1.1.

NOTE – Set the Track Changes Viewing Option in the MS Word to “All Markup” to clearly see the proposed text edits.

**Revision History:**

R0: Initial version.

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| --- | --- | --- | --- | --- | --- |
| 4615 | 36.3.20.5 | 540.43 | MCS13 at 320 MHz only needs to be receivable above -34 dBm (P538L60) and below -30 dBm (P540L43), which is an absurdly narrow range of signal levels and will require great physical perseverance and/or agility in order to experience MCS13 in practice | Reduce the required sensitiivity for the higher MCSs and increase the receiver maximum input level for 5 and 6 GHz | Revised.  See motioned option in 21/xxxx<motionedRevision> which substantially align with the commenter’s goal. |

**Discussion**

The marketability of 4KQAM would be higher if reliable operation could be assured over a readily observable set of ranges. For instance a city education department or a hospital chain is assessing whether to upgrade their APs to 802.11ax or 802.11be and, as part of their evaluation methodology, determines the rate-versus-range of various corporate-owned-business-only (COBO) devices and bring-your-own-devices (BYODs). If the speed increase from MCS12 or MCS13 is only discernible over a very small set of ranges, then the value of 802.11be over 802.11ax in this regard is deemed to be low. Thus, this marketing goal translates to an appreciable dynamic range of received signal levels, such as (for preference) at least 12-15 dB across all bandwidths.

However, in 802.11beD1, the required sensitivity of MCS13 at [80 160 320] MHz is [-40 -37 -34] dBm but the maximum input level at 6 GHz is -30 dBm, which provides only [10 7 4] dB of guaranteed dynamic range.

By comparison, the 802.11ax draft amendment required a minimum of 13 dB dynamic range for MCS11 at 160 MHz (where we have a sensitivity of -43 dB and a max input level of -30 dBm). A very reasonable goal for EHT is “not worse than HE”, aka the EHT dynamic range should increase by 9dB (9+4=13). Ideally the increased dynamic range would come as a fairly defined requirement (for more predictable behavior) with increased sensitivity (for range), but implementation flexibility is likely desirable as well.

As historical context, a maximum input level of -30 dBm for OFDM in 5 GHz was introduced by the 802.11a-1999 amendment. In 802.11g-2003, the maximum input level was defined as -20 dBm for OFDM in 2.4 GHz. These levels have carried forward unchanged in the 802.11n/ac/ax amendments and in the 802.11be drafts for a period of 18-22 years. We understand that the industry is now as good at design, manufacturing, and operation at 5/6 GHz as it is at 2.4 GHz.

Furthermore, consider some future amendment where 16KQAM is defined. If past practice is continued, we will have a min required sensitivity of -28 dBm and a maximum input level of -30 dBm, in which case there is no level at which 16KQAM operation is actually required. This is absurd, and so in this hypothetical future amendment past practice *must* change. Accordingly past practice could (and should) change sooner.

The group needs to select one of three promising options:

**Option A: Increase max input level**

* No improvement in range
* Assuming a future amendment defines 16KQAM, this direction still makes some sense

***Editor, please change the following language as indicated by Word track changes***

36.3.20.5 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 –21 dBm in the 5 GHz and 6 GHz bands and –20 dBm in the 2.4 GHz band, measured at each physical antenna port(#1329) for any baseband EHT modulation.

*(We could also use -20dBm as a round number common to all bands).*

**Option B: Balanced increase in max input level and improvement in sensitivity**

* This option provides most range increase and predictability, so is best for users
* If 16KQAM were defined in a future amendment, a different approach that doesn’t require continued improvement in sensitivity, such as option A, is probably preferred.

***Editor, please change the following language as indicated by Word track changes***

Table 36-66—Receiver minimum input level sensitivity

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Modulation | Rate (R) | Minimum sensitivity (20 MHz PPDU) (dBm) | Minimum sensitivity (40 MHz PPDU) (dBm) | Minimum sensitivity (80 MHz PPDU) (dBm) | Minimum sensitivity (160 MHz PPDU) (dBm) | Minimum Sensitivity (320 MHz PPDU) (dBm) |
| 4096-QAM | 5/6 | –46 | –43 | –40 | –37 | –37 |

36.3.20.5 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 –24 dBm in the 5 GHz and 6 GHz bands and –20 dBm in the 2.4 GHz band, measured at each physical antenna port(#1329) for any baseband EHT modulation.

*(We could choose different numbers of course: e.g., -38 and -25 dBm, etc etc)*

**Option C: Vendor choice**

* Range might or might not improve
* Greatest flexibility for implementers, seems well suited to 16KQAM too if defined in a future amendment

***Editor, please insert the following new section***

36.3.20.6a Minimum dynamic range

In addition to the requirements in 36.3.29.2 (Receiver minimum input sensitivity) and (36.3.20.5 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 range of input levels that is at least 13 dB wide in all bands, measured at each physical antenna port for any supported baseband EHT modulation.