IEEE P802.11  
Wireless LANs

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| LB236 comment resolution for PHY-CCA | | | | |
| Date: 2019-03-12 | | | | |
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|  |  |  |  |  |

Abstract

Resolutions to LB236 comments on CCA and related topics (PHY CCA-ED comment group [1]):

2179

2180

2181

2182

2184

2187

2601

Change history:

r0 (2019-03-12): Initial draft.

Reference:

1. Doc. IEEE 802.11-19/0156r1, “LB236 REVmd phy-sec comments”, M. Montemurro (BlackBerry), January 30, 2019.

Note: all page and line numbers refer to REVmd D2.0.

## Comment 2179

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| **CID** | **Commenter** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 2179 | John Coffey | 2888.33 | 16.3.8.5 | Is an ERP STA necessarily a compliant HR/DSSS STA? Is an HT STA at 2.4 GHz necessarily either an HR/DSSS STA or an ERP STA? The answer to these questions is murky given the current draft. The reason is that the definitions of CCA differ in each of the sections. For example, it is not clear whether ERP's definition of CCA (sections 18.3.4 and 18.4.6) supplements or supplants the HR/DSSS definitions (section 16.3.8.5). In some circumstances it might be important to be able to say with confidence whether a STA is compliant or not, so we should fix this. The proposed change takes the "supplant" approach. | Add at beginning of section "A NonERP HR/DSSS STA shall satisfy all requirements in this section." At line 33, change "The HR/DSSS PHY" to "The STA" (or "The NonERP HR/DSSS STA"). Make similar change at 2858.25 (with "DSSS" instead of "HR/DSSS"). |

## Discussion for 2179

It would be convenient (though it is not essential) to have a uniform way of defining extensions, in such a way that successor amendments are automatically fully compliant with the earlier amendment. So an ERP STA would automatically be an HR/DSSS STA, an HT STA operating at 2.4 GHz would automatically be an ERP STA, an HE STA operating at 2.4 GHz would automatically be an HT STA, and so on.

Of course, no additional requirements should be added to long-completed amendments in such a way as to make deployed and otherwise compliant devices non-compliant.

In the case of ERP, the balloted draft (D2.0) (like its predecessors since 802.11g was ratified in 2003) strongly implies that ERP devices are *not* necessarily fully compliant HR/DSSS devices. The maximum input signal level requirement for ERP STAs is stated in terms of a signal level of -20 dBm (18.4.8.4; 2945.8-14), whereas the corresponding requirement for HR/DSSS STAs is stated in terms of a signal level of -10 dBm (16.3.8.3, 2888.1-6). See also 2937.1-3 (listing the change as an explicit exception for ERP STAs). The CCA requirements mentioned in the comment also differ, but in that case, it is not clear whether the ERP requirements supplement or supplant the HR/DSSS requirements.

Incidentally, the overview of Clause 18 (18.1-18.3, 2936.4-2937.37) has many normative statements that require ERP STAs to implement some of the requirements of an HR/DSSS STA, and many more suggestive, but non-normative, statements that imply that the ERP PHY includes full HR/DSSS functionality (ERP is an “extension” of, “builds on the payload data rates of”, and even “implements all mandatory modes of” the HR/DSSS PHY, among others). A reader could be forgiven for assuming that an ERP STA is already necessarily a fully compliant HR/DSSS STA. But most of these statements are descriptive (the ERP implements all mandatory modes) rather than normative (the ERP shall implement all mandatory modes). In addition, the current text seems to draw a distinction between *modes* (data rates and preambles) and subsidiary requirements (maximum input signal level, and perhaps CCA). In any case, there is no statement that says (and there is no set of statements that collectively say that) “An ERP STA shall comply with all normative requirements of an HR/DSSS STA”, and there is at least one apparent counterexample (see above).

There is a fairly straightforward way of rewording the definitions so that successor standards ‘telescope’, while not adding additional requirements. All we have to do is to add the qualifier “NonERP” (or non-whatever the extension is) to the appropriate normative requirements in the predecessor clauses, and then to add the general statement “A <successor amendment> STA shall comply wth all normative requirements of a <predecessor amendment> STA”.

For the present case of ERP v. HR/DSSS, we should also clean up subclauses 18.3.4 (CCA) and 18.4.6 (CCA performance), which contain incorrect and incomplete specifications. In 18.3.4 (CCA), ERP STAs should be required to detect the PPDUs specified in 18.3.2 (PPDU format), and certainly not 17.3.2 (PPDU format) as at present, since Clause 17 PPDUs are transmitted at 5 GHz. In 18.4.6, the only performance requirements for detecting single-tone modes are for ERP-DSSS/CCK: the ERP STA should be required to detect DSSS and HR/DSSS also, for consistency with 18.3.4. Since DSSS and HR/DSSS modes are virtually indistinguishable over the air from their ERP counterparts ERP-DSSS and ERP-CCK, this does not impose a genuine extra requirement on any ERP device.

(Note that the comment’s proposed resolution only implements a subset of the required statements.)

## Proposed resolution for 2179

REVISED.

In 15.4.6.3 (Receiver maximum input level), at D2.0 2857.58, change “The receiver” to “If the STA is NonERP, the receiver”.

In 15.4.6.5 (CCA), at D2.0 2858.25, add new first paragraph “A NonERP DSSS STA shall satisfy all requirements in this subclause”.

(Same place) change “The DSSS PHY” to “The NonERP DSSS STA”.

In 16.3.8.3 (Receiver maximum input level), at D2.0 2888.3, change “The receiver” to “If the STA is NonERP, the receiver”.

In 16.3.8.5 (CCA), at D2.0 2888.33, add new first paragraph “A NonERP HR/DSSS STA shall satisfy all requirements in this subclause”.

(Same place) change “The HR/DSSS PHY” to “The NonERP HR/DSSS STA”.

In 18.1.2 (Introduction), at 2936.17-25, add new sentence after first sentence: “An ERP STA shall comply with all normative requirements of Clause 16.”

In 18.3.4 (CCA), at D2.0 2942.12, change “17.3.2 (PPDU format)” to “18.3.2 (PPDU format)”.

In 18.4.6 (CCA performance), at D2.0 2943.30, change “valid ERP-DSSS/CCK sync symbols” to “valid DSSS, HR-DSSS, ERP-DSSS or ERP-CCK sync symbols”.

## Comment 2180

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| **CID** | **Commenter** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 2180 | John Coffey | 2888.58 | 16.3.8.5 | "dot11HRCCAModeSupported shall indicate the appropriate operation modes. The PHY shall be conifgured through dot11Current CCAMode." What should happen if the device is ERP or HT, and it does not exactly follow these HR/DSSS CCA definitions? | Add at beginning of section "A NonERP HR/DSSS STA shall satisfy all requirements in this section." At line 33, change "The HR/DSSS PHY" to "The STA" (or "The NonERP HR/DSSS STA"). Make similar change at 2858.48 (with "DSSS" instead of "HR/DSSS"). |

## Discussion for 2180

(See also CIDs 2179, 2182, and 2187.)

This is linked with several other comments that address the relationships between DSSS / HR/DSSS definitions with ERP / HT definitions. As described in much more detail in the discussion on CID 2179, all the proposed resolutions in this document define ERP devices to be fully compliant HR/DSSS devices, while also redefining some existing HR/DSSS definitions to confine them to NonERP devices only.

The proposed resolution slightly rewords and modifies the comment’s proposed resolution.

## Proposed resolution for 2180

REVISED.

In 15.4.6.5 (CCA), at D2.0 2858.34, add new paragraph before current first paragraph: “A NonERP DSSS STA shall satisfy all requirements in this subclause."

In 15.4.6.5 (CCA), at D2.0 2858.47, change “The value” to “For a NonERP DSSS STA, the value“.

In 16.3.8.5 (CCA), at D2.0 2888.32, add new paragraph before current first paragraph: “A NonERP HR/DSSS STA shall satisfy all requirements in this subclause."

In 16.3.8.5 (CCA), at D2.0 2888.58, add at beginning of line “For a NonERP HR/DSSS STA, “.

## Comment 2181

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| **CID** | **Commenter** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 2181 | John Coffey | 2888.62 | 16.3.8.5 | "The CCA shall indicate a clear channel if there is no energy detect or CS." This poses a problem. Often receivers are able to decode below the threshold, and the present wording seems to require the STA to declare clear channel in those conditions. Why? This 'converse' isn't present in the CCA subclauses of Clause 17 and Clause 19 (though it is present in Clause 18), so it can't be a fundamental requirement. It seems we should always permit a STA to declare that the channel is busy. And we should certainly not say a device is noncompliant simply because it can process weaker signals correctly and defer for their duration. | Delete the cited sentence. Delete also the same sentence at 2858.51. |

## Discussion for 2181

The comment understates the problem caused by the cited sentence.

What does “if there is no energy detect or CS” mean? If it means that the criterion to declare medium busy is not met, which is the most natural reading, then in principle the STA is required to make decisions based on arbitrarily small energy differences. That is, if the received signal is -X dBm or above, the STA *shall* declare medium busy, while if the received signal is at –(X + 0.000001) dBm, the STA *shall* indicate a clear channel.

This is not realistic. In practice there is no significant problem, since STAs can simply ignore the requirement to indicate a clear channel. Nobody else will know, and nobody else should care. But if that is the case, then why is the requirement there in the first place? All it achieves is to push all deployed devices out of compliance.

## Proposed resolution for 2181

ACCEPTED.

In 15.4.6.5 (CCA), at 2858.51, delete the sentence “The CCA shall indicate a clear channel if there is no energy detect or CS.”

In 16.3.8.5 (CCA), at 2888.62, delete the sentence “The CCA shall indicate a clear channel if there is no energy detect or CS.”

## Comment 2182

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| **CID** | **Commenter** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 2182 | John Coffey | 2936.13 | 18.1.1 | (This comment is linked to several others concerning CCA.) Add explanatory note saying that an ERP STA really is a fully compliant DSSS and HR/DSSS STA, even though it does not necessarily follow the exact CCA deifinitions from Clauses 15 and 16. | Add at end of paragraph: "An ERP STA shall be a DSSS STA and an HR/DSSS STA. NOTE--Clauses 15 and 16 define CCA requirements for NonERP DSSS and NonERP HR/DSSS STAs respectively. The CCA requirements for ERP STAs defined in this clause supersede those of Clauses 15 and 16." |

## Discussion for 2182

As discussed in the response to CID 2179 above, the differences between ERP and HR/DSSS go beyond CCA. The clarifying note should either be expanded or left out. It seems simpler to leave it out. Some version of the first sentence should be added (see also proposed resolution to CID 2179).

## Proposed resolution for 2182

REVISED.

In 18.1.2 (Introduction), at 2936.17-25, add new sentence after first sentence: “An ERP STA shall comply with all normative requirements of Clause 16.”

(Same proposed resolution as for CID 2179 above.)

## Comment 2184

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| **CID** | **Commenter** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 2184 | John Coffey | 2943.27 | 18.4.6 | "The CCA shall indicate true if there is no CCA "medium busy" condition." The most natural way of reading this is to equate "CCA "medium busy"" with "meets the requirements below to require declaration of "medium busy". In that caes this text is problematic, because it appears to force STAs to declare a clear channel even if the STA is able to decode the preamble of a PPDU that is received at a power level a little below the threshold. This 'converse' isn't present in Clauses 17 and 19. | Delete the cited sentence. |

## Discussion for 2184

(See also CID 2181 above.)

The comment understates the problem caused by the cited sentence.

What does “if there is no medium busy condition” mean? If it means that the criterion to declare medium busy is not met, which is the most natural reading, then in principle the STA is required to make decisions based on arbitrarily small energy differences. That is, if the received signal is -X dBm or above, the STA shall declare medium busy, with probability at least 90%, while if the received signal is at –(X + 0.000001) dBm, the STA shall (unconditionally) indicate a clear channel.

This is not realistic. In practice there is no significant problem, since STAs can simply ignore the requirement to indicate a clear channel. Nobody else will know, and nobody else should care. But if that is the case, then why is the requirement there in the first place? All it achieves is to push all deployed devices out of compliance.

## Proposed resolution for 2184

ACCEPTED.

## Comment 2187

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| **CID** | **Commenter** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 2187 | John Coffey | 2949.14 | 19.1.1 | "... an HT STA shall be capable of transmitting and receiving frames that are compliant with" [11g, 11b]. Does this mean that an HT STA is by definition an ERP or HR/DSSS STA as well? This is not so clear, because the CCA requirements are worded quite differently. It should be made clear. | Add at end of paragraph: "An HT STA that operates in the 5 GHz band shall be an OFDM (Clause 17) STA. An HT STA that operates in the 2.4 GHz band shall be an ERP STA. NOTE--Clauses 15 and 16 define CCA requirements for NonERP DSSS and NonERP HR/DSSS STAs respectively. The CCA requirements for HT STAs defined in this clause supersede those of Clauses 15 and 16." |

## Discussion for 2187

(See also CIDs 2179 and 2182 above.)

As discussed in the response to CID 2179 above, the differences between ERP and HR/DSSS go beyond CCA. The clarifying note should either be expanded or left out. It seems simpler to leave it out. Some version of the first sentence should be added (see also proposed resolution to CIDs 2179 and 2182 (making the analogous change for ERP).

## Proposed resolution for 2187

REVISED.

In 19.1.1 (Introduction to the HT PHY), at D2.0 2949.23, add new paragraph "An HT STA that operates in the 5 GHz band shall comply with all normative requirements of Clause 17. An HT STA that operates in the 2.4 GHz band shall comply with all normative requirements of Clause 18.”

## Comment 2601

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| **CID** | **Commenter** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 2601 | Mark RISON |  | 19 | Re CID 1468: need to be clearer that the ED thresholds are based on declaring busy \*if\* a PPDU of a given type with energy above a certain threshold is present, not based on detecting a PPDU of a given type and \*then\* checking the energy is above the corresponding threshold | As it says in the comment |

## Background for 2601

CID 1468, from LB232, was discussed in doc. IEEE 802.11-18/1048r3, “LB232 comment resolution for PHY CCA—Part I”, S. Coffey (Realtek), November 14, 2018.

The comment was “The HT rules for CCA as they pertain to non-HT transmissions are not clear. The issue is that if you don't know you're dealing with a non-HT transmission (which you don't know unless you successfully pick up the preamble) you don't know you have to apply the rules ("CCA sensitivity requirements for non-HT PPDUs").

The HT rules for CCA as they pertain to non-HT transmissions are given in 19.3.19.5.3 (CCA sensitivity for non-HT PPDUs), which states “CCA sensitivity requirememts for non-HT PPDUs are described in 17.3.10.6 (CCA requirements) and 18.4.6 (CCA performance).”

19.3.19.5.4 (CCA sensitivity in 20 MHz) states that “For an HT STA with the operating channel width equal to 20 MHz, the start of a valid 20 MHz HT signal at a receive level greater than or equal to the minimum modulation and coding rate sensitivity of -82 dBm shall cause the PHY to set PHY-CCA.indication(BUSY) with probability > 90% within 4 s. The receiver shall indicate a channel busy condition for any signal 20 dB or more above the minimum modulation and coding rate sensitivity (-82 + 20 = -62 dBm) in the 20 MHz channel.”

The group’s resolution was “REJECTED. The draft already contains text matching the proposed change, in 19.3.19.5.3.”

## Discussion for 2601

The resolution the group adopted last time was inaccurate: the cited text was in 19.3.19.5.4, not 19.3.19.5.3.

The comment is not completely clear. Let’s assign the label “meaning 1” to “declar[e] busy \*if\* a PPDU of a given type with energy above a certain threshold is present” and the label “meaning 2” to “detect[…] a PPDU of a given type and \*then\* check[…] the energy is above the corresponding threshold”.

It seems that menaing 1 must be correct. The current text does not mention the word “detect” at all. The triggering event is described in terms that are independent of the internal workings of the receiver (“the start of a valid 20 MHz HT signal at a receive level greater than or equal to the minimum modulation and coding rate sensitivity of -82 dBm shall cause”).

Meaning 2 is hard to interpret, because no definition is given for what it means to “detect a PPDU”. If it means “whenever a PPDU of a given type (optionally, but not necessarily, at or above the applicable energy threshold) is present, detect it”, then it seems that there is no difference between meaning 1 and meaning 2. If it means something else, what? And why could the current text plausibly read to require whatever it is?

## Proposed resolution for 2601

REJECTED.

The comment does not adequately explain why the current text is unclear. The group finds that the current text is clear and that no further explanation is necessary.