IEEE P802.11  
Wireless LANs

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| CCA for Clauses 16, 17, 19 | | | | |
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Abstract

This proposal is based upon 14/1518r5 and the discussions that arose.

Brian Hart and Guido Hierzt contributed to this presentation.

I also listened to Peter E and Mark Rison.

The presentation of this proposal is contingent upon straw poll results of 15/0561.

**CID 166**

Background

The standard presently allows an 11b Clause 16 STA to just use one of three CCA schemes: Energy detect CCA, CS and CS with ED threshold. Similarly Clause 17 devices also have a choice.

However, because many (if not all) 11b devices use just CS, 11g OFDM transmissions must use protection mechanism that is usually a RTS/CTS or CTS-to-self.

***As it stands an 11b device using only CS-CCA is not compliant with EN 300 328 V1.8.1 which specifies ED-CCA at -58dBm minimum***.

Clause 19 and 20 devices must use both CS/CCA and energy detect CCA. It is proposed that all devices at 2.4GHz be made similar with respect to CCA and hence also cause 11b devices to be compliant with EN 300 328.

This proposal would not affect present 11b devices but would affect new 11b implementations.

In discussions Atlanta Jan 2015 the following points were made:

* Present energy detect CCA levels for DSSS and CCK are much lower than for energy detect CCA for OFDM.
* EU regulations\* (see NOTE) are specifying -58dBm energy detect CCA across the board so 11b needs to be compliant with this.
* There was good support (26/4) for this proposal in principle when the above 2 points were also intended for inclusion.

**Proposed approach**

**Make all 2.4GHz PHYs have similar CCA thresholds, i.e. CS-CCA at the minimum receive sensitivity, and energy detect CCA at 20dB higher (subject to the EN300 328 limit).**

\*NOTE

*ETSI EN 300 328 V1.8.2*

*“The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal or lower than -70 dBm/MHz at the input to the receiver (assuming a 0 dBi receive antenna). For power levels below 20 dBm e.i.r.p. the CCA threshold level may be relaxed to TL = -70 dBm/MHz + 20 - Pout e.i.r.p. (Pout in dBm).”*

In a 20MHz channel, BW occupied is 16MHz, hence -70dBm/MHz is -58dBm in 20MHz channel.

This creates the Upper Limit for ED CCA

**Summary of existing CCA specs:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Clause** | **Description** | **Min RX** | **CCA -CS** | **Energy Detect CCA** |
| 16 | DSSS  1, 2Mbps  16.4.6.3 | -80dBm  @ 2Mbps) | One of following:  (1 – above ED)  2 – any DSSS  3 – DSSS above ED | -80dBm >100mW  -76dBm >50<100mW  -73dm <50mW |
| 17 | CCK  5.5, 11Mbps  17.3.8.2 | -76dBm  @ 11Mbps | One of following:  (1 – above ED)  4 – any HR (with timer)  5 – HR above ED | -76dBm >100mW  -73dBm >50<100mW  -70dm <50mW |
| 18 | 11a OFDM  18.3.10.6 | -82dBm 20MHz  -85dBm 10MHz  -88dBm 5MHz | -82dBm 20MHz  -85dBm 10MHz  -88dBm 5MHz | Mandatory  -62dBm 20MHz  -65dBm 10MHz  -68dBm 5MHz |
| 19 | 11g ERP  19.4.6 | -82dBm 20MHz | Valid signal  -76dBm\* | No Spec |
| 20 | 11n  20.3.20.5.2 | -82dBm 20MHz  -79dBm 40MHz | HT signal  -82dBm 20MHz  -79dBm 40MHz | -62dBm 20MHz  -59dBm 40MHz  If not support HT-GF  -72dBm for HT-GF (20MHz)  -69dBm for HT-GF (40MHz) |
| 22 | 11ac  22.3.18.5 |  | Primary Channel  -82dBm 20MHz  -79dBm 40MHz  -76dBm 80MHz  -73dBm 160MHz | Secondary channel  Any signal -62dBm 20MHz  -59dBm 40MHz  -72dBm in any 20MHz of 40MHz |

**Summary of proposed CCA specs:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Clause** | **Description** | **Min RX** | **CCA -CS** | **Energy detect CCA** |
| 16 | DSSS  1, 2Mbps  16.4.6.3 | -80dBm  @ 2Mbps | -82dBm | -62dBm |
| 17 | CCK  5.5, 11Mbps  17.3.8.2 | -76dBm  @ 11Mbps | -82dBm | -62dBm |
| 18 | 11a OFDM  18.3.10.6 | -82dBm 20MHz  -85dBm 10MHz  -88dBm 5MHz | -82dBm 20MHz  -85dBm 10MHz  -88dBm 5MHz | Mandatory  -62dBm 20MHz  -65dBm 10MHz  -68dBm 5MHz |
| 19 | 11g ERP  19.4.6 | -82dBm 20MHz | -82dBm | -62dBm |
| 20 | 11n  20.3.20.5.2 | -82dBm 20MHz  -79dBm 40MHz | HT signal  -82dBm 20MHz  -79dBm 40MHz | -62dBm 20MHz  -59dBm 40MHz  If not support HT-GF  -72dBm for HT-GF (20MHz)  -69dBm for HT-GF (40MHz) |
| 22 | 11ac  22.3.18.5 |  | Primary Channel  -82dBm 20MHz  -79dBm 40MHz  -76dBm 80MHz  -73dBm 160MHz | Secondary channel  Any signal -62dBm 20MHz  -59dBm 40MHz  -72dBm in any 20MHz of 40MHz |

**Proposed Changes**

***Make changes as indicated below:***

**16.4.6.5 CCA**

Page 2195 Line 61

Delete

“The DSSS PHY shall provide the capability to perform CCA according to at least one of the following three methods:

— *CCA Mode 1:* Energy above threshold. CCA shall report a busy medium upon detection of any

energy above the ED threshold.

— *CCA Mode 2:* CS only. CCA shall report a busy medium only upon detection of a DSSS signal. This signal may be above or below the ED threshold.

— *CCA Mode 3:* CS with energy above threshold. CCA shall report a busy medium upon detection of a DSSS signal with energy above the ED threshold.”

Insert

*{Note to 802.11REVmc reader, to be removed before publication. The following change has no force until REVmc is ratified (for anticipated ratification date, see* [*http://www.ieee802.org/11/Reports/802.11\_Timelines.htm*](http://www.ieee802.org/11/Reports/802.11_Timelines.htm)*). Pre-existing DSSS STAs compliant to 802.11-2012 remain compliant to 802.11-2012.}*

“The DSSS PHY shall perform CCA according to both:”

— *CCA Mode 1:* Energy above threshold. CCA shall report a busy medium upon detection of any energy above the ED threshold.

— *CCA Mode 2:* CS only. CCA shall report a busy medium only upon detection of a DSSS signal above a receive level of -82dBm.

Page 2196 line 18

*Make changes as shown*

The CCA shall indicate a clear channel if there is no energy detect or CS. The CCA parameters are subject to the following criteria:

a) The ED threshold shall be –62dBm. .

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**Proposed Changes**

***Make changes as indicated below:***

**17.3.8.5 CCA**

Page 2226 Line 61

Delete

“The high rate PHY shall provide the capability to perform CCA according to at least one of the following three methods:

— CCA Mode 1: Energy above threshold. CCA shall report a busy medium upon detecting any energy above the ED threshold.

— CCA Mode 4: CS with timer. CCA shall start a timer whose duration is 3.65 ms and report a busy medium only upon the detection of a high rate PHY signal. CCA shall report an IDLE medium after the timer expires and no high rate PHY signal is detected. The 3.65 ms timeout is the duration of the longest possible 5.5 Mb/s PSDU.

— CCA Mode 5: A combination of CS and energy above threshold. CCA shall report busy at least while a high rate PPDU with energy above the ED threshold is being received at the antenna”

Insert

*{Note to 802.11REVmc reader, to be removed before publication. The following change has no force until REVmc is ratified (for anticipated ratification date, see* [*http://www.ieee802.org/11/Reports/802.11\_Timelines.htm*](http://www.ieee802.org/11/Reports/802.11_Timelines.htm)*). Pre-existing HR/DSSS STAs compliant to 802.11-2012 remain compliant to 802.11-2012.}*

“The high rate PHY shall perform CCA according to both:

— CCA Mode 1: Energy above threshold. CCA shall report a busy medium upon detecting any energy above the ED threshold.

— CCA Mode 4: CS with timer. CCA shall start a timer whose duration is 3.65 ms and report a busy medium only upon the detection of a high rate PHY signal above a receive level of -82dBm. CCA shall report an IDLE medium after the timer expires and no high rate PHY signal is detected. The 3.65 ms timeout is the duration of the longest possible 5.5 Mb/s PSDU.

Page 2206 line 25

*Make changes as shown*

The CCA shall indicate a clear channel if there is no energy detect or CS. The CCA parameters are subject to the following criteria:

a) If a valid high rate signal is detected during its preamble within the CCA window, the ED threshold shall be less than or equal to –62 dBm.

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**Proposed changes to Clause 19.4.6**

Discussion: Clause 19 does not specify any CCA energy detect level. In addition it specifies a level of -76dBm whereas one might expect a value of -82dBm so as to be consistent with 11a, 11n, and 11ac. It is proposed to bring this clause into line with the others.

***Make changes as indicated below:***

**19.4.6 CCA performance**

The CCA shall indicate true if there is no CCA “medium busy” indication. The CCA parameters are subject to the following criteria:

1. When a valid signal at a receive level of–82dBm at the receiver antenna connector is present at the start of the PHY slot, the receiver’s CCA indicator shall report the channel busy with probability CCA\_Detect\_Probabilty within a aCCATime.(M8) CCA\_Detect\_Probabilty is the probability that the CCA does respond correctly to a valid signal and shall be at least 99% for the long slot time and at least 90% for the short slot time.(M8) The values for the other(M8) parameters are found in Table 19-6 (ERP characteristics). Note that the CCA Detect Probability and the power level are performance requirements.
2. In the event that a correct PHY(#61) header is received, the ERP shall hold the CCA signal inactive (channel busy) for the full duration, as indicated by the PHY(#61) LENGTH field. Should a loss of CS occur in the middle of reception, the CCA shall indicate a busy medium for the intended duration of the transmitted PPDU.
3. The CCA mechanism shall detect a medium busy condition within 4 us of any signal with a received energy that is greater or equal to –62 dBm

**Proposed changes to** **ANNEX C.3**

P3197L25

dot11CCAModeSupported OBJECT-TYPE

SYNTAX Unsigned32 (1..7)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

dot11CCAModeSupported is a bit-significant value, representing all of the

CCA modes supported by the PHY. Valid values are:

carrier sense and energy detect (ED\_and\_CS)= 04

This attribute is not used to indicate the CCA modes supported by a higher

rate extension PHY. Rather, the dot11HRCCAModeImplemented attribute is

used to indicate the CCA modes of the higher rate extension PHY."

::= { dot11PhyDSSSEntry 2 }

P3206L27

dot11HRCCAModeImplemented OBJECT-TYPE

SYNTAX Unsigned32 (1..31)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

dot11HRCCAModeImplemented is a bit-significant value, representing all of

the CCA modes supported by the PHY. Valid values are:

carrier sense and energy detect (ED\_and\_CS), and

carrier sense with timer (CS\_and\_Timer)=12,

::= { dot11PhyHRDSSSEntry 5 }

P3197L46

dot11CurrentCCAMode OBJECT-TYPE

SYNTAX INTEGER {

edonly(1),

csonly(2),

edandcs(4), cswithtimer(8),

hrcsanded(16) }

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by an external management entity.

Changes take effect as soon as practical in the implementation.

The current CCA method in operation. Valid values are:

carrier sense and energy detect (edandcs)= 04

::= { dot11PhyDSSSEntry 3 }

dot11EDThreshold OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by an external management entity.

Changes take effect as soon as practical in the implementation.

The current Energy Detect Threshold being used by the DSSS PHY."

::= { dot11PhyDSSSEntry 4 }

P3206L48

dot11HRCCAModeImplemented OBJECT-TYPE

SYNTAX Unsigned32 (1..31)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

dot11HRCCAModeImplemented is a bit-significant value, representing all of

the CCA modes supported by the PHY. Valid values are:

carrier sense and energy detect (ED\_and\_CS) and

carrier sense with timer (CS\_and\_Timer)=12,

::= { dot11PhyHRDSSSEntry 5 }