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 15/0561r2 and the discussions that arose.

Satisfy CID 5011

Mark Rison, Brian Hart, Guido Hiertz, Youhan Kim and VK Jones have contributed to this document.

**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 to 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 effective -58dBm energy detect CCA across the board so 11b needs to be compliant with this in Europe.
* There was good support (26/4) for this proposal in principle when the above 2 points were also intended for inclusion.

Presentation and Straw Poll in Vancouver 2015 polled approaches :

* 12 in favor of adding a new bullet for -62dBm energy detect
* 11 in favor of making -82dBm CS CCA and -62dBm energy detect CCA

\*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 16MHz channel assuming 20 dBm transmit power.

**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 | One of following:  (1 – above ED)  2 – any DSSS  3 – DSSS above ED | -80dBm >100mW  -76dBm >50<100mW  -73dm <50mW  6 – above -62dBm |
| 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  6 – above -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

The DSSS PHY shall provide the capability to perform CCA according toboth:

A – At least one of the following options:

— *CCA Mode 1:* Energy above fine 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.

and

B – *CCA Mode 6*: Energy above coarse threshold. CA shall report a busy medium within aCCATime upon detection of any energy above -62 dBm.

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**17.3.8.5 CCA**

Page 2226 Line 61

The high rate PHY shall provide the capability to perform CCA according toboth:

A – At least one of the following options:

— CCA Mode 1: Energy above fine 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.

and

B – CCA Mode 6: Energy above coarse threshold. CA shall report a busy medium within aCCATime upon detection of any energy above -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 the start of an ERP PPDU at a receive level greater than or equal to –82 dBm at the receiver antenna connector is present, the receiver’s CCA indicator shall report the channel busy with probability greater than 90%.within a aCCATime.(
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 report a medium busy condition within aCCATime of any signal with a received energy that is greater or equal to –62 dBm

**Tidy up Clauses 18, 20 with respect to aCCATime**

Edit as shown

P2264L38

The start of a valid OFDM transmission at a receive level greater than or equal to the minimum modulation and coding rate sensitivity (–82 dBm for 20 MHz channel spacing, –85 dBm for 10 MHz channel spacing, and –88 dBm for 5 MHz channel spacing) shall cause CS/CCA to detect a channel busy condition with a probability > 90% within aCCATime.

P2264 L47

Additionally, the CS/CCA mechanism shall detect a medium busy condition within aCCATime of any signal with a

P2368L43

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 a probability > 90% within aCCATime.

P2369L1

When the secondary channel is idle, the start of a valid 20 MHz HT signal in the primary channel at a receive level greater than or equal to the minimum modulation and coding rate sensitivity of –82 dBm shall cause the PHY to generate a PHY-CCA.indication(BUSY, {primary}) primitive with a probability > 90% within aCCATime. The start of a valid 40 MHz HT signal that occupies both the primary and secondary channels at a receive level greater than or equal to the minimum modulation and coding rate sensitivity of –79 dBm shall cause the PHY to generate a PHY-CCA.indication(BUSY, {primary, secondary}) primitive for both the primary and secondary channels with a probability per channel > 90% within aCCATime.

**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 DSSS PHY in addition to coarse energy detect (which is always supported). Valid values are:

fine energy detect only (fedonly) = 01,

carrier sense only (csonly) = 02,

carrier sense and fine energy detect (csandfed)= 04

or the logical sum of any of these values."

::= { dot11PhyDSSSEntry 2 }

P3197L46

dot11CurrentCCAMode OBJECT-TYPE

SYNTAX INTEGER {

fedonly(1),

csonly(2),

csandfed(4), cswithtimer(8),

hrcsandfed(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 for a DSSS or high rate PHY, in addition to coarse energy detect (which is always supported). Valid values are:

fine energy detect only (fedonly) = 01,

carrier sense only (csonly) = 02,

carrier sense and fine energy detect (csandfed)= 04,

carrier sense with timer (cswithtimer)= 08,

high rate carrier sense and fine energy detect (hrcsandfed)=16,

subject to the support indicated in dot11CCAModeSupported (for the DSSS PHY) or dot11HRCCAModeImplemented (for the high rate PHY). "

::= { dot11PhyDSSSEntry 3 }

dot11EDThreshold OBJECT-TYPE

SYNTAX Integer32 (-62..-38)

UNITS "dBm"

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 coarse energy detect threshold being used by the DSSS or high rate PHY."

DEFVAL { - 62 }

::= { 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 high rate PHY in addition to coarse energy detect (which is always supported). Valid values are:

fine energy detect only (fedonly) = 01,

carrier sense with timer (cswithtimer)=08,

high rate carrier sense and energy detect (hrcsandfed)= 16

or the logical sum of any of these values. "

::= { dot11PhyHRDSSSEntry 5 }