Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Refining the specification in subclause 6.4.2.3.7 - Listen Before Talk (LBT)**
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Re:	Letter Ballot #29 of IEEE P802.16h/D3.
Abstract	There are a number of refinements to be included in subclause 6.4.2.3.7 of IEEE P802.16h/D3.
Purpose	Refine the definition of LBT (Listen Before Talk) and DMA (Dynamic Medium Acquisition) in IEEE P802.16h/D3.
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Refining the specification in subclause 6.4.2.3.7 - Listen Before Talk (LBT)

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1. Introduction

This document covers the following enhancements to IEEE P802.16h/D3:

- Specify default levels for energy detection in DMA.
- Specify default time periods for energy detection in DMA.
- Implementing aspects of the suggested remedy of *Comment 69* in [2].
- Address the need to introduce a SIFS between consecutive FRS transmissions. More on this in section 2.

The suggested editing changes in section 4 are driven by comments received during Session #52 [3].

2. Notes addressing the need to introduce a SIFS between consecutive FRS transmissions

To paraphrase Harry Bims via email:

> *The question concerns the boundary between the DL and the UL in a frame that is subject to the DMA algorithm. The initial FRS that occurs in the DMA window only reserves the channel up until the end of the DL. At that point, another FRS is issued that reserves the channel through the end of the UL. The question is, is there an IFS between the end of the DL and the second FRS? I raise this question because legacy 802.11 devices will look for a ramp down in the TX power before they can lock onto the preamble of a new frame. Thus, the FRS may not be recognized if the transmit power never goes through a ramp down and ramp up cycle. Under this scenario, the amount of IFS is important, because we don't want 11y devices to acquire the channel.*

Furthermore:

> *The SIFS interval is used to turn around an ACK packet in response to receiving a data packet, or to turnaround a CTS packet in response to a RTS packet. Unless an 802.11y device is a hidden node, or is responding to a hidden node, you should never experience an 802.11y device transmitting prior to this SIFS interval. That makes it a good choice, especially since the FRS is essentially a CTS-to-self anyway.*

3. Specific editing changes

Blue underlined text represents specific editorial additions.

~~Red strikethrough~~ text is to be deleted.

Black text is text already in the draft.

Bold italic text is editorial instructions to the editor.

Add the following definition to clause 4 in [1]: 'Abbreviations and Acronyms'.

CCA	Clear Channel Assessment
CMA-CS	Clear Medium Assessment – Carrier Sense
CMA-ED	Clear Medium Assessment – Energy Detection
SIFS	Short Interframe Space

Make the following changes to the title of 6.4.2.3.7.1 [1]

6.4.2.3.7.1 Dynamic Medium ~~Access~~ Acquisition

[*Note to editor: This title was added resolving comments on 16h/D3 [1] and is therefore not present in 16h/D3.*]

Make the following changes in the paragraph following figure h16 in [1]

The gap between the end of the UL and the start of the DL in which Clear Medium Assessment (CMA), the 'listen' in the LBT protocol, is performed must be of sufficient length to allow an asynchronous system to claim the channel if necessary. For instance if the asynchronous system is an 802.11 system, the gap must be at least the duration of the 802.11 AIFS in the band of interest. CMA is similar to the Clear Channel Assessment (CCA) of 802.11 based systems. In this way CMA is a measurement ~~based report~~ that provides an indication (to a certain probability and to a certain threshold level) of whether or not the medium is quiet and therefore available for use. CMA has two thresholds CMA-CS and CMA-ED. The CMA-CS threshold is applied when a valid preamble transmission is detected; otherwise the CMA-ED threshold is applied.

Add the following text after figure h19 in [1]

The DMA protocol should adopt the following parameter values stated in figure h19.

Parameter	**Value**
CMA-CS thresholds These thresholds are intended to be no higher (less sensitive) than the values stated.	-82dBm (20MHz channel bandwidth) -85dBm (10MHz channel bandwidth) -88dBm (5MHz channel bandwidth)
CMA-ED thresholds These thresholds are intended to be no higher (less sensitive) than the values stated.	-72dBm (20MHz channel bandwidth) -75dBm (10MHz channel bandwidth) -78dBm (5MHz channel bandwidth)
T_{CMA} These threshold values are referenced in the receiver after the receiving antenna and any associated connector/cabling losses. Probability of detection during sensing time > 90% in all cases. These values are the same as 802.11 CCA values [B28].	4µs (20MHz channel bandwidth) 8µs (10MHz channel bandwidth) 16µs (5MHz channel bandwidth)
$T_{FRAME\_END\_OFFSET}$ The minimum time allowed to switch Rx/Tx and send FRS.	50µs (all bandwidths)
MAXFRST	4000µs

Table h abc – DMA protocol parameters

Make the following changes to subclause 6.4.2.3.7 'Listen-Before-Talk (LBT)' on page 43 of [1].

When using any carrier sense protocol, such as LBT, in a wireless environment the hidden node problem cannot be 100% avoided. It can only be mitigated. Additionally, in bands such as 3.65 GHz in the US, there is an aggravated hidden node problem due to the distinctly lower transmit power allowed for mobile devices compared to fixed, registered devices. The mobiles are more often geographically disadvantaged due to this transmit power disparity. Fixed, registered client devices can also be geographically disadvantaged (the classical hidden node problem), although not as often. To remedy this the BS transmits a Frame Reservation Signal (FRS) at the end of the DL subframe to reserve the subsequent UL subframe (or used portion, thereof) for the subscriber stations. The form of the FRS is band dependent and should be structured to be receivable by other technologies that may be co-channel. For instance, in bands where 802.11 would be a typical co-channel asynchronous system, the 802.11 CTS transmitted using the appropriate 802.11 burst structure would suffice. If an FRS, intended to protect the DL frame, is followed by an FRS to protect the UL then a SIFS duration shall be introduced between these two frame transmissions. The SIFS duration is an 802.11 parameter [B28] and is bandwidth dependent corresponding to the following values: 16µs (20MHz channel bandwidth), 32µs (10MHz channel bandwidth), and 64µs (5MHz channel bandwidth). The reservation of the UL subframe by the BTS

precludes the need for the SS to also perform LBT. The use of the FRS to protect the UL is shown in *Figure h 21*.

4. References

[1] IEEE P802.16h/D3: *Air Interface for Fixed Broadband Wireless Access Systems Improved Coexistence Mechanisms for License-Exempt Operation*, Draft Standard.

[2] IEEE 802.16h-07_053r2: Letter Ballot #29 *Commentary* database file with resolutions from Session #52.

[3] IEEE C802.16h-07_106: Action Items and Ad hocs for LE TG following Session #52.