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Title	**Text for Annex on Coordinated Coexistence with 802.11**
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Re:	LB 29
Abstract	
Purpose	[Description of what *specific* action is requested of the 802.16 Working Group or subgroup.]
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Text for Annex on Coordinated Coexistence with 802.11

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Introduction

The coordinated coexistence with 802.11 is the best procedure for obtaining high spectral efficiency in a high-interference environment.

This is shown in a simulation, following the 802.19 parameters [1] and 802.16h/D3 [2] document.
The simulation compared the performance of coordinated and uncoordinated 802.16h mode. More details are given in the contribution C802.16h-08/007.

In the following graphs, showing the throughput per user, were used the following abbreviations:

- **NI**: No Interference (only 802.11 system is active)
- **NCX**: No Coexistence (802.16 is not implementing any coexistence protocol)
- **UCX**: Uncoordinated Coexistence (802.16 is implementing UCP)
- **CCX**: Coordinated Coexistence (802.16 is implementing CX-CBP)

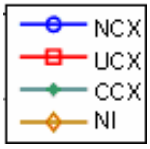

Fig. 1 Color legend

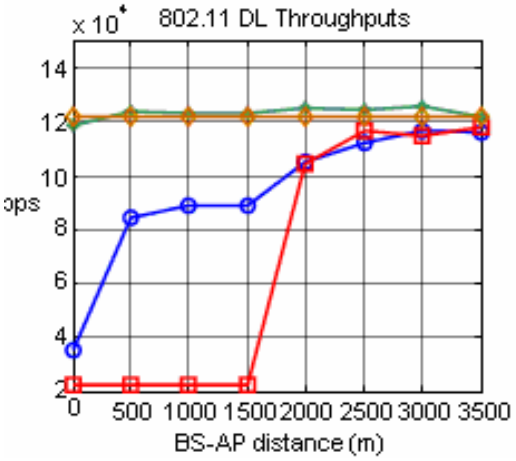

Fig. 2 DL throughputs for 802.11 system

Also the hidden-node performance is much better when the CX-CBP is used as coexistence protocol, as shown below:

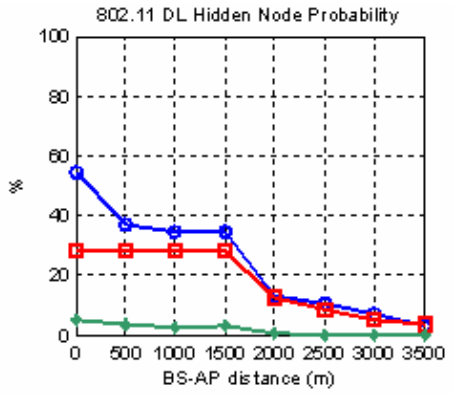

Fig. 3 Hidden nodes probabilities per system /direction

The 802.11 delay performance is not affected by the CX-CBP, while UCP produces a very high delay degradation. See fig. 4.

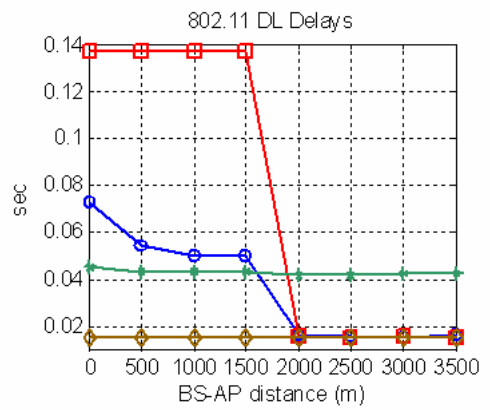

Fig. 4 Delays per system /direction

It is not obvious how to implement the coordinated coexistence in a 802.11 Access Point. In order to give guidance to the 802.11 producers of Access Points, we provide below the text to be annexed to the 802.16 standard.

Text for Annex h_B

Insert at page 181, row 61:

Annex h_B

Recommendation for 802.11 Access Point implementation of the CX-CBP

Synchronization

An 802.11 Access Point, implementing the Coordinated Coexistence procedures described in clause 15.4, shall synchronize its beacon transmission with the absolute time. The absolute time can be provided by methods described in clause 15.2.1., which include the GPS synchronization or network-based synchronization.

Beacon period

The beacon period should be equal to 117 TUs (Time Units). This is 119.8ms. This interval is selected to be similar to the preferred 100ms beacon period of 802.11 and be similar to the 20ms period of the CX-Frame.

Beacon transmission

To occur at the start of the CXCBI, (when 802.16 is not scheduled to transmit). At the beginning of the CXCBI there are two symbols in which 802.16 does not transmit. The 802.11 base station shall check which of the 6 possible beacon transmission slots has minimum interference and use it for beacon transmission. The CXCBI shall be used for the 802.11 base station downlink data transmission first, but at least one slot will be kept vacant for another 802.11 base station beacon transmission.

Quiet intervals

Quiet intervals are scheduled so as to not overlap with the CXSBI intervals and to leave the start of the CXCBI for 802.11 base station downlink transmission. (11.9.2 *Quieting channels for testing*, and 7.3.2.23 *Quiet Element* [4]). The Quiet Elements should use the following parameters:

Quiet Element 1

Quiet count = 1 (start during next beacon)
Quiet period = 1 (in every beacon interval)
Quiet offset = 9 (9*1.024= 9.216ms)
Quiet duration = 11 (11*1024 = 11.26ms)
Protected start of next CXCBI: 1.024*(9+11)-20=240ns

Quiet Element 2

Quiet count = 1
Quiet period = 1
Quiet offset = 29 (29*1.024= 29.7ms)
Quiet duration = 11 (11*1.024 = 11.26ms)
Protected start of next CXCBI: 1.024*(40)-40=240ns

Quiet Element 3

Quiet count = 1
Quiet period = 1
Quiet offset = 48 (48*1.024= 49.152ms)
Quiet duration = 11 (11*1.024 = 11.26ms)
Protected start of next CXCBI: 1.024*(48+11)-60=416ns

Quiet Element 4

Quiet count = 1
Quiet period = 1
Quiet offset = 68 (68*1.024= 69.63ms)
Quiet duration = 11 (11*1.024 = 11.26ms)
Protected start of next CXCBI: 1.024*(69+10)-80=896ns

Quiet Element 5

Quiet count = 1
Quiet period = 1
Quiet offset = 87 (87*1024= 89.08ms)
Quiet duration = 11 (11*1.024 = 11.26ms)
Protected start of next CXCBI: 1.024*(87+11)-100=352ns

Quiet Element 6

Quiet count = 1
Quiet period = 1
Quiet offset = 107 (107*1024= 109.57ms)
Quiet duration = 11 (11*1.024 = 11.26ms)
Protected start of next CXCBI: 1.024*(107+12)-120=830ns

The quiet intervals related to the CX-Frame are shown in Figure **hB-1**hB-1.

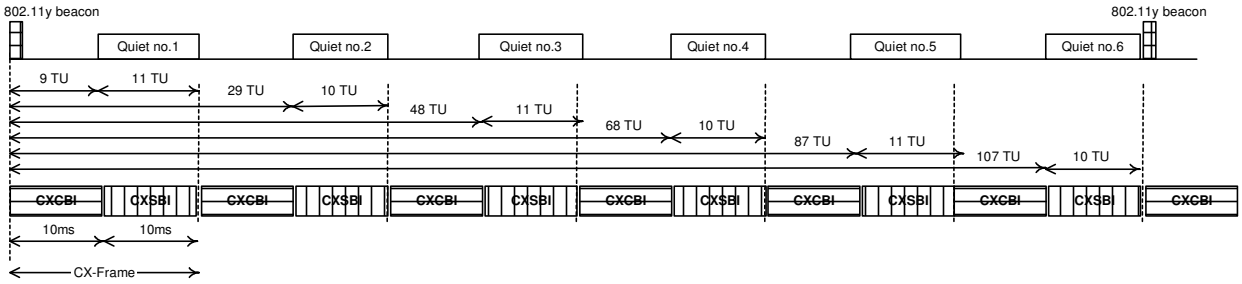

Figure hB-1 The relationship between the 802.11 quiet intervals and the CX-Frame

Insert in Clause 2, references, and up-date the link:

[4?] Standard for Information Technology— Telecommunications and information exchange between systems— Local and metropolitan area networks— Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications.

References

[1] Parameters for simulation of Wireless Coexistence in the US 3.65GHz band, IEEE 802.19-07/11r10
[2] Draft Amendment to IEEE Standard for Local and Metropolitan Area Networks, Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems, Improved Coexistence Mechanisms for License-Exempt Operation, IEEE P802.16h/D3, Oct 2007.
[3] Shahar Hauzner, Simon Adar, Mariana Goldhamer, Some simulation results on the 802.16h coexistence with 802.11y, IEEE C802.16h-08/007, Jannuary 2008.
[4] Standard for Information Technology— Telecommunications and information exchange between systems— Local and metropolitan area networks— Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications.