Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**Proposal and simulation results for the Unsynchronized CX-CBP**	
Date Submitted	**2008-03-11**	
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Re:	LB 29	
Abstract	The document is a proposal for profiles based on the poll taken in November 2007 meeting, in relation with comment 092 in database IEEE 802.16/07-53r2	
Purpose	[Description of what *specific* action is requested of the 802.16 Working Group or subgroup.]	
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Proposal and simulation results for the Unsynchronized CX-CBP

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Introduction

In the contribution C802.16h/08-007 we have shown the performance of the synchronized CX-CBP in relation with the UCP and the "do nothing" approach.

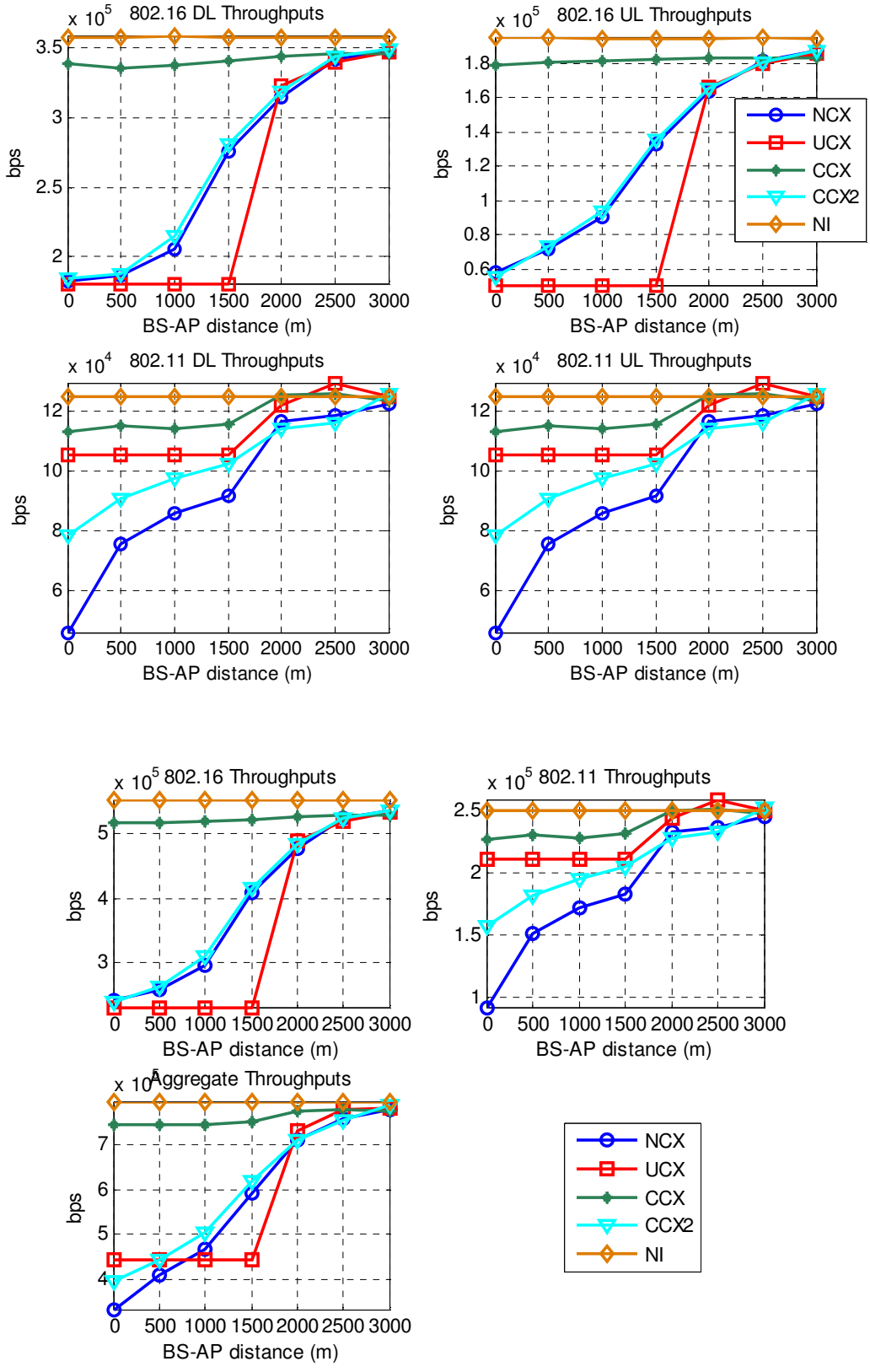
We had the curiosity to see how CX-CBP will perform without synchronizing the 802.16 and 802.11 activity. We used in simulations the same assumptions as in C802.16h/08-007. We present the results below.

Based on results, which place the un-synchronized CX-CBP at an acceptable fairness level versus both 802.11 and 802.16, we propose text changes to 802.16h/D4 draft for accommodating the CX-CBP in the un-synchronized mode.

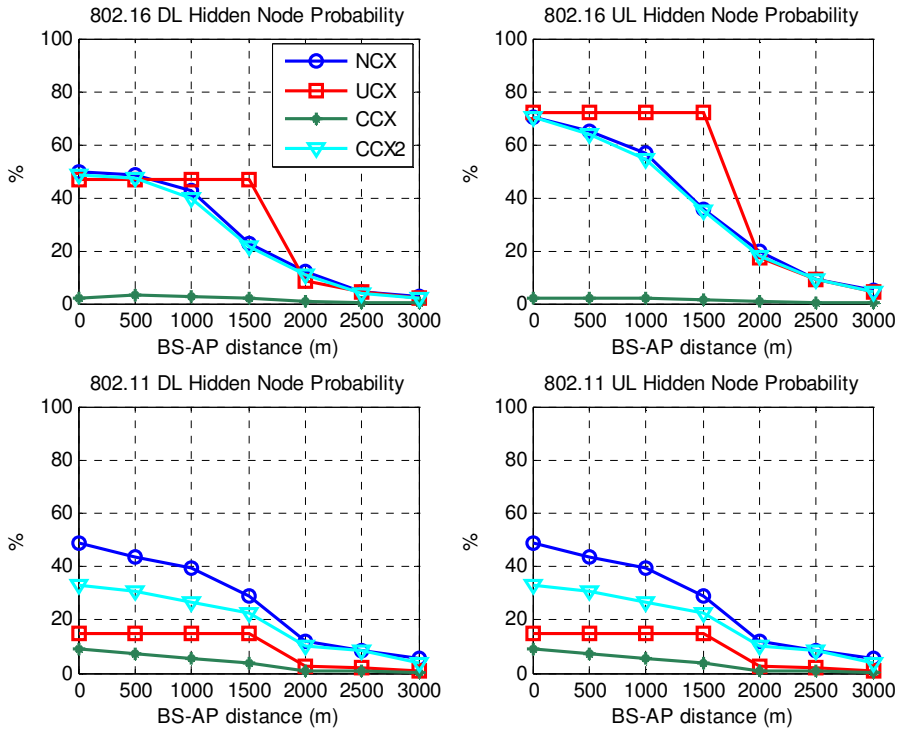
Simulations for Unsynchronized CCX

NCX – no coexistence protocol
UCX – uncoordinated coexistence protocol
CCX – coordinated coexistence – synchronized CX-CBP
CCX2 – coordinated coexistence – unsynchronized CX-CBP
NI – no interference

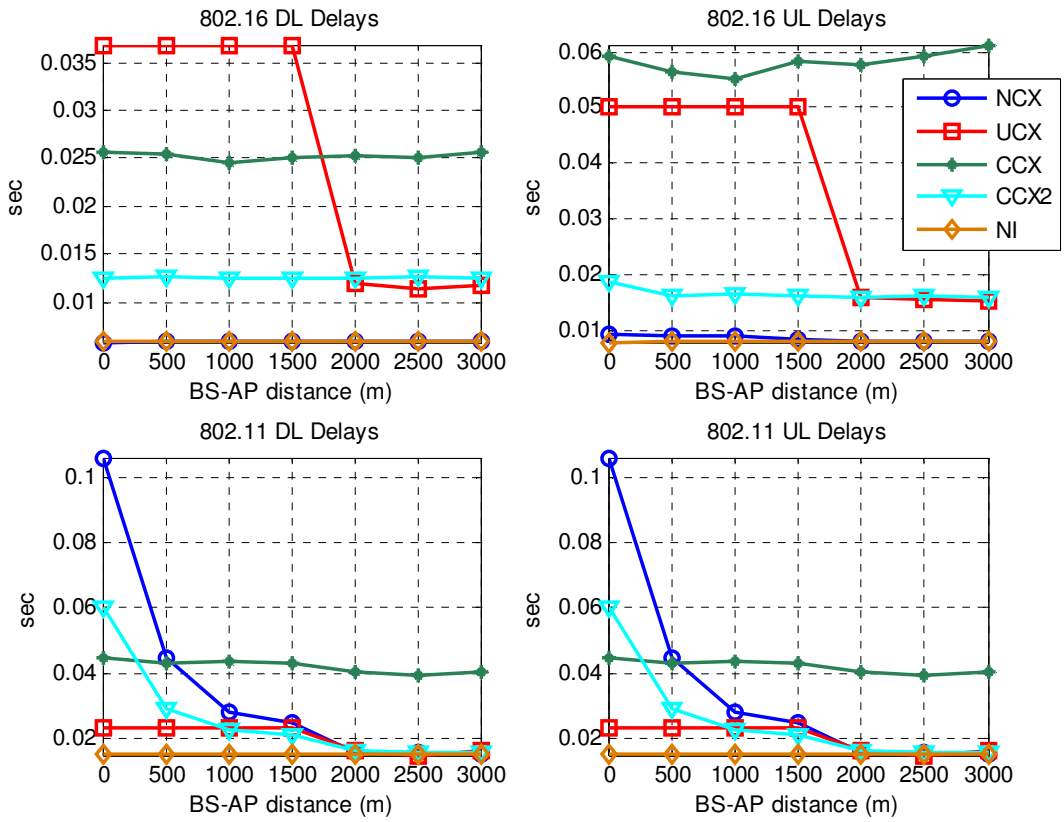
Throughputs



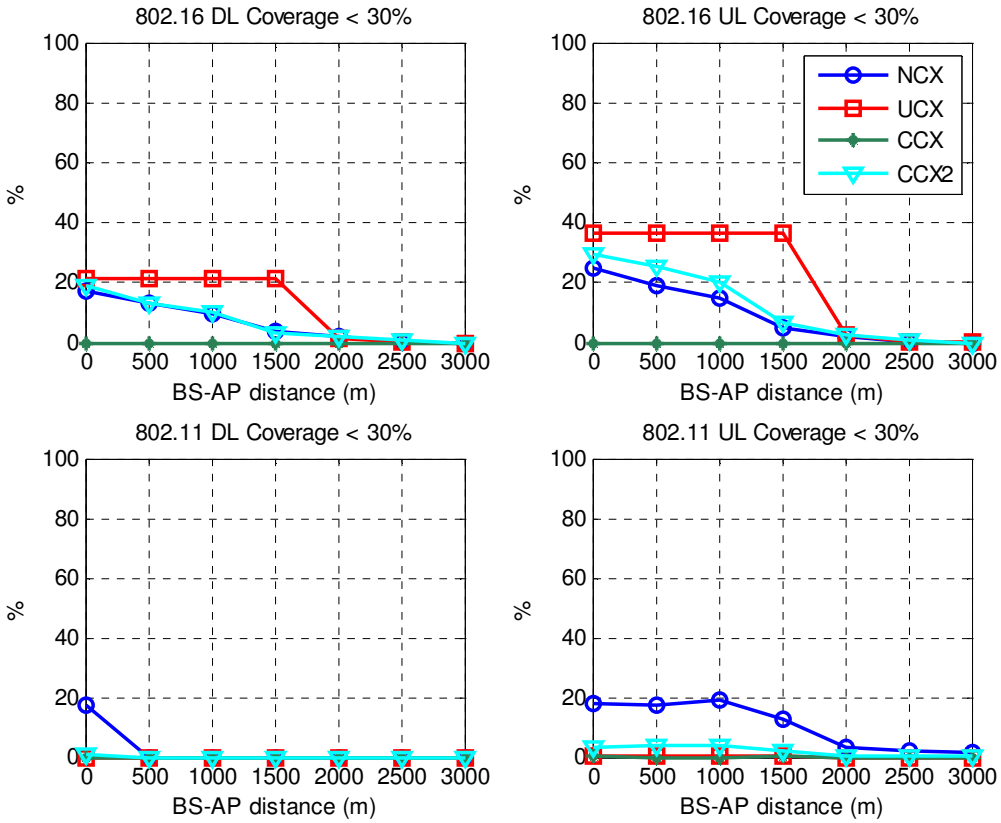
Hidden Node Probabilities



Delay


802.16 DL Delays
802.16 UL Delays
802.11 DL Delays
802.11 UL Delays
sec
BS-AP distance (m)
0
500
1000
1500
2000
2500
3000
NCX
UCX
CCX
CCX2
NI

Coverage



Proposed text changes

15.4 Interference prevention

This subclause describes the methods of preventing the interference, based on the information of the interference that the system had identified (section *15.3*) and a Coexistence Frame structure described in this clause.

A set of rules were defined in *15.4.1*, to ensure efficient interference prevention. The optimal coexistence with 802.11 systems requires the synchronization of the beacon transmitted by 802.11 Access Point with the CXCBP Frame, and some other 802.11 procedures. A CX-CBP protocol is defined for sharing the wireless medium in combined scheduled and contention-based mode, using or not the 802.11 beacon synchronization. These procedures are defined in [Annex h-B].

15.4.1.4 Coordinated Contention Based Protocol

However the 802.16 transmissions during the Common sub-frames in *Figure h 45* may create interference to the Bursty systems. On the other hand the channel and the spectrum will not be used effectively if the 802.16 systems are not able to communicate during the Bursty zone.

In specific bands and regulatory domains, as 3.65-3.7GHz in US, FCC defines an un-restricted contention

protocol as a protocol which avoids creating interference to devices using all other types of contention-based protocols. A Bursty system using such a protocol will have reasonable opportunities to transmit ~~to synchronize~~ within the CX-Frame. ~~and use for its transmissions only the time intervals dedicated to Bursty systems.~~ The optimum coexistence performance will be achieved when the Bursty systems, as 802.11, will synchronize their Beacon and activity intervals with the time intervals dedicated for their activity.

15.4.1.4.1 Frame structure for CX-CBP

The ~~synchronized~~ approach for interference avoidance is based on the CX-Frame in *Figure h 49*, where no more than two 802.16h systems can share a frequency channel in the case that a Bursty system is detected. An 802.16h system will detect the existence of 802.11y systems in the band based on measurements during the CXCC slots dedicated to assessment of interference created by non-802.16h systems.

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The following occupancy rules for the Master and Shared sub-frames are defined:

— MAC Frames 4N and 4N+1 are reserved for scheduled operation; the created time interval is named CXSBI (Coordinated Coexistence Schedule-Based Interval);

— MAC Frames 4N+2 and 4N -1 are reserved for bursty operation; the created time interval is named CXCBI (Coordinated Coexistence Contention-Based Interval);

— The scheduled systems using the channel may use the MAC Frames reserved for Bursty operation in a coordinated coexistence contention-based protocol (CXCBP) mode, defined in continuation;

— If there are two Master scheduled systems, the bursty systems using the channel may use the MAC Frames allocated to scheduled systems according to Slave rules

~~— If there is only one Master system, the bursty system may use the Shared MAC frame if respects the rules for downlink / uplink synchronization.~~

The CX-Frame structure is shown below:

Figure h49—CX-Frame structure for ~~synchronized~~ CXCBP