Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Text remedy on credit token based coexistence protocol for LB 29 reply comment**
Date Submitted	**2007-09-07**
Source(s)	David Grandblaise Motorola Labs Parc Les Algorithmes Commune de Saint Aubin 91193 Gif sur Yvette, France Voice: +33 (0)1 6935 2582 mailto: david.grandblaise@motorola.com
Re:	IEEE 80216h-07/053
Abstract	This contribution is an accompanying document to the LB 29 reply comment database [2] of IEEE 802.16h/D3 [1]. This contribution provides some text remedy on the credit token based rental protocol (CT-CXP) as reply comments to comment #287, 288 and 297.
Purpose	Material related to the reply comment of LB 29 for comment #287, 288 and 297.
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Text remedy on credit token based coexistence protocol for LB 29 reply comment

David Grandblaise
Motorola

Introduction

This contribution is an accompanying document to the LB 29 reply comment database [2] of IEEE 802.16h/D3 [1]. This contribution provides some text remedy on the credit token based rental protocol (CT-CXP) as reply comments to comment #287, 288 and 297.

Specific editorial changes

This section provides a list of changes to the draft document.

Blue 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.

Proposed text

[Related to comment #287 and #288 resolution: Replace Figure h61 of section 15.4.5 with the following updated one as indicate:]

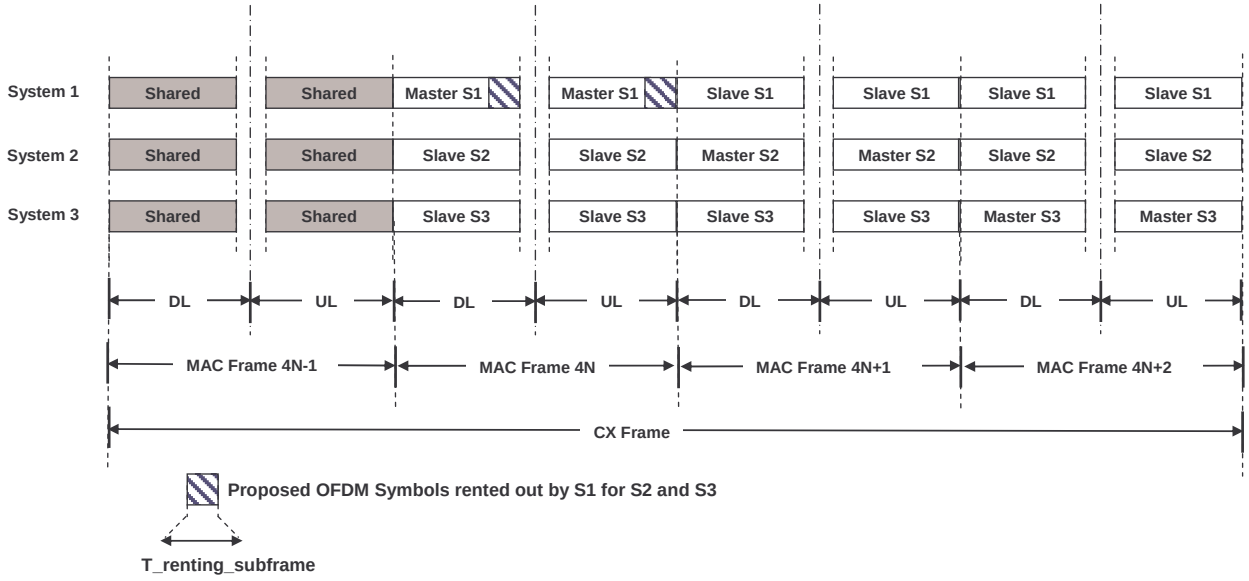

Figure 61: Master subframe (OFDM symbols) sharing within CX-Frame

15.4.5 CT-CX

[Related to comment #297 resolution: add the following text in sub-clause 15.4.5.1.2 as indicate:]

a) The procedure described in *Figure h64* is as follows:

- ….
- If the offeror BS receives one single CT-CX-ADV-RSP message, then the offeror BS grants the renting resource to the single requester by setting the Resource Granting Bit Flag (RGBF) to 1 in the CT-CX-RA-REQ message. The granted requester is not charged with credit token since it is not competing with some other requesters. The offeror provides to the granted requester with the list of the BSIDs of the systems belonging to the offeror's community. This list is provided within the CT-CX-RA-REQ message.
- If the offeror BS receives more than one CT-CX-ADV-RSP message, then it assesses whether he can supply each requester or not:
    - If it can supply, the offeror BS grants the renting resource to all requesters by setting the Resource Granting Bit Flag (RGBF) to 1 in the CT-CX-RA-REQ message.

    - If it cannot, the offeror BS derives and selects requesters with higher bids based on the information received from competing requesters. The offeror BS grants the resource to the selected requesters by setting the Resource Granting Bit Flag (RGBF) to 1 in the CT-CX-RA-REQ message. These selected requesters can access to their requested resource Rented_resource_amount from Renting_subframe_start_time to Renting_subframe_end_time during the guaranteed requested time period (Renting_in_start_time, and Renting_in_end_time). RGBT is set to 0 for the non selected requesters.

  In both cases, the offeror provides to the selected requesters with the list of the BSIDs of the systems belonging to the offeror's community. This list is provided within the CT-CX-RA-REQ message.

- …

b) The procedure described in *Figure h65* is as follows:

- …
- If the offeror BS receives one single CT-CX-ADV-RSP message, then the offeror BS grants the renting resource to the single requester by setting the Resource Granting Bit Flag (RGBF) to 1 in the CT-CX-RA-REQ message. The granted requester is not charged with credit token since it is not competing with some other requesters. The offeror provides to the granted requester with the list of the BSIDs of the systems belonging to the offeror's community. This list is provided within the CT-CX-RA-REQ message.
- If the offeror BS receives more than one CT-CX-ADV-REQ message, then it assesses whether he can supply each requester or not:
    - If it can supply, the offeror BS grants the renting resource to all requesters by setting the Resource Granting Bit Flag (RGBF) to 1 in the CT-CX-RA-REQ message. The offeror provides to the granted requesters with the list of the BSIDs of the systems belonging to the offeror's community. This list is provided within the CT-CX-RA-REQ message.

    - If it cannot, the offeror BS follows the negotiated mode under consideration:
        - If NMBF == 0, same procedure as a) is executed. The offeror BS derives and selects requesters with higher bids based on the information received from competing requesters.

The offeror BS grants the resource to the selected requesters by setting the Resource Granting Bit Flag (RGBF) to 1 in the CT-CX-RA-REQ message. These selected requesters can access to their requested resource Rented_resource_amount from Renting_subframe_start_time to Renting_subframe_end_time during the guaranteed requested time period (Renting_in_start_time, and Renting_in_end_time). RGBT is set to 0 for the non selected requesters.

- If NMBF == 1, iterative negotiation occurs between the offeror BS and each requester BS. Based on the infomation received within the CT-CX-ADV-RSP message, the offeror BS calculates respectively a minimum and maximum payoff (Minimal_payoff and Maximal_payoff) at each iteration. These payoffs allow selecting the remaining requesters at each iteration. An example of payoff calculation is given in section *15.4.2.4.2*. At each iteration, Minimal_payoff and Maximal_payoff are sent within the CT-CX-NEG-REQ message. The iterative negotiation occurs until the negotiation period (bounded by End_negotiation_time) is elapsed. At the end of the negotiation, the final requesters are selected by the offeror BS. The offeror BS grants the resource to the selected requesters by setting the Resource Granting Bit Flag (RGBF) to 1 in the CT-CX-RA-REQ message. These selected requesters can access to their requested resource Rented_resource_amount from Renting_subframe_start_time to Renting_subframe_end_time during the guaranteed requested bounded time period (Renting_in_start_time, and Renting_in_end_time). RGBT is set to 0 for the non selected requesters.

In both cases, the offeror provides to the granted requesters with the list of the BSIDs of the systems belonging to the offeror's community. This list is provided within the CT-CX-RA-REQ message.

[Related to comment #297 resolution: add the following text in sub-clause 15.4.5.1.3 as indicate:]

a) The procedure described in *Figure h66* is as follows:

- …
- If ABF is set to 1, a number of credit tokens equal to Clearing_price* Rented_resource_amount*T_renting_subframe *[(Renting_in_end_time - Renting_in_start_time)/CX_Frame_duration]/RRU_duration will not be usable (for some further renting requests by this same requester) for a time duration equal to [Renting_in_start_time; Renting_in_end_time + δ] where δ is a frozen period margin. This ensures fairness over time between competing requester BSs to access to some other renting offers.
- Once the requester is granted with the resources, the granted requester informs the other members of its community and the members of the offeror's community about its identity and when he will use the granted resources. This information is provided within CT-CX-FRSU message through the backhaul.

b) The procedure described in Figure h67 is as follows:

- …
- If ABF is set to 1:
  - If PBF == 0, a number of CTs equal to Clearing_price* Rented_resource_amount*T_renting_subframe *[(Renting_in_end_time -

Renting_in_start_time)/CX_Frame_duration]/RRU_duration is transferred from the requester's ownership to the offeror's one. This calculation is an example and it is open for implementation.

- If PBF == 1, the CT are not transferred but remains to the requester ownership. However, a number of credit tokens equal to the previous number (as calculated in the previous bullet point) will not be usable (for some further renting requests by this same requester) for a time duration equal to [Renting_in_start_time; Renting_in_end_time + δ] where δ is a frozen period margin. This ensures fairness over time between competing requester BSs to access to some other renting offers.

- Once the requester is granted with the resources, the granted requester informs the other members of its community and the members of the offeror's community about its identity and when he will use the granted resources. This information is provided within CT-CX-FRSU message through the backhaul.

[Update table h8 of subclause 15.5.1 as indicate:]

15.5.1 Coexistence (CX) messages (CX-REQ/RSP)

Table h8 –CX message codes

Code	CXP Message Name	CXP Message Type	Protocol type	Direction	Connection
0	Reserved	—	—	—	
27	…				
25	CT-CX-ADV-REQ	CX-REQ	TCP	BS->BS	~~Basic~~Broadcast
26	CT-CX-ADV-RSP	CX-RSP	TCP	BS->BS	Basic
27	CT-CX-NEG-REQ	CX-REQ	TCP	BS->BS	Basic
28	CT-CX-NEG-RSP	CX-RSP	TCP	BS->BS	Basic
29	CT-CX-RA-REQ	CX-REQ	TCP	BS->BS	Basic
30	CT-CX-RA-RSP	CX-RSP	TCP	BS->BS	Basic
31	CT-CX-ADPD	CX-RSP	TCP	BS->BS	~~Basic~~Multicast
32	CT-CX-ACK	CX-RSP	TCP	BS->BS	Basic
33	CT-CX-NOT	CX-RSP	TCP	BS->BS	Basic
34	CT-CX-FRSU	CX-RSP	TCP	BS->BS	~~Basic~~Broad

					cast
…	…				
51-255	Reserved				

[Update Table h9 in subclause 15.5.1 s indicate:]

Table h10 - TLV types for CXP payload

Type	Parameter Description	Length (bytes)	Comment
…	…		
47	Renting_subframe_start_time	2	in millisecond
48	Renting_subframe_end_time	2	in millisecond
49	Acceptation_Bit_Flag (ABF)	1	Scalar
50	LC	1	Scalar
51	Coexistence_community_BSID	24	List of the BSID of the systems belonging to the community of the offeror for CT-CXP
…	…		

[Update text of subclause 15.5.1.29 as indicate:]

15.5.1.29 CT-CX Resource Allocation Request (CT-CX-RA-REQ)

In case of CT-CX operations over the air, the CT-CXP-RA-REQ message is encapsulated as a CX-REQ-MAC message. The CT-CX-RA-REQ message informs each requester whether he is granted with the resource he bidded for. Each granted requester is informed about the credit token price. Also, if the requester is granted, the offeror provides to the requester some information about the BSIDs of the members of its own community. Detailed process is described within clause *15.4.5*. The CT-CX-RA-REQ message is sent by the offeror BS with mechanisms specified in subclause *15.6*.

In the case of backhaul based inter system communication: after the negotiation is complete, the CT-CX-RA-REQ message informs each requester whether he is granted with the resource he bidded for. Each granted requester is informed about the credit token clearing price necessary to complete the CT-CX operations. Derived from the selection process, the clearing price corresponds to the number of credit tokens per RRU that has to be considered by the selected renter to derive the total number of credit tokens to be considered in the pricing method specified within PBF flag of CT-CX-ADV-REQ message.

CT-CX-RA-REQ message shall include the following parameters that are applicable for both over the air and

backhaul based inter system communications:

BSID of the source BS: BSID of the offeror BS

BSID of the destination BS: BSID of the requester BS associated to the forwarding SS

Resource_Granting_Bit_Flag (RGBF): This flag indicates whether the offeror supplies the resource requested by the requester or not.

Renting_subframe_start_time: This field is useful only when RGBF = 1. This field specifies the starting time of transmission of the selected requester within T_renting_subframe.

Renting_subframe_end_time: This field is useful only when RGBF = 1. This field specifies the ending time of transmission of the selected requester within T_renting_subframe.

Coexistence_community_BSID: This field is useful only when RGBF = 1. This field specifies the BSIDs of the BS belonging to the community of the offeror. This information is transmitted to the requester so that the granted requester can inform these systems about the master usage change within this specific time [Renting_subframe_start_time, Renting_subframe_end_time] of the frame and for a period starting at Renting_in_start_time and ending at Renting_in_end_time.

CT-CX-RA-REQ message shall include the following parameters that are applicable only for backhaul based inter system communications:

Clearing_price: This field is useful only when RGBF = 1. Derived from the selection process, clearing price is the number of credit tokens per RRU the requester has to freeze to acquire the granted resource.

CT-CX-RA-REQ message shall include the following parameters that are applicable inly for over the air based inter system communications:

ID of the destination forwarding SS: ID of the forwarding SS

Code: 29

Attributes are shown in *Table h32*

Table h32- CT CX Resource Allocation Request (CT-CX-RA-REQ) message attributes

Attribute	Contents
BSID of the source BS	BSID of the offer or
BSID of the destination BS	BSID of the requester
Resource_Granting_Bit_Flag (RGBF)	This flag indicates whether the offeror supplies the resource requested by the requester or not: 1 – resource allocation is granted 0 – resource allocation is rejected

Renting_subframe_start_time	This field is useful only when RGBF == 1. This field specifies the starting time of transmission of the selected requester within T_renting_subframe.
Renting_subframe_end_time	This field is useful only when RGBF == 1. This field specifies the ending time of transmission of the selected requester within T_renting_subframe.
Clearing_price	This field is useful only when RGBF == 1. In case of backhaul based inter BS communications: Derived from the selection process, the clearing price corresponds to the number of credit tokens per RRU that has to be considered by the selected renter to derive the total number of credit tokens to be considered in the pricing method specified within PBF flag of CT-CXP-ADV-REQ message. In case of over the air based inter BS communications: Derived from the selection process, clearing price is the number of credit tokens per RRU the requester has to freeze to acquire the granted resource.
ID of the destination forwarding SS	This field is used only with over the air based inter BS communications. ID of the forwarding SS.
Coexistence_community_BSID	This field is useful only when RGBF = 1. This field specifies the BSIDs of the BS belonging to the community of the offeror. This information is transmitted to the requester so that the requester can inform these systems about the master usage change within this specific time [Renting_subframe_start_time, Renting_subframe_end_time] of the frame and for a period starting at Renting_in_start_time and ending at Renting_in_end_time.

[Create new subclause 15.5.1.x (just after 15.5.5.1.33) in sub-clause 15.5.1. as indicate:]

15.5.1.x CT-CX FRame Status Update (CT-CX-FRSU)

Once the requester BS has received the CT-CX-ACK message, it informs the other system members of its community and the members of the offeror BS's community about its identity, and when he will use the granted resources. This information is transmitted within CT-CX-FRSU message The CT-CX-FRSU message is sent through the backhaul. This message aims at updating respectively the granted requester BS's community status, and the corresponding offeror BS's (who has rented out) community status.

The requester BS informs about the following information: its identity (its BSID), the period it will use this granted part of the subframe as master, the specific starting and ending time of the master frame it will use within this period.

CT-CX-FRSU message shall include the following parameters:

BSID of the source BS: BSID of the requester BS which has been granted with the resources.

BSID of the destination BS: BSID of BSs belonging to the same community as the requester, and those belonging to the offeror's community.

Renting_in_start_time: Starting time of the period from which the requester will use the granted part of the frame.

Renting_in_end_time: Ending time of the period the requester will use the granted part of the frame.

Renting_subframe_start_time: Starting time of the part of the frame the requester will use.

Renting_subframe_end_time: Ending time of the part of the frame the requester will use.

Code: x

Attributes are shown in *Table hx*.

Table hx- The CT FRame Status Update (CT-CX-FRSU) message attributes

Attribute	Contents
BSID of the source BS	BSID of the requester
BSID of the destination BS	BSID of BSs belonging to the same community as the requester, and those belonging to the offeror's community
Renting_in_start_time	Starting time of the granted part of the frame the requester will use. Absolute time based on UTC time stamp following the format HH:MM:SS:ms.
Renting_in_end_time	Ending time of the granted part of the frame the requester will use. Absolute time based on UTC time stamp following the format HH:MM:SS:ms
Renting_subframe_start_time	Starting time of the part of the frame the requester will use
Renting_subframe_end_time	Ending time of the part of the frame the requester will use

References

[1] IEEE 802.16h/D3: Part 16: Air Interface for Fixed Broadband Wireless Access Systems Amendment for Improved Coexistence Mechanisms for License-Exempt Operation, Oct 2007.
[1] IEEE 802.16-07_053: IEEE 802.16h/D3 LB 29 comments database.