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|---|---|
| Project | IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**> |
| Title | Action Item from Session #48: MAC messages text update for credit token based coexistence protocol |
| Date Submitted | 2007-05-09 |
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| Re: | Working Group Letter Ballot #24a for IEEE P80216h/D2a |
| Abstract | During sessions # 47 and # 48, several comments (2127, 2152L, 2153L) were made to update and clean up text related to MAC messages for the credit token based coexistence protocol. This contribution provides some text remedy proposals for these comments, and consolidates the previous preliminary contribution [3]. |
| Purpose | Action Item from Session #48: MAC messages text update for credit token based coexistence protocol |
| Notice |  |
| Release |  |
| Patent Policy and Procedures |  |

# Action Item from Session #48: MAC messages text update for credit token based coexistence protocol

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## Overview

During sessions # 47 and # 48, several comments (2127, 2152L, 2153L) were made to update and clean up text related to MAC messages for the credit token based coexistence protocol. This contribution provides some text remedy proposals for these comments, and consolidates the previous preliminary contribution [3].

## Introduction

Figure 1 describes the overall inter system over the air communications messages using relaying SS as RF bridging to convey the MAC messages between the offeror BS and requester BS for the CT-CXP operations. Also, Figure 1 discusses how the different MAC messages could be conveyed with relaying SSs.

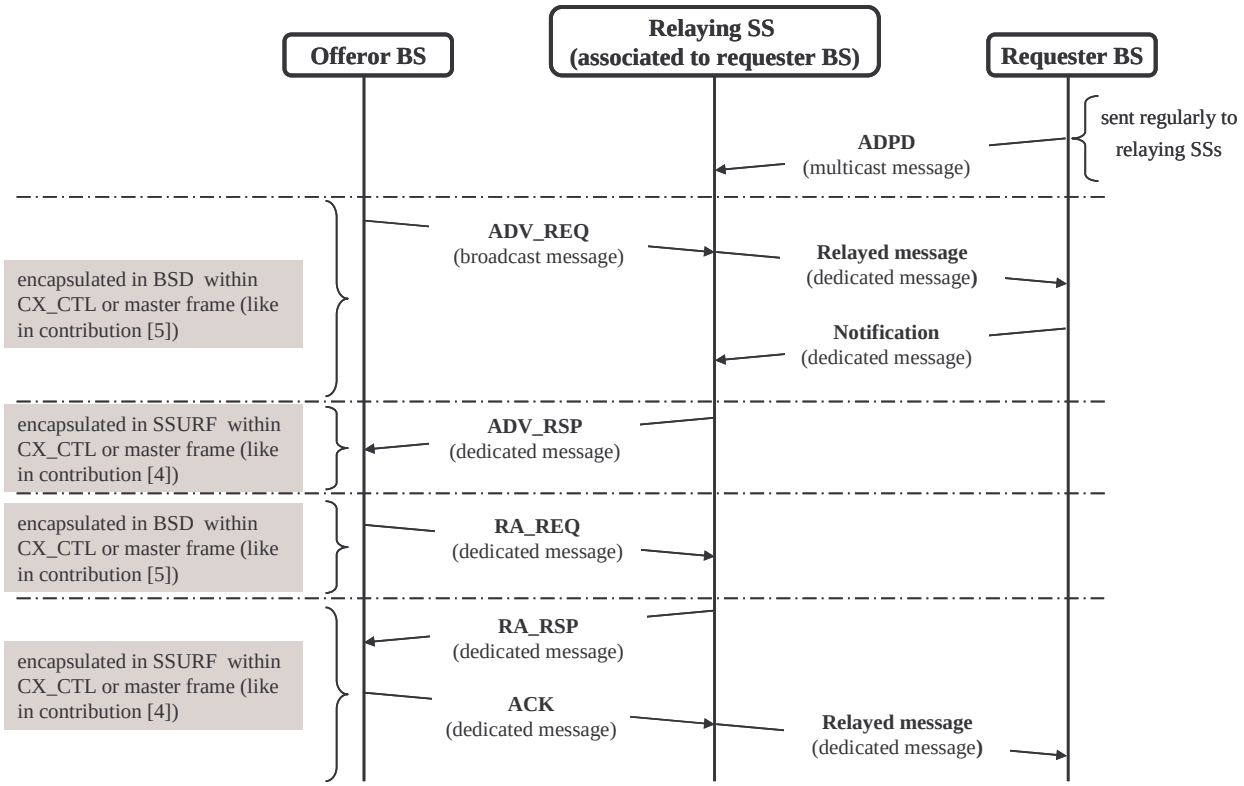


**Figure ha: Inter system over the air communications messages for CT-CXP operations**

## 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 changes

***[Remove text of section 15.4.2.4.6]***
***[Create a new clause 15.x as indicate:]***

### 15.x Inter-system over the air communications

#### 15.x.1 CT-CXP

Figure hb describes the over the air communications messages between the offeror and requester for CT-CXP operations. The messages between the offeror BS and requester BSs are conveyed through SS(s) acting as relay between the offeror and requester BSs. Each relaying SS is associated to the requester BS and is in the overlapping coverage of the offeror and requester BSs. The relaying SS can receive and decode messages from both its serving BS (requester BS) and the foreign BS (offeror BS), and can send transmit message to both offer or and requester BS.

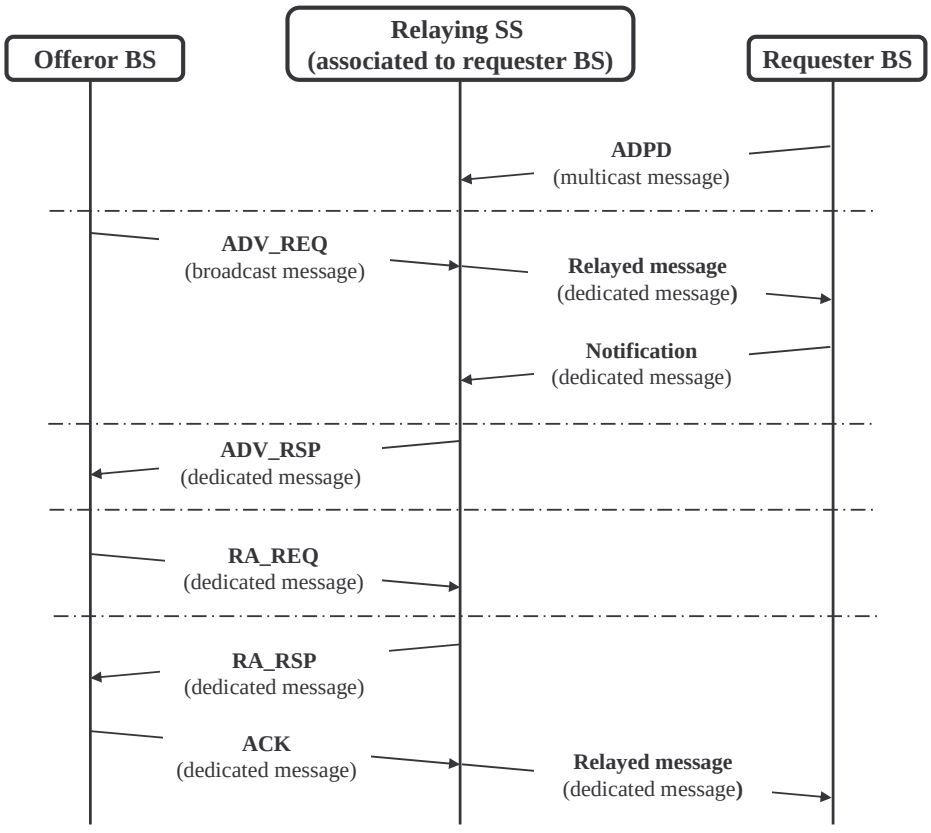


**Figure hb: Inter system over the air communications messages for CT-CXP operations**

ADPD message (Advertisement Discovery Policy Descriptor) is sent from the home requester BS to its associated relaying SSs as a regular multicast data message. Purpose of ADPD is to instruct the attitude of each relaying SS when it receives ADV_REQ message. ADPD specifies whether the relaying SS has to relay ADV_REQ message toward it serving BS (requester BS). If the content ADV_REQ message meets the requirements instructed in ADPD, the relaying SS actually relays ADV_REQ message from the offeror BS to its serving BS (requester BS). Otherwise, it does not. That way, ADPD rules the transmissions from any relaying SS towards its serving BS. This mechanism avoids having incessant transmissions from the relaying SS towards its serving BS when renting conditions proposal specified in ADV_REQ does not meet the requester BS's need. Any policy can be established and can be adapted dynamically in time by the requester.

The ADV_REQ message is sent by the offeror BS within the time interval specified in subclause 15.x.y. If the ADV_REQ content meets the ADPD requirements, the relaying SS relays the ADV_REQ message towards its serving BS followed up the mechanisms specified in subclause 15.x.y. In order to ensure the ADV_REQ message is appropriately received by the requester BS, ADV_REQ message can be sent out by several relaying SSs. If multiple ADV_REQ messages are received from different relaying SSs, the offeror BS selects only one relaying SS to complete the remaining CT-CXP operations (ADV_RSP, RA_REQ, RA_RSP). For that, the offeror BS notifies (through the notification message) each of the relaying SS whether or not it should complete the remaining CT-CXP operations. Once the selected relaying SS has received the ACK message from the offeror BS, it relays this message to its serving BS (requester) to confirm that the requester BS can actually use the rented resources for the agreed renting period with the offeror BS.

During the initial phase, as previously mentioned, in case the renting conditions sent in ADAP message are not met, the relaying SS does not relay the ADV_REQ message to its serving BS (requester). However, upon requester BS recommendation (policy), even if the renting conditions are not met, the requester BS can allow the relaying SS to convey the information about the list of channel LC (parameter included in ADV-REQ). This information will provide the serving BS some further information about other radio resources renting opportunities on other channel (frequency domain).

Whole CT-CXP procedures are detailed in clause 15.4.2.4.

### 6.3.2.3 MAC management messages

***[Update Table page 8 as indicate:]***

| Type | Message Name | Message Description | Connection |
|---|---|---|---|
| 67 | BSD | Base Station Descriptor | Broadcast |
| 68 | SSURF | SS Uplink RF Descriptor | Basic |
| 69 | ADPD | Advertisement Discovery Policy Descriptor | Multicast |
| 70~~69~~ | ADV-REQ~~MADD~~ | ~~Master Advertisement Discovery Descriptor~~Advertisement Request | Broadcast |
| 71 | Notification | Notify whether the relaying SS completes the CT-CXP operations | Basic |
| 72 | ADV-RSP | Advertisement Response | Basic |
| 73 | RA-REQ | Resource Allocation Request | Basic |
| 74 | RA-RSP | Resource Allocation Response | Basic |

| | | | |
|---|---|---|---|
| 75 | ACK | The offeror BS acknowledges the correct reception of RA_RSP message | Basic |
| ~~70~~ | ~~SADD~~ | ~~Slave Advertisement Discovery Descriptor~~ | ~~Broadcast~~ |
| ~~71~~ | ~~ADPD~~ | ~~Advertisement Discovery Policy Descriptor~~ | ~~Broadcast~~ |
| 762 | BS_CCID_REQ | Base Station Co-Channel Interference Detection Indication | Basic |
| 773 | BS_CCID_RSP | Base Station Co-Channel Interference Detection Response | Basic |
| 784 | CXP-REQ-MAC | Coexistence Protocol Request MAC message | Broadcast |
| 795 | CXP-RSP-MAC | Coexistence Protocol Response MAC message | Broadcast |
| 8076 | OCSI_MNTR_REQ | CSI monitoring request message | Broadcast |
| 8177 | OCSI_MNTR_RSP | CSI monitoring response message | Basic |
| 8278-255 | | reserved | |

***[Remove suclauses 15.5.1.64, 15.5.1.65 and 15.5.1.66, and add new subclause as indicate:]***

#### 15.5.1.64 Advertisement Discovery Policy Descriptor (ADPD) message

ADPD message (Advertisement Discovery Policy Descriptor) is sent from the home requester BS to its associated relaying SSs as a regular multicast data message. Purpose of ADPD is to instruct the attitude of each relaying SS when the relaying SS receives ADV_REQ message. ADPD specifies whether the relaying SS has to relay ADV_REQ message toward it serving BS (requester BS).

ADPD message shall include the following parameters:

**BSID of the source BS**: BSID of the requester BS

**ID of the relaying SS**: ID of the relaying BS

**Renting_in_start_time:** Starting time of the period from which the requester BS is interested to rent in some resources. For values received below this specified time, the relaying SS associated BS is not allowed to report ADV_REQ content to its home BS (requester). This starting time is identified by a UTC time stamp following the format HH:MM:SS:ms (Table h1) after the transmission of the message.

**Renting_in_end_time:** Ending time of the period the requester BS is interested to rent in some resources. For values received below this specified time, the relaying SS is not allowed to report ADV_REQ content to its home BS (requester). This ending time is identified by a UTC time stamp following the format HH:MM:SS:ms (Table h1) after the transmission of the message.

**RCTN_MAX:** Maximum admissible number of credit tokens per radio resource unit the requester BS will provide to get the radio resources proposed by the offeror BS. Above this number of tokens, the relaying SS is not allowed to report ADV_REQ content to this home BS (requester).

**Table 108ae—ADPD message format**

| Syntax | Size | Notes |
|---|---|---|
| ADPD_Message_Format( ) { | | |
| Management Message Type = 69 | 8 bits | |
| BSID of the source BS | 48 bits | BSID of the requester |
| ID of the relaying SS | 48 bits | ID of the relaying SS |
| Renting_in_start_time | 16 bits | Absolute time based on UTC time stamp following the format HH:MM:SS:ms |
| Renting_in_end_time | 16 bits | Absolute time based on UTC time stamp following the format HH:MM:SS:ms |
| Maximum required number of credit token (RCTN_MAX) | 48 bits | |
| } | | |

### 15.5.1.65 Advertisement Request (ADV_REQ) message

The Advertisement Request (ADV_REQ) message specifies the advertisement discovery information sent out by the offeror BS towards the relaying SSs (associated to requester BSs and located in the overlapping area of this offeror system and the surrounding requester systems). The ADV_REQ message is sent by the offeror BS within the time interval specified in subclause 15.x.y. If the ADV_REQ content meets the ADPD requirements, the relaying SS relays the ADV_REQ message towards its serving BS followed up the mechanisms specified in subclause 15.x.y.

ADV_REQ message provides the necessary information to these relaying SSs to enable them then to inform their home BS (requester) about radio resources sharing opportunities proposed by the offeror BS.

ADV_REQ message shall include the following parameters:

**BSID of the source BS**: BSID of the offeror

**T_renting_subframe**: Total amount of time per master subframe rented out by the offeror BS.

**Renting_out_start_time**: The starting time of the renting out period proposed by the offeror on that channel. Absolute time based on UTC time stamp following the format HH:MM:SS:ms (Table h1).

**Renting_out_end_time**: The ending time of the renting out period proposed by the offeror on that channel Absolute time based on UTC time stamp following the format HH:MM:SS:ms (Table h1).

**MNCT**: Minimum number of credit tokens per resource unit required per requester's bid.

**LC**: List of other channels (frequency domain) proposed by the offeror BS for renting.

**Table 108ac—ADV_REQ message format**

| Syntax | Size | Notes |
|---|---|---|
| ADV-REQ_Message_Format ( ) { | | |
| Management Message Type = 70 | 8 bits | |
| BSID of the source BS | 48 bits | BSID of the offeror |
| T_renting_subframe | 16 bits | Total amount of time per master subframe rented out by the offer or |
| Renting_out_start_time | 16 bits | The starting time of the renting out period proposed by the offeror on that channel Absolute time based on UTC time stamp following the format HH:MM:SS:ms |
| Renting_out_end_time | 16 bits | The ending time of the renting out period proposed by the offeror on that channel Absolute time based on UTC time stamp following the format HH:MM:SS:ms |
| Minimum number of Credit Token (MNCT) | 48 bits | Minimum number of credit tokens per resource unit required per requester's bid |
| List of Channel (LC) | 16 bits | List of other channels (frequency domain) proposed by the offeror BS for renting |

| | | |
|---|---|---|
| } | | |

### 15.5.1.66 Notification message

In order to ensure the ADV_REQ message is appropriately received by the requester BS, ADV_REQ message can be sent out by several relaying SSs. If multiple ADV_REQ messages are received from different relaying SSs, the offeror BS selects only one relaying SS to complete the remaining CT-CXP operations (ADV_RSP, RA_REQ, RA_RSP). For that, the offeror BS notifies (through the notification message) each of the relaying SS whether or not it should complete the remaining CT-CXP operations. Notification message is a regular data message.

Notification message shall include the following parameters:

**BSID of the source BS**: BSID of the offeror BS

**ID of the relaying SS**: ID of the relaying SS

**Notification Bit Flag (NBF):** This flag indicates whether the relaying SS is selected to complete the CT-CXP operations or not.

**Table 108ac—Notification message format**

| Syntax | Size | Notes |
|---|---|---|
| Notification_Message_Format ( ) { | | |
| Management Message Type = 71 | 8 bits | |
| BSID of the source BS | 48 bits | BSID of the offeror |
| ID of the relaying SS | 48 bits | ID of the relaying SS |
| Notification Bit Flag (NBF) | 1 bit | This flag indicates whether the relaying SS is selected to complete the CT-CXP operations or not:<br>1: relaying SS is selected<br>0: relaying SS is not selected |
| } | | |

### 15.5.1.67 Advertisement Response (ADV-RSP) message

In response to the Advertisement Request message (ADV_REQ), and if the relaying SS has been selected to complete the CT-CXP operations (specified in notification message), the relaying SS responds to the offeror with an Advertisement Reply message (ADV_RSP) mentioning its interest to rent totally or a fraction of the resource offered by the offeror for the total or a portion of the proposed renting period [Renting_out_start_time, Renting_out_send_time]. ADV_RSP content is aligned with renting requirements specified within ADPD message.

The ADV_RSP message is sent by the relaying SS within the time interval and with mechanisms specified in subclause 15.x.y.

ADV_RSP message shall include the following parameters:

**ID of the source relaying SS**: ID of the relaying SS

**BSID of the source BS**: BSID of the requester BS associated to the relaying SS

**BSID of the destination BS**: BSID of the offeror BS

**Requester_bid**: Number of credit tokens per resource unit bidded by the requester in response to the offeror advertisement.

**Rented_resource_amount**: Fraction (scalar) of T_renting_subframe the requester is interested in and bidding for.

**Renting_in_start_time**: Starting time of the period from which the requester is interested to rent in within [Renting_out_start_time, Renting_out_end_time], and for which the requester's bid applies for.

**Renting_in_end_time**: Ending time of the period the requester is interested to rent in within [Renting_out_start_time, Renting_out_end_time], and for which the requester's bid applies for.

**Table 108ac—ADV_RSP message format**

| Syntax | Size | Notes |
|---|---|---|
| ADV-RSP_Message_Format ( ) { | | |
| Management Message Type = 72 | 8 bits | |
| ID of the source relaying SS | 48 bits | ID of the relaying SS |
| BSID of the source BS | 48 bits | BSID of the requester |
| BSID of the destination BS | 48 bits | BSID of the offeror |
| Requester_bid | 48 bits | Number of credit tokens per resource unit bidded by the requester in response to the offeror advertisement |
| Rented_resource_amount | 8 bits | Fraction (scalar) of T_renting_subframe the requester is interested in and bidding for |

| | | |
|---|---|---|
| Renting_in_start_time | 16 bits | Absolute time based on UTC time stamp following the format HH:MM:SS:ms |
| Renting_in_end_time | 16 bits | Absolute time based on UTC time stamp following the format HH:MM:SS:ms |
| } | | |

### 15.5.1.68 Resource Allocation Request (RA_REQ) message

The Allocation Request (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. Detailed process is described within clause 15.4.2.4. The RA_REQ message is sent by the offeror BS within the time interval and with mechanisms specified in subclause 15.x.y.

RA_REQ message shall include the following parameters:

**BSID of the source BS**: BSID of the offeror BS

**ID of the destination relaying SS**: ID of the relaying SS

**BSID of the destination BS**: BSID of the requester BS associated to the relaying 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.

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

**Table 108ac—RA_REQ message format**

| Syntax | Size | Notes |
|---|---|---|
| RA-REQ_Message_Format ( ) { | | |
| Management Message Type = 73 | 8 bits | |
| BSID of the source BS | 48 bits | BSID of the offeror |
| ID of the destination relaying SS | 48 bits | ID of the relaying SS |
| BSID of the destination BS | 48 bits | BSID of the requester associated to the relaying SS |
| Resource_Granting_Bit_Flag (RGBF) | 1 bit | This flag indicates whether the offeror supplies the resource requested by the requester or not: |

| | | |
|---|---|---|
| | | 0 – resource allocation is granted<br>1 – resource allocation is rejected |
| Renting_subframe_start_time | 16 bits | 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 | 16 bits | 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 | 48 bits | This field is useful only when RGBF == 1. Derived from the selection process, clearing price is the number of credit tokens the requester has to freeze to acquire the granted resource. |
| } | | |

### 15.5.1.69 Resource Allocation Response (RA_RSP) message

In response to the resource Allocation Request message (RA_REQ), the Resource Allocation Response (RA_RSP) message indicates whether the requester accepts the granting at the proposed clearing price.

The RA_RSP message is sent by the relaying SS within the time interval and with mechanisms specified in subclause 15.x.y.

RA_RSP message shall include the following parameters:

**ID of the source relaying SS**: ID of the relaying SS.

**BSID of the source BS**: BSID of the requester BS associated to the relaying SS.

**BSID of the destination BS**: BSID of the offeror BS.

**Acceptation_Bit_Flag (ABF)**: In case RGBF ==1, this flag indicates that the requester accepts the granting at the proposed clearing price.

**Table 108ac—RA_RSP message format**

| Syntax | Size | Notes |
|---|---|---|
| RA-RSP_Message_Format ( ) { | | |
| Management Message Type = 74 | 8 bits | |
| ID of the source relaying SS | 48 bits | ID of the relaying SS |
| BSID of the source BS | 48 bits | BSID of the requester |
| BSID of the destination BS | 48 bits | BSID of the offeror |
| Acceptation_Bit_Flag (ABF) | 1 bit | In case RGBF ==1, this flag indicates whether the requester accepts the granting at the proposed clearing price: |

| | | |
|---|---|---|
| | | 0 – acceptation<br>1 – rejection |
| } | | |

### 15.5.1.70 Acknowledgment (ACK) message

The offeror BS acknowledges the reception of the RA_RSP message with the ACK message. The ACK message is sent by the offeror BS within the time interval and with mechanisms specified in subclause 15.x.y. The relaying SS relays this message to its serving BS (requester) with regular data message to confirm that the requester BS can actually use the rented resources for the agreed renting period with the offeor BS.

**Table 108ac—ACK message format**

| Syntax | Size | Notes |
|---|---|---|
| RA-RSP_Message_Format ( ) { | | |
| Management Message Type = 75 | 8 bits | |
| BSID of the source BS | 48 bits | BSID of the offeror |
| ID of the destination relaying SS | 48 bits | ID of the relaying SS |
| BSID of the destination BS | 48 bits | BSID of the requester associated to the relaying SS |
| } | | |

## References

[1] IEEE 802.16h/D2a: Part 16: Air Interface for Fixed Broadband Wireless Access Systems Amendment for Improved Coexistence Mechanisms for License-Exempt Operation; 2007-03-28
[2] IEEE 80216h-07_016r4: New Call for Reply Comments to address the comments from *Letter Ballot #24a Commentary file with resolutions from Session #48*
[3] IEEE C80216h-07_030r1: Action Item from Session #47: Credit token based coexistence protocol text update, David Grandblaise, 2007-03-01
[4] IEEE C80216h-07_027: A method to implement Inter-system communication over air, Shulan Feng, 2007-03-09
[5] IEEE C80216h-07_045: Scheduling master sub-frame/frame for coexistence messages transmission, Shulan Feng, 2007-05-02