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Source(s)	Mariana Goldhamer Alvarion Tel Aviv, 21 HaBarzel Street Israel Voice: +972 3 6456241 Fax: +972 3 645 6204 mailto:mariana.goldhamer@alvarion.com
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Procedures for inter-system communication over the air

Mariana Goldhamer
Alvarion

1 Introduction

This contribution has as target to address several comments in LB24:

- Support for MATI/SATI with low overhead and in a frequent mode
- Support for SSURF for all the SSs with low overhead
- Interferer identification in a simpler mode
- Transmission of the CXP messages over the air

and provide a unified solution for communication over the air.

Insert new clause 15.x

15.x Inter-system communication over the air

This clause describes the inter-system communication over the air using the CXCC and a supplementary channel, created on-demand, named CXCSC- Coexistence Control sub-channel.

15.x.1 Description of the Coexistence Control Sub-Channel

There are some messages which should be sent at relatively high time intervals, and only in the case that there is a need to transmit a specific information. The message exchange will take place over the air, using time-slots created following a specific request, and grouped in a Coexistence Control Sub-Channel.
Below are given examples of messages having a randomly or bursty nature:

1. MAT/SATI needs to be transmitted upon request, and there is no need for permanent allocated bandwidth;
2. SSURF does not need to be transmitted at frequent intervals, as carries the BS info, which may be interesting only if a new system joins the Community
3. The CXP messages are already encapsulated in MAC Messages, however it is not defined how can be transported over the air.

The CXCC will be used to send commands, such as opening a new chain of time-slots for communication over the air, for a limited time. The Communication Request message will indicate, as parameter, the start and the repetition period of the new series of slots, which will have the other timing parameters similar with the slots used by CXCC. These slots will constitute a CXCSC (Coexistence Control Sub-Channel) and will start with a first DL slot (BS will transmit) followed by alternating UL and DL slots. A BS will use a DL slot to transmit, while a SS/MS will use an UL slot to transmit.

The first action to be done, before exchanging information with a specific BS, will be to exchange the security parameters.

Every message sent during such a slot will use 802.16 MAC headers and sub-headers, including length and fragmentation information (necessary if the message is too long).

2 Relaying messages transmitted during CXCC or CXCSC

The Relay Request message instructs a SS/MS receiving this message the following:

- if the message is received during normal operation by a SS/MS, this SS/MS will need to transmit the message, using the procedures defined for SSURF message transmission, during the first scheduled CXCC or CXCSC slot;
- if the message is received during the CXCC or CXCSC slot, it will be transmitted to the BS with which the SS/MS is currently associated.

After the successful reception of a relayed message, will be relayed a Relay Response Message, having as parameter the Relay_Response_ID = Relay_Request_ID + 1.

3 Messages

Add a new clause 6.3.2.3.76 and up-date the Table 14

6.3.2.3.76 Communication Request (COM-REQ) message

A system may initiate a request for communication using dedicated slots in the CXCC, by its Base Station (using the dedicated DL slots) or by its SS/MS (using the dedicated UL slots). The BS/MS will use the mandatory PHY mode with the default parameters and the procedures defined for CMI (clause xx). The Comm_Req message shall have the following parameters:

Parameters:

- Message type
- BS ID of the originating BS
- CID of the originating system; will be set to zero if the message is sent by the BS
- BS ID of the destination BS
- Code of the request, as shown below:
  1 = Security request (to set the security parameters; the requesting BS will behave as a SS/MS to the foreign BS)
  2 = Initiate token protocol
  3 = Initiate CXP over the air
  4 = [Interferer Identification]
- Request ID; will be an random number
- Parameters of the requested communication channel:
  - Absolute time for the first slot
  - Interval between slots (in ms)
  - Number of total slots to be allocated to accommodate this request.

The Table xxx shows the parameters of the COM-REQ message.

Table xxx COM-REQ message format

Syntax	Size	Notes
COM-REQ_Message_Format( ) {		
Management Message Type =76	8 bits	
BS ID of the originating BS	48 bits	
CID of the originating system	16 bits	Will be set to zero if the message is sent by the BS
BS ID of the destination BS	48 bits	
Code of request	8 bits	Defined codes: 1 = Security request 2 = Initiate token protocol 3 = Initiate CXP over the air 4 = Interferer Identification
Request ID	32 bits	Random number
Absolute time for the first slot	32bits	Format: hh (6bits):min (6bits):sec (6bits):ms(10bits): spare(4bits)
Time between slots	16bits	In ms
Number of slots	8 bits	
}		

6.3.2.3.77 Communication Response (COM - RSP) message

This message will be send by a system, in response to a COM-REQ message, using dedicated slots in the CXCC. The message may be sent by the Base Station (using the dedicated DL slots) or by its SS/MS (using the dedicated UL slots). The message parameters are:

- Message type
- BS ID for the responding system
- BS ID of the destination BS; a zero value is not allowed.
- Response ID – should be equal with the RequestID in COM-REQ + 1.
- Parameters of the accepted communication channel (may be different from the requested ones)
- Absolute time for the first slot
- Slot frequency (in ms)
- Number of slots to be allocated to accommodate this request.

The Table yyy shows the parameters of the COM-REQ message.

Table yyy COM-RSP message format

Syntax	Size	Notes
COM-RSP_Message_Format( ) {		
Management Message Type =77	8 bits	
BS ID of the originating BS	48 bits	
BS ID of the destination BS	48 bits	
Response ID	32 bits	Request ID + 1
Absolute time for the first slot	32bits	Format: hh (6bits):min (6bits):sec (6bits):ms(10bits): spare(4bits)
Time between slots	16bits	In ms
Number of slots	8 bits	
}		

6.3.2.3.78 Relay Request (REL-REQ) message

This message will encapsulate the message to be relayed and will be sent:
- During the normal operation:
- from BS(initiator) to SS
- from SS (relay receiver) to BS
- During the CXCSC DL/UL time-slots by a BS, respectively a SS.

Note that the encapsulated message may be encrypted in a different way than the REL-REQ message. The encryption mode of the encapsulated message will be established between the initiator BS and the target BS.

The message parameters are:

- BSID of the source BS
- BSID of the destination BS
- a zero value means that the message is intended for Base Stations in the Coexistence Community
- Length of the relayed message
- Encapsulated message
- Request ID; will be an random number.

The REL-REQ message format is shown in Table zzz.

Table zzz REL-REQ message format

Syntax	Size	Notes
REL-REQ_Message_Format( ) {		
Management Message Type =78	8 bits	
BS ID of the originating BS	48 bits	

BS ID of the destination BS	48 bits	Set to zero if the message is intended for all the Base Stations in the Coexistence Community
Length of the relayed message	16 bits	In bytes
Encapsulated message	variable	
Request ID	32 bits	Random number
}		

6.3.2.3.79 Relay Response (REL-RSP) message

This message will confirm the successful receive operation and will be transmitted:
- During the normal operation:
- from BS(initiator) to SS
- from SS (relay receiver) to BS
- During the CXCSC DL/UL time-slots by a BS, respectively a SS.

The message parameter is:

- Response ID = Request ID +1.

The REL-RSP message format is shown in Table ttt.

Table ttt REL-RSP message format

Syntax	Size	Notes
REL-REQ_Message_Format( ) {		
Management Message Type =79	8 bits	
Response ID	32 bits	
}		