Project	**IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>**	
Title	**MAC messages encapsulation**	
Date Submitted	**2007-09-07**	
Source(s)	Shulan Feng Hisilicon Tech. Co., LTD Bld.17, No.8, Dongbeiwang West Road, Hai-Dian District, Beijing, P. R. China	Voice: +86-10-82829151 Fax: +86-10-82829075 e-mail to : fengsl@hisilicon.com ,
	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-07/019	
Abstract	During meeting #50, LE TG have agreed to encapsulate all inter system communications messages into CX-MAC/RSP MAC message. This contribution provides text remedy on inter-system communication MAC messages encapsulation.	
Purpose	Accept.	
Notice	*This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups.* It represents only the views of the participants listed in the "Source(s)" field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.	
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.	
Patent Policy	The contributor is familiar with the IEEE-SA Patent Policy and Procedures: <http://standards.ieee.org/guides/bylaws/sect6-7.html#6> and <http://standards.ieee.org/guides/opman/sect6.html#6.3>. Further information is located at <http://standards.ieee.org/board/pat/pat-material.html> and <http://standards.ieee.org/board/pat>.	

MAC messages encapsulation

Shulan Feng
HiSilicon

David Grandblaise
Motorola

Introduction

During meeting #50, LE TG have agreed to encapsulate all inter system communications messages into CX-MAC/RSP MAC message.

Inter-system communication messages are exchanged between peers, e.g. BS and BSIS or BS and BS or BS and SS. They can be transmitted over the air or over the backhaul. They can be encapsulated into two CX messages, CX-REQ message and CX-RSP message. All inter-system communication messages from source BS to destination BS are encapsulated into CX-REQ message and all inter-system communication messages from destination BS to source BS are encapsulated into CX-REQ message.

Inter-system communication messages can be categorize to broadcast messages, multicast messages and dedicated messages. Broadcast messages are transmitted by broadcast CID. Multicast messages are transmitted by multicast CID. Dedicated messages are transmitted by basic CID.

Messages mainly transmitted over the air interface are listed in table 14 of section 6.3.2.3. Messages mainly transmitted over the backhaul are listed in table h9 of section 15.5. The main work of this document is harmonizing these two sections, removing duplicated messages and simplifying the implementation.

Proposed Solution

1、Rename the CXP-REQ/RSP MAC message to CX-REQ/RSP MAC message.

2、CX-REQ/RSP MAC messages can be transmitted by broadcast CID, multicast CID or basic CID.

3、Modify the CX-REQ/RSP MAC message format so that it is suitable to transmission both over the air and over the backhaul.

4、Give every intersystem communication message of table 14 a message code and add them into table h9, including BSD, SSURF, BS_CCID_RSP, BS_CCID_REQ, all CT-CX messages, ACCESS-NBS-REQ, ACCESS-NBS-RSP and FORWARD_END_REQ.

5、Move section 6.3.2.3.62~6.3.2.3.72, 6.3.2.3.75, 6.3.2.3.76 to section 15.5. And harmonize two parts.

6、Add a column in table h9 to indicate which CID to be used.

Proposed Text

6.3.2.3 MAC management messages

[Insert the following rows into Table-14 MAC management messages as indicated]

Table 14 MAC management message

Type	Message Name	Message Description	Connection
67	Reserved ~~BSD~~	~~Base Station Descriptor~~	~~Broadcast~~
68	Reserved ~~SSURF~~	~~SS Uplink RF Descriptor~~	~~Basic~~
69	Reserved ~~BS_CCID_REQ~~	~~Base Station Co-Channel Interference Detection Indication~~	~~Basic~~
70	Reserved ~~BS_CCID_RSP~~	~~Base Station Co-Channel Interference Detection Response~~	~~Basic~~
71	CX~~P~~-REQ-MAC	Coexistence ~~Protocol~~ Request MAC message	Broadcast/Basic/Multicast
72	CX~~P~~-RSP-MAC	Coexistence ~~Protocol~~ Response MAC message	Broadcast/Basic/Multicast
73	Reserved ~~ACCESS NBS REQ~~	~~Access neighbor BS requirement message~~	~~Basic~~
74	Reserved ~~ACCESS NBS RSP~~	~~Access neighbor BS response message~~	~~Basic~~
75	Reserved ~~FORWARD END REQ~~	~~Forward end request message~~	~~Basic~~
76	OCSI-MNTR-REQ	CSI monitoring request message	Broadcast
77	OCSI-MNTR-RSP	CSI monitoring response message	Basic
78-255	Reserved		

[Move section 6.3.2.3.62~6.3.2.3.72, 6.3.2.3.75, 6.3.2.3.76 to section 15.5 with following updated text.]

[Replace section 6.3.2.3.73~6.3.2.3.74 with following paragraphs.]

6.3.2.3.62~~73~~ Coexistence ~~Protocol~~ Request MAC message (CX-REQ-MAC)

This message encapsulates the Coexistence ~~Protocol request MAC messages~~ inter-system communication messages from source BS to destination BS. For downlink, based on the number of forwarding SS, CX-REQ-MAC messages may be transmitted using broadcast CID, multicast CID or basic CID. For uplink, CX-REQ-MAC messages should be transmitted using forwarding SS's basic CID allocated by destination BS.

CX-REQ MAC management message shall include the following parameters:

CX Message code: The Code is one byte and identifies the type of coexistence message packet. When a packet is received with an invalid Code, it shall be silently discarded. The code values are defined in Table h 9 of section 15.5.

TLV Encoded Attributes: Coexistence message attributes carry the specific authentication, coexistence resolution, and coexistence negotiation data exchanged between peers. Each coexistence message packet type has its own set of required and optional attributes. Unless explicitly stated, there are no requirements on the ordering of attributes within a CX message. The end of the list of attributes is indicated by the LEN field in the MAC PDU header. The TLV encoded attributes values are defined in Table h10 of section 15.5.

Syntax	Size	Notes
CX-REQ_message_Format() {		
Management Message Type =XX	8bits	
CX Message code	8bits	

TLV Encoded Attributes	variable	TLV Specific
}		

6.3.2.3.6374 Coexistence ~~Protocol~~ Response MAC message (CX-RSP-MAC)

This message encapsulates the Coexistence ~~Protocol request MAC messages~~ inter-system communication messages from destination BS to source BS. For downlink, based on the number of forwarding SS, CX-RSP-MAC messages may be transmitted using broadcast CID, multicast CID or basic CID allocated by destination BS. For uplink, CX-RSP-MAC messages should be transmitted using forwarding SS's basic CID allocated by source BS.

CX-RSP MAC management message shall include the following parameters:

CX Message code: The Code is one byte and identifies the type of coexistence message packet. When a packet is received with an invalid Code, it shall be silently discarded. The code values are defined in Table h 9 of section 15.5.
TLV Encoded Attributes: Coexistence message attributes carry the specific authentication, coexistence resolution, and coexistence negotiation data exchanged between peers. Each coexistence message packet type has its own set of required and optional attributes. Unless explicitly stated, there are no requirements on the ordering of attributes within a CX message. The end of the list of attributes is indicated by the LEN field in the MAC PDU header. The TLV encoded attributes values are defined in Table h10 of section 15.5.

Syntax	Size	Notes
CX-RSP_message_Format() {		
Management Message Type =XX	8bits	
CX Message code	8bits	
TLV Encoded Attributes	variable	TLV Specific
}		

11.20 ~~BSD and SSURF Message and Encodings~~

~~IP_Proxy_Address_IE Encoding:~~

~~Name~~	~~Type (1 byte)~~	~~Length (1 byte)~~	~~Value~~
~~ProxyIPv4 Address~~	~~2~~	~~4~~	~~Proxy IP address if IPv4 is supported.~~
~~ProxyIPv6 Address~~	~~2~~	~~16~~	~~Proxy IP address if IPv6 is supported.~~

~~There can be one and only one information element in an IP_Address_IE.~~

15.5 Messages for WirelssMAN-CX

15.5.1 Coexistence ~~Protocol~~ (CX~~P~~) message (CX~~P~~-REQ/RSP)

The Coexistence Protocol employs two message types: CX~~P~~ Request (CX~~P~~-REQ) and CX~~P~~ Response (CX~~P~~-RSP), as described in *Table h 7*

Table h7 CX~~P~~ message

Type	Message Name	Message Description
~~0~~71	CX~~P~~ -REQ	Coexistence Resolution and Negotiation Request
~~1~~72	CX~~P~~ -RSP	Coexistence Resolution and Negotiation Response

These CX~~P~~ messages can be encapsulated as MAC Messages, over the 802.16 air interface, or as Internet Protocol messages (TCP/IP or UDP). The CX~~P~~ management messages are exchanged between peers, e.g. BS and BSIS or BS and BS or BS and SS., and distinguish between CX~~P~~ requests (BS -> BS/BSIS/SS or SS-> BS) and CX~~P~~ responses (BS/BSIS/SS -> BS or SS->BS). Each MAC/IP message encapsulates one CX~~P~~ message in the Management Message Payload. Coexistence ~~Protocol~~ messages exchanged between the BS and BS or between BS and BSIS or between BS and SS shall use the form shown in ~~*Table h 8*~~*section 6.3.2.3.62 and 6.3.2.3.63*.

[Delete text from Page 144 Line 1 to P145 Line 25.]

[Insert following paragraph before table h9.]

Coexistence messages may be encapsulated to CX-REQ/RSP MAC messages. CX message codes are used to identify the type of coexistence message packet. The code values are defined in table h9.

[Update table h9 of subclause 15.5.1 as described below.]

Table h9 CX~~P~~ message codes

Code	CX Message Name	CX Message Type	Protocol Type	Direction	Connection
0	Reserved				
1	Identify Coexistence Request	CX~~P~~-REQ	TCP	BSIS->BSIS	Basic
2	Identify Coexistence Response	CX~~P~~-RSP	TCP	BSIS->BSIS	Basic
3	~~Reserved~~ BSD	CX-REQ		BS->SS	Broadcast
4	~~Reserved~~ SSURF	CX-REQ		SS->BS	Basic
5	~~Reserved~~ BS_CCID_REQ	CX-REQ		SS->BS	Basic
6	~~Reserved~~ BS_CCID_RSP	CX-RSP		BS->SS	Basic
7	~~Reserved~~ ACCESS-NBS-REQ	CX-REQ		BS->SS	Basic
8	~~Reserved~~ ACCESS-NBS-RSP	CX-RSP		SS->BS	Basic
9	Leaving Neighborhood Indication	CX~~P~~-REQ	TCP	BS->BSIS	Basic
10	Leaving Neighborhood Reply	CX~~P~~-RSP	TCP	BSIS->BS	Basic
11	Add Coexistence Neighbor Request	CX~~P~~-REQ	TCP	BS->BS	Basic
12	Add Coexistence Neighbor Reply	CX~~P~~-RSP	TCP	BS->BS	Basic

13	~~Reserved~~ FORWARD-END-REQ	CX-REQ		BS->SS	
14	Reserved				
15	Delete Coexistence Neighbor Request	CX~~P~~-REQ	TCP	BS->BS	Basic
16	Delete Coexistence Neighbor Reply	CX~~P~~-RSP	TCP	BS->BS	Basic
17	Get_Param_For_Radio_Signature_ Request	CX~~P~~-REQ	UDP	BS->BS	Basic
18	Get_Param_For_Radio_Signature_ Reply	CX~~P~~-RSP	UDP	BS->BS	Basic
19	Evaluate_Interference_Request	CX~~P~~-REQ	UDP	BS->BS	Basic
20	Evaluate_Interference_Reply	CX~~P~~-RSP	UDP	BS->BS	Basic
21	Work_In_Parallel_Request	CX~~P~~-REQ	UDP	BS->BS	Basic
22	Work_In_Parallel_Reply	CX~~P~~-RSP	UDP	BS->BS	Basic
23	Reduce_Power_or_Quit_Sub_Fram e_Request	CX~~P~~-REQ	UDP	BS->BS	Basic
24	Reduce_Power_or_Quit_Sub_Fram e_Reply	CX~~P~~-RSP	UDP	BS->BS	Basic
25	Reserved				
26	Reserved				
27	SS_CCID_IND	CX~~P~~-REQ	UDP	BS->BS	Basic
28	SS_CCID_RSP	CX~~P~~-RSP	UDP	BS->BS	Basic
29	PSD_REQ	CX~~P~~-REQ	UDP	BS->BS	Basic
30	PSD_RSP	CX~~P~~-RSP	UDP	BS->BS	Basic
31	Channel Switch Negotiation Request	CX~~P~~-REQ	TCP	BS->BS	Basic
32	Channel Switch Negotiation Reply	CX~~P~~-RSP	TCP	BS->BS	Basic
33	Channel Switch Request	CX~~P~~-REQ	TCP	BS->BS	Basic
34	Channel Switch Reply	CX~~P~~-RSP	TCP	BS->BS	Basic
35	CT-CX~~P~~ Advertisement Request (CT-CX-ADV-REQ)	CX~~P~~-REQ	TCP	BS->BS	Basic
36	CT-CX~~P~~ Advertisement Reply (CT-CX-ADV-RSP)	CX~~P~~-RSP	TCP	BS->BS	Basic
37	CT-CX~~P~~ Negotiation Request (CT-CX-NEG-REQ)	CX~~P~~-REQ	TCP	BS->BS	Basic
38	CT-CX~~P~~ Negotiation Reply (CT-CX-NEG-RSP)	CX~~P~~-RSP	TCP	BS->BS	Basic
39	CT-CX~~P~~ Resource Allocation Request (CT-CX-RA-REQ)	CX~~P~~-REQ	TCP	BS->BS	Basic
40	CT-CX~~P~~ Resource Allocation Reply (CT-CX-RA-RSP)	CX~~P~~-RSP	TCP	BS->BS	Basic

41	~~Reserved~~ CT-CX Advertisement Discovery Policy Descriptor (CT-CX-ADPD)	CX-RSP	TCP	BS->BS	Basic
42	~~Reserved~~ CT-CX Acknowledgement (CT-CX-ACK)	CX-RSP	TCP	BS->BS	Basic
43	~~Reserved~~ CT-CX Notification (CT-CX-NOT)	CX-RSP	TCP	BS->BS	Basic
44	Reserved				
45	Reserved				
46	Reserved				
47	Reserved				
48	Reserved				
49	Reserved				
50	Reserved				
51	Reserved				
52	Reserved				
53	Regulatory Authority Request	CX~~P~~-REQ	TCP	RAIS->BSIS	Basic
54	Regulatory Authority Response	CX~~P~~-RSP	TCP	BSIS->RAIS	Basic
55	FREQ_AVOIDANCE Request	CX~~P~~-REQ	TCP	BSIS->BS	Basic
56	FREQ_AVOIDANCE Response	CX~~P~~-RSP	TCP	BS->BSIS	Basic
57	Master Subframe Switch Request	CX~~P~~-REQ	TCP	BS->BS	Basic
58	Master Subframe Switch Reply	CX~~P~~-RSP	TCP	BS->BS	Basic
59	OCSI backoff request message	CX~~P~~-REQ	TCP	BS->BS	Basic
60	OCSI backoff response message	CX~~P~~-RSP	TCP	BS->BS	Basic
61-255	Reserved				

[Update table h10 of subclause 15.5.1 as described below.]

Table h9 CX~~P~~ message codes

Type	Parameter Description	Length (bytes)	Comment

01	BSID of source BS	6	
02	GPS Coordinates	2	
03	BS IP of source BS	~~1~~ Variable	4 bytes if IPv4 is supported 16 bytes if IPv6 is supported
04	MAC Frame duration	1	
05	Reserved ~~Type of sub-frame allocation~~	1	
06	Sub-frame number	1	
…	…		
63	Number of Structures	1	Number of structures to be listed in continuations
64	Number of TLVs in a structure	1	Used in conjunction with the Number of structures
65	ID of the destination forwarding SS	6	
66	Notification Bit Flag (NBF)	1	
	BSID of destination	6	
	BS IP of destination BS	Variable	4 bytes if IPv4 is supported 16 bytes if IPv6 is supported
	BS EIRP	1	The BS EIRP is signed in units of 1 dBm.
	BS_GPS_LOC	4	16 MSB for BS Lat 16 LSB for BS long
	BS_HGHT	2	Height of BS antenna above sea level in meters.
	BS_RF_Sector ID	2	Bits 0-7 For Azimuth of beamwidth true north, 2 degree steps Bits 8-15 for -3db Azimuth Beamwidth, 2 degree steps.
	SSID	6	
	SS EIRP		he SS EIRP is signed in units of 1 dBm.
	SS_RF_Sector ID	2	Bits 0-7 For Azimuth of beamwidth true north, 2 degree steps Bits 8-15 for -3db Azimuth Beamwidth, 2 degree steps.
	DFS_LE_PWR_FRQ	4	Bits 0-3: Device Type Bits 4-15: Device detection specific Bits 16-23: 8 bit mean RSSI Bits 24-31: TBD

	INT_BSD_Frq	2	Bits 0-7 For WirelessMAN-CX detection: The frequency of interference BSD detection events per N Tcxcc cycles. Bits 8-15 For non-WirelessMAN-CX detection: The number of interference events per Tcxcc cycles exceeding a threshold RSSI specific to the SS detector.
	CX_CMI_D(n)	1	Coexistence Messaging Interval ID In which WirelessMAN-CX interference detected. Otherwise =0 when detection (leading to this response) done in (No+Io) slot of CXCC.
	RSP_Field	2	The response field indicates: Bit 0: Response to Radar=1 Response to Non-WirelessMAN-CX =0 Bit 1-2: 0 - Resolved 1 - Pending Resolution 2 - Adjust threshold 3 - Inhibit Response Bit 3-9: Interference RSSI Power threshold Adjust ***[John to fix the table]*** Bit 10-15: TBD Threshold for number of interference events per CMI Cycle)
	Master sub-frame index	1	The master sub-frame index claimed by BS.
	Result of access procedure	1	0: SS has successfully access to the requested neighbor BS >0: SS fail to access the requested neighbor BS 1: SS can't get PHY synchronization with neighbor BS 2: SS can't get MAC synchronization with neighbor BS 3: Ranging procedure failed 4: other reason

…	…		

[Remove subclause 6.3.2.3.65]

[Update text of subclause 15.5.1.25 as indicate:]

15.5.1.25 CT-CX Advertisement Request (CT-CX-ADV-REQ)

~~In case of CT-CX operations over the air, t~~The CT-CX-ADV-REQ message is encapsulated as a CX-REQ MAC message. This message specifies the advertisement discovery information sent out by the offeror BS towards the forwarding SSs (associated to requester BSs and located in the overlapping area of this offeror system and the surrounding requester systems) in case of CT-CX operation over the air. The CT-CX-ADV-REQ message is sent by the offeror BS within the mechanisms specified in subclause *15.6*. If the CT-CX-ADV-REQ message content meets the CT-CX-ADPD requirements, the forwarding SS forwards the CT-CX-ADV-REQ message towards its serving BS followed up the mechanisms specified in subclause *15.6*. CT-CX-ADV-REQ message provides the necessary information to these forwarding SSs to enable them then to inform their home BS (requester) about radio resources sharing opportunities proposed by the offeror BS.

In case of CT-CX operations over the backhaul, the offerer sends this broadcast message to advertise to the surrounding future potential requester candidates that it offers temporally resource for renting.

CT-CX-ADV-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

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 RRU required per requester's bid.

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

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

Negotiation_Mode_Bit_Flag (NMBF): This flag indicates which of negotiation mode of CT-CX is used:
0 - non-negotiation mode is active
1 - negotiation mode is active

Start_negotiation_time: If NMBF == 1, this field specifies the starting time of the negotiation between the offerer and the competing requesters.

End_negotiation_time: If NMBF == 1, this field specifies the ending time of the negotiation between the offerer and the competing requesters.

Pricing_Bit_Flag (PBF): If NMBF == 1, PBF specifies the CT-CX pricing method applicable to the negotiation mode for the selected requesters:

0 – CTs are transferred from the requester's ownership to the offeror's one

1 – No CTs transfer ownership from the requester to offeror. However, selected requester's CTs are not usable by this requester for a given time period (the freezing time period) before reuse.

Code: 35

Attributes are shown in *Table h27*.

Table h27—CT-CX Advertisement Request (CT-CX-ADV-REQ) message attributes

Attribute	Contents
BSID of the source BS	BSID of the offer or
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
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
T_renting_subframe	Total amount of time per master subframe rented out by the offer or
Minimum number of Credit Token (MNCT)	Minimum number of credit tokens per RRU required per requester's bid.
List of channels (LC)	List of other channels (frequency domain) proposed by the offeror BS for renting
Negotiation_Mode_Bit_Flag (NMBF)	This field is used only with backhaul based inter BS communications. This flag indicates which of negotiation mode of CT-CX is used: 0 - non-negotiation mode is active 1 - negotiation mode is active

Start_negotiation_time	This field is used only with backhaul based inter BS communications. If NMBF == 1, this field specifies the starting time of the negotiation between the offerer and the competing requesters.
End_negotiation_time	This field is used only with backhaul based inter BS communications. If NMBF == 1, this field specifies the ending time of the negotiation between the offerer and the competing requesters.
Pricing_Bit_Flag (PBF)	This field is used only with backhaul based inter BS communications. If NMBF == 1, PBF specifies the CT-CX pricing method applicable to the negotiation mode for the selected requesters: 0 – CTs are transferred from the requester's ownership to the offeror's one 1 – No CTs transfer ownership from the requester to offeror. However, selected requester's CTs are not usable by this requester for a given time period (the freezing time period) before reuse.

[Remove subclause 6.3.2.3.67]

[Update text of subclause 15.5.1.26 as indicate:]

15.5.1.26 CT-CX Advertisement Reply (CT-CX-ADV-RSP)

In case of CT-CX operations over the air, the CT-CX-ADV-RSP message is encapsulated as a CX-RSP MAC message. In response to the CT-CX-ADV-REQ message, and if the forwarding SS has been selected to complete the CT-CX operations (specified in the CT-CX-NOT message), the forwarding SS responds to the offeror with an CT-CX-ADV-RSP message 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]. CT-CX-ADV-RSP message content is aligned with renting requirements specified within CT-CX-ADPD message. The CT-CX-ADV-RSP message is sent by the forwarding SS within the time interval and with mechanisms specified in subclause *15.6*.

In case of CT-CX operations over the backhaul: in response to CT-CX-ADV-REQ message, each requester can respond to the offeror with an CT-CX-ADV-RSP message 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 out period [Renting_out_start_time, Renting_out_end_time], and its Requester_bid.

CT-CX-ADV-RSP 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 requester BS (associated to the forwarding SS in case of over the air inter BS communications).

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.

CT-CX-ADV-RSP message shall include the following parameters that are applicable only for over the air based inter system communications:

ID of the source forwarding SS: ID of the forwarding SS

Code: 36

Attributes are shown in *Table h28*.

Table h28- The CT CX Advertisement Reply (CT-CX-ADV-RSP) message attributes

Attribute	Contents
BSID of the source BS	BSID of the requester
BSID of the destination BS	BSID of the offeror
Requester_bid	Number of credit tokens per RRU 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. Absolute time based on UTC time stamp following the format HH:MM:SS:ms.
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. Absolute time based on UTC time stamp following the format HH:MM:SS:ms
ID of the source forwarding SS	This field is used only with over the air based inter BS communications. ID of the forwarding SS.

[Update text of subclause 15.5.1.27 as indicate:]

15.5.1.27 CT-CX Negotiation Request (CT-CX-NEG-REQ)

This message is used only for CT-CX operations over the backhaul. This message is used only if NMBF == 1.

The CT-CX-NEG-REQ message is sent out by the offerer only when the NMBF mode flag is set to 1 in the CT-CX-ADV-REQ message, i.e. when the CT-CX negotiation mode is active. At each iteration of the negotiation, the decision making algorithm applied by the offeror derives a minimum and maximal payoff based on the requesters' bids. At each of these iterations, updated values of these payoffs are provided by the offeror to the requesters still bidding for the renting.

Code: 37

Attributes are shown in *Table h29*.

Table h29 - CT-CX Negotiation Request (CT-CX-NEG-REQ) message attributes

Attribute	Contents
BSID of the source BS	BSID of the offeror
BSID of the destination BS	BSID of the requester
Minimal_payoff	Minimal derived payoff corresponding to the lower selected bid at the n^{th} iteration of the negotiation
Maximal_payoff	Maximal derived payoff corresponding to the higher selected bid at the n^{th} iteration of the negotiation

[Update text of subclause 15.5.1.28 as indicate:]

15.5.1.27 CT-CX Negotiation Reply (CT-CX-NEG-RSP)

This message is used only for CT-CX operations over the backhaul. Based on the minimal and maximal payoff information, the CT-CX-NEG-RSP message is sent out by the requester in response to CT-CX-NEG-REQ message in case the requester is willing to make a new bid proposal to be part of the selected requesters.

Code: 38

Attributes are shown in *Table h30*.

Table h30 - CT-CX Negotiation Reply (CT-CX-NEG-RSP) message attributes

Attribute	Contents
BSID of the source BS	BSID of the requester
BSID of the destination BS	BSID of the offer or
Requester_bid_update	Updated number of credit tokens per RRU bidded by the requester in response to CT-CX-NEG-REQ message

[Remove subclause 6.3.2.3.68]

[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-CX-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. Detailed process is described within clause *15.4.2.4*. 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.

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 only for over the air based inter system communications:

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

Code: 39

Attributes are shown in *Table h31*.

Table h31 - 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-CX-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.

[Remove subclause 6.3.2.3.69]

[Update text of subclause 15.5.1.30 as indicate:]

15.5.1.30 CT-CX Allocation Reply (CT-CX-RA-RSP)

In case of CT-CX operations over the air, the CT-CX-RA-RSP message is encapsulated as a CX-RSP MAC message. In response to the CT-CX-RA-REQ message, the CT-CX-RA-RSP message indicates whether the requester accepts the granting at the proposed clearing price. The CT-CX-RA-RSP message is sent by the forwarding SS with mechanisms specified in subclause *15.6.*

In the case of backhaul based inter system communication: In response to the CT-CX-RA-REQ message, the CT-CX-RA-RSP message indicates whether the requester accepts the granting at the proposed clearing price.

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 requester BS (associated to the forwarding SS in the case of over the air inter system communications).

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

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

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

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

ID of the source forwarding SS: ID of the forwarding SS.

Code: 40

Attributes are shown in *Table h32*.

Table h32- CT-CX Resource Allocation Reply (CT-CX-RA-RSP) message attributes

Attribute	Contents
BSID of the source BS	BSID of the requester
BSID of the destination BS	BSID of the offer or
Acceptation_Bit_Flag (ABF)	This field is used only with backhaul based inter BS communications. In case RGBF == 1, this flag indicates whether the requester accepts the granting at the proposed clearing price: 1 – acceptation 0 – rejection
ID of the source forwarding SS	This field is used only with over the air based inter BS communications; ID of the forwarding SS;

[Remove subclause 6.3.2.3.64]

[Create new section 15.5.1.x in subclause 15.5.1 as indicate:]

15.5.1.x CT-CX Advertisement Discovery Policy Descriptor (CT-CX-ADPD)

CT-CX-ADPD message (CT CX Advertisement Discovery Policy Descriptor) is only used for the over the air operations of CT-CX. In case of these CT-CX operations over the air, the CT-CX-ADPD message is

encapsulated as a CX-REQ-MAC message. CT-CX-ADPD message is sent from the home requester BS to its associated forwarding SSs as a regular multicast data message for the CT-CX operations. Purpose of CT-CX-ADPD is to instruct the attitude of each forwarding SS when the forwarding SS receives CT-CX-ADV-REQ message. CT-CX-ADPD specifies whether the forwarding SS has to forward CT-CX-ADV-REQ message toward it serving BS (requester BS).

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

BSID of the source BS: BSID of the requester BS.

ID of the forwarding SS: ID of the forwarding 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 forwarding SS associated BS is not allowed to report CT CX-ADV-REQ message 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 forwarding SS is not allowed to report CT CX-ADV-REQ message 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.

MNCT: Maximum admissible number of credit tokens per RRU the requester BS will provide to get the radio resources proposed by the offeror BS. Above this number of tokens, the forwarding SS is not allowed to report CT CX Advertisement Request message content to this home BS (requester).

Code: 41

Attributes are shown in *Table h33*.

Table h33 - CT-CX-ADPD message attributes

Attribute	Contents
BSID of the source BS	BSID of the offeror
ID of the forwarding SS	ID of the forwarding SS
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. Absolute time based on UTC time stamp following the format HH:MM:SS:ms.
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. Absolute time based on UTC time stamp following the format HH:MM:SS:ms
Minimum number of Credit Token (MNCT)	Minimum number of credit tokens per RRU required per requester's bid.

[Remove subclause 6.3.2.3.70]

[Create new section 15.5.1.x in subclause 15.5.1 as indicate:]

15.5.1.x CT-CX Acknowledgement (CT-CX-ACK)

CT-CX-ACK message (CT CX Acknowledgement) is only used for the over the air operations of CT-CX. In case of these CT-CX operations over the air, the CT-CX-ACK message is encapsulated as a CX-REQ MAC message. The offeror BS acknowledges the reception of the CT-CX-RA-REQ message with the CT-CX-ACK message. The CT-CX-ACK message is sent by the offeror BS with mechanisms specified in subclause *15.6*. The forwarding SS forwards 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.

Code: 42

Attributes are shown in *Table h34*.

Table h34 - CT-CX-ACK message attributes

Attribute	Contents
BSID of the source BS	BSID of the offer or
ID of the forwarding SS	ID of the forwarding SS associated to the destination BS
BSID of the destination BS	BSID of the requester associated to the forwarding SS

[Remove subclause 6.3.2.3.66]

[Create new section 15.5.1.x in subclause 15.5.1 as indicate:]

15.5.1.x CT-CX Notification (CT-CX-NOT)

CT-CX-NOT message (CT CX Notification) is only used for the over the air operations of CT-CX. In case of these CT-CX operations over the air, the CT-CX-NOT message is encapsulated as a CX-RSP MAC message. In order to ensure the CT-CX-ADV-REQ is appropriately received by the requester BS, CT-CX-ADV-REQ can be sent out by several forwarding SSs for the CT-CX operations. If multiple CT CX-ADV-REQ messages are received from different forwarding SSs, the offeror BS selects only one forwarding SS to complete the remaining CT-CX operations (CT-CX-ADV-RSP message, CT-CX-RA-REQ, CT-CX-RA-RSP). For that, the offeror BS notifies (through CT-CX-NOT) each of the forwarding SS whether or not it should complete the remaining CT-CX operations. CT-CX-NOT message is a regular data message.

CT-CX-NOT message shall include the following parameters:

BSID of the source BS: BSID of the offeror BS

ID of the forwarding SS: ID of the forwarding SS associated to the destination BS

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

Code: 43

Attributes are shown in *Table h35*.

Table h35 - CT-CX-NOT message attributes

Attribute	Contents
BSID of the source BSs	BSID of the offer or
ID of the forwarding SS	ID of the forwarding SS associated to the destination BS
Notification Bit Flag (NBF)	This flag indicates whether the forwarding SS is selected to complete the CT-CX operations or not: 1: forwarding SS is selected 0: forwarding SS is not selected

[Remove subclause 6.3.2.3.62]

[Create new section 15.5.1.x in subclause 15.5.1 as indicate:]

15.5.1.x Base Station Descriptor (BSD) message

The base station descriptor (BSD) message is encapsulated as a CX-REQ MAC message. The base station descriptor (BSD) message contains the identification, and other information about the Base Station. This message is sent only in the CX_CMI_D(n) slot of the CXCC (see *15.3.3.1*) claimed by the Base Station and it is intended to be decoded as intelligible interference by subscriber stations associated to other systems (see *15.3.3.4*).

The BSD contains pertinent information related to the base station, allowing foreign (interfered-with) subscriber stations to identify it as interference.

Code: X

Attributes are shown in *Table hx*.

Table hx - BSD message attributes

Attribute	Contents
BSID of source BS	The BSID of BS sending BSD message.
IP_Proxy address	The Coexistence Proxy IP address information provides the IP address of the Coexistence Proxy Server.
BS EIRP	The EIRP at which the BSD message was sent; usually the maximum allowable EIRP for the operation of this Base Station.

BS_RF_Sector_ID	The RF antenna sector ID is used to identify the RF transmitting antenna at the base station where multiple RF antennas may be used or the azimuth direction of transmission if a Beam Forming AAS antenna is used. It contains information about the azimuth direction (with respect to True North) and -3 dB azimuth beamwidth of the antenna pattern.
BS_GPS_LOC	The GPS location of the Base Station emitting the BSD

[Remove subclause 6.3.2.3.63]

[Create new section 15.5.1.x in subclause 15.5.1 as indicate:]

15.5.1.x Subscriber Station Uplink Radio Frequency (SSURF) message

Subscriber Station uplink radio frequency (SSURF) message is encapsulated as a CX-REQ MAC message. The Subscriber Station uplink radio frequency (SSURF) message is the complement to the BSD message except it is sent on the uplink during the CMI interval claimed by the Base Station to which the SS is registered.

This message, if received by foreign (interfered-with) Base Stations, will identify the SS as being an interferer. (*15.3.3.5*)

Code: X

Attributes are shown in *Table hx*.

Table hx - SSURF message attributes

Attribute	Contents
BSID of source BS	BSID of Serving Base Station associated with the SS.
SSID	Subscriber station identifier, in the context of this message, identifies the transmitting SS.
IP_Proxy address	The BS IP address information uniquely identifies an associated base station.
SS EIRP	The EIRP at which the SSURF message was sent; usually the maximum allowable EIRP for the operation of this station.

SS_RF_Sector_ID	The RF antenna sector ID is used to identify the RF transmitting antenna at the subscriber station. It contains information about the azimuth direction (with respect to True North) and -3 dB azimuth beamwidth of the antenna pattern transmitting the SSURF.

[Remove subclause 6.3.2.3.71]

[Create new section 15.5.1.x in subclause 15.5.1 as indicate:]

15.5.1.x BS_CCID_RSP message

The subscriber station co-channel interference indication (BS_CCID_RSP) message is encapsulated as a CX-RSP MAC message. The subscriber station co-channel interference indication (BS_CCID_RSP) message contains co-channel interference information detected at a subscriber station. The source of co-channel interference can be foreign sources such as radars or non-WirelessMAN-CX compliant devices, as well as other WirelessMAN-CX base stations that may or may not be members of the coexistence community.

This is a MAC management message sent by a SS to its home base station when unresolved co-channel interference is detected at a SS. Unresolved co-channel interference typically is interference which is new to the SS and which is not recorded in the SS Interference Table as having been resolved using the Coexistence Protocol by the home base station of the SS. Resolved interference implies that messages destined to the SS will not be corrupted by interference emanating from a foreign WirelessMAN-CX base station. This message is sent either every time (or after a set number of detection instances) the foreign BSD interference is detected and until the interference is resolved.
The message is also sent when non-WirelessMAN-CX systems are detected, such RLAN signals or radars which have higher regulatory priority to the bandwidth. Information about the specific interferer can be sent, assuming that this information can be specifically determined by the interfered-with SS. Such information can include the classification of a radar or bursty non-WirelessMAN-CX system. Thresholds for sending BS_CCID_RSP messages in response to non-WirelessMAN-CX interference can be set in the complementary BS_CCID_REQ message.

Code: X

Attributes are shown in *Table hx*.

Table hx – BS_CCID_RSP message attributes

Attribute	Contents

DFS_LE_PWR_FRQ	This parameter is used to identify the types of interfering devices and provide information that may be specific to the particular devices. The parameter contains the mean RSSI of the radar signals or non-WirelessMAN-CX systems detected during the (No+Io) measurement slots of the Tcxcc. Radar signals may be detected at below *Regulatory threshold* values, and the RSSI level given will be the mean value of such signals. Other radar information such as PPS and Pulse duration will be given in the Device Detection Specific Fields. If non- WirelessMAN-CX systems their signature will be given as number of detected interference events per N Tcxcc cycles. This parameter will be used to support specific interference detectors that may be mandated by for use in specific bands. Additional bit fields are provided in support of these requirements**.**
INT_BSD_Frq	The frequency of interference BSD events detected per Coexistence Control Channel (Tcxcc) cycles (calculated as the number of BSD interference events per N Tcxcc cycles [1 cycle= 10 Sec]). For this specific BSD and BSID, as forwarded by this BS_CCID_RSP message, this value can be set by the home base station to make the SS less responsive to interference detection (such as highly sporadic and transient events). This value is a threshold value determining when a BS_CCID_RSP needs to be sent by the interfered with SS. Only when this value has been exceeded will the BS_CCID_REQ message be sent.
IP_Proxy address	The proxy IP address associated with a foreign base station, derived from the BSD.
BS EIRP	The EIRP of the interfering Base Station, taken from the BSD.
BS_RF_Sector_ID	The RF antenna sector ID is used to identify the RF antenna at the interfering base station where multiple RF antennas may be used; this information is derived from the BSD. It contains information about the azimuth direction (with respect to True North) and 3 dB azimuth beamwidth of the antenna pattern that created the interference.
CX_CMI_D(n)	The Coexistence Messaging Downlink Interval (where n=1-3) during which the interference was received.

[Remove subclause 6.3.2.3.72]

[Create new section 15.5.1.x in subclause 15.5.1 as indicate:]

15.5.1.x BS_CCID_REQ message

This message is encapsulated as a CX-REQ MAC message.

This message is sent to the SS initiating the BS_CCID_RSP message. It is sent by the BS and it is used to indicate whether the interference events identified in the BS_CCID_RSP have been resolved. For DFS and non-WirelessMAN-CX interference events, in addition to this message there likely will be other actions issued by the network management systems, which can entail moving to other channels. For WirelessMAN-CX systems the actions could include reducing EIRP at the interfering BS or assigning the interfered-with SS to a different sub-frame, etc. This message is also sent to adjust the threshold of interference detection at the SS, both to

WirelessMAN-CX and other system interference.

Code: X

Attributes are shown in *Table hx*.

Table hx – BS_CCID_REQ message attributes

Attribute	Contents
BSID	Interfering BS station ID for which this response is sent to SS; set to zero if non-WirelessMAN-CX
RSP_Field	The response field indicates: (1) Interference with foreign BS is/is not resolved (2) Sub DFS threshold and non-WirelessMAN-CX users noted, no response at present (3) TBD threshold/response adjustment variables (TBD).

[Remove subclause 6.3.2.3.75]

[Create new section 15.5.1.x in subclause 15.5.1 as indicate:]

15.5.1.x Access Neighbor BS Request message (ACCESS-NBS-REQ)

This message is encapsulated as a CX-REQ MAC message.

This message is send by BS to its serving SS to request this SS to access neighbor BS during neighbor BS's master sub-frame as a forward SS. After receiving this message, SS tries to access neighbor BS as forward SS during the neighbor BS's master sub-frame.

Code: X

Attributes are shown in *Table hx*.

Table hx –ACCESS-NBS-REQ message attributes

Attribute	Contents
BSID of destination BS	The BSID of Neighbor BS which SS will access to.
Master sub-frame index	The master sub-frame index of neighbor BSID. The requested SS will try to access to neighbor BSID during this sub-frame.

[Remove subclause 6.3.2.3.75]

[Create new section 15.5.1.x in subclause 15.5.1 as indicate:]

15.5.1.x Access Neighbor BS Response message (ACCESS-NBS-RSP)

This message is encapsulated as a CX-RSP MAC message.

After receiving the ACCESS-NBR-REQ message from serving BS, SS tries to access neighbor BS as forward SS during the neighbor BS's master sub-frame. SS uses ACCESS-NBS-RSP to report the serving BS if it can access neighbor BS successfully.

Code: X

Attributes are shown in *Table hx*.

Table hx –ACCESS-NBS-REQ message attributes

Attribute	Contents
BSID of destination BS	The BSID of Neighbor BS which SS will access to.
Result of access procedure	Indicate if SS has successfully access to requested neighbor BS.

[Create new section 15.5.1.x in subclause 15.5.1 as indicate:]

15.5.1.x Forward end request message (FORWARD-END-REQ)

This message is encapsulated as a FORWARD-END-REQ MAC message.

This message will end Inter-system communication procedures via SS forward. This message is transmitted by source BS to forward SS and/or from forward SS to destination BS.

Code: X

Attributes are shown in *Table hx.*

Table hx – FORWARD_END_REQ message attributes

Attribute	Contents
BSID of Destination	The BSID of BS which response to the inter-system communication request.
BSID of source BS	The BSID of BS which initiates the Inter-system communication procedure.