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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
	Mariana Goldhamer Alvarion Ltd. 21A, Ha Barzel Street, Tel Aviv, Israel	E-mail: mariana.goldhamer@alvarion.com
	David Grandblaise Motorola Labs Parc Les Algorithmes Commune de Saint Aubin 91193 Gif sur Yvette, France	Voice: +33 (0)1 6935 2582 e-mailto: david.grandblaise@motorola.com
	John Sydor Communications Research Centre Ottawa, Canada	Voice: 1-613-998-2388 Fax: e-mail to : john.sydor@crc.ca
	Wu Xuyong Huawei, Huawei Industry Base, Bantian, Longgang, Shenzhen, China 518129	Voice: +86-755-28971787 Fax: +86-755-28972352 email to: wuxuyong@huawei.com
	Harry Bims Apple, Inc. Cupertino, CA	Voice: 1-650-283-4174 email to: harrybims@mac.com

Re:	IEEE 802.16-08/026 IEEE 802.16 Working Group Letter Ballot Recirc #29c: Announcement

Abstract	

Purpose	Accept.

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 for inter-system communication over the air

Shulan Feng, Mariana Goldhammer, David Grandblaise, John Sydor, Xuyong Wu

HiSilicon, Alvarion, Motorola, CRC, Huawei

Introduction

To resolve the comment on the transmission over the IP network, the CX protocol is separated to two parts. The messages over the backhaul are transformed into primitives. Messages over the air need to be rewritten. This document gives the text for the inter-system communication messages over the air.

Proposed changes

[Replace the content of 6.3.2.3.64, 6.3.2.3.65 as following]

6.3.2.3.64 Coexistence Forward Request message (CX-FWD-REQ)

This message transmits inter-system coexistence information from a source BS to a destination BS. For the downlink, based on the number of forwarding SSs, the CX-FWD-REQ message may be transmitted using a broadcast CID, multicast CID or basic CID allocated by the source BS. For the uplink, the CX-FWD-REQ message should be transmitted using the forwarding SS's basic CID allocated by the destination BS.

The CX-FWD-REQ management message shall include the following parameters:

Action Code: The Action Code is one byte in length, and identifies the action type for an inter-system coexistence message. When a message is received with an invalid Action Code, it shall be silently discarded. The action code values are defined in Table hxx of section 15.5.3.

TLV Encoded Attributes: The message attributes carry the specific authentication, coexistence resolution, and coexistence negotiation data exchanged between peers. Each coexistence message Action Code has its own set of required and optional attributes. Unless explicitly stated, there are no requirements on the ordering of attributes within a CX-FWD-REQ 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 hyy of section 11.xx

Table 108ac—CX-FWD-REQ message format

Syntax	Size	Notes

CX- FWD-REQ _Message_Format () {		
Management Message Type = 69	8 bits	
Action Code	8 bits	
BSID	48bit	If the CX-FWD-REQ message is sent from the source BS to the forwarding SS, the BSID shall be the "BSID of destination BS". If the CX-FWD-REQ message is sent from the forwarding SS to the destination BS, the BSID shall be the "BSID of source BS".
TLV Encoded Attributes	variable	TLV specify
}		

Table 108ac—

6.3.2.3.65 Coexistence Forward Response message (CX-FWD-RSP)

This message transmits inter-system coexistence information from a destination BS to a source BS. For the downlink, based on the number of forwarding SSs, the CX-FWD-RSP message may be transmitted using a broadcast CID, multicast CID or basic CID allocated by the destination BS. For the uplink, the CX- FWD-RSP message should be transmitted using the forwarding SS's basic CID allocated by the source BS.

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

Action Code: The Action Code is one byte in length and identifies the action type for an inter-system coexistence message. When a message is received with an invalid action code, it shall be silently discarded. The action code values are defined in Table hxx of section 15.5.3.

TLV Encoded Attributes: The message attributes carry the specific authentication, coexistence resolution, and coexistence negotiation data exchanged between peers. Each coexistence message Action Code has its own set of required and optional attributes. Unless explicitly stated, there are no requirements on the ordering of attributes within a CX-FWD-RSP 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 hyy of section 11.xx.

Table 108ad—CX-RSP message format

Syntax	Size	Notes
CX-RSP _Message_Format () {		
Management Message Type = 70	8 bits	
Action Code	8 bits	

BSID	48bit	If the CX-FWD-RSP message is sent from the destination BS to the forwarding SS, the BSID should be the "BSID of source BS". If the CX-FWD-REQ message is sent from the forwarding SS to the source BS, the BSID should be the "BSID of destination BS".
TLV Encoded Attributes	variable	TLV specify
}		

Table 108ad—

[Insert after 6.3.2.3.65 the following sub-section]

6.3.2.3.xx Coexistence Forward Indication message (CX-FWD-IND)

This message transmits inter-system coexistence information from a destination BS to a source BS. For the downlink, based on the number of forwarding SSs, the CX-FWD-IND message may be transmitted using a broadcast CID, multicast CID or basic CID allocated by the destination BS. For the uplink, the CX-FWD-IND message should be transmitted using the forwarding SS's basic CID allocated by the source BS.

The CX-FWD-IND management message shall include the following parameters:

Action code: The Action Code is one byte in length and identifies the action type for an inter-system coexistence message. When a message is received with an invalid Action Code, it shall be silently discarded. The values of action codes are defined in Table hxx of section 15.5.3.

TLV Encoded Attributes: Coexistence message attributes carry the specific authentication, coexistence resolution, and coexistence negotiation data exchanged between peers. Each coexistence message Action Code has its own set of required and optional attributes. Unless explicitly stated, there are no requirements on the ordering of attributes within a CX-FWD-IND 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 hyy of section 11.xx.

Table ???   CX-IND message format

Syntax	Size	Notes
CX-RSP _Message_Format () {		
Management Message Type = 71	8 bits	
Action Code	8 bits	

BSID	48bit	If the CX-FWD-REQ message is sent from the source BS to the forwarding SS, the BSID shall be the "BSID of destination BS". If the CX-FWD-REQ message is sent from the forwarding SS to the destination BS, the BSID shall be the "BSID of source BS".
TLV Encoded Attributes	variable	TLV specific
}		

[Insert in clause 11 a new clause 11.xx[

11.xx CX inter-system communication encodings

The following Type-Length-Value (TLV) types may be present in CX- FWD-REQ, CX- FWD-RSP and CX-FWD-IND messages, depending on the coexistence action identified by their Action Code.

Table hyyy TLV types for inter-system coexistence messages

Type	Name	Length (bytes)	Value
01	BSID of Source BS	6	The BSID of the source base station
02	GPS coordinates	3	GPS coordinates
03	Network Address of source BS	4 or 16	Higher-layer protocol network address of the source base station length = 4 bytes if IPv4 is supported length = 16 bytes if IPv6 is supported
04	MAC Frame number	1	The 8 least-significant bits of the absolute MAC Frame number
05	Time shift from the MAC Frame start	2	Time shift from the MAC Frame start (in microseconds)
06	Duration of the time slot	2	Duration of the time slot (in microseconds)
07	Channel information	2	The channel information of the requested BS. Contains the modulation mode and alternative Channel Flag Bit0~Bit7: Modulation mode (0- reserved; 1- OFDM; 2-OFDMA; 3-15 reserved) Bit8~Bit15: alternative Channel Flag (0- no ALTCH; 1- have ALTCH)
08	Tx power	1	Tx power in dBm
09	Channel Center Frequency	4	Channel Center Frequency in 10kHz
10	Antenna Type	1	Transmit antenna type or receive antenna type.(1 - omni, 2 - directional)
11	Antenna Gain	1	Transmit antenna gain or receive antenna gain in dBi. Signed value

12	Acceptance indication	1	1 - accepted 2 - rejected 3,- message dependent
13	Channel width	2	In 0.01MHz
14	Reduction of transmit power	1	Reduction of transmit power in dB
15	Gap DIUC/UIUC insertion	1	Gap DIUC/UIUC insertion 1 - for this system 2 - for systems which do not comply with this criteria
16	Number of distinct BS configurations	1	Number of distinct BS configurations < 20
17	Number of SSs	1	Number of SSs < 200
18	Two field structure	2	Each element in the structure is coded with 8 bits)
19	Radio signature type	1	Radio Signature type: 1 - RSS1 of this system, signature from SS1 (logical numbering) 2 - RSS2 of this system . . 199 - RSS199 of this system 200 - RBS1 of this system (BS in configuration 1, logical numbering) 201 - RBS2 of this system, configuration 2 . . 220 - RBS20 of this system, configuration 20 221 - maximum interference from all the CX_SS (compatible with WirelessMAN-CX), which operate inside the frequency block 222- maximum interference from all the CX_BS, which operate inside the frequency block 223 - maximum interference from all the CX_SS, which operate in a channel, which overlaps the operating channel of the requesting BS 224 - maximum interference from all the CX_BS, which operate in a channel, which overlaps the operating channel of the requesting BS 225 - maximum interference from all the NON-CX_SS, which operate in a channel, which overlaps the operating channel of the requesting BS 226 - maximum interference from all the NON-CX_BS, which operate in a channel, which overlaps the operating channel of the requesting BS 227 - maximum interference from all the CX_SS, which operate in the upper adjacent channel relative to the operating channel of the requesting BS 228 - maximum interference from all the CX_BS, which operate in the upper adjacent channel relative to the operating channel of the requesting BS 229 - maximum interference from all the CX_SS, which operate in the lower adjacent channel relative to the operating channel of the requesting BS 230 - maximum interference from all the CX_BS, which operate in the lower adjacent channel relative to the operating channel of the requesting BS

20	Renting_out_start_time	4	The starting time of the renting out period proposed by the offeror on that channel in absolute time. The absolute time is based on a UTC time stamp that has the format HH:MM:SS:ms
21	Renting_out_end_time	4	The ending time of the renting out period proposed by the offeror on that channel in absolute time. The absolute time is based on a UTC time stamp that has the format HH:MM:SS:ms.
22	T_renting_sub-frame	2	Total amount of time per master sub-frame rented out by the offeror BS (in milliseconds)
23	Minimum number of Credit Token (MNCT)	6	Minimum number of Credit Token (MNCT) (in number of credit tokens)
24	Requester_bid	6	Number of credit tokens per resource unit bidded by the requester in response to the offeror advertisement (in number of credit tokens)
25	Rented_resource_amount	1	Fraction (scalar) of T_renting_sub-frame the requester is interested in and bidding for.
26	Renting_in_start_time	2	Starting time for the period the requester is interested to rent in [Renting_out_start_time, Renting_out_end_time], and for which the requester's bid applies for (in milliseconds)
27	Renting_in_end_time	2	Ending time for the period the requester is interested to rent in [Renting_out_start_time, Renting_out_end_time], and for which the requester's bid applies for (in milliseconds)
28	Renting_sub-frame_start_time	2	This field specifies the starting time for transmission by the selected requester within T_renting_sub-frame (in milliseconds)
29	Renting_sub-frame_end_time	2	This field specifies the ending time for transmission by the selected requester within T_renting_sub-frame (in milliseconds)
30	Acceptation_Bit_Flag (ABF)	1	This flag indicates that the requester accepts the grant at the proposed clearing price.
31	LC	1	List of other channels (frequency domain) proposed by the offeror BS for renting
32	Coexistence_community_BSID	24	List of BSIDs for the systems belonging to the community of the offeror for CT-CXP
33	Adjacent Channel Leakage Ratio (ACLR)	1	Ratio of the transmitter power to the leakage power in the adjacent channel (in dB)
34	Number of concatenated structures	1	Number of structures to be listed consecutively
35	ID of the forwarding SS	6	ID of the forwarding SS
36	Notification Bit Flag (NBF)	1	This flag indicates whether the forwarding SS is selected to complete the CT-CXP operations: 1: forwarding SS is selected 0: forwarding SS is not selected
37	BSID of destination BS	6	BSID of destination BS

38	Network address of destination BS	variable	Higher-layer protocol network address of the destination base station length = 4 bytes if IPv4 is supported length = 16 bytes if IPv6 is supported
39	EIRP	1	The EIRP of the BS or SS (in signed units of 1 dBm)
40	GPS_LOC	6	The GPS location of the Base Station or SS. 24 MSB for BS Lat 24 LSB for BS long
41	HGHT	2	Height of BS or SS antenna above sea level (in meters).

42	RF_Sector_ID	5	The RF antenna sector ID is used to identify the RF transmitting antenna at the base station or SS where multiple RF antennas may be used or a Beam Forming AAS antenna is used.
			bits 0-3: ID
			bits 4-7: gain (dBi),2dB resolution
			bits 8-15: azimuth, 2 degree resolution
			bits 16-23: 3dB aperture, 2 degrees resolution
			bites 24-25: polarization, with:
			   00 - vertical,
			   01- horizontal,
			   11: circular
			bit 26: beam-forming, 1=yes
			bits 27-30 no.of antenna elements
			bits 31-34 no.of possible beams
			bit 35 - Interference cancellation capability
			bit 36 - MIMO capability (which can imply interference cancellation to the same PHY cases)
			bits 37-39: reserved
			Note: In the case of beamforming the antenna gain refers to the gain of a single beam
			  The azimuth and 3dB aperture refers to the whole sector covered
			  Beam directions will be considered as uniformly spaced within the sector Beamwidth will be approximated as the sector beamwidth divided by the number of antennas
			  A "1" in either MIMO capability or Interference cancellation capability would mean that the BS/SS is able to devote antenna resources to cancel external interference.

43	Type of Interfering Device:	1	Type of interfering device. Bit 0: Set to 1 for a non-WirelessMAN-CX interfering source. Bits 1-5: Device Type Bits 6-15: Device Detection specific
44	Inhibition Period	2	Number of CXCC cycles that the interfered-with device has been inhibited prior to sending an interference report.
45	Interference Threshold	1	Threshold in dBm for a valid interference event for this device.
46	Interference Incidence frequency	2	Number of interference events per specified CXCC cycles, from indicated interference sources sustained by the device
47	RSSI Report	2	Mean and standard deviation of RSSI.

48	CX_CMI	1	CMI intervals in which interference detections occur for the device.
49	Interfering Device Identity	4	The SSID or BSID of the interfering device.
50	Interference Victim Device Identity	4	The BSID or SSID of victim device(s)
51	CCID	2	The Interference report number for which this message applies
52	Inhibition Period Set	2	Inhibits the interference report of the device by the specified number of CXCC cycles
53	Interference Threshold Set	2	Set the interference threshold of the device to the specified level.
54	**RTK:** Real time key for basic connectivity creation using BS_NURBC.	2	**RTK:** Real time key for basic connectivity creation using BS_NURBC.
55	Interference Resolution Status	1	Resolution of interference to which stated CCID applies: resolved/tolerated/pending
56	Sub-Frame ID	1	The sub-frame ID in the CX-frame, 0,1,2,3.
57	Switching Acknowledge	1	The acknowledgement of a master sub-frame switching request. 0: rejection for fail in switching; 1: succeeded in switching
58	Rolling back indication	1	Rolling back indication. 0: switch to one of the alternative channels; 1: switch back to the channel before the last channel switching request
59	OCSN	1	OCSN of the occupying OCSI
60	Backoff request	1	OCSI backoff request. 1- start backoff request 0- end of backoff request
61	Response indication	1	OCSI backoff response. 01- refuse to backoff 00- refuse to end the backoff 11- notification of acceptance and backoff begin 10- notification of acceptance and backoff end because of timer and counter having run out
62	Radio signature identifier	1	Radio signature identifier
63	Offset from the start of the signature slot	1	Offset from the start of the signature slot (in microseconds)

[Add the section 15.5.3 after section 15.5.2 as following]

15.5.3 MAC messages for inter-system communication over the air

CX-FWD-REQ, CX-FWD-RSP and CX-FWD-IND MAC messages are used for inter-system communication over the air. The SS in the overlapped area of two systems can be used as the forwarder for the inter-system communication over the air. The forwarding SS shall transmit the CX-FWD-REQ and CX-FWD-IND messages from the source BS to the destination BS and transmit the CX-FWD-RSP message from the destination BS to source BS. If the connection ID in the intersystem coexistence message payload is broadcast ID, all the serving SS shall be the forwarding SS.

The Action Code in the CX-FWD-REQ, CX-FWD-RSP and CX-FWD-IND is used to identify the corresponding coexistence action. Intersystem communication messages with different Action Codes may contain different TLV encoded attributes. Table hxx shows the encoding of each coexistence action.

Table hxx Action Code

Action Code	Coexistence action name	Coexistence Message Name	Connection
0	BSD	CX-FWD-REQ	Broadcast
1	SSURF	CX-FWD-REQ	Basic
2	CT-CXP Advertisement Request (CT-CX-ADV-REQ)	CXFWD-REQ	Broadcast
3	CT-CXP Advertisement Response (CT-CX-ADV-RSP)	CX-FWD-RSP	Basic
4	CT-CXP Resource Allocation Request (CT-CX-RA-REQ)	CX-FWD-REQ	Basic
5	CT-CXP Resource Allocation Response (CT-CX-RA-RSP)	CX-FWD-RSP	Basic
6	CT-CXP Advertisement Discovery Policy Descriptor (CT-CX-ADPD)	CX-FWD-RSP	Multicast
7	CT-CXP Acknowledgement (CT-CX-ACK)	CX-FWD-RSP	Basic
8	CT-CXP Notification (CT-CX-NTF)	CX-FWD-RSP	Basic
9	Add Neighbor Request	CX-FWD-RSP	Broadcast
10	Add Neighbor Response	CX-FWD-REQ	Basic
11	Delete Neighbor Request	CX-FWD-RSP	Basic
12	Delete Neighbor Response	CX-FWD-REQ	Basic
13	Get Parameter for Radio Signature Request	CX-FWD-RSP	Basic
14	Get Parameter for Radio Signature Response	CX-FWD-REQ	Basic
15	Evaluate Interference Request	CX-FWD-RSP	Basic
16	Evaluate Interference-Response	CX-FWD-REQ	Basic
17	Work as Slave Request	CX-FWD-RSP	Basic
18	Work as Slave Response	CX-FWD-REQ	Basic
19	Reduce Power or Quit Sub-Frame Request	CX-FWD-RSP	Basic
20	Reduce Power or Quit Sub-Frame Response	CX-FWD-REQ	Basic
21	CMI Interference Indication	CX-FWD-RSP	Basic
22	CMI Interference Resolution	CX-FWD-REQ	Basic
23	Channel Switch Request	CX-FWD-RSP	Basic

24	Channel Switch Response	CX-FWD-REQ	Basic
25	Master Sub-Frame Switch Request	CX-FWD-RSP	Basic
26	Master Sub-Frame Switch Response	CX-FWD-REQ	Basic
27	OCSI Backoff Request	CX-FWD-RSP	Basic
28	OCSI Backoff Response	CX-FWD-REQ	Basic
29~255	Reserved	CX-FWD-RSP	Basic

15.5.3.1 CX-FWD-REQ(Action Code : Base Station Descriptor (BSD))

The BSD – related attributes contain the information characteristic for the Base Station. This message is sent every CXCC repetition period but only in the CX_CMI_D(n) slot of the CXCC (see *15.3.3.2,15.3.1.2.2*) claimed by the Base Station. It is intended to be decoded as intelligible interference by subscriber stations associated with other systems (see *15.3.3.4*). The CX-**FWD-**REQ with Action Type=BSD is also sent on an occasional basis in the CX_CMI_D(4) slot.

The BSD attributes contain pertinent information related to the base station, allowing foreign (interfered-with) subscriber stations to identify it as interference.
  The CX-**FWD-**REQ message containing the BSD attributes also contains a UL_MAP message, directing CX-**FWD-**REQ (Action type=SSURF) messages (*15.6.1.4*) to the complementary CX_CMI_U(n) slot.

The following parameters shall be included in the CX-**FWD-**REQ (Action type=BSD) message.

Network address of Source BS: The network address of the Base Station emitting the BSD.
BS EIRP: The BS EIRP is signed in units of 1 dBm. The EIRP at which the BSD message was sent; usually the maximum allowable EIRP for the operation of this Base Station.
BSID of the source BS: Base Station Identifier of the Base Station emitting the BSD..
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 a Beam Forming AAS antenna is used. This contains information about:
— the ID of RF transmitting antenna at the base station
— the antenna gain (dBi)
— the azimuth direction of transmission relative to the true North
— the antenna aperture at 3dB attenuation
— the antenna polarization (Vertical, Horizontal, Circular)
GPS_LOC: The GPS location of the Base Station emitting the BSD
HGHT: The height of the antenna emitting the BSD

15.5.3.2 CX-FWD-REQ(Action Code : Subscriber Station Uplink Radio Frequency (SSURF))

The Subscriber Station Uplink Radio Frequency (SSURF) message is transmitted as a CX-FWD-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 claimed by the Base Station to which the SS is registered.

This CX-FWD-REQ message, if received by foreign (interfered-with) Base Stations, will identify the SS as being an interferer. (*错误！未找到引用源。*). The SSURF is sent on its working channel using

the same power as a regular data transmission and with a sub-carrier allocation known to the interference neighborhood.

A CX-**FWD-**REQ message having SSURF as its Action Code shall include the following parameters:

ID of the forwarding SS: Subscriber station MAC (Media Access Control) identifier, in the context of this message, identifies the transmitting SS. This SS is the source of co-channel interference reported in this message.

BSID of the source BS: Serving Base Station associated with the SS.

EIRP: The SS EIRP is signed in units of 1 dBm. The EIRP at which the SSURF message was sent; usually the maximum allowable EIRP for the operation of this station.

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 ID of RF transmitting antenna at the subscriber station
— the antenna gain (dBi)
— the azimuth direction of transmission relative to the true North
— the antenna aperture at 3dB attenuation
— the antenna polarization (Vertical, Horizontal, Circular)

Network address of Source BS: The network address of the associated base station.

GPS Loc: The GPS location of the SS emitting the SSURF

HGHT: Height of the SS above sea level in meters.

15.5.3.3 CX-FWD-REQ(Action Code : CT-CXP Advertisement Request (CT-CX-ADV-REQ))

The CT-CX-ADV-REQ message is transmitted as a CX-**FWD-**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) when CT-CXP operation is over the air. The CT-CX-ADV-REQ message is sent by the offeror BS within the mechanisms specified in subclause *错误！未找到引用源。*. 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 following mechanisms specified in subclause *错误！未找到引用源。*. CT-CX-ADV-REQ message provides the necessary information to these forwarding SSs to enable them to inform their home BS (requester) about radio resource sharing opportunities proposed by the offeror BS.

A CX-**FWD-**REQ message having CT-CX-ADV-REQ as its Action Code shall include the following

parameters:

BSID of the source BS: BSID of the offeror

T_renting_sub-frame: Total amount of time per master sub-frame 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, expressed in absolute time. The absolute time is based on a UTC time stamp that follows the HH:MM:SS:ms format.

Renting_out_end_time: The ending time of the renting out period proposed by the offeror on that channel, expressed in absolute time. The absolute time is based on a UTC time stamp that follows the HH:MM:SS:ms format.

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.

ID of the forwarding SS: ID of the forwarding SS

15.5.3.4CX-**FWD-**RSP(Action Code :**CT-CXP Advertisement Response (CT-CX-ADV-RSP))**

The CT-CX-ADV-RSP message is transmitted as a CX-FWD-RSP MAC message. In response to the CT-CX-ADV-REQ message, and if the forwarding SS has been selected to complete the CT-CXP operations (specified in the CT-CX-NTF message), the forwarding SS responds to the offeror with an CT-CX-ADV-RSP message mentioning its interest to rent all 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 *错误！未找到引用源。* .

A CX-FWD-RSP message having CT-CX-ADV-RSP as its Action Code shall include the following parameters:

BSID of the source BS: BSID of the requester BS

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_sub-frame 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.

The 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 forwarding SS: ID of the forwarding SS

15.5.3.5   CX-**FWD-**REQ(Action Code :**CT-CXP Resource Allocation Request (CT-CX-RA-REQ))**

The CT-CX-RA-REQ message is transmitted as a CX-**FWD-**REQ MAC message. The CT-CX-RA-REQ message informs each requester whether or not the resource bidded for has been granted. Each granted requester is informed about the credit token clearing price. Also, if the resource is granted, the offeror provides to the requester some information about the BSIDs of the members of its own community. The detailed process is described within clause *错误！未找到引用源。*. The CT-CX-RA-REQ message is sent by the offeror BS with mechanisms specified in subclause *错误！未找到引用源。*.

A CX-**FWD-**REQ message having CT-CX-RA-REQ as its Action Code shall include the following parameters:

BSID of the source BS: BSID of the offeror BS

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

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

Renting_sub-frame_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_sub-frame.

Renting_sub-frame_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_sub-frame.

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_sub-frame_start_time, Renting_sub-frame_end_time] of the frame

and for a period starting at Renting_in_start_time and ending at Renting_in_end_time.

15.5.3.6 CX-**FWD**-RSP(Action Code :**CT-CXP Resource Allocation Response (CT-CX-RA-RSP))**

The CT-CX-RA-RSP message is transmitted as a CX-**FWD**-RSP MAC message. In response to the CT-CX-RA-REQ message, the CT-CX-RA-RSP message indicates whether the requester accepts the grant at the proposed clearing price. The CT-CX-RA-RSP message is sent by the forwarding SS with mechanisms specified in subclause *错误！未找到引用源。*.

A CX-**FWD-**RSP message having CT-CX-RA-RSP as its Action Code shall include the following parameters:

BSID of the source BS: BSID of the requester BS (associated with the forwarding SS when using over the air inter-system communications).

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

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

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

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

15.5.3.7 CX-FWD-REQ(Action Code : CT-CXP Advertisement Discovery Policy Descriptor (CT-CX-ADPD)_

The CT-CX-ADPD message is transmitted as a CX-**FWD-**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 CT-CXP operations. The purpose of CT-CX-ADPD is to describe the CT-CXP advertisement policy 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 a CT-CX-ADV-REQ message toward its serving BS (requester BS).

A CX-REQ message having CT-CX-ADPD as its Action Code shall include the following parameters:

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

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

Renting_in_start_time: Starting time of the period from which the requester BS is interested to rent in some resources. For values received before this specified time, the forwarding SS 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 that follows the HH:MM:SS:ms format, and occurs 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 before 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 that follows the HH:MM:SS:ms format, and occurs 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).

15.5.3.8 CX-FWD-REQ(Action Code :CT-CXP Acknowledgement (CT-CX-ACK))

The CT-CX-ACK message is transmitted as a CX-FWD-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 *错误！未找到引用源。*. The forwarding SS forwards this message to its serving BS (requester) with a regular data message to confirm that the requester BS can actually use the rented resources for the agreed renting period with the offeor BS.

A CX-FWD-REQ message having CT-CX-ACK as its Action Code shall include the following parameters:

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

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

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

15.5.3.9 CX-FWD-RSP(Action Code : CT-CXP Notification (CT-CX-NTF))

The CT-CX-NTF message is transmitted as a CX-FWD-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-CXP operations. If multiple CT CX-ADV-REQ messages are received from different forwarding SSs, the requester BS selects only one forwarding SS to complete the remaining CT-CXP operations (CT-CX-ADV-RSP message, CT-CX-RA-REQ, CT-CX-RA-RSP). For that, the offeror BS indicates to (through CT-CX-NTF) each of the forwarding SSs whether or not it should complete the remaining CT-CXP operations. The CT-CX-NTF message is a regular data message.

A CX-FWD-RSP message having CT-CX-NTF as its Action Code 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 with the destination BS (requester)

Notification Bit Flag (NBF): This flag indicates whether the forwarding SS is selected to complete the CT-CXP operations.

15.5.3.10 CX-FWD-REQ(Action Code :Add Neighbor Request)

The CX-FWD-REQ message with Action Code = Add Neighbor Request is sent by the BS to the coexistence neighbor BS to request to add it to coexistence neighbor list. A CX-FWD-REQ message having Add Neighbor Request as Action Code shall include the following parameters:

Channel Center Frequency: The center frequency of the requesting BS in KHz.

Channel Width: The channel width of the requesting BS in KHz

Channel information: The channel information of the requesting BS, including Modulation mode, and alternative Channel Flag.

RTK: Real time key for basic connectivity creation using BS_NURBC.

15.5.3.11 CX-FWD-RSP(Action Code: Add Neighbor Response)

The CX-FWD-RSP message with Action Code = Add Neighbor Response is sent by the BS to respond to the Add Coexistence Neighbor Request.

A CX-FWD-RSP message having Add Neighbor Response as Action Code has no TLV parameters.

15.5.3.12 CX-FWD-REQ(Action Code: Delete Neighbor Request)

The CX-FWD-RSP message with Action Code = Delete Neighbor Request is sent by the BS to the coexistence neighbor BS to request deletion from its coexistence neighbor list.

A CX-FWD-REQ message having Delete Neighbor Request as its Action Code has no TLV parameters.

15.5.3.13 CX-FWD-RSP(Action code: Delete   Neighbor Response)

The CX-FWD-RSP message with Action Code = Delete Neighbor Response is sent by the BS to

respond to the CX-FWD-REQ message with Action Code = Delete Neighbor Request. A CX-FWD-RSP message having delete neighbor response as Action Code has no TLV parameters.

15.5.3.14 CX-FWD-REQ(Action Code: Get Parameter for Radio Signature Request)

The message CX-FWD-REQ with Action Code = Get Parameter for Radio Signature Request is used by a Base Station to request that another BS communicate its radio signature parameters.
The message CX-FWD-REQ with Action Code = Get Parameter for Radio Signature Request shall use the following parameter:
BSID of the destination BS: The BSID of the destination BS.

15.5.3.15 CX-FWD-RSP (Action Code:Get Parameter for Radio Signature Response)

In response to CX-FWD-REQ with Action Code = Get Parameter for Radio Signature Request, the BS shall use the CX-FWD-RSP(Action Code:Get Parameter for Radio Signature Response) to indicate the powers, antenna gains, etc used for the transmission of its Radio Signatures. The following parameters may be included in this message:

TLV Name	Notes
GPS coordinates	The GPS coordinates of the IBS
Channel Center Frequency	in 10kHz
Channel Width	in 10kHz
Tx Power	Maximum electrical transmitted power in dBm
Antenna Type	Transmit antenna type (1 – omni, 2 – directional)
Antenna Gain	Transmit antenna gain in dBi
MAC Frame number	Requested MAC Frame number to place the Radio signature (see the MAC Frame numbering starting from the absolute time)
Number of distinct BS configurations	Number of distinct BS configurations, for different combinations of powers and beam directions, to be used for radio signatures (<20)
Number of SSs	Number of SSs. Total number of SSs to be used for radio signatures (<200)
Master sub-frame ID	

15.5.3.16   CX-FWD-REQ (Action Code: Evaluate Interference Request)

The CX-FWD-REQ(Action Code: Evaluate Interference Request) message is used by a BS for requesting other BSs in the community to either transmit their Radio Signatures or to be silent, in order to coordinate their operation during this measurement. This measurement allows evaluating the maximum aggregated co-channel

and adjacent channel interference. The message is sent to every Base Station in the Community, indicating either the request to send the Radio Signature or to insert a Gap DIUC/UIUC interval for the duration of the Radio Signature. The Radio signature may be transmitted by the BS or by the associated SSs. When the Radio Signature is transmitted by the BS, which is denoted as RBS, there are 20 different radio signatures to choose from, which may differ due to Beam Forming or power concentration on specific sub-channels.

The various RBS signatures are identified by the configuration number. The various SS signatures are identified by the RSS number, which runs from 1 to 199. The message indicates the MAC Frame number, the offset from its start and the duration of the requested Radio Signature time-slot. A number of radio signatures may be concatenated, under the constraint that their total duration, including the propagation delays, does not exceed the total time-slot duration. It is recommended that this duration will be lower than 1ms. The time-slot shall use the DL sub-frame for BS signatures and UL sub-frame for SS signatures. The Radio Signature should be transmitted using the operational characteristics of the radio behavior.

When a specific BS is requested to be inserted in a GAP/DIUC, the parameters specifying the transmission of the Radio Signature shall not be sent.

The following parameters may be included in this message.

TLV Parameter's Name	Notes
GPS coordinates	The GPS coordinates of the IBS
Channel Center Frequency(*ChannelCenterFrequency*)	Channel Center Frequency of the requesting BS, for sending the Radio signature (see *8.5.1*)
Channel width	Channel width of the Requesting BS, in units of 10kHz
Number of concatenated signatures	The number of concatenated radio signatures in a time-slot = N
Radio signature type	List with N values
Gap DUIC/UIUC insertion	Gap DUIC/UIUC insertion for this system or systems which do not comply with
MAC Frame number	MAC Frame number for sending the radio signature
Time shift from the MAC Frame start	Start of the signature slot or Gap interval, as offset from the MAC Frame start,(in microseconds)
Duration of the time-slot	Duration of the signature slot or Gap interval, in microseconds; the duration of the Gap interval may be higher than the duration of the Radio signature slot, in order to cover the propagation delays. The duration of the time-slot shall be less than 1ms.

15.5.3.17 CX-FWD-RSP (Action Code: Evaluate-Interference-Response)

A message sent by the BSs, in response to the CX-FWD-REQ message with the Action Code = Evaluate-Interference-Request. It provides the timing and the identification of the scheduled radio signatures.

The following parameters may be included in this message:

TLV Parameter's Name	Notes
Acceptance indication	Acceptance code: 1, if the request is fully accepted 2, if the request is rejected 3, if the requested will be executed at a different time; in this case the message will supplementary include the following three fields indicating when will be transmitted the radio signatures.
MAC Frame number	MAC Frame number for sending the radio signature
Time shift from the MAC Frame start	Start of the signature slot or Gap interval, as offset from the MAC Frame start (in microseconds)
Duration of the time-slot	Duration of the signature slot or Gap interval, in microseconds; the duration of the Gap interval may be higher than the duration of the Radio signature slot, in order to cover the propagation delays.
Number of concatenated signatures	The number of two field structures in the list

Two field structure	{
	    - Offset from the start of the signature slot, in microseconds (8 bits)
	    - Radio Signature type (8 bits)
	 }

15.5.3.18   CX-FWD-REQ(Action Code: Work as Slave Request)

A message sent by a new BS to request use of an existing Master sub-frame, to a BS already acting as Master in the specific sub-frame, and requesting the existing BS to evaluate its interference. If more than one Base Station is using the sub-frame as Master, the IBS will send this message to every BS separately.

The Radio Signature transmitted during the claimed Master sub-frame will consist of a DL sub-frame, starting with the first zone using the mandatory permutation (if applicable) and continuing with other used zones and their permutations. Each zone will be transmitted using the operational power.

The following parameters may be included in this message:

TLV Parameter's Name	Notes
GPS coordinates	The GPS coordinates of the IBS
Channel Center Frequency(*ChannelCenterFrequency*)	Channel Center Frequency of the requesting BS, for sending the Radio signature (see *8.5.1*)
Channel width	Channel width of the requesting BS for sending the Radio Signature, in 10kHz unit
Sub-Frame ID	Master sub-frame ID.
Tx Power	Power to be used (in dBm)
Antenna Type	Transmit antenna type (1 – omni, 2 – directional)

Antenna Gain	Transmit antenna gain in dBi.
MAC Frame number	Requested MAC Frame number to place the BS Radio Signatures (see the MAC Frame numbering starting from the absolute time)
Time shift from the MAC Frame start	Start of the claimed Master sub-frame, relative to start of the mentioned MAC frame, in μs
Duration of the time-slot	Duration of the Radio signature (shall be shorter than the claimed sub-frame duration), in μs

15.5.3.19   CX-FWD-REQ(Action Code:Work as Slave Response)

A message sent by an existing Master BS (OBS) in response to the CX-FWD-REQ (Action Type=Work_In_Paraller_Request) message.

The following parameters may be included in this message:

TLV Parameter's Name	Notes
Channel Center Frequency (*ChannelCenterFrequency*)	Channel identifier of the responding OBS
Channel width	Channel width of the responding OBS
Antenna type	Receive antenna type for the OBS
Antenna Gain	Receive antenna gain for the OBS
Acceptance indication	1:=Acceptance 2 = Rejection 3 – Accepted if the IBS transmit power is reduced
Reduction of transmit power	indicates the request for transmit power reduction, in dB

15.5.3.20   CX-FWD-REQ(Action Code: Reduce Power or Quit Sub-Frame Request)

The CX-FWD-REQ(Action Code: Reduce Power or Quit Sub-Frame Request) message is sent by an operating Base Station, which is using the sub-frame as Master, in order to request that a newer Base Station cease its operation as Master or Slave in the current sub-frame. In addition, the message may indicate an acceptable power reduction for the Base Station to use when transmitting on the sub-frame as a Slave.

The following parameters may be included in this message:

TLV Parameter's Name	Notes
Channel Center Frequency	Channel Center Frequency of the requesting BS, in 10kHz unit
Channel width	Channel width of the requesting BS, in 10kHz unit
Master sub-frame ID	The Master sub-frame used by the requesting BS

Duration of the time-slot	Duration of the sub-frame
Number of concatenated structures	The number of two field structures, each structure having two parameters indicated in the two field structure.

Two field structure	{
	   - Radio Signature identifier (8bits)
	   - Reduction of transmit power; 255 dB has the significance of a request to STOP using the sub-frame (8 bits)
	}

15.5.3.21   CX-FWD-RSP(Action Code:Reduce Power or Quit Sub-Frame Response)

The CX-FWD-RSP(Action Code:Reduce Power or Quit Sub-Frame Response) message is sent by a new Base Station, in response to the operating Base Station's CX-FWD-REQ(Action Code: Reduce Power or Quit Sub-Frame Request) message. The message indicates the actual power reduction for the requested signatures.

The following parameters may be included in this message:

TLV Parameter's Name	Notes
Channel Center Frequency	Channel Center Frequency of the replying BS
Channel width	Channel width of the replying BS, in units of 10kHz
Number of concatenated structures	The number of two field structures, each structure having two parameters indicated in the two field structure.

Two field structure	{
	   - Signature identifier (8bits)
	   - Reduction of transmit power; 255 dB has the significance of a request to STOP using the sub-frame (8 bits)
	}

15.5.3.22   CX-FWD-REQ(Action Code :CMI Interference Indication)

The CX-FWD-REQ message with Action Code = CMI Interference Indication is sent by the BS to indicate the intensity and type of interference it is receiving as a system. The information content of this message is derived from foreign SSURF and BSD messages received by the system. Non-WirelessMAN-CX interference detected by the system is similarly reported. The message specifies the threshold of interference sensitivity of the victim BS or SS, and assigns a CCID report number to specific sources of interference, allowing higher levels of the CX protocol to track the resolution or mitigation of the interference to the victim terminals.

A CX-FWD-REQ message having CMI Interference Indication as Action Code shall include the following parameters:

Interference Victim Device Identity: BSID or SSID of victim system devices

Type of Interfering Device: Type of interfering device. (1) Type or identity of non-WirelessMAN-CX interfering source. Or (2) BSID or SSID of interfering WirelessMAN-CX device

Inhibition Period: Number of CXCC cycles interfered-with device has been inhibited prior to sending an interference report.

Interference Threshold: Threshold (in dBm) for a valid interference event for this device.

RSSI Report: Mean RSSI level and standard deviation of interference of each interference source.

CX_CMI: CMI intervals in which interference detections occur for the device.

RF Sector ID: Radiation pattern characteristics of Interfering systems' BS or SS

EIRP: EIRP of the interfering system's device

Interfering Device Identity: The SSID or BSID of the interfering device.

Network Address: Network address of the system to which this interfering device is associated.

GPS: GPS coordinates of interfering system's BS

Height: Height of BS of interfering system

CCID: Interference report number relating to the specific interference event.

15.5.3.23   CX-FWD-RSP(Action Code :CMI Interference Resolution)

The CX-FWD-RSP message with Action Code = CMI Interference Resolution is sent to the BS generating the CX-FWD-REQ message with Action Code = CMI Interference Indication. This message sets the threshold of interference detection at the victim device and indicates to that device the status of interference resolution. Other actions related to the Coexistence Protocol and interference mitigation may be taken as well and may precede and/or preclude the sending of this message. Such actions may be related to CINR measurements and other channel quality assessments or involve rapid channel changes as a result of primary user requirements.

A CX-FWD-RSP message having CMI Interference Resolution as its Action Code shall include the following parameters:

Interference Victim Device Identity: BSID or SSID of victim device(s)

CCID: Interference report number to which this message applies

Inhibition Period Set: Inhibit interference report of device by given number of CXCC cycles

Interference Threshold Set: Set interference threshold of device to given level.

Interference Incidence count cycles: The number of CXCC cycles in which there was an interference incidence.

Interference Resolution Status: Resolution of interference to which stated CCID applies: resolved/tolerated/pending

15.5.3.24   CX-FWD-REQ(Action Code :Channel Switch Request)

The CX-FWD-REQ message with Action Code = Channel Switch Request is sent by a BS to another coexistence BS in the community to request to switch to an alternative channel.

A CX-FWD-REQ message having Channel Switch Request as Action Code shall include the following parameters:

BSID of source BS: The requesting BS identifier.

BSID of destination BS: BS identifier of the requested BS.

Channel Center Frequency: Channel Center Frequency of the requested BS.

Channel Width: Channel Width of the requested BS.

Rolling back indication: Rolling back indication.

MAC Frame Number: Frame sequence number to switch channel.

15.5.3.25   CX-FWD-RSP(Action Code :Channel Switch Response)

The CX-FWD-RSP message with Action Code = Channel Switch Response is sent by the BS to reply to the CX-FWD-REQ message with Action Code = Channel Switch Request.

A CX-FWD-RSP message having Channel Switch Response as Action Code shall include the following parameters:

BSID of source BS: The requesting BS identifier.

BSID of destination BS: BS identifier of the requested BS.

Switch Acknowledge: The acknowledge for the channel switch request.

Channel Center Frequency: Channel Center Frequency of the requested BS will switch to.

Channel Width: Channel Width of the requested BS.

MAC Frame Number: Frame sequence number of the channel swithing.

15.5.3.26 CX-FWD-REQ(Action Code:Master Sub-Frame Switch Request)

The CX-FWD-REQ message with Action Code = Master Sub-Frame Switch Request is sent by a BS to another coexistence BS in the community to request that the master sub-frame switch to an ALTSF.

A CX-FWD-REQ message having Master Sub-Frame Switch Request as Action Code shall include the following parameters:

BSID of source BS: The requesting BS identifier.

BSID of destination BS: BS identifier of the requested BS.

Channel Center Frequency: Channel Center Frequency of the requested BS.

Channel Width: Channel Width of the requested BS.

Sub-Frame ID: The current master sub-frame ID of the requested BS.

Rolling back indication: Rolling back indication.

MAC Frame Number: Frame sequence number to switch channel.

15.5.3.27 CX-FWD-RSP(Action Code : Master Sub-Frame Switch Response)

The CX-FWD-RSP message with Action Code = Master Sub-Frame Switch Response is sent by BS to reply to the CX-FWD-REQ message with Action Code = Master Sub-Frame Switch Request.

A CX-FWD-RSP message having Master Sub-Frame Switch Response as Action Code shall include the following parameters:

BSID of source BS: The requesting BS identifier.

BSID of destination BS: BS identifier of the requested BS.

Switching Acknowledge: The acknowledge of master sub-frame switching request.

Channel Center Frequency: Target Channel Center Frequency of the requested BS.

Channel Width: Target Channel Width of the requested BS.

Sub-Frame ID: The sub-frame ID of the requested BS will switch its master sub-frame to.

MAC Frame Number: MAC Frame sequence number of the master sub-frame switching.

15.5.3.28   CX-FWD-REQ(Action Code: OCSI Backoff Request)

The CX-FWD-REQ message with Action Code = OCSI Backoff Request is sent by the BS to its neighbor BS when the sender BS is informed by its SS that collision has been detected in the OCSI which is occupied by this neighbor. See *错误！未找到引用源。*

A CX-FWD-REQ message having OCSI Backoff Request as Action Code shall include the following parameters:

BSID of source BS: The requesting BS identifier

BSID of destination BS: BS identifier of the requested BS

OCSN: OCSN of the occupying OCSI

Backoff Request: The type of backoff request.

15.5.3.29   CX-FWD-RSP(Action Code: OCSI Backoff Response)

The CX-FWD-RSP message with Action Code = OCSI Backoff Response is sent by the BS to its neighbor BS, in response according to its action. See *错误！未找到引用源。*

A CX-FWD-RSP message having OCSI Backoff Response as Action Code shall include the following parameters:

BSID of source BS: The requesting BS identifier

BSID of destination BS: BS identifier of the requested BS

OCSN: OCSN of the occupying OCSI

Response indication: OCSI backoff response indication.