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Re:	Changes to Draft Standard
Abstract	Changes primarily related to comments from sessions 49 & 50 and use of the new CXCC concept.
Purpose	Editorial changes; technical changes due to new CXCC
Notice	
Release	
Patent Policy and Procedures	

Text updates for Same-PHY signaling sections of Draft Document

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Introduction

Changes to the operation of the CXCC necessitate re-writing and signaling structure changes to the operation of BSD, SSURF, and other related messages used with Same-PHY interference identification.

Given below are proposed changes to be made to the draft document.

Italic script are instructions to the editor
Red script ~~strike-through~~ are deletions from the original Ref 1 text
Blue script are additions to the original Ref 1 text.
Black script is the original text of Ref 1.

Ref 1: Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems IEEE P802.16h/D2c, July 2007

(1) The following changes are proposed to Ref 1. on page 10, between lines 48 and 63. The changes conform to the new CXCC description.

6.3.2.3.62 Base Station Descriptor (BSD) message

The base station descriptor (BSD) message contains the identification~~,~~ and other information about the BaseStation. This message is sent every CXCC repetition period but only in the CX_CMI_D(n) slot of the CXCC (see *15.3.3.1,15.3.1.2.2*) 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 is also sent on an occasional basis in the CX_CMI_D(4) slot .

(2) The following line should be deleted since it no longer is relevant to the new CXCC concept. This is line 51 on Page 11 of Ref 1.

~~The BSD message shall be preceded by a preamble and shall use QPSK 1/2, CC encoded.~~

(3) The following changes are proposed to Ref 1. on pages 11 and 12, between lines 48 and 63. The changes conform to the new CXCC description. Additionally, as discussed in Session #49, the SSID is to be identified with the MAC ID of the subscriber terminal.

6.3.2.3.63 Subscriber Station Uplink Radio Frequency (SSURF) 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*). 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 neighbourhood.

A SSURF message shall include the following parameters to identify a subscriber station:

SSID: 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 interferences reported in this message.

BS ID: Serving Base Station associated with the SS.

BS EIRP: The BS 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.

BS_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.

BS IP_Proxy address information: The BS IP address information uniquely identifies an associated base station. The encoding of this field is given above in TLV format.

Table 108ab—SSURF message format

Syntax	Size	Notes
SSURF_Message_Format( ) {		
Management Message Type = 68	8 bits	
SS ID	48 bits	MAC ID of sending SS
BS ID	48 bits	Associated base station identifier
BS EIRP	8 bits	dBm
BS_RF_Sector_ID	16 bits	Bits 0-7 For Azimuth of Beamwidth wrt true north, 2 degree steps Bits 8-15 for -3 dB Azimuth Beamwidth, 2 degree steps
BS IP Proxy_Address_IE( )	Variable	
}		

The SSURF message is sent in the claimed uplink CMI by a SS only if ~~a CMI~~ it is scheduled. ~~in its UL MAP~~. ~~The SSURF message shall be preceded by a preamble and shall use QPSK 1/2, CC encoded.~~

(4) The following changes are proposed to Ref 1. on page 19, Line 42 to Page 20, Line 42. The change is a deletion to an interference measuring approach superseded by the new CXCC operation and other changes related to the new CXCC concept. Additional changes undertaken to clarify operation with the context of the new CXCC; RSSI parameter modified as well. Table 108aj modified as a consequence….including the title which was incorrect.

CX_CMI_D(n): The Coexistence Messaging Downlink Interval (where n=1-~~3~~4) during which the interference was received. If this variable contains zero, detection of interference was done during silent period of sub-channel 1 of CXCC, and not during CMI interval.

INT_BSD_Frq: This parameter is used to quantify the number of interference instances either from other same-PHY WirelessMAN-CX sources or from non-WirelessMAN-CX sources. Quantification is done by counting interference events per CXCC repetition periods (5.12 sec; see 15.3.1.1) ~~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]).~~ Same PHY WirelessMAN-CX sources are identified during CMI in Sub-channel 2; non-WirelessMAN-CX sources are identified during silent periods created in Sub-channel 1 (See 15.3.1.2.2 and 15.3.1.2.1). The parameter sent applies only to: (a) ~~For~~ this specific BSD and BSID, as forwarded by this BS_CCID_RSP message (in the case of same-PHY WirelessMAN-CX) or, (b) to the specific non-WirelessMAN-CX source identified in the DFS_LE_PWR_FRQ parameter. ~~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.~~The threshold for the detection of an interference event is set by the BS_CCID_RSP message.

DFS_LE_PWR_FRQ: This parameter is used to identify the types of interfering non-WirelessMAN-CX devices and provide information that may be specific to those ~~the~~ particular devices. Up to 32 classes of devices are possible to identify. ~~The parameter contains the mean RSSI of the radar signals or non-WirelessMAN-CX systems detected during the (No+Io) measurement slots of the Texcc. 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~~ Radar information such as PPS and Pulse duration will be given in the Device Detection Specific field ~~Fields~~. ~~If non- WirelessMAN-CX systems their signature will be given as number of detected interference events per N Texcc 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~~. The CCID is the identification number of this specific BS_CCID_RSP message and is used to tag this specific interference event. The number will be a rolling number from 1 to 65536.

RSSI report: The mean and standard deviation of the interfering signal reported by this message**.** Measured only for interfering signals exceeding Interference RSSI threshold in BS_CCID_REQ message. See Section 8.2.2, 8.3.9,8.4.11 for details.

Table 108aj—BS_CCID_~~REQ~~RSP message format

Syntax	Size	Notes
BS_CCID_RSP_Message_Format( ) {		
Management Message Type = 76	8 bits	
DFS_LE_PWR_FRQ	32 bits	~~Bits 0-3:Device Type~~ ~~Bits 4-15:Device detection specific~~ ~~Bits 16-23: 8 bit mean RSSI~~ ~~Bits 24-31: TBD~~ Bit 0: Set to 1 for non-WirelessMAN-CX Bits1-5: Device Type Bits 6-15: Device detection specific Bits 15-31: CCID
INT_BSD_Frq	16 bits	Bits 0-7 ~~for WirelessMAN-CX detection~~: The ~~frequency~~ number of interference ~~BSD~~ detection events per ~~N Texcc~~ (Bits 8-15) CXCC repetition cycles. ~~Bits 8-15 For non-WirelessMAN-CX detection: The number of interference events per Texcc cycles exceeding a threshold RSSI specific to the SS detector.~~).
BSID	48 bits	Foreign Base Station ID; Set to 0 for Non-WirelessMAN-CX Interference
BS_RF_Sector_ID	16 bits	Bits 0-7 For azimuth of beam wrt True North, 2 degree steps Bits 8-15 for -3 dB azimuth Beamwidth, 2 degree steps Set to 0 for Non-WirelessMAN-CX Interference
BS EIRP	8 bits	Nominal EIRP of interfering BS; Set to 0 for Non-WirelessMAN-CX Interference
CX_CMI_D(n)	8 bits	Coexistence Messaging Interval ID In which WirelessMAN-CX interference detected. Set to 0 if interference event detected during Silent period of sub-channel 1. Set to 1-3 if detected during CX_CMI_D(1-3); Set to 4 if detected during CX_CMI_D(4). ~~Otherwise =0 when detection (leading to this response) done in (No+Io) slot of CXCC~~
RSSI report	16 bits	dBm for RSSI and dB for standard deviation
IP_BS Proxy_Address	Variable	(Proxy IP) Set to 0 for Non-WirelessMAN-CX Interference
}		

(5) The following changes are proposed to Ref 1. on page 20, Line 45 to Page 21, Line 35. The change is in response to improvements suggested in Session 49 and includes editorial corrections.

6.3.2.3.72 BS_CCID_REQ 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 (specifically identified by the CCID) 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 WirelessMANCX 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 RSSI threshold of interference detection at the SS, the number of CXCC repetition periods over which a interference measurement takes place, ~~both to WirelessMAN-CX and other system interference. BS_CCID_REQ shall contain the following parameters:~~ and to inhibit the sending of BS_CCID_RSP messages due to specifically identified interferers..

BS_CCID_REQ shall contain the following parameters:

BSID: The identity of the foreign BS noted in the BS_CCID_~~REQ~~RSP. This can be null if the message was originally due to DFS or non-WirelessMAN-CX sources.

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).~~

(1) The specific BS_CCID_RSP that this message is in reaction to, as indicated by the CCID (bits 0-15). If this value is 0, this message is resetting threshold parameters.

(2) Status of the interference resolution (bits 16-17), which if equal to:
0= DL interference source identified in the BS_CCID_RSP has been resolved/tolerated/pending and SS must cease sending a BS_CCID_RSP until the given inhibition period (applicable to the specific source) expires.
1= Stop sending all BS_CCID_RSP until given inhibition period expires.
2= Start sending BS_CCID_RSP, reset inhibition period.
3= Vacant.

(3) RSSI threshold. (bits 18-25) Interference measured higher than this mean RSSI level in the operational bandwidth of the receiver will be construed as an Interference Event and will trigger and RSSI measurement for the calculation of a mean level and standard deviation for the interfering signal. Levels are set between -40 and -103 dBm in increments of 0.25 dB. See Sections 8.2.2, 8.3.9, 8.4.1.1 for details
(4) The number of CXCC repetition cycles (bits 26-33) for the SS measurement of interference before a BS_CCID_RSP message is to be sent, given that RSSI threshold is exceeded at least once.
(5) The length of the inhibition period during which the SS suppresses BS_CCID_RSP messages due to either a specifically identified interference source or to all interference in general.

Table 108ak—BS_CCID_~~RSP~~REQ message format

Syntax	Size	Notes
BS_CCID_REQ_Message_Format(){		
Management Message Type = 77	8 bits	
BSID	48 bits	Interfering BS station ID for which this response is sent to SS; set to zero if non-WirelessMAN-CX
RSP_Field	~~16~~32 bits	Bits 0-15: CCID of BS_CCIC_RSP to which this message is reacting to. If 0, this message is for reset of threshold parameters. Bits 16-17: Resolution Status 0= Interference resolved/tolerated/pending 1= Stop sending all BS_CCID_RSP for given inhibition period. 2= Start sending BS_CCID_RSP messages, reset inhibition period. Bits 18-25: Threshold RSSI Setting. Bits 26-33: CXCC repetition cycles Bits 34-48: Inhibition Period ~~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)~~
}		

(6)The following changes are proposed to Ref 1. on page 38, Lines 31-36. Same-PHY techniques should be mentioned in this paragraph as they complement the Section 6.4.2.3.3 in general.

The reporting mechanisms for an SS informing the BS of the detection of another occupant are described in *6.3.2.3.33* for the REP-REQ/REP-RSP MAC messages. For further detail of message content, see *11.11* and *11.12* respectively. With same-PHY systems similar mechanisms are undertaken using the BS_CCID_RSP/REQ MAC messages (6.3.2.3.71 and 6.3.2.3.72).

(7) Page 72 of Ref 1; lines 1 to 22 need to be editorially corrected. Additionally more elaboration is required to indicate the use of CMI for channel measurement purposes, especially with the use of the CXCC sub-channels. The last paragraph is recommended for deletion because it is not known what is meant by "pattern measurement". Clarification by the author of the paragraph and editorial changes may improve it.

15.1.3.2.1 Channel Measurement in the Operating Stage

The BS may request SS to measure one or more channels on its behalf in the operating stage. To undertake this the BS should schedule available measurement interval for SS via periodic_channel_measurement_IE (8.4.5.3.5). During scheduled measurement interval, the BS shall not transmit MAC PDUs to that SS or request any uplink transmission from SSs. BS should schedule measurement interval properly so that no effect on normal traffic transmission between BS and SS. Similar channel measurements can be undertaken using the CMI measurement techniques embedded within CXCC sub-channel 2, for measuring the effect of interference from members of the coexistence community and/or other BS in the interference neighbourhood. Non-WirelessMAN-CX interference can be detected and quantified using the silent periods provided in the CXCC sub-channel 1.

Upon receiving a direct measurement command from the BS ~~requirement~~, the SS shall start to measure the indicated channel during the scheduled measurement intervals. SS shall continue to measure the indicated channel during the scheduled measurement intervals until the measurement interval ends or serving BS schedules the SS to receive and/or send the results ~~signal during~~ of the measurement interval..

~~BS may schedule one or more measurement pattern for SS. Measurement interval of different measurement pattern shall not be overlapped. Measurement patterns are identified by measurement_request_index parameter in periodic_channel_measurement_IE. SS should report measurement result corresponding to each measurement request from BS.~~

(8) Page 72 of Ref 1, lines 28-36 show recommended editorial changes.

15.1.4 Frame Structure for WirelessMAN-CX

There are two basic kinds of frame-based ~~structure~~ enhancements for WirelessMAN-CX compared to other WirelessMAN systems. One enhancement (see *15.1.4.1*) ~~is for~~ implements interference identification between neighbor systems using known time intervals within the frames. ~~Another~~ The other supports (see *15.1.4.2*) ~~is for~~ interference ~~prevention and~~ ~~resolution~~ mitigation between neighboring systems by sharing ~~operating in~~ the same band ~~using resource sharing~~ in the time domain, by creating ~~defining~~ multiple subframes in each DL period and UL period of the frame structure.

(9) Page 72 of Ref 1, lines 37-49 show recommended editorial changes and changes tied to the new CXCC.

15.1.4.1 Frame Structure for interference identification

There are two types of interference-control time intervals defined in WirelessMAN-CX~~,~~: ~~called~~ Coexistence Signaling Interval (CSI) (see *15.1.4.1.1*) and Coexistence Messaging Interval (CMI) (see *15.1.4.1.2*). ~~While~~ CSI refers to short time intervals reserved periodically at the end of ~~in~~ some Master sub-frames, CMI refer to longer intervals reserved periodically as master and shared sub-frames within CXCC sub-channel 2. CSIs are also reserved in cycles counted by master frames~~., while CMIs are allocated according to absolute time in cycles counted by seconds. CMIs are reserved slots within the CXCC.~~ CSI is defined to carry signaling between neighbor systems which may use different PHY or profile, whereas CMI is defined to carry messages between neighbor systems which are using the same profile.

(10) Page 72, lines 50-65 Containing Figure h26 is recommended for deletion since it adds little to the understanding of CSI and CMI. The use of these has been given in greater detail in Ref 1.

DELETE

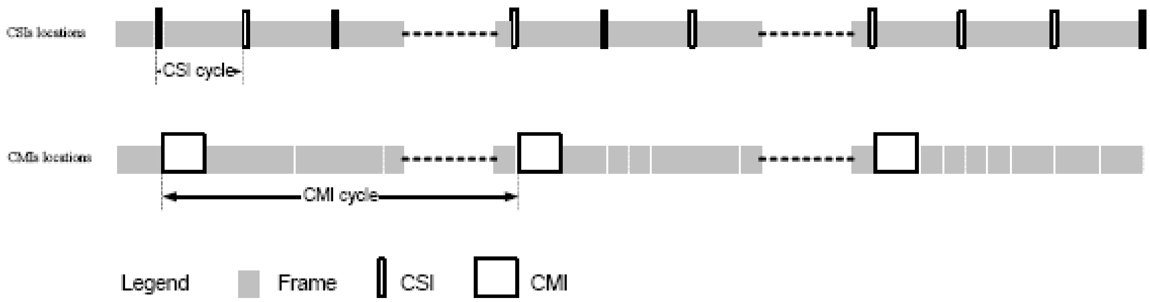

Figure h26—CSI and CMI locations in WirelessMAN-CX

(11) Page 75 of Ref 1, containing section 15.1.4.1.2 needs to be revised as a consequence of the new CXCC. The recommended changes, both technical and editorial, as proposed below.

15.1.4.1.2 Coexistence messaging interval

Coexistence Messaging Intervals (CMIs) are a series of reserved physical slots used for coexistence protocol messaging. The CMI are located in ~~used~~ ~~with systems~~ ~~using~~ the Coexistence Control Channel (CXCC) Sub-Channel 2 .~~and having the same profile (*15.2.2*) and synchronized MAC frames~~. ~~The position of a~~ The location of a specific CMI is defined by its UL/DL CX_MAC_NO, which is referenced with respect to a universally synchronized time source. ~~Each~~ There are four CMI, each with a DL and UL slot ~~has 2 pairs of slots (2 uplinks and 2 downlinks)~~ in the CXCC Tcxcc cycle. The slots are labeled CX_CMI_Dn and CX_CMI_Un where (n= 1- 4 ~~6~~) ~~represents a unique system..~~ For (n=1-3), only the master frames appearing in the CXCC sub-channel 2 are used. A system which claims one of the three master sub-frames, establishes its presence within a coexistence community. That claim must be continually maintained by having the system transmitting BSD or SSURF messages (see 6.3.2.3.62 & 6.3.2.3.63) into the claimed CMI every CXCC cycle (Tcxcc) . The shared sub-frame of CXCC sub-channel 2 occurs at (n=4). This CMI slot is used on an occasional basis by the WirelessMAN-CX systems to indicate their presence for the purpose of sporadic interference identification (detailed below). Details on the CXCC control channel are given in Sec. 15.3.1

Other than for spectrum claiming purposes, the ~~The~~ CMIs are used by WirelessMAN-CX systems (BSs and their SSs) to mediate their co-channel coexistence. The CMI provide an opportunity for systems ~~(BSs and their SSs)~~ to indicate to ~~other systems (BSs and their SSs)~~ each other the extent of the interference they can cause; newly arriving IBSs will use the CMI to make themselves known to established communities of operating base stations (OBS). Newly entering SS make their presence known when they are detected by base stations to which they are not associated. Sporadic interference from either a BS or SS will also be detected by the same process.

A Coexistence Community can consist of a maximum of n=3 systems. Each system claims a unique CMI by a process outlined in Section *15.3.3.3*. Within the CXCC sub-channel 2 there are a total of 4 paired CMI available ~~which repeat twice~~ every CXCC cycle (Tcxcc). ~~For example, a system claiming the CX_CMI_D1 would have two downlink transmission opportunities labeled (CX_CMI_D1) and two uplink transmission opportunities (CX_CMI_U1) in the Tcxcc cycle~~. A system must broadcast its BSD and SSURF messages respectively in ~~on all of~~ its claimed downlink and uplink CMI; when it does this all other members of the Coexistence Community remain silent and monitor to detect the extent of the interference that is caused by these specific transmissions. This operation is a mechanism used by the WirelessMAN-CX same PHY systems to sense each other's presence, and allows Cognitive Radio methods to be used to control and mitigate interference amongst Coexistence Community systems. ~~The sparse packing of the CMI with randomly placed BSD and SSURF messages allows the detection of interference sources that may exist outside the Coexistence Community, as detailed in Section *15.3.3.1*. *Figure h 30* shows an example of a claimed CMI slot pair within the CXCC and shows the relation to the uplink and downlink frame structure. Also shown is an unclaimed CMI pair. The figure shows the events at a given CX_MAC_NO, for a 5 ms frame duration.~~ These techniques are used specifically with CMI associated with the master subframes 1-3 measurably indicate the extent of one systems interference on a neighbouring system that is within a coexistence community. However, there will always be the danger that more distant co-channel systems that are not in the coexistence community are occupying the same CMI and hence same master sub-frame. Such systems likely will create noticeable interference. This interference (termed sporadic) will be hard to determine since (primarily) BSD and SSURF messages will overlap, especially in the CMI of n=1-3. To mitigate this, and at least provide opportunities for detection, the CMI associated with the shared sub-frame 4 of the CXCC subchannel 2 (CX_CMI_D/U4) is used by all systems to randomly (p=0.1) transmit both BSD and SSURF messages. If a system is not transmitting the interference messages during this CMI, it remains silent in the interference detection mode.

Another process that supports detection of sporadic interference on the uplink involves the positioning of SSURF messages in the CX_CMI_U(1-3). By sparingly and randomly separating SSURF messages, space will be created within the CMI slot to provide collision free detection opportunities for sporadic interfering SSURFs. Because of repetition time of the CXCC is so fast, considerable latitude is available in maintaining wide temporal separations between SSURF messages under anticipated WirelessMAN-CX deployment scenarios.

Insert this new modified figure h1, delete the one now in Ref 1.

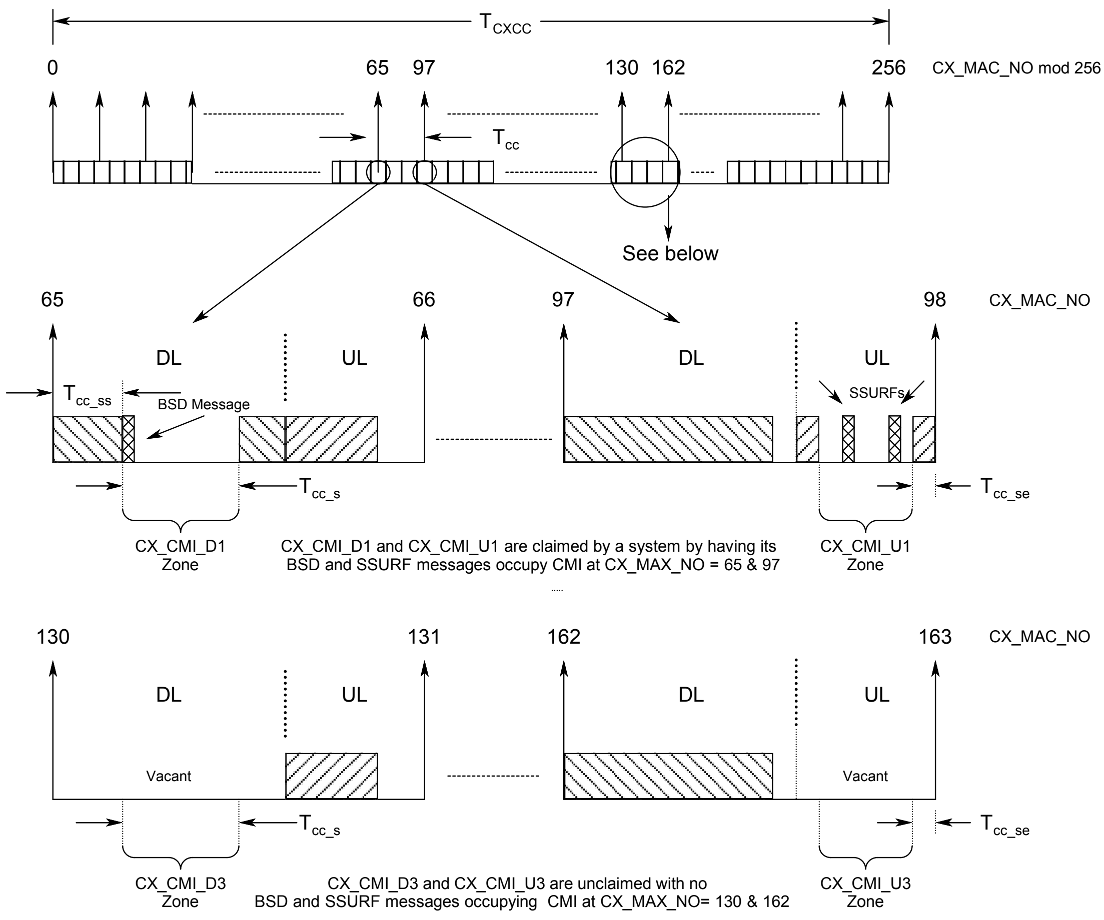

Figure h17 Example of claimed and unclaimed CMI (for a 5 Ms Frame Duration CXCC)

(12) The following changes are proposed to Ref 1. on page 89, Lines 12-29. The changes are provided to give more detail as how this sub-channel supports same-PHY signaling for control of co-channel interference

15.3.1.2.2 Sub-channel 2

Sub-channel 2 will be used for ~~data~~ transmission of interference identification messages and sub-frame claiming processes between systems using a same PHY profile. ~~and their specific Master sub-frames~~. Sub-channel CXCC allocations, corresponding to specific Master sub-frames, will be claimed by the systems. ~~and used to transmit randomly chosen but periodic~~ A system claims by continually occupying a specific sub-frame in the downlink and uplink by sending BSD and SSURF messages every CXCC repetition period. Such transmissions (called CMI messages) will be undertaken only by ~~Only~~ the system claiming a specific CXCC allocation , which will transmit while all other systems will remain silent.

The CMI intervals are identified as CX_CMI_D(n) for messages sent on the (n=1-3) Master sub-frames of sub-channel 2. Master sub-frames are claimed and continually used by the claiming WirelessMAN-CX system to indicate its operation and used of the channel and its associated sub-frames.

For n=4, the CMI is sent on the shared sub-frame, and only on an occasional basis by a system (this is used for identification of sporadic interference emanating from outside the coexistence community).

The complement of the downlink CMI are the uplink intervals, identified as CX_CMI_U(n).

Only BSD messages are sent in the downlink CMI and SSURF messages (scheduled by the BSD) are sent on the uplink.

~~The Shared sub-frames will only be used to transmit BSD and SSURF for purposes of interferer identification~~ .

The CXCC sub-channel 2, containing the CMI, uses the defined MAC Frames within the MAC Frame numbers 256-511.

(13) The following changes are proposed to Ref 1. on pages101, line 57 to page 102, Line 9. The changes due to inclusion of the new CXCC.

15.3.3 Coexistence messaging mechanism

Interference resolution among systems having the same profile is undertaken by the transmission, reception,and detection of messages sent during coexistence messaging intervals (CMI). Every radio emitter in aWirelessMAN-CX system has scheduled intervals on the CXCC sub-channel 2 to transmit identity data unique to itself during the CMI claimed by the system. All other WirelessMAN-CX systems, by detecting these messages, can determine the origin of the interference and can quantify the severity of its effects. Such messaging implements interference sensing and identification required for Cognitive Radio applications. Wireless-MAN-CX systems can use sensed information to alter their temporal or spatial emission characteristics insupport of coexistence with other similar systems or avoid or accommodate interference caused by othernon-WirelessMAN-CX systems.

This subclause provides mechanisms for interference identification when system use same profile. The CMI based mechanisms rely on CXCC usage.

(14) The following changes are proposed to Ref 1. on pages102, lines 9-65. The changes due to inclusion of the new CXCC, as well as editorial.

15.3.3.1 Coexistence Messaging Interval (CMI) for Interference resolution with same Profile Systems ~~using the CXCCREP-REQ~~

The CMI has duration 1.9 ms and is a repetitive slot found in specific master and shared subframes of the Coexistence Control Channel (CXCC) sub-channel 2. A CMI is claimed by a system and consists of paired ~~2~~ uplink and ~~2~~ downlink slots found over the duration of a CXCC cycle (Tcxcc, see 10.5.2, *15.3.1~~.2.3.3.2~~*, ~~*10.5.1*~~). Downlinks carry Base station Descriptor (BSD) messages (*6.3.2.3.62*) unique to the identity of the base station controlling the system to which a particular CMI is associated. Uplink messages carry Subscriber Station Uplink Radio Frequency (SSURF) messages (*6.3.2.3.63*) unique to the subscriber stations associated with the same base station and associated with the same CMI. During a given CMI all other networks, not associated with that particular CMI, remain silent and receive only.

Every BSD (Section *6.3.2.3.62* and *15.3.3.4*) sent downlink has a BSID associated with it. The BSID, when received by a foreign SS, indicates to the foreign SS the source of interference to it. The SSURF messages (see *6.3.2.3.63* and *15.3.3.5*) when received by a foreign BS, indicate to the foreign BS the sources of interference to it. Only one BSD message is inserted randomly into the ~~1.9 second duration of the~~ downlink CMI whereas multiple SSURFs are inserted inside the uplink CMI (Section *15.1.4.1.2*).

CMI slots CX_CMI_D/U (1-3) are used exclusively for claiming sub-frames and interference messaging. These slots are associated with the 3 master sub-frames of the CXCC repetitive cycle. CMI slot CX_CMI_D/U(4) is used identification of sporadic users (see XXX) and is associated with the shared sub-frame of the CXCC cycle (detailed below).

~~The rationale for the random placement of the BSD is to handle the event where two or more BSDs appear in the same CMI. This can occur when adjacent interfering co-channel coexistence communities contain systems claiming the same CMI.~~

Normally the CMI claiming process and the Candidate Channel Determination process (*15.3.3.2*) that every BS undertakes before entry into the Coexistence Community limits a single system to a unique CMI and specific sub-frame structure. However, the uniqueness of the CMI cannot be guaranteed because of sporadic interference and situations where hidden systems becoming visible to each other. Such situations will lead to collisions of BSD and SSURF messages, making it difficult to resolve the sources of interference. To overcome the collision processes and loss of CMI uniqueness in resolving interference, several other detection processes are implemented~~. The detection of the multiple BSD messages from overlapping systems is achieved by randomizing their transmissions within the CMI. Randomization limits the chance that BSDs within the same CMI collide. This allows SS to detect foreign BSDs within durations that they are normally expecting only their home BSD. Such detection will force both interfering systems to invoke coexistence protocol measures which either result in changes to the CMI occupancy or to having one system move to an alternate channel.~~
All systems have access to the shared CMI frame of the CXCC cycle, called CX_CMI_D/U(4) . Every system, after having claimed one of the master CMI sub-frames CX_CMI_D/U(1-3) will with a probability of (0.1) send BSD and SSURF messages on the shared CMI frame. If the system is not sending, then it will remain silent over the duration of the shared frame, having its BS and SS operate in the respective receive states. In this manner it is expected that co-channel, same CMI systems will have occasional instances where their mutual interference detection can be realized. Once this is done other techniques, based on the coexistence protocol will have to be implemented to reduce interference between these systems

The second technique for identification of same- master CMI sub-frame systems is achieved by sparsely populating the uplink CMI with SSURF messages. Sparse population and random placement of SSURF within the 1.9 msec duration of the CMI slot ensures that SSURFs from distant system have access to the detection interval offered by the shared CMI. See XXX.

~~The probability of BSD collisions within the same CMI can be calculated and it is a process dependent on the width of the BSD (which is dependent on the datagram content, modulation, and channel bandwidth) and the width of the CMI within which the BSD is randomly placed For WirelessMAN-CX systems the CMI is Tcc_s (1.9 ms).~~

~~For the worst BSD collision case, there are n base stations in the common coverage area, the successful (non-overlapping) BSD transmission probability is~~

$$\cancel{p=1-\frac{1}{m}\bullet\frac{1}{m}\bullet C_n^2=1-\frac{1}{m}\bullet\frac{1}{m}\bullet\frac{n!}{(n-2)!\bullet 2!}}$$

~~Where . Assume the CMI downlink duration time length is t which is the uplink portion of a physical frame (physical frame duration is varying from 2, 2.5, 4, 5, 8, 10, 12.5 to 20ms), the BSD downlink PDU time duration is td, which is typically <<1 ms.~~

(15) The following changes are proposed to Ref 1. on pages103, line 1 to page 104 line 43. The changes due to inclusion of the new CXCC, as well as editorial.

15.3.3.2 Candidate Channel Determination (Using GPS/UTC Synchronized CMI and Common Profile)

Candidate Channel Determination (CCD) is the process used by WirelessMAN-CX systems (conforming to a synchronized CMI and common profile) where the base station monitors a band to which it has access and selects, within that band, a channel having minimal use and occupancy by neighboring wireless systems. This process is used, for example, by an IBS prior to forming a Coexistence Community. Since a base station can only receive uplink traffic, this process relies on the monitoring uplink transmission intervals and the measurement of interference signal power [I] and thermal noise power [N]. Each candidate channel will be ranked in terms of its [I/N] ratio. Those channels with the lowest ratio or ideally a ratio of 1 will be selected for use by the base station and be candidates for entry by an IBS, since such channels will have the lowest amount of discernable activity on them, hence likely have lower interference.

[I] and [N] will be determined using the RSSI measurement capability of the base station receiver as detailed in Section 8.4.11.2. After synchronization to a universal timing standard and initialization of the base station's operating parameters, the base station will select a channel and undertake noise floor measurements during the ~~(No+Io)~~ silent intervals which are unoccupied by the WirlelessMAN-CX systems during CXCC sub-channel 1 slots (section 15.3.1.2.1 ~~*15.1.5.3*~~) ~~used by WirelessMANCX networks,~~ but may be used by non-WirelessMAN-CX.

The ~~(No +Io) slots, will be~~ silent intervals, free of WirelessMAN-CX transmissions, ~~and~~ will provide an opportunity ~~interval~~ allowing for the measurement of the mean receiver noise floor [N]. The noise floor is the noise power spectral density of the received channel (No) multiplied by the channel bandwidth. Measurement will be undertaken long enough to determine whether [N] has Gaussian characteristics. Measurements not deemed as Gaussian and/or RSSI measurements that result in a combined [N] and interference noise [I] floor higher than 1dB above [N] alone ((N+I)/N>1 dB) will be an indication that channel may be occupied by non-WirelessMAN-CX users. In this instance the value of the mean interfering RSSI will be taken as the [N+I] created by the occupying non-WirelessMAN-CX user and the given channel will be discarded from further consideration as it is ~~considered~~ occupied .~~(the~~ The discarded channel's noise plus interference floor will be stored in the BS interference table however~~)~~. Otherwise, the measurement will provide a value for [N].

The determination of [N] may be difficult if the channels have high occupancy even though specific ~~measurement~~ silent intervals ~~(No+Io)~~ are provided on ~~the~~ CXCC sub-channel 1. The manufacturer of the WirelessMAN-CX receiver may be required to resort to special measurement techniques or determine a-priori the noise figure of the receiver. The Gaussian characteristic test is recommended as a proof of thermal noise unaltered by manmade interference and requires multiple sampling of the channel to be statistically valid.

[I] measurements on channels occupied by WirelessMAN-CX systems will be undertaken by calculating the mean signal strength and variance due to uplink SSURF messages summed over the uplink CMI intervals CX_CMI_U(n) {n=1-3}. The number of Tcxcc cycles over which the measurements are to be conducted will be a variable ~~(TBD)~~ set for the base station by the operator. Measurement of the RSSI will be done in accordance with Section 8.4.11.2. The mean RSSI and variance calculated for the summed SSURF occurrences over the repeated CMI intervals of the channel will be construed as interference values [I] and [Var I] for the channel. In essence, what this measurement represents is the total interference power that the Base Station measures on a given channel due to the total of all Subscriber Stations operating on that channel. Because of the granularity of the measurements (each interfering SS will be separately detected) it will be possible for the BS to obtain a more sophisticated understanding of the interference environment beyond what is simply given by [I] and [Var I]. The incorporation of advanced interference detection approaches will not be considered in the context of the current discussion.

The channels are then ranked, with the channel having the lowest I/N and smallest [Var I] measurements likely selected for IBS entry into a Coexistence Community. This process is undertaken for each channel that is specified for the band of operation for the WirelessMAN-CX system and in essence identifies “white space” spectrum. Additionally, the passive PSD monitoring process described in section *15.5.1.19 15.5.1.20* can be considered as a parallel process to the CCD, and can be used as another method of ascertaining spectrum occupancy. *Figure h 48* shows the CCD process.

Delete the current Figure h48 on Page 104 of Ref 1 and replace it with the flowchart Provided below.

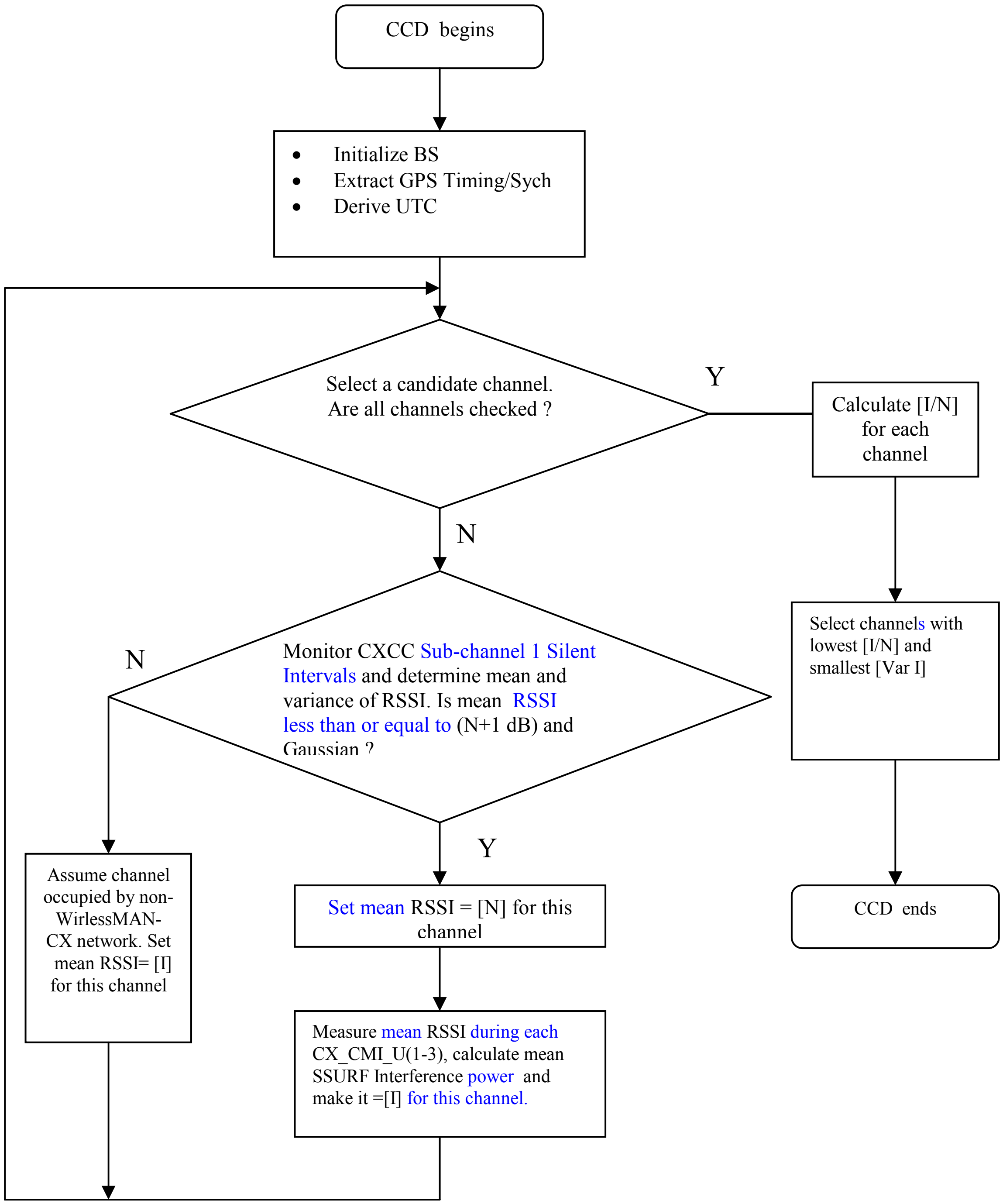

Figure h48 Candidate Channel Determination Process