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Re:	IEEE 802.16h-06/011 – working group review.
Abstract	This document specifies two updated MAC messages and deletes two previous CP messages to the draft IEEE802.16h working document. The sections and paragraphs given below refer to those of the subject working draft document IEEE802.16h-06/010.
Purpose	This document is provided to add more detailed definition of two previously described MAC messages used in signaling coexistence and co-channel interference information between WirelessMAN-CX systems
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Co-Channel Interference MAC messages (BS_CCID_IND & BS_CCID_RSP) for Synchronized WirelessMAN -CX Same Profile Systems

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Rationale

BS_CCID_IND and BS_CCID_RSP messages are used in same-profile IEEE 802.16h WirelessMAN-CX systems that are synchronized to a universal timing standard such as GPS. These messages are used to identify and resolve co-channel interference in systems that share common spectrum resources (such as LE systems).

The BS_CCID_IND message is a MAC message sent by an interfered-with Subscriber Station under conditions where a new interfering base station is detected by the SS which is not registered in the SS's Interference Table (Section15.2.2.4 Table H4).

This message contains the identity of the SS being affected by the interference and the identity (proxy IP address and CMI) and emission characteristics (EIRP, BS RF antenna sector ID, and mean of the interference RSSI) of the newly detected interference. This information is taken (or measured as RSSI) from the BSD that is demodulated during the interferer's CMI.

The purpose of the BS_CCID_IND is to indicate to the home BS the level of co -channel interference intensity experienced by the SS. During each CMI foreign base stations of a coexistence community are given the unique opportunity to broadcast their presence (via the BSD) and thus be detected by all other proximate, co -channel subscriber stations. Those subscriber stations receiving the BSD will be by default, interfered with by that base station. If the BSD is newly detected (for exa mple, from a formerly hidden base station), the SS generates the BS_CCID_IND message and sends it to its home BS for resolution. When the interference is resolved, by for example scheduling changes to downlink traffic, the home BS sends its response to the interfered-with SS. Once this is done the SS Interference Table is updated at the SS and BS_CCID_IND messages will cease being sent. Resolved interference means that downlink data destined for the SS will be sent during interference free intervals negotiated by the CP. It does not necessarily mean that the interference will physically disappear. This being the case the SS will continue to register interference during the CMI specific to the interfering BS and the number of interference instances over a giv en number of CMI cycles will be recorded. In this manner the subscriber station continually tracks the level of interference it receives from each base station of the Coexistence Community. Such information is useful to higher -level network management syst ems, such as Cognitive Radio, that optimize spectrum usage amongst many co -channel users. Figure 1 shows the above process.

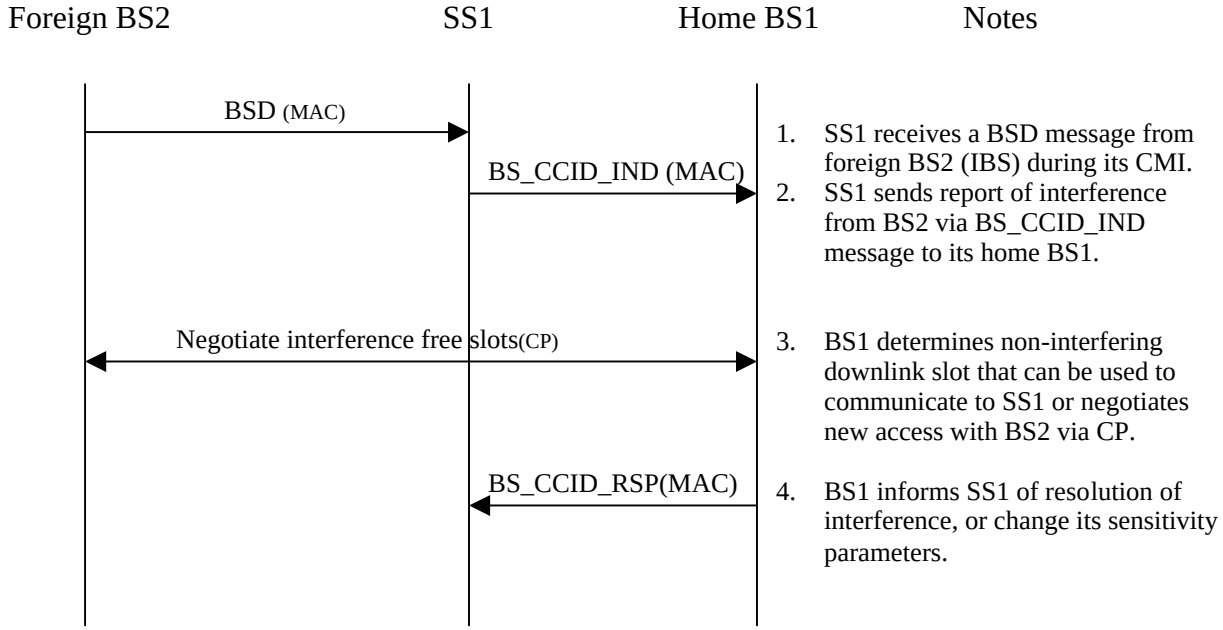

Figure 1. An Example of BS_CCID_IND and BS_CCID_RSP usage

The BS_CCID_IND message is also used for Dynamic Frequency Selection (DFS) processes, which identify higher priority co-channel users such as military and weather radars, or satellite systems. Subscriber stations may be equipped with radar detectors. Such SS, on detection of higher priority signals, will forward DFS information to the base station and its network management systems via this message. Additionally the BS_CCID_IND is used to signal the presence of non-WirelessMAN-CX users, which are detected when their power is found present in CMI_ID_54 (see 15.2.1.1.7). Since the radars can be detected below their regulatory DFS threshold, there is a capability with the BS_CCID_IND message to indicate the power the radar or interference is detected at. Additionally, bit field space is left in the message to allow further categorization of the radar or the attributes of the non-WirelessMAN-CX system so detected.

There may be instances of sporadic and highly transient interference. To deal with such events the SS may be set with a threshold, below which it will not respond with a BS_CCID_IND message. This threshold may be adjusted by the BS (via the BS_CCID_IND message, see below). The threshold may be both the number of and power of the interference events detected per CMI cycles. In every cycle, all BS in a geographical locale (and not only in a Coexistence Community) will have one instance of broadcasting their BSD. To undertake this the INT_BSD_Frq bit field is used in the BS_CCID_IND message.

BS_CCID_RSP Message

The BS_CCID_RSP is a message is sent by the home base station its subscriber station in response to the BS_CCID_IND. It contains parameters needed by the SS to either resolve co-channel interference, change its interference response threshold (as they relate to the DFS_LE_PWR_FRQ field of the BS_CCID_RSP), or indicate to the SS that interference has been successfully resolved.

6.3.2.3.64. BS_CCID_IND message

[*add it as a new section 6.3.2.3.64 in draft IEEE 802.16h-06/010*]
[*delete section 15.6.1.31 in draft IEEE 802.16h-06/010*]

The subscriber station co-channel interference indication (BS_CCID_IND) 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 WirelessMAB-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 sent also when non-WirelessMAN-CX systems are detected, such RLAN signals or radars which have higher regulatory priority to the bandwidth.

The length of BSD message is an integral number of bytes.

This BS_CCID_IND MAC management message shall contain the following minimum information to help determine the source and victim of co-channel interference:

BS_ID
The foreign BS identity taken from the BSD message.

IP_ BS Proxy_Address_IE
The proxy IP address associated with a foreign base station, derived from the BSD.

BS RF_Sector_ID
The RF antenna sector ID is used to identify the RF antenna in a base station if multiple RF antenna are used for RF reuse purpose; it is taken from the BSD.

BS EIRP
The EIRP of the interfering Base Station, taken from the BSD.

CMI_ID_XX
The Coexistence Messaging Interval during which the interference was received.

SS_ID
The subscriber station identifier: a 48 bit long field identifying the subscriber station that generated this BS_CCID_IND management message. This subscriber station is a victim of co-channel interference reported in this message.

INT_BSD_Frq
The frequency of interference BSD events detected per CMI cycles (calculated as the number of BSD interference events per N full CMI cycles [1 cycle= 1 min TBD]) . For this specific BSD, as relayed by this BS_CCID_IND 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).

DFS_LE_PWR_FRQ
This parameter is used to identify the mean RSSI of the radar signals or non-WirelessMAN-CX systems detected in CMI_ID_54. Radar signals may be detected at below DFS threshold values and the value given for their signature will be radar events (pulses) per minute. If non-WirelessMAN-CX systems their signature will be given as number of detected CMI_ID_54 events per N CMI cycles [1 minute=1 Cycle TBD]

Table 1. BS_CCID_IND message format

Syntax	Size	Notes
SSD_Message_Format ( ) {		
Management Message Type =69	8 bits	
SS_ID	48 bits	Subscriber station ID
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
INT_BSD_Frq	16 bits	The frequency of interference BSD (or non-WirelessMAN–CX) interference events at set detection power threshold

BS ID	48 bits	Foreign BS_ID
BS_RF_Sector_id	8 bits	1-255 for RF reuse BS 0 reserved for no RF reuse BS
BS EIRP	8 bits	Nominal EIRP of interfering BS
CMI_ID_XX	8 bits	Coexistence Messaging Interval ID (CMI_ID_54 for non-Wireless MAN-CX)
IP_BS Proxy_Address	Variable	(Proxy IP)
}		

6.3.2.3.65. BS_CCID_RSP message

[*add it as a new section 6.3.2.3.65 in draft IEEE 802.16h-06/010*]
[*delete section 15.6.1.32 in draft IEEE 802.16h-06/010*]

This message is sent to the SS initiating the BS_CCID_IND message. It is sent by the BS and it is used to indicate whether the interference events identified in the BS_CCID_IND have been resolved. For DFS and non-IEEE 802.16h responses, other responses will be issued by the network management systems, which can entail moving to other channels, reducing EIRP, etc, at the SS.

BS_CCID_RSP shall contain the following parameters:

BS_ID

The identity of the foreign BS noted in the BS_CCID_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-IEEE 802.16h users noted, no response at present
(3) TBD threshold/response adjustment variables (TBD)

Table 2. BS_CCID_RSP message format

Syntax	Size	Notes
SSD_Message_Format ( ) {		
Management Message Type =70	8 bits	
BS_ID	48 bits	Interfering BS station ID for which this response is sent to SS; set to zero if non-WirelessMAN -CX
RSP_Field	16 bits	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 (-95 to –55 dBm (TBD) Bit 10-15: TBD Threshold for number of interference events per CMI Cycle)
}		