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Title	**A Scheme for the absolute identification and numbering of Coexistence Control Channel Slots**
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Abstract	Revision reflects ongoing Study Group discussion on use of Control Channel
Purpose	Revised comments
Notice	
Release	
Patent Policy and Procedures	

A scheme for the absolute identification and numbering of Coexistence Control Channel Slots

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Introduction

A scheme is required that will identify the intervals of time in which the Coexistence Control Channel (CX_CC) slots are available. The position of these slots needs to be universally known to all WirelessMAN-CX systems in order to coordinate noise and interference measurements, identify non-Wireless MAN_CX users, and to send specific signaling required for the resolution of inter-system co-channel interference. The scheme described below is proposed.

The Coexistence Control Channel (CX_CC) is composed of time slots of approximately 1.9 milliseconds duration (Tcc-s) that have a repetitive cycle of 10 seconds (T_cxcc). There are 50 slots in every repetitive cycle. Each slot occurs every 200 ms (Tcc). The start of this period is 0030:000 in Absolute Time, thus there are 8640 T-cxcc cycles per 24 hour day. The positions of the uplink and downlink slots inside the frame is detailed in Section 10.5.2.

The CX_CC time slots are designed to appear within the Common sub-frame and within the Master sub-frame within the specific IEEE 802.16d-2004 MAC frame. The numbering of MAC frame is defined in Section 6.4.1.3 is given by the CX_MAC_NO. The number for the same CX_CC slot changes depending on the MAC frame duration; however the position of a the specific slot in absolute time is independent of the MAC frame numbering. Thus, the same CX_CC slot occurs at exactly the same time, regardless if a 5, 10, or 20 msec frame duration is chosen.

GPS Timing Distribution to other Non-WirelessMAN-CX systems

GPS timing control slots occur every second. They consist of a total of 10 slots within the T_cxcc superframe; 5 for downlink signaling of GPS timing and 5 for uplink signaling of GPS timing. These timing pulses will consist of 800 usec (T_gpsbrst) OFDM/OFDMA (TBD) constituted energy pulses that are designed to be detectable by non-WirelessMAN-CX (other) systems with which WirelessMAN-CX systems may be required to operate with on a co-channel basis. Since these other systems may operate on bandwidths differing from the bandwidths of the OFDM/OFDMA WirelessMAN-CX systems, it is expected that detection threshold differences will be present. To counter this, the form of the TBD OFDM/OFDMA energy pulses will be such that a universally known decoding system (used by the other systems) will allow extraction of the GPS timing. In this manner, other systems co-channel and proximate to WirelessMAN-CX systems will be able to have a dependable timing reference that can be used to coordinate inter-system co-channel coexistence by using TBD coexistence protocols. In particular, this system is conceived to be used in bands such as the US 3650-3700 GHz band which may see both indoor and outdoor systems complying to the IEEE 802.16h and IEEE 802.11y Standards, which are currently in their formative stages. The timing distribution by WirelessMAN-CX systems is an altruistic support mechanism specifically designed for non-wirelessMAN-CX systems to use, thus precluding them for the requirement to have GPS or other timing receivers.

Quiet (No+Io) Periods for the Detection of Other Systems

The selection of operational channels by WirelessMAN-CX systems necessitates the identification of unoccupied channels or at least channels having (No+Io) Noise floors below some prescribed level. This process is often known as 'white-space' identification and refers to the identification of bandwidth that can be used with minimum interference to other systems. The FCC in the US and Industry Canada have alluded to the necessity of advanced License-Exempt wireless systems to have such a capability.

Additionally there is the requirement to detect the presence of priority users (such as Radars in the 5 GHz LE allocations) and other systems (such as IEEE 802.11y; IEEE802.11a/b/g). Ideally such detection and measurement must un-corrupted by at least WirelessMAN-CX transmissions.

To do this it is proposed that WirelessMAN-CX systems, universally synchronized with a timing system (such as GPS) have specific instances in their operating cycles during which uncorrupted interference measurements can be undertaken. To achieve this during the T_cxcc superframe there will be 10 measurement instances inside the CX_CC control slots, each of duration 1 msec (T_nmeas) during which all WirelessMAN-CX systems will cease transmitting and only undertake reception. T_nmeas will begin 100 usec (TBD) after the completion of the GPS burst (T_gpsbrst) used for the distribution of timing.

CMI Organization

For same-PHY systems using the Coexistence Message Interval signaling (using BSD and SSURF messaging); provision has been made to accommodate 6 co-channel systems.
Each system (n) has 3 downlink CMI (CX_CMI_Dn) slots and 3 uplink slots (CX_CMI_Un) per repetitive cycle in which to schedule and transmit BSD and SSURF messages. Initially only CMI intervals 1-3 will be used, with 3 intervals (4-6) reserved for future applications. During each T_cxcc superframe there will be a total of 6 downlink 6 uplink CMI slots.

CMI messages are sent in either the common portions of the uplink or downlink frames in accordance to the timing specified in Section 10.5.2.

Frequency Keyed Slots

There are 4 slots dedicated to using frequency keyed slots in order to facilitate inter-system and other identification purposes.

AT1-4

AT1-4 are special slots having durations of 20 msec for use in Ad-Hoc signaling amongst WirelessMAN-CX systems not having normal IP backhaul. See Section 15.4.3.2

Insert the following new section as 10.5.3 (after Control Channel)

10.5.3 Coexistence Control Channel Function and Frame Numbering Scheme

Function Of Control Channel	Control Channel Function Name & Chapter	CX_MAC_NO containing Control Channel for given Frame Duration			
		5 ms	10 ms	20 ms	Starting Time WRT Absolute Reference (msec)
GPS Timing Recovery (DL)	TBD GPS timing recovery	1	1	1	0
GPS Timing Recovery (UL)		41	21	11	200
GPS Timing Recovery (DL)		81	41	21	400
GPS Timing Recovery (UL)		121	61	31	600
GPS Timing Recovery (DL)		161	81	41	800
GPS Timing Recovery (UL)		201	101	51	1000
GPS Timing Recovery (UL)		241	121	61	1200
CX_CMI_D1		281	141	71	1400
CX_CMI_U1		321	161	81	1600
CX_CMI_D2		361	181	91	1800
No+Io		401	201	101	2000
CX_CMI_U2		441	221	111	2200
AT2		481	241	121	2400
Spare	TBD use	521	261	131	2600
CX_CMI_D3		561	281	141	2800
No+Io		601	301	151	3000
Spare		641	321	161	3200
CX_CMI_U3		681	341	171	3400
AT3		721	361	181	3600
Spare	TBD use	761	381	191	3800
No+Io		801	401	201	4000
CX_CMI_D4	Reserved	841	421	211	4200

Spare		881	441	221	4400
CX_CMI_U4	Reserved	921	461	231	4600
AT4		961	481	241	4800
No+Io		1001	501	251	5000
Spare	TBD	1041	521	261	5200
CX_CMI_D5	Reserved	1081	541	271	5400
Spare		1121	561	281	5600
CX_CMI_U5	Reserved	1161	581	291	5800
No+Io		1201	601	301	6000
Spare		1241	621	311	6200
CX_CMI_D6	Reserved	1281	641	321	6400
Spare	TBD use	1321	661	331	6600
CX_CMI_U6	Reserved	1361	681	341	6800
No+Io		1401	701	351	7000
Freq_Key 1		1441	721	361	7200
Freq_Key 2		1481	741	371	7400
Freq_Key 3		1521	761	381	7600
Freq_Key 4		1561	781	391	7800
No+Io		1601	801	401	8000
Spare		1641	821	411	8200
Spare		1681	841	421	8400
Spare		1721	861	431	8600
Spare		1761	881	441	8800
No+Io		1801	901	451	9000
Spare		1841	921	461	9200
Spare		1881	941	471	9400
Spare		1921	961	481	9600
Spare		1961	981	491	9800