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Re:	Call for Comments and Contribution, “IEEE 802.16’s License-Exempt (LE) Task Group”, 2005-12-15 Item 1.
Abstract	This document contains new additions to the draft IEEE802.16h working document The sections and paragraphs given below refer to those of the subject working draft document IEEE802.16h-05/027.
Purpose	This document contains new additions to the draft IEEE802.16h working document dealing with the use of CTS in a synchronized network environment. The document details a synchronized CTS system and describes how this is used to coordinate co-channel networks, resolve entry of new networks and undertake interference control between networks in a co-existing community as we as new interference, some of which may not be due to IEEE 802.16h systems. The concepts detailed herein should be construed as a continuation and modification of the concepts brought forth in previous documents submitted by the authors.
Notice	
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CTS usage in Synchronized IEEE 802.16h Ad Hoc Networks

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Introduction: Given below a recommended changes to IEEE 802.16h-05/027.

Section 15.2.1.1

The 3rd bullet of this section is not clear in its definition of a "community" for LE ad -hoc networks, nor does this definition clearly tie the notion of "community" to the concept of "Coexistence Neighbor (CoNBR) BS or "Coexistence Neighborhood". Furthermore, there a re in bullets 11 and 12 concept of "coexistence neighbor". "coexistence Neighbor Networks" and "network coexistence neighborhood" which seem superfluous, and mildly contradictory.

The following changes are requested for Bullet 3 of section 15.2.1.1:

Community: A community of a ~~BSs~~ Base Station is formed in an ad -hoc ~~mode~~ manner~~; in this community are included~~ when it includes Coexistence Neighbor Base Stations and consequently, their Coexistence Neighbor Networks ~~if any two of the base stations form a neighborhood or have a successive neighborhood relationship between each other; e~~ To support this e very Base Station shall maintain ~~the~~ a table of the operational parameters of the Coexistence Neighbor Base Stations forming ~~the~~ its community, and shall exchange such tables with its Coexistence Neighbors . ~~Supplementary, when using IP -based communication approach:~~ Furthermore:

- *~~An SS~~ A Subscriber Station associated with a base station will not communicate directly with a foreign base station. ~~BS in IP-based communication;~~*
- *Base stations will communicate to each other via IP and will themselves be IP addressable, and;*
- *The community is assumed to have resolved problems related to co-channel interference by and between its coexistence neighbor networks*
- *~~It is not~~ There will be no need to register the SS location.*

The 11th bullet of this section is confusing in its definition of neighbors and the impact interference has in this definition. The following changes are requested:

- *Coexistence Neighbor (CoNBR) ~~BSs~~ Base Stations: The base stations and the subscriber stations they control, which can ~~could~~ create or sustain interference to or from ~~each~~ other base stations and the subscriber stations controlled by them, ~~or that have valid SSs in t he common coverage area~~ are called Coexistence Neighbor (CoNBR) ~~BSs~~ Base Stations. Such base stations ~~and shall~~ form a coexistence community ~~neighborhood~~. Coexistence Neighbor base stations have resolved problems with the co-channel interference generated by and between themselves.*

  ~~*There are 2 basic conditions to form a coexistence neighborhood:*~~

  - ~~*1)Common Coverage area: base stations need to be close enough in geography;*~~
  - ~~*2)Valid SSs exist in the common coverage area: When SS transfer data with on BS at a time, it shall consider other BSs as an interference source at the same time.*~~

The 12th bullet is confusing because it defines "BSs & their SSs" as a network, yet every reference in the draft to a network implies a single base station and its subscribers . This latter situation should be reflected in the definition given below. That such networks can interfere with each other means that the base stations are coexistence neighbors. Logically, such neighboring base stations are also neighboring networks. Such neighboring networks, form communities, as defined above. The following changes are requested for bullet 12:

- *Coexistence Neighbor Network and Network~~s~~: A network is defined as a single base station and the subscriber stations that it directly controls in a master-slave relationship. A Coexistence Neighbor Base Station creates a ~~BSs & their SSs are called~~ Coexistence Neighbor Network.~~, and shall form a network coexistence neighborhood.~~*

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE802.16h-05/027)

15.2.1.1.3.1 Coexistence Time Slot for Synchronized LE Systems

A coexistence time slot (CTS) is a reserved physical frame used for the coexistence protocol signaling purposes. The beginning of the first CTS is at HH:MM:00 UTC, the second CTS is at HH:MM:06 UTC, etc. The beginning of every CTS slot is specified by a UTC message (time stamp). (Figure A8).

Every CTS is given an identification signified by the seconds reading of the UTC time stamp; for example, CTS_ID_06 is the CTS beginning at UTC HH:MM:06. There are only 10 unique CTS_ID identifiers.

Each CTS slot is 20 msec long and is evenly divided to form a 10 msec uplink and 10 msec downlink subframe.

There will be one CTS every 6 seconds or 10 slots per minu te. Every base station (and its associated network) must only choose and occupy one CTS and by means of over -the air -signaling (discussed below), indicate activity on that slot once per minute. There are a maximum of 9 CTS available to form a community of networks. These slots will be used sequentially by the base stations of the community. In the case of CTS slot chosen by multiple base stations, the randomization of the messaging will allow coexistence (See Appendix XXX).

The 10^{th} CTS slot is made avail able to other networks to announce their presence, in an identification protocol discussed in Section TBD. This CTS slot shall have the UTC time stamp of HH:MM:54 UTC

The CTS shall be used by ad hoc wireless LE networks to mediate their co -channel coexistence. The CTS will be an opportunity for a networks to indicate to other networks the extent of the interference they can cause; newly arriving interfering base stations (IBS) will use the CTS to make themselves known to established communities of opera ting base stations (OBS). Newly entering SS will make their presence known when they are detected by base stations to which they are not associated (see Section TBD). Sporadic interference from BS or SS will also be detected by the same process.

The CTS w ill also be used for “Keep Alive” purposes allowing member base stations of a community to an opportunity to announce their presence to all other base stations which are silent. The CTS can also be used for the purpose of having one community of base sta tions discover the presence of other communities of base stations in an over-the-air manner.

Assuming a maximum of 10 CTS, each CTS should be the duration of a frame. If the frame duration is 20 msecs, the CTS occupancy is 20/6000 or ~.33% of the total available time for network communication.

The CTS discovery period is bi -directional. It allows OBS and IBS to announce to their presence (and interference potential) to the whole community of SS. Eventually, it allows the whole community of SS to announce their presence (and interference potential) to the BS.

While the CTS signaling and discovery are over -the-air processes, the actual mediation and passage of interference resolution messages is undertaken using IP signaling. In this sense it is assumed t hat all networks forming a community, and their constituent terminals are IP devices and can be addressed through IP backbones. Ad -Hoc, LE Networks conforming to the IEEE 802.16h standard, but not connected to an IP backone, will be identified as such in their over-the-air signaling (Section TBD).

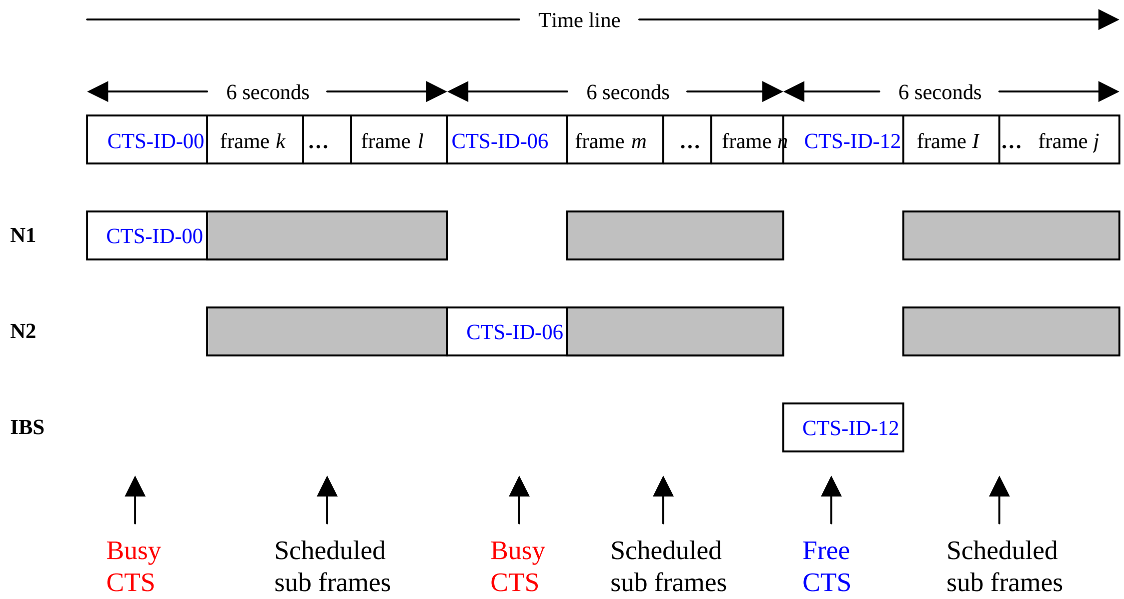

Figure A8. Timing of Coexistence Time Slot

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE802.16h - 05/027)

15.2.1.1.5.1 CTS Frame Structure for Synchronized LE Systems

The CTS is the duration of a frame (20 msec) , and consists of an uplink and downlink intervals of equal size (10 msec). Downlink messages carry information (Radio Signatures/BSD messages TBD) unique to the identity of the base station controlling the network for which the particular CTS is associated. Uplink messages carry information (Radio Signatures/SSURF messages TBD) unique to the subscriber stations associated with the network and base station associated with the same CTS. During a CTS all other networks, not associated with the particular CTS, remain silent and receive only.

A base station descriptor (BSD) messages (section 15.6.1.2.2) are broadcast within the downlink portion of the CTS every minute by a base station. This is always done in the same CTS frame, ie the frame claimed by the base station. In broadcasting in this manner the base station announces its (and its network's) existence. The BSD serves two purposes. First, it contains pertinent information related to the base station, allowing other base stations to identify it (via their SS). Secondly, it allows the differentiation of a CTS frame from a non-CTS frame. When it is received, SS associated with the BS will recognize the frame containing the BSD message as a CTS frame, and will transmit SSURF (uplink Radio Signature) messages (section 15.6.1.2.3) in response to it. Note that SSURF will use the uplink bandwidth granted only in the CTS frame, and is not transmitted in the data link.

Every BSD sent downlink has a BS_ID associated with it, it is always included in the DL_MAP message as specified in IEEE 802.16-2004. This is thus a de facto tag to the downlink frame, and can be used as an interference identification tag as well. The message contains the UL-MAP, which addresses specific SS to send their SSURF messages. The duration of the BSD message is typically 1 msec (TBD).

There is only one downlink BSD PDU in the CTS frame and it is transmitted at random starting point within the downlink time interval of the CTS. The rationale for the random placement of the BSD within the downlink subframe is given in Appendix XXX. The CTS frame structure is shown below:

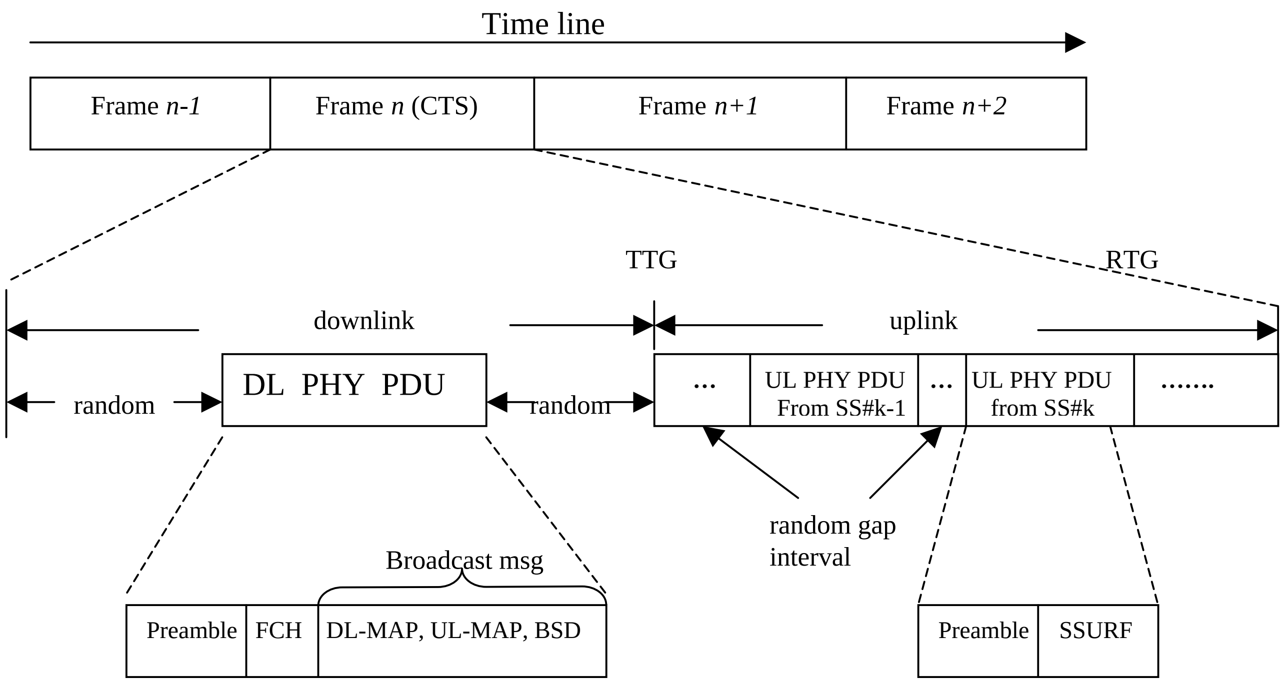

Figure 1. Example of OFDM CTS frame structure with TDD

In addition to the base station ID contained in the DL_MAP message, the BSD message sent by the base station contains the following information (Table 1) pertinent to the base station.

Name	Type (1 byte)	Length (bytes)	Value	Phy Scope
BS IPv4 Address	1	4	Base station IP address if IPv4 supported.	All
BS IPv6 Address	2	16	Base station IP address if IPv6 is supported.	All
BS EIRP	3	2	Signed in units of 1dBm.	All
RF antenna sector ID	4	1	The RF antenna sector identifier for a base station if RF reused in a base station. 1 – 255 for FDD only 0 – reserved for TDD only	TBD

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE802.16h-05/027)

15.3.1.1.1 Interference Identification & Resolution via CTS Detection

It will be assumed that through the process of establishing network entry, all interference at the time of entry will have been accommodated. It is also assumed that a mechanism is in place that partitions the downlink and uplink sub frames in time in a manner that allows interfering terminals from Coexistence Neighbor Networks to be scheduled to operate during times where they will not interfere. A successful partitioning of time and an optimal assignment of terminal transmissions resulting in interference-free operation is considered the starting state of the interference control process detailed below.

Interference control considers 2 types of co-channel interference: Interference that is generated by other 802.16h networks (A) and everything else (B).

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE 802.16h-05/027)

15.3.1.1.2 Interference from 802.16h networks:

There are two types and two categories of interference which are seen by IEEE 802.16h TDD networks:

1. New interference generated into the subscriber stations which are members of a community. This interference is generated by foreign networks (BS) which are members of the same community. The BS and SS are Coexistence Neighbor Networks forming the community.

2. New interference into the networks (BS) which are members of a community. This interference is generated by foreign subscriber stations which are members of the same community. The BS and SS are Coexistence Neighbor Networks forming the community.
3. New interference to the subscriber stations which are members of a community generated by foreign base stations which are not members of that community. The SS and BS are initially not Coexistence Neighbor Networks in this instance.
4. New interference to the base stations which are members of the community by foreign subscriber stations which are not members of that community. The SS and BS are initially not Coexistence Neighbor Networks in this instance.

Scenario 1: Resolution of new int erference to established SS by foreign BS; all members of the same community, all are coexistence neighbor networks in the same community.

- All Subscriber Stations of a community have a SS Interference Table (Section 15.2.1.2.2). Interference from a foreign BS will be detected during its CTS and checked against the table.
- Since the foreign BS is not registered in the table, the SS will then create a new entry in the table for the foreign BS then it sends a SS_CCID_IND message to its home BS, indicating t he identity of the interfering BS.
- Since the interfering BS is part of its community, the BS will then schedule downlink transmissions directed to the reporting SS to a time interval that is free of downlink interference from the interfering BS. This being done, the BS then sends a SS_CCID_RSP message to the SS. Since the BS and the interfering BS form a community and are coexistence neighbors networks, they will have pre -arranged non-interfering scheduled time intervals.
- The SS, on receiving the SS_CCID_RS P from its BS, now assumes that downlink interference has been resolved. The SS then updates its SS Interference Table and will inhibit any further interference responses due to detection of that foreign BS in the CTS. It now ignores interference, and when link data arrives, it is only during the interference-free scheduled interval.

Scenario 2: Resolution of foreign (new) SS interference to an established base station. Both BS and SS are within Coexistence Neighbor Networks forming a community.

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- All B ase Stations have a BS Interference Table (Section 15.2.1.2.3). Interference from new SSURFs will be detected because they are not included initially in this table and the interference is not resolved.
- The IP address of the BS controlling the interfering S S is derived from the SSURF. The interfered -with network will realize the new SS is a member of a network in its community. Since the networks are Coexistence Neigbor Networks, they have interference free intervals scheduled between themselves. A BS_CCID_IND message is then sent to the BS controlling the interfering SS, indicating a need to resolve the uplink interference.

- The controlling base station, since it is a member of the community and has a pre -arranged non - interfering time interval with the inter fered-with BS, assigns the SS uplink to the non -interfering time interval which will not interfere with the interfered-with base station.
- A BS_CCID_RSP message is sent back to the interfered -with BS, indicating a resolution of the uplink interference.
- The BS Interference Table is updated at the interfered -with BS to show the resolved status, however, statistics on the interference are continued to be gathered.

Scenario 3: This scenario is similar to 1 except that the Base Station generating the interfere nce is not initially part of the community. This interference is typical of sporadic interference from distant base stations. The subscriber station's network and the interfering base station's network are not coexistence neighbor networks, hence they are not members of the same community.

- Since the foreign BS is not registered as a known interferer to the SS (not being in the SS Interference Table) , the SS will then create a new entry in the table for the foreign BS and send a SS_CCID_IND message to its home BS, indicating the identity of the interfering BS. At this point the interference is unresolved.
- Since the interfering BS is not part of the community, the BS readdresses the SS_CCID_IND to the interfering BS's IP address and begins a negotiation with it to share downlink capacity.
- On achieving a successful negotiation the BS will schedule downlink messages to the SS during those intervals of time that are free of interference from the interfering BS. A SS_CCIC_RSP message will be sent to the SS.
- The SS, on receiving the SS_CCID_RSP from its BS, now assumes that downlink interference has been resolved. The SS then updates its SS Interference Table and will inhibit any further interference responses due to detection of that foreign BS in the CTS.
- As a consequence of this process, the formerly interfering BS is now a member of the host BS community and is registered as such the Base Station's Regional Data Base Identity Table (section 15.2.1.2.4). The formerly interfering BS and the host BS are now coexistence neighbor networks.

Scenario 4: The Base Station detects a SSURF from a SS that is associated with a network not part of the Base Station's community. Both BS and SS at the start are not coexistence neighbors networks.

- All Base Stations have a BS Interference Table (Section 15.2.1.2.3). Interference from new SSURFs will be detected because it is not included initially in this table and the interference is not resolved. The new SSURF will be associated with a network not a member of the interfe red-with Base Station's community.

- The IP address of the BS controlling the interfering SS is derived from the SSURF. A BS_CCID_IND message is sent to the controlling BS indicating a need to negotiate uplink coexistence.
- It is assumed that both base stations can negotiate interference-free uplink time intervals. Consequently, each BS is now a member of each other's community and is registered in their respective BS Interference Tables.
- A BS_CCID_RSP message is sent back to the interfered-with BS, indicating a resolution of the uplink interference.
- The BS Interference Table is updated to show the resolved status for the particular SS initially causing new interference. The formerly interfering SS will have its uplinks scheduled (by its controlling base station) to be during intervals where the interfered-with BS not requesting uplink traffic. Statistics on the interfering SS are still gathered and updated by the BS, and these are registered in the BS Interference Table.

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE 802.16h-05/027)

15.3.1.1.3 Interference from Non-IEEE 802.16h systems.

Coexistence with other non-IEEE802.16h systems will primarily consist of avoidance between systems. Over-the-air RF signaling, as is the case with the IEEE 802.16h, will not likely be possible with non-compliant systems. The negotiation of spectrum, time slots, and space, as undertaken between IEEE 802.16h networks, will not likely be possible with other, non-compliant networks.

To facilitate avoidance IEEE 802.16h networks will indicate spectrum occupancy and provide an opportunity for non-IEEE 802.16h systems to indicate that they are in co-channel operation. The avoidance schemes depend on the operational characteristics of the non-compliant IEEE 802.16h networks, as detailed below.

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE 802.16h-05/027)

15.3.1.1.3.1 Non-IEEE 802.16h Systems capable of GPS/UTC Timing Recovery

Non-IEEE 802.16h LE systems that are capable of GPS/UTC timing recovery can monitor the CTS intervals to determine the existence of co-channel IEEE 802.16h users. Monitoring the intervals and undertaking CCI measurements over several CTS cycles will allow a non-IEEE 802.16h system to determine the occupancy on a channel and avoid settling on it.

Additionally, CTS_ID54 (TBD) will be left unoccupied by IEEE 802.16h systems. Non-IEEE 802.16h systems occupying LE spectrum can insert downlink and uplink power bursts (TBD) into this interval. Such energy can be detected by IEEE 802.16h systems which will consequently avoid use of the given channel.

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE 802.16h - 05/027)

15.3.1.1.3.2 Non-IEEE 802.16h Systems not capable of GPS/UTC Timing Recovery

The majority of co -channel interferers will be systems and devices that cannot perform rudimentary of signaling required for IEEE 802.16h coexistence and channel detection. To deal with such interferers the IE EE 802.16h networks will have to opt for avoidance of such users. To facilitate this IEEE 802.16h BS and SS will have the ability to undertake Power Spectral Density mappings of selected bandwidth and disseminate such information as part of their TBD inter – network messaging.

Sections 15.6.1.34. and 15.6.1.36 describe the instructions and formatting that will be used by the IEEE 802.16h networks to undertake PSD measurements of contented spectrum. These measurements should be undertaken by a BS prior to occupancy of spectrum space and they can be undertaken throughout the operational period of a network to determine encroachments and to identify other spectrum that may have to be used in the event of uncontrolled interference arising in the occupied spectrum.

The PSD measurements will be undertaken by the SS as well and this sensor information will be sent to the BS.

PSD measurement information forms part of the data base that is exchanged between networks as part of their mutual spectrum management tasks. SSURF messages (TBD) could be used to transport spectrum information.

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE 802.16h - 05/027)

15.2.1.2.1 Interference Control with CTS Synchronized Systems: Interference Tables at the BS and SS

The CTS interval is used in a community of coexistence neighbor networks to monitor existing and/or detect new interferers to and within that community. New interference needs to be resolved between interfering networks and within the community. When this happens it is scheduled to intervals where its effects are no longer deleterious. Networks that resolve their mutual interference (by scheduling or other techniques) are called coexistence neighbor networks. The resolution of interference requires that the base stations and/or their subscriber station keep tables of interferers. Base Stations need to keep tables of Subscriber Stations which interfere on the uplink. Subscriber Stations need to keep tables of Base Stations that interfere on the downlink. This is done for the following reason. The CTS is an opportunity for every network to makes its interference effects on neighboring networks felt. These effects are resolved, by scheduling, but they are not necessarily eliminated. Therefore, to keep the affected terminal from responding to resolved interference, a table is provided to indicate the status of the resolution. By resolving the interference at the network level, the terminal is inhibited from responding to that same interference when it is detected during the CTS. The terminal will however respond to new interference that is not included in the table or has not been resolved.

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE 802.16h-05/027)

15.2.1.2.2 Subscriber Station Interference Table

This table is created within each subscriber station and contains the BS_ID, interference incidence, and nominal CCI level related to every interfering base station identified during the process of monitoring the CTS and the downlink BSD. The table is created by the SS and is unique to the SS. The Table indicates the BS_ID of the interfering Base Station, the identity of the CTS in which the interference was detected, the number of interference incidences, and the nominal CCI as measured during the CTS_ID interval.

BS_ID	Interference Frequency	Nominal CCI	Interference Resolved Yes /No	CTS_ID

Table TBDXX Subscriber Station Interference Table

BS_ID is the Base Station ID that has been demodulated during the specified CTS_ID. This value is extracted from the BSD transmitted by the interfering network during its CTS.

Interference Frequency is the ratio of the number of interfering BS D messages detected to the number of CTS that have transpired. It is an indication of the severity of interference from a particular Base Station. Demodulatable BSD interference indicates a high likelihood of interference on the downlink data stream. Nominal CCI refers to the CCI measurement that is undertaken by the SS during the given CTS_ID. It is the ratio of the peak signal power from the interfering BS to the nominal noise floor measured during the CTS interval. CCI measurement is given in Section TBD of the IEEE 802.16-2004 Standard.

It is possible no BS_ID or Interference incidence value is present, yet a nominal CCI is given and associated with a specific CTS_ID. This is an indication of sub -demodulation interference; ie, interference that i s above the noise floor the SS receiver but below the demodulation threshold.

It can be possible that there are several BS_ID associated to the same CTS_ID. This is a case where several networks, not of the same communities, have claimed the same CTS_ID.

Any interference that is detected, results in a SS_CCID_IND message being sent to the Base Station and its network management system. The interference is noted and recorded in the SS Interference Table. Until a response message (SS_CCID_IND) is receiv ed at the SS, the SS_CCID_IND messages are sent with each interference incidence. When the interference is resolved, the BS will indicate to the SS via a SS_CCID_RSP message that this is the case. In that event the SS will indicate to itself, through the S S Interference Table, that the resolution of co -channel interference on the data link has been resolved. In this case, the SS will cease sending SS_CCID_IND messages when it reads a foreign BS_ID during the CTS. However, the SS will continue monitoring the nature and frequency of the interference, and adjusting the table as necessary.

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE 802.16h-05/027)

15.2.1.2.3 Base Station Interference Table

The Base Station Interference Table is created by the BS by monitoring the foreign CTS uplink slots and recording the identity of foreign SSURFs.

CTS_ID	SS_ID	BS_ID	IP_Address	Interference Frequency	Nominal CCI	Interference Resolution Yes/No

Table TDB- XX Base Station Interference Table

The CTS_ID is the identity of the CTS in which the interfering SSURF/Radio Signature was demodulated. The SS_ID, BS_ID, and IP_Address are extracted from the SSURF and they give the identities of the SS causing the interference and the network to which it is associated. The Interference Frequency is the ratio of the number of SSURFs of a particular identity that were recorded to the number of CTS intervals that have transpired (this value may not necessarily be representative of interference incidence since the frequency of SSURFs is variable and controlled by a BS). The CCI is the nominal recording taken for the CTS duration and indicates the interference due to SS registered with this particular CTS; the CCI may be due to several networks sharing the same CTS.

Every foreign SSURF/Radio Signature that is demodulated is identified along with its host base station and the IP address of the home base station. The foreign SSURF, by being demodulated during the CTS, indicates that the Subscriber Station originating the SSURF will be an interferer on the uplink when it transmits link data. In order to resolve this situation the interfered-with base station must communicate by means of a BS_CCID_IND message that is directed to the interfering base station the fact that the subscriber station is causing uplink interference. When the interfering Base Station resolves the uplink interference by assigning the interfering SS to a time interval where it will not cause interference to the Base Station, a response BS_CCID_RSP is sent to the Base Station indicating this. Such a response will be noted as an Interference Resolution, and future SSURFs from the SS will not trigger a BS_CCID_IND message. Realize that during the CTS all interfering SS will continue to show their presence, even after they have been identified and the data link interference with them has been resolved.

By having such an interference table the BS will be able to differentiate new interfering SS, for which interference resolution must take place, from old interfering SS, for which interference resolution has taken place.

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE 802.16h-05/027)

15.2.1.2.4 BS Regional Data Base Identity Tables.

By the use of the CTS slots it will be possible for a network to determine its coexistence neighbor networks. In doing so, the identities of each coexistence neighbor base station that are members of a community will be known.

Each base station that has community will keep the identities of all its coexistence neighbor base stations in a table. This table will include of the BS_ID, IP addresses, emission information and GPS locations of the community members. The tables are exchanged regularly between base stations and expanded with new information about networks that are not even members of a base station's community. It is in the interest of the BS to have as many entries in this table as possible and ultimately, all of the IEEE 802.16h networks that are in a region, even if they do not interfere with each other.

Such tables are important, because they create within the network an exchangeable regional data base that shows the complete association of all proximate neighbors. Such tables are useful because, for example, networks which are far away and not a members of a community, but which create sporadic interference, will become quickly identified because of the shared tables between un-associated member networks.

BS_ID	IP Address	GPS Location	Antenna Beamwidth	Antenna Direction	Polariztion	Operator ID	EIRP

Table TBD-XX Regional Data Base Identity Table

BS_ID is the Base Station ID of the base station controlling the network.
IP address is the IP address that can be used to address the base station
GPS Location is the GPS coordinates of the base station.
Antenna Beamwidth is the beamwidth of the sector controlled by the BS.
Antenna Direction is the direction of the sector.
Polarization is the polarization used in the sector.
Operator ID is the identity of the operator controlling the BS.

EIRP is the nominal EIRP of the Sector.

This is only a partial list of the information that can be kept in the Regional Data base identity table. The table is expanded by having BS exchanged and update tables amongst themselves. Ideally, the table contains identity information on all base stations in the region where the IEEE 802.16h networks are operating.

This following section is to be inserted in the Draft IEEE 802.16h working document (IEEE 802.16h-05/027)

APPENDIX XXX

CTS Slot Collision Resolution

There is the possibility that two or more potentially interfering base stations choose the same CTS slot. Such base stations and the respective networks they control may coexist peacefully without interference to each other because of hidden SS or no SS in the common coverage area. Essentially, such networks do not form a community because they do not interfere with each other. However, when the hidden SS or new SS enters into the common coverage area, co-channel interference will be detected at the new SS resulting in a situation that impacts the neighboring base stations having a common CTS.

CTS slot collision occurs in this situation. Two co-channel base stations, inadvertently and independently, have chosen the same CTS prior to interference being detected by the networks. To resolve this situation the start times of downlink sub frame PDU and uplink SSURF messages in the CTS slots are randomized. This reduces the possibility that two networks, sharing the same CTS, will overlap in their downlink and uplink transmissions. Realize that the downlink slot will be 10 msec wide and that the downlink sub frame PDU itself is only < 1 msec.

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

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

Where $m = \frac{t}{t_d}$. Assume the CTS 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 CTS downlink PDU time duration is t_d, which is typically < 1 msec.