Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**IBS entry process in Synchronized IEEE 802.16h Ad Hoc Networks**
Date Submitted	**2006-02-28**
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Re:	Call for Comments and Contribution, "IEEE 802.16's License-Exempt (LE) Task Group", 2006-02 Item 3.
Abstract	This document specifies an entry process of a new BS into a Interference Neighborhood and the Creation of a Coexistence Community Using GPS/UTC time Synchronization
Purpose	This document specifies an entry process of a new BS into a Interference Neighborhood and the Creation of a Coexistence Community Using GPS/UTC time synchronization. The document IEEE802.16h-06_003 details a synchronized CTS system and describes how it is used to coordinate co-channel networks, resolve entry of new networks and undertake interference control between networks in a co-existing community as well as new interference, some of which may not be due to IEEE 802.16h systems. This is a continuation of document IEEE802.16h-06_003 and IEEE802.16h-06_010r1
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IBS entry process in Synchronized IEEE 802.16h Ad Hoc Networks

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Insert this section at the end of Section 15.2.1.3

Entry of a new BS into a Interference Neighborhood and the Creation of a Coexistence Community Using GPS/UTC time Synchronization.

In applications where the CTS intervals are synchronized to a GPS (or similar precision timing reference) and are given UTC time stamps (Fig H13), entry of a new Base Station (IBS) will be undertaken in 4 steps, with the IBS:

(a) Monitoring the CTS Intervals,
(b) Selecting an Empty CTS interval,
(c) Claiming an empty CTS interval,
(d) Negotiating capacity and creation of a Coexistence Community.

Prior to entry into a Community of Operating Base Stations (OBS) it is assumed that the IBS will have undertaken Adaptive Channel Selection (TBD Section) and has selected a candidate channel, is synchronized to a downlink GPS signal and can derive a UTC time stamp, and has no operational SS yet deployed. It is assumed that the IBS is deployed within an Interference Neighborhood: ie: active interference from existing Operating Base Stations is present. The IBS entry process is shown in Figure 1. Figure 2 shows aspects of the entry procedure with signalling.

(a) Monitoring the CTS

Having tuned to the candidate channel, the IBS monitors and determines the level of activity on each CTS interval by demodulating the uplink SSURF (Sec 6.3.2.3.45) messages and storing their parameters in its Base Station Information Table(See Table h2). All demodulated SSURF messages will be from SSs that will interfere with the BS on the uplink and eventually, coexistence will have to be arranged with each of the OBS controlling these SSs. Each CTS interval from CTS-ID-00 to CTS-ID-54 is monitored. Each interval is monitored over a duration of 5 CTS cycles or minutes (TBD). If CTS-ID-54 has detectable power in it, the channel will be construed as occupied by a non-IEEE 802.16 system (See 15.3.1.1.3.1) which may also be synchronized to the GPS/UTC. The channel will be abandoned if CTS-ID-54 is occupied (See 15.3.1.1.3). The signalling seen by an IBS is shown in Figure 2.

(b) Selection of an Empty CTS Interval

The monitored CTS intervals in which no (demodulated) SSURF messages are received become candidate CTS intervals. Empty CTS intervals indicate that it is still possible for the IBS to create a new Coexistence Community including the OBS (only a maximum of 9 co-channel networks can be accommodated by a single channel. Full loading is indicated by having all 9 CTS intervals occupied).

During each candidate CTS interval a RSSI (see 8.4.11.2) will be undertaken during the uplink duration. RSSI is undertaken to determine the presence or absence of low level (un-demodulated) uplink SSURF messages. Each candidate CTS interval is monitored in this manner over a duration of 10 CTS cycles or minutes (TBD). An interval will be considered as useable and chosen if the mean RSSI power measurement in it is no greater than {[N] +3 dB) (TBD); where [N] is the thermal noise floor of the IBS receiver.

The absence of uplink SSURFs means that the CTS is free of uplink (and possibly downlink occupancy). The particular interval is now considered as being ready for claiming.

(c) **Claiming Procedure.**

The purpose of the claiming process is to make adjacent OBS networks (which are likely members of different Coexistence Communities) aware of the presence of the IBS. Claiming is undertaken by having the IBS broadcast its BSD during an empty CTS. Since the OBS are silent and are monitoring the downlink on each CTS other than their own, the broadcast message will likely be detected during what was previously an empty CTS interval (see discussion on undetected broadcasts below).

To begin the claiming procedure the IBS broadcasts at maximum EIRP a BSD (see 6.3.2.3.44) message. This message, when received by foreign SS belonging to adjacent networks that form the Interference Neighborhood, will result in those SS informing their home base stations of the presence of a new base station (the IBS) using the IP signalling message BS_CCID_IND (see 15.6.1.32). All OBS having SS that detect the BSD during the claimed CTS interval will in this manner respond back to the IBS informing it that it has been detected and is a de facto interferer on the downlink. The IBS will include in its BS Information table the IP addresses of all of the OBS that have redirected their BS_CCID_IND messages to it. The IBS continues its BSD broadcast routine until no new BS_CCID_IND messages are detected (the threshold for this is TBD). With the receipt of the BS_CCID_IND messages the IBS will have determined the extent of its Interference Neighborhood, as determined by foreign SS interference reception of the IBS's BSD messages transmitted during the claimed CTS interval. By receiving the BS_CCID_IND messages, the IBS will now know with which OBS it must negotiate coexistence.

(d) Capacity Negotiation and membership in the Coexistence Community

The OBS networks which the IBS creates or sustains interference to/from become listed in the BS Information Table (See XXX) of the IBS. This table contains the BS_IDs and IP addresses derived either from uplink SSURF messages that the IBS demodulated during its monitoring phase (above (a)) or from the BS_CCID_IND messages that it received via the IP backhaul from the OBS as part of the claiming procedure ((c) above).

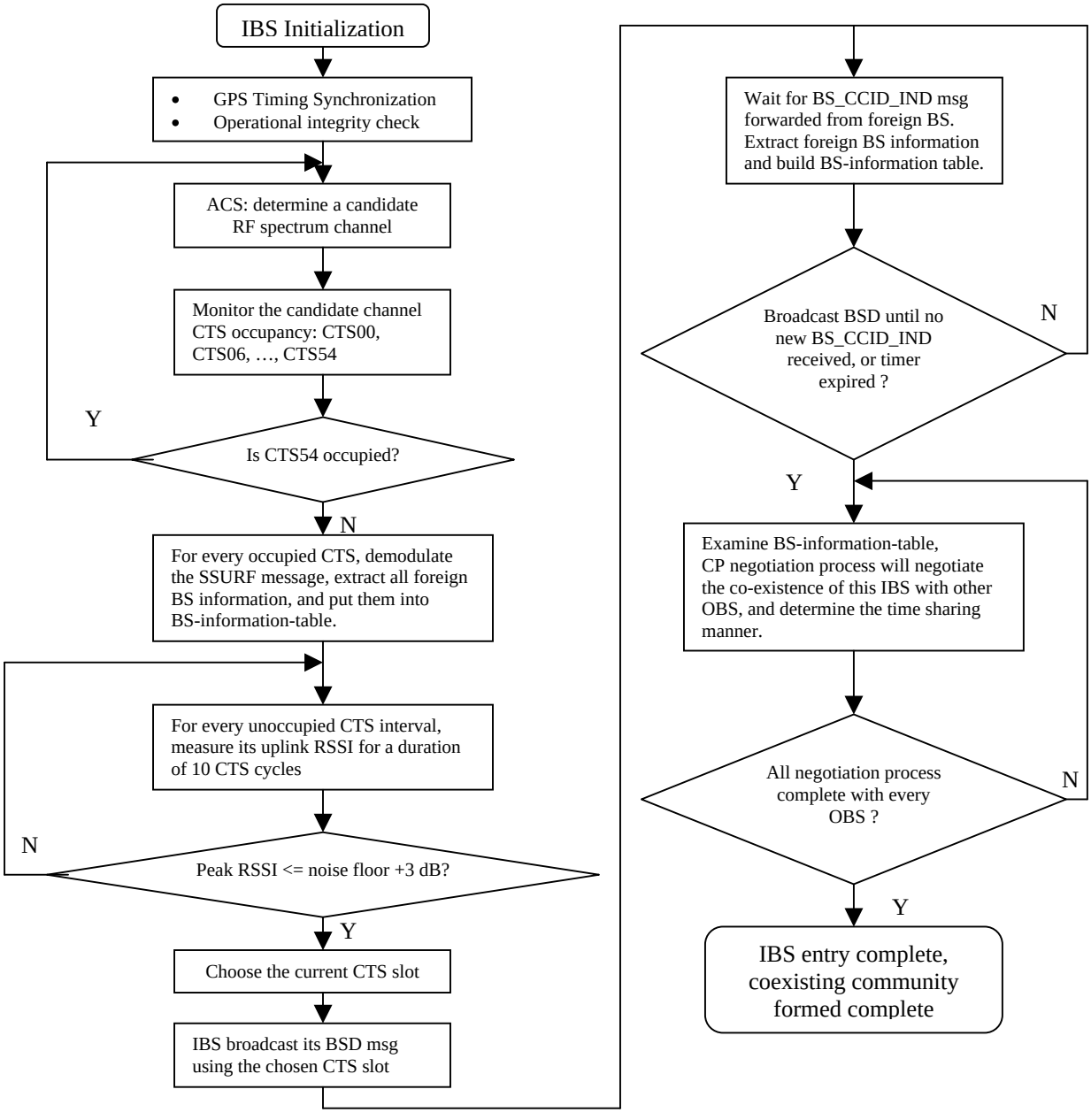
Communication and negotiation with each OBS listed in the BS Information Table is undertaken via the {TBD} Coexistence Protocol (CP). Coexistence entails allocation of uplink and downlink transmission intervals in a manner that eliminates co-channel interference amongst users that would otherwise experience it and sustain degraded communications. This is done by parsing uplink and downlink intervals and establishing master subframes (see Sec 15.2.1.1.2). Each OBS that the IBS has listed in its BS Information Table as an interfering network must partake in such a resolution procedure. By undertaking this process the IBS thus creates a Coexistence Community for itself, and consequently becomes accommodated by the neighbouring networks of its interference neighbourhood.

<u>Undetected BSD Broadcasts/Undetected Uplink SSURF messages.</u>

The BSD and SSURF messages are sent at the lowest, most robust modulation rate specified for IEEE 802.16-2004 transmissions. This rate will be ½ rate BPSK with a nominal sensitivity of 6.4 dB SNR. (see 8.3.11.1). These transmissions may be received at levels below threshold and will be individually undemodulated. However, because of the statistical variation in the propagation channel whose variance can exceed 6 dB, there is a finite probability that eventually such signals shall eventually exceed demodulation threshold levels and be detected. The time to achieve this is TBD. Furthermore, below threshold signals can be detected

by power detectors or detection techniques that will provide indication of signals below demodulation thresholds. These techniques can be instituted either as part of the RF system or in parallel with the demodulation process..

Figure 1. IBS community entry process.



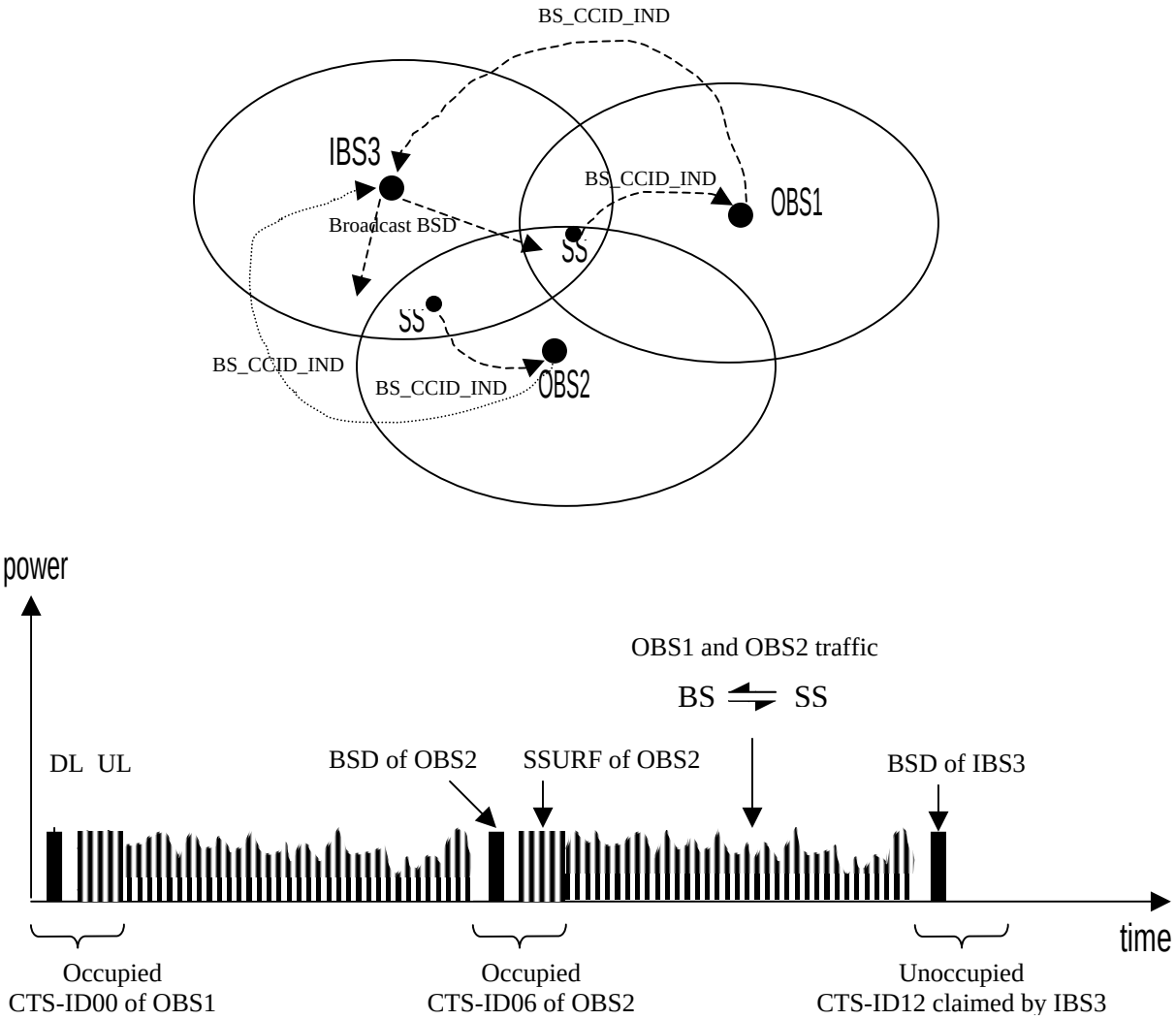


Figure 2 IBS3 Entry Signalling