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Re:	**80216h-05_028：Call for Comments and Contributions: IEEE 802.16 License-Exempt Task Group (2005-12-15)**
Abstract	**Considering the interference condition between the initializing base station and the operation radio network near the IBS, we can find several scenarios. Study on these cases may be helpful for the standard development and make the WD easier to be understood by the working group.**
Purpose	**To include the scenario description into the ANNEX，after consolidation, we can go further base on same assumptions.**
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Initialization scenario case study on interference situation

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Overview

Considering the interference condition between the initializing base station and the operating radio network near the IBS, we can find several scenarios. Study on these cases may be helpful for the standard development and make the WD easier to be understood by the working group.

Reference

[1] IEEE 802.16h-05/026: License-Exempt Task Group Meeting Minutes for Session #40 (2005-12-06)

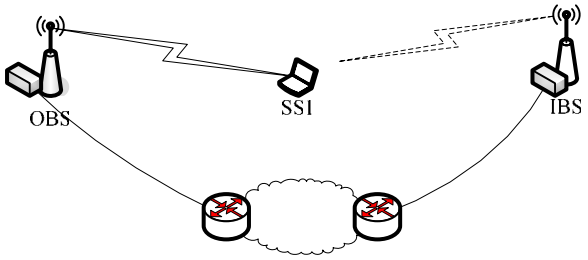
[2] IEEE 802.16-05/027: Working Document for P802.16h (2005-12-02)

[3] IEEE C802.16h-05/041: Treatment by OBS on error report in IBS_IPBC procedure (Wu Xuyong, Pan Zhong, Zhao Quanbo; 2005-11-09)

[4] IEEE 802.16h-05/003: Detailed Scope of IEEE 802.16h Standard

Discussion

See to the figure below:



Suppose OBS and SS1 is part of a operation network, SS1 have a stable air link with it's BS before IBS start, OBS have a wired link Now the IBS comes into this area with wire link to the core network, IBS could contact OBS if he knows the address, unfortunately it does not know the IP address and probably there may be no regulatory server to ask for help. Notice here, the IBS will not have any SS attached before IBS itself has finished initialization. Based on list of assumptions referred to the working document, we can study on cases IBS is in and what kind of problems it may meet.

There is three kind of situation may exist in both SS2BS and BS2SS interference/signaling,

1) not able to be detected

2) interference detected but signaling not able to be decoded

3) interference detected and the signaling is decodable

We will use three kind of line with arrow to indicate these situation in the following figure during discussion.

Interference/signaling detectable and decodable
Interference/signaling detectable but not decodable
Interference/signaling not detectable

[note: based on the synchronization assumption, the BS/BS and SS/SS interference could be ignored.]

We can easily list out the possible cases by logical thinking as below:

Case1x：IBS interference/signaling can not detected by SS1

Case1a：the IBS can not detect the signal from the operating network

Case1b：the IBS can detect the signal from the operating network, but not decodable

Case1c：the IBS can detect and decode the signaling from the operating network

Case2x：IBS interference/signaling can detected by SS1 but not decodable

Case2a：the IBS can not detect the signal from the operating network

Case2b：the IBS can detect the signal from the operating network, but not decodable

Case2c：the IBS can detect and decode the signaling from the operating network

Case3x：IBS interference/signaling can detected and decoded by SS1

Case3a：the IBS can not detect the signal from the operating network

Case3b：the IBS can detect the signal from the operating network, but not decodable

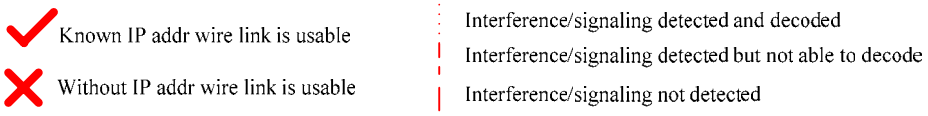
Case3c：the IBS can detect and decode the signaling from the operating network

We can discuss these cases one by one in the following:

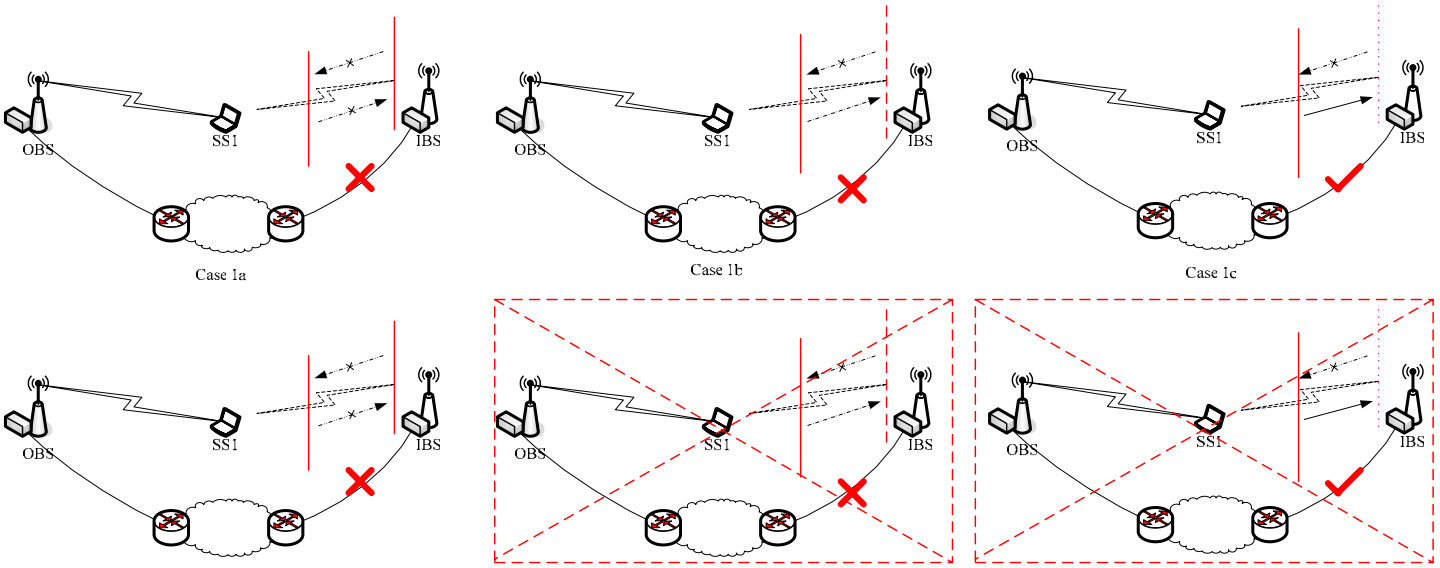
Note:

1)The red tick here means one of the BS may know the IP address of another BS by receiving the signaling from the air; The red cross here stands for that the BS can not know the IP address of another BS by the signaling from the air.

2)The red dot line in one side means that from this side, the station can decode the signaling from the transmitter; The red dash line means from this side, the station can detect but can not decode; and the read solid line means the station can not sense the existence of the transmitter.



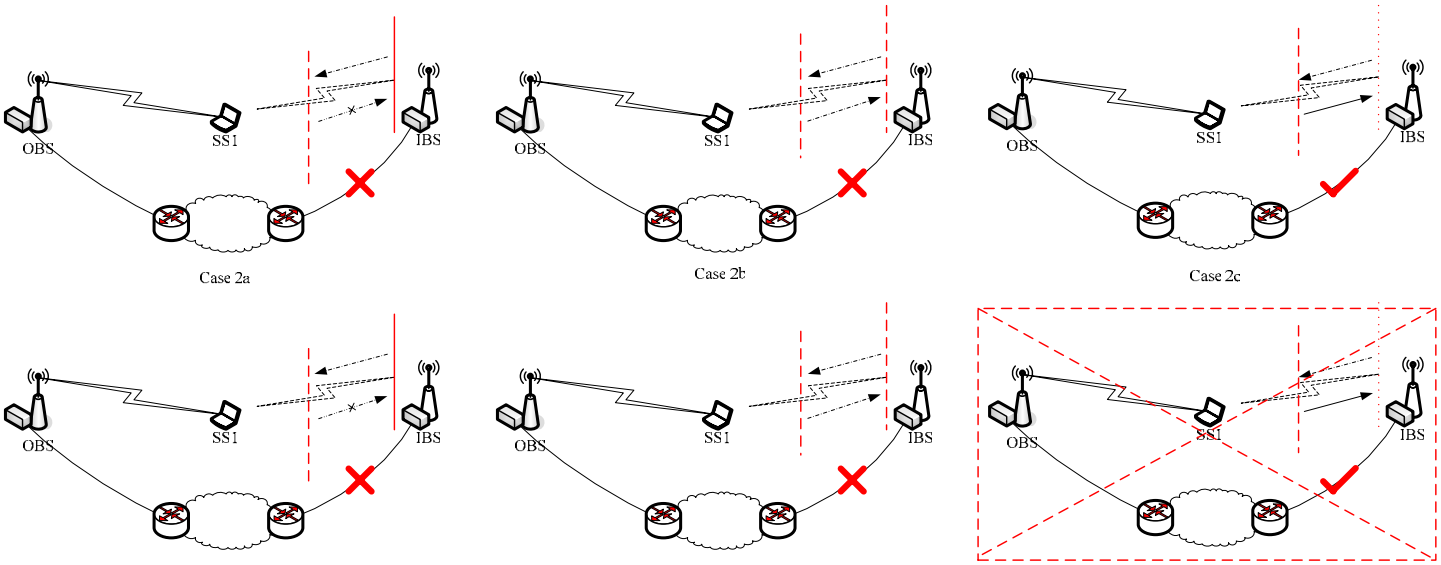
Case 1x:



[Note: although logically case 1b and 1c could happen, these cases are not normally exist, because the channel propagation are symmetric in both direction, but the BSs' transmition power are normally higher than the SSs'. So when the IBS couldn't been detected by SS1, the IBS will not detect SS1's signal also.]

In these cases IBS doesn't interference with SS1, which means the OBS's network is not necessary to contact IBS. So case 1x(1a/1b/1c) are not the target initialization scenarios in 16h.

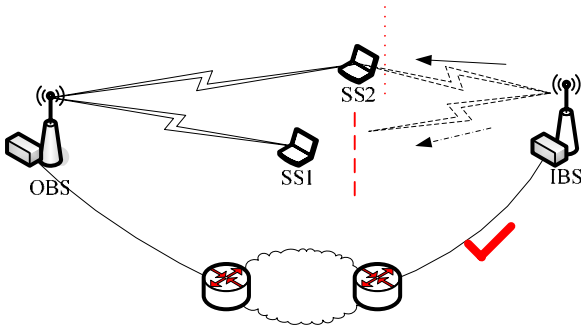
Case 2x:



[Note: case 2c normally doesn't happen for the same reason with case 1b & 1c.]

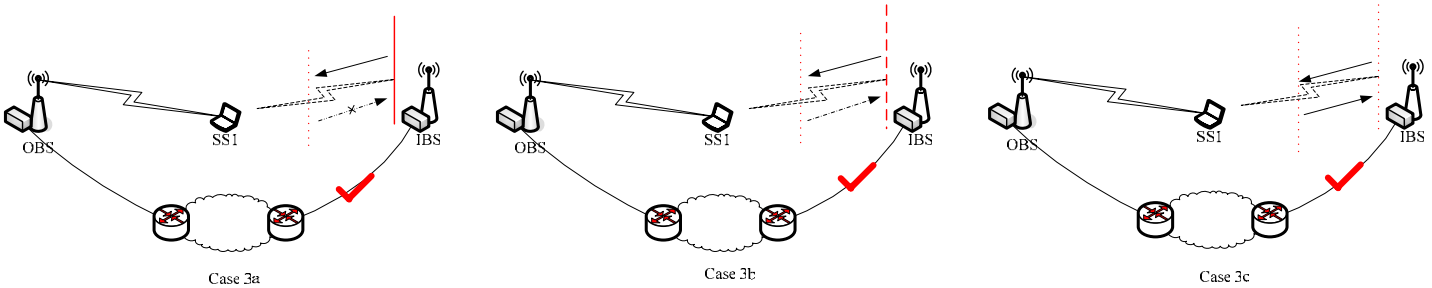
In these cases, IBS's signaling could be detected by SS1, but SS1 could not decode the signaling. The problem here is, IBS may interfere to SS1, but SS1 can't know who is the interferer, so it can not tell the OBS who is the interferer, so the OBS could not contact IBS for cooperation. These cases is the worst cases that 16h should deal with.

The reason for this problem is the difference of condition between decodable signaling and troubling interference. The condition could be measured in SNR requirement, the lower SNR required for the signaling, the lower probability to have this problem; another approach may help was introduced to the working document 15.2.1.1.3[2] in the meetings before is shown in IEEE C802.16h-05/041[3],and we could easily understand it in the following figure.



No matter how hard we try, we could not absolutely get rid of the difference, so we can not totally get rid of this problems, all we could do is to make the probability as low as possible. Once in operating network all the interfered SSs could not decode the signaling, we have no chance to tell who is coming to interfere the network, and this operating network may need to switch/escape to another channel.

Case 3x:



These cases are most interesting cases that 16h need to make out the solution. We can see each one of the 3 cases here is a normal case, and we need to deal with them all. In order to find the common solution, we need to take the advantage of the common condition. That is, SS can decode the IBS signaling. It's understood that if we don't depends on the IBS signaling transmition, in case 3a and 3b, operation network will not be able to find IBS in the core network. And the only way we may enable the operating network to do this is using the SS to relay the signaling which is managed to contain the IP address information.

The security issue may be mitigated by checking the instant random key and frame numbering in the contact requirement message sent by the OBS. That may prevent the IBS being cheated by someone faraway or by someone which is not able to control or access the 16h air link. We may need to think about this approach if we have no other choice to meet the cooperation contact requirement in case 3a and 3b.

For the sake of Case 2a and 3a, it's not logical to randomly choose the periodically silent CTS to occupy by the IBS, otherwise in the CTS which the IBS choose will cause collusion and make the initializing procedure not effective. Instead, it's needed to have a predefined periodical ICTS among all the CTS, and every IBS know the timing of ICTS as well. And the rest CTS will be used as OCTS and reallocated periodically to carry the signaling such as radio signature by the OBSs.

Proposed text change

1) Introduce the case study into annex. In this phase, we proposed to add a ANNEX clause, ANNEX 3. Coexistence scenarios for 16h. and section A3.1. BS initialization case study. And insert the content in the upper section into A3.1.

2) change 15.2.1.1.3 as indicate:

15.2.1.1.3 Coexistence Time Slot

CTS (Coexistence Time Slot): a predefined time slot for the coexistence protocol signaling purpose, especially for the ~~initializing~~ BS to contact its coexistence neighbor ~~operating~~ BS through one or more coexistence neighbor SSs in the common coverage area. ICTS(Initialization Coexistence Time Slot): the periodical appointed CTS specially used by IBS to contact its neighbor OBS. When the IBS get the OCTS allocation and start the operating stage, it will ceased to use the ICTS.

OCTS(Operation Coexistence Time Slot): the rest CTS other than ICTS, periodically reallocated to OBSs.
CTSN(Coexistence Time Slot Number): the periodical number of CTS according to the time order.
ICTS must not be used for other purpose by all the BSs, so that it will be an interference free slot for the coexistence neighbor discovery purpose. Initializing BS (IBS) shall use this slot to broadcast its IP identifier, by sending a message and/or by cognitive radio signaling ~~(t.b.d.)~~, so that the coexistence neighbor operating BS (OBS) could find the new coexistence neighbor in IP network after the SS report the message. Then the IBS and OBS begin further negotiation for coexistence protocol.
After coordination with the neighbors in the community, IBS will get periodical interference free OCTSs, and become OBS, after that, it will cease to use the ICTS.
Not to break the downlink PDU, and to prevent overhead of more preamble and gaps. CTS slots shall be located before RTG/TTG in TTD frame structure or before the preamble of downlink frame in FDD frame structure .To unify the location in these two kind of duplexing frame , CTS slots in FDD frame shall be put into the downlink structure right before the preamble, and shall be located right before RTG in TDD frame.
The IBS_IPBC broadcasting procedure is unidirectional, only from the IBS to the SSs in IBS/OBS's common coverage, and the SSs shall report all the useful information to their OBSs they registered to. The SSs that succeed in receiving the message should report the IP address of IBS and the frame number of the starting frame of IBS_IPBC, the SSs failed to received the broadcasting message but got IBS_IPBC like interference in the ICTS should report the error status and the starting frame number of receiving the ICTS interference. By the IBS IP address reported from the SSs, the OBSs will then find the IBS in the IP network, and go further signaling using IP network. And by checking the frame number in the report, OBS need to find out if the SSs that report the error status in IBS_IPBC receiving have got the same interference source, then OBS will update the database and reply to the SSs which send the error report.
The CTS/ICTS parameters need to be unified in a particular region, and to be well known by the BSs. So that each BS could know the exact time to transmit the broadcasting message in its initialization. The parameters include:
T_CTSstart : CTS starting time from the beginning of the frame (ms)
$T_{CTSdurat}$: CTS duration time (ms)
$N_{CTSstart}$: CTS starting frame number frames
$N_{CTSintv}$: ~~CTS interval framesframes~~ Number of frames between 2 CTS slots.
N_{ICTS_Cycle}: ICTS cycle counted in CTS cycles

N_{OCTS_Cycle}: OCTS cycle counted in ICTS cycles

Assuming $N_{CTSintv}$=4, N_{ICTS_Cycle}=4, N_{OCTS_Cycle}=2, here is a example of the timing indication:

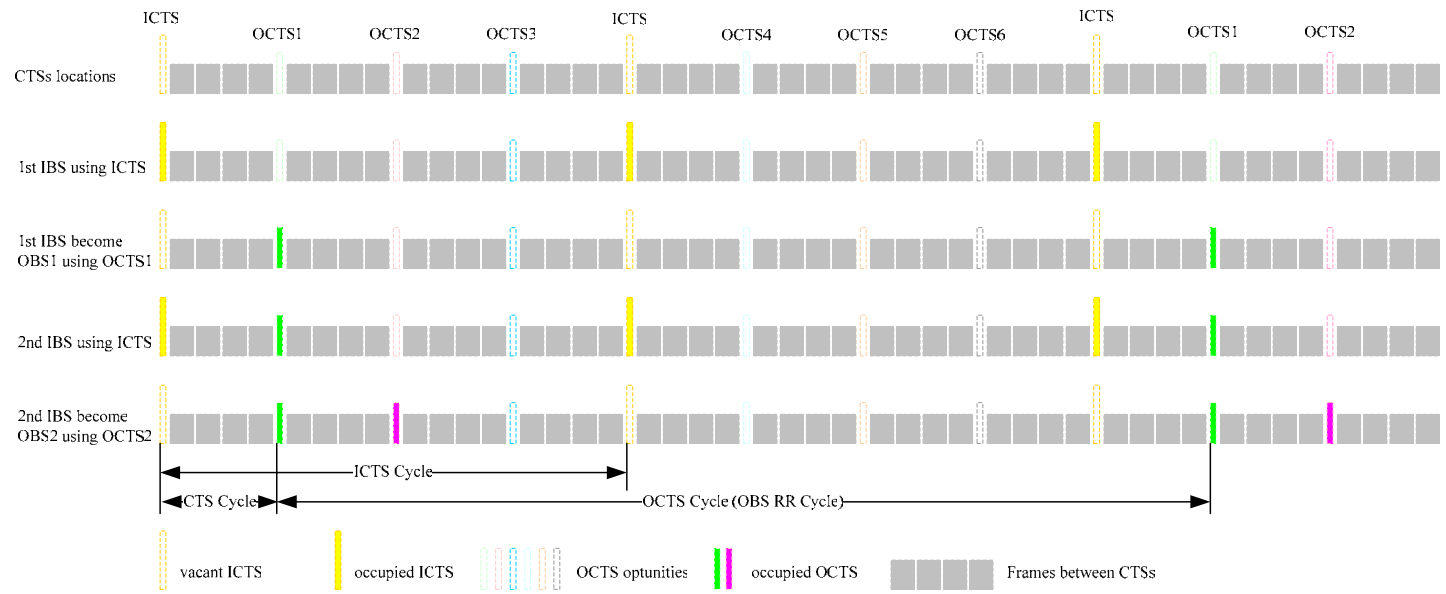


Figure h10- ICTS/OCTS occupation and timing example