Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	Consolidation text for ANNEX in 16h WD
Date Submitted	**2006-~~04-30~~**
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Re:	80216h-06_011：Working Group Review: P802.16h Working Document (2006-04-07)
Abstract	Editorial and clarification text on current ANNEX B&C
Purpose	Clarify the current ANNEX text
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Annex B

(informative)

GPS Timing and Base Station Synchronization

Every WirelessMAN-CX systems ~~IEEE 802.16h network~~ should ~~will~~ be synchronized to a globally distributed reference timing system that is capable of allowing the network Base Stations to synthesize a 1 pps NTI and a UTC time stamp. The Global Positioning System (GPS) is capable of providing these ~~such a~~ temporal references to the Base Stations that are ~~providing they are~~ equipped with GPS receivers.

The ~~Every~~ Bbase stations equipped with a GPS receiver ~~are~~~~would be~~ capable of receiving a UTC synchronized 1 pps timing signal. The ~~accuracy of the~~ clock pulses derived from a ~~using~~ GPS receiver are accurate to +/- 100 usec and the derived pulses ~~that are derived~~ typically have rise times within +/- 2.5 nsec. Fig 1 shows a typical GPS 1 sec pulse and its duration (Trimble Inc. Palisade output).

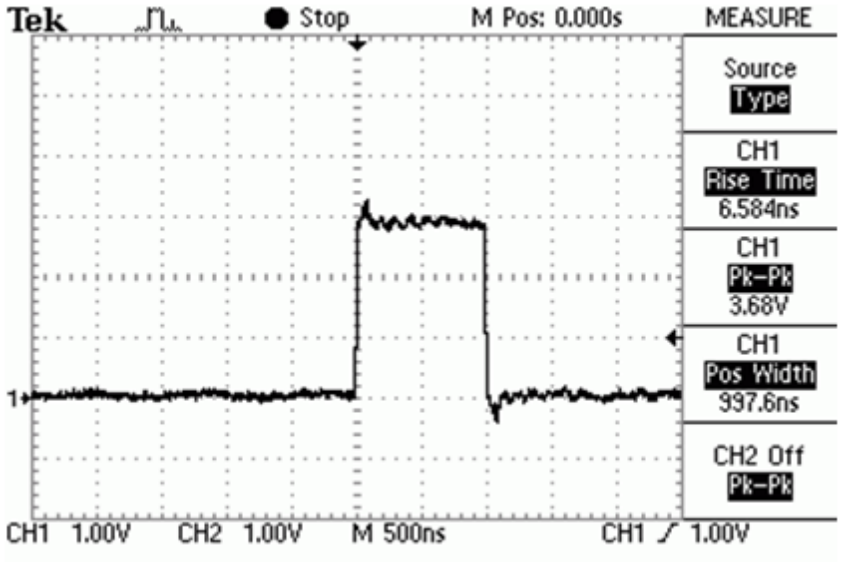


Figure h-B1—GPS 1pps Pulse

The availability of a globally distributed clock will result in ~~a~~ common temporal unit that can be used in negotiating access times to spectrum shared by a community of ad-hoc users. Non- WirelessMAN-CX ~~IEEE 802.16h~~ networks having different architectures and messaging signals could also use a common 1 second interval for synchronization of their networks. This would conceivably allow~~–~~ communication between all ~~them and I~~IEEE 802.16~~h~~ networks in a synchronized manner, ~~to~~ facilitating the exchange of information related to coexistence and spectrum sharing.

The one second reference ~~unit~~ time is ~~considered~~ appropriate ~~ideal~~ because it is distributed directly by the GPS~~, as such and the length of the unit is seemingly appropriate.~~ WirelessMAN-CX ~~IEEE 802.16h~~ networks typically have frames on~~in~~ the order of several to tens of milliseconds, which is ~~of~~ a granularity that could allow several to several tens of networks to negotiate coexistence subintervals within the 1 second span. Additionally, for IP networks, the 1 second interval is of a

length sufficient- to -accommodate inter-router TCP/IP latency, especially over networks that are likely -to be close to each other, such as ad-hoc licence exempt ~~LE networks~~systems.

Annex C

(informative)

interference scenario case study

C.1 Base Station initialization scenario case study

See to the figure below:

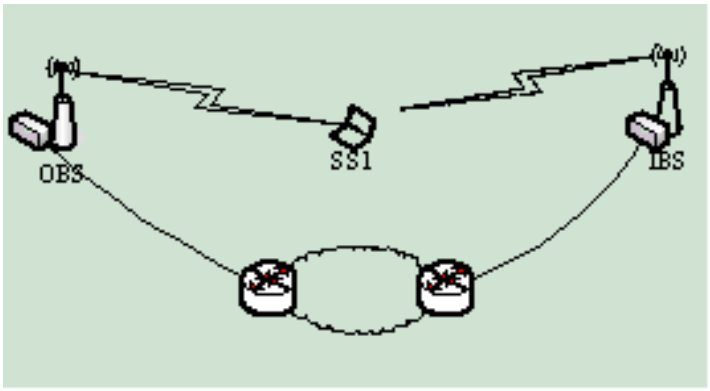


Figure h-C1—Enviorment of initializing basestation

Suppose OBS and SS1 are~~is~~ part of an operating~~on~~ network, SS1 has~~ve~~ a stable air link with OBS ~~it's BS before IBS start,~~and -OBS has~~ve~~ a wired link. Now assume that ~~the~~ IBS comes into this area and already has a wired ~~with wire~~ link ~~to the core network,~~ IBS could contact OBS if he knows the IP address of OBS., U~~u~~nfortunately IBS~~it~~ does not know OBS's~~the~~ IP address and ~~probably~~ there may be no regulatory server to ask for help. Notice also that ~~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 are~~is~~ three kinds of situations that may exist in both SS2BS and BS2SS interference/signaling,

- No interference/signaling ~~t able to be~~ detectable~~ed~~
- Interference/signaling detectable~~ed~~ but signaling is not decodable~~not able to be decoded~~
- interference detected and the signaling is decodable

The following designations will be used to illustrate these three cases in Figure h-C2. ~~We will use three kind of line with arrow to indicate these situation in the following figure during discussion.~~

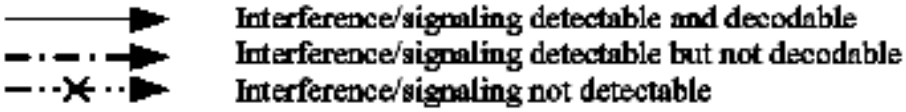


Figure h-C2—Legend of arrow indicating interference direction

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

The possible cases are: ~~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: he 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

These cases are shown in Figure h-C4. ~~We can discuss these cases one by one in the following:~~

~~Note:~~

1)The red tick signifies that ~~here means~~ one of the BS may know the IP address of another BS by receiving the signaling from the air; The red cross signifies ~~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.

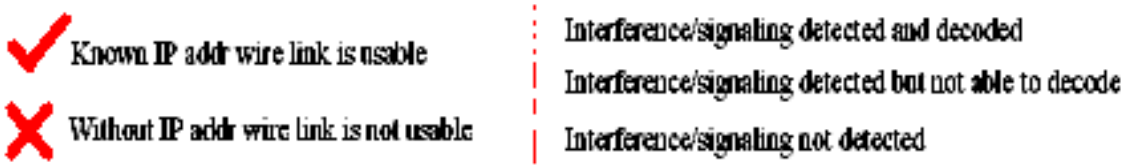


Figure h-C3—Legend of line indicating interference situation and symbols indicating wirelink usability

Case 1x:

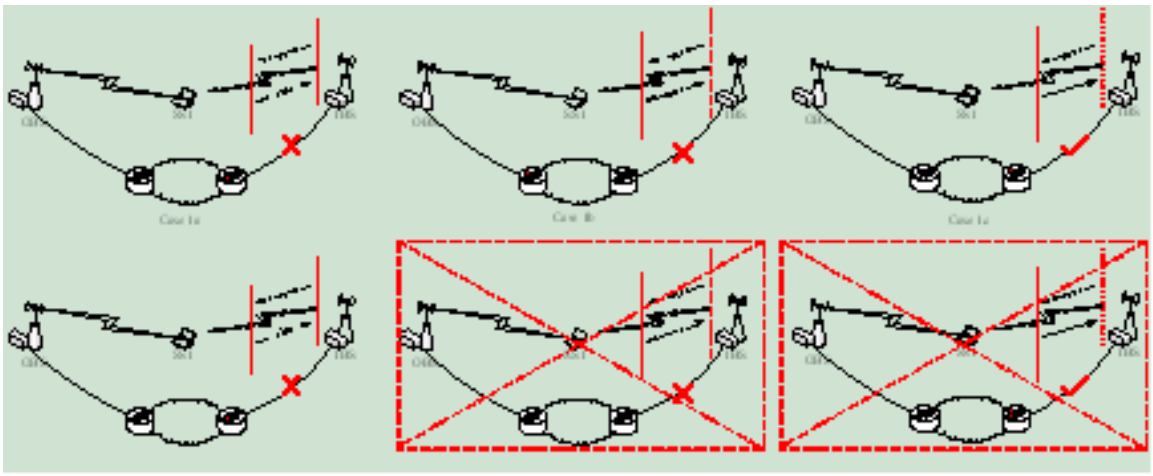
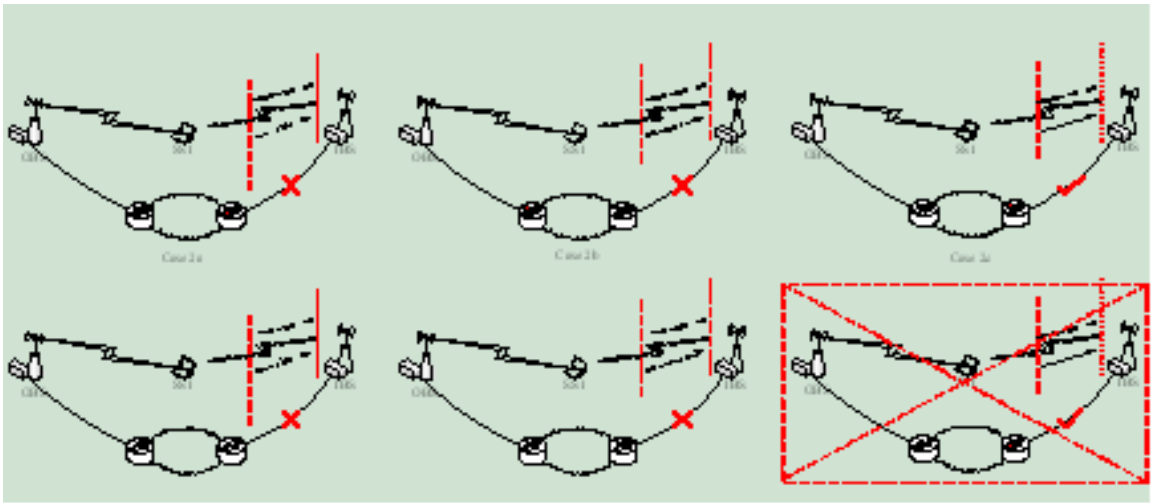


Figure h-C4—case 1x study

[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 that the OBS's network does not need to contact the ~~is not necessary to contact~~ IBS. This Case 1x is not a ~~So case 1x(1a/1b/1c) are not the~~ target initialization scenario~~s~~ for WirelessMAN-CX base station ~~in 16h~~.



Case-2x:

Figure h-C5—case 2x study

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

In case 2x, ~~these cases~~, IBS's signaling may ~~could~~ be detected by SS1, but SS1 can~~ould~~ not decode the signaling. ~~The problem here is,~~ IBS may interfere to SS1, but SS1 can not indentify ~~'t know who is~~ the interferer, so SS1 ~~it ca~~can not inform ~~tell~~ the OBS who is the interferer, so the OBS could not contact IBS for cooperation. Case 2x ~~These cases~~ is the worst case for WirelessMAN-CX~~s that 16h should deal with.~~

This is worst case problem is due to~~e reason for this problem is~~ the difference of SNR conditions between decodable signaling and troubling interference. The condition could be specified by a ~~measured in SS~~NR 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 in the meetings before is shown in IEEE C802.16h-05/041,and we could easily understand it in the following figure.

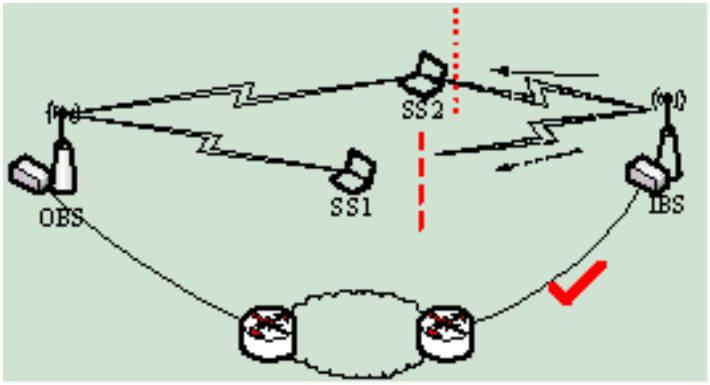


Figure h-C6—Enhanced mechanism dealing with case 2x

Some SSs (eg. SS1 in the figure h-C6) interfered by IBS can not decode the information contained in the broadcast signaling while some SSs decode it at the same time (eg. SS2 in the figure h-C6). All these interfered SS will report to OBS for the signaling. Dealing with all the report, OBS will try to figure out the interferer of the SSs which can not decode the signaling by report message of other SS at the same time, and make use of the interference time/frame number inside each report message.

We could not absolutely get rid of the difference of the signal requirement between to be decoded and to interfere the transceiver , so we can not totally get rid of the possibility of the SSs to be not able to decode the signaling while being interfered, all we could do is to make the bad effect as little as possible. I don't understand this solution. 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:

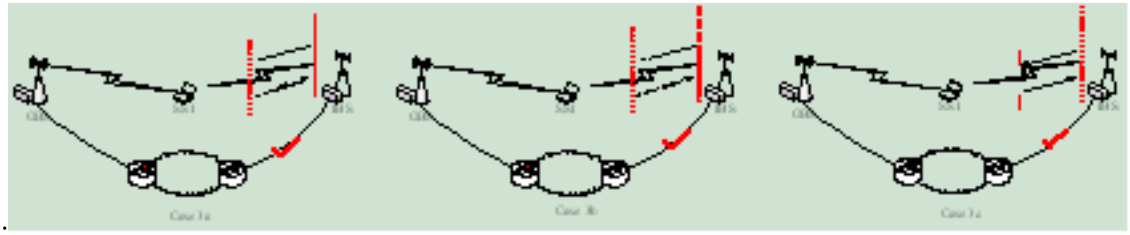


Figure h-C7—case 3x study

Case 3x is the ~~These cases are~~ most applicable use of WirelessMAN-CX ~~interesting cases that 16h need to make out the~~ solution. The ~~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 of Case3x is that ~~. 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.

One security issue of CP message between BSs through IP network is roused, how to qualify that the message is from a neighbor station. The BS should make sure that the sender system of the message received its signaling broadcasted. It means that the send system of the CP message should have air interface which can receive and decode the air signaling, nevertheless the system is close enough in distance so that it can receive and decode the signaling send in the air by the BS. If BS send only static information in the signaling, it will not be able to find out if the CP message sender is really its neighbor or just someone who have got the static information unexpected before. Thise 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 CSI to occupy by the IBS, otherwise in the CSI which the IBS choose will cause collusion and make the initializing procedure not effective. Instead, it's needed to have a predefined periodical ICSI among all the CSI, and every IBS know the timing of ICSI as well. And the rest CSI will be used as OCSI and reallocated periodically to carry the signaling such as radio signature by the OBSs.