Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**New Additions in support of IEEE802.16h**
Date Submitted	**2005-11-17**
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Re:	Additions to the working document targeted toward introducing a network time constant and new radio resource management parameters. Based on feed back of contribution C802.16h-05/044r1
Abstract	Suggestions for the use of a global timing reference for IEEE 802.16h networks; radio resource management parameters, and proposals for a IEEE 802.16h profile for 5 Ghz LE operation.
Purpose	Additions to working draft IEEE 802.16h
Notice	
Release	
Patent Policy and Procedures	

New additions in Support of IEEE802.16h

John Sydor

The following new additions are for insertion into document IEEE802.16h-05/022.
Insert this section in line 34 page 5 after section that ends: neighborhoods:t.b.d

A community will be limited to a reasonable size; the size limitations and interactions between different coexistence neighborhoods: t.b.d.

All Base Stations and their networks will as a first step seek the avoidance of co-channel utilization of the same spectrum, and will be equipped with a spectrum detection and monitoring capability which will allow this.
All base stations are synchronized to a ~~1 pps~~ GPS clock. The start of all MAC frame and other transaction are referenced to the rising edge of this clock.
All base stations and their networks, operating in the LE bands, will provide the opportunity to other non-IEEE 802.16h systems to communicate their coexistence requests to the IEEE 802.16h networks. The IEEE 802.16h systems will recognize the use of radar and other systems having higher priority to LE spectrum ~~and will have mandatory signaling that will support decisions made in the ITU-RM 1652~~.

Insert this section starting line 15 page 70:

15.7.2.1 BS Synchronization
15.7.2.1.1 Synchronization of the IEEE 802.16h Networks

All base stations forming a community of users sharing common radio spectrum will use a common clock to synchronize their MAC frames. The common clock will be available to all outdoor IEEE 802.16h networks. Such a clock can be provided by global navigational systems such as GPS (Annex 2) or can be distributed by other mean . Every BS upon activation, will as a first step ensure the derivation of the common system clock.

15.7.2.1.1.1 Network Time Interval

All synchronized IEEE 802.16h base stations will either synthesize or derive a 1 pps clock broadcast by a global navigational system or other means. The 1 sec duration is called the Network Time Interval (NTI). The rising edge of the 1 pps synchronization pulse will be considered as the start of the NTI. The 1pps pulse will have a stability of +/- ~~100~~ XX microseconds, as measured from rising edge to rising edge.

15.7.2.1.1.2 Granularity of the NTI

The NTI will be comprised of ~~1000 1 Millisecond slots~~NTI_S unit that will be used by both TDD and FDD networks to negotiate times and durations of co-channel occupancy. Negotiation for access time to common spectrum will be specified in terms of the NTI_S unit ~~1 millisecond units~~. Occupancy times will be specified in terms of time from the beginning of the NTI and in terms of negotiated number of NTI_S unit~~1 millisecond~~ intervals.

15.7.2.1.1.3 UTC Standard Time

The common clock specified in 15.7.2.1.1 will provide a Universal Coordinated Time (UTC) signal to all IEEE802.16h networks, making all networks synchronized to this referenced time stamp. IEEE 802.16h base stations will use the UTC time standard for coordinating and identifying specific NTI intervals.

Insert the sections below into their corresponding sections in the Working Draft Document.

15.7.2.2 Shared Radio Resource Management

15.7.2.2.1 Legitimate Request for Bandwidth and Transmission Time

An IEEE 802.16h network that is a member of a community of networks granted access to shared spectrum resources only if it forms an actual network comprised of at least one base station and one subscriber station and supports a bi-directional link..

15.7.2.2.2 Coverage Area

~~*An IEEE 802.16h network that is a member of community of networks will be required to provide information about the coverage area that it occupies. This information is to be made available by the BS and will constitute part of its shared data base.*~~

~~*The coverage area will be a multiplication of the mean range [Rm] of the SS (as measured from the BS) and the maximum angular azimuth angle [Az], in degrees, over which the BS services reliably using its antennas. Otherwise, the azimuth width will be taken as the -3 dB beamwidth of the fixed BS antenna or the maximum operational azimuth scan width of a steerable BS antenna.*~~

~~*The coverage area [CA] will be calculated as CA= [Rm²] x [pi] x [Az/360]*~~

15.7.2.2.3 Direction of Coverage Area

~~*An IEEE 802.16h network that is a member of a community of networks will be required to provide information about the direction of its coverage area. This information is to be made available by the BS and will constitute part of its shared data base.*~~

~~*The direction of the coverage area will be the considered as the direction (in azimuth degrees away from True North) of the main lobe of the antenna producing the coverage area for the BS, for fixed BS antennas. For base stations using scanning antennas the direction will be the direction of a vector, equidistant in azimuth, from the edges of the total scanned area.*~~

15.7.2.2.4 Bandwidth Utilization

~~*An IEEE 802.16h network that is a member of a community of networks will be required to provide information about its utilization of bandwidth. This information is to be made available by the BS and will constitute part of its shared data base.*~~

~~*A networks utilization of bandwidth will be supplied as a number of variables; these being:*~~

(a) ~~*Number of registered subscriber stations on the network,*~~

(b) ~~Average downlink utilization to downlink allocation [DLeff]~~
(c) ~~Average uplink utilization to uplink allocation [ULeff]~~

~~The downlink and uplink utilization factors [DLeff and ULeff] will be averages that are calculated over 6 hour intervals, and are updated accordingly by the Base Station.~~

Insert the following in section 15.2.2.3.1.Same PHY Profile

Same PHY Profile

For networks using the same 802.16 PHY Profile, including elements as:

- ~~Channel spacing~~
- insert
- *Mandatory channel spacing for LE system in ~~5725-5850~~TBD MHz will be ~~10~~TBD MHz.*
-

Insert between current lines 24 and 25:

-
- PHY mode:
  - WirelessMAN-OFDM (256 FFT points)

    Mandatory profiles for operation in the LE 5725-5850 MHz band will be:
    -profM3_pmp,profP3_10,profC3_23,TDD,profR13
    ~~Optional profile for operation in the LE 5725-5850 MHz bands will be~~
    ~~-profM3_pmp,profP3_10,profC3_23,FDD,profR13~~
  - WirelessMAN OFDMA 2k (in future 128, 512, 1k) FFT points
  - WirelessMAN SCa,

the inter-network communication may be done using 802.16 messages over the air, including messages defined by 802.16h amendment. The procedures for sending these messages are described in t.b.d.

Insert the following Annex 2 at the end of the IEEE 802.16h working document

GPS Timing and Base Station Synchronization

Every IEEE 802.16h network 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 such a temporal references to the Base Stations providing they are equipped with GPS receivers.*

Every base station equipped with a GPS receiver would be capable of receiving a UTC synchronized 1 pps timing signal. The accuracy of the clock pulses derived from using GPS are accurate to +/- 100 usec and the 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).

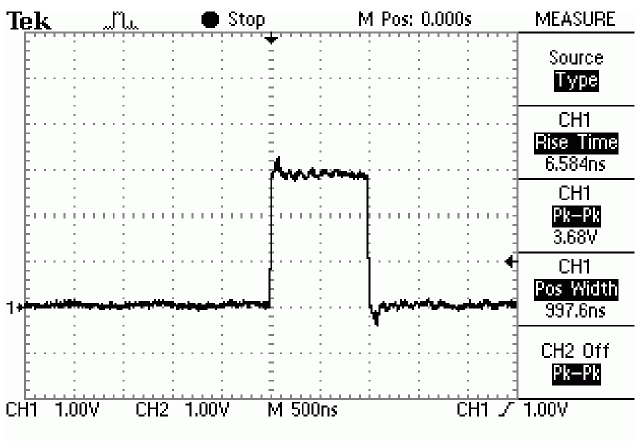

Figure 1 GPS 1pps Pulse

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-IEEE 802.16h networks having different architectures and messaging signals could also use a common 1 sec interval for synchronization of their networks. This would conceivably allow communication between them and IEEE 802.16h networks in a synchronized manner, to facilitating the exchange of information related to coexistence and spectrum sharing.

The one second unit is considered ideal because it is distributed by the GPS as such and the length of the unit is seemingly appropriate. IEEE 802.16h networks typically have frames 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 LE networks.