Detailed Scope of IEEE 802.16h Standard

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Purpose: Guidance for further work

General issues

- ***802.16h applicability***
  - Un-coordinated frequency operation in all bands in which 802.16-2004 is applicable, including bands allowing shared services
- ***Interference detection and prevention – general architecture***
  - Shared Radio Resource Management – principles and shared distributed system architecture

Interference victims and sources

- Identification of the interference situations
  - Interferer identification
  - Self-declaration
    - Discussion: Generally the victims are also sources of interference, if the units use similar eirp power levels and have similar receive antennae
- Creating a framework for identification
  - Avoid overloading
    - Discussion: should be identified only the interference sources, otherwise the needed resources may be exaggerated; Base Stations should identify them-self in any case; STs should identify them-selves if they hear another system
  - Identification of NOT-interfering situations
    - Discussion: according to the existing literature sources, it is important to determine groups of units (e.g. AP, STs) that do NOT interfere with each other. The activity of these units may be scheduled in parallel, when using different frequency channels.

Identification of primary users

- The cognitive properties of these users, like radars, are defined in regulations
- Messages to disseminate the information
  - Discussion: the STs should transmit to BS the information regarding a detected Radar
- Avoid false-identification situations
  - Discussion: Bursty traffic may be interpreted as Radar presence.

Interference prevention examples

- Adaptive Channel Selection – ACS
  - For inter-802.16 system coexistence
    - Discussion: the channel switching policy may be different for Radars avoidance and co-existence; a different naming is needed for co-existence
- Dynamic Frequency Selection - DFS
  - For coexistence with target Primary Services (Radars)
- Pro-active cognitive approach
  - Announce when a system/unit transmits and receives
  - Discussion: another system will try avoiding interfering or be interfered; this approach will be useful for providing coexistence between different 802.16 PHY modes (as OFDM, OFDMA, SC) or between 802.16 and other spectrum users

Transmission of information - Messages

- Between BS and SS
  - Report like messages
    - Discussion: to inform the BS about interference levels, their distribution in time, existence of primary users
  - Action request like messages
    - Discussion: to request channel switching
- Between different BSs
  - Discussion: to inform the BS about interference levels, their distribution in time, existence of primary users, traffic targets.
  - Problem: BS will generally have to associate with another Base station and for doing this, to hop between the two or more frequency channels; will be easier if SS will be used for relaying messages; the SS will use similar procedures with those defined for hand-over.
- Connection sponsorship
  - Discussion: a SS may convey the BS message

Transmission of information – using a common management system

- Decentralized control
  - Discussion: a common management system approach is easy to use, as most of 802.16e systems will be manageable. A system may have 2 management addresses, access rights and security features(security of internal management): one for intra-system management and one for inter-system Shared Radio Resource management.
- A system may make available to other systems, for example, its channel number, scheduling, transmitted power info, traffic targets to other systems
  - Discussion: based on this information, other systems may identify the interference sources and ask for a different Shared Radio Resource allocation.

Using a common management system – IP address transmission

- A system should know the Network Management address of other systems
  - Discussion: to communicate
  - Should be transmitted in a PHY independent mode
    - Discussion: to address inter-802.16 PHY modes (OFDM, OFDMA,SC) transmission; messages that can be translated in simple PHY properties may be used by each one of the PHY modes.
- A system can host the common MIB info for systems that work in an Ad-hoc mode
  - Discussion: systems working in Ad-Hoc mode may not implement the MIBs standards and Network Management functionality.
- A system should be able to receive requests from other systems, regarding the operating channel, scheduling, etc.
  - Discussion: to adapt its Shared Radio Resource usage.

Common 802.16h policies – channel selection

- How to select a “free” channel (for DCS and DFS)
  - Acceptable S/(N+I)
  - Acceptable time occupancy
  - Capability of systems sharing the spectrum to implement a Shared Radio Resource policy
- No free channels may exist; what should be done.
  - Discussion: nobody has rights, in LE operation, to own frequency channels; the meaning of a “free” channel is not obvious and may change in the context of a general Shared Radio Resource.

Interference reduction policies - 1

- BS synchronization
  - Discussion: the Tx/Rx synchronization will transform TDD systems in FDD-like systems, avoiding BS-BS and SS-to-SS interference.
  - GPS
    - Discussion: to implement a general synchronization policy, with the condition that BSs have a GPS receiver.
  - Ad-hoc
    - Discussion: to allow that systems will synchronize one to each other, without implementing GPS receiver or being mounted with visibility to GPS Satellites.

Interference reduction policies - 2

- Shared Radio Resource Management
  - Define the “fairness” criteria
    - Discussion: in order to have a fair resource sharing, a collection of rules and criteria should be defined
  - Distributed scheduling to avoid interference
    - Discussion: scheduling is one of the used tools for RRM in existing cellular systems; however, the used algorithms imply a central scheduling approach, not suitable to a shared RRM approach.
  - Distributed power control
    - Discussion: distributed power control algorithms are already used for RRM in existing cellular systems.

Interference reduction policies - 3

- Connection sponsorship (roaming)
  - Discussion: a system may prefer to handle another's system user, instead to suffer from its interference. This is the case of SS working in the vicinity of an BS belonging to another network