Title: Comments on the Working Document – Session #41

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Source: Mariana Goldhamer Voice:+972 3 645 6241 mariana.goldhamer@alvarion.com
ALVARION
21a HaBarzel Street, Tel Aviv, Israel

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Purpose:

Comments on the Working Document – Session #41

Mariana Goldhamer

Alvarion

IEEE 802.16h – LE Task Group PAR

- PAR - Title
  - Improved Coexistence Mechanisms for License-Exempt Operation
- PAR - Scope
  - To specify improved mechanisms, as policies and MAC enhancements, to enable coexistence among license-exempt systems based on IEEE Standard 802.16 and to facilitate the coexistence of such systems with primary users
- Applicability
  - Un-coordinated operation (may be regulatory licensed or license-exempt bands) in all the bands in which 802.16-2004 is applicable:
- More info: http://grouper.ieee.org/groups/802/16/le/index.html

Scope of this presentation

- High-level view of requirements
- High-level view of achievements
- Identification of areas for more work
- Basis for discussion and agreement of what should be done
- Eventual task assignments

Main targets for achieving better coexistence

- Compatibility of channel widths and channel centers
- BS Tx synchronization
  - Error correction – best support
- Adaptive channel selection
- Flexible separation of interferers
- Control of interference
- Better coexistence with primary spectrum users
- Tools:
  - Communication between 802.16-based systems
  - Coexistence Protocol

Compatibility of channel widths and channel centers

- Recommend a number of channel widths and possible a center freq. Raster
  - For different regulatory domains
    - 5GHz
    - 3.65GHz
    - Germany: 3.5GHz
- Initial contributions this meeting

BS Tx Synchronization

- Same MAC frame duration
  - Can be agreed by operators
  - Ad-hoc systems:
    - Have to detect the existing users
    - If no existing users, to use the default value
  - Default value
    - To allow fast ARQ; 5ms?; 20ms: too long
- Max BS Tx duration
  - Can be agreed by operators
  - Ad-hoc systems:
    - Have to detect the existing users
    - If no existing users, to use the default value
  - Default value: 3ms?
- Not defined in the WD

Adaptive Channel Selection

- A new Base Station can use:
  - Cumulated, relatively long term, interference measurements
  - Can use the data base of GPS positions for BSs to create its BS Community topology
  - Can use radio measurements defined by the Radio Signature process
    - Not defined yet
- No text under 15.4.1 – ACS
- Channel switch procedures – not described under ACS

ACS - Long term measurements

- Taken on every possible frequency channel
- Based on some history
  - BS measures the interference of other SS
    - No guarantee that all the interfering SSs are active during measurement process
  - SS measures the interference of other BSs
    - Improved REPORT mechanism, to collect the SS measurements of interference (through MAC messages)

ACS-GPS Position

- Allows to create a Community
- For every possible frequency
  - Scheduling the Radio Signatures of foreign BS and SS and take a better measurement of the cumulated interference
  - The scheduling of cumulated activity is not included in the WD
  - If no interference is measured
    - GPS position can be used to determine the nearest interferers and make a decision
      - Low interference, at noise level, still reduces the C/(I+N) by 3dB!

ACS – Radio Signatures + CP – missing!

- To be used inside a BS Neighborhood
  - Intelligent process, suitable for managed BSs implementing the Coexistence Protocol
  - No other activities to take place in parallel
    - Synchronized Coexistence zone
- Two kinds of measurements
  - All BS transmit their Radio Signature in the same scheduled interval
    - Power density visible at IBS and ISS
  - All SS transmit their Radio Signature in the same scheduled interval
    - Power density visible at IBS and ISS
  - Improved Report system to convey info from SS to BS

ACS – Radio Signatures – Ad-Hoc Systems

- Should work at predefined intervals
  - Not sure an Ad-Hoc system has a GPS
  - Ad-Hoc systems shall sync. with GPS-controlled systems or an existing systems
    - How to identify GPS controlled systems?
      - Use PHY markers?
- Should not impede on usual operation
- Not defined in the WD

ACS – Other

- Same PHY
  - Messages not described in the format of 802.16 MAC
    - 15.6.1.2
- Free channel selection – ACS and DFS
  - Not described the procedure to find the "optimized distribution"

Separation of interferers

- Time separation
  - Using Master sub-frames
    - Coexistence-zones? CX-Z
  - A number of possible alternatives
    - To be chosen by operators
  - Default should be defined
- Signaling to Ad-Hoc systems
  - Protocol and PHY usage defined
  - Needs definition of new preambles
  - Using coding of MAC Messages is not possible due to the Interleaver

Flexibility in assignment of Master time-slots

- Token protocol
  - Demand/Offering
  - Winner establishment
  - Delay concern
    - May use BS/BS Communication?

Control of interference

- Procedures defined, in association with use of Master/Slave frames
  - Use an existing Master frame
  - Create a new Master frame
  - Power control request
  - Interferer identification
    - Based on Radio Signatures and their timing
- Coexistence Protocol
  - Most of messages defined
  - Parameters still missing

Better coexistence with primary spectrum users

- Radars
  - Issues fixed in Corrigenda
- Wireless microphones
  - Send SMS message:
    - GPS coordinates
    - Send operating frequencies
  - Not defined yet
- Emergency services
  - As for wireless microphones
  - Not defined yet

Communication

- IP level communication for 802.16 PHY-independent approach
- Obtaining the IP Address:
  - Regional data-base
    - Security issues should not be in the scope of the standard
      - We lack competence
      - Operators can create VPNs using commercial products
  - Information exchanged between operators (off-line process)
  - Use of CTS (Coexistence Time Slot)

Coexistence Time-Slot

- Used for sending the IP Address, in interference-free mode
  - Energy pulses
    - Time-coded
      - New PHY
    - Sub-Frequency coded
      - Needs definition of new preambles
  - Security problem
    - IP Address can be obtain too easy
    - Possible solution: send an Identifier and take the IP address from the secured database
    - Needs re-definition

Coexistence Protocol

- Most of the messages defined
- Need finishing
  - Parameters missing
  - Types missing

Not clear definitions

- How the BS sync. their frame numbers
- BS Information Table
  - Time origin for CTS
  - How are obtained the number of registered SSs and victim SS

Discussion ☺