COMMENTS ON PROCEEDING 12-354

The SAS in 3.55 GHz – 3.7 GHz bands

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Sony
Outline

- Introduction
- Aggregate interference
- White Spaces standardization
- Summary
- Response to petitions for reconsideration
- Questions
Wireless Communication R&D activities in Sony

- 4G/5G
- Wi-Fi
- Cognitive Radio System (CRS)
- IoT
Why are we here

• Sony encourages the Commission to use an aggregate measurement of GAA interference to enforce PAL incumbent protection.

• Sony recommends the use of existing standards to coordinate frequency assignment among multiple SASs.

• Sony suggests the use of existing standards that have been designed to address the “equitable and coordination challenges” in limiting GAA use.
Sony’s activities for TV White Spaces

Sony has joined Ofcom UK TV White Spaces trials in 2014

Sony has passed TVWS database qualification for trial

8 databases & 11 devices certification candidates

(Reference) "Ofcom TV Whitespaces Pilot Update Event", Ofcom UK, 26 June 2014

(Reference) https://tvws-databases.ofcom.org.uk/
Aggregate interference in field test

- Co-channel aggregate interference
Aggregate interference in field test (Video)
Taking into account aggregated interference

• The field test shows that co-channel interference from WSDs affects DTV reception where the signal is weak at the antenna.
  • Even when only a small number of devices are operating

• Sony believes that the same problem will occur in the Citizens Broadband Radio Service.
  • Both for interference from GAA/PAL to incumbents, and from GAA to PAL
White Spaces standardization

- **ETSI**
  - ETSI EN 303 143 (ETSI TS 103 143): System architecture for information exchange between different Geo-location Databases (GLDBs) enabling the operation of White Space Devices (WSDs)
    - Status: ETSI TS 103 143 was published. ETSI EN 303 143 is entering EN approval procedure.
  - ETSI EN 303 144: Enabling the operation of Cognitive Radio System (CRS) dependent for their use of radio spectrum on information obtained from Geo-location Databases (GLDBs); Parameters and procedures for information exchange between different GLDBs
    - Status: ETSI EN 303 144 is entering EN approval procedure.
  - ETSI EN 303 145 (ETSI TS 103 145): System Architecture and High Level procedures for Coordinated and Uncoordinated Use of TV White Spaces
    - Status: ETSI TS 103 145 was published. ETSI EN 303 145 is entering EN approval procedure.
  - ETSI EN 303 387: Signalling Protocols and information exchange for Coordinated use of TV White Spaces; Interface between Cognitive Radio System (CRS) and Spectrum Coordinator (SC)
    - Status: ETSI EN 303 145 is entering EN approval procedure.

- **IEEE 802**
  - IEEE 802.19.1-2014: TV White Space Coexistence Methods
    - Published.
  - IEEE P802.19.1a: Amendment: Coexistence Methods for geo-location capable devices operating under general authorization
    - New project.
Coordinated and Uncoordinated use of TVWS

Spectrum management between different GLDBs
ETSİ EN 303 143 & ETSİ EN 303 144 (1/2)

- Following the EC Mandate M/512, ETSİ has been developing standards for information exchange between GLDBs in neighboring regions.
- The information exchange protects different incumbents whose information is registered at different GLDBs in neighboring regions.
ETSİ EN 303 143 & ETSİ EN 303 144 (2/2)

- The incumbent information in different GLDBs may be different

- A CRS that uses spectrum authorized by one GLDB might interfere with incumbents registered in a different GLDB (known as the victim GLDB)

- Information exchange between GLDBs allows:
  - Discovery of victim GLDBs
  - Exchange of limited incumbent information
  - Exchange of CRS spectrum usage modification information
  - Exchange of CRS registration information to enable service continuity between regions
Coordination among multiple SASs

- SASs can have different incumbent information for different regions.

- The interface defined in EN 303 143 and EN 303 144 can be used as a baseline for the interface between SASs.
• ETSI is working on both uncoordinated and coordinated use of TVWS
  • **Uncoordinated use** of white spaces: “each Cognitive Radio System (CRS) uses independently the available white space resources obtained with the help of the geo-location database.”
  • **Coordinated use** of white spaces: “each CRS uses available white space resources obtained with the help of the geo-location database and with additional knowledge of spectrum usage by its neighbor CRSs obtained from the Spectrum Coordinator (SC). The case in which the SC assigns directly channels to the CRSs is also part of the coordinated use of white spaces.”

• There can be deployments of both uncoordinated and coordinated usage operating at the same time in the same geographical area.
ETSI EN 303 145 & ETSI EN 303 387 (2/3)

- TVWS system functional architecture
  - The TVWS system has three different entities (the CRS, the SC, and the GLDB) and four reference points (A, B, C, and D). Each entity is defined by its functional roles and reference points with other entities.
ETSI EN 303 145 & ETSI EN 303 387 (3/3)

• Coordinated usage of TVWS allows CRSs to operate without causing harmful interference to each other:
  • Channel assignments of the CRSs may be coordinated individually
  • Selected transmit powers may be coordinated individually, in a manner that interference or aggregate interference does not affect incumbents or the CRSs themselves

• Information exchange between SC and CRS allows:
  • Coordination service (information / management service)
  • Registration, authentication and channel access
  • Sensing and measurement
  • Reconfiguration

• The interface defined in EN 303 145 and EN 303 387 can be used as a baseline for the interface between SAS and CBSD.
IEEE 802.19.1 - 2014

- **System architecture**
  - The *coexistence discovery and information server* (CDIS) provides coexistence discovery service to the *coexistence managers* (CM).
  - The CM provides either information or management service to the WSOs it serves.
  - Communication between the CM and the WSOs is performed via their *coexistence*

- **Coexistence services**
  - **Services for WSOs**
    - Within information service the CM provides the WSO information about its potential neighbors including their operating frequencies, potential interference levels, etc.
    - Within the management service the CM provides the WSO reconfiguration requests that create such configuration of this WSO that its operation is improved according to some criteria.
  - **Services for CM**
    - The coexistence discovery service provides coexistence set information to the CM for WSOs served by this CM including inter-CM and intra-CM coexistence discovery

\[\text{Note: Actually interface C is not defined in the current standard}\]
IEEE P802.19.1a (1/2)

- To develop independent radio technology methods for exchanging coexistence information among heterogeneous networks operating under general authorization over IP-based networks
  - The need for efficient spectrum sharing in TV White Space bands, the 5 GHz license-exempt bands and the 3.5 GHz general authorized access bands

- New features might be needed
  - Different system operators/administrators might implement different CDIS and limit information exchange among operators/administrators
  - Current CMs discover each other via a common CDIS
  - Information exchange between system operators/administrators is needed
  - Discover procedure between CMs needs to be changed
IEEE P802.19.1a (2/2)

Press Release from IEEE-SA

IEEE Launches Task Group to Enable Network-Based Coexistence for Geo-Location Devices Operating Under General Authorization

IEEE P802.19.1a Task Group to develop independent radio technology methods for exchanging coexistence information among heterogeneous networks operating under general authorization over IP-based networks

IEEE Standards Association
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PISCATAWAY, N.J., USA, 20 October 2015 – IEEE, the world’s largest professional organization dedicated to advancing technology for humanity, today announced an amendment to IEEE 802.19.1a-2014, which focuses on methods for exchanging coexistence information among heterogeneous networks operating under general authorization. The IEEE P802.19.1a Task Group is addressing the need for efficient spectrum sharing in TV White Space bands, the 5 GHz license-exempt bands and the 2.5 GHz general authorized access bands. The amendment will specify coexistence methods operating over an IP-based network and enable the family of IEEE 802® wireless standards to most effectively utilize these bands in tandem with non-IEEE 802 systems.

With a growing demand to mitigate co-channel interference among wireless networks and devices, including both IEEE 802 and non-IEEE 802 systems operating under general authorization, the IEEE P802.19.1a Task Group aims to define the network-based coexistence information exchange among devices in order to enable comprehensive network-based coexistence management. The proposed standard specifies the following:

- Procedures and protocols for collection and exchanging coexistence information between heterogeneous networks
- Spectrum resource measurements and network performance metrics, such as packet error ratio, delay, etc.
- Information elements and data structures to capture coexistence information

For more information on the IEEE 802.19 Wireless Coexistence Working Group, please visit standards.ieee.org/develop/wg/WG802.19.html.

Standards mapping to SAS architecture

- ETSI EN 303 387
- ETSI EN 303 144
- IEEE P802.19.1a
- ETSI EN 303 144
- ETSI EN 303 387
- Proxy/Network Manager
- SAS1
- SAS2
- FCC Databases (Commercial Users/Licenses)
- ESC (Federal Incumbent Use)
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Summary

• Sony encourages the Commission to use an aggregate measurement of GAA interference to enforce PAL incumbent protection.
  • See test result

• Sony recommends the use of existing standards to coordinate frequency assignment among multiple SASs.
  • ETSI EN 303 143 and ETSI EN 303 144

• Sony suggests the use of existing standards that have been designed to address the “equitable and coordination challenges” in limiting GAA use.
  • ETSI EN 303 145 and ETSI EN 303 387

• SAS standardization should occur at international SDOs.
  • e.g. IEEE, ETSI, etc.
Response to petitions for reconsideration

• Google response to petitions for reconsideration, Oct. 19, 2015:
  III. The Commission’s Approach to Location Accuracy Protects Incumbent Operations While Allowing CBSD Operators Flexibility in Deciding How to Ensure Coexistence with Higher Priority Users.
    C. The Commission Should Continue to Permit Professional Installers to Report CBSD Positioning and Also Allow Devices to Provide Geolocation Accuracy Information to SAS Providers.
    D. SAS Providers Should Not Be Required to Perform Additional, Detailed Validation of Location Data.

• Sony supports the following two recommendations from Google:
  C. Where a device’s location uncertainty exceeds 50 meters, the spectrum available to it should be calculated based on the possibility that the device could be anywhere in the radius of uncertainty.
  D. Section 96.61 establishes reasonable security and verification procedures, and the Commission will evaluate SAS performance during the certification process.

Questions (1/2)

• 96.39 Citizens Broadband Radio Service Device (CBSD) General Requirements
  (b) Operability: All CBSDs must be capable of two-way operation on any authorized frequency assigned by an SAS. Equipment deployed by Grandfathered Wireless Broadband Licensees during their license term will be exempt from this requirement.

  • Is it possible for CBSDs to support only GAA operation?

• 96.43 – Additional Requirements for Category A CBSDs
  (b) When registering with an SAS, Category A CBSDs must transmit all information required under section 96.39. This transmission shall also indicate whether the device will be operated indoors or outdoors.

  • What are the definitions of “indoors” and “outdoors”?
  • How do CBSDs detect “indoors” or “outdoors” operations?
Questions (2/2)

• 96.59 – Frequency Assignment

(a) An SAS must determine the available and appropriate channels/frequencies for CBSDs at any given location using the information supplied by CBSDs, including location, the authorization status and operating parameters of other CBSDs in the surrounding area, information communicated by the ESC, other SASs, and such other information necessary to ensure effective operations of CBSDs consistent with this part. All such determinations and assignments shall be made in a non-discriminatory manner, consistent with this part.

• What does “using the information supplied by CBSDs” mean?
• Are CBSDs required to report operation/usage information to the SAS?