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<b>Title</b>	<b>Procedures for spectrum sharing with specific spectrum users</b>	
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<b>Re:</b>	IEEE 802.16h-06/015r1 – Working Group Review	
<b>Abstract</b>		
<b>Purpose</b>	Provide content for the 802.16h Working Document	
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# Procedures for spectrum sharing with specific spectrum users

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## Introduction

The 802.16h PAR has in scope to provide improved coexistence with primary users, however until now the only primary users ( actually radio applications) addressed are the Radars operating in 5GHz. This document provides a network solution for detecting the existence of other primary or specific radio applications. Note that it is a difference between the spectrum services (a good list is provided in the ITU – Radio Regulations – 2004) and the actual radio applications, which are indicating the actual usage of the spectrum (good coverage in the ECC Decision 25).

*Insert paragraph after*

## Network – based identification of specific spectrum services or applications

### Overview

The method described below allows identifying specific (protected) spectrum users based on their GPS coordinates and the geographic protection area, as defined by the national regulations. Such spectrum users, during their activity period at a specific location, register themselves with a data-base of the National Radio Administration and indicated the range of used frequencies. The National Radio Administration (NRA) uses secure IP communication with the Base Station Identification Servers operating on its territory and provides them with the information needed to protect the operation of these users. However, also the BWA services may be affected by the transmitters of the protected applications. This method includes provisions for evaluating the interference which may be caused by the other applications to the BWA services. The BSIS send the information to Base Stations, which will select accordingly the operating frequencies and the used transmission powers.

### Architecture

The proposed architecture uses different servers for the BWA systems and the systems to be protected, namely the BSIS (Base Station Identification Server) for the BWA systems and the RAIS (Radio Application Identification Server) for the devices providing specific radio applications. Generally the BSIS will be maintained by a Service Provider and the RAIS will be provided by the National Radio Administration. The communication of the BS with the BSIS or of the specific radio devices with the RAIS is secured by VPN or other procedures.

The fig. xx give an example of the proposed architecture. To the BSIS are connected the Base Stations providing BWA services. The RAIS has connections with the Base Stations providing TV applications, Satellite applications, Military applications, Health applications, Security applications, etc. In all these cases secure communication shall be established between the RAIS and the Base Stations or the Service Providers providing these services.

A special class are the Ad-Hoc protected applications, as wireless microphones or TV car transmissions, which are mobile ad-hoc protected applications. In this situation will be established a secure communication between a Laptop with cellular interface or a hand-held device and the RAIS.

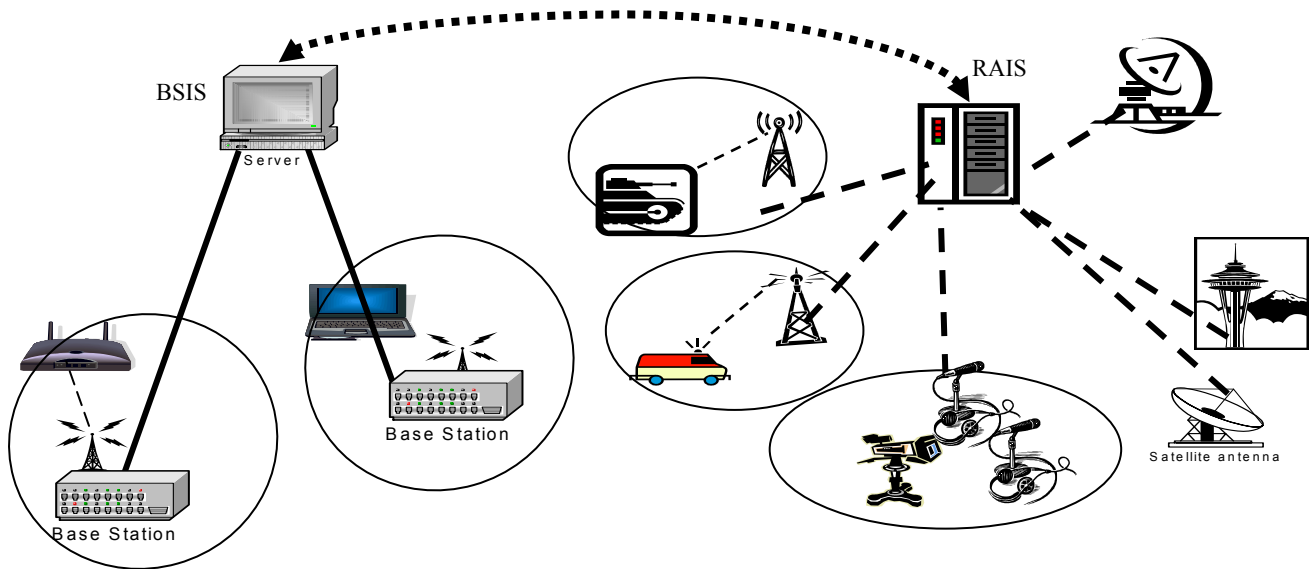


Fig. xx: Architecture for coexistence of BWA and preferred radio applications

## Operation

Any special Radio Application should inform the RAIS about the following:

- Radio application identification
- GPS location of the center of the protection area (not necessarily the GPS location of its operation)
- Required radius of the protection area (optional)
- Tx power
- List including N structures for N channels as described below:
  - Center frequency of the transmit channel i (both FDD and TDD);
  - Channel width of channel i;
  - ACLR of channel i
  - ACLR in the 2<sup>nd</sup> adjacent channel to channel i
  - Center frequency of the receive channel j, if it is used FDD
  - Bandwidth of channel j;
  - Antenna type and direction
  - Date and absolute time of requested operation start

- Duration of operation; for ad-hoc systems the duration will be max. [4 ] hours. In case of longer operation, the spectrum request shall be renewed.

The information should be securely transmitted to the operator-specific BSIS. For military users, etc. may be recommended the protection area, without giving the exact information of their location. The BSISs contain the GPS coordinates of the deployed Base Stations and their cell sizes. A special program will establish which systems shall change the operating frequencies. Special messages are sent to the affected BSs with the request to change the operating frequency (DFS) and eventually with a recommendation for the new operating frequencies. From this moment all the operators in the frequency range will share the available spectrum, following procedures to be agreed or those defined by IEEE 802.16h.

The BSIS will inform the RAIS about the availability of the requested spectrum in the moment that all the affected Base Station entered in stable operation using the new frequencies.

The BSIS communication with RAIS is supported by the Coexistence Protocol messages Regulatory Authority Request and Regulatory Authority Response. The BSIS communication with the Base Stations is supported by the CP messages DFS Request and DFS Response.

**Insert to section 4 - Abbreviations**

- NRA National Radio Administration
- RAIS Radio Application Identification Server
- ACLR Adjacent Channel Leakage Ratio
- CXP Coexistence Protocol

**Content for section 15.5**

**Source BSID**

A 48bit field indicating the ID of the entity sending the CXP message. This entity may be a Base Station or a BSIS/RAIS.

**Destination BSID**

A 48bit field indicating the ID of the entity that is the destination of the CXP message. This entity may be a Base Station or a BSIS/RAIS.

**Insert in Table h10 – CP Message codes:**

Code	CP Message Name	CP Message type	Protocol type	Direction
45	Regulatory Authority Request	CP-REQ	TCP	RAIS ->BSIS
46	Regulatory Authority Response	CP-RSP	TCP	BSIS->RAIS
47	DFS Request	CP-REQ	TCP	BSIS-BS
48	DFS Response	CP-RSP	TCP	BS-BSIS

**Insert in Table h11:**

**Table h11—TLV types for CP payload**

Type	Parameter Description	Length (bits)	Comment
34	Radio Application Identifier (guidance from ECC Decision 25)	64	ASCII coding: AGA - Air Ground Air

		<p> BSS - Broadcasting Satellite Service  CRS - Central Radio Station  DCS 1800 - Digital Communication System  DECT - Digital Enhanced Cordless  Telecommunication System  DME - Distance Measuring Equipment  DSI - Detailed Spectrum Investigation  DVB-T - Terrestrial Digital Video Broadcasting  EESS - Earth Exploration-Satellite Service  EGSM - Extended GSM  ENG - Electronic News Gathering  EPIRB - Emergency Position-Indicating  Radiobeacon  ERMES - European Radio Messaging System  FSS - Fixed Satellite Service  FWA - Fixed Wireless Access  GMDSS - Global Maritime Distress and Safety  System  GNSS - Global Navigation Satellite System  GSM - Global System for Mobile  Communications  HAPS - High Altitude Platform Systems  HDTV - High Definition Television  HIPERLAN - High Performance Radio Local  Area Network  IBCN - Integrated Broadband Communications  Network  ILS - Instrument Landing System  IMT-2000- International Mobile  Telecommunications  ISM - Industrial, Scientific and Medical  applications  JTIDS - Joint Tactical Information Distribution  System  MIDS - Multifunctional Information  Distribution System  MLS - Microwave Landing System  MSI - Maritime Safety Information  MSS - Mobile Satellite Service  MWS - Multimedia Wireless Systems  NGSO - Non-geostationary Satellite Orbit  OB - Outside Broadcasting  OR - Off-Route  PAMR - Public Access Mobile Radio (PMR)  PMR - Professional Mobile Radio, Privat  Mobile Radio  R - Route  RA - Radio Astronomy  SAB - Services Ancillary to Broadcasting  SAP - Services Ancillary to Programming  S-PCS - Satellite Personal Communication  System  SRD - Short Range Device  TETRA - Terrestrial Trunked Radio  RFID - Radio Frequency Identification systems  RLAN - Radio Local Area Network  RTTT - Road Transport &amp; Traffic Telematics  SNG - Satellite News Gathering </p>
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			SRD - Short Range Devices SSR - Secondary Surveillance Radar T-DAB - Terrestrial Digital Audio Broadcasting TACAN - Tactical Air Navigation System VLBI - Very Long Baseline Interferometry (Radio Astronomy) VOR - VHF Omni-directional Range VTS - Vessel Traffic System (radar) VSAT - Very Small Aperture Terminal
35	Radius of protection area	16	In meters
36	Date	16	Format: day (8 bits):month (4 bits):year(8bits) – decimal digits
37	Absolute time	24	Format: hour(8bits): minutes (8 bits): seconds (8 bits) – decimal digits
38	Antenna direction	16	In degrees, clock-wise, reference Nord (180 for Sud)
39	Absolute frequency	24	In kHz, decimal ASCII notation
40	Long duration	24	In minutes, hexa number
41	ACLR	8	Ratio of the transmitter power to the leakage power in the adjacent channel, in dB
42	Number of structures	8	Number of structures to be listed in continuations
43	Number of TLVs in a structure	8	Used in conjunction with the Number of structures

*Insert messages:*

#### 15.5.2.45 Regulatory Authority Request Message

The Regulatory Authority (RAIS) communicates to BSIS which are the operating parameters of the service to be protected, the date and time requested for protection, the area of protection, etc. The message is sent separately for each application to be protected.

Code: 45

Attributes are show in Table hxy

**Table hxy Regulatory Authority Request Message attributes**

Attribute	Contents
Radio Application identifier	Radio Application identifier
Tx power	Tx power (eirp) of the application to be protected
Antenna type	Of the application to be protected, same for Tx and Rx
Antenna gain	Of the application to be protected, same for Tx and Rx
Antenna direction	Of the application to be protected, same for Tx and Rx
Latitude	The latitude information of the center of the area to be protected.
Longitude	The longitude information of the center of the area to be protected.
Altitude	The altitude information of the center of the area to be protected.
Maximum coverage	Required radius of the protection area (optional) for a transmitter power of 1W eirp
Number of structures	Number of elements of the following seven fields structures
Number of TLVs in a structure	7

Absolute frequency of the transmit channel	Center frequency of Tx operation of the protected application
Channel width of the transmit channel	Channel width of operation of the protected application
Absolute frequency of the receive channel	Center frequency of Rx operation of the protected application
Tx power	Maximum transmitted power in the channel
ACLR	ACLR of the first adjacent channel, for the protected application
ACLR	ACLR of the second adjacent channel, for the protected application
Channel width of the receive channel	Channel width of operation of the protected application
Date	Date of the requested operation start
Absolute time	Hour/min/sec of the requested operation start
Long duration	Duration of the requested operation

#### 15.5.2.46 Regulatory Authority Response Message

The BSIS responds to the RAIS to Regulatory Authority Request with a Regulatory Authority Response message.

Code: 46

The messages specify, as confirmation, the date and time at which the requested protection will take place.

The attributes are shown in Table hxz.

**Table hxz Regulatory Authority Response attributes**

Attribute	Contents
Radio Application identifier	Radio Application identifier
Date	Date of the requested operation start
Absolute time	Hour/min/sec of the requested operation start
Long duration	Duration of the requested operation

#### 15.5.2.47 DFS Request Message

The BSIS communicates to BS which are the operating parameters of the application to be protected, the date and time requested for protection, the area of protection, etc. The message is sent separately for each application to be protected.

Code: 47

Attributes are show in Table hxt. The BSIS can adapt the parameters received in the Regulatory Authority Request message to the BS specific radio capability (ACLR, selectivity, etc)

**Table hxt DFS Request Message attributes**

Attribute	Contents
Radio Application identifier	Radio Application identifier
Tx power	Tx power (eirp) of the application to be protected
Antenna type	Of the application to be protected, same for Tx and Rx

Antenna gain	Of the application to be protected, same for Tx and Rx
Antenna direction	Of the application to be protected, same for Tx and Rx
Latitude	The latitude information of the center of the area to be protected.
Longitude	The longitude information of the center of the area to be protected.
Altitude	The altitude information of the center of the area to be protected.
Maximum coverage	Required radius of the protection area (optional) for a transmitter power of 1W eirp
Number of structures	Number of elements of the following seven fields structures
Number of TLVs in a structure	7
Absolute frequency of the transmit channel	Center frequency of Tx operation of the protected application
Channel width of the transmit channel	Channel width of operation of the protected application
Absolute frequency of the receive channel	Center frequency of Rx operation of the protected application
Tx power	Maximum transmitted power in the channel
ACLR	ACLR of the first adjacent channel, for the protected application
ACLR	ACLR of the second adjacent channel, for the protected application
Channel width of the receive channel	Channel width of operation of the protected application
Date	Date of the requested operation start
Absolute time	Hour/min/sec of the requested operation start
Long duration	Duration of the requested operation

### 15.5.2.48 DFS Response Message

The BS responds to the BSIS to DFS Request with a DFS Response message.

Code: 48

The messages specify, as confirmation, the date and time at which the requested protection will take place.

The attributes are shown in Table hxu

**Table hxu DFS Response attributes**

Attribute	Contents
Radio Application identifier	Radio Application identifier
Date	Date of the requested operation start
Absolute time	Hour/min/sec of the requested operation start
Long duration	Duration of the requested operation