Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Procedures for spectrum sharing with specific spectrum users**
Date Submitted	~~16 Sept 2006~~ 2006-09-28
Source(s)	Mariana Goldhamer Alvarion Tel Aviv, 21 HaBarzel Street Israel Voice: +972 544 22 55 48 mailto:mariana.goldhamer@alvarion.com
Re:	IEEE 802.16h-06/015r1 – Working Group Review
Abstract	
Purpose	Provide content for the 802.16h Working Document
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.
Patent Policy and Procedures	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.

Procedures for spectrum sharing with specific spectrum users

Mariana Goldhamer
Alvarion

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.

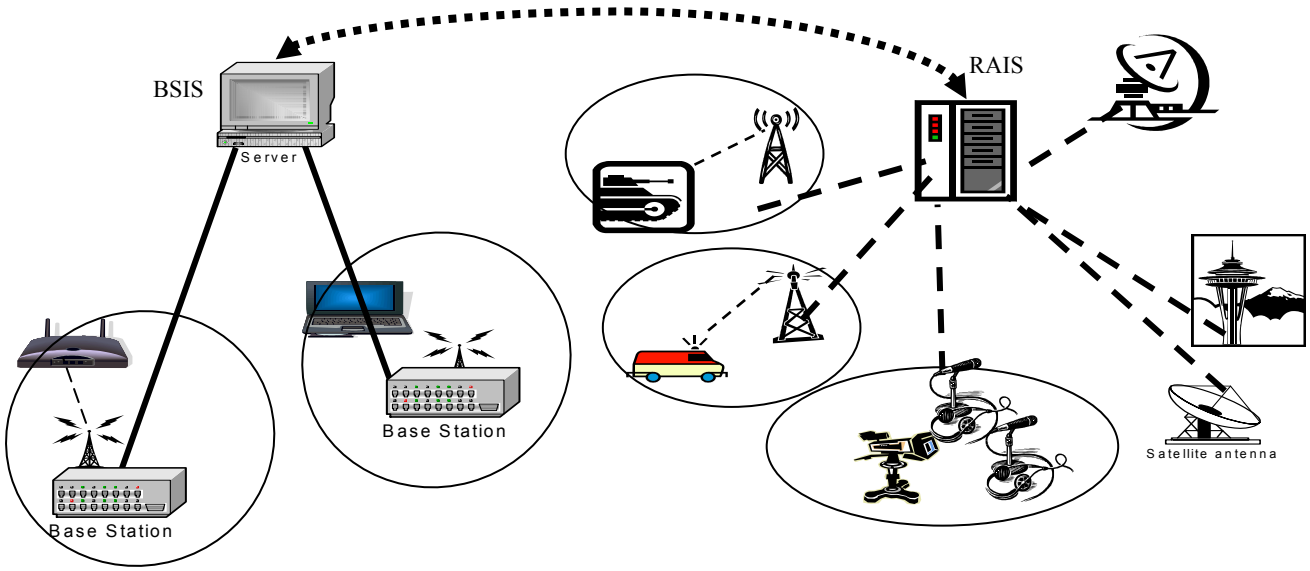

Fig. xx: Architecture for coexistence of BWA and preferred radio applications

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 2nd adjacent channel to channel i
- Center frequency of the receive channel j, if 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 (FREQ_AVOIDANCE) 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 FREQ_AVOIDANCE Request and FREQ_AVOIDANCE 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	FREQ_AVOIDANCE Request	CP-REQ	TCP	BSIS-BS
48	FREQ_AVOIDANCE Response	CP-RSP	TCP	BS-BSIS

Insert in Table h11:

Table h11—TLV types for CP payload

Type	Parameter Description	Length (bits)	Comment

50	Radio Application Identifier (guidance from ECC Decision 25)	64	ASCII coding: AGA - Air Ground Air 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 & Traffic Telematics SNG - Satellite News Gathering 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
51	Radius of protection area	16	In meters
52	Date	16	Format: day (8 bits):month (4 bits):year(8bits) – decimal digits
53	Absolute time	24	Format: hour(8bits): minutes (8 bits): seconds (8 bits) – decimal digits
54	Antenna direction	16	In degrees, clock-wise, reference North (180 for South)
55	Absolute frequency	24	In kHz, decimal ASCII notation
56	Long duration	24	In minutes, hex number
57	ACLR	8	Ratio of the transmitter power to the leakage power in the adjacent channel, in dB
58	Number of structures	8	Number of structures to be listed in continuations
59	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 FREQ_AVOIDANCE 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 FREQ_AVOIDANCE 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 FREQ_AVOIDANCE Response Message

The BS responds to the BSIS to FREQ_AVOIDANCE Request with a FREQ_AVOIDANCE 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 FREQ_AVOIDANCE 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