IEEE P802.19
Wireless Coexistence

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| System Design Document |
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| Author(s): |
| Name | Company | Address | Phone | email |
| Mika Kasslin | Nokia Research Center | Itämerenkatu 11-13, 00180 Helsinki, Finland | +358-50-4836294 | mika.kasslin@nokia.com |
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Abstract

This document is a system design document of 802.19 Task Group 1. The document contains system requirements, terminology, architecture and draft outline of the specification. The document describes also in which clause order proposals are presented and voted in the task group as per the draft development process (19-10/0029).

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# Terminology

# System Requirements

This section provides requirements for 802.19.1 system. There are 10 system requirements (R1-R10) that can be grouped into three different categories: General, Discovery, Communication and Algorithm. On the other hand, the requirements can be also grouped from the view point of whether they relate to the system’s internal operation or interactions with world outside the system. Both these aspects are illustrated in Figure 1 below that provides an overview of the system requirements.

Figure 1. Overview of system requirements

## R1

802.19.1 system shall enable discovery for 802.19.1 compliant TVBD networks and devices.

Explanatory notes:

* 802.19.1 system is required to identify potential 802.19.1 compliant TVBD networks or devices that need to coexist as one crucial step in order to achieve coexistence
* The term discovery should be understood as determining the presence of 802.19.1 compliant TVBD network or device and identifying its attribute such as ID

## R2

802.19.1 system shall be able to obtain information required for TVWS coexistence.

Explanatory notes:

* 802.19.1 system obtains this information from outside world, for example, from TVWS database, from 802.19.1 compliant TVBD networks/devices, etc.

## R3

802.19.1 system shall have means to exchange obtained information.

Explanatory notes:

* Without constraining the mechanism of communication, this requirement puts a high level requirement to provide means of exchanging information necessary for TVWS coexistence.

## R4

802.19.1 system shall be able to provide reconfiguration requests and/or commands and corresponding control information to 802.19.1 compliant TVBD networks and devices to implement TVWS coexistence decisions.

Explanatory notes:

* Examples of reconfiguration requests/commands are: to change center frequency, to adjust transmit power, possibly affect time scheduling, etc.
* Reconfiguration requests and/or commands and corresponding control information are provided from 802.19.1 system to TVBD networks or devices, for example
	+ From a part of 802.19.1 system deployed in TVBD device to device management system via a SAP internal for the TVBD device
	+ From a part of 802.19.1 system deployed in TVBD network (e.g. in network management system) to radio nodes of TVBD network, e.g. base stations, access points, etc.

## R5

802.19.1 system shall be able to update information required for TVWS coexistence.

Explanatory notes:

* This requirement highlights the capacity to update/refresh coexistence related information, such as location information of TVBD networks and devices, spectrum utilization by TVBD networks and devices.

## R6

802.19.1 system should be able to analyze obtained information.

Explanatory notes:

* An example of analysis is the processing of raw data to generate a set of new data for assisting decision making.

## R7

802.19.1 system shall enable TVWS coexistence decision making.

Explanatory notes:

* As an example of decision making, deciding on which actions should be taken by TVBD networks/devices to solve coexistence problem

## R8

802.19.1 system shall be able to support different topologies of decision making for TVWS coexistence (e.g. centralized, distributed and autonomous).

Explanatory notes:

* This requirement underlines the possibility of having various approaches to implement decision making in coexistence scenarios.
* It also underlines that 802.19.1 system must be capable to support these different approaches of decision making for coexistence.

## R9

802.19.1 system shall support appropriate security mechanisms. This shall include user/device authentication, integrity and confidentiality of open exchanges, and data privacy and policy correctness attestation and enforcement.

Explanatory notes:

* 802.19.1 system shall be able to authenticate, provide integrity and/or confidentiality to all entities involved in 802.19.1 data exchange
* 802.19.1 system shall support privacy of sensitive data, and secure means to store and process such data while it resides in 802.19.1 entities
	+ Sensitive data may be geolocation, user and device credentials, and time alignment
* 802.19.1 system shall enable enforcement of coexistence policies for the 802.19.1 compliant TVBD networks or devices
	+ This includes secure means to detect and/or to remediate compromised behavior

## R10

802.19.1 system shall utilize a set of mechanisms to achieve coexistence of TVBD networks and devices.

# System Architecture

802.19.1 system architecture has three logical entities and six logical interfaces. 802.19.1 logical entity is defined by its functional role(s) and interfaces with other 802.19.1 logical entities and with external elements.

The three logical entities are:

* Coexistence Manager (CM)
* Coexistence Enabler (CE)
* Coexistence Discovery and Information Server (CDIS)

The six logical interfaces are:

* Interface A
* Interface B1
* Interface B2
* Interface B3
* Interface C
* Interface D

Additionally, three external elements are assumed from the world outside the 802.19.1 system:

* TVWS database
* TVBD network or device
* Operator Management Entity (OME)

Figure 2. 802.19.1 system architecture

## Logical Entities

### Coexistence Enabler (CE)

Functions related to the functional role of the entity are:

* Request and obtain information, required for coexistence, from TVBD network or device
* Translate reconfiguration requests/commands and control information received from the CM into IVBD-specific reconfiguration requests/commands and send them to the TVBD network or device

### Coexistence Manager (CM)

Functions related to the functional role of the entity are:

* Discovery of other CMs
	+ To solve coexistence problems between TVBD networks they serve
* Coexistence decision making
	+ This includes generating and providing corresponding coexistence requests/commands and control information to CE(s)
* Support exchange of information required for coexistence among CMs
	+ This may include hierarchical and/or peer-to-peer decision making capabilities in CM deployments
* Assist network operators in management related to TVWS coexistence

### Coexistence Discovery and Information Server (CDIS)

Functions related to the functional role of the entity are:

* Support discovery of CMs
	+ Facilitates opening interfaces between CMs
* Collect, aggregate, and provide information facilitating coexistence
	+ This includes data storage, data processing, etc.

## Logical Interfaces

The six logical interfaces in 802.19.1 system architecture can be split into three groups:

* Interfaces between 802.19.1 entities
	+ Interface B1
	+ Interface B2
	+ Interface B3
* Interfaces between an 802.19.1 entity and TVBD network/device
	+ Interface A
* Interfaces between 802.19.1 entities and TVWD database or OME
	+ Interface C
	+ Interface D

Different interfaces in each group are distinguished by their usage, types of information exchanged, and underlying protocols.

### Interface A

Interface between CE and TVBD network or device

* From TVBD network or device
	+ Information required for coexistence
	+ Configuration/information requests for coexistence
	+ Configuration/measurement/information responses for coexistence
	+ And other information as needed
* From CE to TVBD network or device
	+ Reconfiguration requests/commands and control information (corresponding to coexistence requests/commands and control information received from CM)
	+ Requests/commands related to control of measurements performed by TVBD network or device
	+ And other information as needed

### Interface B1

Interface between CE and CM

* From CE to CM
	+ Information required for coexistence (information obtained from TVBD network or device)
	+ And other information as needed
* From CM to CE
	+ Coexistence requests/commands and control information
	+ And other information as needed

### Interface B2

Interface between CM and CDIS

* From CM to CDIS
	+ Information required for discovery (obtained by this CM)
	+ Information required for coexistence (obtained by this CM)
	+ And other information as needed
* From CDIS to CM
	+ Information required for discovery (obtained by other CMs)
	+ Information required for coexistence (obtained by other CMs)
	+ And other information as needed

### Interface B3

Interface between CM and CM

* From CM to CM
	+ Information and message required for discovery and coexistence
	+ And other information as needed

### Interface C

Interface between CM/CDIS and TVWS database

* From TVWS database to CM/CDIS
	+ Information required for coexistence (information on available TV channels)
	+ And other information as needed

### Interface D

Interface between CM and OME

* From OME to CM
	+ Network operator related information e.g. spectrum policy/limitations concerning operator networks
	+ And other information as needed

# Outline of the Draft

# Clause order for draft development process