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**Reconfigurable Radio Systems (RRS);
Signalling Protocols and information exchange
for Coordinated use of TV White Spaces;
Interface between Cognitive Radio System (CRS)
and Spectrum Coordinator (SC)**

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Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Reconfigurable Radio Systems (RRS).

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Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

The present document provides the parameters and procedures for such information exchange between Cognitive Radio System (CRS) and Spectrum Coordinator (SC) in Coordinated use of TV White Spaces. This work is based on the system architecture and high level procedures for coordinated and uncoordinated use of TV White Spaces as defined in ETSI EN 303 145 [i.1].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI EN 303 145: "Reconfigurable Radio Systems (RRS); System Architecture and High Level Procedures for Coordinated and Uncoordinated Use of TV White Spaces".
- [i.2] ETSI EN 301 598: "White Space Devices (WSD); Wireless Access Systems operating in the 470 MHz to 790 MHz TV broadcast band; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".
- [i.3] IETF PAWS: "Protocol to Access White-Space (PAWS) Databases", (draft-ietf-paws-protocol-20).
- [i.4] ECC Report 159 - January 2011: "Technical and operational requirements for the possible operation of cognitive radio systems in the "white spaces" of the frequency band 470-790 MHz".
- [i.5] ISO/IEC 10731 (1994): "Information Technology - Open Systems Interconnection - Basic Reference Model: Conventions for the Definition of OSI Services".
- [i.6] Recommendation ITU-T X.680: "Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI EN 303 145 [i.1], ECC Report 159 [i.4] and the following apply:

channel usage parameters: parameters sent by a CRS to inform the spectrum coordinator (SC) / Geo-location database (GLDB) of the actual radio resources that will be used by CRSs

Cognitive Radio System (CRS): white spaces device (WSD) or network of WSDs (i.e. a master WSD and some slave WSDs)

device parameters: parameters that specify the technical characteristics of an individual CRS, and its location

Geo-location Database (GLDB): entity whose operation is mandated or authorized by a regulatory authority

NOTE: It also provides a WSD in a CRS with location specific information on the available frequencies and associated maximum EIRP values that the WSD is permitted to use which allow for protection of the incumbent service and are derived from information provided by the WSD and the minimum required Adjacent Channel Leakage Ratio (ACLR) of the WSD. The GLDB consists of database and geo-location functions.

operational parameters: transmission parameters communicated from SC/GLDB to a CRS to allow the CRS to operate as required

Spectrum Coordinator (SC): entity that coordinates spectrum usage of CRS based on the information obtained from geo-location database as well as supplemental spectrum usage data from different CRSs using its service

White Space Device (WSD): WSD controlled by a SC/GLDB and which operates in white spaces

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity
ASN	Abstract SyntaxNotation
CRS	Cognitive Radio System
EIRP	Effective Isotropic Radiated Power
GLDB	Geo-location Database
ID	IDentifier
LTE	Long Term Evolution
PHY	Physical layer
SAP	Service Access Point
SC	Spectrum Coordinator
SCGLDB	Spectrum Coordinator and Geo-location Database
SC-SAP	Spectrum Coordinator Service Access Point
TV	TeleVision
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
WSD	White Space Device

4 Service access points

4.1 General

This following clauses describe the primitives related to the Service Access Points as identified in ETSI EN 303 145 [i.1] and also shown in Figure 4.1 below.

Clause 4.2 describes the primitives associated to the control function (C-SAP in Figure 4.1).

Clause 4.3 describes the primitives associated to the spectrum coordination function (SC-SAP in Figure 4.1).

Clause 4.4 describes the primitives associated to the communication function (Com-SAP in Figure 4.1).

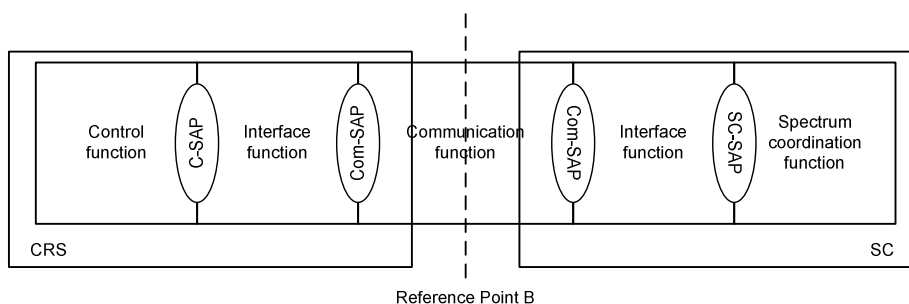


Figure 4.1: Reference model for the information exchange between a CRS and a SC (Reference point B) [i.1]

4.2 Control Service Access Point (C-SAP)

4.2.1 Initialization

The initialization service provides a set of primitives or method through which the control function provides the device parameters of a CRS and obtains initialization of a CRS.

Initialization.request

Function

This primitive is used by the control function to request initialization of a CRS.

Semantics of the service primitive

```
Initialization.request(
    initializationID,
    deviceDescriptor,
    geolocation,
    deviceCapabilities
)
```

Parameters

Name	Type	Description
initializationID	TransactionID	initializationID uniquely identifies one transaction of requesting initialization for a CRS.
deviceDescriptor	DeviceDescriptor	Device descriptor describes the physical profile of a CRS.
geolocation	Geolocation	Geo-location information of CRS.
deviceCapabilities	DeviceCapabilities	Device capabilities provide the additional information needed for initialization.

When used

This primitive shall be used by the control function when a CRS needs to provide CRS information as described by the physical profile, geo-location and device capabilities of CRS.

Effect of receipt

The interface function receives the request for device parameters and geo-location information of a CRS.

*Initialization.response***Function**

This primitive is used by the interface function to provide the results of initialization to the control function as a response to the *Initialization.request* primitive.

Semantics of the service primitive

```
Initialization.response(
    initializationID,
    rulesetInformation,
    scgldbInformation
)
```

Parameters

Name	Type	Description
initializationID	TransactionID	initializationID uniquely identifies one transaction of requesting initialization for a CRS.
rulesetInformation	RulesetInformation	Ruleset Information contains parameters for the ruleset of a regulatory domain described in [i.3].
scgldbInformation	SCGLDBInformation	SCGLDB Information contains list of name and URI of SC and GLDB.

When used

This primitive shall be used by the interface function when it receives the request of initialization.

Effect of receipt

The control function receives the response (e.g. ruleset information of a regulatory domain, the list of name and URI of SC and GLDB, etc.) of the initialization request of a CRS.

4.2.2 Subscription

The subscription service provides a set of primitives or method through which the control function provides the subscription request of a CRS and obtains subscription of a CRS.

*Service_Subscription.request***Function**

This primitive is used by the control function to request subscription of a CRS.

Semantics of the service primitive

```
Service_Subscription.request(
    subscriptionID,
    subscriptionRequest
)
```

Parameters

Name	Type	Description
subscriptionID	TransactionID	subscriptionID uniquely identifies one transaction of requesting subscription for a CRS.
subscriptionRequest	SubscriptionRequest	CRS subscription to coordination service (management or information).

When used

This primitive shall be used by the control function when a CRS needs to request its subscription as described by the subscription request.

Effect of receipt

The interface function receives the request for subscription of a CRS.

Service_Subscription.response

Function

This primitive is used by the interface function to provide the results of the subscription to the control function as a response to the *Service_Subscription.request* primitive.

Semantics of the service primitive

```
Service_Subscription.response(
    subscriptionID,
    status
)
```

Parameters

Name	Type	Description
subscriptionID	TransactionID	subscriptionID uniquely identifies one transaction of requesting subscription for a CRS.
status	Status	Status of subscription.

When used

This primitive shall be used by the interface function when it receives the status of a subscription.

Effect of receipt

The control function receives the results of subscription of a CRS.

4.2.3 Subscription update

The subscription update service provides a set of primitives or method through which the control function provides the subscription update request of a CRS and obtains subscription update of a CRS.

Service_Subscription_Update.request

Function

This primitive is used by the control function to request service subscription update of a CRS.

Semantics of the service primitive

```
Service_Subscription_Update.request(
    subscriptionUpdateID,
    subscriptionRequest
)
```

Parameters

Name	Type	Description
subscriptionUpdateID	TransactionID	subscriptionUpdateID uniquely identifies one transaction of updating service subscription for a CRS.
subscriptionRequest	SubscriptionRequest	CRS subscription to coordination service (management, information or no service).

When used

This primitive shall be used by the control function when a CRS needs to request its subscription update as described by the subscription update request.

Effect of receipt

The interface function receives the request for subscription update of a CRS.

Service_Subscription_Update.response

Function

This primitive is used by the interface function to provide the results of the subscription update to the control function as a response to the *Service_Subscription_Update.request* primitive.

Semantics of the service primitive

```
Service_Subscription_Update.response(
    subscriptionUpdateID,
    status
)
```

Parameters

Name	Type	Description
subscriptionUpdateID	TransactionID	subscriptionUpdateID uniquely identifies one transaction of updating service subscription for a CRS.
status	Status	Status of the subscription update.

When used

This primitive shall be used by the interface function when it receives the status of the subscription update.

Effect of receipt

The control function receives the result of the subscription update of a CRS.

4.2.4 Subscription change

The subscription change service provides a set of primitives or method through which the interface function provides the subscription change of a CRS.

Service_Subscription_Change.request

Function

This primitive is used by the interface function to request a subscription change of a CRS.

Semantics of the service primitive

```
Service_Subscription_Change.request(
    subscriptionChangeID,
    subscriptionChangeRequest
)
```

Parameters

Name	Type	Description
subscriptionChangeID	TransactionID	subscriptionChangeID uniquely identifies one transaction of requesting subscription change for a CRS.
subscriptionChangeRequest	SubscriptionChangeRequest	CRS subscription to coordination service (management or information).

When used

This primitive shall be used by the interface function when it needs to request the subscription change for a CRS as described by the subscription change request.

Effect of receipt

The control function receives the request for subscription change of a CRS.

Service_Subscription_Change.response

Function

This primitive is used by the control function to provide the result of service a subscription change to the interface function as a response to the *Service_Subscription_Change.request* primitive.

Semantics of the service primitive

```
Service_Subscription_Change.response(
    subscriptionChangeID,
    status
)
```

Parameters

Name	Type	Description
subscriptionChangeID	TransactionID	subscriptionChangeID uniquely identifies one transaction of requesting subscription change for a CRS.
status	Status	Status of subscription change.

When used

This primitive shall be used by the control function to generate a response to the subscription change request.

Effect of receipt

The interface function receives the result of subscription change request of a CRS.

4.2.5 Registration

The registration service provides a set of primitives or method through which the control function provides the device parameters and geo-location information of a CRS and obtains the registration of a CRS.

Network_Registration.request

Function

This primitive is used by the control function to request registration of a CRS.

Semantics of the service primitive

```
Network_Registration.request(
    registrationID,
    deviceDescriptor,
    geolocation,
    deviceCharacteristics
)
```

Parameters

Name	Type	Description
registrationID	TransactionID	registrationID uniquely identifies one transaction of requesting registration for a CRS.
deviceDescriptor	DeviceDescriptor	Device descriptor describes the physical profile of a CRS.
geolocation	Geolocation	Geo-location information of CRS.
deviceCharacteristics	DeviceCharacteristics	Device characteristics provide CRS's device information (e.g. antenna, installation, etc.).

When used

This primitive shall be used by the control function when a CRS needs to request its registration as described by the physical profile, geo-location and characteristics of CRS.

Effect of receipt

The interface function receives the request for registration of a CRS.

Network_Registration.response

Function

This primitive is used by the interface function to provide the results of registration of a CRS to the control function as a response to the *Network_Registration.request* primitive.

Semantics of the service primitive

```
Network_Registration.response(
    registrationID,
    rulesetInformation,
    scgldbInformation
)
```

Parameters

Name	Type	Description
registrationID	TransactionID	registrationID uniquely identifies one transaction of requesting registration for a CRS.
rulesetInformation	RulesetInformation	Ruleset Information contains parameters for the ruleset of a regulatory domain described in [i.3].
scgldbInformation	SCGLDBInformation	SCGLDB Information contains list of name and URI of SC and GLDB.

When used

This primitive shall be used by the interface function when it receives the status of registration.

Effect of receipt

The control function receives the result (e.g. ruleset information of a regulatory domain, the list of name and URI of SC and GLDB, etc.) of registration of a CRS.

4.2.6 Registration update

The CRS registration update service provides a set of primitives or method through which the control function provides the device parameters and geo-location information of a CRS and obtains the registration of a CRS.

Network_Registration_Update.request

Function

This primitive is used by the control function to request registration update of a CRS.

Semantics of the service primitive

```
Network_Registration_Update.request(
    registrationUpdateID,
    deviceDescriptor,
    geolocation,
    deviceCharacteristics
)
```

Parameters

Name	Type	Description
registrationUpdateID	TransactionID	registrationUpdateID uniquely identifies one transaction of requesting registration update for a CRS.
deviceDescriptor	DeviceDescriptor	Device descriptor describes the physical profile of a CRS.
geolocation	Geolocation	Geo-location information of CRS.
deviceCharacteristics	DeviceCharacteristics	Device characteristics provide CRS's device information (e.g. antenna, installation, etc.).

When used

This primitive shall be used by the control function when a CRS needs to request its registration as described by the physical profile, geo-location and characteristics of CRS.

Effect of receipt

The interface function receives the request for registration of a CRS.

Network_Registration_Update.response

Function

This primitive is used by the interface function to provide the results of registration update of a CRS to the control function as a response to the *Network_Registration_Update.request* primitive.

Semantics of the service primitive

Network_Registration_Update.response(

registrationUpdateID
rulesetInformation
scgldbInformation
)

Parameters

Name	Type	Description
registrationUpdateID	TransactionID	registrationUpdateID uniquely identifies one transaction of requesting registration update for a CRS.
rulesetInformation	RulesetInformation	Ruleset Information contains parameters for the ruleset of a regulatory domain described in [i.3].
scgldbInformation	SCGLDBInformatoin	SCGLDB Information contains list of name and URI of SC and GLDB.

When used

This primitive shall be used by the interface function when it receives the status of registration update.

Effect of receipt

The control function receives the result of registration update of a CRS.

4.2.7 Requesting channel access

The requesting channel access service provides a set of primitives or method through which the control function provides the device parameters and geo-location information of a CRS and requests spectrum usage for a CRS.

Coordinated_Channel.request

Function

This primitive is used by the control function to request spectrum usage for a CRS.