# IEEE P802.19

Wireless Coexistence Working Group

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| Re: | |
| Abstract | This file contains proposal to System Description and Reference Model clauses in response to Call for Proposals (P802.19-10/57r2). It uses IEEE draft standard template. |
| Purpose | To propose text for System Description and Reference Model clauses of P802.19.1 draft standard |
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# IEEE P802.19™/D0.0
# Draft Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 19: TV White Space Coexistence Methods

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# Contents

# Draft Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 19: TV White Space Coexistence Methods

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## 1. Overview

### 1.1 Scope

The standard specifies radio technology independent methods for coexistence among dissimilar or independently operated TV Band Device (TVBD) networks and dissimilar TV Band Devices

### 1.2 Purpose

The purpose of the standard is to enable the family of IEEE 802 Wireless Standards to most effectively use TV White Space by providing standard coexistence methods among dissimilar or independently operated

TVBD networks and dissimilar TVBDs. This standard addresses coexistence for IEEE 802 networks and devices and will also be useful for non IEEE 802 networks and TVBDs.

# 2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

# 3. Definitions, Abbreviations and Acronyms

## 3.1 Definitions

For the purposes of this draft standard, the following terms and definitions apply. *The Authoritative Dictionary of IEEE Standards, Seventh Edition,* should be referenced for terms not defined in this clause.

## 3.2 Abbreviations and Acronyms

# 4. System Description

## 4.1 System Architecture

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

Three logical entities are:

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

Five logical interfaces are:

— Interface A
— Interface B1
— Interface B2
— Interface B3

— Interface C.

The 802.19.1 system interacts with two external elements:

— TVWS database
— TVBD network or device.

Figure 1 shows 802.19.1 system architecture.

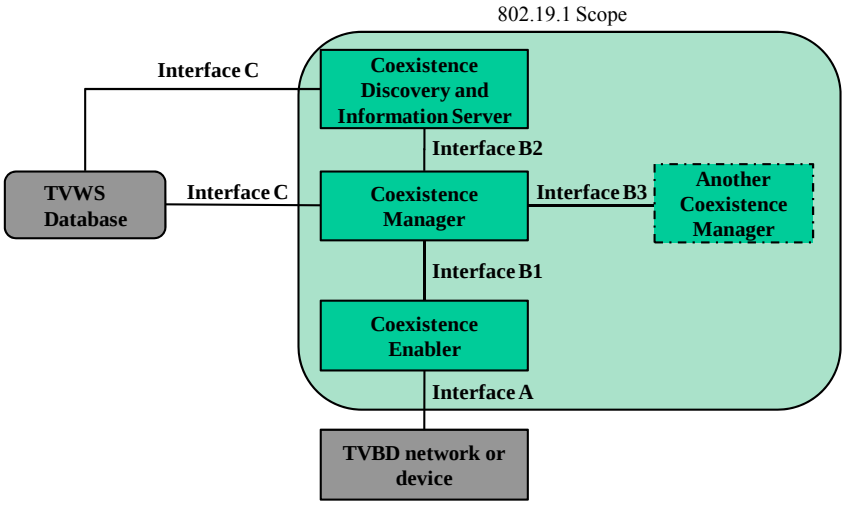


**Figure 1 System Architecture**

## 4.2 Logical entities

### 4.2.1 Coexistence Enabler

Coexistence Enabler has the following functional roles:

— Obtain information required for coexistence from TVBD network or device and provide it to CM
— Provide information required for coexistence (generated by IEEE 802.19.1 system or obtained by IEEE 802.19.1 system from external entities) to TVBD network or device
— Facilitate sharing of information required for coexistence among TVBD networks or devices via the IEEE 802.19.1 system
— Request TVBD network or device to perform measurements required for coexistence by itself or according to commands received from CM
— Obtain measurement results required for coexistence from TVBD network or device and provide them to CM
— Request TVBD network or device to perform reconfiguration required for coexistence according to commands received from CM
— Receive information about observed or predicted events related to coexistence from TVBD network or device and provide it to CM

— Provide information about observed or predicted events related to coexistence (generated by IEEE 802.19.1 system) to TVBD network or device.

#### 4.2.2 Coexistence Manager

Coexistence Manager has the following functional roles:

— Coexistence decision making
— Discovery of other CMs
— Support exchange of information required for coexistence among CMs
— Support sharing of information required for coexistence among TVBD networks or devices.

#### 4.2.3 Coexistence Discovery and Information Server

Coexistence Discovery and Information Server has the following functional roles:

— Support discovery of CMs
— Collect, store, aggregate, and provide information required for coexistence
— Support exchange of information required for coexistence among CMs
— Support sharing of information required for coexistence among TVBD networks or devices.

### 4.3 Logical Interfaces

Five logical interfaces defined in the 802.19.1 system architecture can be split into three groups:

— Interfaces between 802.19.1 entities:
  — Interface B1
  — Interface B2
  — Interface B3
— Interface between an 802.19.1 entity and TVBD network/device:
  — Interface A
— Interface between 802.19.1 entities and TVWD database:
  — Interface C.

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

#### 4.3.1 Interface A

Interface A between CE and TVBD network or device is used to transmit the following:

— From TVBD network or device to CE:
  — Information required for coexistence
  — Measurement results required for coexistence
  — Information about observed or predicted events related to coexistence
— From CE to TVBD network or device:

- Information required for coexistence (generated by IEEE 802.19.1 system or obtained by IEEE 802.19.1 system from external entities)
- Measurement requests required for coexistence
- Reconfiguration requests required for coexistence
- Information about observed or predicted events related to coexistence (generated by IEEE 802.19.1 system).

#### 4.3.2 Interface B1

Interface B1 between CE and CM is used to transmit the following:

- From CE to CM:
  - Information required for coexistence
- From CM to CE:
  - Reconfiguration commands required for coexistence.

#### 4.3.3 Interface B2

Interface B2 between CM and CDIS is used to transmit the following:

- From CM to CDIS:
  - Information required for discovery
  - Information required for coexistence
- From CDIS to CM:
  - Information required for discovery
  - Information required for coexistence.

#### 4.3.4 Interface B3

Interface B3 between different CMs is used to transmit the following:

- Information required for coexistence.

#### 4.3.5 Interface C

Interface C between CM and TVWS database or between CDIS and TVWS database is used to transmit the following:

- From TVWS database:
  - Information required for coexistence.

# 5. IEEE 802.19.1 reference model

## 5.1 General description

Figure 2 illustrates reference model of Coexistence Enabler.

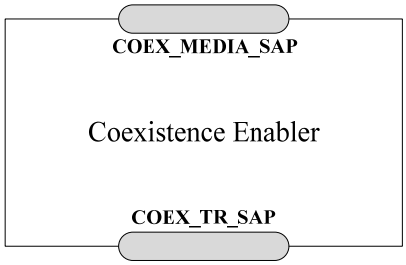


**Figure 2 Reference model of Coexistence Enabler**

Coexistence Enabler has two service access points:

— Coexistence Media SAP (COEX_MEDIA_SAP)
— Coexistence Transport SAP (COEX_TR_SAP).

Figure 3 illustrates reference model of Coexistence Manager and Coexistence Discovery and Information Server.

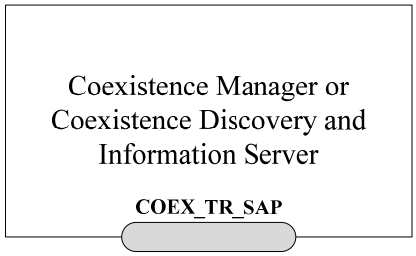


**Figure 3 Reference model of Coexistence Manager and Coexistence Discovery and Information Server**

Coexistence Manager and Coexistence Discovery and Information Server have one service access point:

— Coexistence Transport SAP (COEX_TR_SAP).

COEX_MEDIA_SAP defines the interface A between CE and TVBD network/device. Example reference model of CE describing example implementation of interface A inside a base station is shown in Figure 4.

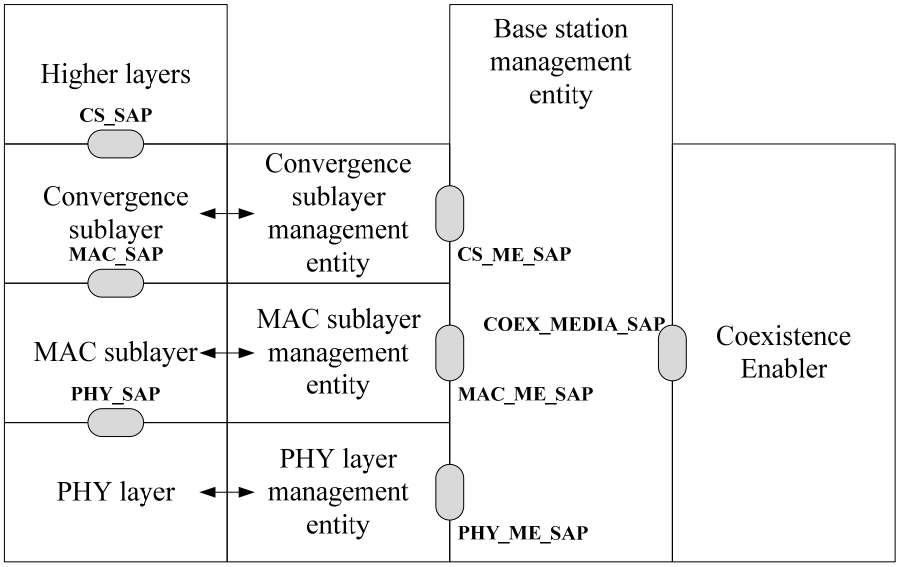


**Figure 4 Example reference model for interface A**

The left side of Figure 4 shows typical reference model of radio interface including data, control and management planes for physical layer, MAC sublayer, and convergence sublayer. The middle part of Figure 4 shows base station management entity. The right part of Figure 4 shows CE.

Typically, radio interface is implemented in such a way that it provides management interface for base station management entity. In Figure 4, such interface is represented by three service access points PHY_ME_SAP, MAC_ME_SAP, and CS_ME_SAP, corresponding to physical layer, MAC sublayer, and convergence sublayer. This service access points can be used to obtain information from radio interface and to request reconfiguration of radio interface. Correspondingly, CE can use these service access points to implement interface A. Interface A is defined by service access point COEX_MEDIA_SAP. Communication between radio interface management service access points PHY_ME_SAP, MAC_ME_SAP, and CS_ME_SAP and CE service access point COEX_MEDIA_SAP is done via base station management entity.

COEX_TR_SAP provides means for Coexistence Enabler, Coexistence Manager, and Coexistence Discovery and Information Server to communicate with each other and with external entities by using transport services provided by underlying layers. The underlying layers could be application layer, transport layer, network layer, and link layer. Example reference model of CE and CM describing example of using COEX_TR_SAP for interface B1 is shown in Figure 5.

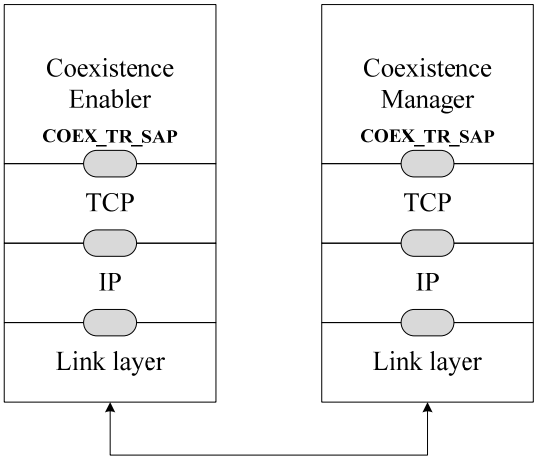


**Figure 5 Example of using COEX_TR_SAP for interface B1**

Information required for coexistence and reconfiguration commands that are exchanged between CE and CM over interface B1 are forwarded to transport layer, for example, to TCP, for transmission. This is done using COEX_TR_SAP service access point of CE and CM.

## 5.2 Service access points

### 5.2.1 Coexistence Media SAP

#### 5.2.1.1 General description

Coexistence Media SAP (COEX_MEDIA_SAP) defines the interface A between CE and TVBD network/device. The Coexistence Media SAP is defined as a set of primitives that provides the following services:

- Information service:
  - Used by CE to obtain information required for coexistence from TVBD network/device
  - Used by TVBD network/device to obtain information required for coexistence from CE
  - Used by TVBD network/device to share information required for coexistence with other TVBD networks/devices via the IEEE 802.19.1 system
- Measurement service:
  - Used by CE to request TVBD network/device to perform measurements required for coexistence
  - Used by CE to to obtain measurement results required for coexistence from TVBD network/device
- Reconfiguration service:
  - Used by CE to request TVBD netrwork/device to perform reconfiguration required for coexistence
- Event service:
  - Used by TVBD network/device to receive information about observed or predicted events related to coexistence from CE
  - Used by CE to receive information about observed or predicted events related to coexistence from TVBD network/device.

Primitives described in Table 1 are used to define the Coexistence Media SAP.

Table 1 – Coexistencre Media SAP primitives

| Primitive | Service | Description |
|---|---|---|
| COEX_INFO_OBTAINING | Information | Used by CE to obtain information required for coexistence from TVBD network/device.<br><br>Also, used by TVBD network/device to obtain information required for coexistence from CE. |
| COEX_INFO_SHARING | Information | Used by TVBD network/device to identify the capability of sharing information to other TVBD networks/devices via the IEEE 802.19.1 system. |
| COEX_INFO_PROVISION | Information | Used by TVBD network/device to provide information to the IEEE 802.19.1 system for sharing with other TVBD networks/devices. |
| COEX_RCF | Reconfiguration | Used by CE to request reconfiguration of TVBD networks/devices required for coexistence. |
| COEX_MEAS | Measurement | Used by CE to request TVBD network/device to perform measurement required for coexistence and to obtain measurement results. |
| COEX_EVENT | Event | Used by TVBD network/device to inform CE about events related to coexistence observed or predicted by TVBD network/device.<br>Also, used by CE to inform TVBD network/device about events related to coexistence observed or predicted by IEEE 802.19.1 system. |

#### 5.2.1.2 Information service

##### 5.2.1.2.1 COEX_INFO_OBTAINING

###### 5.2.1.2.1.1 COEX_INFO_OBTAINING.request

***Function***

Used by CE to request information required for coexistence from TVBD network/device.

Also, used by TVBD network/device to request information required for coexistence from CE.

***Semantics***

COEX_INFO_OBTAINING.request(

    CoexInfoParamIds

)

| Name | Type | Description |
|---|---|---|
| CoexInfoParamIds | COEX_I_PARAM_IDs | This parameter contains list of information parameter IDs requested by CE. |

***When generated***

Generated by CE to request information required for coexistence from TVBD network/device.

Generated by TVBD network/device to request information required for coexistence from CE.

***Effect on receipt***

When TVBD network/device receives this primitive, the TVBD network/device shall send COEX_INFO_OBTAINING.confirm back to the CE.

When CE receives this primitive, CE shall send COEX_INFO_OBTAINING.confirm back to the TVBD network/device.

#### 5.2.1.2.1.2 COEX_INFO_OBTAINING.confirm

***Function***

Used by TVBD network/device to provide information required for coexistence to CE.

Used by CE to provide information required for coexistence to TVBD network/device.

***Semantics***

COEX_INFO_OBTAINING.confirm(

    CoexInfoParams

)

| Name | Type | Description |
|---|---|---|
| CoexInfoParams | COEX_I_PARAMs | This parameter contains list of information parameters requested by CE. |

***When generated***

Generated by TVBD network/device in response to COEX_INFO_OBTAINING.request from CE.

Generated by CE in response to COEX_INFO_OBTAINING.request from TVBD network/device.

***Effect on receipt***

When CE receives this primitive, it examines the received information required for coexistence.

When TVBD network/device receives this primitive, it examines the received information required for coexistence.

#### 5.2.1.2.2 COEX_INFO_SHARING

##### 5.2.1.2.2.1 COEX_INFO_SHARING.request

***Function***

Used by TVBD network/device to identify the capability of sharing information to other TVBD networks/devices via the IEEE 802.19.1 system.

***Semantics***

COEX_INFO_SHARING.request(

InfoDestination,

CoexInfoParamIds

)

| Name | Type | Description |
|---|---|---|
| InfoDestination | INFO_DEST | This parameter contains list of destinations to which TVBD network/device would like to provide information for sharing with other TVBD networks/devices. |
| CoexInfoParamIds | COEX_I_PARAM_IDs | This parameter contains list of information parameter IDSs which TVBD network/device would like to share with other TVBD networks/devices. |

***When generated***

Generated by TVBD network/device to initiate the procedure to share information with other TVBD networks/devices via the IEEE 802.19.1 system.

***Effect on receipt***

When CE receives this primitive, CE shall send COEX_INFO_SHARING.confirm back to the TVBD network/device.

#### 5.2.1.2.2.2 COEX_INFO_SHARING.confirm

***Function***

Used by CE to inform TVBD network/device about the capability of sharing information to other TVBD networks/devices via the IEEE 802.19.1 system.

***Semantics***

COEX_INFO_SHARING.confirm(

CoexInfoParamIds

)

| Name | Type | Description |
|---|---|---|
| CoexInfoParamIds | COEX_I_PARAM_IDs | This parameter contains list of information parameter IDs which IEEE 802.19.1 system can share with other TVBD networks/devices. |

***When generated***

Generated by CE in response to COEX_INFO_SHARING.request from TVBD network/device.

***Effect on receipt***

When TVBD network/device receives this primitive, it examines the received information about the capability of sharing information to other TVBD networks/devices via the IEEE 802.19.1 system.

### 5.2.1.2.3 COEX_INFO_PROVISION

#### 5.2.1.2.3.1 COEX_INFO_PROVISION.request

***Function***

Used by TVBD network/device to provide information to the IEEE 802.19.1 system for sharing with other TVBD networks/devices.

***Semantics***

COEX_INFO_PROVISION.request(

InfoDestination,

CoexInfoParams

)

| Name | Type | Description |
|---|---|---|
| InfoDestination | INFO_DEST | This parameter contains list of destinations to which TVBD network/device provides information. |
| CoexInfoParams | COEX_I_PARAMs | This parameter contains list of information parameters which TVBD network/device is providing. |

***When generated***

Generated by TVBD network/device to provide information to the IEEE 802.19.1 system for sharing with other TVBD networks/devices.

***Effect on receipt***

When CE receives this primitive, CE shall send COEX_INFO_PROVISION.confirm back to the TVBD network/device.

#### 5.2.1.2.3.2 COEX_INFO_PROVISION.confirm

***Function***

Used by CE to inform TVBD network/device about the status of the request to provide information to the IEEE 802.19.1 system for sharing with other TVBD networks/devices.

***Semantics***

COEX_INFO_PROVISION.confirm(

    InfoProvisionStatus

)

| Name | Type | Description |
|---|---|---|
| InfoProvisionStatus | I_STATUS | This parameter describes the status of information provision request issued by the TVBD network/device. |

***When generated***

Generated by CE in response to COEX_INFO_PROVISION.request from TVBD network/device.

***Effect on receipt***

When TVBD network/device receives this primitive, it examines the received information about the status of the request to provide information to the IEEE 802.19.1 system for sharing with other TVBD networks/devices.

#### 5.2.1.3 Reconfiguration service

##### 5.2.1.3.1 COEX_RCF

###### 5.2.1.3.1.1 COEX_RCF.request

***Function***

Used by CE to request reconfiguration of TVBD networks/devices required for coexistence.

***Semantics***

COEX_RCF.request(

CoexReconParams

)

| Name | Type | Description |
|---|---|---|
| CoexReconParams | COEX_R_PARAMs | This parameter contains list of reconfiguration parameters according to which TVBD network/device shall perform reconfiguration. |

***When generated***

Generated by CE to request reconfiguration of TVBD networks/devices required for coexistence.

***Effect on receipt***

When TVBD network/device receives this primitive, it performs corresponding reconfiguration. Then, TVBD network/device shall send COEX_RCF.confirm back to the CE.

###### 5.2.1.3.1.2 COEX_RCF.confirm

***Function***

Used by TVBD network/device to inform CE about the results of the request to perform reconfiguration of TVBD networks/devices required for coexistence.

***Semantics***

COEX_RCF.confirm(

CoexReconResults

)

| Name | Type | Description |
|---|---|---|
| CoexReconResutls | COEX_R_RESULTs | This parameter describes the result of the reconfiguration requested by the CE. |

***When generated***

Generated by TVBD network/device in response to the COEX_RCF.request from CE.

***Effect on receipt***

When CE receives this primitive, it examines the received information about the status of the request to perform reconfiguration of TVBD networks/devices required for coexistence.

#### 5.2.1.4 Measurement service

##### 5.2.1.4.1 COEX_MEAS

###### 5.2.1.4.1.1 COEX_MEAS.request

***Function***

Used by CE to request TVBD network/device to perform measurement required for coexistence.

***Semantics***

COEX_MEAS.request(

CoexMeasuParams

)

| Name | Type | Description |
|---|---|---|
| CoexMeasuParams | COEX_M_PARAMs | This parameter contains list of measurement parameters according to which TVBD network/device shall perform measurement. |

***When generated***

Generated by CE to request TVBD network/device to perform measurement required for coexistence.

***Effect on receipt***

When TVBD network/device receives this primitive, it performs requested measurement. Then, TVBD network/device shall send COEX_MEAS.confirm back to CE.

#### 5.2.1.4.1.2 COEX_MEAS.confirm

***Function***

Used by TVBD network/device to provide requested measurement results to CE.

***Semantics***

COEX_MEAS.confirm(

CoexMeasuResults

)

| Name | Type | Description |
|---|---|---|
| CoexMeasuResults | COEX_M_RESULTs | This parameter contains list of results of measurement performed by TVBD network/device |

***When generated***

Generated by TVBD network/device in response to the COEX_MEAS.request from CE.

***Effect on receipt***

When CE receives this primitive, it examines the received measurement results required for coexistence.

### 5.2.1.5 Event service

#### 5.2.1.5.1 COEX_EVENT.indication

***Function***

Used by TVBD network/device to inform CE about events related to coexistence observed or predicted by TVBD network/device.

Also, used by CE to inform TVBD network/device about events related to coexistence observed or predicted by IEEE 802.19.1 system.

***Semantics***

COEX_EVENT.indication(

CoexEventParams

)

| Name | Type | Description |
|---|---|---|
| CoexEventParams | COEX_E_PARAMs | This parameter contains list of event parameters. |

***When generated***

Generated by TVBD network/device to inform CE about events related to coexistence observed or predicted by TVBD network/device.

Generated by CE to inform TVBD network/device about events related to coexistence observed or predicted by IEEE 802.19.1 system.

***Effect on receipt***

When CE receives this primitive, it examines the received information about events realted to coexistence observed or predicted by TVBD network/device.

When TVBD network/device receives this primitive, it examines the received information about events realted to coexistence observed or predicted by IEEE 802.19.1 system.

### 5.2.2 Coexistence Transport SAP

#### 5.2.2.1 General description

Coexistence Transport SAP (COEX_TR_SAP) provides means for Coexistence Enabler, Coexistence Manager, and Coexistence Discovery and Information Server to communicate with each other and with external entities by using transport services provided by underlying layers. The Coexistence Transport SAP is defined as a set of primitives that provides the following service:

— Transport service:
  — Used by CE, CM, CDIS or external entity to send coexistence protocol data unit to each other and to external entities and to receive acknoledgement of such operation
  — Used by CE, CM, and CDIS or external entity to receive coexistence protocol data unit from each other and from external entities.

Primitives described in Table 2 are used to define the Coexistence Transport SAP.

Table 2 – Coexistencre Transport SAP primitives

| Primitive | Service | Description |
|---|---|---|
| CP_PACKET_SEND | Transport | Used by CE, CM, CDIS or external entity to send a coexistence protocol data unit using a |

| | | |
|---|---|---|
| | | transport service provider. |
| CP_PACKET_RECEIVE | Transport | Used by a transport service provider to deliever a coexistence protocol data unit to CE, CM, CDIS or external entity. |

#### 5.2.2.2 Transport service

#### CP_PACKET_SEND

#### CP_PACKET_SEND.request

***Function***

Used by CE, CM, CDIS or external entity to request the transport service provider to transport a coexistence protocol data unit.

***Semantics***

CP_PACKET_SEND.request (

TransportPref,

SourceID,

DestinationID,

CoexProtocolPDU

)

| Name | Type | Description |
|---|---|---|
| TransportPref | TRANSPORT_PREF | Transport protocol preference. |
| SourceID | TRANSPORT_ADDR | Address of the entity sending coexistence protocol data unit. |
| DestinationID | TRANSPORT_ADDR | Address of the entity to receive coexistence protocol data unit. |
| CoexProtocolPDU | OCTET_STRING | Coexistence protocol data unit to be transported. |

***When generated***

Generated by CE, CM, CDIS or external entity to request the transport service provider to transport a coexistence protocol data unit.

***Effect on receipt***

The specific transport servce provider receiving this primitive attempts to transport the coexistence protocol data unit.

### CP_PACKET_SEND.confirm

***Function***

Used by transport service provider to acknowledge transportation of the coexistence protocol data unit if such acknowledgment is supported by the transport service provider.

***Semantics***

CP_PACKET_SEND.confirm(

TransportPref,

SourceID,

DestinationID,

TransportStatus

)

| Name | Type | Description |
|---|---|---|
| TransportPref | TRANSPORT_PREF | Transport protocol preference. |
| SourceID | TRANSPORT_ADDR | Address of the entity sending coexistence protocol data unit. |
| DestinationID | TRANSPORT_ADDR | Address of the entity to receive coexistence protocol data unit. |
| TransportStatus | BOOLEAN | Indicates whether the transfer of coexistence protocol data unit is successful or not. |

***When generated***

Generated by the transport service provider to confirm delivery of coexistence protocol data if such acknowledgement is supported by the transport service provider.

***Effect on receipt***

When CE, CM, CDIS or external entity receives this primitive, it learns about the staus of the requested delivery of coexistence protocol data.

### CP_PACKET_RECEIVE

***Function***

Used by transport service provider to deliver a coexistence protocol data unit to CE, CM, CDIS or external entity.

***Semantics***

CP_PACKET_RECEIVE(

TransportPref,

SourceID,

DestinationID,

CoexProtocolPDU

)

| Name | Type | Description |
|---|---|---|
| TransportPref | TRANSPORT_PREF | Transport protocol preference. |
| SourceID | TRANSPORT_ADDR | Address of the entity sending coexistence protocol data unit. |
| DestinationID | TRANSPORT_ADDR | Address of the entity to receive coexistence protocol data unit. |
| CoexProtocolPDU | OCTET_STRING | Coexistence protocol data unit to be delivered. |

***When generated***

Generated by the transport service provider when it has coexistence protocol data unit for CE, CM, CDIS or external entity.

***Effect on receipt***

The CE, CM, CDIS or external entity receiving this primitive gets coexistence protocol data unit.

## 5.3 Data types

### 5.3.1 Coexistence Media SAP data types

The following data types are defined for Coexistence Media SAP.

#### 5.3.1.1 Information service data types

The following data types are defined for information service of Coexistence Media SAP.

```
I_PARAM_ID ::= ENUMERATED{
   BSSID,
   SSID,
   BSSType,
   BeaconPeriod,
   DTIMPeriod,
   Timestamp,
```

```
   LocalTime,
   PHYParameterSet,
   CFParameterSet,
   IBSSATIMWindow,
   CapabilityInformation,
   BSSBasicRateSet,
   OperationalRateSet,
   Country,
   IBSSDFSRecoveryInterval,
   Load,
   TPCTransmitPower,
   TPCLinkMargin,
   NeighbourBSSSet,
   ListOfAvailableChannels,
   NetworkChannels,
   AntennaInfo,
   TVBDInfo,
   SysEntityID,
   TVBDID,
   ListOfNeighbours,
   …
}

COEX_I_PARAM_IDs ::= SEQUENCE OF I_PARAM_ID

I_PARAM_VALUE ::= CHOICE{
   BSSID                          STRING,
   SSID                           STRING,
   BSSType                        ENUMERATED,
   BeaconPeriod                   INTEGER,
   DTIMPeriod                     INTEGER,
   Timestamp                      INTEGER,
   LocalTime                      INTEGER,
   PHYParameterSet                PHY_PARAM_SET,
   CFParameterSet                 CF_PARAM_SET,
   IBSSATIMWindow                 TU,
   CapabilityInformation          BSS_CAPA_INFO,
   BSSBasicRateSet                SET OF INTEGER,
   OperationalRateSet             SET OF INTEGER,
   Country                        STRING,
   IBSSDFSRecoveryInterval        INTEGER,
   Load                           BSS_LOAD,
   TPCTransmitPower               INTEGER,
   TPCLinkMargin                  INTEGER,
   NeighbourBSSSet                NEIBR_BSS_SET,
   ListOfAvailableChannels        LIST_TV_CHANNELS,
   NetworkChannels                NETWORK_CHANNELS,
   AntennaInfo                    ANTENNA_INFO,
   TVBDInfo                       TVBD_INFO,
   SysEntityID                    INTEGER,
   TVBDID                         STRING,
   ListOfNeighbours               LIST_NEIGHBOURS,
   …
}

COEX_I_PARAM ::= SEQUENCE{
   InfoParamId          I_PARAM_ID,
```

```
   InfoStatus            I_STATUS,
   InfoParamValue        I_PARAM_VALUE
}

COEX_I_PARAMs ::= SEQUENCE OF COEX_I_PARAM

I_STATUS ::= ENUMERATED{
   SUCCESS,
   NOT_AVAILABLE_NOW,
   NOTSUPPORTED,
   BUSY,
   …
}

SYS_ENTITY_ID ::= INTEGER

INFO_DEST ::= SEQUENCE OF SYS_ENTITY_ID
```

Table 3 describes parameters of data types of information service of Coexistence Media SAP.

Table 3 – Parameters of data types of information service of Coexistence Media SAP

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| BSSID | MAC_ADDR | N/A | The BSSID of the found BSS. | 802.11-2007 Scan. confirm<br><br>BSS Description Set |
| SSID | OCTET_STRING | 1..32 octets | The SSID of the found BSS. | |
| BSSType | ENUMERATED | INFRASTRUCTURE, INDEPENDENT | The type of the found BSS. | |
| BeaconPeriod | INTEGER | N/A | The Beacon period of the found BSS (in TU). | |
| DTIMPeriod | INTEGER | As defined in frame format | The DTIM period of the BSS (in beacon periods). | |
| Timestamp | INTEGER | N/A | The timestamp of the received frame (probe response/beacon) from the found BSS. | |
| LocalTime | INTEGER | N/A | The value of the STA fs TSF timer at the start of reception of the first octet of the timestamp field of the received frame (probe response or beacon) from the found BSS. | |
| PHYParameter Set | PHY_PARAM_SET | As defined in frame format or according to the relevant PHY clause | The parameter sets relevant to the PHY from the received Beacon or Probe Response frame. If no PHY Parameter Set information element is present in the received frame, this parameter | |

| | | | | |
|---|---|---|---|---|
| | | | contains the channel number on which the frame was received. Valid channel numbers are defined in the relevant PHY clause. | |
| CFParameter Set | CF_PARAM_ SET | As defined in frame format | The parameter set for the CF periods, if found BSS supports CF mode. | |
| IBSSATIM Window | TU | As defined in frame format | The parameter set for the IBSS, if found BSS is an IBSS. | |
| Capability Information | BSS_CAPA_ INFO | As defined in frame format | The advertised capabilities of the BSS. | |
| BSSBasicRate Set | SET OF INTEGER | 1..127 inclusive (for each integer in the set) | The set of data rates that must be sup-ported by all STAs that desire to join this BSS. The STAs must be able to receive and transmit at each of the data rates listed in the set. | |
| Operational RateSet | SET OF INTEGER | 1..127 inclusive (for each integer in the set) | The set of data rates that the STA desires to use for communication within the BSS. The STA must be able to receive at each of the data rates listed in the set. This set is a superset of the rates contained in the BSSBasicRateSet parameter. | |
| Country | STRING | As defined in the Country element | The information required to identify the regulatory domain in which the STA is located and to configure its PHY for operation in that regulatory domain. Present only when TPC functionality is required, as specified in 11.8, or when dot11MultiDomain CapabilityEnabled is true. | |
| IBSSDFS Recovery Interval | INTEGER | 1..255 | Only present if BSSType = INDEPENDENT. The time interval that is used for DFS recovery. Present only when DFS functionality is required. | |
| Load | BSS_LOAD | As defined in frame format | The values from the BSS Load information element if such an element was present in the probe response or Beacon frame, else null. | |
| TPCTransmit | INTEGER | | The Transmit Power field | 802.11-2007 |

| | | | | |
|---|---|---|---|---|
| Power | | | shall be set to the transmit power used to transmit the frame containing the TPC Report element. The field is coded as a signed integer in units of decibels relative to 1 mW. The maximum tolerance for the transmit power value reported in the TPC Response element shall be ± 5 dB. This tolerance is defined as the difference, in decibels, between the reported power value and the actual EIRP of the STA (measured when transmitting 1500 octet frames). | TPC report<br><br>MLME-TPCADAPT .confirm |
| TPCLink Margin | INTEGER | | The Link Margin field contains the link margin at the time and for the rate at which the frame containing the TPC Request element was received. The field is coded as a signed integer in units of decibels. The LinkMargin field shall be set to 0 and shall be ignored when a TPC Report element is included in a Beacon frame or Probe Response frame. The measurement method of Link Margin is beyond the scope of this standard. | |
| Neighbour BSSSet | NEIBR_BSS_ SET | Specified in the regulatory domain | Report the neighbor of an BSS<br><br>Repot the channel of the neighbor BSS | 11k Neighbour report |
| ListOfAvailable Channels | LIST_TV_ CHANNELS | | | 802.11af<br>802.22 |
| Network Channels | NETWORK_ CHANNELS | | The parameter reports the network channels that TV band devices and networks are operating on. | 802.11af<br><br>IEEE 802.22 M-WRAN-SERVICE-REPORT |
| AntennaInfo | ANTENNA_ INFO | | Specifying the antenna information of TV band devices. | IEEE 1900.6 |
| TVBDInfo | TVBD_INFO | | The value identifies the type of device at the geolocation registering | IEEE 802.22<br><br>IEEE 802.11 |

| | | | | |
|---|---|---|---|---|
| | | | | device types are denoted as WLAN STA and WLAN AP |
| NeighbourBSS Set | NEIBR_BSS_ SET | Specified in the regulatory domain | Report the neighbor of an BSS. Repot the channel of the neighbor BSS. | 802.11k Neighbour report |
| SysEntityID | INTEGER | | Logical ID of IEEE 802.19.1 system entity. | Parameters added for TVBD |
| TVBDID | STRING | | This TVBDID can be the FCC ID | |
| ListOfAvailable Channels | LIST_TV_CHAN NELS | | This parameter gives the list of availe channels (TV channels) as decided by the IEEE 802.19.1 system. | From IEEE 802.19.1 system to TVBDs |
| ListOf Neighbours | LIST_ NEIGHBOURS | | This parameters gives the TVBD ID, TVBDInfo, occupied channels, mobility (fixed, moible), | |

#### 5.3.1.2 Reconfiguration service data types

The following data types are defined for reconfiguration service of Coexistence Media SAP.

```
COEX_R_OBJ_ID ::= ENUMERATED{
   ChannelSwitch,
   ChangeTransmitPower,
   Scheduling
}

R_PROFILE_PARAM_ID ::= ENUMERATED{
   NewRegulatoryClass,
   ChannelNumber,
   ChannelSwitchMode,
   ChannelSwitchCount,
   DSELocalPowerConstraint,
   NewNetworkChannels,
   DisallowedChannels,
   OperatingChannels,
   Scheduling
   …
}

R_PROFILE_PARAM _VALUE ::= CHOICE{
   NewRegulatoryClass                INTEGER,
   ChannelNumber,                    INTEGER,
   ChannelSwitchMode                 CHANNEL_SWITCH_MODE,
   ChannelSwitchCount                INTEGER,
   DSELocalPowerConstraint           INTEGER,
   NewNetworkChannels                NET_CHANNELs,
   DisallowedChannels                SET OF INTEGER,
```

```
   OperatingChannels                SET OF INTEGER,
   Schedule                         SCHEDULE,
   …
}

R_PROFILE_PARAM ::= SEQUENCE{
   ReconProfileParamID              R_PROFILE_PARAM_ID,
   ReconProfileParamValue           R_PROFILE_PARAM_VALUE
}

COEX_R_PROFILE ::= SEQUENCE OF R_PROFILE_PARAM

COEX_R_PARAM ::= SEQUENCE{
   CoexReconObjID                   COEX_R_OBJ_ID,
   CoexReconProfile                 COEX_R_PROFILE
}

COEX_R_PARAMs ::= SEQUENCE OF COEX_R_PARAM

R_STATUS ::= ENUMERATED{
   SUCCESS,
   NOTSUPPORTED,
   BUSY,
   TOANOTHERVALUE,
   …
}

COEX_R_RESULT ::= SEQUENCE{
   CoexReconObjID       COEX_R_OBJ_ID,
   ReconStatus          R_STATUS,
   CoexReconParams      COEX_R_PARAMs          OPTIONAL
}

COEX_R_RESULTs ::= SEQUENCE of COEX_R_RESULT
```

Table 4 and Table 5 describe parameters of data types of reconfiguration service of Coexistence Media SAP.

Table 4 – Parameters of data types of reconfiguration service of Coexistence Media SAP

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| NewRegulatory Class | INTEGER | | The New Regulatory Class field is set to the number of the regulatory class after the channel switch, as defined in Annex J in IEEE 802.11 standards | 802.11-2007 Channel Switch<br><br>802.11y Extended Channel Switch |
| NewChannel Number | INTEGER | As specified in the regulatory domain | The number of the new channel to be switched to. | |
| ChannelSwitch Mode | CHANNEL_ SWITCH_MODE | 0 or 1 | A Channel Switch Mode set to 1 means that the | |

| | | | | |
|---|---|---|---|---|
| | | | STA in a BSS to which the frame containing the element is addressed shall transmit no further frames within the BSS until the scheduled channel switch. A STA in an IBSS may treat a Channel Switch Mode field set to 1 as advisory. A Channel Switch Mode set to 0 does not impose any requirement on the receiving STA. | |
| ChannelSwitch Count | INTEGER | Specifies the number of TBTTs until the channel switch event, as described for the Channel Switch Announcement element. | The Channel Switch Count field either shall be set to the number of TBTTs until the STA sending the Channel Switch Announcement element switches to the new channel or shall be set to 0. A value of 1 indicates that the switch shall occur immediately before the next TBTT. A value of 0 indicates that the switch shall occur at any time after the frame containing the element is transmitted. | |
| DSELocal Power Constraint | INTEGER | Maximum 4w | The local maximum transmit power for a channel is thus defined as the maximum transmit power level specified for the channel in the Country element minus the local power constraint specified for the channel in the DSE Power Constraint frame. | 802.11y<br><br>802.11af |
| NewNetwork Channels | NET_ CHANNELS | | Specifies the network channels and maximum transmit power in a regulation domain that the TVBD are allowed to operate in TV band. The parameter has been defined in subclause 5.2.1.2 but is used for reconfiguration purpose. The parameter is used here to indicate the network channels that the TVBD should change to. | 802.11af |
| Disallowed | SET OF | | The parameter is used for | IEEE 802.22 |

| | | | | |
|---|---|---|---|---|
| Channels | INTEGER | | disallowing a number of channels among the list of available channels from the TVWS database. | |
| Operating Channels | SET OF INTEGER | | The parameter is used to select chanels for operation from the list of available channels | IEEE 802.22 |

1

2 Table 5 – Parameters of data types of reconfiguration service of Coexistence Media SAP

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| BSSType | BSS_TYPE | INFRASTRUCTURE, INDEPENDENT, ANY_BSS | Determines whether infrastructure BSS, IBSS, or both, are included in the scan. | 802.11-2007 Scan.request |
| BSSID | STRING | Any valid individual orbroadcast MAC address | Identifies a specific or wildcard BSSID. | |
| SSID | STRING | 0..32 octets | Specifies the desired SSID or the wildcard SSID. | |
| ScanType | ENUMERATED | ACTIVE, PASSIVE | Indicates either active or passive scanning. | |
| ProbeDelay | INTEGER | N/A | Delay (in microseconds) to be used prior to transmitting a Probe frame during active scanning. | |
| ChannelList | SEQUENCE OF INTEGER | Each channel will be selected from the valid channel range for the appropriate PHY and carrier set. | Specifies a list of channels that are examined when scanning for a BSS. | |
| MinChannel Time | INTEGER | ProbeDelay | The minimum time (in TU) to spend on each channel when scanning. | |
| MaxChannel Time | INTEGER | MinChannelTime | The maximum time (in TU) to spend on eachchannel when scanning. | |
| ChMeasuType | Ch_MEASU_ TYPE | 0,1,2 | 0: Basic request;<br>1: Clear channel assessment (CCA) request<br>2: Receive power indication (RPI) histogram request | .11-2007 measure ment request |
| Channel Number | INTEGER | Specified in regulatory domain | Channel number for which the measurement request applies | |
| StartTime | INTEGER | | The parameter specifies the time at which the requested measurement, as specified by the | |

| | | | | |
|---|---|---|---|---|
| | | | MeasurementType parameter, shall start. A value of 0 shall indicate it shall start immediately. | |
| Duratioin | INTEGER | | The Measurement Duration field shall be set to the duration of the requested measurement, as specified by the MeasurementType parameter, expressed in TUs. | |
| LinkMeasu PeerAdd | STRING | Any valid individual MAC address | The address of the peer MAC entity to which the Link Measure Request shall be sent. | 802.11k Link measure ment |
| LinkMeasu TxPower | INTEGER | | The transmit power to be used when transmitting the Link Measurement Request frame and included in the frame body | |
| LinkMeasu MaxiTxPower | INTEGER | | The maximum transmit power to be used by the transmitting STA on its operating channel. | |
| Sensing Window | SENSING_ WINDOW | | Specification consists of: NumSensingPeriods SensingPeriodDuration SensingPeriodInterval | 802.22 SM-SSF |
| SignalType | SIGNAL_TYPE | | The interger number specifies the following types of signals to be sensed by the spectrum sensor.<br>0: Any Signal Type<br>1: IEEE 802.22 WRAN<br>2: ATSC<br>3: DVB-T<br>4: ISDB-T<br>5: NTSC<br>6: PAL<br>7: SECAM<br>8: Wireless Microphone<br>9: IEEE 802.22.1 Sync Burst<br>10: IEEE 802.22.1 PPDU MFS1<br>11: DVB-TIEEE 802.22.1 PPDU<br>MSF2<br>12: IEEE 802.22.1 PPDU MSF3<br>13: Medical telemetry devices<br>14: Studio-transmitter link | |

| | | | | |
|---|---|---|---|---|
| | | | 15-24 Reserved | |
| SensingMode | SENSING_ MODE | | Mode 0: For each signal type the SSF generates a binary decision as to whether the signal is present in the television channel<br>Mode 1: Same as sensing mode 0 with the addition of a confidence metric for binary decision<br>Mode 2: For each signal type the spectrum sensor generates an estimate of the field strength of that Signal<br>Mode 3: Same as sensing mode 2 with the standard deviation of the field strength estimate from sensing mode 2.<br>Mode4: reserved | |
| Detection Threshold | REAL | -160~70 | The parameter specifies the noise power in dBm. | IEEE 1900.6 |
| Performance Metric | PERF_METRIC | | Parameter that indicates the quality of sensing. | |
| Geolocation | STRING | | Reques to obtain the geolocation information of the TV band devices. | IEEE 802.22 GL-SAP, 802.11af, 1900.6 |

#### 5.3.1.3 Measurement service data types

The following data types are defined for measurement service of Coexistence Media SAP.

```
COEX_M_OBJ_ID ::= ENUMERATED{
   802.11BSSScan,
   802.11ChannelMeasu,
   802.11kLinkMeasu,
   802.22Sensing
}

M_PROFILE_PARAM_ID ::= ENUMERATED{
   BSSType,
   BSSID,
   SSID,
   ScanTYpe,
   ProbeDelay,
   ChannelList,
   MinChannelTime,
   MaxChannelTIme,
   ChMeasuType,
```

```
   ChannelNumber,
   StartTime,
   Duration,
   LinkMeasuPeerAdd,
   LinkMeasuTxPower,
   LinkMesuMaxiTxPower,
   SensingWindow,
   SignalType,
   SensingMode,
   DetectionThreshold,
   PerformanceMetric,
   Geolocation,
   …
}

M_PROFILE_PARAM_VALUE ::= CHOICE{
   BSSType                          BSS_TYPE,
   BSSID                            STRING,
   SSID                             STRING,
   ScanType                         SCAN_TYPE,
   ProbeDelay                       INTEGER,
   ChannelList                      SEQUENCE OF INTEGER,
   MinChannelTIme                   INTEGER,
   MaxChannelTime                   INTEGER,
   ChMeasuType                      CH_MEASU_TYPE,
   ChannelNumber                    INTEGER,
   StartTime                        INTEGER,
   Duration                         INTEGER,
   LinkMeasuPeerAdd                 STRING,
   LinkMeasuTxPower                 INTEGER,
   LinkMeasuMaxiTxPower             INTEGER,
   SensingWindow                    SENSING_WINDOW,
   SignalType                       SIGNAL_TYPE,
   SensingMode                      SENSING_MODE,
   DetectionThreshold               REAL,
   PerformanceMetric                PERF_METRIC,
   Geolocation                      STRING,
   …
}

M_PROFILE_PARAM ::= SEQUENCE{
   MeasuProfileParamID              M_PROFILE_PARAM_ID,
   MeasuProfileParamValue           M_PROFILE_PARAM_VALUE
}

COEX_M_PROFILE ::= SEQUENCE OF M_PROFILE_PARAM

COEX_M_PARAM ::= SEQUENCE{
   CoexMeasuObjID                   COEX_M_OBJ_ID,
   CoexMeasuProfile                 COEX_M_PROFILE
}

COEX_M_PARAMs ::= SEQUENCE OF COEX_M_PARAM

M_STATUS ::= ENUMERATED{
   SUCCESS,
   NOTSUPPORTED,
```

```
   BUSY,
   …
}

M_RESULT_PARAM_ID ::= ENUMERATED{
   BSSID,
   SSID,
   BSSType,
   BeaconPeriod,
   DIMPeriod,
   TimeStamp,
   LocalTime,
   PHYParameterSet,
   CFParameterSet,
   IBSSATIMWindow,
   CapabilityInformation,
   BSSBasicRateSet,
   OperationalRateSet,
   Country,
   IBSSDFSRecoveryInterval,
   Load,
   ChMeasuType,
   ChannelNumber,
   StartTime,
   Duration,
   ChMeasuReport,
   TransmitPower,
   LinkMagin,
   RCPI,
   RSNI,
   ReceiveAntennaID,
   TransmitAntennaID,
   SensingResult,
   Geolocation,
   …
}

M_RESULT_PARAM_VALUE ::= CHOICE{
   BSSID                              STRING,
   SSID                               STRING,
   BSST                               BSS_TYPE,
   BeaconPeriod                       INTEGER,
   DIMPeriod                          INTEGER,
   TimeStamp                          INTEGER,
   LocalTime                          INTEGER,
   PHYParameterSet                    PHY_PARAM_SET,
   CFParameterSet                     CF_PARAM_SET,
   IBSSATIMWindow                     TU,
   CapabilityInformation              BSS_CAPA_INFO,
   BSSBasicRateSet                    SET OF INTEGER,
   OperationalRateSet                 SET OF INTEGER,
   Country                            STRING,
   IBSSDFSRecoveryInterval            INTEGER,
   Load                               BSS_LOAD,
   ChMeasuType                        CH_MEASU_TYPE,
   ChannelNumber                      INTEGER,
   StartTime                          INTEGER,
```

```
   Duration                          INTEGER,
   ChMeasuReport                     CH_MEASU_REPORT,
   TransmitPower                     INTEGER,
   LinkMargin                        INTEGER,
   RCPI                              REAL,
   RSNI                              REAL,
   ReceiveAntennaID                  INTEGER,
   TransmitAntennaID                 INTEGER,
   SensingResult                     SENSING_RESULT,
   Geolocation                       STRING,
   …
}

M_RESULT_PARAM ::= SEQUENCE{
   MeasuResultParamID                M_RESULT_PARAM_ID,
   MeasuResultParamValue             M_RESULT_PARAM_VALUE
}

M_RESULT_PARAMs ::= SEQUENCE OF M_RESULT_PARAM

COEX_M_RESULT ::= SEQUENCE{
   CoexMeasuObjID                    COEX_M_OBJ_ID,
   MeasuStatus                       M_STATUS,
   MeasuResultParams                 M_RESULT_PARAMs
}

COEX_M_RESULTs ::= SEQUENCE of COEX_M_RESULT
```

Table 6 describes parameters of data types of measurement service of Coexistence Media SAP.

Table 6 – Parameters of data types of measurement service of Coexistence Media SAP

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| BSSID | STRING | N/A | The BSSID of the found BSS. | 802.11-2007 Scan. confirm<br><br>BSS Description Set |
| SSID | STRING | 1..32 octets | The SSID of the found BSS. | |
| BSSType | BSS_TYPE | INFRASTRUCTURE, INDEPENDENT | The type of the found BSS. | |
| BeaconPeriod | INTEGER | N/A | The Beacon period of the found BSS (in TU). | |
| DTIM Period | INTEGER | As defined in frame format | The DTIM period of the BSS (in beacon periods). | |
| Timestamp | INTEGER | N/A | The timestamp of the received frame (probe response/beacon) from the found BSS. | |
| LocalTime | INTEGER | N/A | The value of the STA fs TSF timer at the start of reception of the first octet of the timestamp field of the received frame (probe | |

| | | | | |
|---|---|---|---|---|
| | | | response or beacon) from the found BSS. | |
| PHYParameter Set | PHY_PARAM_ SET | As defined in frame format or according to the relevant PHY clause. | The parameter sets relevant to the PHY from the received Beacon or Probe Response frame. If no PHY Parameter Set information element is present in the received frame, this parameter contains the channel number on which the frame was received. Valid channel numbers are defined in the relevant PHY clause. | |
| CFParameter Set | CF_PARAM_ SET | As defined in frame format | The parameter set for the CF periods, if found BSS supports CF mode. | |
| IBSSATIM Window | TU | As defined in frame format | The parameter set for the IBSS, if found BSS is an IBSS. | |
| Capability Information | BSS_APA_INFO | As defined in frame format | The advertised capabilities of the BSS. | |
| BSSBasicRate Set | SET OF INTEGER | 1..127 inclusive (for each integer in the set) | The set of data rates that must be sup-ported by all STAs that desire to join this BSS. The STAs must be able to receive and transmit at each of the data rates listed in the set. | |
| Operational RateSet | SET OF INTEGER | 1..127 inclusive (for each integer in the set) | The set of data rates that the STA desires to use for communication within the BSS. The STA must be able to receive at each of the data rates listed in the set. This set is a superset of the rates contained in the BSSBasicRateSet parameter. | |
| Country | STRING | As defined in the Country element | The information required to identify the regulatory domain in which the STA is located and to configure its PHY for operation in that regulatory domain. Present only when TPC functionality is required, as specified in 11.8, or when dot11MultiDomainCapabilityEnabled is true. | |
| IBSSDFS Recovery | INTEGER | 1..255 | Only present if BSSType = INDEPENDENT. The | |

| | | | | |
|---|---|---|---|---|
| Interval | | | time interval that is used for DFS recovery. Present only when DFS functionality is required. | |
| Load | BSS_LOAD | As defined in frame format | The values from the BSS Load information element if such an element was present in the probe response or Beacon frame, else null. | |
| Measurement Type | CH_MEASU_ TYPE | 0,1,2 | 0: Basic request;<br>1: Clear channel assessment (CCA) request<br>2: Receive power indication (RPI) histogram request | .11-2007 measure ment report |
| Channel Number | INTEGER | Specified in regulatory domain | channel number for which the measurement report applies | |
| StartTime | INTEGER | | The parameter specifies the time at which the requested measurement, as specified by the MeasurementType parameter, has started. A value of 0 shall indicate it shall start immediately. | |
| Duratioin | INTEGER | | The Measurement Duration field shall be set to the duration of the requested measurement, as specified by the MeasurementType parameter, expressed in TUs. | |
| ChMeasu Report | CH_MEASU_ REPORT | | Result of selected measurement. See the following tables for the parameter description of BasicReport, CCAReport and RPIhistogramReport | |
| TransmitPower | INTEGER | As defined in the TPC Report element | The contents of the Transmit Power field of the received Link Measurement Report frame. Present only(#1472) if ResultCode = SUCCESS. | 802.11k Link measure ment |
| LinkMargin | INTEGER | As defined in the TPC Report element | The contents of the Link Margin field of the received Link Measurement Report frame. Present only(#1472) if Result-Code = SUCCESS. | |

| | | | | |
|---|---|---|---|---|
| RCPI | REAL | As defined in 15.4.8.5 (Received Channel Power Indicator Measurement(11k)), or 17.3.10.6 (Received Chan-nel Power Indicator Measure-ment(11k)), or 18.4.8.5 (Received Channel Power Indicator Measurement(11k)) | The RCPI level of the corresponding Link Measurement Request frame received at the reporting STA. Present only(#1472) if ResultCode = SUCCESS. | |
| RSNI | REAL | As defined in 7.3.2.41 (RSNI element(11k)) | The RSNI of the corresponding Link Measurement Request frame received at the reporting STA. Present only(#1472) if ResultCode = SUCCESS | |
| Receive AntennaID | INTEGER | 0~255 | The Antenna ID corresponding to the antenna on which the Link Measurement Request frame was received at the report-ing STA. Antenna ID is defined in 7.3.2.29 (EDCA Parameter Set element). | |
| Transmit AntennaID | INTEGER | 0~255 | The Antenna ID corresponding to the antenna used to transmit the Link Mea-surement Report frame. Antenna ID is defined in 7.3.2.29 (EDCA Parameter Set element). | |
| SensingResult | SENSING_ RESULT | | Return the result of spectrum measurement for the selected sensing mode. | |
| Geolocation | String | | Result of geolocation measurement | IEEE 802.22 GL-SAP, 802.11af and 1900.6 |

1

2 **5.3.1.4 Event service data types**

3 The following data types are defined for event service of Coexistence Media SAP.

```
COEX_E_ID ::= ENUMERATED{
   NewBSSStart,
   Interference,
   NewChannelAdded,
   ChannelRemoved,
   NeighbourChange,
   InformationForSharing,
   NetworkChannelChanged,
   …
}

E_PARAM_ID ::= ENUMERATED{
   BSSID,
   NeighbourChange,
   InterferenceLevels,
   AddedChannelList,
   RemovedChannelList,
   UpdatedNetworkChannels
   …
}

E_PARAM_VALUE ::= CHOICE {
   BSSID                          STRING,
   NeighbourChange                NEIGHBOUR_CHANGE,
   InterferenceLevels             INTERFERENCE_LEVELs,
   AddedChannelList               LIST_TV_CHANNELS,
   RemovedChannelList             LIST_TV_CHANNELS,
   UpdatedNetworkChannels         NETWORK_CHANNELS,
   …
}

E_PARAM ::= SEQUENCE{
   EventParamID                   E_PARAM_ID
   EventParamValue                E_PARAM_VALUE
}

E_PARAMs ::= SEQUENCE OF E_PARAM

COEX_E_PARAM ::= SEQUENCE{
   CoexEventId          COEX_E_ID
   CoexEvenParams       E_PARAMs
}

COEX_E_PARAMs ::= SEQUENCE OF COEX_E_PARAM
```

Table 7 describes parameters of data types of event service of Coexistence Media SAP.

Table 7 – Parameters of data types of event service of Coexistence Media SAP

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| BSSID | STRING | Any valid | Identifies a specific or | 11-2007 |

| | | | | |
|---|---|---|---|---|
| | | individual or broadcast MAC address | wildcard BSSID that just started. | Start(a new BSS) |
| Neighbour Change | NEIGHBOUR_ CHANGE | | A set of BSSID that | 802.11-2007 |
| InterfereLevels | INTERFERENCE _LEVELs | | | 802.19.1 specific |
| AddedChannel List | LIST_TV_ CHANNELS | Specified in regulatory domain | This parameter indicates the changes on the available channels by specifiying a list of channel numbers that become available. | 802.19.1 specific |
| Removed ChannelList | LIST_TV_ CHANNELS | Specified in regulatory domain | This parameter indicates the changes on the available channels by specifiying a list of channel numbers that are no more available. | 802.19.1 specific |
| Neighbour Change | NEIGHBOUR_ CHANGE | | A set of BSSID that | 802.19.1 |
| Updated Network Channels | NET_ CHANNELS | | Indicates the changes of network channels | 802.19.1 |

#### 5.3.1.5 Common data types

The following common data types are defined. They are used in the data type definitions of several services of Coexistence Media SAP.

```
TU ::= INTEGER

PHY_PARAM_SET ::= SET{
   aSlotTime                        INTEGER
   aSIFSTime                        INTEGER
   aCCATime                         INTEGER
   aPHY-RX-START-Delay              INTEGER
   aRxTxTurnaroundTime              INTEGER
   aTxPLCPDelay                     INTEGER
   aRxPLCPDelay                     INTEGER
   aRxTxSwitchTime                  INTEGER
   aTxRampOnTime                    INTEGER
   aTxRampOffTime                   INTEGER
   aTxRFDelay                       INTEGER
   aRxRFDelay                       INTEGER
   aAirPropagationTime              INTEGER
   aMACProcessingDelay              INTEGER
   aPreambleLength                  INTEGER
   aPLCPHeaderLength                INTEGER
   aMPDUDurationFactor              INTEGER
   aMPDUMaxLength                   INTEGER
   aCWmin                           INTEGER
```

```
   aCWmax                              INTEGER
}

CF_PARAM_SET ::= SET{
   CfpCount             INTEGER
   CfpPeriod            INTEGER
   CfpMaxDur            TU
   CfpDurRem            TU
}

BSS_CAPA_INFO ::= SET{
   ESS                                 BOOLEAN
   IBSS                                BOOLEAN
   CFPollable                          BOOLEAN
   CFPollRequest                       BOOLEAN
   Privacy                             BOOLEAN
   ShortPreamble                       BOOLEAN
   PBCC                                BOOLEAN
   ChannelAgility                      BOOLEAN
   SpectrumMgmt                        BOOLEAN
   QoS                                 BOOLEAN
   ShortSlotTime                       BOOLEAN
   APSD                                BOOLEAN
   DSSSOFDM                            BOOLEAN
   DelayedBlockAck                     BOOLEAN
   ImmediateBlockAck                   BOOLEAN
}

BSS_LOAD ::= SET{
   STACount                            INTEGER
   CHUtilization                       INTEGER
   AvailableAddmissionCap              INTEGER
}

NEIBR_BSS ::= SEQUENCE{
   NeighbourBSSId                      BSSID,
   NeighbourBSSChannel                 INTEGER
}

NEIBR_BSS_SET ::= SEQUENCE OF NEIBR_BSS

TV_CHANNEL_NUMBER ::= INTEGER

TV_CHANNEL_NUMBERS ::= SEQUENCE OF TV_CHANNEL_NUMBER

TV_POWER_LIMIT ::= INTEGER

TV_POWER_LIMITS ::= SEQUENCE OF TV_POWER_LIMIT

LIST_TV_CHANNELS ::= SEQUENCE{
   NumTVChannels                       INTEGER,
   TimeStamp                           TU,
   TVChannelNums                       TV_CHANNEL_NUMBERS,
   TVChannelPowerLimits                TV_POWER_LIMITS
}
```

Table 8 describes parameters of LIST_TV_CHANNELS data type.

Table 8 – Parameters of LIST_TV_CHANNELS data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| NumberOfTV Channels | INTEGER | Dependens on counry | The number of available TV channels. The parameter also specifies the vector size of information element xxx.2 and xxx.3 | 802.11af whitespace map |
| TimeStamp | TU | | It indicates the TSF timestamp when a STA accesses TV bands database to get the White Space Map information | |
| TVChannel Numbers | SEQUENCE OF INTEGER | | Specifies the list of TV channels for a given regulatory domin | |
| TVChannel PowerLimits | SEQUENCE OF INTEGER | | Specifies the power constraints of availbel TV channels | |

```
NETWORK_CHANNEL ::= SEQUENCE{
   OperationClass                    INTEGER,
   NumberofNetworkChannels           INTEGER,
   NetworkChannelNumber              INTEGER,
   NetworkChPowerConstraint          REAL
}
```

Table 9 describes parameters of NETWORK_CHANNEL data type.

Table 9 – Parameters of NETWORK_CHANNEL data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| NumberOf Network Channel | INTEGER | | The number of available network channels for 802.11 devices. The parameter also specifies the vector size of information element xxx.1, xxx.2 and xxx.3 | 802.11af network channel enablement |
| OperationClass | INTEGER | | It indicates the operation classes that the listed network channels apply. | |
| Network Channel Number | INTEGER | | Specifies the list of network channels for a given regulatory domin | |
| NetworkCh | rREAL | | Specifies the power | |

| | | | | |
|---|---|---|---|---|
| Power Constraint | | | constraints of availbel network channels | |

```
NETWORK_CHANNELS ::= SEQUENCE OF NETWORK_CHANNEL

POLARIZATION ::= ENUMERATED{
   Linear,
   Elliptical,
   Circular,
   …
}

ANTENNA_GAIN ::= SEQUENCE{
   Country                          STRING,
   TVChannelNumber                  TV_CHANNEL_NUMBER,
   AntennaGain                      REAL
}

ANTENNA_GAINS ::= SEQUENCE OF ANTENNA_GAIN

ANTENNA_INFO ::= SEQUENCE{
   AntennaBandwidth                 REAL,
   AntennaBeamPointing              REAL,
   AntennaBeamwidth                 REAL,
   AntennaDirectivityGain           REAL,
   AntennaHeight                    REAL,
   AntennaPolarization              POLARIZATION,
   AntennaGains                     ANTENNA_GAINS
}
```

Table 10 describes parameters of ANTENNA_INFO data type.

Table 10 – Parameters of ANTENNA_INFO data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| Antenna Bandwidth | REAL | | Bandwidth of the antenna used at the TV band devices. | 1900.6 |
| AntennaBeam Pointing | REAL | | The DataSeet.AntennaBeamPointing parameter specifies the beam pointing direction of the antenna used at the spectrum measurement module by giving the azimuthal angle with respect to North and elevation angle with respect to the horizon. | |
| Antenna Beamwidth | REAL | | Beamwidth of the antenna used at the spectrum measurement module, | |

| | | | | |
|---|---|---|---|---|
| | | | normally specified as half-power horizontal and vertical beamwidth. | |
| Antenna DirectivityGain | REAL | | Directivity gain in dBi of the antenna radiation pattern at the TV band devices. | |
| AntennaHeight | REAL | | Height of the antenna in meters with respect to sea level. (cf. 6.3.32) | |
| Antenna Polarization | ENUMERATED | | Polarization of the antenna used at the TV band devices. (cf. 6.3.32)<br>0: Linear polarization<br>1: Circular polarization<br>2: Elliptical polarization | |
| AntennaGain | ANTENNA_ GAINS | | Power gain in dB of the antenna used at the TV band devices for a list of TV channels. | |

```
TVBD_INFO ::= ENUMERATED{
   WRAN_BS,
   WRAN_CPE,
   WLANSTA,
   WLANAP,
   MAN_AP,
   MAN_STA
   …
}

NEIGHBOUR ::= SEQUENCE{
   TVBDID,                          STRING,
   TVBDInfo              TVBD_INFO,
   TVBDOccupiedChannels,            LIST_TV_CHANNELS,
   Mobility                         MOBILITY,
   …
}

LIST_NEIGHBOURS ::= SEQUENCE OF NEIGHBOUR

MOBILITY ::= ENUMERATED{
   FIXED,
   MOBILE,
   …
}

CHANNEL_SWITCH_MODE ::= ENUMERATED{
   TXRestricted,
   NOTRestricted
}

BSS_TYPE ::= ENUMERATED{
```

```
   INFRASTRUCTURE,
   INDEPENDENT,
   ANYBSS
}

SCAN_TYPE ::= ENUMERATED{
   ACTIVE,
   PASSIVE
}

CH_MEASU_TYPE ::= ENUMERATED{
   BASIC,
   CCA,
   RPI
}

SENSING_WINDOW ::= SEQUENCE{
   NumSensingPeriods                INTEGER,
   SensingPeriodDuration            INTEGER,
   SensingPeriodInterval            INTEGER
}
```

Table 11 describes parameters of SENSING_WINDOW data type.

Table 11 – Parameters of SENSING_WINDOW data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| NumSensing Periods | INTEGER | 0 to 63 | The number of sensing periods | |
| SensingPeriod Duration | INTEGER | 0 to 1023 | Duration of each sensing in terms of the number symbols | |
| SensingPeriod Interval | INTEGER | 0 to 2047 | Duration of interval in terms of the number of frames. | 802.22 SM-SSF |

```
SIGNAL_TYPE ::= ENUMERATED{
   Any,
   802.22WRAN,
   ATSC,
   DVB_T,
   ISDB_T,
   NTSC,
   PAL,
   SECAM,
   Microphone,
   802.22.1SyncBurst,
   802.22.1PPDUMFS1,
   802.22.1PPDUMSF2,
   802.22.1PPDUMSF3,
   MedicalTele,
   Studio,
```

```
   …
}

SENSING_MODE ::= ENUMERATED{
   Hard,
   HardWithConfidenceValue,
   Soft,
   SoftWithConfidenceValue
}

PERF_METRIC ::= SEQUENCE{
   PerfMetricPd          INTEGER,
   PerfMetricPfa         INTEGER
}
```

Table 12 describes parameters of PERF_METRIC data type.

Table 12 – Parameters of PERF_METRIC data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| PerfMetricPd | INTEGER | | | When the PerformanceMetric.pd is specified sensors perform sensing by setting the rate of detection according to this value. Rate of detection is expressed as a percentage bounded between 0% and 100%. |
| PerfMetricPfa | INTEGER | | | When the PerformanceMetric.pfa is specified sensors perform sensing by setting the rate of false alarm according this value. Rate of false alarm is expressed as a percentage bounded between 0% and 100%. |

```
BASIC_REPORT ::= SEQUENCE{
   BSS                              BOOLEAN,
   OFDM                             BOOLEAN,
   UnidentifiedSignal               BOOLEAN,
   PrimaryServiceSignal             BOOLEAN,
   Unmeasured                       BOOLEAN,
   …
}
```

Table 13 describes parameters of BASIC_REPORT data type.

Table 13 – Parameters of BASIC_REPORT data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| BSS | BOOLEAN | | BSS bit, which shall be set to 1 when at least one valid MPDU was received in the channel during the measurement period from another BSS or IBSS. Otherwise, the BSS bit shall be set to 0. | |
| OFDM | BOOLEAN | | OFDM preamble bit, which shall be set to 1 when at least one sequence of short training symbols, as defined in 17.3.3, was detected in the channel during the measurement period without a subsequent valid Signal field (see 17.3.4). This may indicate the presence of an OFDM preamble, such as highperformance RLAN/2 (HIPERLAN/2). Otherwise, the OFDM preamble bit shall be set to 0. | |
| Unidentified Signal | BOOLEAN | | May be set to 1 when significant power is detected in the channel during the measurement period that cannot be characterized as radar, an OFDM preamble, or a valid MPDU. Otherwise, the Unidentified Signal bit shall be set to 0. The definition of significant power is implementation dependent. | |
| PrimaryService Signal | BOOLEAN | | Shall be set to 1 when primary service signals was detected operating in the channel during the measurement period. The algorithm to detect radar shall satisfy regulatory requirements and is outside the scope of this standard. Otherwise, the Radar bit shall be set to 0. | |
| Unmeasured | BOOLEAN | | Shall be set to 1 when this channel has not been measured. Otherwise, the | |

| | | | | |
|---|---|---|---|---|
| | | | Unmeasured bit shall be set to 0. When the Unmeasured field is set to 1, all the other bit fields shall<br>be set to 0. | |

```
CCA_REPORT ::= SEQUENCE{
   CCABusy              REAL,
   …
}
```

Table 14 describes parameters of CCA_REPORT data type.

Table 14 – Parameters of CCA_REPORT data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| CCABusy | REAL | From 0 to 1 | The CCA Busy Fraction field shall contain the fractional duration over which CCA indicated the channel was busy during the measurement duration. The resolution of the CCA busy measurement is in microseconds. The CCA Busy Fraction value is defined as Ceiling (255 * [Duration CCA indicated channel was busy (microseconds)] / (1024 * [Measurement duration (TUs)])). | |

```
RPI_REPORT ::= SEQUENCE{
   RPIHistogramReportRPI0Density0              INTEGER,
   RPIHistogramReportRPI0Density1              INTEGER,
   RPIHistogramReportRPI0Density2              INTEGER,
   RPIHistogramReportRPI0Density3              INTEGER,
   RPIHistogramReportRPI0Density4              INTEGER,
   RPIHistogramReportRPI0Density5              INTEGER,
   RPIHistogramReportRPI0Density6              INTEGER,
   RPIHistogramReportRPI0Density7              INTEGER
}
```

Table 15 describes parameters of RPI_REPORT data type.

Table 15 – Parameters of RPI_REPORT data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| RPIHistogramReportRPI0Density0 | INTEGER | 0~255 | Density for Power ≤ –87 | |
| RPIHistogramReportRPI0Density1 | INTEGER | 0~255 | Density for –87 < Power ≤–82 | |
| RPIHistogramReportRPI0Density2 | INTEGER | 0~255 | Density for –82 < Power ≤–77 | |
| RPIHistogramReportRPI0Density3 | INTEGER | 0~255 | Density for –77 < Power ≤–72 | |
| RPIHistogramReportRPI0Density4 | INTEGER | 0~255 | Density for –72 < Power ≤–67 | |
| RPIHistogramReportRPI0Density5 | INTEGER | 0~255 | Density for –67 < Power ≤–62 | |
| RPIHistogramReportRPI0Density6 | INTEGER | 0~255 | Density for –62 < Power ≤–57 | |
| RPIHistogramReportRPI0Density7 | INTEGER | 0~255 | Density for –57 < Power | |

```
CH_MEASU_REPORT ::= CHOICE{
   BasicReport          BASIC_REPORT,
   CCAReport            CCA_REPORT,
   RPIHistogramReport   RPI_REPORT
}

INTERVAL ::= SEQUENCE{
   IntervalStart        REAL,
   IntervalStop         REAL
}

CONFIDENCE_LEVEL ::= SEQUENCE{
   ConfidenceLevelValue             REAL,
   ConfidenceLevelInterval          INTERVAL
}

MODE0RESULT ::= SEQUENCE{
   SignalType           SIGNAL_TYPE,
   Presence             BOOLEAN
}

MODE0RESULTs ::= SEQUENCE OF MODE0RESULT
```

Table 16 describes parameters of MODE0RESULT data type.

Table 16 – Parameters of MODE0RESULT data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| SignalType | SIGNAL_TYPE | | | |
| Presence | BOOLEAN | 0 or 1 | For each signal type the SSF generates a binary decision as to whether the signal is present in the television channel | IEEE 802.22 |

```
MODE1RESULT ::= SEQUENCE{
   Mode0Result          MODE0RESULT,
   ConfidenceLevel      CONFIDENCE_LEVEL
}

MODE1RESULTS ::= SEQUENCE OF MODE1RESULT
```

Table 17 describes parameters of MODE1RESULT data type.

Table 17 – Parameters of MODE1RESULT data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| SignalType | SIGNAL_TYPE | | | |
| SignalPresence | BOOLEAN | | For each signal type the SSF generates a binary decision as to whether the signal is present in the television channel | IEEE 802.22 |
| Confidence Level | CONFIDENCE_ LEVEL | | Confidence of measurement result for each type of signal specified | IEEE 1900.6 |

```
MODE2RESULT ::= SEQUENCE{
   SignalType           SIGNAL_TYPE,
   Strength             REAL
}

MODE2RESULTS ::= SEQUENCE OF MODE2RESULT
```

Table 18 describes parameters of MODE2RESULT data type.

Table 18 – Parameters of MODE2RESULT data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| SignalType | SIGNAL_TYPE | | | |
| Strength | REAL | | For each signal type the | IEEE 802.22 |

| | | | | |
|---|---|---|---|---|
| | | | SSF generates an estimate of the field strength of that signal | |

```
MODE3RESULT ::= SEQUENCE{
   Mode2Result          MODE2RESULT,
   StandardDeviation    REAL
}

MODE3RESULTS ::= SEQUENCE OF MODE3RESULT
```

Table 19 describes parameters of MODE3RESULT data type.

Table 19 – Parameters of MODE3RESULT data type

| Name | Type | Valid range | Description | Note |
|---|---|---|---|---|
| SignalType | SIGNAL_TYPE | | | |
| Strength | REAL | | For each signal type the SSF generates an estimate of the field strength of that signal | IEEE 802.22 |
| Standard Deviatoin | REAL | | The standard deviation of the field strength estimate from sensing mode | IEEE 802.22 |

```
SENSING_RESULT ::= CHOICE{
   Mode0Results         MODE0RESULTs,
   Mode1Results         MODE1RESULTs,
   Mode2Results         MODE2RESULTs,
   Mode3Results         MODE3RESULTs
}

TRANSMISSIONINTERVAL ::= SEQUENCE{
   TransmissionStart                TU,
   TransmissionDuration             TU,
   TransmissionChannel              Network_CHANNEL
}

TRANSMISSIONSEQUENCE ::= SEQUENCE OF TRANSMISSIONINTERVAL

SCHEDULE ::= SEQUENCE{
   SchedulingStartTime              TU,
   SchedulingPeriodDuration         TU,
   NumberOfSchedulingPeriods        INTEGER,
   TransmissionSequence             TRANSMISSIONSEQUENCE
}

INTERFERENCE_LEVEL ::= SEQUENCE{
   NetworkChannel                   NETWORK_CHANNEL,
   Interference                     REAL
```

```
}

INTERFERENCE_LEVELs ::= SEQUENCE OF INTERFERENCE_LEVEL

NEIGHBOUR_CHANGE ::= SEQUENCE{
   AddedBSSs            SEQUENCE OF STRING,
   RemovedBSSs          SEQUENCE OF STRING
}
```

### 5.3.2 Coexistence Transport SAP data types

The following data types are defined for Coexistence Transport SAP.

```
TRANSPORT_PREF ::= ENUMERATED{
            TCP,
   UDP,
   HTTP,
   SNMP,
   …
}

TRANSPORT_ADDR ::= OCTET_STRING
```

# 6. Procedures and protocols

## 6.1 Generic procedures for information exchange

## 6.2 Protocols

# 7. Coexistence mechanisms and algorithms