IEEE P802.19
Wireless Coexistence

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| Profile O CE |
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Abstract

This document is a submission to IEEE 802.19 TG1 that contains description of profile O based CE. Mobility information related parameters are described in 19-13/0063r0.

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# Entity operation

* + 1. **Profile O**
			1. General description

Profile O is designed for CEs that use operating frequency mode and that are capable of representing one or more WSOs that each are independently subscribed to either the management service or the information service available in a CM. Number of WSOs the CE is capable of representing concurrently is implementation dependent.

A CE that operates as per profile O shall support the following CE-initiated procedures:

* WSO subscription
* WSO subscription update
* WSO registration
* WSO registration update
* Obtaining coexistence report
* Providing one-time measurement report
* Providing scheduled measurement reports

A CE that operates as per profile O shall support the following CM-initiated procedures:

* Providing coexistence report
* Obtaining available channel list from WSO
* Requesting measurements
* Sending reconfiguration request from CM to CE

High level flow chart of the CE operation is provided in the following figure.



After receiving a request to start operation, the CE shall establish a connection to a CM. Such a request may be received as an example from a management entity of a WSO to which the CE is connected. Alternatively the CE may be implemented as a client or agent process that is initiated by a user. In order to establish a connection to a CM, the CE needs the CM ID, the CM IP address and the CM port number. The CE may try to discover CMs in order to obtain all this information of a CM. Connection establishment is performed as specified in [reference to common operations clause].

Once the CE is connected to a CM, it checks whether there is a reason to initiate a CE-initiated procedure, whether a first message of a CM-initiated procedure is received and requires processing or whether the connection to the CM is to be terminated.

Rules and operations related to initiation and execution of the supported CE-initiated procedures are specified in **Error! Reference source not found.**.

Operations related to execution of the supported CM-initiated procedures are specified in **Error! Reference source not found.**.

Actions upon receiving a first message of a CM-initiated procedure that the CE doesn’t support are implementation specific and beyond the scope of the specification.

Rules and operations related to the connection termination are specified in **Error! Reference source not found.**. Once the CE has terminated the connection to the CM it may stop its operation.

* + - 1. CE-initiated procedure execution

A CE may initiate any of the CE-initiated procedures it supports at any time within the following constraints:

* The WSO subscription update procedure may be initiated only on those WSOs for which the CE has a service subscription with a CM
* The WSO registration procedure may be initiated only on those WSOs for which the CE has a service subscription with a CM
* The WSO registration update procedure may be initiated only on those WSOs for which the CE has a service subscription with a CM and for which the CE has performed the WSO registration
* The obtaining coexistence report procedure may be initiated only on one or more WSOs for which the CE has the information service subscription with a CM and for which the CE has performed the WSO registration
* The providing one-time measurement report procedure may be initiated only on those WSOs for which the CE has a service subscription with a CM, for which the CE has performed the WSO registration and for which the CE has a measurement request for a one-time measurement pending. It is implementation dependent how many measurement requests for a one-time measurement a CE may have concurrently pending.
* The providing scheduled measurement reports procedure may be initiated only on those WSOs for which the CE has a service subscription with a CM, for which the CE has performed the WSO registration and for which the CE has a measurement request for a scheduled measurement pending. It is implementation dependent how many measurement requests for a scheduled measurement a CE may have concurrently pending.

Further procedure specific constraints may apply and if that is the case those are specified in the clauses below that specify execution of each CE-initiated procedure.

* + - * 1. WSO subscription

In order for a CE to subscribe a coexistence service for one or more WSOs the CE shall perform the WSO subscription procedure specified in [reference] in the manner specified in this clause.

Once the CE has wsoID, clientID, clientPassword, coexistence service type, serverID and serverPassword for each WSO for which the CE intends to subscribe a coexistence service, the CE shall generate a SubscriptionRequest message with the parameters of the CxMessage as shown in Table A.1 and send the message to the CM. The subscriptionRequest field of the CxMessage shall contain one or more elements that each contains information described in Table A.2. Each element represents one WSO and there shall be as many elements in the subscriptionRequest field as is the number of WSOs for which the CE intends to subscribe a coexistence service.

Table A.1 – CxMessage fields in SubscriptionRequest message when requesting subscription

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Header*** | ***CxHeader*** | ***requestID*** |
| ***Payload*** | ***CxPayload*** | ***subscriptionRequest*** |

Table A.2 – subscriptionRequest payload element for one WSO when requesting subscription

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***wsoID*** | ***INTEGER*** | WSO identifier that is managed by the CE and that uniquely identifies the WSOs connected to the CE and for which the CE requests service subscription. |
| ***clientID*** | ***IA5String*** | WSO subscription identifier |
| ***clientPassword*** | ***IA5String*** | WSO subscription password |
| ***coexistenceService*** | ***CoexistenceService*** | Set to “information” if the intent is to subscribe to the information service.Set to “management” if the intent is to subscribe to the management service. |

Upon receiving a SubscriptionResponse message from the CM, the CE shall consider having a service subscription for a WSO when all the following conditions are met:

1. The serverID for the WSO in the SubscriptionResponse message payload equals the serverID for the WSO that the CE has
2. The serverPassword for the WSO in the SubscriptionResponse message payload equals the serverPassword for the WSO that the CE has
3. The status for the WSO in the SubscriptionResponse message payload equals noError

If any of the conditions fail, the CE shall consider the WSO subscription for the WSO failed and the CE shall have no service subscription for the WSO. Actions of a CE upon a failed subscription for a WSO are implementation dependent and beyond the scope of the standard.

* + - * 1. WSO subscription update

In order for a CE to update coexistence service subscription for one or more WSOs the CE shall perform the WSO subscription update procedure specified in [reference] in the manner specified in this clause.

Once the CE has a new coexistence service type for each WSO for which the CE intends to update the coexistence service subscription, the CE shall generate a SubscriptionRequest message with the parameters of the CxMessage as shown in Table A.3 and send the message to the CM. The subscriptionRequest field of the CxMessage shall contain one or more elements that each contains information described in Table A.4. Each element represents one WSO and there shall be as many elements in the subscriptionRequest field as is the number of WSOs for which the CE intends to update coexistence service subscription.

Table A.3 – CxMessage fields in SubscriptionRequest message when requesting subscription update

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***header*** | ***CxHeader*** | ***requestID*** |
| ***payload*** | ***CxPayload*** | ***subscriptionRequest*** |

Table A.4 – subscriptionRequest payload element for one WSO when requesting subscription update

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***wsoID*** | ***INTEGER*** | WSO identifier that is managed by the CE and that uniquely identifies the WSOs connected to the CE and for which the CE requests service subscription update.  |
| ***clientID*** | ***IA5String*** | Not present |
| ***clientPassword*** | ***IA5String*** | Not present |
| ***coexistenceService*** | ***CoexistenceService*** | Set to “information” if the intent is to update the service subscription to the information service.Set to “management” if the intent is to update the service subscription to the management service. |

Upon receiving a SubscriptionResponse message from the CM, the CE shall consider having a service subscription for a WSO when all the following conditions are met:

1. The status for the WSO in the SubscriptionResponse message payload equals noError

If any of the conditions fail, the CE shall consider the WSO subscription update for the WSO failed and the CE shall have the service subscription for the WSO unchanged. Actions of a CE upon a failed subscription update for a WSO are implementation dependent and beyond the scope of the standard.

The CE informs the result of the subscription to the WSO.

* + - * 1. WSO registration

In order for a CE to register one or more WSOs the CE shall perform the WSO registration procedure specified in [reference] in the manner specified in this clause.

 Once the CE has all the registration information for those WSOs that the CE intends to register to the CM, the CE shall generate a RegistrationRequest message with the parameters of the CxMessage as shown in Table A.5 and send the message to the CM. The registrationRequest field of the CxMessage shall contain one or more elements that each contains information described in Table A.6. Each element represents one WSO and there shall be as many elements in the registrationRequest field as is the number of WSOs that the CE intends to register.

Table A.5 – CxMessage fields in RegistrationRequest message when requesting registration

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Header*** | ***CxHeader*** | ***requestID*** |
| ***Payload*** | ***CxPayload*** | ***registrationRequest*** |

Table A.6 – registrationRequest payload element for one WSO when requesting registration

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***operationCode*** | ***OperationCode*** | Shall be set to indicate new registration. |
| ***wsoID*** | ***INTEGER*** | WSO identifier that is managed by the CE and that uniquely identifies the WSOs connected to the CE and for which the CE requests registration. |
| ***networkID*** | ***OCTET STRING*** | Identifier of the network to which the WSO belongs. |
| ***networkTechnology*** | ***NetworkTechnology*** | Shall be set to a value that represents the network technology of the WSO. |
| ***networkType*** | ***NetworkType*** | Shall be set to a value that represents the network type of the WSO. |
| ***deviceRegulatoryID*** | ***OCTET STRING*** | Shall be set to a value that equals the regulatory identifier of the WSO. |
| ***deviceSN*** | ***OCTET STRING*** | Shall be set to a value that equals the serial number of the WSO. |
| ***listOfAvailableFrequencies*** | ***AvailableChannelList*** | As specified in Table A.7. |
| ***discoveryInformation*** | ***DiscoveryInformation*** | As specified in Table A.8.  |
| ***aCLR*** | ***REAL*** | Not present |
| ***aCS*** | ***REAL*** | Not present |
| ***guaranteedQoSOfBackhaulConn*** | ***QuaranteedQoSOfBackhaulConnection*** | Not present |
| ***listOfSuppFrequencies*** | ***ListOfSupportedFrequencies*** | As specified in Table A.9. |
| ***listOfOperFrequencies*** | ***ListOfOperatingFrequencies*** | As specified in Table A.10. |
| ***minTxPower*** | ***REAL*** | Shall be set to a value that represents the minimum transmit power of the WSO. |
| ***txScheduleSupported*** | ***BOOLEAN*** | Shall be set to a value that represents the WSO’s capability to support transmit scheduling. |
| ***reconfigurationSupported*** | ***BOOLEAN*** | Shall be set to FALSE |
| ***addNetworkTechnology*** | ***SEQUENCE of NetworkTechnology*** | Not present |
| ***radioEnvInformation*** | ***RadioEnvironmentInformation*** | Not present |
| ***requiredResource*** | ***RequiredResource*** | As specified in Table A.11. |
| ***measurementCapability*** | ***MeasurementCapability*** | As specified in Table A.12. |
| ***mobilityInformation*** | ***MobilityInformation*** | As specified in Table A.13. |

The listOfAvailableFrequencies parameter shall comprise of parameters described in Table A.7. The CE shall set the parameters in the listOfAvailableFrequencies parameter as specified in Table A.7.

Table A.7 – listOfAvailableFrequencies parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***frequencyRange*** | ***FrequencyRange*** | Shall be set to indicate the available frequency range. |
| ***txPowerLimit*** | ***REAL*** | Shall be set to indicate the power limit in the available frequency range. |
| ***availableStartTime*** | ***GeneralizedTime*** | Shall be set to indicate start time of the available frequency range if applicable. |
| ***availableDuration*** | ***REAL*** | Shall be set to indicate duration of the available frequency range if applicable. |

The discoveryInformation parameter shall comprise of parameters described in Table A.8. The CE shall set the parameters in the discoveryInformation parameter as specified in Table A.8.

Table A.8 – discoveryInformation parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***geolocation*** | ***Geolocation*** | Shall be set to indicate WSO location (latitude, longitude and altitude) and whether the antenna is indoors, outdoors or in unknown environment |
| ***maxTxPowerPerHz*** | ***REAL*** | Shall be set to indicate the max transmit power density of the WSO. |
| ***rxSensitivity*** | ***REAL*** | Shall be set to indicate the receiver sensitivity of the WSO. |
| ***rxAntennaGain*** | ***AntennaGain*** | Shall be set to indicate the receive antenna gain of the WSO. |
| ***txAntennaGain*** | ***AntennaGain*** | Shall be set to indicate the transmit antenna gain of the WSO. |
| ***txSignalBW*** | ***INTEGER*** | Shall be set to indicate the transmission signal bandwidth of the WSO. |
| ***minReqSNR*** | ***REAL*** | Shall be set to indicate the minimum required SNR of the WSO. |
| ***tolerableInterferenceLevel*** | ***REAL*** | Shall be set to indicate the interference level the WSO tolerates.  |

The listOfSuppFrequencies parameter shall comprise of parameters described in Table A.9. The CE shall set the parameters in the listOfSuppFrequencies parameter as specified in Table A.9.

Table A.9 – listOfSuppFrequencies parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***frequencyRange*** | ***FrequenyRange*** | Shall be set to indicate the frequency range in which the WSO is capable of operating. |

The listOfOperFrequencies parameter shall comprise of parameters described in Table A.10. The CE shall set the parameters in the listOfOperFrequencies parameter as specified in Table A.10.

Table A.10 – listOfOperFrequencies parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***frequencyRange*** | ***FrequenyRange*** | Shall be set to indicate the frequency range in which the WSO currently operates.  |
| ***Occupancy*** | ***REAL*** | Optionally present. If present, this parameter shall be set to indicate occupancy of the WSO frequency range. |

The requiredResource parameter shall comprise of parameters described in Table A.11. The CE shall set the parameters in the requiredResource parameter as specified in Table A.11.

Table A.11 – requiredResource parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***requestedBandwidth*** | ***REAL*** | Shall be set to indicate bandwidth requested for the WSO.  |
| ***Occupancy*** | ***REAL*** | Shall be set to indicate expected occupancy of the operating frequency if the operating frequency bandwidth is equal to the requested bandwidth.  |

The measurementCapability parameter shall comprise of parameters described in Table A.12. The CE shall set the parameters in the measurementCapability parameter as specified in Table A.12.

Table A.12 – measurementCapability parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***sinrSupport*** | ***BOOLEAN*** | Shall be set to TRUE, if SINR measurements are supported. Otherwise, this parameter shall be set to FALSE. |
| ***ferSupport*** | ***BOOLEAN*** | Shall be set to TRUE, if FER measurements are supported. Otherwise, this parameter shall be set to FALSE. |
| ***ipnfSupport*** | ***BOOLEAN*** | Shall be set to TRUE, if IPNF measurements are supported. Otherwise, this parameter shall be set to FALSE. |
| ***signalDistributionSupport*** | ***BOOLEAN*** | Shall be set to TRUE, if Signal Distribution measurements are supported. Otherwise, this parameter shall be set to FALSE. |
| ***spectrumSupport*** | ***BOOLEAN*** | Shall be set to TRUE, if Spectrum measurements are supported. Otherwise, this parameter shall be set to FALSE. |
| ***ownNetworkChannelLoadSupport*** | ***BOOLEAN*** | Shall be set to TRUE, if Own Network Channel Load measurements are supported. Otherwise, this parameter shall be set to FALSE. |
| ***totalChannelLoadSupport*** | ***BOOLEAN*** | Shall be set to TRUE, if Total Channel Load measurements are supported. Otherwise, this parameter shall be set to FALSE. |
| ***otherUsersSupport*** | ***BOOLEAN*** | Shall be set to TRUE, if Other Users measurements are supported. Otherwise, this parameter shall be set to FALSE. |

Table A.13 – mobilityInformation parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***TBD*** | ***TBD*** | TBD |
| ***TBD*** | ***TBD*** | TBD |
| ***TBD*** | ***TBD*** | TBD |

Upon receiving a RegistrationResponse message from the CM, the CE shall consider having a WSO registered to the CM when all the following conditions are met:

1. The status for the WSO in the RegistrationResponse message payload equals noError

If any of the conditions fail, the CE shall consider the WSO registration for the WSO failed and the CE shall have no registration for the WSO. Actions of a CE upon a failed registration for a WSO are implementation dependent and beyond the scope of the standard.

The CE shall maintain record on the following information for each registered WSO that the CE represents:

1. List of available frequencies
2. List of supported frequencies
3. Measurement capability

The CE shall use the list of supported frequencies record to ensure that it doesn’t accept any reconfiguration commands targeted to a registered WSO that have a mismatch with the supported frequencies. The CE shall use the list of available frequencies record to ensure that it doesn’t accept any reconfiguration commands targeted to a registered WSO that are not within the limits of the available frequencies. The CE shall use the measurement capability record to ensure that it doesn’t accept any measurement requests from the CM targeted to a registered WSO that the WSO doesn’t support.

The CE informs the result of the registration to the WSO.

* + - * 1. WSO registration update

In order for a CE to update registration of one or more WSOs the CE shall perform the WSO registration update procedure specified in [reference] in the manner specified in this clause.

 Once the CE has all the registration update information for those WSOs for which the CE intends to update registration to the CM, the CE shall generate a RegistrationRequest message with the parameters of the CxMessage as shown in Table A.14 and send the message to the CM. The registrationRequest field of the CxMessage shall contain one or more elements that each contains one or more of the information described in Table A.15. Only the information and parameters that have changed and are the reason for the registration update shall be included in the registrationRequest payload element. Each element represents one WSO and there shall be as many elements in the registrationRequest field as is the number of WSOs for which the CE intends to update the registration.

Table A.14 – CxMessage fields in RegistrationRequest message when requesting registration update

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Header*** | ***CxHeader*** | ***requestID*** |
| ***payload*** | ***CxPayload*** | ***registrationRequest*** |

Table A.15 – registrationRequest payload element for one WSO when requesting registration update

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***operationCode*** | ***OperationCode*** | Shall be set to indicate registration update. |
| ***wsoID*** | ***INTEGER*** | WSO identifier that is managed by the CE and that uniquely identifies the WSOs connected to the CE and for which the CE requests registration update. |
| ***networkID*** | ***OCTET STRING*** | Not present |
| ***networkTechnology*** | ***NetworkTechnology*** | Not present |
| ***networkType*** | ***NetworkType*** | Not present |
| ***deviceRegulatoryID*** | ***OCTET STRING*** | Not present |
| ***deviceSN*** | ***OCTET STRING*** | Not present |
| ***listOfAvailableFrequencies*** | ***AvailableFrequencies*** | As specified in Table A.16. |
| ***discoveryInformation*** | ***DiscoveryInformation*** | As specified in Table A.17.  |
| ***aCLR*** | ***REAL*** | Not present |
| ***aCS*** | ***REAL*** | Not present |
| ***guaranteedQoSOfBackhaulConn*** | ***QuaranteedQoSOfBackhaulConnection*** | Not present |
| ***listOfSuppFrequencies*** | ***ListOfSupportedFrequencies*** | Not present |
| ***listOfOperFrequencies*** | ***ListOfOperatingFrequencies*** | As specified in Table A.18. |
| ***minTxPower*** | ***REAL*** | Shall be set to a value that represents the minimum transmit power of the WSO. |
| ***txScheduleSupported*** | ***BOOLEAN*** | Not present |
| ***reconfigurationSupported*** | ***BOOLEAN*** | Not present |
| ***addNetworkTechnology*** | ***SEQUENCE of NetworkTechnology*** | Not present |
| ***radioEnvInformation*** | ***RadioEnvironmentInformation*** | Not present |
| ***requiredResource*** | ***RequiredResource*** | As specified in Table A.19. |
| ***measurementCapability*** | ***MeasurementCapability*** | Not present |
| ***mobilityInformation*** | ***MobilityInformatoin*** | As specified in Table A.20. |

The listOfAvailableFrequencies parameter shall comprise of parameters described in Table A.16. The CE shall set the parameters in the listOfAvailableFrequencies parameter as specified in Table A.16.

Table A.16 – listOfAvailableFrequencies parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***frequencyRange*** | ***FrequencyRange*** | Shall be set to indicate the available frequency range. |
| ***txPowerLimit*** | ***REAL*** | Shall be set to indicate the power limit in the available frequency range. |
| ***availableStartTime*** | ***GeneralizedTime*** | Shall be set to indicate start time of the available frequency range if applicable. |
| ***availableDuration*** | ***REAL*** | Shall be set to indicate duration of the available frequency range if applicable. |

The discoveryInformation parameter shall comprise of parameters described in Table A.17. The CE shall set the parameters in the discoveryInformation parameter as specified in Table A.17.

Table A.17 – discoveryInformation parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***geolocation*** | ***Geolocation*** | Shall be set to indicate WSO location (latitude, longitude and altitude) and whether the antenna is indoors, outdoors or in unknown environment |
| ***maxTxPowerPerHz*** | ***REAL*** | Shall be set to indicate the max transmit power density of the WSO. |
| ***rxSensitivity*** | ***REAL*** | Shall be set to indicate the receiver sensitivity of the WSO. |
| ***rxAntennaGain*** | ***AntennaGain*** | Shall be set to indicate the receive antenna gain of the WSO. |
| ***txAntennaGain*** | ***AntennaGain*** | Shall be set to indicate the transmit antenna gain of the WSO. |
| ***txSignalBW*** | ***INTEGER*** | Shall be set to indicate the transmission signal bandwidth of the WSO. |
| ***minReqSNR*** | ***REAL*** | Shall be set to indicate the minimum required SNR of the WSO. |
| ***tolerableInterferenceLevel*** | ***REAL*** | Shall be set to indicate the interference level the WSO tolerates.  |

The listOfOperFrequencies parameter shall comprise of parameters described in Table A.18. The CE shall set the parameters in the listOfOperFrequencies parameter as specified in Table A.18.

Table A.18 – listOfOperFrequencies parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***frequencyRange*** | ***FrequenyRange*** | Shall be set to indicate the frequency range in which the WSO currently operates.  |
| ***occupancy*** | ***REAL*** | Optionally present. If present, this parameter shall be set to indicate occupancy of the WSO frequency range. |

The requiredResource parameter shall comprise of parameters described in Table A.19. The CE shall set the parameters in the requiredResource parameter as specified in Table A.19.

Table A.19 – requiredResource parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***requestedBandwidth*** | ***REAL*** | Shall be set to indicate bandwidth requested for the WSO.  |
| ***Occupancy*** | ***REAL*** | Shall be set to indicate expected occupancy of the operating frequency if the operating frequency bandwidth is equal to the requested bandwidth.  |

Table A.20 – mobilityInformation parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***TBD*** | ***TBD*** | TBD |
| ***TBD*** | ***TBD*** | TBD |
| ***TBD*** | ***TBD*** | TBD |

Upon receiving a RegistrationResponse message from the CM, the CE shall consider having the registration update successful when all the following conditions are met:

1. The status for the WSO in the RegistrationResponse message payload equals noError

If any of the conditions fail, the CE shall consider the WSO registration update for the WSO failed. Actions of a CE upon a failed registration update for a WSO are implementation dependent and beyond the scope of the standard.

The CE informs the result of the registration update to the WSO.

* + - * 1. Obtaining coexistence report

In order for a CE to obtain a coexistence report for one or more subscribed and registered WSOs the CE shall perform the obtaining coexistence report procedure specified in [reference] in the manner specified in this clause.

 The CE shall generate a CoexistenceReportRequest message with the parameters of the CxMessage as shown in Table A.21 and send the message to the CM. The reportRequest field of the CxMessage shall contain one or more elements that each contains information described in Table A.22. Each element represents one WSO and there shall be as many elements in the reportRequest field as is the number of WSOs for which the CE requests a coexistence report.

Table A.21 – CxMessage fields in CoexistenceReportRequest message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***header*** | ***CxHeader*** | ***requestID*** |
| ***payload*** | ***CxPayload*** | ***reportRequest*** |

Table A.22 – reportRequest payload element for one WSO

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***wsoID*** | ***INTEGER*** | WSO identifier that is managed by the CE and that uniquely identifies the WSOs connected to the CE and for which the CE requests coexistence report. |

Upon receiving a CoexistenceReportResponse message from the CM, the CE provides the message payload information to the WSO.

* + - * 1. Providing one-time measurement report

In order for a CE to provide a one-time measurement report related to one or more subscribed and registered WSOs to the CM, the CE shall perform the providing one-time measurement reports procedure specified in [reference] in the manner specified in this clause.

The CE shall generate a MeasurementResponse message with the parameters of the CxMessage as shown in Table A.23 and send the message to the CM. The measurementRsp field of the CxMessage shall contain one or more elements that each contains information described in Table A.24. Each element represents a measurement report from one WSO and there shall be as many elements in the measurementRsp field as is the number of WSOs for which the CE provides a measurement report.

Table A.23 – CxMessage fields in MeasurementResponse message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***header*** | ***CxHeader*** | ***requestID*** |
| ***payload*** | ***CxPayload*** | ***measurementRsp*** |

Table A.24 – measurementRsp parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***wsoID*** | ***INTEGER*** | WSO identifier that is managed by the CE and that uniquely identifies the WSOs connected to the CE and for which the CE provides a measurement report. |
| ***measurementDescription*** | ***MeasurementDescription*** | As specified in Table A.25 |
| ***measurementReport*** | ***MeasurementReport*** | As specified in Table A.26 |

The mesurementDescription parameter shall comprise of parameters described in Table A.25. The CE shall set the parameters in the measurementDescription parameter as specified in Table A.25.

Table A.25 – measurementDescription parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***measType*** | ***MeasurementType*** | Shall be set to a value that indicates the measurement type of this measurement report.  |
| ***measSchedule*** | ***MeasurementSchedule*** | Not present |
| ***startStopFreq*** | ***FrequencyIndication*** | Shall be set to indicate the frequency span (start frequency, stop frequency) on which the reported measurement was taken.  |

The measurementReport parameter shall comprise of parameters described in Table A.26. The CE shall set the parameters in the measurementReport parameter as specified in Table A.26.

Table A.26 – measurementReport parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***sinrReport*** | ***SinrReport*** | Shall be present only if the measType equals sinr. When present this parameter shall contain the SINR report obtained from the WSO. |
| ***ferReport*** | ***FerReport*** | Shall be present only if the measType equals fer. When present this parameter shall contain the FER report obtained from the WSO. |
| ***signalDistributionReport*** | ***SignalDistributionReport*** | Shall be present only if the measType equals signalDistribution. When present this parameter shall contain the signal distribution report obtained from the WSO. |
| ***spectrumReport*** | ***SpectrumReport*** | Shall be present only if the measType equals spectrum. When present this parameter shall contain the spectrum report obtained from the WSO. |
| ***ownNetworkChannelLoadReport*** | ***OwnNetworkChannelLoadReport*** | Shall be present only if the measType equals ownNetworkChannelLoad. When present this parameter shall contain the own network channel load report obtained from the WSO. |
| ***totalChannelLoadReport*** | ***TotalChannelLoadReport*** | Shall be present only if the measType equals totalChannelLoad. When present this parameter shall contain the total channel load report obtained from the WSO. |
| ***otherUsersReport*** | ***OtherUsersReport*** | Shall be present only if the measType equals otherUsers. When present this parameter shall contain the other users report obtained from the WSO. |

Upon receiving a MeasurementConfirm message from the CM, the CE shall consider transmission of one-time measurement report successful, when all the following conditions are met:

1. The status for the WSO in the MeasurementConfirm message payload equals noError

If any of the conditions fail, the CE shall consider the one-time measurement report transmission failing. Actions of a CE upon a failed transmission of a one-time measurement report are implementation dependent and beyond the scope of the standard.

Once the CM has successfully completed provisioning of one-time measurement report it shall consider the request for a one-time measurement completed.

* + - * 1. Providing scheduled measurement reports

In order for a CE to provide scheduled measurement reports related to one or more subscribed and registered WSOs to the CM, the CE shall perform the providing scheduled measurement reports procedure specified in [reference] in the manner specified in this clause.

 The CE shall generate MeasurementResponse messages with the parameters of the CxMessage as shown in Table A.27 and send the message to the CM as long as the request for scheduled measurements is valid. The request becomes invalid once the schedule in the request expires.

The measurementRsp field of the CxMessage shall contain one or more elements that each contains information described in Table A.28. Each element represents a measurement report from one WSO and there shall be as many elements in the measurementRsp field as is the number of WSOs for which the CE provides a measurement report.

Table A.27 – CxMessage fields in MeasurementResponse message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Header*** | ***CxHeader*** | ***requestID*** |
| ***Payload*** | ***CxPayload*** | ***measurementRsp*** |

Table A.28 – measurementRsp parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***wsoID*** | ***INTEGER*** | WSO identifier that is managed by the CE and that uniquely identifies the WSOs connected to the CE and for which the CE provides a measurement report. |
| ***measurementDescription*** | ***MeasurementDescription*** | As specified in Table A.25 |
| ***measurementReport*** | ***MeasurementReport*** | As specified in Table A.26 |

The mesurementDescription parameter shall comprise of parameters described in Table A.25. The CE shall set the parameters in the measurementDescription parameter as specified in Table A.25.

Table A.29 – measurementDescription parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***measType*** | ***MeasurementType*** | Shall be set to a value that indicates the measurement type of this measurement report.  |
| ***measSchedule*** | ***MeasurementSchedule*** | Not present |
| ***startStopFreq*** | ***FrequencyIndication*** | Shall be set to indicate the frequency span (start frequency, stop frequency) on which the reported measurement was taken.  |

The measurementReport parameter shall comprise of parameters described in Table A.26. The CE shall set the parameters in the measurementReport parameter as specified in Table A.26.

Table A.30 – measurementReport parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***sinrReport*** | ***SinrReport*** | Shall be present only if the measType equals sinr. When present this parameter shall contain the SINR report obtained from the WSO. |
| ***ferReport*** | ***FerReport*** | Shall be present only if the measType equals fer. When present this parameter shall contain the FER report obtained from the WSO. |
| ***signalDistributionReport*** | ***SignalDistributionReport*** | Shall be present only if the measType equals signalDistribution. When present this parameter shall contain the signal distribution report obtained from the WSO. |
| ***spectrumReport*** | ***SpectrumReport*** | Shall be present only if the measType equals spectrum. When present this parameter shall contain the spectrum report obtained from the WSO. |
| ***ownNetworkChannelLoadReport*** | ***OwnNetworkChannelLoadReport*** | Shall be present only if the measType equals ownNetworkChannelLoad. When present this parameter shall contain the own network channel load report obtained from the WSO. |
| ***totalChannelLoadReport*** | ***TotalChannelLoadReport*** | Shall be present only if the measType equals totalChannelLoad. When present this parameter shall contain the total channel load report obtained from the WSO. |
| ***otherUsersReport*** | ***OtherUsersReport*** | Shall be present only if the measType equals otherUsers. When present this parameter shall contain the other users report obtained from the WSO. |

Upon receiving a MeasurementConfirm message from the CM, the CE shall consider transmission of a scheduled measurement report successful, when all the following conditions are met:

1. The status for the WSO in the MeasurementConfirm message payload equals noError

If any of the conditions fail, the CE shall consider the scheduled measurement report transmission failing. Actions of a CE upon a failed transmission of a scheduled measurement report are implementation dependent and beyond the scope of the standard.

* + - 1. CM-initiated procedure execution

Upon receiving a first message of a CM-initiated procedure that a CE supports, the CE shall take the CM-initiated procedure into execution within the following constraints:

* The providing coexistence report procedure is taken into execution only on those WSOs for which the CE has a service subscription with a CM and for which the CE has performed the WSO registration
* The obtaining available channel list from WSO procedure is taken into execution only on those WSOs for which the CE has a service subscription with a CM and for which the CE has performed the WSO registration
* The requesting measurements procedure is taken into execution only on those WSOs for which the CE has a service subscription with a CM and for which the CE has performed the WSO registration
* The sending reconfiguration request from CM to CE procedure is taken into execution only on those WSOs for which the CE has a service subscription with a CM and for which the CE has performed the WSO registration

Further procedure specific constraints may apply and if that is the case those are specified in the clauses below that specify execution of each CE-initiated procedure.

* + - * 1. Providing coexistence report

Upon receiving a CoexistenceReportAnnouncement message (Table A.31) from the CM, the CE shall provide the information available in the coexistenceReport field of the message to the relevant WSOs.

Table A.31 – CxMessage fields in CoexistenceReportAnnouncement message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Header*** | ***CxHeader*** | ***requestID*** |
| ***Payload*** | ***CxPayload*** | ***coexistenceReport*** |

Once the CE has provided the information in the coexistence reports to the relevant WSOs, the CE shall generate and send a CoexistenceReportConfirm message to the CM. The CE shall set the parameters in the CoexistenceReportConfirm message as shown in Table A.32.

Table A.32 – CxMessage fields in CoexistenceReportConfirm message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Status*** | ***Status*** | Shall be set to indicate whether the report was received properly. |

* + - * 1. Obtaining available channel list from WSO

Upon receiving an AvailableChannelsRequest (Table A.33) message from the CM, the CE shall obtain available channel list relevant to the WSOs to which the request applies.

Table A.33 – CxMessage fields in AvailableChannelsRequest message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***header*** | ***CxHeader*** | ***requestID*** |
| ***payload*** | ***CxPayload*** | ***listOfwsoIDs*** |

The CE shall generate an AvailableChannelsResponse message with the parameters of the CxMessage as shown in Table A.34 and send the message to the CM. The availableFrequencies field of the CxMessage shall contain one or more elements that each contains information described in Table A.35. Each element represents a measurement report from one WSO and there shall be as many elements in the availableFrequencies field as is the number of WSOs for which the CE provides an available channel list.

Table A.34 – CxMessage fields in AvailableChannelsResponse message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Header*** | ***CxHeader*** | ***requestID*** |
| ***Payload*** | ***CxPayload*** | ***availableFrequencies*** |

Table A.35 – availableFrequencies parameter element

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***wsoID*** | ***INTEGER*** | WSO identifier of the WSO for which the list of available channels is provided. |
| ***frequencyRange*** | ***FrequencyRange*** | Shall be set to indicate the available frequency range. |
| ***txPowerLimit*** | ***REAL*** | Shall be set to indicate the power limit in the available frequency range. |
| ***availableStartTime*** | ***GeneralizedTime*** | Shall be set to indicate start time of the available frequency range if applicable. |
| ***availableDuration*** | ***REAL*** | Shall be set to indicate duration of the available frequency range if applicable. |

* + - * 1. Requesting measurements

Upon receiving a MeasurementRequest message (Table A.36) from the CM, the CE shall verify that the request is on a measurement type that the WSO to which the request applies is supported by the WSO.

Table A.36 – CxMessage fields in MeasurementRequest message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Header*** | ***CxHeader*** | ***requestID*** |
| ***Payload*** | ***CxPayload*** | ***listOfMeasurementRequests*** |

The CE shall generate a MeasurementConfirm message that shall have parameters as shown in Table A.37.

Table A.37 – CxMessage fields in MeasurementConfirm message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Header*** | ***CxHeader*** | ***requestID*** |
| ***Payload*** | ***CxPayload*** | ***status*** |

If the request is on measurement type the WSO to which the request applies is supported by the WSO, the CE shall consider a measurement request pending and shall set the ***status*** to ***noError*** in the MeasurementConfirm message. If there is an error in the request, the ***status*** shall be set to indicate the reason for the error.

The CE obtains required measurement results from the WSO and uses the mechanisms specified in sections **Error! Reference source not found.** and **Error! Reference source not found.** to provide the measurement reports to the CM as per the request. If the request is to provide a one-time measurement report, the CE shall consider a request on one-time measurement pending and once the CE has information for a measurement report available, it shall act as specified in **Error! Reference source not found.**. If the request is to provide scheduled measurement reports, the CE shall consider a request on scheduled measurements pending and once the CE has information for first scheduled measurement report available, it shall invoke the providing scheduled measurements procedure specified in **Error! Reference source not found.**.

* + - * 1. Sending reconfiguration request from CM to CE

Upon receiving a ReconfigurationRequest message (Table A.38) from the CM, the CE shall verify that the request complies with the list of available frequencies and with the list of supported frequencies of the WSO to which the request applies. If the request is in conflict with available and/or supported frequencies, the CE shall reject the request and indicate this to the CM. If the request is within the limits of both available and supported frequencies, the CE shall instruct the WSO accordingly.

Table A.38 – CxMessage fields in ReconfigurationRequest message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Header*** | ***CxHeader*** | ***requestID*** |
| ***Payload*** | ***CxPayload*** | ***reconfigurationRequest*** |

The CE expects the reconfigurationRequest field of the CxMessage to contain one or more elements that each contains information described in Table A.39. Each element represents reconfiguration parameters of one WSO.

Table A.39 – reconfigurationRequest fields in ReconfigurationRequest message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***wsoID*** | ***OCTET STRING*** | WSO ID. |
| ***operatingFrequency*** | ***FrequencyRange*** | Operating frequency range allocated for the WSO. |
| ***txPowerLimit*** | ***REAL*** | Maximum power allocated for the WSO. |
| ***channelIsShared*** | ***BOOLEAN*** | ***TRUE***, if the frequency will be shared with other WSOs, ***FALSE*** otherwise. |
| ***txSchedule*** | ***txSchedule*** | Not supported. |

Upon completing the request verification and possible communication with the WSOs, the CE shall generate and send a ReconfigurationResponse (Table A.40) to the CM. The ***status*** shall be set to indicate whether the reconfiguration was accepted (***status*** = ***noError***) or not (***status*** indicates the reason for the error).

Table A.40 – CxMessage fields in ReconfigurationResponse message

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***Header*** | ***CxHeader*** | ***requestID*** |
| ***payload*** | ***cxPayload*** | ***status*** |

* + - 1. Connection termination

A CE may initiate connection termination to a CM only when it has no WSOs registered and subscribed to the CM. Connection termination shall be done as specified in [reference to common operations clause].