IEEE P802.19
Wireless Coexistence

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| Profile O based CE |
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Abstract

This document is a submission to IEEE 802.19 TG1 that contains an incomplete description of CE entity operations based on profile in which frequency mode is used. This initial description is submitted to the TG1 to facilitate discussion on profiles and their impact on entity operations. Further updates of the submission are targeted for the latter half of January 2013.

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# Entities Operation

# Profile O based CE operation

# 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
* Announcing available channel list change by WSO
* Providing one-time measurement report
* Providing scheduled measurement reports
* Sending resource reconfiguration request from CE to CM
* Sending event indication from CE to CM

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

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

High level flow chart of the CE operation is provided in Figure 1.



Figure - High level flow chart of the profile O based CE

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 and 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 7.1.2.

Operations related to execution of the supported CM-initiated procedures are specified in 7.1.3.

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 7.1.4. Once the CE has terminated the connection to the CM it may stop its operation.

# 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 announcing available channel list change by WSO 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 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
* 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
* The sending resource reconfiguration request procedure may be initiated only on those WSOs for which the CE has the management service subscription with a CM and for which the CE has performed the WSO registration
* The sending event indication from CE to CM 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

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.

# 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 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 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 – CxMessage fields in SubscriptionRequest message when requesting subscription

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

Table – 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 the information service for the WSOSet to “management” if the intent is to subscribe the management service for the WSO |

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.

# 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 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 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 – CxMessage fields in SubscriptionRequest message when requesting subscription update

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

Table – 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 for the WSO to the information service.Set to “management” if the intent is to update the service subscription for the WSO 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.

# 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 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 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 – CxMessage fields in RegistrationRequest message when requesting registration

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

Table – 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 7. |
| ***discoveryInformation*** | ***DiscoveryInformation*** | As specified in Table 8.  |
| ***aCLR*** | ***REAL*** | Not present |
| ***aCS*** | ***REAL*** | Not present |
| ***guaranteedQoSOfBackhaulConn*** | ***QuaranteedQoSOfBackhaulConnection*** | Not present |
| ***listOfSuppFrequencies*** | ***ListOfSupportedFrequencies*** | As specified in Table 9. |
| ***listOfOperFrequencies*** | ***ListOfOperatingFrequencies*** | As specified in Table 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 11. |
| ***measurementCapability*** | ***MeasurementCapability*** | As specified in Table 12. |

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

Table – listOfAvailableFrequencies parameter element

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

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

Table – discoveryInformation parameter element

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

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

Table – listOfSuppFrequencies parameter element

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

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

Table – listOfOperFrequencies parameter element

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

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

Table – requiredResource parameter element

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

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

Table – measurementCapability 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 informs the result of the registration to the WSO.

# 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 13 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 14. 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 – CxMessage fields in RegistrationRequest message when requesting registration update

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

Table – 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*** | 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 15. |
| ***discoveryInformation*** | ***DiscoveryInformation*** | As specified in Table 16.  |
| ***aCLR*** | ***REAL*** | Not present |
| ***aCS*** | ***REAL*** | Not present |
| ***guaranteedQoSOfBackhaulConn*** | ***QuaranteedQoSOfBackhaulConnection*** | Not present |
| ***listOfSuppFrequencies*** | ***ListOfSupportedFrequencies*** | As specified in Table 17. |
| ***listOfOperFrequencies*** | ***ListOfOperatingFrequencies*** | As specified in Table 18. |
| ***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 19. |
| ***measurementCapability*** | ***MeasurementCapability*** | As specified in Table 20. |

The listOfAvailableFrequencies parameter shall comprise of parameters described in Table 15. The CE shall set the parameters in the listOfAvailableFrequencies parameter as specified in Table 15.

Table – listOfAvailableFrequencies parameter element

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

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

Table – discoveryInformation parameter element

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

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

Table – listOfSuppFrequencies parameter element

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

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

Table – listOfOperFrequencies parameter element

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

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

Table – requiredResource parameter element

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

The measurementCapability parameter shall comprise of parameters described in Table 20. The CE shall set the parameters in the measurementCapability parameter as specified in Table 20.

Table – measurementCapability 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 update to the WSO.

# 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 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 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 – CxMessage fields in CoexistenceReportRequest message

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

Table – 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.

# Announcing available channel list change by WSO

In order for a CE to provide an updated list of available channels related to one or more subscribed and registered WSOs to the CM, the CE shall perform the announcing available channel list change by WSO procedure specified in [reference] in the manner specified in this clause.

The CE shall generate an AvailableChannelsAnnouncement message with the parameters of the CxMessage as shown in Table 23 and send the message to the CM. The channelsAnnouncement field of the CxMessage shall contain one or more elements that each contains information described in Table 24. Each element represents one WSO and there shall be as many elements in the channelsAnnouncement field as is the number of WSOs for which the CE updates the list of available channels.

Table – CxMessage fields in AvailableChannelsAnnouncement message

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

Table – listOfAvailableFrequencies 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 updates the list of available channels. |
| ***TBD*** | ***TBD*** | TBD |
| ***TBD*** | ***TBD*** | TBD |

# Providing one-time measurement report

TBD

# Providing scheduled measurement reports

TBD

# Sending resource reconfiguration request from CE to CM

TBD

# Sending event indication from CE to CM

TBD

# CM-initiated procedure execution

TBD

# Providing coexistence report

TBD

# Obtaining available channel list from WSO

TBD

# Obtaining information from WSO

TBD

# Requesting measurements

TBD

# Sending reconfiguration request from CM to CE

TBD

# Keep alive

TBD

# 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].