**IEEE P802.19**

**Wireless Coexistence**

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| Purpose | [] | |
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# **Executive Summary**

This submission provides the text proposal for Annex A of IEEE 802.19.1 Rev.

The proposal contains the followings:

* Merge ASN.1 codes of 802.19.1 and 802.19.1a so as not to conflict each other.
* Fix ASN.1 compiling error in the existing text of Annex A of 802.19.1
* Editorial changes for better readability

**------------------------------------------- Proposed Changes ---------------------------------------**

# **(normative) Data types**

IEEE802191DataType DEFINITIONS AUTOMATIC TAGS ::= BEGIN

**-----------------------------------------------------------**

**--Exported data types**

**-----------------------------------------------------------**

--Exported data types

EXPORTS

--Coexistence protocol entity ID

CxID,

--Status

Status,

--CxMedia status

CxMediaStatus,

--Coexistence service

CoexistenceService,

--Subscribed service

SubscribedService,

--Network technology

NetworkTechnology,

--Network type

NetworkType,

--Discovery information

DiscoveryInformation,

--Geolocation

Geolocation,

--Coverage area

CoverageArea,

--Installation parameters

InstallationParameters,

--Frequency range

FrequencyRange,

--List of available frequencies

ListOfAvailableFrequencies,

--List of operating frequencies

ListOfOperatingFrequencies,

--List of available channel numbers

ListOfAvailableChNumbers,

--List of operating channel numbers

ListOfOperatingChNumbers,

--List of supported frequencies

ListOfSupportedFrequencies,

--Required resource

RequiredResource,

--Operation code for registration

OperationCode,

--Measurement capability

MeasurementCapability,

--List of available frequencies of the subject WSO

ListOfSubjectWSOAvailableFrequencies,

--Transmission schedule

TxSchedule,

--CM registration

CMRegistration,

--CE registration

CERegistration,

--Coexistence report

CoexistenceReport,

--Channel priority

ChannelPriority,

--List of subject CEs

ListOfSubjectCEs,

--List of neighbor CMs transport information

ListOfNeighborCMsTransport,

--List of neighbor CM

ListOfNeighborCMs,

--List of neighbor CM WSOs

ListOfNeighborCMWSOs,

--List of CEs for reconfiguration

ReconfigListOfCEs,

--Channel classification information

ChClassInfo,

--Channel classification information list

ChClassInfoList,

--Failed parameters

FailedParameters,

--Event parameters

EventParams,

--Required information description

ReqInfoDescr,

-- Requested information value

ReqInfoValue,

-- Negotiation status

NegotiationStatus,

-- Negotiation information

NegotiationInformation,

-- Winner CM ID list

ListOfWinnerCMID,

-- Slot time position list

ListOfSlotTimePosition,

--Measurement description

MeasurementDescription,

--Measurement result

MeasurementResult,

--Mobility Information

MobilityInformation,

--Entity profile

EntityProfile,

--List of master CM candidates

ListOfMasterCMCandidates,

--List of neighbor CMs

ListOfNeighborCMs,

--Coexistence protocol entity type

CxType,

--Guaranteed QoS of backhaul connection

GuaranteedQoSOfBackhaulConnection,

--List of coexistence reports

ListOfCoexistenceReports,

--List Of Accessible CMs

ListOfAccessibleCMs,

--List of GCOs

ListOfGCOs,

--List of CEs

ListOfCEs,

--List of desired performances

ListOfDesiredPerformances,

--Coordinates

Coordinates,

--Range

Range,

--Region

Region,

--Antenna Characteristics

AntennaCharacteristics,

--Capability of multi-antenna signal processing

MultiAntProCap,

--Type of frequency

TypeOfFrequency,

--GCO Descriptor

GCODescriptor,

--Receiver information

ReceiverInfo,

--Receiver type

ReceiverType,

--Modulation type

ModulationType,

--Filter characteristics

FilterCharacteristics,

--Energy detection information

EnergyDetectionInfo,

--Spectrum request modification

SpecRequestModification,

--Graph edge

GraphEdge,

--Interference relationship graph

InterferenceRelationshipGraph,

--Spectrum allocation supporting information

SpecAllocationSupportingInfo,

--List of candidate serving CMs

ListOfCandidateServingCMs,

--List of moving GCOs

ListOfMovingGCOs,

--List of candidate served GCOs

ListOfCandidateServedGCOs,

--List of estimated available bandwidth

ListOfEstimatedAvailableBandwidth;

**-----------------------------------------------------------**

**--Coexistence protocol entity ID**

**-----------------------------------------------------------**

--Coexistence protocol entity type

CxType ::= ENUMERATED {

--Coexistence enabler

ce,

--Coexistence manager

cm,

--Coexistence discovery and information server

cdis,

--Coordination enabler

coe

}

--Coexistence protocol entity ID

CxID ::= SEQUENCE {

--Entity type

type CxType,

--Entity ID

id OCTET STRING

}

**-----------------------------------------------------------**

**--Status**

**-----------------------------------------------------------**

--Status

Status ::= ENUMERATED {

--Primitive/message is successfully processed

noError,

--Primitive/message is rejected due to security reasons

rejected,

--Primitive/message cannot be successfully processed because according to the current entity status different primitive/message is expected

invalidEntityStatus,

--Primitive/message cannot be successfully processed because of invalid values of parameters

invalidArgument,

--Primitive/message cannot be successfully processed because of the process error in the receiving entity

processFailure,

--Primitive/message cannot be successfully processed because of the connection error

networkFailure

}

--CxMedia status

CxMediaStatus ::= ENUMERATED {

noErrorAccepted,

noErrorRejected,

errorInvalidEntityStatus,

errorInvalidArgument,

errorProcessFailure,

errorNetworkFailure,

errorUnknown

}

**-----------------------------------------------------------**

**--Coexistence service**

**-----------------------------------------------------------**

--Coexistence service

CoexistenceService ::= ENUMERATED {

--Information service

information,

--Management service

management,

--No service

noService

}

SubscribedService ::= ENUMERATED {

information,

management,

interCMCoexistenceSetElementsNeighbors,

allCoexistenceSetElementsNeighbors

}

**-----------------------------------------------------------**

**--Network technology**

**-----------------------------------------------------------**

NetworkTechnology ::= ENUMERATED {

--IEEE 802.11 technologies except for IEEE 802.11af

ieee802dot11Technology,

--IEEE 802.11af

ieee802dot11af,

--IEEE 802.22

ieee802dot22,

--Radio microphone

radioMic,

--Area broadcast

areaBroadcast,

--ECMA 392

ecma392,

--3GPP Technology

technologyOf3gpp,

--MulteFire

multeFire,

...

}

**-----------------------------------------------------------**

**--Network type or device category**

**-----------------------------------------------------------**

NetworkType ::= ENUMERATED {

--For TVBD complied with FCC C.F.R Part 15

fixed,

mode1,

mode2,

--For WSD complied with ETSI EN 301 598

typeA,

typeB,

--For CBSD complied with FCC C.F.R Part 96

categoryA,

categoryB,

...

}

-----------------------------------------------------------

-- List of accessible CMs

-----------------------------------------------------------

--List of accessible CMs (Used in Profile 3)

ListOfAccessibleCMs ::= SEQUENCE OF SEQUENCE {

--CM ID

cmID CxID OPTIONAL,

--IP address

ipAddress OCTET STRING OPTIONAL,

--Port number

portNumber INTEGER OPTIONAL,

--Server password

serverPassword IA5String OPTIONAL,

...

}

**-----------------------------------------------------------**

**--Discovery information**

**-----------------------------------------------------------**

DiscoveryInformation ::= SEQUENCE {

--Latitude [degree]

coordinateX REAL OPTIONAL,

--Longitude [degree]

coordinateY REAL OPTIONAL,

--Altitude [m]

coordinateZ REAL OPTIONAL,

--Maximum transmit power [dBm]

maxTxPower REAL OPTIONAL,

--Receiver sensitivity [dBm]

rxSensitivity REAL OPTIONAL,

--Antenna gain [dBi]

antennaGain REAL OPTIONAL,

--Minimum required SNR [dB]

minReqSNR REAL OPTIONAL,

--Antenna height above ground [m]

antennaHeight REAL OPTIONAL,

...

}

----------------------------------------------------------------------------

--Region information

----------------------------------------------------------------------------

--Region (Used in Profile 3)

Region ::= SEQUENCE{

--Sequence of geolocation. The size shall be more than 3.

geolocation SEQUENCE OF Geolocation

}

--Rectangular Region (Used in Profile 3)

RectangularRegion ::= SEQUENCE{

--Geolocation of the upper-left point of the rectangular

geolocationUpper Geolocation,

--Geolocation of the lower-right point of the rectangular

geolocationLower Geolocation

}

--Range (Used in Profile 3)

Range ::= CHOICE {

--Information of the bounded area defined by the multiple geolocations

multipointRegion Region,

--Rectangular area defined by the upper-left and lower right points

rectangularRegion RectangularRegion

}

**-----------------------------------------------------------**

**--Location**

**-----------------------------------------------------------**

--Coordinates

Coordinates ::=

--Location

Geolocation ::= CHOICE {

--Place name or ID

placeID OCTET STRING,

--Coordinates of the GCO

coordinates Coordinates

}

**-----------------------------------------------------------**

**--Coverage area**

**-----------------------------------------------------------**

--Coverage area

CoverageArea ::= SEQUENCE {

--Coverage radius [m]

radius REAL OPTIONAL,

--Reference central frequency [MHz]

refFrequency REAL OPTIONAL,

--Reference height of master station [m]

refMasterHeight REAL OPTIONAL,

--Reference height of slave station [m]

refSlaveHeight REAL OPTIONAL,

--Reference transmission power [dBm]

refTxPower REAL OPTIONAL,

...

}

**-----------------------------------------------------------**

**--Antenna information**

**-----------------------------------------------------------**

--Height type (Used in Profile 3)

HeightType ::= ENUMERATED {

--Above ground level

agl,

--Above sea level

asl

}

--Antenna type (Used in Profile 3)

AntennaType ::= ENUMERATED {

--Linear array

linear,

--Planar array

planar,

--Circular

circular,

...

}

--MIMO type (Profile 3)

MIMOType ::= ENUMERATED {

--2D MIMO

twoDimentional,

--3D MIMO

threeDimentional

}

-- Multiple antenna processing capability (Profile 3)

MultiAntProCap ::= ENUMERATED {

--Directional beam forming capability

beamforming,

--Multiple antenna precoding capability

precoding,

...

}

--Antenna Characteristics (Profile 3)

AntennaCharacteristics ::= SEQUENCE {

--Antenna height [meter]

antennaHeight REAL OPTIONAL,

--Antenna height type

antennaHeightType HeightType OPTIONAL,

--Antenna gain [dB]

antennaGain REAL OPTIONAL,

--Antenna type

antennaType AntennaType OPTIONAL,

--Number of antenna

numberOfAntenna INTEGER OPTIONAL,

--MIMO type

mimoType MIMOType OPTIONAL,

--Multiple antenna processing capability

multiAntProCap MultiAntProCap OPTIONAL,

--Azimuth angle [deg]

azimuthAngle REAL OPTIONAL,

--Downtilt angle [deg]

downtiltAngle REAL OPTIONAL,

--beamwidth [deg]

beamwidth REAL OPTIONAL,

...

}

--Receiver information (Profile 3)

ReceiverInfo ::= SEQUENCE {

--Receiver type

receiverType ReceiverType OPTIONAL,

-- Modulation Type

modulationType ModulationType OPTIONAL,

-- Filter Characteristics

filterCharacteristics FilterCharacteristics OPTIONAL,

--Tolerable interference level[dBm]

tolerableInterferenceLevel REAL OPTIONAL

}

--Receiver type (Profile 3)

ReceiverType ::= ENUMERATED {

--Successive interference canceller

sic,

--Zero-forcing

zeroForcing,

...

}

--Modulation Type (Profile 3)

ModulationType ::= ENUMERATED {

--OFDM

ofdm,

--FBMC

fbmc,

...

}

--Modulation parameters (Profile 3)

ModulationParameters ::= SEQUENCE OF CHOICE{

ofdm BOOLEAN,

--The overlapping K factor for FBMC

fbmcoverlappingFactor INTEGER,

...

}

--Filter Characteristics (Profile 3)

FilterCharacteristics ::= SEQUENCE {

--Adjacent channel selectivity of the GCO [dB]

acs REAL OPTIONAL,

--FBMC overlapping factor range as the maximum number

fbmcOverlappingFactor INTEGER OPTIONAL,

...

}

--SIC demodulation procedure (Profile 3)

SICDemodulationProcedure ::= ENUMERATED{

--demodulate desired signal directly

procedure1,

--demodulate interference then desired signal

procedure2,

...

}

**-----------------------------------------------------------**

**--Installation parameters**

**-----------------------------------------------------------**

--Installation parameters

InstallationParameters ::= SEQUENCE {

--Operating height of master station [m] (Profile 2 only)

opMasterHeight REAL OPTIONAL,

--Operating height of slave station [m] (Profile 2 only)

opSlaveHeight REAL OPTIONAL,

--Operating transmission power [dBm] (Profile 2 only)

opTxPower REAL OPTIONAL,

--Geolocation of GCO (Profile 3 only)

geolocation Geolocation OPTIONAL,

--Antenna characteristics of GCO (Profile 3 only)

antennaCharacteristics AntennaCharacteristics OPTIONAL,

-- EIRP capability [dBm/MHz] of GCO (Profile 3 only)

eirpCapability REAL OPTIONAL,

--Adjacent channel leakage ratio of the GCO [dB] (Profile 3 only)

aclr REAL OPTIONAL,

--Guaranteed QoS of backhaul connection of the GCO (Profile 3 only)

guaranteedQoSOfBackhaulConnection GuaranteedQoSOfBackhaulConnection OPTIONAL,

--Receiver information (Profile 3 only)

receiverInfo ReceiverInfo OPTIONAL,

--Management regional range of GCO (Profile 3 only)

managementRange Range OPTIONAL,

--Indoor deployment (Profile 3 only)

indoorDeployment BOOLEAN OPTIONAL,

...

}

-----------------------------------------------------------

-- List of desired performances

-----------------------------------------------------------

--List of desired performances (Profile 3)

ListOfDesiredPerformances ::= SEQUENCE OF SEQUENCE {

--Subject frequency range

frequencyRange FrequencyRange OPTIONAL,

--Desired energy detection successful rate in percentage [0 ~ 100]

desiredEnergyDectionSuccessRate REAL OPTIONAL,

--Percentage of activated cells of one operator [0 ~ 100]

desiredActivationRate REAL OPTIONAL,

...

}

**-----------------------------------------------------------**

**--Guaranteed QoS of backhaul connection related data types**

**----------------------------------------------------------**

--Bakhaul Type identifier (Profile 3)

BackhaulTypeID ::= ENUMERATED{

xDSL,

opticalFibre,

...

}

--Guaranteed QoS of backhaul connection

GuaranteedQoSOfBackhaulConnection ::= SEQUENCE{

--Backhaul type ID

backhaulTypeID BackhaulTypeID OPTIONAL,

--Guaranteed minimum bit rates of backhaul connection [Mb/s]

guaranteedMinimumBitRates REAL OPTIONAL,

--Guaranteed maximum latency [ms]

guaranteedMaximumLatency REAL OPTIONAL,

...

}

--Spectrum request modification (Profile 3)

SpecRequestModification ::= SEQUENCE {

--Spectrum request grouping information. GCOs with the same group index request spectrum together.

groupIndex REAL OPTIONAL,

--Spectrum that GCO shall check with the spectrum management database regarding to the availability.

spectrumCheck FrequencyRange OPTIONAL

}

--List of spectrum usage information (Profile 3)

ListOfSpecUsageInfo ::= SEQUENCE OF SEQUENCE{

-- Geolocation information of GCO

listOfGeolocation SEQUENCE OF Geolocation

}

-----------------------------------------------------------

--Energy detection information

-----------------------------------------------------------

--Energy detection information (Profile 3)

EnergyDetectionInfo ::= SEQUENCE {

-- Energy detection threshold [dBm]

energyDetectionTh REAL OPTIONAL,

-- Energy detection successful rate

energyDetectionSuccessfulRate REAL OPTIONAL,

-- Percentage of activated cells within one operator over the management region

activationRate REAL OPTIONAL,

...

}

**-----------------------------------------------------------**

**--Frequency range related data types**

**-----------------------------------------------------------**

--Frequency range

FrequencyRange ::= SEQUENCE {

--Start frequency [MHz]

startFreq REAL OPTIONAL,

--Stop frequency [MHz]

stopFreq REAL OPTIONAL

}

-- Types of frequency(Profile 3)

TypeOfFrequency ::= ENUMERATED {

--“Specific” as specified in ETSI EN 301 598

specific,

--“Generic” as specified in ETSI EN 301 598

generic,

--“Priority Access License (PAL)” as specified in FCC C.F.R Part 96

pal,

--“General Authorized Access (GAA)” as specified in FCC C.F.R Part 96

gaa,

...

}

--Aggregated interference control parameters(Profile 3)

AggInterfCtrlParams ::= SEQUENCE{

--Reference point ID to be protected

referencePointID INTEGER OPTIONAL,

--Installation parameters of reference point

installationParameters InstallationParameters OPTIONAL,

--Adjacent channel leakage ratio of the GCO [dB]

aclr REAL OPTIONAL,

--Protection ratio of the reception to be protected[dB]

protectionRatio REAL OPTIONAL,

...

}

--List of available frequencies

ListOfAvailableFrequencies ::= SEQUENCE OF SEQUENCE {

--Frequency range

frequencyRange FrequencyRange OPTIONAL,

--Transmission power limit [dBm]

txPowerLimit REAL OPTIONAL,

--Start time when this frequency range is available

availableStartTime GeneralizedTime OPTIONAL,

--Duration during which this frequency range is available [s]

availableDuration REAL OPTIONAL,

--Timestamp

timestamp GeneralizedTime OPTIONAL,

--Stop time of availability of this frequency range

availableStopTime GeneralizedTime OPTIONAL,

--Maximum total bandwidth [Hz]

maxTotalBandwidth REAL OPTIONAL,

--Maximum contiguous bandwidth [Hz]

maxContiguousBandwidth REAL OPTIONAL,

--Resolution bandwidth [Hz]

resolutionBandwidth REAL OPTIONAL,

--Type of available frequency

typeOfAvailablefrequency TypeOfFrequency OPTIONAL,

--Location validity [meter]

locationValidity REAL OPTIONAL,

--Aggregated interference control parameters

aggInterfCtrlParams AggInterfCtrlParams OPTIONAL,

...

}

--List of supported frequencies

ListOfSupportedFrequencies ::= SEQUENCE OF SEQUENCE {

-- The frequency borders of each possible sub band or channel

supportedFrequency FrequencyRange OPTIONAL,

-- Extra channel configuration

-- (subchannelization or channel aggregation) supported or not

extraChannelizationIsSupported BOOLEAN OPTIONAL,

-- Extra channel configuration description

extraChannelizationDescription ExtraChannelizationDescription OPTIONAL,

-- The frequency borders of each possible sub band or channel

frequencyRange FrequencyRange OPTIONAL,

}

--Extra channelization description

ExtraChannelizationDescription ::= SEQUENCE{

--Maximum number of non-contiguous channels

--supported in channel aggregation

maxNuNonconCH INTEGER OPTIONAL,

--Maximum number of contiguous channels supported in channel bonding

maxNuConCH INTEGER OPTIONAL,

--Min channel raster for fine tuning of frequency [MHz]

minChRaster REAL OPTIONAL,

--Maximum supported bandwidth per channel [MHz]

maxCHBW REAL OPTIONAL,

--Minimum supported bandwidth per channel [MHz]

minCHBW REAL OPTIONAL,

--Resolution for additional channel bandwidth between minCHBW and maxCHBW [MHz]

resolutionSBW REAL OPTIONAL,

--Minimum bandwidth within either maxCHBW or minCHBW.

--Any number or location, which fits within

--either maxCHBW or minCHBW is allowed [MHz].

minUnderlayBW REAL OPTIONAL,

--Offset of the start frequency in the case of maxCHBW [MHz]

offsetFreqMaxCHBW REAL OPTIONAL,

--Offset of the start frequency in the case of minCHBW [MHz]

offsetFreqMinCHBW REAL OPTIONAL,

--Offset always based on the Primary Channelization or not

offsetPerPrimaryChannelization BOOLEAN OPTIONAL,

--Maximum number of channel that GCO can simultaneously use.

maxNumberOfSimultaneousUse INTEGER OPTIONAL,

--List of supported bandwidth

listOfSupportedBandwidth SEQUENCE OF REAL OPTIONAL,

...

}

--Parameter type of frequency utilization pattern (Profile 3)

ParameterType ::= ENUMERATED{

-- Number of frequency usage per time unit

numberFrequencyUsagePerTimeUnit,

-- Number of successful usage per time unit

numberSuccessfulUsagePerTimeUnit,

-- Number of failed usage per time unit

numberFailedUsagePerTimeUnit,

-- Number of frequency usage per time unit and per area unit

numberFrequencyUsagePerTimeUnitPerAreaUnit,

-- Number of successful usage per time unit and per area unit

numberSuccessfulUsagePerTimeUnitPerAreaUnit,

-- Number of failed usage per time unit and per area unit

numberFailedUsagePerTimeUnitPerAreaUnit

}

--Frequency utilization pattern (Profile 3)

FreqUtilizationPattern ::= SEQUENCE {

-- Range of investigated frequency

frequencyRange FrequencyRange OPTIONAL,

-- Parameter type of frequency utilization pattern

parameterType ParameterType OPTIONAL,

-- Threshold of time duration for successful frequency usage

timeThresholdForSuccessfulUsage REAL OPTIONAL,

-- Window start time

windowStartTime GeneralizedTime OPTIONAL,

-- Window stop time

windowStopTime GeneralizedTime OPTIONAL,

-- Coverage area

coverageArea CoverageArea OPTIONAL,

-- Frequency utilization pattern value

parameterValue INTEGER OPTIONAL

}

--GCO number limit (Profile 3)

CoChGCOLimit ::= SEQUENCE {

--Management area

operationRange Range OPTIONAL,

--Maximum number of GCOs given by the coexistence management service

maxNumCoChGCOs INTEGER OPTIONAL

}

--List of operating frequencies

ListOfOperatingFrequencies ::= SEQUENCE OF SEQUENCE {

--Frequency range

frequencyRange FrequencyRange OPTIONAL,

--Occupancy if known [fractional value between 0 and 1]

occupancy REAL OPTIONAL,

--Priority index of frequencyRange

freqRankIndex INTEGER OPTIONAL,

-- Operating EIRP [dBm]

operatingEirp REAL OPTIONAL,

--Resolution bandwidth [Hz]

resolutionBandwidth REAL OPTIONAL,

--Type of operating frequency

typeOfOperatingFrequency TypeOfFrequency OPTIONAL,

--Energy detection information

energyDetectionInfo EnergyDetectionInfo OPTIONAL,

--Modulation parameters

modulationParameters ModulationParameters OPTIONAL,

--Demodulation procedure

sicDemodulationProcedure SICDemodulationProcedure OPTIONAL,

--Interference leakage weighting factor

intLeakageFactor REAL OPTIONAL,

--List of reference point locations.

listOfSpecUsageInfoOfRefPoints ListOfSpecUsageInfo OPTIONAL,

--List of co-channel neighbor GCOs location

listOfSpecUsageInfoOfNeightborGCOs ListOfSpecUsageInfo OPTIONAL,

--Co-channel GCO limit

coChGCOLimit CoChGCOLimit OPTIONAL,

--Frequency utilization pattern parameter

freqUtilizationPattern FreqUtilizationPattern OPTIONAL,

...

}

**-----------------------------------------------------------**

**--Available channel numbers**

**-----------------------------------------------------------**

ConstOfChUseID ::= ENUMERATED {

regulationMaxTxPower,

regulationMaxAntGain,

regulationMaxAntHeight,

regulationTVDBUpdateTime,

outOfBandEmissionLimit,

...

}

ConstOfChUseValue ::= CHOICE {

--Maximum transmit power allowed by regulations [dBm]

regulationMaxTxPower REAL,

--Maximum antenna gain allowed by regulation [dBi]

regulationMaxAntMaxGain REAL,

--Maximum antenna height above ground allowed by regulation [m]

regulationAntMaxHeight REAL,

--WSO location update time required by regulation [s]

regulationTVDBUpdateTime REAL,

--Out of band emission power density limit [dBm/MHz]

outOfBandEmissionLimit REAL,

...

}

ConstOfChUses ::= SEQUENCE OF SEQUENCE {

constOfChUseID ConstOfChUseID OPTIONAL,

constOfChUseValue ConstOfChUseValue OPTIONAL

}

ListOfAvailableChNumbers ::= SEQUENCE OF SEQUENCE {

chNumber INTEGER OPTIONAL,

availableStartTime GeneralizedTime OPTIONAL,

--Duration of availability [s]

availableDuration REAL OPTIONAL,

constOfChUses ConstOfChUses OPTIONAL

}

**-----------------------------------------------------------**

**--Operating channel numbers**

**-----------------------------------------------------------**

ListOfOperatingChNumbers ::= SEQUENCE OF SEQUENCE {

chNumber INTEGER OPTIONAL,

--Occupancy [fractional value between 0 and 1]

occupancy REAL OPTIONAL

}

**-----------------------------------------------------------**

**--Required resource**

**-----------------------------------------------------------**

--Required resource

RequiredResource ::= SEQUENCE OF SEQUENCE {

--Required bandwidth [MHz]

requiredBandwidth REAL OPTIONAL,

--Expected occupancy if known [fractional value between 0 and 1]

occupancy REAL OPTIONAL

}

**-----------------------------------------------------------**

**--Operation code for registration**

**-----------------------------------------------------------**

--Operation code for registration

OperationCode ::= ENUMERATED {

--New registration

new,

--Update of registration information

update,

--Deregistration

delete,

--Modification of registration information

modify,

--Remove

remove,

--Inform the spectrum usage release

release

}

**-----------------------------------------------------------**

**--Measurement capability**

**-----------------------------------------------------------**

MeasurementCapability ::= ENUMERATED {

energyDetection,

featureDetection,

...

}

**-----------------------------------------------------------**

**--Reconfiguration related data types**

**-----------------------------------------------------------**

--Transmission schedule

TxSchedule ::= SEQUENCE {

--Schedule start time

scheduleStartTime GeneralizedTime OPTIONAL,

--Schedule frame duration [s]

scheduleFrameDuration REAL OPTIONAL,

--Number of schedule frames

numberOfFrames INTEGER OPTIONAL,

--Transmission start time within a schedule frame [s]

transmissionStartTime REAL OPTIONAL,

--Transmission duration within a schedule frame [s]

transmissionDuration REAL OPTIONAL

}

**-----------------------------------------------------------**

**--CM registration**

**-----------------------------------------------------------**

--CM registration

CMRegistration ::= SEQUENCE {

--CM IP address

ipAddress OCTET STRING OPTIONAL,

--CM port number

portNumber INTEGER OPTIONAL

}

--List of WSO for registration

ListOfWSORegistrations ::= SEQUENCE OF SEQUENCE {

--New registration, registration update or deregistration

operationCode OperationCode OPTIONAL,

--WSO ID

wsoID OCTET STRING OPTIONAL,

--Network technology

networkTechnology NetworkTechnology OPTIONAL,

--Location

geolocation Geolocation OPTIONAL,

--Coverage area

coverageArea CoverageArea OPTIONAL,

-- Mobility information

mobilityInformation MobilityInformation OPTIONAL,

--Installation parameters

installationParameters InstallationParameters OPTIONAL,

--List of available frequencies

listOfAvailableFrequencies ListOfAvailableFrequencies OPTIONAL,

-- Operating frequency if available

operatingFrequency FrequencyRange OPTIONAL,

-- Upper limit of transmission power level in its operating frequency [dBm]

txPowerLimit REAL OPTIONAL,

--Maximum number of controllable WSO

maximumNumberOfControllableWSO INTEGER OPTIONAL

}

--Set of detailed contact information

Contact ::= CHOICE {

--Phone number

phoneNumber NumericString,

--E-mail address

email UTF8String,

...

}

--User contact information

UserContactInformation ::= SEQUENCE {

--User name

username OCTET STRING,

--Contact information

contact SEQUENCE OF Contact

}

--GCO device type (Profile 3)

GCOType ::= ENUMERATED {

--“AP” (Access Point)

wlanAP,

--“STA” (Station)

wlanSTA,

--eNB

eNodeB,

--UE

ue,

--“Master” for TVBD/WSD

master,

--“Slave” for TVBD/WSD

slave,

--“CBSD” (Citizens Broadband Radio Service Device)

cbsd,

--“EUD” (End User Device)

eud,

...

}

--Emission class (Profile 3)

EmissionClass ::= ENUMERATED {

--“Class 1” as specified in ETSI EN 301 598

class1,

--“Class 2” as specified in ETSI EN 301 598

class2,

--“Class 3” as specified in ETSI EN 301 598

class3,

--“Class 4” as specified in ETSI EN 301 598

class4,

--“Class 5” as specified in ETSI EN 301 598

class5,

...

}

--GCO Descriptor (Profile 3)

GCODescriptor ::= SEQUENCE {

--Network type

networkType NetworkType OPTIONAL,

--Emission class

emissionClass EmissionClass OPTIONAL,

--GCO type

gcoType GCOType OPTIONAL,

--Network technology

networkTechnology NetworkTechnology OPTIONAL,

--Additional network technologies of GCO

addNetworkTechnologies SEQUENCE OF NetworkTechnology OPTIONAL,

--Regulatory ID of GCO

gcoRegulatoryID OCTET STRING OPTIONAL,

--Call sign

callSign OCTET STRING OPTIONAL,

--Serial number

serialNumber OCTET STRING OPTIONAL,

--User contact information

userContactInformation UserContactInformation OPTIONAL,

--Sensing capability

sensingCapability BOOLEAN OPTIONAL,

...

}

-----------------------------------------------------------

--GraphEdge

-----------------------------------------------------------

--Graph Edge parameters (Profile 3)

GraphEdge ::= SEQUENCE {

--Head vertex of edge

head OCTET STRING,

--tail vertex of edge

tail OCTET STRING,

--weight of the edge

weight REAL

}

-----------------------------------------------------------

--Graph of interference relationship

-----------------------------------------------------------

--Graph representation of interference relationship among GCOs (Profile 3)

InterferenceRelationshipGraph ::= SEQUENCE {

--Graph Edge

edge GraphEdge,

...

}

--List of GCOs for registration

ListOfGCORegistrations ::= SEQUENCE OF SEQUENCE {

--New registration, registration update or deregistration

operationCode OperationCode OPTIONAL,

--GCO ID

gcoID OCTET STRING OPTIONAL,

--Network ID

networkID OCTET STRING OPTIONAL,

--GCO Descriptor

gcoDescriptor GCODescriptor OPTIONAL,

--Coverage area

coverageArea CoverageArea OPTIONAL,

--Installation parameters

installationParameters InstallationParameters OPTIONAL,

--List of available frequencies

listOfAvailableFrequencies ListOfAvailableFrequencies OPTIONAL,

-- List of operating frequencies

listOfOperatingFrequencies ListOfOperatingFrequencies OPTIONAL,

-- operation region

operationRegion Range OPTIONAL,

--Spectrum transition capability

spectrumTransitionCapability BOOLEAN OPTIONAL,

--Maximum number of controllable GCO

maxNumberOfControllableGCO INTEGER OPTIONAL,

--List of desired performance

listOfDesiredPerformances ListOfDesiredPerformances OPTIONAL,

--GCO IDs that are included in interference set

interferenceSet SEQUENCE OF OCTET STRING OPTIONAL,

--Graph information to represent interference relationship

interferenceGraph InterferenceRelationshipGraph OPTIONAL,

...

}

--CE registration

CERegistration ::= SEQUENCE OF SEQUENCE{

--CE ID

ceID CxID OPTIONAL,

-- List of WSO registration

listOfWSORegistration ListOfWSORegistrations OPTIONAL,

-- List of GCO registration

listOfGCORegistrations ListOfGCORegistrations OPTIONAL

}

**-----------------------------------------------------------**

**--Coexistence report**

**-----------------------------------------------------------**

-- List of recommended operation frequencies (Profile 3)

ListOfRecOperationFrequencies ::= SEQUENCE OF SEQUENCE {

--Range of recommended operation frequency

frequencyRange FrequencyRange OPTIONAL,

--Recommended maximum EIRP [dBm]

recommendedMaxEirp REAL OPTIONAL,

--Start time

availableStartTime GeneralizedTime OPTIONAL,

--Stop time

availableStopTime GeneralizedTime OPTIONAL,

--Resolution bandwidth [Hz]

resolutionBandwidth REAL OPTIONAL,

--location validity [meter]

locationValidity REAL OPTIONAL,

...

}

--Coexistence report

CoexistenceReport ::= SEQUENCE OF SEQUENCE {

--Network ID

networkID OCTET STRING OPTIONAL,

--Network Technology

networkTechnology NetworkTechnology OPTIONAL,

--List of the identification numbers of operating channels

listOfOperatingChNumbers ListOfOperatingChNumbers OPTIONAL,

--GCO ID

gcoID OCTET STRING OPTIONAL,

--List of recommended operation frequencies (Only in Profile 3)

listOfRecOperationFrequencies ListOfRecOperationFrequencies OPTIONAL

}

--List of coexistence reports (Profile 3)

ListOfCoexistenceReports ::= SEQUENCE OF SEQUENCE {

--Region information that the coexistence report is valid.

region Region OPTIONAL,

--List of operating frequencies

listOfOperatingFrequencies ListOfOperatingFrequencies OPTIONAL,

--List of recommended information on operation frequencies

listOfRecOperationFrequencies ListOfRecOperationFrequencies OPTIONAL

}

--Channel priority information

ChannelPriority ::= SEQUENCE OF SEQUENCE {

channelNumber INTEGER OPTIONAL,

priority INTEGER OPTIONAL

}

**-----------------------------------------------------------**

**--Coexistence set information related data types**

**-----------------------------------------------------------**

--Interference direction

InterferenceDirection ::= ENUMERATED {

--Subject WSO creates interference to neighbor WSO

source,

--Neighbor WSO creates interference to subject WSO

victim,

--Both subject WSO and neighbor WSO create interference to each other

mutual

}

--Network geometry class

NetworkGeometryClass ::= ENUMERATED {

--Class#1 network geometry

class1,

--Class#2 network geometry

class2,

--Class#3 network geometry

class3,

--Class#4 network geometry

class4

}

--List of neighbor WSOs

ListOfNeighborWSOs ::= SEQUENCE OF SEQUENCE {

--Neighbor WSO ID

wsoID OCTET STRING OPTIONAL,

--Neighbor WSO network technology

networkTechnology NetworkTechnology OPTIONAL,

--Interference direction

interferenceDirection InterferenceDirection OPTIONAL,

--Network geometry classification

networkGeometryClass NetworkGeometryClass OPTIONAL,

--Normalized distance to subject WSO [fractional value]

distance REAL OPTIONAL,

--List of operating frequencies

--Not used in CoexistenceSetInformationAnnouncement

--Used in CoexistenceReportAnnouncement and CxMediaCoexistenceReportIndication

listOfOperatingFrequencies ListOfOperatingFrequencies OPTIONAL,

listOfAvailableFrequencies ListOfAvailableFrequencies OPTIONAL

}

--List of neighbor GCOs

ListOfNeighborGCOs ::= SEQUENCE OF SEQUENCE {

--Neighbor GCO ID

gcoID OCTET STRING OPTIONAL,

--GCO descriptor

gcoDescriptor GCODescriptor OPTIONAL,

--Network geometry classification

networkGeometryClass NetworkGeometryClass OPTIONAL,

--List of operating frequencies

listOfOperatingFrequencies ListOfOperatingFrequencies OPTIONAL,

--List of available frequencies

listOfAvailableFrequencies ListOfAvailableFrequencies OPTIONAL

}

--List of master CM candidate

ListOfMasterCMCandidates ::= SEQUENCE OF SEQUENCE {

--ID of Master CM candidate

cmID CxID OPTIONAL,

--IP address of CM

ipAddress OCTET STRING OPTIONAL,

--Port number

portNumber INTEGER OPTIONAL

}

--List of neighbor CEs

ListOfNeighborCEs ::= SEQUENCE OF SEQUENCE {

--Neighbor CE ID

ceID CxID OPTIONAL,

--List of neighbor WSOs

listOfNeighborWSOs ListOfNeighborWSOs OPTIONAL,

--List of neighbor GCOs

listOfNeighborGCOs ListOfNeighborGCOs OPTIONAL

}

--List of CEs

ListOfCEs ::= SEQUENCE OF CxID

--List of neighbor CMs

ListOfNeighborCMs ::= SEQUENCE OF SEQUENCE {

--Neighbor CM ID

neighborCMID CxID OPTIONAL,

--Neighbor CM ID

cmID CxID OPTIONAL,

--List of neighbor CEs

listOfNeighborCEs ListOfNeighborCEs OPTIONAL,

--Neighbor CM profile

cmProfile EntityProfile OPTIONAL,

--List of coexistence set element

listOfCoexSetElement ListOfCoexSetElement OPTIONAL

}

--List of available frequencies of the subject WSO

ListOfSubjectWSOAvailableFrequencies ::= SEQUENCE OF SEQUENCE {

--Frequency range

frequencyRange FrequencyRange OPTIONAL,

--List of neighbor CMs

listOfNeighborCMs ListOfNeighborCMs OPTIONAL

}

--List of GCOs

ListOfGCOs ::= SEQUENCE {

--GCO ID

gcoID OCTET STRING OPTIONAL,

--GCO descriptor

gcoDescriptor GCODescriptor OPTIONAL,

--Installation

installationParameters InstallationParameters OPTIONAL,

}

--List of subject WSOs

ListOfSubjectWSOs ::= SEQUENCE OF SEQUENCE {

--Subject WSO ID

wsoID OCTET STRING OPTIONAL,

--List of available frequencies of the subject WSO

listOfSubjectWSOAvailableFrequencies ListOfSubjectWSOAvailableFrequencies OPTIONAL

}

--List of subject CEs

ListOfSubjectCEs ::= SEQUENCE OF SEQUENCE {

--Subject CE ID

ceID CxID OPTIONAL,

--List of subject WSOs

listOfSubjectWSOs ListOfSubjectWSOs OPTIONAL

}

--List of neighbor CMs transport information

ListOfNeighborCMsTransport ::= SEQUENCE OF SEQUENCE {

--Neighbor CM ID

cmID CxID OPTIONAL,

--Neighbor CM profile

cmProfile EntityProfile OPTIONAL,

-- Neighbor CM IP address

ipAddress OCTET STRING OPTIONAL,

-- Neighbor CM port number

portNumber INTEGER OPTIONAL

}

**-----------------------------------------------------------**

**--Coexistence set information**

**-----------------------------------------------------------**

ListOfCoexSetElement ::= SEQUENCE OF SEQUENCE {

networkID OCTET STRING OPTIONAL,

networkTechnology NetworkTechnology OPTIONAL

}

**-----------------------------------------------------------**

**--Coexistence set element information related data types**

**-----------------------------------------------------------**

--List of neighbor CM WSOs

ListOfNeighborCMWSOs ::= SEQUENCE OF SEQUENCE {

--WSO ID

wsoID OCTET STRING OPTIONAL,

--List of available frequencies

listOfAvailableFrequencies ListOfAvailableFrequencies OPTIONAL,

--List of operating frequencies

listOfOperatingFrequencies ListOfOperatingFrequencies OPTIONAL,

--Network geometry classification

networkGeometryClass NetworkGeometryClass OPTIONAL

}

**-----------------------------------------------------------**

**--Coexistence set element reconfiguration related data types**

**-----------------------------------------------------------**

--List of WSOs

ReconfigListOfWSOs ::= SEQUENCE OF SEQUENCE {

--WSO ID

wsoID OCTET STRING OPTIONAL,

--Potential new operating frequency

newOperatingFrequency FrequencyRange OPTIONAL,

--Additionally operable network technology

addNetworkTechnology NetworkTechnology OPTIONAL

}

--Reconfiguration list of CEs

ReconfigListOfCEs ::= SEQUENCE OF SEQUENCE {

--CE ID

ceID CxID OPTIONAL,

--List of WSOs

reconfigListOfWSOs ReconfigListOfWSOs OPTIONAL

}

**-----------------------------------------------------------**

**--Channel classification**

**-----------------------------------------------------------**

--Information on operating channel

OperatingChannelInfo ::= SEQUENCE {

--Identification number of operating channel number

operatingChannelNumber INTEGER OPTIONAL,

--List of network ID

listOfNetworkID SEQUENCE OF OCTET STRING OPTIONAL,

...

}

--Channel classification information

ChClassInfo ::= SEQUENCE {

availableChannelList SEQUENCE OF INTEGER OPTIONAL,

restrictedChannelList SEQUENCE OF INTEGER OPTIONAL,

protectedChannelList SEQUENCE OF INTEGER OPTIONAL,

unclassifiedChannelList SEQUENCE OF INTEGER OPTIONAL,

operatingChannelList SEQUENCE OF OperatingChannelInfo OPTIONAL,

coexistenceChannelList SEQUENCE OF OperatingChannelInfo OPTIONAL,

...

}

--Channel classification information list

ChClassInfoList ::= SEQUENCE OF SEQUENCE {

networkID OCTET STRING OPTIONAL,

chClassInfo ChClassInfo OPTIONAL

}

**-----------------------------------------------------------**

**--Failed parameters**

**-----------------------------------------------------------**

FailedParameterID ::= ENUMERATED {

listOfoperatingChNumber,

txPowerLimit,

channelIsShared,

txSchedule

}

FailedParameterValue ::= CHOICE {

listOfoperatingChNumber SEQUENCE OF INTEGER,

--Transmit power limit [dBm]

txPowerLimit REAL,

channelIsShared BOOLEAN,

txSchedule TxSchedule

}

FailedParameters ::= SEQUENCE OF SEQUENCE {

failedParameterID FailedParameterID OPTIONAL,

failedParameterValue FailedParameterValue OPTIONAL

}

**-----------------------------------------------------------**

**--Event indication**

**-----------------------------------------------------------**

EventDescr ::= ENUMERATED{

sinrThresholdReached,

qosDegradation,

...

}

EventParams ::= SEQUENCE {

eventDescr EventDescr OPTIONAL

}

**-----------------------------------------------------------**

**--Information Acquiring**

**-----------------------------------------------------------**

ReqInfoDescr ::= SEQUENCE OF ENUMERATED {

sinr,

desiredBandwidth,

desiredOccupancy,

desiredQoS,

desiredCoverage,

channelNumber,

subscribedService,

interferenceLevel,

fairness,

threshold,

mobilityInformation,

...

}

ReqInfoValue ::= SEQUENCE OF SEQUENCE {

reqInfoDescr ReqInfoDescr OPTIONAL,

reqInfoValue CHOICE {

--SINR value [dB]

sinrValue [1] REAL,

--Desired bandwidth value [MHz]

desiredBandwidthValue [2] REAL,

--Desired occupancy value

desiredOccupancyValue [3] REAL,

--Desired QoS value [fractional value between 0 and 1]

desiredQoSValue [4] REAL,

--Desired coverage value [m]

desiredCoverageValue [5] REAL,

channelNumberValue [6] REAL,

subscribedServiceValue SubscribedService,

--Interference level value [dBm]

interferenceLevelValue [7] REAL,

--Fairness value [fractional value between 0 and 1]

fairnessValue [8] REAL,

--Threshold value [factional value between 0 to 1]

thresholdValue [9] REAL,

mobilityInformation [10] MobilityInformation,

...

}

}

**-----------------------------------------------------------**

**--Negotiation**

**-----------------------------------------------------------**

--Negotiation status

NegotiationStatus ::= SEQUENCE {

negotiationSuccess BOOLEAN OPTIONAL,

negotiationFailure BOOLEAN OPTIONAL,

underNegotiation BOOLEAN OPTIONAL,

...

}

--Start and end time

StartEndTime ::= SEQUENCE {

--Start time [s]

startTime REAL OPTIONAL,

--End time [s]

endTime REAL OPTIONAL

}

--Time sharing unit information

TimeSharingUnitInfo ::= SEQUENCE {

referenceTime GeneralizedTime OPTIONAL,

windowTime StartEndTime OPTIONAL,

slotTime StartEndTime OPTIONAL,

...

}

--Negotiation information

NegotiationInformation ::= SEQUENCE {

mode BOOLEAN OPTIONAL,

listOfChNumber SEQUENCE OF INTEGER OPTIONAL,

timeSharingUnitInfo TimeSharingUnitInfo OPTIONAL,

slotTimePosition StartEndTime OPTIONAL,

numberOfSlots INTEGER OPTIONAL,

disallowedSlotTimePosition StartEndTime OPTIONAL,

--List of contention numbers [factional value between 0 to 1]

listOfContentionNumbers SEQUENCE OF REAL OPTIONAL,

...

}

--List of winner CM ID

ListOfWinnerCMID ::= SEQUENCE OF CxID

--List of slot time position [s]

ListOfSlotTimePosition ::= SEQUENCE OF REAL

**-----------------------------------------------------------**

**--Measurement**

**-----------------------------------------------------------**

MeasurementSchedule ::= SEQUENCE {

measStartTime GeneralizedTime OPTIONAL,

numberOfMeasurements INTEGER OPTIONAL,

--Time between measurements [s]

timeBetweenMeasurements REAL OPTIONAL

}

MeasurementFreq ::= CHOICE {

chan SEQUENCE OF INTEGER,

freq FrequencyRange

}

MeasurementType ::= ENUMERATED {

interferenceLevel,

throughput

}

MeasurementDescription ::= SEQUENCE {

measType MeasurementType OPTIONAL,

measSchedule MeasurementSchedule OPTIONAL,

measFreq MeasurementFreq OPTIONAL

}

MeasurementReport ::= CHOICE {

--Interference level value [dBm]

interferenceLevelValue REAL,

--Throughput value [Mb/s]

throughputValue REAL,

...

}

MeasurementResult ::= SEQUENCE {

measurementDescription MeasurementDescription OPTIONAL,

measurementReport MeasurementReport OPTIONAL

}

-----------------------------------------------------------

--Mobility Information

-----------------------------------------------------------

MobilityInformation ::= CHOICE {

--Maximum speed [km/h]

maxSpeed REAL,

--Speed information

speedInformation SpeedInformation,

--Route information

routeInformation RouteInformation

}

SpeedInformation ::= SEQUENCE {

--WSO speed [km/h]

wsoSpeed REAL OPTIONAL,

--WSO direction [degree]

wsoDirection REAL OPTIONAL,

--GCO speed [km/h]

gcoSpeed REAL OPTIONAL,

--GCO direction [degree]

gcoDirection REAL OPTIONAL

}

RouteInformation ::= SEQUENCE {

plannedRoute SEQUENCE OF Geolocation OPTIONAL,

plannedTime SEQUENCE OF GeneralizedTime OPTIONAL

}

**-----------------------------------------------------------**

**--Entity profile**

**-----------------------------------------------------------**

--Entity profile

EntityProfile ::= ENUMERATED {

--Profile 1

profile1,

--Profile 2

profile2,

--Profile 3

profile3

}

-----------------------------------------------------------

--Spectrum allocation Supporting Information

-----------------------------------------------------------

--Spectrum allocation supporting information (Profile 3)

SpecAllocationSupportingInfo ::= SEQUENCE {

--The value indicating the interference aggregation effect of a pair of a target GCO and an existing GCO

spectrumAllocationCoefficient REAL,

--existing GCO spectrum allocation information gives the spectrum allocation of the GCO as in a given pair

gcoSpecAllocation ListOfOperatingFrequencies

}

----------------------------------------------------------

--Candidate serving CM information for Moving GCO

----------------------------------------------------------

--List of serving CM (Profile 3)

ListOfCandidateServingCMs ::= SEQUENCE OF SEQUENCE{

-- ID of Candidate serving CM

cmID CxID OPTIONAL,

-- Estimated arrival time

arrivalTime GeneralizedTime OPTIONAL,

-- Estimated residence duration [s]

residenceDuration REAL OPTIONAL,

-- Resource serving priority

selectionPriorityLevel INTEGER OPTIONAL

}

--List of moving GCOs (Profile 3)

ListOfMovingGCOs ::= SEQUENCE OF SEQUENCE{

-- GCO ID

gcoID OCTET STRING OPTIONAL,

-- Estimated arrival time

arrivalTime GeneralizedTime OPTIONAL,

-- Estimated residence duration [s]

residenceDuration REAL OPTIONAL,

-- Desired Bandwidth [MHz]

desiredBandwidth REAL OPTIONAL

}

--List of candidate served GCOs (Profile 3)

ListOfCandidateServedGCOs ::= SEQUENCE OF SEQUENCE{

-- GCO ID

gcoID OCTET STRING OPTIONAL,

-- Mobility information

mobilityInformation MobilityInformation OPTIONAL,

-- Desired Bandwidth [MHz]

desiredBandwidth REAL OPTIONAL

}

--List of estimated available bandwidth (Profile 3)

ListOfEstimatedAvailableBandwidth ::= SEQUENCE OF SEQUENCE{

-- GCO ID

gcoID OCTET STRING OPTIONAL,

-- Estimated Available Bandwidth [MHz]

estimatedAvailableBandwidth REAL OPTIONAL

}

END

**------------------------------------------- End of Changes --------------------------------------------**

**------------------------------------------- Proposed Changes ---------------------------------------**

***Delete all the contents of A.2 in 802.19.1a (all the contents are included in above text)***

**------------------------------------------- End of Changes --------------------------------------------**