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TECHNICAL SPECIFICATION

**Universal Mobile Telecommunications System (UMTS);  
LTE;  
Telecommunication management;  
Generic Radio Access Network (RAN)  
Network Resource Model (NRM)  
Integration Reference Point (IRP);  
Information Service (IS)  
(3GPP TS 28.662 version 19.2.0 Release 19)**



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# Foreword

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# Introduction

The present document is part of a TS-family covering the 3<sup>rd</sup> Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; as identified below:

28.661: Generic Radio Access Network (RAN) Network Resource Model (NRM); Integration Reference Point (IRP); Requirements;

**28.662: Generic Radio Access Network (RAN) Network Resource Model (NRM); Integration Reference Point (IRP); Information Service (IS);**

28.663: Generic Radio Access Network (RAN) Network Resource Model (NRM); Integration Reference Point (IRP); Solution Set (SS) definitions.

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# 1 Scope

The present document specifies the Generic Radio Access Network (RAN) network resource model (NRM) that can be used for telecommunication network management purposes, including management of converged networks.

This document specifies the semantics and behaviour of information object class attributes and relations visible in the NRM in a protocol and technology neutral way. It does not define their syntax and encoding.

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# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 32.101: "Telecommunication management; Principles and high level requirements".
- [3] 3GPP TS 32.102: "Telecommunication management; Architecture".
- [4] 3GPP TS 32.150: "Telecommunication management; Integration Reference Point (IRP) Concept and definitions".
- [5] Void.
- [6] Void.
- [7] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E\_UTRA); Base Station (BS) radio transmission and reception".
- [8] Void.
- [9] Void.
- [10] 3GPP TS 28.661: "Telecommunication management; Generic Radio Access Network (RAN) Network Resource Model (NRM) Integration Reference Point (IRP); Requirements".
- [11] 3GPP TS 32.111-2: "Telecommunication management; Fault Management; Part 2: Alarm Integration Reference Point (IRP): Information Service (IS)".
- [12] 3GPP TS 28.652: "Telecommunication management; Universal Terrestrial Radio Access Network (UTRAN) Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".
- [13] 3GPP TS 28.658: "Telecommunication management; Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".
- [14] 3GPP TS 28.655: "Telecommunication management; GSM/EDGE Radio Access Network (GERAN) Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".
- [15] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

- [16] 3GPP TS 32.302: "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Information Service (IS)".
- [17] 3GPP TS 32.662: "Telecommunication management; Configuration Management (CM); Kernel CM Information Service (IS)".
- [18] 3GPP TS 25.106: "Technical Specification Group Radio Access Network; UTRA repeater radio transmission and reception".
- [19] 3GPP TS 45.005: "Radio transmission and reception".
- [20] 3GPP TS 45.010: "Radio subsystem synchronization".
- [21] 3GPP TS 25.104: "Base Station (BS) radio transmission and reception (FDD)".
- [22] Void.
- [23] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".
- [24] 3GPP TS 28.541: "NR and NG-RAN Network Resource Model (NRM) stage 2 and stage 3".
- [25] 3GPP TS 28.652: "UTRAN Network Resource Model (NRM) Integration Reference Point (IRP): Information Service (IS)".
- [26] 3GPP TS 37.466: "Iuant Interface: Application Part".
- [27] 3GPP TS 28.532: "Management and Orchestration: Generic Management Services".
- [28] 3GPP TS 36.106: "FDD repeater radio transmission and reception".

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## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the definitions given in TR 21.905 [1], TS 32.150 [4], TS 32.101 [2], TS 32.102 [3] and the following apply. The definitions defined in the present document take precedence over those, if any, in TS 32.150 [4], TS 32.101 [2], TS 32.102 [3] and TR 21.905 [1], in that order.

**Network Resource Model (NRM):** See definition in TS 28.622 [15].

### 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

CM	Configuration Management
IOC	Information Object Class
RDN	Relative Distinguished Name
SS	Solution Set

# 4 Model

## 4.1 Imported information entities and local labels

Label reference	Local label
TS 28.622 [15], IOC, ManagedFunction	ManagedFunction
TS 28.652 [12], IOC, UtranGenericCell	UtranGenericCell
TS 28.658 [13], IOC, EUTranGenericCell	EUTranGenericCell
TS 28.655 [14], IOC, GSMCell	GSMCell
TS 28.541 [24], IOC, NRSectorCarrier	NRSectorCarrier
TS 28.541 [24], IOC, NRCellDU	NRCellDU
TS 28.658 [13], IOC, ENBFunction	ENBFunction
TS 28.652 [25], IOC, NodeBFunction	NodeBFunction
TS 28.655 [14], IOC, BssFunction	BssFunction

## 4.2 Class diagrams

### 4.2.1 Relationships

This subclause depicts the set of classes (e.g. IOCs) that encapsulates the information relevant for this IRP. This subclause provides the overview of the relationships of relevant classes in UML. Subsequent subclauses provide more detailed specification of various aspects of these classes.

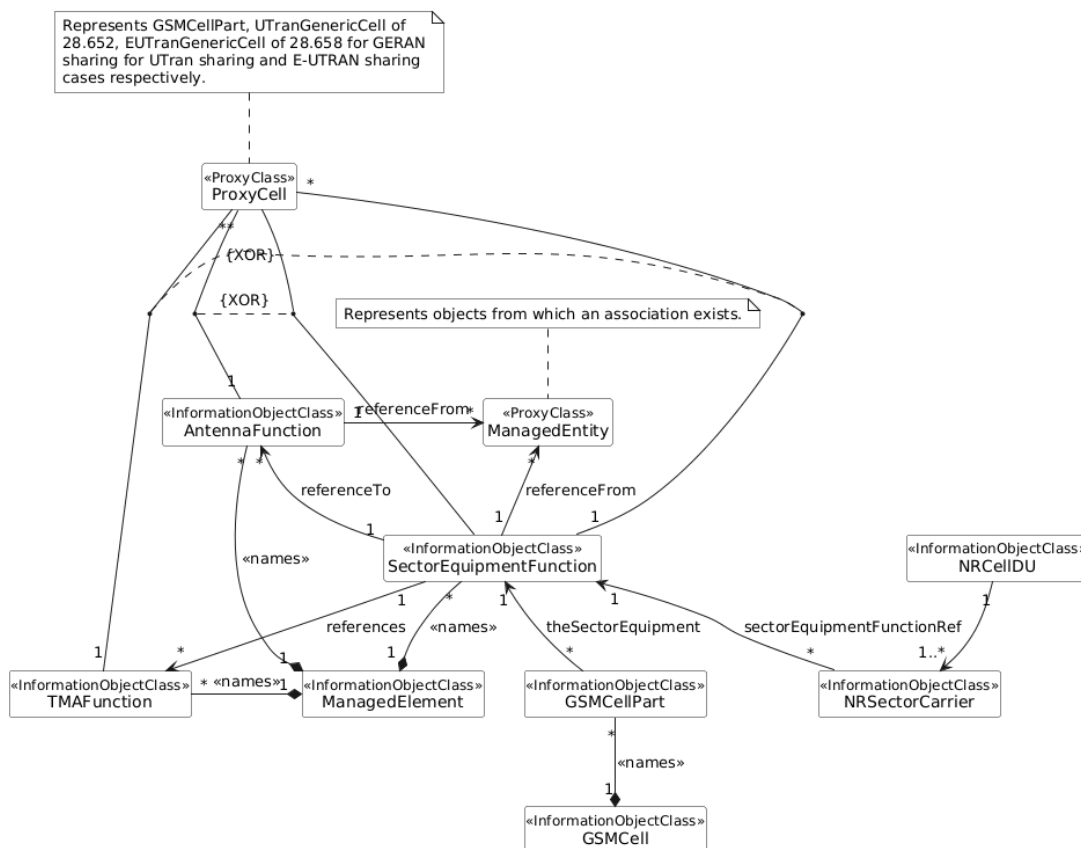


Figure 4.2.1.1: UTRAN/E-UTRAN/NR/GERAN sharing

Figure 4.2.1.2: Void

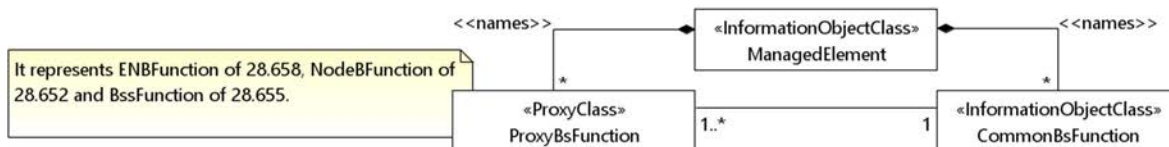


Figure 4.2.1.3: CommonBsFunction NRM fragment

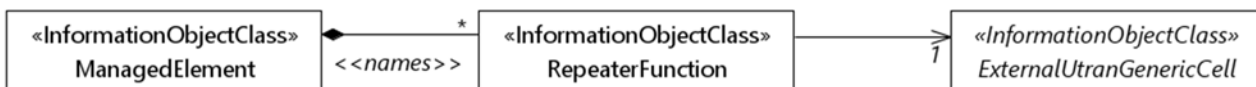


Figure 4.2.1.4: RepeaterFunction NRM fragment



Figure 4.2.1.5: RepeaterFunction related VsDataContainer Containment/Naming and Association diagram

## 4.2.2 Inheritance

This subclause depicts the inheritance relationships.

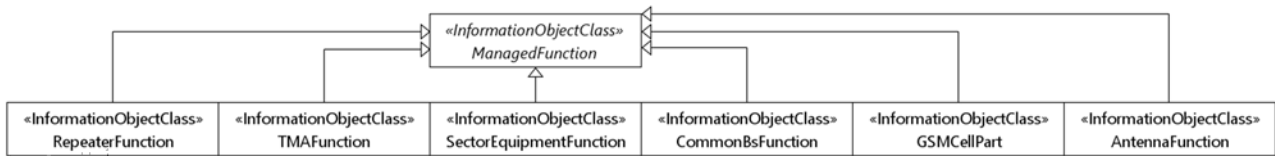


Figure 4.2.2.1: Inheritance diagram (1/2)

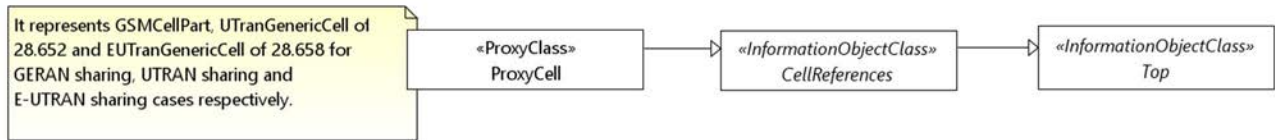


Figure 4.2.21.2: Inheritance diagram (2/2)

## 4.3 Class definitions

### 4.3.1 SectorEquipmentFunction

#### 4.3.1.1 Definition

This IOC represents a set of cells within a geographical area that has common functions relating to AntennaFunction, TMAFunction and supporting equipment, such as power amplifier.

#### 4.3.1.2 Attributes

Attribute name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
fqBandList	M	T	F	F	T
confOutputPower	O	T	T	F	F
<b>Attribute related to role</b>					
referenceFrom	O	T	F	F	T
referenceTo	M	T	T	F	T

#### 4.3.1.3 Attribute constraints

None.

#### 4.3.1.4 Notifications

The common notifications defined in subclause 4.5 are valid for this IOC, without exceptions or additions.

### 4.3.2 AntennaFunction

#### 4.3.2.1 Definition

This IOC represents an array of radiating elements that may be tilted to adjust the RF coverage of a cell(s).

### 4.3.2.2 Attributes

Attribute name	Support Qualifier	isReadable	isWritable	isInvariant	IsNotifyable
beamTilt	O	T	T	F	T
elevation	O	T	T	F	T
retTiltValue	O	T	T	F	T
bearing	O	T	T	F	T
retGroupName	O	T	T	F	T
maxAzimuthValue	O	T	T	F	T
minAzimuthValue	O	T	T	F	T
horizBeamwidth	O	T	T	F	T
vertBeamwidth	O	T	T	F	T
latitude	M	T	T	F	T
longitude	M	T	T	F	T
<b>Attribute related to role</b>					
referenceFrom	O	T	F	F	T

### 4.3.2.3 Attribute constraints

None.

### 4.3.2.4 Notifications

The common notifications defined in subclause 4.5 are valid for this IOC, without exceptions or additions.

## 4.3.3 TMAFunction

### 4.3.3.1 Definition

This IOC represents a Tower Mounted Amplifier or a number of TMA subunits within one TMA, each separately addressable by a specific index at the application layer.

### 4.3.3.2 Attributes

Attribute name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
tmaSubunitNumber	M	T	T	F	T
tmaStateFlag	M	T	O	F	T
tmaFunctionFlag	M	T	T	F	T
tmaMinGain	M	T	F	F	T
tmaMaxGain	M	T	F	F	T
tmaResolution	M	T	F	F	T
tmaGainFigure	M	T	O	F	T
tmaNumberOfSubunits	M	T	F	F	T
tmaBaseStationId	CO	T	CO	F	T
tmaSectorId	CO	T	CO	F	T
tmaAntennaBearing	CO	T	CO	F	T
tmaInstalledMechanicalTilt	CO	T	CO	F	T
tmaSubunitType	CO	T	CO	F	T
tmaSubunitRxFrequencyBand	CO	T	CO	F	T
tmaSubunitTxFrequencyBand	CO	T	CO	F	T
tmaGainResolution	CO	T	CO	F	T
<b>Attribute related to role</b>					
theCellList	CM	T	F	F	T

### 4.3.3.3 Attribute Constraints

Name	Definition
theCellList	Condition: Association between <code>SectorEquipmentFunction</code> and <code>ProxyCellList</code> is absent; and association between <code>SectorEquipmentFunction</code> and <code>NRSectorCarrier</code> is absent.
tmaBaseStationId through tmaGainResolution	Condition: The interface towards the TMA subunit supports TS 37.466 [26]

### 4.3.3.4 Notifications

The common notifications defined in subclause 4.5 are valid for this IOC, without exceptions or additions.

## 4.3.4 GSMCellPart

### 4.3.4.1 Definition

A GSM cell can consist of a number of carriers. These carriers can be configured in a number of ways, for example, the carriers can have different propagation properties which are sent with different antenna tilt, with different RF power, different radio band and even possibly different antenna.

The various `GSMCellPart` instances capture different radio propagation properties allowing different frequency planning schemes, e.g. some `GSMCellPart` instances can use frequency groups planned for tighter frequency reuse.

Hence, a GSM cell can, and in some cases must, be distributed on more than one `SectorEquipmentFunction`.

This IOC is required as part of the capability to satisfy the Requirements statement identified below.

Referenced TS	Requirement label	Comment
TS 28.661 [10]	REQ-GRAN_NRM-CON-001	
TS 28.661 [10]	REQ-GRAN_NRM-CON-002	

### 4.3.4.2 Attributes

Attribute name	Support Qualifier	isReadable	isWritable	isInvariant	IsNotifyable
aRFCN	M	T	T	F	T
tsc	M	T	T	F	T
aTA	M	T	T	F	T
<b>Attribute related to role</b>					
theSectorEquipment	M	T	F	F	T

### 4.3.4.3 Attribute constraints

None

### 4.3.4.4 Notifications

The common notifications defined in subclause 4.5 are valid for this IOC, without exceptions or additions.

## 4.3.5 CommonBsFunction

### 4.3.5.1 Definition

This IOC represents common aspects of Base Station (BS) functionality shared by several radio access technologies.

Referenced TS	Requirement label	Comment
TS 28.661 [10]	REQ-GRAN_NRM-CON-001	
TS 28.661 [10]	REQ-GRAN_NRM-CON-002	

#### 4.3.5.2 Attributes

Attribute name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifiable
sharedTechnologies	M	T	O	F	T
Attribute related to role					
theProxyBsList	M	T	F	F	T

#### 4.3.5.3 Attribute constraints

None

#### 4.3.5.4 Notifications

There is no notification defined.

### 4.3.6 *CellReferences*

#### 4.3.6.1 Definition

This IOC represents the three references to `TMAFunction`, `SectorEquipmentFunction` and `AntennaFunction`. The references are used by various classes of cells, e.g. *UtranGenericCell*.

This is an abstract class.

#### 4.3.6.2 Attributes

Attribute name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifiable
Attribute related to role					
relatedSectorEquipment	CM	T	F	F	T
relatedTMAList	CM	T	F	F	T
relatedAntennaList	CM	T	F	F	T

#### 4.3.6.3 Attribute constraints

Name	Definition
relatedSectorEquipment	Condition: Supporting the GERAN sharing case. In such case, there shall be at least one <code>GSMCellPart</code> present at one end of this association.
relatedAntennaList	Condition: Association between <code>SectorEquipmentFunction</code> and <code>ProxyCell</code> is not supported.
relatedTMAList	Condition: Association between <code>SectorEquipmentFunction</code> and <code>ProxyCell</code> is not supported.

#### 4.3.6.4 Notifications

There is no notification defined.

### 4.3.7 *RepeaterFunction*

#### 4.3.7.1 Definition

This IOC represents the management aspect of a repeater. For the information on repeater see 3GPP TS 25.106 [18] for UMTS and TS 36.106 [28] for LTE.

This IOC is required as part of the capability to satisfy the Requirements statement identified below.

Referenced TS	Requirement label	Comment
TS 28.661 [10]	REQ-GRAN_NRM-CON-003	

#### 4.3.7.2 Attributes

Attribute name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
priority	M	T	T	F	T
latitude	M	T	F	F	F
longitude	M	T	F	F	F
ctrlConnMode	M	T	T	F	T
environmentInfo	M	T	-	F	-
powerSwitch	M	T	T	F	T
ulAttenuation	M	T	T	F	T
dlAttenuation	M	T	T	F	T
firmwareVer	M	T	F	F	F
repeaterType	M	T	F	F	F
<b>Attribute related to role</b>					
externalUTRANCell	M	T	F	F	T

#### 4.3.7.3 Attribute constraints

None.

#### 4.3.7.4 Notifications

The common notifications defined in subclause 4.5 are valid for this IOC, without exceptions or additions.

### 4.3.8 ProxyCell <<ProxyClass>>

#### 4.3.8.1 Definition

This IOC represents GSMCellPart, UTranGenericCell and EUtranGenericCell.

#### 4.3.8.3 Attribute constraints

See respective IOCs

#### 4.3.8.4 Notifications

See respective IOCs.

### 4.3.9 ProxyBsFunction <<ProxyClass>>

#### 4.3.8.1 Definition

This IOC represents ENBFunction, NodeBFunction and BssFunction.

#### 4.3.8.3 Attribute constraints

See respective IOCs.

#### 4.3.8.4 Notifications

See respective IOCs.



Attribute Name	Documentation and Allowed Values	Properties
aRFCN	This attribute (Absolute Radio Frequency Channel Number) defines a pair of Radio Frequency (RF) channel frequencies for uplink and downlink use.  See TS 45.005 [19] clause 2 for the ARFCN for GSM. ARFCN are based on a 200 kHz channel raster.  allowedValues: See TS 45.005 [19] clause 2.	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
aTA	This attribute (allowed Timing Advance) defines the signal sent by the BTS to the MS which the MS uses to advance its timings of transmissions to the BTS so as to compensate for propagation delay.  allowedValues: See TS 45.010 [20]	type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
bearing	The bearing in degrees that the antenna is pointing in. Antenna bearing" in Ref. TS 37.466 [26].  allowedValues: See "Antenna bearing" in TS 37.466 [26].	type: Integer multiplicity: 0..1 isOrdered: True isUnique: False defaultValue: None isNullable: False
confOutputPower	It defines the allowed total power to use for all cells together in this sector. It may be set by the operator and/or set to a value limited by HW limitation or licensed power, e.g.: 20, 40, 60, 80,120 watts  allowedValues: N/A	type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
ctrlConnMode	Remote communication mode used by a repeater to send and receive control message, such as GSM SMS, WCDMA SMS, Circle Switch Data-CSD, Package Switch Dat-IP, Serial port.  allowedValues: N/A	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
dlAttenuation	Downlink signal attenuation of the device to change downlink gain.  allowedValues: N/A	type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
environmentInfo	The repeater device is located either in the building or out of the building.  allowedValues: N/A	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
firmwareVer	Version of the device firmware.  allowedValues: N/A	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False

Attribute Name	Documentation and Allowed Values	Properties
fqBandList	<p>The list of frequency bands/ranges supported by the hardware associated with the SectorEquipmentFunction.</p> <p>Valid frequency bands/ranges may be found in TS 25.104 (UTRA) [21], 36.104 (E-UTRA) [7] and 38.104 (NR) [23].</p> <p>AllowedValues: Operating band id or supported &lt;UL,DL,mode&gt; expressed as a string.</p> <p>Examples for NR: Bands: {"n1", "n12"} Frequencies: {"1920–1980, 2110–2170, FDD", "699–716, 729–746, FDD"}</p>	<p>type: String multiplicity: 1..* isOrdered: False isUnique: True defaultValue: None isNullable: False</p>
elevation	<p>The elevation the antenna function should have, based on World Geodetic System (1984 version) global reference frame (WGS 84).</p> <p>allowedValues: Positive values correspond to meters above sea level. Negative values correspond to meters below sea level. If empty, value is not defined.</p>	<p>type: Real multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>
horizBeamwidth	<p>The 3 dB power beamwidth of the antenna pattern in the horizontal plane. A value of 360 indicates an omnidirectional antenna.</p> <p>Note: The value of this attribute has no operational impact on the network, e.g. the NE behaviour is not affected by the value setting of this attribute. Note as well that this attribute is not supported over the luant interface.</p> <p>A single integral value corresponding to an angle in degrees between 0 and 360.</p> <p>allowedValues: N/A</p>	<p>type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>
latitude	<p>The latitude of the antenna location based on World Geodetic System (1984 version) global reference frame (WGS 84). Positive values correspond to the northern hemisphere.</p> <p>allowedValues: -90.0000 to +90.0000</p>	<p>type: Real multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>
longitude	<p>The longitude of the antenna location based on World Geodetic System (1984 version) global reference frame (WGS 84). Positive values correspond to degrees east of 0 degrees longitude.</p> <p>allowedValues: -180.0000 to +180.0000</p>	<p>type: Real multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>
maxAzimuthValue	<p>The maximum amount of change of azimuth the RET system can support. This is the change in degrees clockwise from bearing.</p> <p>Note: The value of this attribute has no operational impact on the network, e.g. the NE behaviour is not affected by the value setting of this attribute. Note as well that this attribute is not supported over the luant interface.</p> <p>A single integral value corresponding to an angle in degrees between 0 and 360 with a resolution of 0.1 degrees.</p> <p>allowedValues: N/A</p>	<p>type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>

Attribute Name	Documentation and Allowed Values	Properties
minAzimuthValue	<p>The minimum amount of change of azimuth the RET system can support. This is the change in degrees counter-clockwise from bearing.</p> <p>Note: The value of this attribute has no operational impact on the network, e.g. the NE behaviour is not affected by the value setting of this attribute. Note as well that this attribute is not supported over the Luant interface.</p> <p>A single integral value corresponding to an angle in degrees between 0 and 360 with a resolution of 0.1 degrees.</p> <p>allowedValues: N/A</p>	<p>type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>
priority	<p>The priority of a repeater decided by an operator.</p> <p>allowedValues: N/A</p>	<p>type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>
powerSwitch	<p>Power switch of device which has two status: ON/OFF.</p> <p>allowedValues: ON, OFF</p>	<p>type: Boolean multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>
relatedAntennaList	<p>This attribute contains the DNs of one or more AntennaFunction.</p> <p>allowedValues: N/A</p>	<p>type: DN multiplicity: 1..* isOrdered: False isUnique: True defaultValue: None isNullable: False</p>
relatedSectorEquipment	<p>This attribute contains the DN of one SectorEquipmentFunction.</p> <p>allowedValues: N/A</p>	<p>type: DN multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>
relatedTMAList	<p>This attribute contains the DNs of one or more TmaFunction.</p> <p>allowedValues: N/A</p>	<p>type: DN multiplicity: 1..* isOrdered: False isUnique: True defaultValue: None isNullable: False</p>
repeaterType	<p>The repeater type defined by operator, such as wide band, frequency selective, indoor and fiber optic.</p> <p>allowedValues: N/A</p>	<p>type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>
retGroupName	<p>The group name is a textual, alpha-numeric string to define a logical grouping of antennas which may be in different cells.</p> <p>This attribute permits the definition of a logical grouping of the antennas. This may be defined either at installation time, or by management activity to provisioning the group name via the ltf-N.</p> <p>allowedValues: N/A (String size is bounded to 80 characters.)</p>	<p>type: String multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False</p>

Attribute Name	Documentation and Allowed Values	Properties
retTiltValue	The electrical tilt setting of the antenna, "Tilt value" in Ref. 3GPP TS 37.466 [26].  allowedValues: See "Tilt value" in Ref. TS 37.466 [26].	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
beamTilt	The beam tilt of the wanted antenna beam in the vertical plane. A positive value on the beam tilt indicates an antenna beam direction below the vertical plane."	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
sharedTechnologies	This attribute defines the radio access technologies sharing the common functionalities of a Base Station (BS).  allowedValues: GSM, UMTS, LTE, or any combination thereof.	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaAntennaBearing	A data field defined in Table B.3 of 3GPP TS 37.466 [26].  See TS 37.466 [26].  allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaBaseStationId	A data field defined in Table B.3 of TS 37.466 [26]  allowedValues: N/A	type: String multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaFunctionFlag	Defined in TS 37.466 [26]  allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaGainFigure	Defined in TS 37.466 [26]  allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaGainResolution	A data field defined in Table B.3 of TS 37.466 [26]  allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaInstalledMechanicalTilt	A data field defined in Table B.3 of TS 37.466 [26]  allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False

Attribute Name	Documentation and Allowed Values	Properties
tmaMaxGain	Defined in TS 37.466 [26] allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaMinGain	Defined in TS 37.466 [26] allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaNumberOfSubunits	Defined in TS 37.466 [26] allowedValues: --	Defined in 3GPP TS 37.466 [26] type: -- multiplicity: -- isOrdered: -- isUnique: -- defaultValue: -- isNullable: --
tmaResolution	Defined in TS 37.466 [26] allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaSectorId	A data field defined in Table B.3 of TS 37.466 [26] allowedValues: N/A	type: String multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaStateFlag	Defined in TS 37.466 [26] allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaSubunitNumber	Defined in TS 37.466 [26] allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
tmaSubunitRxFrequencyBand	A data field defined in Table B.3 of TS 37.466 [26] allowedValues: See TS 37.466 [26].	type: Integer multiplicity: 2 isOrdered: True isUnique: True defaultValue: None isNullable: False
tmaSubunitType	A data field defined in Table B.3 of TS 37.466 [26] allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False

Attribute Name	Documentation and Allowed Values	Properties
tmaSubunitTxFrequencyBand	A data field defined in Table B.3 of TS 37.466 [26]  allowedValues: See TS 37.466 [26].	type: Integer multiplicity: 2 isOrdered: True isUnique: True defaultValue: None isNullable: False
tsc	This attribute has the same definition as the one used in GsmCell IOC. The presence of GSMCellPart means the tsc attribute in GsmCell IOC instance is irrelevant (not applicable).  allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
ulAttenuation	Uplink signal attenuation of the device to change uplink gain. allowedValues: N/A	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
vertBeamwidth	The 3 dB power beamwidth of the antenna pattern in the vertical plane.  The value of this attribute has no operational impact on the network, e.g. the NE behaviour is not affected by the value setting of this attribute.  This attribute is not supported over the luan interface.  allowedValues: A single integral value corresponding to an angle in degrees between 0 and 180.	type: Integer multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
<b>Attribute related to role</b>		
externalUTRANCell	This role (when present) represents RepeaterFunction capability to identify one ExternalUtranCell. When present, it shall contain one ExternalUtranCell DN.  allowedValues: N/A	type: DN multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: None isNullable: False
theProxyBsList	A CommonBsFunction instance serves a number of ProxyBsFunction instances. This CommonBsFunction role-attribute contains a list of DNs of ENBFunction (TS 28.658 [13]), NodeBFunction (TS 28.652 [12]) and BssFunction (TS 28.655 [14]) that it serves.  allowedValues: N/A	type: DN multiplicity: 1..* isOrdered: False isUnique: True defaultValue: None isNullable: False
referenceFrom	This attribute contains the DNs of one or more objects (e.g. antenna, cells, sector carrier) if associations from them exist.  allowedValues: N/A	type: DN multiplicity: * isOrdered: False isUnique: True defaultValue: None isNullable: False
referenceTo	This attribute contains the DNs of one or more objects (e.g. TMA) if associations to them exist.  allowedValues: N/A	type: DN multiplicity: * isOrdered: False isUnique: True defaultValue: None isNullable: False

## 4.4.2 Constraints

None

## 4.5 Common Notifications

### 4.5.1 Alarm notifications

This subclause presents a list of notifications, defined in TS 32.111-2 [11], that IRPManager can receive. The notification header attribute `objectClass/objectInstance`, defined in TS 32.302 [16], would capture the DN of an instance of an IOC defined in this IRP specification.

Name	Qualifier	Notes
<code>notifyAckStateChanged</code>	See Alarm IRP (TS 32.111-2 [11])	
<code>notifyChangedAlarm</code>	See Alarm IRP (TS 32.111-2 [11])	
<code>notifyClearedAlarm</code>	See Alarm IRP (TS 32.111-2 [11])	
<code>notifyNewAlarm</code>	See Alarm IRP (TS 32.111-2 [11])	
<code>notifyComments</code>	See Alarm IRP (TS 32.111-2 [11])	
<code>notifyAlarmListRebuilt</code>	See Alarm IRP (TS 32.111-2 [11])	
<code>notifyPotentialFaultyAlarmList</code>	See Alarm IRP (TS 32.111-2 [11])	

### 4.5.2 Configuration notifications

This subclause presents a list of notifications, defined in TS 32.662 [17], that IRPManager can receive. The notification header attribute `objectClass/objectInstance`, defined in TS 32.302[16], would capture the DN of an instance of an IOC defined in this IRP specification.

Name	Qualifier	Notes
<code>notifyAttributeValueChange</code>	O	
<code>notifyObjectCreation</code>	O	
<code>notifyObjectDeletion</code>	O	

## Annex A: Diagrams

```

@startuml
'Figure 4.2.1.1: UTRAN/E-UTRAN/NR/GERAN sharing
skinparam ClassStereotypeFontStyle normal
skinparam ClassBackgroundColor White
skinparam shadowing false
skinparam monochrome true
skinparam style strictuml
hide members
hide circle
class GSMCellPart <<InformationObjectClass>>
class GSMCell <<InformationObjectClass>>
class TMAFunction <<InformationObjectClass>>
class ProxyCell <<ProxyClass>>
class SectorEquipmentFunction <<InformationObjectClass>>
class ManagedElement <<InformationObjectClass>>
class AntennaFunction <<InformationObjectClass>>
class NRCellDU <<InformationObjectClass>>
class NRSectorCarrier <<InformationObjectClass>>
class ManagedEntity <<ProxyClass>>

GSMCell "1" *-u- "*" GSMCellPart: <<names>>
GSMCellPart "*" -u-> "1" SectorEquipmentFunction : theSectorEquipment
ManagedElement "1" *-l- "*" TMAFunction : <<names>>
ManagedElement "1" *-u- "*" AntennaFunction : <<names>>
ManagedElement "1" *-u- "*" SectorEquipmentFunction : <<names>>

ProxyCell "*" -- "1" TMAFunction
ProxyCell "*" -- "1" AntennaFunction
ProxyCell "*" -- "1" SectorEquipmentFunction
(ProxyCell, TMAFunction) .. (ProxyCell, SectorEquipmentFunction) : {XOR}
(ProxyCell, AntennaFunction) .. (ProxyCell, SectorEquipmentFunction) : {XOR}

ManagedEntity "*" <-- "1" SectorEquipmentFunction : referenceFrom
SectorEquipmentFunction "1" --> "*" TMAFunction : references
SectorEquipmentFunction "1" --> "*" AntennaFunction : referenceTo
ManagedEntity "*" <-l- "1" AntennaFunction : referenceFrom
NRCellDU "1" --> "1..*" NRSectorCarrier
SectorEquipmentFunction "1" <-- "*" NRSectorCarrier : sectorEquipmentFunctionRef

note top of ProxyCell
Represents GSMCellPart, UTranGenericCell of
28.652, EUTranGenericCell of 28.658 for GERAN
sharing for UTran sharing and E-UTRAN sharing
cases respectively.
end note

note top of ManagedEntity
Represents objects from which an association exists.
end note

@end

```

## Annex B (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2013-09	SA#61	SP-130433	0001		F	Add missing Repeater Object IS definitions	11.1.0
2014-06	SA#64	SP-140359	0002		F	remove the feature support statements	11.2.0
2014-10	-	-	-			Update to Rel-12 version (MCC)	<b>12.0.0</b>
2016-01	-	-	-			Update to Rel-13 version (MCC)	<b>13.0.0</b>
2016-06	SA#72	SP-160408	0005	1	A	Correcting references and reintroducing attributes.	13.1.0
2017-03	SA#75	-	-	-		Promotion to Release 14 without technical change	14.0.0
2018-06	-	-	-	-	-	Update to Rel-15 version (MCC)	15.0.0
2018-12	SA#82	SP-181156	0007	1	F	Correct SectorEquipmentFunction property to support NR.	15.1.0
2018-12	SA#82	SP-181156	0008	2	F	Align NR frequency bands supported by the hardware associated with the SectorEquipmentFunction	15.1.0
2019-09	SA#85	SP-190751	0009	-	F	Correct references and add reference to TR21.905	15.2.0
2019-12	SA#86	SP-191173	0010	1	F	Correct use of ProxyCellList	15.3.0
2020-07	-	-	-	-	-	Update to Rel-16 version (MCC)	16.0.0
2022-03	-	-	-	-	-	Update to Rel-17 version (MCC)	17.0.0
2024-03	SA#103	SP-240205	0014	-	F	R18 CR 28.662 Rapporteur's clean up for Rel-18 upgrade	18.0.0
2025-06	SA#108	SP-250554	0019	1	A	Rel-18 CR 28.662 Update sector equipment and antenna function definitions	18.1.0
2025-06	SA#108	SP-250559	0016	-	C	Rel 19 CR TS 28.662 Remove Support Qualifier from attribute constraints	19.0.0
2025-09	SA#109	SP-251081	0023	1	A	R19 CR 28.662 Correct references to align with RAN specifications	19.1.0
2025-12	SA#110	SP-251379	0024	1	F	Rel-19 CR 28.662 Update sector equipment and antenna function (stage 2)	19.2.0

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## History

<b>Version</b>	<b>Date</b>	<b>Status</b>
V19.1.0	October 2025	Publication
V19.2.0	February 2026	Publication