5G;
NR;
Radio Resource Control (RRC);
Protocol specification
(3GPP TS 38.331 version 16.3.1 Release 16)
Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for ETSI members and non-members, and can be found in ETSI SR 000 314: “Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards”, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Legal Notice

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp.

Modal verbs terminology

In the present document "shall", "shall not", "should", "should not", "may", "need not", "will", "will not", "can" and "cannot" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"must" and "must not" are NOT allowed in ETSI deliverables except when used in direct citation.
5.3.5.13.1 General .............................................................................................................. 91
5.3.5.13.2 Conditional reconfiguration removal ................................................................. 91
5.3.5.13.3 Conditional reconfiguration addition/modification .............................................. 91
5.3.5.13.4 Conditional reconfiguration evaluation ............................................................ 91
5.3.5.13.5 Conditional reconfiguration execution .............................................................. 92
5.3.5.14 Sidelink dedicated configuration .............................................................................. 92
5.3.6 Counter check ............................................................................................................. 94
5.3.6.1 General .............................................................................................................. 94
5.3.6.2 Initiation ........................................................................................................... 94
5.3.6.3 Reception of the CounterCheck message by the UE ........................................... 94
5.3.7 RRC connection re-establishment .............................................................................. 95
5.3.7.1 General .............................................................................................................. 95
5.3.7.2 Initiation ........................................................................................................... 95
5.3.7.3 Actions following cell selection while T311 is running ........................................ 97
5.3.7.4 Actions related to transmission of RRCReestablishmentRequest message .......... 99
5.3.7.5 Reception of the RRCReestablishment by the UE ................................................. 100
5.3.7.6 T311 expiry ..................................................................................................... 101
5.3.7.7 T301 expiry or selected cell no longer suitable .................................................... 101
5.3.7.8 Reception of the RRCSetup by the UE ............................................................... 101
5.3.8 RRC connection release .......................................................................................... 105
5.3.8.1 General .............................................................................................................. 105
5.3.8.2 Initiation ........................................................................................................... 105
5.3.8.3 UE actions upon the expiry of DataInactivityTimer .......................................... 104
5.3.8.4 T320 expiry ..................................................................................................... 104
5.3.8.5 UE actions upon the expiry of RRCSetup message ........................................... 104
5.3.9 RRC connection release requested by upper layers ................................................. 105
5.3.9.1 General .............................................................................................................. 105
5.3.9.2 Initiation ........................................................................................................... 105
5.3.10 Radio link failure related actions .......................................................................... 105
5.3.10.1 Detection of physical layer problems in RRC_CONNECTED ................................ 105
5.3.10.2 Recovery of physical layer problems ................................................................. 105
5.3.10.3 Detection of radio link failure .......................................................................... 105
5.3.10.4 RLF cause determination ................................................................................ 107
5.3.10.5 RLF report content determination .................................................................... 108
5.3.11 UE actions upon going to RRC_IDLE .................................................................. 110
5.3.12 UE actions upon PUCCH/SRS release request ....................................................... 111
5.3.13 RRC connection resume ....................................................................................... 112
5.3.13.1 General .............................................................................................................. 112
5.3.13.1a Conditions for resuming RRC Connection for sidelink communication ............ 113
5.3.13.2 Initiation ........................................................................................................... 113
5.3.13.3 Actions related to transmission of RRCResumeRequest or RRCResumeRequest1 message ................................................................. 115
5.3.13.4 Reception of the RRCResume by the UE .......................................................... 116
5.3.13.5 T319 expiry or Integrity check failure from lower layers while T319 is running ...... 119
5.3.13.6 Cell re-selection or cell selection while T390, T319 or T302 is running (UE in RRC_INACTIVE) ............................................................ 120
5.3.13.7 Reception of the RRCSetup by the UE ............................................................... 120
5.3.13.8 RNA update .................................................................................................... 120
5.3.13.9 Reception of the RRCRelease by the UE .......................................................... 120
5.3.13.10 Reception of the RRCReject by the UE ............................................................ 121
5.3.13.11 Inability to comply with RRCResume ................................................................ 121
5.3.13.12 Inter RAT cell reselection ................................................................................ 121
5.3.14 Unified Access Control ......................................................................................... 121
5.3.14.1 General .............................................................................................................. 121
5.3.14.2 Initiation ........................................................................................................... 121
5.3.14.3 Void .................................................................................................................. 123
5.3.14.4 T302, T390 expiry or stop (Barring alleviation) ................................................. 123
5.3.14.5 Access barring check ....................................................................................... 124
5.3.15 RRC connection reject ......................................................................................... 124
5.3.15.1 Initiation ........................................................................................................... 124
5.3.15.2 Reception of the RRCReject by the UE ............................................................ 124
5.4 Inter-RAT mobility ..................................................................................................... 125
5.4.1 Introduction .............................................................................................................. 125
5.4.2 Handover to NR
5.4.2.1 General
5.4.2.2 Initiation
5.4.2.3 Reception of the RRCReconfiguration by the UE
5.4.3 Mobility from NR
5.4.3.1 General
5.4.3.2 Initiation
5.4.3.3 Reception of the MobilityFromNRCommand by the UE
5.4.3.4 Successful completion of the mobility from NR
5.4.3.5 Mobility from NR failure

5.5 Measurements
5.5.1 Introduction
5.5.2 Measurement configuration
5.5.2.1 General
5.5.2.2 Measurement identity removal
5.5.2.3 Measurement identity addition/modification
5.5.2.4 Measurement object removal
5.5.2.5 Measurement object addition/modification
5.5.2.6 Reporting configuration removal
5.5.2.7 Reporting configuration addition/modification
5.5.2.8 Quantity configuration
5.5.2.9 Measurement gap configuration
5.5.2.10 Reference signal measurement timing configuration
5.5.2.10a RSSI measurement timing configuration
5.5.2.11 Measurement gap sharing configuration
5.5.3 Performing measurements
5.5.3.1 General
5.5.3.2 Layer 3 filtering
5.5.3.3a Derivation of layer 3 beam filtered measurement
5.5.4 Measurement report triggering
5.5.4.1 General
5.5.4.2 Event A1 (Serving becomes better than threshold1)
5.5.4.3 Event A2 (Serving becomes worse than threshold)
5.5.4.4 Event A3 (Neighbour becomes offset better than SpCell)
5.5.4.5 Event A4 (Neighbour becomes better than threshold)
5.5.4.6 Event A5 (SpCell becomes worse than threshold1 and neighbour becomes better than threshold2)
5.5.4.7 Event A6 (Neighbour becomes offset better than SCell)
5.5.4.8 Event B1 (Inter RAT neighbour becomes better than threshold)
5.5.4.9 Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2)
5.5.4.10 Event I1 (Interference becomes higher than threshold)
5.5.4.11 Event C1 (The NR sidelink channel busy ratio is above a threshold)
5.5.4.12 Event C2 (The NR sidelink channel busy ratio is below a threshold)
5.5.4.13 Void
5.5.4.14 Void
5.5.5 Measurement reporting
5.5.5.1 General
5.5.5.2 Reporting of beam measurement information
5.5.5.3 Sorting of cell measurement results
5.5.6 Location measurement indication
5.5.6.1 General
5.5.6.2 Initiation
5.5.6.3 Actions related to transmission of LocationMeasurementIndication message
5.5a Logged Measurements
5.5a.1 Logged Measurement Configuration
5.5a.1.1 General
5.5a.1.2 Initiation
5.5a.1.3 Reception of the LoggedMeasurementConfiguration by the UE
5.5a.1.4 T330 expiry
5.5a.2 Release of Logged Measurement Configuration
5.5a.2.1 General ................................................................................................................................. 168
5.5a.2.2 Initiation ................................................................................................................................. 168
5.5a.3 Measurements logging ............................................................................................................ 168
5.5a.3.1 General ................................................................................................................................. 168
5.5a.3.2 Initiation ................................................................................................................................. 168
5.6 UE capabilities ............................................................................................................................... 169
5.6.1 UE capability transfer .................................................................................................................. 169
5.6.1.1 General ........................................................................................................................................ 169
5.6.1.2 Initiation ...................................................................................................................................... 170
5.6.1.3 Reception of the UE CapabilityEnquiry by the UE ................................................................. 170
5.6.1.4 Setting band combinations, feature set combinations and feature sets supported by the UE...... 171
5.6.1.5 Void .............................................................................................................................................. 173
5.7 Other ................................................................................................................................................ 173
5.7.1 DL information transfer ............................................................................................................. 173
5.7.1.1 General ........................................................................................................................................ 173
5.7.1.2 Initiation ...................................................................................................................................... 174
5.7.1.3 Reception of the DLInformationTransfer by the UE ............................................................... 174
5.7.1a DL information transfer for MR-DC ............................................................................................ 174
5.7.1a.1 General ........................................................................................................................................ 174
5.7.1a.2 Initiation ...................................................................................................................................... 174
5.7.1a.3 Actions related to reception of DLInformationTransferMRDC message ............................... 174
5.7.2 UL information transfer ............................................................................................................ 175
5.7.2.1 General ........................................................................................................................................ 175
5.7.2.2 Initiation ...................................................................................................................................... 175
5.7.2.3 Actions related to transmission of ULInformationTransfer message ....................................... 175
5.7.2.4 Failure to deliver ULInformationTransfer message ............................................................... 175
5.7.2a UL information transfer for MR-DC ........................................................................................... 176
5.7.2a.1 General ........................................................................................................................................ 176
5.7.2a.2 Initiation ...................................................................................................................................... 176
5.7.2a.3 Actions related to transmission of ULInformationTransferMRDC message ............................... 176
5.7.2b UL transfer of IRAT information ................................................................................................ 176
5.7.2b.1 General ........................................................................................................................................ 176
5.7.2b.2 Initiation ...................................................................................................................................... 177
5.7.2b.3 Actions related to transmission of ULInformationTransferIRAT message ............................... 177
5.7.3 SCG failure information .............................................................................................................. 177
5.7.3.1 General ........................................................................................................................................ 177
5.7.3.2 Initiation ...................................................................................................................................... 177
5.7.3.3 Failure type determination for (NG)EN-DC ............................................................................... 178
5.7.3.4 Setting the contents of MeasResultSCG-Failure ......................................................................... 179
5.7.3.5 Actions related to transmission of SCGFailureInformation message ........................................ 179
5.7.3a EUTRA SCG failure information ............................................................................................... 181
5.7.3a.1 General ........................................................................................................................................ 181
5.7.3a.2 Initiation ...................................................................................................................................... 181
5.7.3a.3 Actions related to transmission of SCGFailureInformationEUTRA message ......................... 181
5.7.3b MCG failure information ........................................................................................................... 182
5.7.3b.1 General ........................................................................................................................................ 182
5.7.3b.2 Initiation ...................................................................................................................................... 182
5.7.3b.3 Failure type determination ........................................................................................................... 182
5.7.3b.4 Actions related to transmission of MCGFailureInformation message .................................... 183
5.7.3b.5 T316 expiry ................................................................................................................................. 184
5.7.4 UE Assistance Information .......................................................................................................... 185
5.7.4.1 General ........................................................................................................................................ 185
5.7.4.2 Initiation ...................................................................................................................................... 185
5.7.4.3 Actions related to transmission of UEAssistanceInformation message .................................... 189
5.7.4.3a Setting the contents of OverheatingAssistance IE ............................................................... 194
5.7.4a Void ................................................................................................................................................. 195
5.7.5 Failure information .................................................................................................................... 195
5.7.5.1 General ........................................................................................................................................ 195
5.7.5.2 Initiation ...................................................................................................................................... 195
5.7.5.3 Actions related to transmission of FailureInformation message ............................................... 195
5.7.6 DL message segment transfer .................................................................................................... 196
5.7.6.1 General ........................................................................................................................................ 196
5.7.6.2 Initiation ............................................................................................................................. 196
5.7.6.3 Reception of DL Dedicated Message Segment by the UE .................................................. 196
5.7.7 UL message segment transfer .............................................................................................. 196
5.7.7.1 General ............................................................................................................................. 196
5.7.7.2 Initiation ............................................................................................................................. 196
5.7.7.3 Actions related to transmission of UL Dedicated Message Segment message ...................... 197
5.7.8 Idle/inactive Measurements .................................................................................................. 197
5.7.8.1 General ............................................................................................................................. 197
5.7.8.1a Measurement configuration .............................................................................................. 197
5.7.8.2 Void .................................................................................................................................... 198
5.7.8.2a Performing measurements ............................................................................................... 198
5.7.8.3 T331 expiry or stop ........................................................................................................... 200
5.7.8.4 Cell re-selection or cell selection while T331 is running .................................................... 201
5.7.9 Mobility history information ............................................................................................... 201
5.7.9.1 General ............................................................................................................................. 201
5.7.9.2 Initiation ............................................................................................................................. 201
5.7.10 UE Information ................................................................................................................... 202
5.7.10.1 General ............................................................................................................................. 202
5.7.10.2 Initiation ............................................................................................................................. 202
5.7.10.3 Reception of the UE Information Request message .......................................................... 202
5.7.10.4 Actions upon successful completion of random-access procedure .................................... 204
5.7.10.5 RA information determination for RA report and RLF report .......................................... 205
5.7.12 IAB Other Information ...................................................................................................... 206
5.7.12.1 General ............................................................................................................................. 206
5.7.12.2 Initiation ............................................................................................................................. 206
5.7.12.3 Actions related to transmission of IAB Other Information message .................................. 206
5.8 Sidelink .................................................................................................................................. 208
5.8.1 General ............................................................................................................................... 208
5.8.2 Conditions for NR sidelink communication operation .......................................................... 208
5.8.3 Sidelink UE information for NR sidelink communication ...................................................... 209
5.8.3.1 General ............................................................................................................................. 209
5.8.3.2 Initiation ............................................................................................................................. 209
5.8.3.3 Actions related to transmission of Sidelink UE Information NR message ............................ 210
5.8.4 Void ..................................................................................................................................... 211
5.8.5 Sidelink synchronisation information transmission for NR sidelink communication ............... 211
5.8.5.1 General ............................................................................................................................. 211
5.8.5.2 Initiation ............................................................................................................................. 212
5.8.5.3 Transmission of SLSS ........................................................................................................ 212
5.8.5.4a Sidelink synchronisation information transmission for V2X sidelink communication ......... 214
5.8.5.4a.1 General ........................................................................................................................... 214
5.8.5.4a.2 Initiation ........................................................................................................................... 214
5.8.6 Sidelink synchronisation reference ....................................................................................... 214
5.8.6.1 General ............................................................................................................................. 214
5.8.6.2 Selection and reselection of synchronisation reference ....................................................... 214
5.8.6.3 Sidelink communication transmission reference cell selection .......................................... 217
5.8.7 Sidelink communication reception ....................................................................................... 217
5.8.8 Sidelink communication transmission ................................................................................... 218
5.8.9 Sidelink RRC procedure ...................................................................................................... 220
5.8.9.1 Sidelink RRC reconfiguration ............................................................................................ 220
5.8.9.1.1 General ........................................................................................................................... 220
5.8.9.1.2 Actions related to transmission of RRC Reconfiguration Sidelink message ...................... 220
5.8.9.1.3 Reception of an RRC Reconfiguration Sidelink by the UE ............................................ 221
5.8.9.1.4 Void .................................................................................................................................. 222
5.8.9.1.5 Void .................................................................................................................................. 222
5.8.9.1.6 Void .................................................................................................................................. 222
5.8.9.1.7 Void .................................................................................................................................. 222
5.8.9.1.8 Reception of an RRC Reconfiguration Failure Sidelink by the UE ................................. 222
5.8.9.1.9 Reception of an RRC Reconfiguration Complete Sidelink by the UE ......................... 223
5.8.9.1a Sidelink radio bearer management ..................................................................................... 223
5.8.9.1a.1 Sidelink DRB release ...................................................................................................... 223
5.8.9.1a.2 Sidelink DRB addition/modification ............................................................................... 224
5.8.9.1a.3 Sidelink SRB release ...................................................................................................... 225
5.8.9.1a.4 Sidelink SRB addition .......................................................... 226
5.8.9.2 Sidelink UE capability transfer ............................................. 226
5.8.9.2.1 General ........................................................................... 226
5.8.9.2.2 Initiation ........................................................................ 226
5.8.9.2.3 Actions related to transmission of the UECapabilityEnquirySidelink by the UE ........................................ 226
5.8.9.2.4 Actions related to reception of the UECapabilityEnquirySidelink by the UE ........................................ 227
5.8.9.3 Sidelink radio link failure related actions .......................... 227
5.8.9.4 Sidelink common control information .................................. 228
5.8.9.4.1 General ........................................................................ 228
5.8.9.4.2 Actions related to reception of MasterInformationBlockSidelink message ............................................ 228
5.8.9.4.3 Transmission of MasterInformationBlockSidelink message ................................................................. 228
5.8.9.5 Actions related to PC5-RRC connection release requested by upper layers ........................................ 229
5.8.10 Sidelink measurement ............................................................... 229
5.8.10.1 Introduction ....................................................................... 229
5.8.10.2 Sidelink measurement configuration ..................................... 230
5.8.10.2.1 General ........................................................................ 230
5.8.10.2.2 Sidelink measurement identity removal .......................... 230
5.8.10.2.3 Sidelink measurement identity addition/modification ...... 231
5.8.10.2.4 Sidelink measurement object removal .................................. 231
5.8.10.2.5 Sidelink measurement object addition/modification .... 231
5.8.10.2.6 Sidelink reporting configuration removal ........................ 232
5.8.10.2.7 Sidelink reporting configuration addition/modification .... 232
5.8.10.2.8 Sidelink quantity configuration ........................................ 232
5.8.10.3 Performing NR sidelink measurements .............................. 233
5.8.10.3.1 General ........................................................................ 233
5.8.10.3.2 Derivation of NR sidelink measurement results .............. 233
5.8.10.4 Sidelink measurement report triggering .............................. 233
5.8.10.4.1 General ........................................................................ 233
5.8.10.4.2 Event S1 (Serving becomes better than threshold) ......... 234
5.8.10.4.3 Event S2 (Serving becomes worse than threshold) ........ 235
5.8.10.5 Sidelink measurement reporting ......................................... 235
5.8.10.5.1 General ........................................................................ 235
5.8.11 Zone identity calculation .......................................................... 236
5.8.12 DFN derivation from GNSS ....................................................... 236

6 Protocol data units, formats and parameters (ASN.1) ...................... 238
6.1 General .................................................................................. 238
6.1.1 Introduction .......................................................................... 238
6.1.2 Need codes and conditions for optional downlink fields ........ 238
6.1.3 General rules ........................................................................ 241
6.2 RRC messages .......................................................................... 241
6.2.1 General message structure .................................................... 241
   – NR-RRC-Definitions ............................................................. 241
   – BCCH-BCH-Message ......................................................... 241
   – BCCH-DL-SCH-Message ................................................... 242
   – DL-CCCH-Message .......................................................... 242
   – DL-DCCCH-Message ........................................................ 243
   – PCCCH-Message ............................................................... 243
   – UL-CCCH-Message .......................................................... 244
   – UL-CCCH1-Message .......................................................... 244
   – UL-DCCCH-Message ......................................................... 245
6.2.2 Message definitions ................................................................. 247
   – CounterCheck .................................................................... 247
   – CounterCheckResponse ...................................................... 248
   – DedicatedSIBRequest ....................................................... 249
   – DL-DedicatedMessageSegment ........................................... 250
   – DLInformationTransfer ..................................................... 251
   – DLInformationTransferMRDC ............................................. 252
   – FailureInformation ............................................................. 253
   – IABOtherInformation ......................................................... 254
   – LocationMeasurementIndication ........................................ 257
   – LoggedMeasurementConfiguration .................................... 258
6.3.2 Radio resource control information elements ............................................................................. 346

– SCGFailureInformationEUTRA .......................................................................................................... 290

– RRCReestablishment ................................................................. 266

– RRCReestablishmentComplete .......................................................... 266

– RRCReestablishmentRequest .......................................................... 267

– RRCReconfiguration .............................................................. 268

– RRCReconfigurationComplete ..................................................... 273

– RRCReject ............................................................................. 275

– RRCRelease ......................................................................... 276

– RRCResume ......................................................................... 279

– RRCResumeComplete .............................................................. 281

– RRCResumeRequest ................................................................. 283

– RRCResumeRequestI ................................................................. 283

– RRCSetup ............................................................................. 284

– RRCSetupComplete ............................................................... 285

– RRCSetupRequest ................................................................... 287

– RRCSystemInfoRequest ........................................................... 288

– SCGFailureInformation ........................................................... 289

– SCGFailureInformationEUTRA .................................................. 290

– SecurityModeCommand .......................................................... 292

– SecurityModeComplete .......................................................... 293

– SecurityModeFailure ............................................................. 293

– SIB1 .................................................................................. 294

– SidelinkUEInformationNR ...................................................... 297

– SystemInformation ................................................................. 299

– UEAssistanceInformation ......................................................... 300

– UECapabilityEnquiry .............................................................. 307

– UECapabilityInformation .......................................................... 308

– UEInformationRequest ........................................................... 309

– UEInformationResponse .......................................................... 310

– UL Dedication Message Segment ............................................. 319

– ULInformationTransfer ............................................................. 320

– ULInformationTransferIRAT ...................................................... 320

– ULInformationTransferMRDC ..................................................... 321

6.3 RRC information elements ............................................................................................................ 322

6.3.0 Parameterized types ................................................................................................................... 322

– SetupRelease .......................................................................... 322

6.3.1 System information blocks ....................................................................................................... 323

– SIB2 .................................................................................. 323

– SIB3 .................................................................................. 327

– SIB4 .................................................................................. 328

– SIB5 .................................................................................. 332

– SIB6 .................................................................................. 335

– SIB7 .................................................................................. 335

– SIB8 .................................................................................. 336

– SIB9 .................................................................................. 337

– SIB10 ................................................................. 338

– SIB11 ................................................................. 339

– SIB12 ................................................................. 339

– SIB13 ................................................................. 341

– SIB14 ................................................................. 342

6.3.1a Positioning System information blocks ..................................................................................... 342

– PosSystemInformation-r16-IEs ...................................................... 342

– PosSI-SchedulingInfo ............................................................. 343

– SIBpos ................................................................. 345

6.3.2 Radio resource control information elements ............................................................................ 346

– AdditionalSpectrumEmission .......................................................... 346

– Alpha ................................................................. 346

– AMF-Identifier ................................................................. 346
<table>
<thead>
<tr>
<th>3GPP TS 38.331 version 16.3.1 Release 16</th>
<th>ETSI TS 138 331 V16.3.1 (2021-01)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- ReportConfigId</td>
<td>566</td>
</tr>
<tr>
<td>- ReportConfigInterRAT</td>
<td>566</td>
</tr>
<tr>
<td>- ReportConfigNR</td>
<td>570</td>
</tr>
<tr>
<td>- ReportConfigNR-SL</td>
<td>577</td>
</tr>
<tr>
<td>- ReportConfigToAddModList</td>
<td>579</td>
</tr>
<tr>
<td>- ReportInterval</td>
<td>579</td>
</tr>
<tr>
<td>- ReselectionThreshold</td>
<td>580</td>
</tr>
<tr>
<td>- ReselectionThresholdQ</td>
<td>580</td>
</tr>
<tr>
<td>- ResumeCause</td>
<td>580</td>
</tr>
<tr>
<td>- RLC-BearerConfig</td>
<td>581</td>
</tr>
<tr>
<td>- RLC-Config</td>
<td>582</td>
</tr>
<tr>
<td>- RLF-TimersAndConstants</td>
<td>584</td>
</tr>
<tr>
<td>- RNTI-Value</td>
<td>585</td>
</tr>
<tr>
<td>- RSRP-Range</td>
<td>585</td>
</tr>
<tr>
<td>- RSRQ-Range</td>
<td>586</td>
</tr>
<tr>
<td>- RSSI-Range</td>
<td>586</td>
</tr>
<tr>
<td>- SCellIndex</td>
<td>586</td>
</tr>
<tr>
<td>- SchedulingRequestConfig</td>
<td>587</td>
</tr>
<tr>
<td>- SchedulingRequestId</td>
<td>588</td>
</tr>
<tr>
<td>- SchedulingRequestResourceConfig</td>
<td>589</td>
</tr>
<tr>
<td>- ScramblingId</td>
<td>590</td>
</tr>
<tr>
<td>- SCS-SpecificCarrier</td>
<td>590</td>
</tr>
<tr>
<td>- SDAP-Config</td>
<td>591</td>
</tr>
<tr>
<td>- SearchSpace</td>
<td>592</td>
</tr>
<tr>
<td>- SearchSpaceId</td>
<td>597</td>
</tr>
<tr>
<td>- SearchSpaceZero</td>
<td>597</td>
</tr>
<tr>
<td>- SecurityAlgorithmConfig</td>
<td>598</td>
</tr>
<tr>
<td>- SemiStaticChannelAccessConfig</td>
<td>598</td>
</tr>
<tr>
<td>- Sensor-LocationInfo</td>
<td>599</td>
</tr>
<tr>
<td>- ServCellIndex</td>
<td>599</td>
</tr>
<tr>
<td>- ServingCellConfig</td>
<td>600</td>
</tr>
<tr>
<td>- ServingCellConfigCommon</td>
<td>609</td>
</tr>
<tr>
<td>- ServingCellConfigCommonSIB</td>
<td>612</td>
</tr>
<tr>
<td>- ShortI-RNTI-Value</td>
<td>613</td>
</tr>
<tr>
<td>- ShortMAC-1</td>
<td>614</td>
</tr>
<tr>
<td>- SINR-Range</td>
<td>614</td>
</tr>
<tr>
<td>- SI-RequestConfig</td>
<td>614</td>
</tr>
<tr>
<td>- SI-SchedulingInfo</td>
<td>615</td>
</tr>
<tr>
<td>- SK-Counter</td>
<td>617</td>
</tr>
<tr>
<td>- SlotFormatCombinationsPerCell</td>
<td>617</td>
</tr>
<tr>
<td>- SlotFormatIndicator</td>
<td>619</td>
</tr>
<tr>
<td>- S-NSSAI</td>
<td>621</td>
</tr>
<tr>
<td>- SpeedStateScaleFactors</td>
<td>622</td>
</tr>
<tr>
<td>- SPS-Config</td>
<td>622</td>
</tr>
<tr>
<td>- SPS-ConfigIndex</td>
<td>623</td>
</tr>
<tr>
<td>- SPS-PUCCH-AN</td>
<td>624</td>
</tr>
<tr>
<td>- SPS-PUCCH-AN-List</td>
<td>624</td>
</tr>
<tr>
<td>- SRB-Identity</td>
<td>625</td>
</tr>
<tr>
<td>- SRS-CarrierSwitching</td>
<td>625</td>
</tr>
<tr>
<td>- SRS-Config</td>
<td>626</td>
</tr>
<tr>
<td>- SRS-RSRP-Range</td>
<td>637</td>
</tr>
<tr>
<td>- SRS-TPC-CommandConfig</td>
<td>637</td>
</tr>
<tr>
<td>- SSB-Index</td>
<td>638</td>
</tr>
<tr>
<td>- SSB-MTC</td>
<td>638</td>
</tr>
<tr>
<td>- SSB-PositionQCL-Relation</td>
<td>640</td>
</tr>
<tr>
<td>- SSB-ToMeasure</td>
<td>640</td>
</tr>
<tr>
<td>- SS-RSSI-Measurement</td>
<td>641</td>
</tr>
<tr>
<td>- SubcarrierSpacing</td>
<td>642</td>
</tr>
<tr>
<td>- TAG-Config</td>
<td>642</td>
</tr>
<tr>
<td>- TCI-State</td>
<td>643</td>
</tr>
<tr>
<td>- TCI-StateId</td>
<td>644</td>
</tr>
</tbody>
</table>
6.3.3 UE capability information elements .......................... 657
  - AccessStratumRelease ............................................................... 657
  - BandCombinationList ............................................................... 658
  - BandCombinationListSidelinkEUTRA-NR ................................. 661
  - CA-BandwidthClassEUTRA ...................................................... 662
  - CA-BandwidthClassNR ............................................................ 663
  - CA-ParametersEUTRA .............................................................. 663
  - CA-ParametersNR ................................................................. 664
  - CA-ParametersNRDC ............................................................... 666
  - CarrierAggregationVariant ...................................................... 667
  - CodebookParameters .............................................................. 668
  - FeatureSetCombination ........................................................... 671
  - FeatureSetCombinationId .......................................................... 673
  - FeatureSetDownlink ................................................................. 673
  - FeatureSetDownlinkId ............................................................... 677
  - FeatureSetDownlinkPerCC ......................................................... 677
  - FeatureSetDownlinkPerCC-Id .................................................... 678
  - FeatureSetEUTRA-DownlinkId .................................................. 678
  - FeatureSetEUTRA-UplinkId ....................................................... 679
  - FeatureSets ........................................................................... 679
  - FeatureSetUplink ................................................................. 680
  - FeatureSetUplinkId ................................................................. 684
  - FeatureSetUplinkPerCC .......................................................... 684
  - FeatureSetUplinkPerCC-Id ........................................................ 685
  - FreqBandIndicatorEUTRA ......................................................... 685
  - FreqBandList ......................................................................... 686
  - FreqSeparationClass ............................................................... 686
  - FreqSeparationClassDL-Only .................................................... 687
  - HighSpeedParameters ............................................................. 687
  - IMS-Parameters ................................................................ 687
  - InterRAT-Parameters .............................................................. 688
  - MAC-Parameters ................................................................ 689
  - MeasAndMobParameters .......................................................... 691
  - MeasAndMobParametersMRDC .................................................. 693
  - MIMO-Layers ..................................................................... 694
  - MIMO-ParametersPerBand ....................................................... 695
  - ModulationOrder ................................................................. 700
  - MRDC-Parameters ................................................................. 700
  - NRDC-Parameters ................................................................. 702
  - OLPCC-SRS-Pos ................................................................. 702
  - PDCP-Parameters ................................................................. 703
  - PDCP-ParametersMRDC .......................................................... 704
  - Phy-Parameters ................................................................. 704
  - Phy-ParametersMRDC ............................................................ 710
6.3.4 Other information elements .............................................................................................. 733

- PowSav-Parameters ........................................................................................................ 710
- ProcessingParameters ..................................................................................................... 711
- RAT-Type ....................................................................................................................... 712
- RF-Parameters ............................................................................................................... 712
- RF-ParametersMRDC ..................................................................................................... 716
- RLC-Parameters ........................................................................................................... 717
- SDAP-Parameters ........................................................................................................... 718
- SidelinkParameters ........................................................................................................... 718
- SON-Parameters .............................................................................................................. 721
- SpatialRelationsSRS-Pos ................................................................................................. 722
- SRS-SwitchingTimeNR ................................................................................................... 722
- SRS-SwitchingTimeUTRA ............................................................................................... 723
- SupportedBandwidth ...................................................................................................... 723
- UE-BasedPerfMeas-Parameters ....................................................................................... 723
- UE-CapabilityList ............................................................................................................ 724
- UE-CapabilityRequestList ............................................................................................... 724
- UE-CapabilityRequestFilterCommon ............................................................................... 725
- UE-CapabilityRequestFilterNR ....................................................................................... 726
- UE-MRDC-Capability ...................................................................................................... 727
- UE-NR-Capability .......................................................................................................... 728
- SharedSpectrumChAccessParamsPerBand ........................................................................ 731

6.3.5 Sidelink information elements .......................................................................................... 750

- SL-BWP-Config ............................................................................................................... 750
- SL-BWP-ConfigCommon ................................................................................................. 751
- SL-BWP-PoolConfig ........................................................................................................ 751
- SL-BWP-PoolConfigCommon ........................................................................................ 752
- SL-CBR-PriorityTxConfigList ......................................................................................... 753
- SL-CBR-CommonTxConfigList ....................................................................................... 754
- SL-ConfigDedicatedNR .................................................................................................... 755
- SL-ConfiguredGrantConfig ............................................................................................ 757
- SL-DestinationIdentity .................................................................................................... 758
- SL-FreqConfig ................................................................................................................ 759
- SL-FreqConfigCommon .................................................................................................. 760
- SL-LogicalChannelConfig .............................................................................................. 761
7.1 Timers .................................................................................................................................................. 808
  7.1.1 Timers (Informative) ...................................................................................................................... 808
  7.1.2 Timer handling ................................................................................................................................. 815

7.2 Counters ........................................................................................................................................... 815

7.3 Constants .......................................................................................................................................... 816

7.4 UE variables ...................................................................................................................................... 816
  – VarConditionalReconfig ...................................................................................................................... 817
  – VarConnEstFailReport ........................................................................................................................ 818
  – VarLogMeasConfig ............................................................................................................................. 818
  – VarLogMeasReport .............................................................................................................................. 819
  – VarMeasConfig .................................................................................................................................. 819
  – VarMeasConfigSL ................................................................................................................................. 820
  – VarMeasIdleConfig ............................................................................................................................... 820
  – VarMeasIdleReport .............................................................................................................................. 821
  – VarMeasReportList ............................................................................................................................... 821
  – VarMeasReportListSL .......................................................................................................................... 822
  – VarMobilityHistoryReport .................................................................................................................. 822
  – VarPendingRNA-Update ...................................................................................................................... 822

7.5 UE Capability Information Sidelink ..................................................................................................... 823
  – UECapabilityInformationSidelink ........................................................................................................ 823

7.6 PC5 RRC messages ............................................................................................................................. 796
  – Short Message .................................................................................................................................... 796
  – PC5-RRC-Definitions .......................................................................................................................... 796

6.6.1 General message structure ............................................................................................................ 796
  – PC5-RRC-Definitions .......................................................................................................................... 796
  – SBCCH-SL-BCH-Message .................................................................................................................... 797
  – SCCH-Message .................................................................................................................................... 797
  – MasterInformationBlockSidelink ......................................................................................................... 798
  – MeasurementReportSidelink ............................................................................................................... 799
  – RRCReconfigurationSidelink .............................................................................................................. 800
  – RRCReconfigurationCompleteSidelink ............................................................................................... 802
  – RRCReconfigurationFailureSidelink .................................................................................................... 803
  – UE Capability Enquiry Sidelink ........................................................................................................... 804
  – UE Capability Information Sidelink ..................................................................................................... 805
  – End of PC5-RRC-Definitions ........................................................................................................... 806

3GPP TS 38.331 version 16.3.1 Release 16

ETSI TS 138 331 V16.3.1 (2021-01)
A.2 Procedural specification ....................................................................................................................... 870
A.1 Introduction ........................................................................................................................................ 870
Annex A (informative): Guidelines, mainly on use of ASN.1 ........................................................... 870

12 Processing delay requirem ents for RRC procedures ............................................................................ 866
– Multiplicity and type constraints definitions ....................................................................................... 865
11.4 Inter-node RRC multiplicity and type constraint values ................................................................... ............. 865
11.3 Inter-node RRC information element definitions ........................................................................................... 865
11.2 Inter-node RRC messages .................................................................................................. ............................ 838
11 Radio information related interactions between network nodes .......................................................... 838
10.5 Not comprehended field ................................................................................................... .............................. 837
10.4 Mandatory field missing .................................................................................................. ............................... 835
10.2 ASN.1 violation or encoding error ........................................................................................ ......................... 835
10 General .......................................................................................................................... 834
9.2.3 Default values timers and constants ..................................................................................... ..................... 831
9.2.2 Default MAC Cell Group configuration .................................................................................... ............... 831
9.2.1 Default SRB configurations ...................................................................................................................... 831
9.2 Default radio configurations .......................................................................................................................... 830
9.1.2 Void ................................................................................................................................................ 830
9.1.1 Logical channel configurations ................................................................................................................. 827
9.1 Specified and default radio configurations............................................................................................... 827
9.1.1.5 STCH configuration .................................................................................................... ........................ 828
9.1.1.4 SCCH configuration .................................................................................................... ........................ 828
9.1.1.3 PCCH configuration.............................................................................................................. 828
9.1.1.2 CCCH configuration .............................................................................................................. 828
9.1.1.1 BCCH configuration .............................................................................................................. 827
9.1 Specified configurations .......................................................................................................................... 827
9.1.1 Specified radio channel configurations ............................................................................................... 827
8 Protocol data unit abstract syntax ......................................................................................................... 826
8.5 Padding ............................................................................................................................................ 826
8.4 Extension ........................................................................................................................................... 826
8.3 Basic production ........................................................................................................................... 826
8.2 Structure of encoded RRC messages ................................................................................................. ..................... 826
8.1 General ................................................................................................................................................ 826
8. Generic error handling ................................................................................................................................. 835
7.3 Field set to a not comprehended value ............................................................................................ 835
7.2 Mandatory field missing .................................................................................................................. 835
7.1 General ................................................................................................................................................ 834
6.1 Protocol error handling ............................................................................................................................. 834
5.1 Not comprehended field .................................................................................................................. 833
5.0 Mandatory field missing ................................................................................................................ 832
4.2 Multiple ASN.1 violation or encoding error .................................................................................. 831
4.1 Basic ASN.1 violation or encoding error .................................................................................. 831
3.7 Multiple not comprehended field .................................................................................................. 830
3.6 Not comprehended field ................................................................................................................ 829
3.5 Multiple Mandatory field missing ................................................................................................ 829
3.4 Multiple Mandatory field missing ................................................................................................ 829
3.3 Multiple required field missing .................................................................................................. 828
3.2 Multiple required field missing .................................................................................................. 828
3.1 Required field missing .................................................................................................................. 827
2.3 Multiple reseatable optional field .................................................................................................. 827
2.2 Multiple reseatable optional field ................................................................................................ 827
2.1 Multiple reseatable optional field ................................................................................................ 827
1.1 General ................................................................................................................................................ 827
1.0 Re-seatable optional field ............................................................................................................. 826

Annex A (informative): Guidelines, mainly on use of ASN.1 ........................................................................ 870
A.1 Introduction ........................................................................................................................................ 870
A.2 Procedural specification ....................................................................................................................... 870
A.2.1 General principles .................................................................................................................... 870
Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x  the first digit:
   1  presented to TSG for information;
   2  presented to TSG for approval;
   3  or greater indicates TSG approved document under change control.

y  the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z  the third digit is incremented when editorial only changes have been incorporated in the document.
1 Scope

The present document specifies the Radio Resource Control protocol for the radio interface between UE and NG-RAN. The scope of the present document also includes:

- the radio related information transported in a transparent container between source gNB and target gNB upon inter gNB handover;
- the radio related information transported in a transparent container between a source or target gNB and another system upon inter RAT handover.
- the radio related information transported in a transparent container between a source eNB and target gNB during E-UTRA-NR Dual Connectivity.

The RRC protocol is also used to configure the radio interface between an IAB-node and its parent node [2].

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 38.300: "NR; Overall description; Stage 2".
[3] 3GPP TS 38.321: "NR; Medium Access Control (MAC); Protocol specification".
[4] 3GPP TS 38.322: "NR; Radio Link Control (RLC) protocol specification".
[5] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) protocol specification".
[9] 3GPP TS 38.215: "NR; Physical layer measurements".
[12] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".
[13] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[14] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

[15] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[16] 3GPP TS 38.211: "NR; Physical channels and modulation".

[17] 3GPP TS 38.212: "NR; Multiplexing and channel coding".


[19] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[20] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in Idle mode and RRC Inactive state".

[21] 3GPP TS 23.003: "Numbering, addressing and identification".

[22] 3GPP TS 36.101: "E-UTRA; User Equipment (UE) radio transmission and reception".

[23] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".


[25] 3GPP TS 22.261: "Service requirements for the 5G System".

[26] 3GPP TS 38.306: "User Equipment (UE) radio access capabilities".

[27] 3GPP TS 36.304: "E-UTRA; User Equipment (UE) procedures in idle mode".

[28] ATIS 0700041: "WEA 3.0: Device-Based Geo-Fencing".

[29] 3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".

[30] 3GPP TS 33.401: "3GPP System Architecture Evolution (SAE); Security architecture".

[31] 3GPP TS 36.211: "E-UTRA; Physical channels and modulation".


[33] 3GPP TS 36.104: "E-UTRA; Base Station (BS) radio transmission and reception".

[34] 3GPP TS 38.101-3 "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[35] 3GPP TS 38.423: "NG-RAN, Xn application protocol (XnAP)".

[36] 3GPP TS 38.473: "NG-RAN; F1 application protocol (F1AP)".

[37] 3GPP TS 36.423: "E-UTRA; X2 application protocol (X2AP)".

[38] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core network protocols; Stage 3".

[39] 3GPP TS 38.101-2 "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[40] 3GPP TS 36.133: "E-UTRA; Requirements for support of radio resource management".

[41] 3GPP TS 37.340: "E-UTRA and NR; Multi-connectivity; Stage 2".

[42] 3GPP TS 38.413: "NG-RAN, NG Application Protocol (NGAP)".

[43] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".
3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**BH RLC channel**: An RLC channel between two nodes, which is used to transport backhaul packets.

**CEIL**: Mathematical function used to 'round up' i.e. to the nearest integer having a higher or equal value.
**DAPS bearer:** a bearer whose radio protocols are located in both the source gNB and the target gNB during DAPS handover to use both source gNB and target gNB resources.

**Dedicated signalling:** Signalling sent on DCCH logical channel between the network and a single UE.

**Dormant BWP:** The dormant BWP is one of downlink BWPs configured by the network via dedicated RRC signalling. In the dormant BWP, the UE stops monitoring PDCCH on/for the SCell, but continues performing CSI measurements, Automatic Gain Control (AGC) and beam management, if configured. For each serving cell other than the SpCell or PUCCH SCell, the network may configure one BWP as a dormant BWP.

**Field:** The individual contents of an information element are referred to as fields.

**FLOOR:** Mathematical function used to 'round down' i.e. to the nearest integer having a lower or equal value.

**Global cell identity:** An identity to uniquely identifying an NR cell. It is consisted of cellIdentity and plmn-Identity of the first PLMN-Identity in plmn-IdentityList in SIB1.

**Information element:** A structural element containing single or multiple fields is referred as information element.

**NPN-only Cell:** A cell that is only available for normal service for NPNs' subscriber. An NPN-capable UE determines that a cell is NPN-only Cell by detecting that the cellReservedForOtherUse IE is set to true while the npn-IdentityInfoList IE is present in CellAccessRelatedInfo.

**NR sidelink communication:** AS functionality enabling at least V2X Communication as defined in TS 23.287 [55], between two or more nearby UEs, using NR technology but not traversing any network node.

**PNI-NPN identity:** an identifier of a PNI-NPN comprising of a PLMN ID and a CAG -ID combination.

**Primary Cell:** The MCG cell, operating on the primary frequency, in which the UE either performs the initial connection establishment procedure or initiates the connection re-establishment procedure.

**Primary SCG Cell:** For dual connectivity operation, the SCG cell in which the UE performs random access when performing the Reconfiguration with Sync procedure.

**Primary Timing Advance Group:** Timing Advance Group containing the SpCell.

**PUCCH SCell:** An SCell configured with PUCCH.

**PUSCH-Less SCell:** An SCell configured without PUSCH.

**RLC bearer configuration:** The lower layer part of the radio bearer configuration comprising the RLC and logical channel configurations.

**Secondary Cell:** For a UE configured with CA, a cell providing additional radio resources on top of Special Cell.

**Secondary Cell Group:** For a UE configured with dual connectivity, the subset of serving cells comprising of the PSCell and zero or more secondary cells.

**Serving Cell:** For a UE in RRC_CONNECTED not configured with CA/DC there is only one serving cell comprising of the primary cell. For a UE in RRC_CONNECTED configured with CA/DC the term 'serving cells' is used to denote the set of cells comprising of the Special Cell(s) and all secondary cells.

**SNPN identity:** an identifier of an SNPN comprising of a PLMN ID and an NID combination.

**Special Cell:** For Dual Connectivity operation the term Special Cell refers to the PCell of the MCG or the PSCell of the SCG, otherwise the term Special Cell refers to the PCell.

**Split SRB:** In MR-DC, an SRB that supports transmission via MCG and SCG as well as duplication of RRC PDUs as defined in TS 37.340 [41].

**SSB Frequency:** Frequency referring to the position of resource element RE=#0 (subcarrier #0) of resource block RB#10 of the SS block.

**UE Inactive AS Context:** UE Inactive AS Context is stored when the connection is suspended and restored when the connection is resumed. It includes information as defined in clause 5.3.8.3.
V2X sidelink communication: AS functionality enabling V2X Communication as defined in TS 23.285 [56], between nearby UEs, using E-UTRA technology but not traversing any network node.

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].

- 5GC: 5G Core Network
- ACK: Acknowledgement
- AM: Acknowledged Mode
- ARQ: Automatic Repeat Request
- AS: Access Stratum
- ASN.1: Abstract Syntax Notation One
- BAP: Backhaul Adaptation Protocol
- BCD: Binary Coded Decimal
- BH: Backhaul
- BLER: Block Error Rate
- BWP: Bandwidth Part
- CA: Carrier Aggregation
- CAG: Closed Access Group
- CAG-ID: Closed Access Group Identifier
- CAPC: Channel Access Priority Class
- CBR: Channel Busy Ratio
- CCCH: Common Control Channel
- CG: Cell Group
- CHO: Conditional Handover
- CLI: Cross Link Interference
- CMAS: Commercial Mobile Alert Service
- CP: Control Plane
- CPC: Conditional PSCell Change
- C-RNTI: Cell RNTI
- CSI: Channel State Information
- DAPS: Dual Active Protocol Stack
- DC: Dual Connectivity
- DCCCH: Dedicated Control Channel
- DCI: Downlink Control Information
- DCP: DCI with CRC scrambled by PS-RNTI
- DFN: Direct Frame Number
- DL: Downlink
- DL-PRS: Downlink Positioning Reference Signal
- DL-SCH: Downlink Shared Channel
- DM-RS: Demodulation Reference Signal
- DRB: (user) Data Radio Bearer
- DRX: Discontinuous Reception
- DTCH: Dedicated Traffic Channel
- EN-DC: E-UTRA NR Dual Connectivity with E-UTRA connected to EPC
- EPC: Evolved Packet Core
- EPS: Evolved Packet System
- ETWS: Earthquake and Tsunami Warning System
- E-UTRA/5GC: E-UTRA connected to 5GC
- E-UTRA/EPC: E-UTRA connected to EPC
- FDD: Frequency Division Duplex
- FFS: For Further Study
- GERAN: GSM/EDGE Radio Access Network
- GNSS: Global Navigation Satellite System
- GSM: Global System for Mobile Communications
- HARQ: Hybrid Automatic Repeat Request
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRNN</td>
<td>Human Readable Network Name</td>
</tr>
<tr>
<td>IAB</td>
<td>Integrated Access and Backhaul</td>
</tr>
<tr>
<td>IAB-DU</td>
<td>IAB-node DU</td>
</tr>
<tr>
<td>IAB-MT</td>
<td>IAB Mobile Termination</td>
</tr>
<tr>
<td>IDC</td>
<td>In-Device Coexistence</td>
</tr>
<tr>
<td>IE</td>
<td>Information element</td>
</tr>
<tr>
<td>IMSI</td>
<td>International Mobile Subscriber Identity</td>
</tr>
<tr>
<td>kB</td>
<td>Kilobyte (1000 bytes)</td>
</tr>
<tr>
<td>L1</td>
<td>Layer 1</td>
</tr>
<tr>
<td>L2</td>
<td>Layer 2</td>
</tr>
<tr>
<td>L3</td>
<td>Layer 3</td>
</tr>
<tr>
<td>LBT</td>
<td>Listen Before Talk</td>
</tr>
<tr>
<td>MAC</td>
<td>Medium Access Control</td>
</tr>
<tr>
<td>MCG</td>
<td>Master Cell Group</td>
</tr>
<tr>
<td>MDT</td>
<td>Minimization of Drive Tests</td>
</tr>
<tr>
<td>MIB</td>
<td>Master Information Block</td>
</tr>
<tr>
<td>MPE</td>
<td>Maximum Permissible Exposure</td>
</tr>
<tr>
<td>MR-DC</td>
<td>Multi-Radio Dual Connectivity</td>
</tr>
<tr>
<td>N/A</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>NE-DC</td>
<td>NR E-UTRA Dual Connectivity</td>
</tr>
<tr>
<td>(NG)EN-DC</td>
<td>E-UTRA NR Dual Connectivity (covering E-UTRA connected to EPC or 5GC)</td>
</tr>
<tr>
<td>NGEN-DC</td>
<td>E-UTRA NR Dual Connectivity with E-UTRA connected to 5GC</td>
</tr>
<tr>
<td>NID</td>
<td>Network Identifier</td>
</tr>
<tr>
<td>NPN</td>
<td>Non-Public Network</td>
</tr>
<tr>
<td>NR-DC</td>
<td>NR-NR Dual Connectivity</td>
</tr>
<tr>
<td>NR/5GC</td>
<td>NR connected to 5GC</td>
</tr>
<tr>
<td>PCell</td>
<td>Primary Cell</td>
</tr>
<tr>
<td>PDCP</td>
<td>Packet Data Convergence Protocol</td>
</tr>
<tr>
<td>PDU</td>
<td>Protocol Data Unit</td>
</tr>
<tr>
<td>PLMN</td>
<td>Public Land Mobile Network</td>
</tr>
<tr>
<td>PNI-NPN</td>
<td>Public Network Integrated Non-Public Network</td>
</tr>
<tr>
<td>posSIB</td>
<td>Positioning SIB</td>
</tr>
<tr>
<td>PRS</td>
<td>Positioning Reference Signal</td>
</tr>
<tr>
<td>PSCell</td>
<td>Primary SCG Cell</td>
</tr>
<tr>
<td>PWS</td>
<td>Public Warning System</td>
</tr>
<tr>
<td>QoS</td>
<td>Quality of Service</td>
</tr>
<tr>
<td>RAT</td>
<td>Radio Access Technology</td>
</tr>
<tr>
<td>RLC</td>
<td>Radio Link Control</td>
</tr>
<tr>
<td>RMT-C</td>
<td>RSSI Measurement Timing Configuration</td>
</tr>
<tr>
<td>RNA</td>
<td>RAN-based Notification Area</td>
</tr>
<tr>
<td>RNTI</td>
<td>Radio Network Temporary Identifier</td>
</tr>
<tr>
<td>ROHC</td>
<td>Robust Header Compression</td>
</tr>
<tr>
<td>RPLMN</td>
<td>Registered Public Land Mobile Network</td>
</tr>
<tr>
<td>RRC</td>
<td>Radio Resource Control</td>
</tr>
<tr>
<td>RS</td>
<td>Reference Signal</td>
</tr>
<tr>
<td>SBAS</td>
<td>Satellite Based Augmentation System</td>
</tr>
<tr>
<td>SCell</td>
<td>Secondary Cell</td>
</tr>
<tr>
<td>SCG</td>
<td>Secondary Cell Group</td>
</tr>
<tr>
<td>SCS</td>
<td>Subcarrier Spacing</td>
</tr>
<tr>
<td>SFN</td>
<td>System Frame Number</td>
</tr>
<tr>
<td>SFTD</td>
<td>SFN and Frame Timing Difference</td>
</tr>
<tr>
<td>SI</td>
<td>System Information</td>
</tr>
<tr>
<td>SIB</td>
<td>System Information Block</td>
</tr>
<tr>
<td>SL</td>
<td>Sidelink</td>
</tr>
<tr>
<td>SLSS</td>
<td>Sidelink Synchronisation Signal</td>
</tr>
<tr>
<td>SNPN</td>
<td>Stand-alone Non-Public Network</td>
</tr>
<tr>
<td>SpCell</td>
<td>Special Cell</td>
</tr>
<tr>
<td>SRB</td>
<td>Signalling Radio Bearer</td>
</tr>
<tr>
<td>SRS</td>
<td>Sounding Reference Signal</td>
</tr>
<tr>
<td>SSB</td>
<td>Synchronization Signal Block</td>
</tr>
<tr>
<td>TAG</td>
<td>Timing Advance Group</td>
</tr>
</tbody>
</table>
In the ASN.1, lower case may be used for some (parts) of the above abbreviations e.g. c-RNTI.

4 General

4.1 Introduction

This specification is organised as follows:

- clause 4.2 describes the RRC protocol model;
- clause 4.3 specifies the services provided to upper layers as well as the services expected from lower layers;
- clause 4.4 lists the RRC functions;
- clause 5 specifies RRC procedures, including UE state transitions;
- clause 6 specifies the RRC messages in ASN.1 and description;
- clause 7 specifies the variables (including protocol timers and constants) and counters to be used by the UE;
- clause 8 specifies the encoding of the RRC messages;
- clause 9 specifies the specified and default radio configurations;
- clause 10 specifies generic error handling;
- clause 11 specifies the RRC messages transferred across network nodes;
- clause 12 specifies the UE capability related constraints and performance requirements.

4.2 Architecture

4.2.1 UE states and state transitions including inter RAT

A UE is either in RRC_CONNECTED state or in RRC_INACTIVE state when an RRC connection has been established. If this is not the case, i.e. no RRC connection is established, the UE is in RRC_IDLE state. The RRC states can further be characterised as follows:

- **RRC_IDLE**:
  - A UE specific DRX may be configured by upper layers;
  - UE controlled mobility based on network configuration;
  - The UE:
    - Monitors Short Messages transmitted with P-RNTI over DCI (see clause 6.5);
    - Monitors a Paging channel for CN paging using 5G-S-TMSI;
    - Performs neighbouring cell measurements and cell (re-)selection;
    - Acquires system information and can send SI request (if configured).
- Performs logging of available measurements together with location and time for logged measurement configured UEs.

**RRC_INACTIVE:**
- A UE specific DRX may be configured by upper layers or by RRC layer;
- UE controlled mobility based on network configuration;
- The UE stores the UE Inactive AS context;
- A RAN-based notification area is configured by RRC layer;

The UE:
- Monitors Short Messages transmitted with P-RNTI over DCI (see clause 6.5);
- Monitors a Paging channel for CN paging using 5G-S-TMSI and RAN paging using fullI-RNTI;
- Performs neighbouring cell measurements and cell (re-)selection;
- Performs RAN-based notification area updates periodically and when moving outside the configured RAN-based notification area;
- Acquires system information and can send SI request (if configured).
- Performs logging of available measurements together with location and time for logged measurement configured UEs.

**RRC_CONNECTED:**
- The UE stores the AS context;
- Transfer of unicast data to/from UE;
- At lower layers, the UE may be configured with a UE specific DRX;
- For UEs supporting CA, use of one or more SCells, aggregated with the SpCell, for increased bandwidth;
- For UEs supporting DC, use of one SCG, aggregated with the MCG, for increased bandwidth;
- Network controlled mobility within NR and to/from E-UTRA;
- The UE:
  - Monitors Short Messages transmitted with P-RNTI over DCI (see clause 6.5), if configured;
  - Monitors control channels associated with the shared data channel to determine if data is scheduled for it;
  - Provides channel quality and feedback information;
  - Performs neighbouring cell measurements and measurement reporting;
  - Acquires system information;
  - Performs immediate MDT measurement together with available location reporting.

Figure 4.2.1-1 illustrates an overview of UE RRC state machine and state transitions in NR. A UE has only one RRC state in NR at one time.
Figure 4.2.1-2 illustrates an overview of UE state machine and state transitions in NR as well as the mobility procedures supported between NR/5GC E-UTRA/EPC and E-UTRA/5GC.

4.2.2 Signalling radio bearers

"Signalling Radio Bearers" (SRBs) are defined as Radio Bearers (RBs) that are used only for the transmission of RRC and NAS messages. More specifically, the following SRBs are defined:

- SRB0 is for RRC messages using the CCCH logical channel;
- SRB1 is for RRC messages (which may include a piggybacked NAS message) as well as for NAS messages prior to the establishment of SRB2, all using DCCH logical channel;
- SRB2 is for NAS messages and for RRC messages which include logged measurement information, all using DCCH logical channel. SRB2 has a lower priority than SRB1 and may be configured by the network after AS security activation;
- SRB3 is for specific RRC messages when UE is in (NG)EN-DC or NR-DC, all using DCCH logical channel.

In downlink, piggybacking of NAS messages is used only for one dependant (i.e. with joint success/failure) procedure: bearer establishment/modification/release. In uplink piggybacking of NAS message is used only for transferring the initial NAS message during connection setup and connection resume.

NOTE 1: The NAS messages transferred via SRB2 are also contained in RRC messages, which however do not include any RRC protocol control information.

Once AS security is activated, all RRC messages on SRB1, SRB2 and SRB3, including those containing NAS messages, are integrity protected and ciphered by PDCP. NAS independently applies integrity protection and ciphering to the NAS messages, see TS 24.501 [23].

Split SRB is supported for all the MR-DC options in both SRB1 and SRB2 (split SRB is not supported for SRB0 and SRB3).

For operation with shared spectrum channel access, SRB0, SRB1 and SRB3 are assigned with the highest priority Channel Access Priority Class (CAPC), (i.e. CAPC = 1) while CAPC for SRB2 is configurable.

4.3 Services

4.3.1 Services provided to upper layers

The RRC protocol offers the following services to upper layers:
- Broadcast of common control information;
- Notification of UEs in RRC_IDLE, e.g. about a mobile terminating call;
- Notification of UEs about ETWS and/or CMAS;
- Transfer of dedicated signalling;
- Broadcast of positioning assistance data.

4.3.2 Services expected from lower layers

In brief, the following are the main services that RRC expects from lower layers:
- Integrity protection, ciphering and loss-less in-sequence delivery of information without duplication;

4.4 Functions

The RRC protocol includes the following main functions:
- Broadcast of system information:
  - Including NAS common information;
  - Information applicable for UEs in RRC_IDLE and RRC_INACTIVE (e.g. cell (re-)selection parameters, neighbouring cell information) and information (also) applicable for UEs in RRC_CONNECTED (e.g. common channel configuration information);
  - Including ETWS notification, CMAS notification;
- Including positioning assistance data.

- RRC connection control:
  - Paging;
  - Establishment/modification/suspension/resumption/release of RRC connection, including e.g. assignment/modification of UE identity (C-RNTI, full-I-RNTI, etc.), establishment/modification/suspension/resumption/release of SRBs (except for SRB0);
  - Access barring;
  - Initial AS security activation, i.e. initial configuration of AS integrity protection (SRBs, DRBs) and AS ciphering (SRBs, DRBs);
  - RRC connection mobility including e.g. intra-frequency and inter-frequency handover, associated AS security handling, i.e. key/algorithm change, specification of RRC context information transferred between network nodes;
  - Establishment/modification/suspension/resumption/release of RBs carrying user data (DRBs);
  - Radio configuration control including e.g. assignment/modification of ARQ configuration, HARQ configuration, DRX configuration;
  - In case of DC, cell management including e.g. change of PSCell, addition/modification/release of SCG cell(s);
  - In case of CA, cell management including e.g. addition/modification/release of SCell(s);
  - QoS control including assignment/ modification of semi-persistent scheduling (SPS) configuration and configured grant configuration for DL and UL respectively, assignment/ modification of parameters for UL rate control in the UE, i.e. allocation of a priority and a prioritised bit rate (PBR) for each RB of UE and logical channel of IAB-MT.
  - Recovery from radio link failure.
- Inter-RAT mobility including e.g. AS security activation, transfer of RRC context information;
- Measurement configuration and reporting:
  - Establishment/modification/release of measurement configuration (e.g. intra-frequency, inter-frequency and inter- RAT measurements);
  - Setup and release of measurement gaps;
  - Measurement reporting.
- Configuration of BAP entity and BH RLC channels for the support of IAB-node.
- Other functions including e.g. generic protocol error handling, transfer of dedicated NAS information, transfer of UE radio access capability information.
- Support of self-configuration and self-optimisation.
- Support of measurement logging and reporting for network performance optimisation, as specified in TS 37.320 [61].
5 Procedures

5.1 General

5.1.1 Introduction

This clause covers the general requirements.

5.1.2 General requirements

The UE shall:

1. process the received messages in order of reception by RRC, i.e. the processing of a message shall be completed before starting the processing of a subsequent message;

   NOTE: Network may initiate a subsequent procedure prior to receiving the UE’s response of a previously initiated procedure.

1. within a clause execute the steps according to the order specified in the procedural description;

1. consider the term 'radio bearer' (RB) to cover SRBs and DRBs unless explicitly stated otherwise;

1. set the rrc-TransactionIdentifier in the response message, if included, to the same value as included in the message received from the network that triggered the response message;

1. upon receiving a choice value set to setup:
   2. apply the corresponding received configuration and start using the associated resources, unless explicitly specified otherwise;

1. upon receiving a choice value set to release:
   2. clear the corresponding configuration and stop using the associated resources;

1. in case the size of a list is extended, upon receiving an extension field comprising the entries in addition to the ones carried by the original field (regardless of whether the network signals more entries in total); apply the following generic behaviour unless explicitly stated otherwise:
   2. create a combined list by concatenating the additional entries included in the extension field to the original field while maintaining the order among both the original and the additional entries;
   2. for the combined list, created according to the previous, apply the same behaviour as defined for the original field.

5.1.3 Requirements for UE in MR-DC

In this specification, the UE considers itself to be in:

- EN-DC, if and only if it is configured with nr-SecondaryCellGroupConfig according to TS 36.331[10], and it is connected to EPC,
- NGEN-DC, if and only if it is configured with nr-SecondaryCellGroupConfig according to TS 36.331[10], and it is connected to 5GC,
- NE-DC, if and only if it is configured with mrdc-SecondaryCellGroup set to eutra-SCG,
- NR-DC, if and only if it is configured with mrdc-SecondaryCellGroup set to nr-SCG,
- MR-DC, if and only if it is in (NG)EN-DC, NE-DC or NR-DC.
NOTE: This use of these terms deviates from the definition in TS 37.340 [41] and other specifications. In TS 37.340, these terms include also the case where the UE is configured with E-UTRA or NR MCG only (i.e. no NR or E-UTRA SCG) but with one or more bearers terminated in a secondary node (i.e. using NR PDCP).

The UE in (NG)EN-DC only executes a sub-clause of clause 5 in this specification when the subclause:

- is referred to from a subclause under execution, either in this specification or in TS 36.331 [10]; or
- applies to a message received on SRB3 (if SRB3 is established); or
- applies to field(s), IE(s), UE variable(s) or timer(s) in this specification that the UE is configured with.

When executing a subclause of clause 5 in this specification, the UE follows the requirements in clause 5.1.2 and in all subclauses of this specification applicable to the messages (including processing time requirements), fields, IEs, timers and UE variables indicated in the subclause under execution.

5.2 System information

5.2.1 Introduction

System Information (SI) is divided into the MIB and a number of SIBs and posSIBs where:

- the MIB is always transmitted on the BCH with a periodicity of 80 ms and repetitions made within 80 ms (TS 38.212 [17], clause 7.1) and it includes parameters that are needed to acquire SIB1 from the cell. The first transmission of the MIB is scheduled in subframes as defined in TS 38.213 [13], clause 4.1 and repetitions are scheduled according to the period of SSB;

- the SIB1 is transmitted on the DL-SCH with a periodicity of 160 ms and variable transmission repetition periodicity within 160 ms as specified in TS 38.213 [13], clause 13. The default transmission repetition periodicity of SIB1 is 20 ms but the actual transmission repetition periodicity is up to network implementation. For SSB and CORESET multiplexing pattern 1, SIB1 repetition transmission period is 20 ms. For SSB and CORESET multiplexing pattern 2/3, SIB1 transmission repetition period is the same as the SSB period (TS 38.213 [13], clause 13). SIB1 includes information regarding the availability and scheduling (e.g. mapping of SIBs to SI message, periodicity, SI-window size) of other SIBs with an indication whether one or more SIBs are only provided on-demand and, in that case, the configuration needed by the UE to perform the SI request. SIB1 is cell-specific SIB;

- SIBs other than SIB1 and posSIBs are carried in SystemInformation (SI) messages, which are transmitted on the DL-SCH. Only SIBs or posSIBs having the same periodicity can be mapped to the same SI message. SIBs and posSIBs are mapped to the different SI messages. Each SI message is transmitted within periodically occurring time domain windows (referred to as SI-windows with same length for all SI messages). Each SI message is associated with an SI-window and the SI-windows of different SI messages do not overlap. That is, within one SI-window only the corresponding SI message is transmitted. An SI message may be transmitted a number of times within the SI-window. Any SIB or posSIB except SIB1 can be configured to be cell specific or area specific, using an indication in SIB1. The cell specific SIB is applicable only within a cell that provides the SIB while the area specific SIB is applicable within an area referred to as SI area, which consists of one or several cells and is identified by systemInformationAreaID;

- The mapping of SIBs to SI messages is configured in schedulingInfoList, while the mapping of posSIBs to SI messages is configured in pos-SchedulingInfoList. Each SIB is contained only in a single SI message and each SIB and posSIB is contained at most once in that SI message;

- For a UE in RRC_CONNECTED, the network can provide system information through dedicated signalling using the RRCReconfiguration message, e.g. if the UE has an active BWP with no common search space configured to monitor system information, paging, or upon request from the UE.

- For PSCell and SCells, the network provides the required SI by dedicated signalling, i.e. within an RRCReconfiguration message. Nevertheless, the UE shall acquire MIB of the PCell to get SFN timing of the SCG (which may be different from MCG). Upon change of relevant SI for SCell, the network releases and adds the concerned SCell. For PCell, the required SI can only be changed with Reconfiguration with Sync.
5.2.2 System information acquisition

5.2.2.1 General UE requirements

The UE applies the SI acquisition procedure to acquire the AS, NAS- and positioning assistance data information. The procedure applies to UEs in RRC_IDLE, in RRC_INACTIVE and in RRC_CONNECTED.

The UE in RRC_IDLE and RRC_INACTIVE shall ensure having a valid version of (at least) the MIB, SIB1 through SIB4, SIB5 (if the UE supports E-UTRA), SIB11 (if the UE is configured for idle/inactive measurements), SIB12 (if UE is capable of NR sidelink communication and is configured by upper layers to receive or transmit NR sidelink communication), and SIB13, SIB14 (if UE is capable of V2X sidelink communication and is configured by upper layers to receive or transmit V2X sidelink communication).

5.2.2.2 SIB validity and need to (re)-acquire SIB

5.2.2.2.1 SIB validity

The UE shall apply the SI acquisition procedure as defined in clause 5.2.2.3 upon cell selection (e.g. upon power on), cell-reselection, return from out of coverage, after reconfiguration with sync completion, after entering the network from another RAT, upon receiving an indication that the system information has changed, upon receiving a PWS notification, upon receiving request (e.g., a positioning request) from upper layers; and whenever the UE does not have a valid version of a stored SIB or posSIB or a valid version of a requested SIB.

When the UE acquires a MIB or a SIB or an SI message in a serving cell as described in clause 5.2.2.3, and if the UE stores the acquired SIB, then the UE shall store the associated areaScope, if present, the first PLMN-Identity in the PLMN-IdentityInfoList for non-NPN-only cells or the first NPN identity (SNPN identity in case of SNPN, or PNI-NPN identity in case of PNI-NPN) in the NPN-IdentityInfoList for NPN-only cells, the cellIdentity, the systemInformationAreaID, if present, and the valueTag, if present, as indicated in the si-SchedulingInfo for the SIB. If the UE stores the acquired posSIB, then the UE shall store the associated areaScope, if present, the cellIdentity, the systemInformationAreaID, if present, the valueTag, if provided in assistanceDataSIB-Element, and the expirationTime if provided in assistanceDataSIB-Element. The UE may use a valid stored version of the SI except MIB, SIB1, SIB6, SIB7 or SIB8 e.g. after cell re-selection, upon return from out of coverage or after the reception of SI change indication. The valueTag and expirationTime for posSIB is optionally provided in assistanceDataSIB-Element, as specified in TS 37.355 [49].

NOTE: The storage and management of the stored SIBs in addition to the SIBs valid for the current serving cell is left to UE implementation.

The UE shall:

1> delete any stored version of a SIB after 3 hours from the moment it was successfully confirmed as valid;

1> for each stored version of a SIB:
5.2.2.2 SI change indication and PWS notification

A modification period is used, i.e. updated SI message (other than SI message for ETWS, CMAS and positioning assistance data) is broadcasted in the modification period following the one where SI change indication is transmitted. The modification period boundaries are defined by SFN values for which SFN mod m = 0, where m is the number of radio frames comprising the modification period. The modification period is configured by system information. The UE receives indications about SI modifications and/or PWS notifications using Short Message transmitted with P-RNTI over DCI (see clause 6.5). Repetitions of SI change indication may occur within preceding modification period. SI change indication is not applicable for SI messages containing posSIBs.
UEs in RRC_IDLE or in RRC_INACTIVE shall monitor for SI change indication in its own paging occasion every DRX cycle. UEs in RRC_CONNECTED shall monitor for SI change indication in any paging occasion at least once per modification period if the UE is provided with common search space, including pagingSearchSpace, searchSpaceSIB1 and searchSpaceOtherSystemInformation, on the active BWP to monitor paging, as specified in TS 38.213 [13], clause 13.

ETWS or CMAS capable UEs in RRC_IDLE or in RRC_INACTIVE shall monitor for indications about PWS notification in its own paging occasion every DRX cycle. ETWS or CMAS capable UEs in RRC_CONNECTED shall monitor for indication about PWS notification in any paging occasion at least once every defaultPagingCycle if the UE is provided with common search space, including pagingSearchSpace, searchSpaceSIB1 and searchSpaceOtherSystemInformation, on the active BWP to monitor paging.

For Short Message reception in a paging occasion, the UE monitors the PDCCH monitoring occasion(s) for paging as specified in TS 38.304 [20] and TS 38.213 [13].

If the UE receives a Short Message, the UE shall:

1. if the UE is ETWS capable or CMAS capable, the etwsAndCmasIndication bit of Short Message is set, and the UE is provided with searchSpaceSIB1 and searchSpaceOtherSystemInformation on the active BWP or the initial BWP:
   1. immediately re-acquire the SIB1;
   2. if the UE is ETWS capable and si-SchedulingInfo includes scheduling information for SIB6:
      1. acquire SIB6, as specified in sub-clause 5.2.2.3.2, immediately;
   2. if the UE is ETWS capable and si-SchedulingInfo includes scheduling information for SIB7:
      1. acquire SIB7, as specified in sub-clause 5.2.2.3.2, immediately;
   2. if the UE is CMAS capable and si-SchedulingInfo includes scheduling information for SIB8:
      1. acquire SIB8, as specified in sub-clause 5.2.2.3.2, immediately;

   NOTE: In case SIB6, SIB7, or SIB8 overlap with a measurement gap it is left to UE implementation how to immediately acquire SIB6, SIB7, or SIB8.

1. if the systemInfoModification bit of Short Message is set:
   1. apply the SI acquisition procedure as defined in sub-clause 5.2.2.3 from the start of the next modification period.

### 5.2.2.3 Acquisition of System Information

#### 5.2.2.3.1 Acquisition of MIB and SIB1

The UE shall:

1. apply the specified BCCH configuration defined in 9.1.1.1;
1. if the UE is in RRC_IDLE or in RRC_INACTIVE; or
1. if the UE is in RRC_CONNECTED while T311 is running:
   1. acquire the MIB, which is scheduled as specified in TS 38.213 [13];
   2. if the UE is unable to acquire the MIB;
      1. perform the actions as specified in clause 5.2.2.5;
   2. else:
      1. perform the actions specified in clause 5.2.2.4.1.
1> if the UE is in RRC_CONNECTED with an active BWP with common search space configured by searchSpaceSIB1 and pagingSearchSpace and has received an indication about change of system information; or

1> if the UE is in RRC_CONNECTED with an active BWP with common search space configured by searchSpaceSIB1 and the UE has not stored a valid version of a SIB, in accordance with sub-clause 5.2.2.2.1, of one or several required SIB(s), in accordance with sub-clause 5.2.2.1, and, UE has not acquired SIB1 in current modification period or if requested by upper layers; or

1> if the UE is in RRC_IDLE or in RRC_INACTIVE; or

1> if the UE is in RRC_CONNECTED while T311 is running:

2> if ssb-SubcarrierOffset indicates SIB1 is transmitted in the cell (TS 38.213 [13]) and if SIB1 acquisition is required for the UE:

3> acquire the SIB1, which is scheduled as specified in TS 38.213 [13];

3> if the UE is unable to acquire the SIB1:

4> perform the actions as specified in clause 5.2.2.5;

3> else:

4> upon acquiring SIB1, perform the actions specified in clause 5.2.2.4.2.

2> else if SIB1 acquisition is required for the UE and ssb-SubcarrierOffset indicates that SIB1 is not scheduled in the cell:

3> perform the actions as specified in clause 5.2.2.5.

NOTE: The UE in RRC_CONNECTED is only required to acquire broadcasted SIB1 if the UE can acquire it without disrupting unicast data reception, i.e. the broadcast and unicast beams are quasi co-located.

5.2.2.3.2 Acquisition of an SI message

For SI message acquisition PDCCH monitoring occasion(s) are determined according to searchSpaceOtherSystemInformation. If searchSpaceOtherSystemInformation is set to zero, PDCCH monitoring occasions for SI message reception in SI-window are same as PDCCH monitoring occasions for SIB1 where the mapping between PDCCH monitoring occasions and SSBs is specified in TS 38.213[13]. If searchSpaceOtherSystemInformation is not set to zero, PDCCH monitoring occasions for SI message are determined based on search space indicated by searchSpaceOtherSystemInformation. PDCCH monitoring occasions for SI message which are not overlapping with UL symbols (determined according to tdd-UL-DL-ConfigurationCommon) are sequentially numbered from one in the SI window. The \(x \times N + K\)th PDCCH monitoring occasion (s) for SI message in SI-window corresponds to the \(K\)th transmitted SSB, where \(x = 0, 1, \ldots, X-1, K = 1, 2, \ldots, N\), \(N\) is the number of actual transmitted SSBs determined according to ssb-PositionsInBurst in SIB1 and \(X\) is equal to CEIL(number of PDCCH monitoring occasions in SI-window/N). The actual transmitted SSBs are sequentially numbered from one in ascending order of their SSB indexes. The UE assumes that, in the SI window, PDCCH for an SI message is transmitted in at least one PDCCH monitoring occasion corresponding to each transmitted SSB and thus the selection of SSB for the reception SI messages is up to UE implementation.

When acquiring an SI message, the UE shall:

1> determine the start of the SI-window for the concerned SI message as follows:

2> if the concerned SI message is configured in the schedulingInfoList:

3> for the concerned SI message, determine the number \(n\) which corresponds to the order of entry in the list of SI messages configured by schedulingInfoList in si-SchedulingInfo in SIB1;

3> determine the integer value \(x = (n-1) \times w\), where \(w\) is the si-WindowLength;

3> the SI-window starts at the slot \(a\), where \(a = x \mod N\), in the radio frame for which SFN mod \(T = \text{FLOOR}(x/N)\), where \(T\) is the si-Periodicity of the concerned SI message and \(N\) is the number of slots in a radio frame as specified in TS 38.213 [13];
2> else if the concerned SI message is configured in the pos-SchedulingInfoList and offsetToSI-Used is not configured:

3> create a concatenated list of SI messages by appending the pos-SchedulingInfoList in posSI-SchedulingInfo in SIB1 to schedulingInfoList in si-SchedulingInfo in SIB1

3> for the concerned SI message, determine the number \( n \) which corresponds to the order of entry in the concatenated list;

3> determine the integer value \( x = (n – 1) \times w \), where \( w \) is the si-WindowLength;

3> the SI-window starts at the slot \( #a \), where \( a = x \mod N \), in the radio frame for which SFN mod \( T = \text{FLOOR}(x/N) \), where \( T \) is the posSI-Periodicity of the concerned SI message and \( N \) is the number of slots in a radio frame as specified in TS 38.213 [13];

2> else if the concerned SI message is configured by the pos-SchedulingInfoList and offsetToSI-Used is configured:

3> determine the number \( m \) which corresponds to the number of SI messages with an associated si-Periodicity of 8 radio frames (80 ms), configured by schedulingInfoList in SIB1;

3> for the concerned SI message, determine the number \( n \) which corresponds to the order of entry in the list of SI messages configured by pos-SchedulingInfoList in SIB1;

3> determine the integer value \( x = m \times w + (n – 1) \times w \), where \( w \) is the si-WindowLength

3> the SI-window starts at the slot \( #a \), where \( a = x \mod N \), in the radio frame for which SFN mod \( T = \text{FLOOR}(x/N) \), where \( T \) is the posSI-Periodicity of the concerned SI message and \( N \) is the number of slots in a radio frame as specified in TS 38.213 [13];

1> receive the PDCCH containing the scheduling RNTI, i.e. SI-RNTI in the PDCCH monitoring occasion(s) for SI message acquisition, from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by si-WindowLength, or until the SI message was received;

1> if the SI message was not received by the end of the SI-window, repeat reception at the next SI-window occasion for the concerned SI message in the current modification period;

NOTE 1: The UE is only required to acquire broadcasted SI message if the UE can acquire it without disrupting unicast data reception, i.e. the broadcast and unicast beams are quasi co-located.

NOTE 2: The UE is not required to monitor PDCCH monitoring occasion(s) corresponding to each transmitted SSB in SI-window.

NOTE 3: If the concerned SI message was not received in the current modification period, handling of SI message acquisition is left to UE implementation.

NOTE 4: A UE in RRC_CONNECTED may stop the PDCCH monitoring during the SI window for the concerned SI message when the requested SIB(s) are acquired.

1> perform the actions for the acquired SI message as specified in sub-clause 5.2.2.4.

5.2.2.3.3 Request for on demand system information

The UE shall:

1> if SIB1 includes si-SchedulingInfo containing si-RequestConfigSUL and criteria to select supplementary uplink as defined in TS 38.321[13], clause 5.1.1 is met:

2> trigger the lower layer to initiate the Random Access procedure on supplementary uplink in accordance with [3] using the PRACH preamble(s) and PRACH resource(s) in si-RequestConfigSUL corresponding to the SI message(s) that the UE requires to operate within the cell, and for which si-BroadcastStatus is set to notBroadcasting;

2> if acknowledgement for SI request is received from lower layers:

3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;
1> else if SIB1 includes *si-SchedulingInfo* containing *si-RequestConfig* and criteria to select normal uplink as defined in TS 38.321[13], clause 5.1.1 is met:

2> trigger the lower layer to initiate the random access procedure on normal uplink in accordance with TS 38.321 [3] using the PRACH preamble(s) and PRACH resource(s) in *si-RequestConfig* corresponding to the SI message(s) that the UE requires to operate within the cell, and for which *si-BroadcastStatus* is set to *notBroadcasting*;

2> if acknowledgement for SI request is received from lower layers:

3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;

1> else:

2> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the parameters for which values are provided in SIB1;

2> apply the default MAC Cell Group configuration as specified in 9.2.2;

2> apply the *timeAlignmentTimerCommon* included in SIB1;

2> apply the CCCH configuration as specified in 9.1.1.2;

2> initiate transmission of the RRCSystemInfoRequest message in accordance with 5.2.2.3.4;

2> if acknowledgement for RRCSystemInfoRequest message is received from lower layers:

3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;

1> if cell reselection occurs while waiting for the acknowledgment for SI request from lower layers:

2> reset MAC;

2> if SI request is based on RRCSystemInfoRequest message:

3> release RLC entity for SRB0.

NOTE: After RACH failure for SI request it is up to UE implementation when to retry the SI request.

5.2.2.3.3a Request for on demand positioning system information

The UE shall:

1> if SIB1 includes *posSI-SchedulingInfo* containing *posSI-RequestConfigSUL* and criteria to select supplementary uplink as defined in TS 38.321[13], clause 5.1.1 is met:

2> trigger the lower layer to initiate the Random Access procedure on supplementary uplink in accordance with [3] using the PRACH preamble(s) and PRACH resource(s) in *posSI-RequestConfigSUL* corresponding to the SI message(s) that the UE requires to operate within the cell, and for which *posSI-BroadcastStatus* is set to *notBroadcasting*;

2> if acknowledgement for SI request is received from lower layers:

3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;

1> else if SIB1 includes *posSI-SchedulingInfo* containing *posSI-RequestConfig* and criteria to select normal uplink as defined in TS 38.321[13], clause 5.1.1 is met:

2> trigger the lower layer to initiate the random access procedure on normal uplink in accordance with TS 38.321 [3] using the PRACH preamble(s) and PRACH resource(s) in *posSI-RequestConfig* corresponding to the SI message(s) that the UE upper layers require for positioning operations, and for which *posSI-BroadcastStatus* is set to *notBroadcasting*;

2> if acknowledgement for SI request is received from lower layers:

3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;
else:
    2> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the parameters for which values are provided in SIB1;
    2> apply the default MAC Cell Group configuration as specified in 9.2.2;
    2> apply the timeAlignmentTimerCommon included in SIB1;
    2> apply the CCCH configuration as specified in 9.1.1.2;
    2> initiate transmission of the RRCSystemInfoRequest message with rrcPosSystemInfoRequest in accordance with 5.2.2.3.4;
    2> if acknowledgement for RRCSystemInfoRequest message with rrcPosSystemInfoRequest is received from lower layers:
        3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;
 1> if cell reselection occurs while waiting for the acknowledgment for SI request from lower layers:
    2> reset MAC;
    2> if SI request is based on RRCSystemInfoRequest message with rrcPosSystemInfoRequest:
        3> release RLC entity for SRB0.

NOTE: After RACH failure for SI request it is up to UE implementation when to retry the SI request.

5.2.2.3.4 Actions related to transmission of RRCSystemInfoRequest message

The UE shall set the contents of RRCSystemInfoRequest message as follows:

1> if the procedure is triggered to request the required SI message(s) other than positioning:
    2> set the requested-SI-List to indicate the SI message(s) that the UE requires to operate within the cell, and for which si-BroadcastStatus is set to notBroadcasting;
1> else if the procedure is triggered to request the required SI message(s) for positioning:
    2> set the requestedPosSI-List to indicate the SI message(s) that the UE upper layers require for positioning operations, and for which posSI-BroadcastStatus is set to notBroadcasting.

The UE shall submit the RRCSystemInfoRequest message to lower layers for transmission.

5.2.2.3.5 Acquisition of SIB(s) or posSIB(s) in RRC_CONNECTED

The UE shall:

1> if the UE is in RRC_CONNECTED with an active BWP not configured with common search space with the field searchSpaceOtherSystemInformation and the UE has not stored a valid version of a SIB, in accordance with sub-clause 5.2.2.2.1, of one or several required SIB(s), in accordance with sub-clause 5.2.2.1 or if requested by upper layers:
    2> for the SI message(s) that, according to the si-SchedulingInfo or posSI-SchedulingInfo in the stored SIB1, contain at least one required SIB or requested posSIB:
        3> if onDemandSIB-Request is configured and timer T350 is not running:
            4> initiate transmission of the DedicatedSIBRequest message in accordance with 5.2.2.3.6;
            4> start timer T350 with the timer value set to the onDemandSIB-RequestProhibitTimer;
1> else if the UE is in RRC_CONNECTED with an active BWP configured with common search space with the field searchSpaceOtherSystemInformation and the UE has not stored a valid version of a SIB, in accordance with
sub-clause 5.2.2.2.1, of one or several required SIB(s), in accordance with sub-clause 5.2.2.1 or if requested by upper layers:

2> for the SI message(s) that, according to the \textit{si-SchedulingInfo} in the stored SIB1, contain at least one required SIB and for which \textit{si-BroadcastStatus} is set to \textit{broadcasting}:

3> acquire the SI message(s) as defined in sub-clause 5.2.2.3.2;

2> for the SI message(s) that, according to the \textit{si-SchedulingInfo} in the stored SIB1, contain at least one required SIB and for which \textit{si-BroadcastStatus} is set to \textit{notBroadcasting}:

3> if \textit{onDemandSIB-Request} is configured and timer T350 is not running:

4> initiate transmission of the \textit{DedicatedSIBRequest} message in accordance with 5.2.2.3.6;

4> start timer T350 with the timer value set to the \textit{onDemandSIB-RequestProhibitTimer};

4> acquire the requested SI message(s) corresponding to the requested SIB(s) as defined in sub-clause 5.2.2.3.2.

2> for the SI message(s) that, according to the \textit{posSI-SchedulingInfo} in the stored SIB1, contain at least one requested posSIB and for which \textit{posSI-BroadcastStatus} is set to \textit{broadcasting}:

3> acquire the SI message(s) as defined in sub-clause 5.2.2.3.2;

2> for the SI message(s) that, according to the \textit{posSI-SchedulingInfo} in the stored SIB1, contain at least one requested posSIB and for which \textit{posSI-BroadcastStatus} is set to \textit{notBroadcasting}:

3> if \textit{onDemandSIB-Request} is configured and timer T350 is not running:

4> initiate transmission of the \textit{DedicatedSIBRequest} message in accordance with 5.2.2.3.6;

4> start timer T350 with the timer value set to the \textit{onDemandSIB-RequestProhibitTimer};

4> acquire the requested SI message(s) corresponding to the requested posSIB(s) as defined in sub-clause 5.2.2.3.2.

NOTE: UE may include on demand request for SIB and/or posSIB(s) in the same \textit{DedicatedSIBRequest} message.

5.2.2.3.6 Actions related to transmission of \textit{DedicatedSIBRequest} message

The UE shall set the contents of \textit{DedicatedSIBRequest} message as follows:

1> if the procedure is triggered to request the required SIB(s):

2> include \textit{requestedSIB-List} in the \textit{onDemandSIB-RequestList} to indicate the requested SIB(s);

1> if the procedure is triggered to request the required posSIB(s):

2> include \textit{requestedPosSIB-List} in the \textit{onDemandSIB-RequestList} to indicate the requested posSIB(s).

The UE shall submit the \textit{DedicatedSIBRequest} message to lower layers for transmission.

5.2.2.4 Actions upon receipt of System Information

5.2.2.4.1 Actions upon reception of the \textit{MIB}

Upon receiving the \textit{MIB} the UE shall:

1> store the acquired \textit{MIB};

1> if the UE is in RRC\_IDLE or in RRC\_INACTIVE, or if the UE is in RRC\_CONNECTED while \textit{T311} is running:

2> if the \textit{cellBarred} in the acquired \textit{MIB} is set to \textit{barred}:
3> consider the cell as barred in accordance with TS 38.304 [20];
3> if intraFreqReselection is set to notAllowed; and
3> if the cell operates in licensed spectrum or the cell belongs to a PLMN which is indicated as being equivalent to the registered PLMN or the cell belongs to the registered SNPN of the UE:
4> consider cell re-selection to other cells on the same frequency as the barred cell as not allowed, as specified in TS 38.304 [20].
3> else:
4> consider cell re-selection to other cells on the same frequency as the barred cell as allowed, as specified in TS 38.304 [20].
2> else:
3> apply the received systemFrameNumber, pdcch-ConfigSIB1, subCarrierSpacingCommon, ssb-SubcarrierOffset and dmrs-TypeA-Position.

5.2.2.4.2 Actions upon reception of the SIB1
Upon receiving the SIB1 the UE shall:
1> store the acquired SIB1;
1> if the cellAccessRelatedInfo contains an entry of a selected SNPN or PLMN and in case of PLMN the UE is either allowed or instructed to access the PLMN via a cell for which at least one CAG ID is broadcast:
2> in the remainder of the procedures use npn-IdentityList, trackingAreaCode, and cellIdentity for the cell as received in the corresponding entry of npn-IdentityInfoList containing the selected PLMN or SNPN;
1> else if the cellAccessRelatedInfo contains an entry with the PLMN-Identity of the selected PLMN:
2> in the remainder of the procedures use plmn-IdentityList, trackingAreaCode, and cellIdentity for the cell as received in the corresponding PLMN-IdentityInfo containing the selected PLMN;
1> if in RRC_CONNECTED while T311 is not running:
2> disregard the frequencyBandList, if received, while in RRC_CONNECTED;
2> forward the cellIdentity to upper layers;
2> forward the trackingAreaCode to upper layers;
2> forward the received posSIB-MappingInfo to upper layers, if included;
2> apply the configuration included in the servingCellConfigCommon;
2> if the UE has a stored valid version of a SIB or posSIB, in accordance with sub-clause 5.2.2.2.1, that the UE requires to operate within the cell in accordance with sub-clause 5.2.2.1:
3> use the stored version of the required SIB or posSIB;
2> else:
3> acquire the required SIB or posSIB requested by upper layer as defined in sub-clause 5.2.2.3.5;
NOTE: Void.
1> else:
2> if the UE supports one or more of the frequency bands indicated in the frequencyBandList for downlink for TDD, or one or more of the frequency bands indicated in the frequencyBandList for uplink for FDD, and they are not downlink only bands, and
2> if the UE is IAB-MT or supports at least one additionalSpectrumEmission in the NR-NS-PmaxList for a supported band in the downlink for TDD, or a supported band in uplink for FDD, and

2> if the UE supports an uplink channel bandwidth with a maximum transmission bandwidth configuration (see TS 38.101-1 [15] and TS 38.101-2 [39]) which
   - is smaller than or equal to the carrierBandwidth (indicated in uplinkConfigCommon for the SCS of the initial uplink BWP), and
   - is wider than or equal to the bandwidth of the initial uplink BWP, and

2> if the UE supports a downlink channel bandwidth with a maximum transmission bandwidth configuration (see TS 38.101-1 [15] and TS 38.101-2 [39]) which
   - is smaller than or equal to the carrierBandwidth (indicated in downlinkConfigCommon for the SCS of the initial downlink BWP), and
   - is wider than or equal to the bandwidth of the initial downlink BWP, and

2> if frequencyShift7p5khz is present and the UE supports corresponding 7.5kHz frequency shift on this band; or frequencyShift7p5khz is not present:

3> if trackingAreaCode is not provided for the selected PLMN nor the registered PLMN nor PLMN of the equivalent PLMN list:
   4> consider the cell as barred in accordance with TS 38.304 [20];
   4> if intraFreqReselection is set to notAllowed:
      5> consider cell re-selection to other cells on the same frequency as the barred cell as not allowed, as specified in TS 38.304 [20];
   4> else:
      5> consider cell re-selection to other cells on the same frequency as the barred cell as allowed, as specified in TS 38.304 [20];

3> else if UE is IAB-MT and if iab-Support is not provided for the selected PLMN nor the registered PLMN nor PLMN of the equivalent PLMN list nor the selected SNPN nor the registered SNPN:
   4> consider the cell as barred for IAB-MT in accordance with TS 38.304 [20];

3> else:
   4> apply a supported uplink channel bandwidth with a maximum transmission bandwidth which
      - is contained within the carrierBandwidth indicated in uplinkConfigCommon for the SCS of the initial uplink BWP, and which
      - is wider than or equal to the bandwidth of the initial BWP for the uplink;
   4> apply a supported downlink channel bandwidth with a maximum transmission bandwidth which
      - is contained within the carrierBandwidth indicated in downlinkConfigCommon for the SCS of the initial downlink BWP, and which
      - is wider than or equal to the bandwidth of the initial BWP for the downlink;
   4> select the first frequency band in the frequencyBandList, for FDD from frequencyBandList for uplink, or for TDD from frequencyBandList for downlink, which the UE supports and for which the UE supports at least one of the additionalSpectrumEmission values in nr-NS-PmaxList, if present;
   4> forward the cellIdentity to upper layers;
   4> forward the trackingAreaCode to upper layers;
   4> forward the received posSIB-MappingInfo to upper layers, if included;
   4> forward the PLMN identity or SNPN identity or PNI-NPN identity to upper layers;
4> if in RRC_INACTIVE and the forwarded information does not trigger message transmission by upper layers:
5> if the serving cell does not belong to the configured ran-NotificationAreaInfo:
6> initiate an RNA update as specified in 5.3.13.8;
4> forward the ims-EmergencySupport to upper layers, if present;
4> forward the eCallOverIMS-Support to upper layers, if present;
4> forward the UAC-AccessCategory1-SelectionAssistanceInfo or UAC-AC1-SelectAssistInfo for the selected PLMN to upper layers, if present and set to a, b or c;
4> apply the configuration included in the servingCellConfigCommon;
4> apply the specified PCCH configuration defined in 9.1.1.3;
4> if the UE has a stored valid version of a SIB, in accordance with sub-clause 5.2.2.2.1, that the UE requires to operate within the cell in accordance with sub-clause 5.2.2.1:
5> use the stored version of the required SIB;
4> if the UE has not stored a valid version of a SIB, in accordance with sub-clause 5.2.2.2.1, of one or several required SIB(s), in accordance with sub-clause 5.2.2.1:
5> for the SI message(s) that, according to the si-SchedulingInfo, contain at least one required SIB and for which si-BroadcastStatus is set to broadcasting:
6> acquire the SI message(s) as defined in sub-clause 5.2.2.3.2;
5> for the SI message(s) that, according to the si-SchedulingInfo, contain at least one required SIB and for which si-BroadcastStatus is set to notBroadcasting:
6> trigger a request to acquire the SI message(s) as defined in sub-clause 5.2.2.3.3;
4> if the UE has received request from upper layers:
5> for the SI message(s) that, according to the posSI-SchedulingInfo, contain at least one requested posSIB and for which posSI-BroadcastStatus is set to broadcasting:
6> acquire the SI message(s) as defined in sub-clause 5.2.2.3.2;
5> for the SI message(s) that, according to the posSI-SchedulingInfo, contain at least one requested posSIB for which posSI-BroadcastStatus is set to notBroadcasting:
6> trigger a request to acquire the SI message(s) as defined in sub-clause 5.2.2.3.3a;
4> apply the first listed additionalSpectrumEmission which it supports among the values included in NR-NS-PmaxList within frequencyBandList in uplinkConfigCommon for FDD or in downlinkConfigCommon for TDD;
4> if the additionalPmax is present in the same entry of the selected additionalSpectrumEmission within NR-NS-PmaxList:
5> apply the additionalPmax for UL;
4> else:
5> apply the p-Max in uplinkConfigCommon for UL;
4> if supplementaryUplink is present in servingCellConfigCommon; and
4> if the UE supports one or more of the frequency bands indicated in the frequencyBandList for the supplementaryUplink; and
4> if the UE supports at least one `additionalSpectrumEmission` in the `NR-NS-PmaxList` for a supported supplementary uplink band; and

4> if the UE supports an uplink channel bandwidth with a maximum transmission bandwidth configuration (see TS 38.101-1 [15] and TS 38.101-2 [39]) which

- is smaller than or equal to the `carrierBandwidth` (indicated in `supplementaryUplink` for the SCS of the initial uplink BWP), and which

- is wider than or equal to the bandwidth of the initial uplink BWP of the SUL;

5> consider supplementary uplink as configured in the serving cell;

5> select the first frequency band in the `frequencyBandList` for the `supplementaryUplink` which the UE supports and for which the UE supports at least one of the `additionalSpectrumEmission` values in `nr-NS-PmaxList`, if present;

5> apply a supported supplementary uplink channel bandwidth with a maximum transmission bandwidth which

- is contained within the `carrierBandwidth` (indicated in `supplementaryUplink` for the SCS of the initial uplink BWP), and which

- is wider than or equal to the bandwidth of the initial BWP of the SUL;

5> apply the first listed `additionalSpectrumEmission` which it supports among the values included in `NR-NS-PmaxList` within `frequencyBandList` for the `supplementaryUplink`;

5> if the `additionalPmax` is present in the same entry of the selected `additionalSpectrumEmission` within `NR-NS-PmaxList` for the `supplementaryUplink`;

6> apply the `additionalPmax` in `supplementaryUplink` for SUL;

5> else:

6> apply the `p-Max` in `supplementaryUplink` for SUL;

2> else:

3> consider the cell as barred in accordance with TS 38.304 [20]; and

3> perform barring as if `intraFreqReselection` is set to `notAllowed`;

5.2.2.4.3 Actions upon reception of SIB2

Upon receiving `SIB2`, the UE shall:

1> if in RRC_IDLE or in RRC_INACTIVE or in RRC_CONNECTED while T311 is running:

2> if, for the entry in `frequencyBandList` with the same index as the frequency band selected in 5.2.2.4.2, the UE supports at least one `additionalSpectrumEmission` in the `NR-NS-PmaxList` within the `frequencyBandList`:

3> apply the first listed `additionalSpectrumEmission` which it supports among the values included in `NR-NS-PmaxList` within `frequencyBandList`;

3> if the `additionalPmax` is present in the same entry of the selected `additionalSpectrumEmission` within `NR-NS-PmaxList`:

4> apply the `additionalPmax`;

3> else:

4> apply the `p-Max`;

3> if the UE selects a frequency band (from the procedure in clause 5.2.2.4.2) for the supplementary uplink:
if, for the entry in frequencyBandListSUL with the same index as the frequency band selected in clause 5.2.2.4.2, the UE supports at least one additionalSpectrumEmission in the NR-NS-PmaxList within the frequencyBandListSUL:

- apply the first listed additionalSpectrumEmission which it supports among the values included in NR-NS-PmaxList within frequencyBandListSUL;

- if the additionalPmax is present in the same entry of the selected additionalSpectrumEmission within NR-NS-PmaxList:
  - apply the additionalPmax;
  - else:
    - apply the p-Max;

- else:
  - apply the p-Max.

5.2.2.4.4 Actions upon reception of SIB3

No UE requirements related to the contents of this SIB3 apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/or within the corresponding field descriptions.

5.2.2.4.5 Actions upon reception of SIB4

Upon receiving SIB4 the UE shall:

1> if in RRC_IDLE, or in RRC_INACTIVE or in RRC_CONNECTED while T311 is running:

2> for each entry in the interFreqCarrierFreqList:

3> select the first frequency band in the frequencyBandList, and frequencyBandListSUL, if present, which the UE supports and for which the UE supports at least one of the additionalSpectrumEmission values in NR-NS-PmaxList, if present:

3> if, the frequency band selected by the UE in frequencyBandList to represent a non-serving NR carrier frequency is not a downlink only band:

4> if, for the selected frequency band, the UE supports at least one additionalSpectrumEmission in the NR-NS-PmaxList within the frequencyBandList:

5> apply the first listed additionalSpectrumEmission which it supports among the values included in NR-NS-PmaxList within frequencyBandList;

5> if the additionalPmax is present in the same entry of the selected additionalSpectrumEmission within NR-NS-PmaxList:

6> apply the additionalPmax;

5> else:

6> apply the p-Max;

5> if frequencyBandListSUL is present in SIB4 and, for the frequency band selected in frequencyBandListSUL, the UE supports at least one additionalSpectrumEmission in the NR-NS-PmaxList within FrequencyBandListSUL:

6> apply the first listed additionalSpectrumEmission which it supports among the values included in NR-NS-PmaxList within frequencyBandListSUL;
6> if the additionalPmax is present in the same entry of the selected additionalSpectrumEmission within NR-NS-PmaxList:
7> apply the additionalPmax;
6> else:
7> apply the p-Max;
5> else:
6> apply the p-Max;
4> else:
5> apply the p-Max;

1> if in RRC_IDLE or RRC_INACTIVE, and T331 is running:
2> perform the actions as specified in 5.7.8.1a;

5.2.2.4.6 Actions upon reception of SIB5
No UE requirements related to the contents of this SIB5 apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/or within the corresponding field descriptions.

5.2.2.4.7 Actions upon reception of SIB6
Upon receiving the SIB6 the UE shall:

1> forward the received warningType, messageIdentifier and serialNumber to upper layers;

5.2.2.4.8 Actions upon reception of SIB7
Upon receiving the SIB7 the UE shall:

1> if there is no current value for messageIdentifier and serialNumber for SIB7; or
1> if either the received value of messageIdentifier or of serialNumber, or of both messageIdentifier and serialNumber are different from the current values of messageIdentifier and serialNumber for SIB7:
2> use the received values of messageIdentifier and serialNumber for SIB7 as the current values of messageIdentifier and serialNumber for SIB7;
2> discard any previously buffered warningMessageSegment;
2> if all segments of a warning message have been received:
3> assemble the warning message from the received warningMessageSegment(s);
3> forward the received warning message, messageIdentifier, serialNumber and dataCodingScheme to upper layers;
3> stop reception of SIB7;
3> discard the current values of messageIdentifier and serialNumber for SIB7;
2> else:
3> store the received warningMessageSegment;
3> continue reception of SIB7;
1> else if all segments of a warning message have been received:
2> assemble the warning message from the received warningMessageSegment(s);
2> forward the received complete warning message, messageIdentifier, serialNumber and dataCodingScheme to upper layers;
2> stop reception of SIB7;
2> discard the current values of messageIdentifier and serialNumber for SIB7;
1> else:
2> store the received warningMessageSegment;
2> continue reception of SIB7;

The UE should discard any stored warningMessageSegment and the current value of messageIdentifier and serialNumber for SIB7 if the complete warning message has not been assembled within a period of 3 hours.

5.2.2.4.9 Actions upon reception of SIB8

Upon receiving the SIB8 the UE shall:
1> if the SIB8 contains a complete warning message and the complete geographical area coordinates (if any):
2> forward the received warning message, messageIdentifier, serialNumber, dataCodingScheme and the geographical area coordinates (if any) to upper layers;
2> continue reception of SIB8;
1> else:
2> if the received values of messageIdentifier and serialNumber are the same (each value is the same) as a pair for which a warning message and the geographical area coordinates (if any) are currently being assembled:
3> store the received warningMessageSegment;
3> store the received warningAreaCoordinatesSegment (if any);
3> if all segments of a warning message and geographical area coordinates (if any) have been received:
4> assemble the warning message from the received warningMessageSegment;
4> assemble the geographical area coordinates from the received warningAreaCoordinatesSegment (if any);
4> forward the received warning message, messageIdentifier, serialNumber, dataCodingScheme and geographical area coordinates (if any) to upper layers;
4> stop assembling a warning message and geographical area coordinates (if any) for this messageIdentifier and serialNumber and delete all stored information held for it;
3> continue reception of SIB8;
2> else if the received values of messageIdentifier and/or serialNumber are not the same as any of the pairs for which a warning message is currently being assembled:
3> start assembling a warning message for this messageIdentifier and serialNumber pair;
3> start assembling the geographical area coordinates (if any) for this messageIdentifier and serialNumber pair;
3> store the received warningMessageSegment;
3> store the received warningAreaCoordinatesSegment (if any);
3> continue reception of SIB8;
The UE should discard warningMessageSegment and warningAreaCoordinatesSegment (if any) and the associated values of messageIdentifier and serialNumber for SIB8 if the complete warning message and the geographical area coordinates (if any) have not been assembled within a period of 3 hours.

NOTE: The number of warning messages that a UE can re-assemble simultaneously is a function of UE implementation.

5.2.2.4.10 Actions upon reception of SIB9

Upon receiving SIB9 with referenceTimeInfo, the UE may perform the related actions as specified in subclause 5.7.1.3.

5.2.2.4.11 Actions upon reception of SIB10

Upon receiving SIB10, the UE shall:

1> Forward the HRNN-list entries with the corresponding PNI-NPN and SNPN identities to upper layers;

5.2.2.4.12 Actions upon reception of SIB11

Upon receiving SIB11, the UE shall:

1> if in RRC_IDLE or RRC_INACTIVE, and T331 is running:
   2> perform the actions as specified in 5.7.8.1a;

5.2.2.4.13 Actions upon reception of SIB12

Upon receiving SIB12, the UE shall:

1> if the UE has stored at least one segment of SIB12 and the value tag of SIB12 has changed since a previous segment was stored:
   2> discard all stored segments;
1> store the segment;
1> if all segments have been received:
   2> assemble SIB12-IEs from the received segments;
   2> if sl-FreqInfoList is included in sl-ConfigCommonNR:
      3> if configured to receive NR sidelink communication:
         4> use the resource pool(s) indicated by sl-RxPool for NR sidelink communication reception, as specified in 5.8.7;
      3> if configured to transmit NR sidelink communication:
         4> use the resource pool(s) indicated by sl-TxPoolSelectedNormal, or sl-TxPoolExceptional for NR sidelink communication transmission, as specified in 5.8.8;
         4> perform CBR measurement on the transmission resource pool(s) indicated by sl-TxPoolSelectedNormal and sl-TxPoolExceptional for NR sidelink communication transmission, as specified in 5.5.3.1;
         4> use the synchronization configuration parameters for NR sidelink communication on frequencies included in sl-FreqInfoList, as specified in 5.8.5;
      2> if sl-RadioBearerConfigList or sl-RLC-BearerConfigList is included in sl-ConfigCommonNR:
         3> perform sidelink DRB reconfiguration as specified in 5.8.9.1a;
      2> if sl-MeasConfigCommon is included in sl-ConfigCommonNR:
3> store the NR sidelink measurement configuration.

The UE should discard any stored segments for SIB12 if the complete SIB12 has not been assembled within a period of 3 hours. The UE shall discard any stored segments for SIB12 upon cell (re-) selection.

5.2.2.4.14 Actions upon reception of SIB13

Upon receiving SIB13, the UE shall perform the actions upon reception of SystemInformationBlockType21 as specified in 5.2.2.28 in TS 36.331 [10].

5.2.2.4.15 Actions upon reception of SIB14

Upon receiving SIB14, the UE shall perform the actions upon reception of SystemInformationBlockType26 as specified in 5.2.2.33 in TS 36.331 [10].

5.2.2.4.16 Actions upon reception of SIBpos

No UE requirements related to the contents of the SIBpos apply other than those specified elsewhere e.g. within TS 37.355 [49], and/or within the corresponding field descriptions.

5.2.2.5 Essential system information missing

The UE shall:

1> if in RRC_IDLE or in RRC_INACTIVE or in RRC_CONNECTED while T311 is running:

2> if the UE is unable to acquire the MIB:

3> consider the cell as barred in accordance with TS 38.304 [20]; and

3> perform barring as if intraFreqReselection is set to allowed;

2> else if the UE is unable to acquire the SIB1:

3> consider the cell as barred in accordance with TS 38.304 [20].

3> if the cell operates in licensed spectrum and intraFreqReselection in MIB is set to notAllowed:

4> consider cell re-selection to other cells on the same frequency as the barred cell as not allowed, as specified in TS 38.304 [20].

3> else:

4> consider cell re-selection to other cells on the same frequency as the barred cell as allowed, as specified in TS 38.304 [20].

5.3 Connection control

5.3.1 Introduction

5.3.1.1 RRC connection control

RRC connection establishment involves the establishment of SRB1. The network completes RRC connection establishment prior to completing the establishment of the NG connection, i.e. prior to receiving the UE context information from the 5GC. Consequently, AS security is not activated during the initial phase of the RRC connection. During this initial phase of the RRC connection, the network may configure the UE to perform measurement reporting, but the UE only sends the corresponding measurement reports after successful AS security activation. However, the UE only accepts a re-configuration with sync message when AS security has been activated.

Upon receiving the UE context from the 5GC, the RAN activates AS security (both ciphering and integrity protection) using the initial AS security activation procedure. The RRC messages to activate AS security (command and successful
response) are integrity protected, while ciphering is started only after completion of the procedure. That is, the response to the message used to activate AS security is not ciphered, while the subsequent messages (e.g. used to establish SRB2 and DRBs) are both integrity protected and ciphered. After having initiated the initial AS security activation procedure, the network may initiate the establishment of SRB2 and DRBs, i.e. the network may do this prior to receiving the confirmation of the initial AS security activation from the UE. In any case, the network will apply both ciphering and integrity protection for the RRC reconfiguration messages used to establish SRB2 and DRBs. The network should release the RRC connection if the initial AS security activation and/or the radio bearer establishment fails. A configuration with SRB2 without DRB or with DRB without SRB2 is not supported (i.e., SRB2 and at least one DRB must be configured in the same RRC Reconfiguration message, and it is not allowed to release all the DRBs without releasing the RRC Connection). For IAB-MT, a configuration with SRB2 without DRB is supported.

The release of the RRC connection normally is initiated by the network. The procedure may be used to re-direct the UE to an NR frequency or an E-UTRA carrier frequency.

The suspension of the RRC connection is initiated by the network. When the RRC connection is suspended, the UE stores the UE Inactive AS context and any configuration received from the network, and transits to RRC_INACTIVE state. The RRC message to suspend the RRC connection is integrity protected and ciphered.

The resumption of a suspended RRC connection is initiated by upper layers when the UE needs to transit from RRC_INACTIVE state to RRC_CONNECTED state or by RRC layer to perform a RNA update or by RAN paging from NG-RAN. When the RRC connection is resumed, network configures the UE according to the RRC connection resume procedure based on the stored UE Inactive AS context and any RRC configuration received from the network. The RRC connection resume procedure re-activates AS security and re-establishes SRB(s) and DRB(s).

In response to a request to resume the RRC connection, the network may resume the suspended RRC connection and send UE to RRC_CONNECTED, or reject the request to resume and send UE to RRC_INACTIVE (with a wait timer), or directly re-suspend the RRC connection and send UE to RRC_INACTIVE, or directly release the RRC connection and send UE to RRC_IDLE, or instruct the UE to initiate NAS level recovery (in this case the network sends an RRC setup message).

**NOTE:** In case the UE receives the configurations for NR sidelink communication via the E-UTRA, the configurations for NR sidelink communication in SIB12 and sl-ConfigDedicatedNR within RRCReconfiguration used in subclause 5.3 are provided by the configurations in SystemInformationBlockType28 and sl-ConfigDedicatedNR within RRCConnectionReconfiguration as specified in TS 36.331[10], respectively.

### 5.3.1.2 AS Security

AS security comprises of the integrity protection and ciphering of RRC signalling (SRBs) and user data (DRBs).

RRC handles the configuration of the AS security parameters which are part of the AS configuration: the integrity protection algorithm, the ciphering algorithm, if integrity protection and/or ciphering is enabled for a DRB and two parameters, namely the keySetChangeIndicator and the nextHopChainingCount, which are used by the UE to determine the AS security keys upon reconfiguration with sync (with key change), connection re-establishment and/or connection resume.

The integrity protection algorithm is common for SRB1, SRB2, SRB3 (if configured) and DRBs configured with integrity protection, with the same keyToUse value. The ciphering algorithm is common for SRB1, SRB2, SRB3 (if configured) and DRBs configured with the same keyToUse value. For MR-DC, integrity protection is not enabled for DRBs terminated in eNB. Neither integrity protection nor ciphering applies for SRB0.

**NOTE 0:** All DRBs related to the same PDU session have the same enable/disable setting for ciphering and the same enable/disable setting for integrity protection, as specified in TS 33.501[11].

RRC integrity protection and ciphering are always activated together, i.e. in one message/procedure. RRC integrity protection and ciphering for SRBs are never de-activated. However, it is possible to switch to a 'NULL' ciphering algorithm (nea0).

The 'NULL' integrity protection algorithm (nia0) is used only for SRBs and for the UE in limited service mode, see TS 33.501[11] and when used for SRBs, integrity protection is disabled for DRBs. In case the 'NULL' integrity protection algorithm is used, 'NULL' ciphering algorithm is also used.

**NOTE 1:** Lower layers discard RRC messages for which the integrity protection check has failed and indicate the integrity protection verification check failure to RRC.
The AS applies four different security keys: one for the integrity protection of RRC signalling (K_{RRCint}), one for the ciphering of RRC signalling (K_{RRCenc}), one for integrity protection of user data (K_{UPint}) and one for the ciphering of user data (K_{UPenc}). All four AS keys are derived from the K_{gNB} key. The K_{gNB} key is based on the K_{AMF} key (as specified in TS 33.501 [11]), which is handled by upper layers. The integrity protection and ciphering algorithms can only be changed with reconfiguration with sync. The AS keys (K_{gNB}, K_{RRCint}, K_{RRCenc}, K_{UPint} and K_{UPenc}) change upon reconfiguration with sync (if masterKeyUpdate is included), and upon connection re-establishment and connection resume. For each radio bearer an independent counter (\textit{COUNT}, as specified in TS 38.323 [5]) is maintained for each direction. For each radio bearer, the \textit{COUNT} is used as input for ciphering and integrity protection. It is not allowed to use the same \textit{COUNT} value more than once for a given security key. As specified in TS 33.501 subclause 6.9.4.1 [11], the network is responsible for avoiding reuse of the \textit{COUNT} with the same RB identity and with the same key, e.g. due to the transfer of large volumes of data, release and establishment of new RBs, and multiple termination point changes for RLC-UM bearers and multiple termination point changes for RLC-AM bearer with SN terminated PDCP re-establishment (COUNT reset) due to SN only full configuration whilst the key stream inputs (i.e. bearer ID, security key) at MN have not been updated. In order to avoid such re-use, the network may e.g. use different RB identities for RB establishments, change the AS security key, or an RRC_CONNECTED to RRC_IDLE/RRC_INACTIVE and then to RRC_CONNECTED transition. In order to limit the signalling overhead, individual messages/packets include a short sequence number (PDCP SN, as specified in TS 38.323 [5]). In addition, an overflow counter mechanism is used: the hyper frame number (HFN, as specified in TS 38.323 [5]). The HFN needs to be synchronized between the UE and the network. For each SRB, the value provided by RRC to lower layers to derive the 5-bit BEARER parameter used as input for ciphering and for integrity protection is the value of the corresponding \textit{srb-Identity} with the MSBs padded with zeroes. For a UE provided with an \textit{sk-counter}, \textit{keyToUse} indicates whether the UE uses the master key (K_{gNB}) or the secondary key (S-K_{gNB} or S-K_{gNB}) for a particular DRB. The secondary key is derived from the master key and \textit{sk-Counter}, as defined in TS 33.501[11]. Whenever there is a need to refresh the secondary key, e.g. upon change of MN with K_{gNB} change or to avoid COUNT reuse, the security key update is used (see 5.3.5.7). When the UE is in NR-DC, the network may provide a UE configured with an SCG with an \textit{sk-Counter} even when no DRB is setup using the secondary key (S-K_{gNB}) in order to allow the configuration of SRB3. The network can also provide the UE with an \textit{sk-Counter}, even if no SCG is configured, when using SN terminated MCG bearers.

5.3.2 Paging

5.3.2.1 General

![Figure 5.3.2.1-1: Paging](image)

The purpose of this procedure is:

- to transmit paging information to a UE in RRC_IDLE or RRC_INACTIVE.

5.3.2.2 Initiation

The network initiates the paging procedure by transmitting the \textit{Paging} message at the UE's paging occasion as specified in TS 38.304 [20]. The network may address multiple UEs within a \textit{Paging} message by including one \textit{PagingRecord} for each UE.
5.3.2.3 Reception of the *Paging message* by the UE

Upon receiving the *Paging* message, the UE shall:

1> if in RRC_IDLE, for each of the *PagingRecord*, if any, included in the *Paging* message:
   2> if the *ue-Identity* included in the *PagingRecord* matches the UE identity allocated by upper layers:
      3> forward the *ue-Identity* and *accessType* (if present) to the upper layers;

1> if in RRC_INACTIVE, for each of the *PagingRecord*, if any, included in the *Paging* message:
   2> if the *ue-Identity* included in the *PagingRecord* matches the UE's stored fullI-RNTI:
      3> if the UE is configured by upper layers with Access Identity 1:
         4> initiate the RRC connection resumption procedure according to 5.3.13 with *resumeCause* set to *mps-PriorityAccess*;
      3> else if the UE is configured by upper layers with Access Identity 2:
         4> initiate the RRC connection resumption procedure according to 5.3.13 with *resumeCause* set to *mcs-PriorityAccess*;
      3> else if the UE is configured by upper layers with one or more Access Identities equal to 11-15:
         4> initiate the RRC connection resumption procedure according to 5.3.13 with *resumeCause* set to *highPriorityAccess*;
      3> else:
         4> initiate the RRC connection resumption procedure according to 5.3.13 with *resumeCause* set to *mt-Access*;
   2> else if the *ue-Identity* included in the *PagingRecord* matches the UE identity allocated by upper layers:
      3> forward the *ue-Identity* to upper layers and *accessType* (if present) to the upper layers;
      3> perform the actions upon going to RRC_IDLE as specified in 5.3.11 with release cause 'other'.

5.3.3 RRC connection establishment

5.3.3.1 General

![Diagram](attachment:5.3.3.1.png)

*Figure 5.3.3.1-1: RRC connection establishment, successful*
The purpose of this procedure is to establish an RRC connection. RRC connection establishment involves SRB1 establishment. The procedure is also used to transfer the initial NAS dedicated information/message from the UE to the network.

The network applies the procedure e.g. as follows:

- When establishing an RRC connection;
- When UE is resuming or re-establishing an RRC connection, and the network is not able to retrieve or verify the UE context. In this case, UE receives RRCSetup and responds with RRCSetupComplete.

5.3.3.1a Conditions for establishing RRC Connection for sidelink communication

For NR sidelink communication, an RRC connection establishment is initiated only in the following cases:

1> if configured by upper layers to transmit NR sidelink communication and related data is available for transmission;
2> if the frequency on which the UE is configured to transmit NR sidelink communication is included in sl-FreqInfoList within SIB12 provided by the cell on which the UE camps; and if the valid version of SIB12 does not include sl-TxPoolSelectedNormal for the concerned frequency;

For V2X sidelink communication, an RRC connection is initiated only when the conditions specified for V2X sidelink communication in subclause 5.3.3.1a of TS 36.331 [10] are met.

NOTE: Upper layers initiate an RRC connection. The interaction with NAS is left to UE implementation.

5.3.3.2 Initiation

The UE initiates the procedure when upper layers request establishment of an RRC connection while the UE is in RRC_IDLE and it has acquired essential system information, or for sidelink communication as specified in sub-clause 5.3.3.1a.

The UE shall ensure having valid and up to date essential system information as specified in clause 5.2.2.2 before initiating this procedure.

Upon initiation of the procedure, the UE shall:

1> if the upper layers provide an Access Category and one or more Access Identities upon requesting establishment of an RRC connection:
2> perform the unified access control procedure as specified in 5.3.14 using the Access Category and Access Identities provided by upper layers;
3> if the access attempt is barred, the procedure ends;
1> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the parameters for which values are provided in SIB1; 
1> apply the default MAC Cell Group configuration as specified in 9.2.2;
1> apply the CCCH configuration as specified in 9.1.1.2;

Figure 5.3.3.1-2: RRC connection establishment, network reject
1> apply the timeAlignmentTimerCommon included in SIB1;

1> start timer T300;

1> initiate transmission of the RRCSetupRequest message in accordance with 5.3.3.3;

5.3.3.3 Actions related to transmission of RRCSetupRequest message

The UE shall set the contents of RRCSetupRequest message as follows:

1> set the ue-Identity as follows:

2> if upper layers provide a 5G-S-TMSI:

3> set the ue-Identity to ng-5G-S-TMSI-Part1;

2> else:

3> draw a 39-bit random value in the range 0..2^{39}-1 and set the ue-Identity to this value;

NOTE 1: Upper layers provide the 5G-S-TMSI if the UE is registered in the TA of the current cell.

1> set the establishmentCause in accordance with the information received from upper layers;

The UE shall submit the RRCSetupRequest message to lower layers for transmission.

The UE shall continue cell re-selection related measurements as well as cell re-selection evaluation. If the conditions for cell re-selection are fulfilled, the UE shall perform cell re-selection as specified in 5.3.3.6.

5.3.3.4 Reception of the RRCSetup by the UE

The UE shall perform the following actions upon reception of the RRCSetup:

1> if the RRCSetup is received in response to an RRCReestablishmentRequest; or

1> if the RRCSetup is received in response to an RRCResumeRequest or RRCResumeRequest1:

2> discard any stored UE Inactive AS context and suspendConfig;

2> discard any current AS security context including the K{RRCCenc} key, the K{RRCCint} key, the K{UPint} key and the K{UPenc} key;

2> release radio resources for all established RBs except SRB0, including release of the RLC entities, of the associated PDCP entities and of SDAP;

2> release the RRC configuration except for the default L1 parameter values, default MAC Cell Group configuration and CCCH configuration;

2> indicate to upper layers fallback of the RRC connection;

2> stop timer T380, if running;

1> perform the cell group configuration procedure in accordance with the received masterCellGroup and as specified in 5.3.5.5;

1> perform the radio bearer configuration procedure in accordance with the received radioBearerConfig and as specified in 5.3.5.6;

1> if stored, discard the cell reselection priority information provided by the cellReselectionPriorities or inherited from another RAT;

1> stop timer T300, T301 or T319 if running;

1> if T390 is running:

2> stop timer T390 for all access categories;
perform the actions as specified in 5.3.14.4;

if T302 is running:

stop timer T302;

perform the actions as specified in 5.3.14.4;

stop timer T320, if running;

if the RRCSetup is received in response to an RRCResumeRequest, RRCResumeRequest1 or RRCSetupRequest:

if T331 is running:

stop timer T331;

perform the actions as specified in 5.7.8.3;

enter RRC_CONNECTED;

stop the cell re-selection procedure;

consider the current cell to be the PCell;

set the content of RRCSetupComplete message as follows:

if upper layers provide a 5G-S-TMSI:

if the RRCSetup is received in response to an RRCSetupRequest:

set the ng-5G-S-TMSI-Value to ng-5G-S-TMSI-Part2;

else:

set the ng-5G-S-TMSI-Value to ng-5G-S-TMSI;

if upper layers selected an SNPN or a PLMN and in case of PLMN UE is either allowed or instructed to access the PLMN via a cell for which at least one CAG ID is broadcast:

set the selectedPLMN-Identity from the npn-IdentityInfoList;

else:

set the selectedPLMN-Identity to the PLMN selected by upper layers from the plmn-IdentityList;

if upper layers provide the 'Registered AMF':

include and set the registeredAMF as follows:

if the PLMN identity of the 'Registered AMF' is different from the PLMN selected by the upper layers:

include the plmnIdentity in the registeredAMF and set it to the value of the PLMN identity in the 'Registered AMF' received from upper layers;

set the amf-Identifier to the value received from upper layers;

include and set the guami-Type to the value provided by the upper layers;

if upper layers provide one or more S-NSSAI (see TS 23.003 [21]):

include the s-NSSAI-List and set the content to the values provided by the upper layers;

set the dedicatedNAS-Message to include the information received from upper layers;

if connecting as an IAB-node:

include the iab-NodeIndication;
if the SIB1 contains idleModeMeasurementsNR and the UE has NR idle/inactive measurement information concerning cells other than the PCell available in VarMeasIdleReport; or

if the SIB1 contains idleModeMeasurementsEUTRA and the UE has E-UTRA idle/inactive measurement information available in VarMeas IdleReport:

  if the UE has logged measurements available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:

    include the logMeasAvailable in the RRCSetupComplete message;

    if Bluetooth measurement results are included in the logged measurements the UE has available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:

      include the logMeasAvailableBT in the RRCSetupComplete message;

    if WLAN measurement results are included in the logged measurements the UE has available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:

      include the logMeasAvailableWLAN in the RRCSetupComplete message;

  if the UE has connection establishment failure or connection resume failure information available in VarConnEstFailReport and if the RPLMN is equal to plmn-Identity stored in VarConnEstFailReport:

    include connEstFailInfoAvailable in the RRCSetupComplete message;

  if the UE supports RLF report for inter-RAT MRO NR as defined in TS 36.306 and if the UE has radio link failure or handover failure information available in VarRLF-Report of TS 36.331:

    if reconnectCellId in VarRLF-Report of TS 36.331 is not set:

      set timeUntilReconnection in VarRLF-Report to the time that elapsed since the last radio link failure or handover failure;

      set nrReconnectCellId in reconnectCellId in VarRLF-Report to the global cell identity and the tracking area code of the PCell;

    include rlf-InfoAvailable in the RRCSetupComplete message;

  if the UE supports storage of mobility history information and the UE has mobility history information available in VarMobilityHistoryReport:

    include the mobilityHistoryAvailable in the RRCSetupComplete message;

  if the RRCSetup is received in response to an RRCResumeRequest, RRCResumeRequest1 or RRCSetupRequest:

    if speedStateReselectionPars is configured in the SIB2:
4> include the mobilityState in the RRCSetupComplete message and set it to the mobility state (as specified in TS 38.304 [20]) of the UE just prior to entering RRC_CONNECTED state;

1> submit the RRCSetupComplete message to lower layers for transmission, upon which the procedure ends.

5.3.3.5 Reception of the RRCReject by the UE

The UE shall:

1> perform the actions as specified in 5.3.15;

5.3.3.6 Cell re-selection or cell selection while T390, T300 or T302 is running (UE in RRC_IDLE)

The UE shall:

1> if cell reselection occurs while T300 or T302 is running:

   2> perform the actions upon going to RRC_IDLE as specified in 5.3.11 with release cause 'RRC connection failure';

1> else if cell selection or reselection occurs while T390 is running:

   2> stop T390 for all access categories;

   2> perform the actions as specified in 5.3.14.4.

5.3.3.7 T300 expiry

The UE shall:

1> if timer T300 expires:

   2> reset MAC, release the MAC configuration and re-establish RLC for all RBs that are established;

   2> if the UE supports RRC Connection Establishment failure with temporary offset and the T300 has expired a consecutive connEstFailCount times on the same cell for which connEstFailureControl is included in SIB1:

      3> for a period as indicated by connEstFailOffsetValidity:

         4> use connEstFailOffset for the parameter Qoffsettemp for the concerned cell when performing cell selection and reselection according to TS 38.304 [20] and TS 36.304 [27];

NOTE 1: When performing cell selection, if no suitable or acceptable cell can be found, it is up to UE implementation whether to stop using connEstFailOffset for the parameter Qoffsettemp during connEstFailOffsetValidity for the concerned cell.

2> if the UE has connection establishment failure information or connection resume failure information available in VarConnEstFailReport and if the RPLMN is not equal to plmn-identity stored in VarConnEstFailReport, or

2> if the cell identity of current cell is not equal to the cell identity stored in measResultFailedCell in VarConnEstFailReport:

      3> reset the numberOfConnFail to 0;

2> clear the content included in VarConnEstFailReport except for the numberOfConnFail, if any;

2> store the following connection establishment failure information in the VarConnEstFailReport by setting its fields as follows:

      3> set the plmn-Identity to the PLMN selected by upper layers (see TS 24.501 [23]) from the PLMN(s) included in the plmn-IdentityList in SIB1;
3> set the `measResultFailedCell` to include the global cell identity, tracking area code, the cell level and SS/PBCH block level RSRP, and RSRQ, and SS/PBCH block indexes, of the failed cell based on the available SSB measurements collected up to the moment the UE detected connection establishment failure;

3> if available, set the `measResultNeighCells`, in order of decreasing ranking-criterion as used for cell re-selection, to include neighbouring cell measurements for at most the following number of neighbouring cells: 6 intra-frequency and 3 inter-frequency neighbours per frequency as well as 3 inter-RAT neighbours, per frequency/ set of frequencies per RAT and according to the following:

4> for each neighbour cell included, include the optional fields that are available;

NOTE 2: The UE includes the latest results of the available measurements as used for cell reselection evaluation, which are performed in accordance with the performance requirements as specified in TS 38.133 [14].

3> if available, set the `locationInfo` as follows:

4> if available, set the `commonLocationInfo` to include the detailed location information;

4> if available, set the `bt-LocationInfo` to include the Bluetooth measurement results, in order of decreasing RSSI for Bluetooth beacons;

4> if available, set the `wlan-LocationInfo` to include the WLAN measurement results, in order of decreasing RSSI for WLAN APs;

4> if available, set the `sensor-LocationInfo` to include the sensor measurement results as follows;

5> if available, include the `sensor-MeasurementInformation`;

5> if available, include the `sensor-MotionInformation`;

3> set `perRAInfoList` to indicate random access failure information as specified in 5.7.10.5;

3> if the `numberOfConnFail` is smaller than 8:

4> increment the `numberOfConnFail` by 1;

2> inform upper layers about the failure to establish the RRC connection, upon which the procedure ends;

The UE may discard the connection establishment failure or connection resume failure information, i.e. release the UE variable `VarConnEstFailReport`, 48 hours after the last connection establishment failure is detected.

### 5.3.3.8 Abortion of RRC connection establishment

If upper layers abort the RRC connection establishment procedure, due to a NAS procedure being aborted as specified in TS 24.501 [23], while the UE has not yet entered RRC_CONNECTED, the UE shall:

1> stop timer T300, if running;

1> reset MAC, release the MAC configuration and re-establish RLC for all RBs that are established;
5.3.4 Initial AS security activation

5.3.4.1 General

The purpose of this procedure is to activate AS security upon RRC connection establishment.

5.3.4.2 Initiation

The network initiates the security mode command procedure to a UE in RRC_CONNECTED. Moreover, the network applies the procedure as follows:

- when only SRB1 is established, i.e. prior to establishment of SRB2 and/ or DRBs.

5.3.4.3 Reception of the SecurityModeCommand by the UE

The UE shall:

1> derive the $K_{ENB}$ key, as specified in TS 33.501 [11];

1> derive the $K_{RRCint}$ key associated with the integrityProtAlgorithm indicated in the SecurityModeCommand message, as specified in TS 33.501 [11];

1> request lower layers to verify the integrity protection of the SecurityModeCommand message, using the algorithm indicated by the integrityProtAlgorithm as included in the SecurityModeCommand message and the $K_{RRCint}$ key;

1> if the SecurityModeCommand message passes the integrity protection check:

2> derive the $K_{RRCenc}$ key and the $K_{UPenc}$ key associated with the cipheringAlgorithm indicated in the SecurityModeCommand message, as specified in TS 33.501 [11];

2> derive the $K_{UPint}$ key associated with the integrityProtAlgorithm indicated in the SecurityModeCommand message, as specified in TS 33.501 [11];

2> configure lower layers to apply SRB integrity protection using the indicated algorithm and the $K_{RRCint}$ key immediately, i.e. integrity protection shall be applied to all subsequent messages received and sent by the UE, including the SecurityModeComplete message;
2> configure lower layers to apply SRB ciphering using the indicated algorithm, the $K_{RRC\text{enc}}$ key after completing the procedure, i.e. ciphering shall be applied to all subsequent messages received and sent by the UE, except for the SecurityModeComplete message which is sent unciphered;

2> consider AS security to be activated;

2> submit the SecurityModeComplete message to lower layers for transmission, upon which the procedure ends;

1> else:

2> continue using the configuration used prior to the reception of the SecurityModeCommand message, i.e. neither apply integrity protection nor ciphering.

2> submit the SecurityModeFailure message to lower layers for transmission, upon which the procedure ends.

5.3.5 RRC reconfiguration

5.3.5.1 General

The purpose of this procedure is to modify an RRC connection, e.g. to establish/modify/release RBs, to perform reconfiguration with sync, to setup/modify/release measurements, to add/modify/release SCells and cell groups, to add/modify/release conditional handover configuration, to add/modify/release conditional PSCell change configuration. As part of the procedure, NAS dedicated information may be transferred from the Network to the UE.

RRC reconfiguration to perform reconfiguration with sync includes, but is not limited to, the following cases:

- reconfiguration with sync and security key refresh, involving RA to the PCell/PSCell, MAC reset, refresh of security and re-establishment of RLC and PDCP triggered by explicit L2 indicators;

- reconfiguration with sync but without security key refresh, involving RA to the PCell/PSCell, MAC reset and RLC re-establishment and PDCP data recovery (for AM DRB) triggered by explicit L2 indicators.

- reconfiguration with sync for DAPS and security key refresh, involving RA to the target PCell, establishment of target MAC, and

- for non-DAPS bearer: refresh of security and re-establishment of RLC and PDCP triggered by explicit L2 indicators;
- for DAPS bearer: establishment of RLC for the target PCell, refresh of security and reconfiguration of PDCP to add the ciphering function, the integrity protection function and ROHC function of the target PCell;
- for SRB: refresh of security and establishment of RLC and PDCP for the target PCell;
- reconfiguration with sync for DAPS but without security key refresh, involving RA to the target PCell, establishment of target MAC, and:
  - for non-DAPS bearer: RLC re-establishment and PDCP data recovery (for AM DRB) triggered by explicit L2 indicators.
  - for DAPS bearer: establishment of RLC for target PCell, reconfiguration of PDCP to add the ciphering function, the integrity protection function and ROHC function of the target PCell;
- for SRB: establishment of RLC and PDCP for the target PCell.

In (NG)EN-DC and NR-DC, SRB3 can be used for measurement configuration and reporting, for UE assistance (re-)configuration and reporting for power savings, to (re-)configure MAC, RLC, physical layer and RLF timers and constants of the SCG configuration, and to reconfigure PDCP for DRBs associated with the S-K_{gNB} or SRB3, and to reconfigure SDAP for DRBs associated with S-K_{gNB} in NGEN-DC and NR-DC, and to add/modify/release conditional PSCell change configuration, provided that the (re-)configuration does not require any MN involvement, and to transmit RRC messages between the MN and the UE during fast MCG link recovery. In (NG)EN-DC and NR-DC, only measConfig, radioBearerConfig, conditionalReconfiguration, otherConfig and/or secondaryCellGroup are included in RRCReconfiguration received via SRB3, except when RRCReconfiguration is received within DLInformationTransferMRDC.

5.3.5.2 Initiation

The Network may initiate the RRC reconfiguration procedure to a UE in RRC_CONNECTED. The Network applies the procedure as follows:
- the establishment of RBs (other than SRB1, that is established during RRC connection establishment) is performed only when AS security has been activated;
- the addition of Secondary Cell Group and SCells is performed only when AS security has been activated;
- the reconfigurationWithSync is included in secondaryCellGroup only when at least one RLC bearer or BH RLC channel is setup in SCG;
- the reconfigurationWithSync is included in masterCellGroup only when AS security has been activated, and SRB2 with at least one DRB or, for IAB, SRB2, are setup and not suspended;
- the conditionalReconfiguration for CPC is included only when at least one RLC bearer is setup in SCG;
- the conditionalReconfiguration for CHO is included only when AS security has been activated, and SRB2 with at least one DRB or, for IAB, SRB2, are setup and not suspended.

5.3.5.3 Reception of an RRCReconfiguration by the UE

The UE shall perform the following actions upon reception of the RRCReconfiguration, or upon execution of the conditional reconfiguration (CHO or CPC):

1> if the RRCReconfiguration is applied due to a conditional reconfiguration execution upon cell selection while timer T311 is running, as defined in 5.3.7.3:
   2> remove all the entries within VarConditionalReconfig, if any;
1> if the RRCReconfiguration includes the daps-SourceRelease:
   2> reset the source MAC and release the source MAC configuration;
   2> for each DAPS bearer:
      3> release the RLC entity or entities as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the source SpCell;
reconfigure the PDCP entity to release DAPS as specified in TS 38.323 [5];

for each SRB:

release the PDCP entity for the source SpCell;

release the RLC entity as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the source SpCell;

release the physical channel configuration for the source SpCell;

discard the keys used in the source SpCell (the K_{gNB} key, the K_{RRCenc} key, the K_{RRCint} key, the K_{UPint} key and the K_{UPenc} key), if any;

if the \textit{RRCReconfiguration} is received via other RAT (i.e., inter-RAT handover to NR):

if the \textit{RRCReconfiguration} does not include the \textit{fullConfig} and the UE is connected to 5GC (i.e., delta signalling during intra 5GC handover):

re-use the source RAT SDAP and PDCP configurations if available (i.e., current SDAP/PDCP configurations for all RBs from source E-UTRA RAT prior to the reception of the inter-RAT HO \textit{RRCReconfiguration} message);

else:

if the RRCReconfiguration includes the \textit{fullConfig}:

perform the full configuration procedure as specified in 5.3.5.11;

if the RRCReconfiguration includes the \textit{masterCellGroup}:

perform the cell group configuration for the received \textit{masterCellGroup} according to 5.3.5.5;

if the RRCReconfiguration includes the \textit{masterKeyUpdate}:

perform AS security key update procedure as specified in 5.3.5.7;

if the RRCReconfiguration includes the \textit{sk-Counter}:

perform security key update procedure as specified in 5.3.5.7;

if the RRCReconfiguration includes the secondaryCellGroup:

perform the cell group configuration for the SCG according to 5.3.5.5;

if the RRCReconfiguration includes the mrdc-SecondaryCellGroupConfig:

if the \textit{mrdc-SecondaryCellGroupConfig} is set to \textit{setup}:

if the \textit{mrdc-SecondaryCellGroupConfig} includes \textit{mrdc-ReleaseAndAdd}:

perform MR-DC release as specified in clause 5.3.5.10;

if the received \textit{mrdc-SecondaryCellGroup} is set to nr-SCG:

perform the RRC reconfiguration according to 5.3.5.3 for the \textit{RRCReconfiguration} message included in \textit{mrdc-SecondaryCellGroupConfig};

if the received \textit{mrdc-SecondaryCellGroup} is set to eutra-SCG:

perform the RRC connection reconfiguration as specified in TS 36.331 [10], clause 5.3.5.3 for the \textit{RRCConnectionReconfiguration} message included in \textit{eutra-SCG};

else (\textit{mrdc-SecondaryCellGroupConfig} is set to \textit{release}):

perform MR-DC release as specified in clause 5.3.5.10;

if the \textit{RRCReconfiguration} message includes the radioBearerConfig:
2> perform the radio bearer configuration according to 5.3.5.6;
1> if the RRCReconfiguration message includes the radioBearerConfig2:
2> perform the radio bearer configuration according to 5.3.5.6;
1> if the RRCReconfiguration message includes the measConfig:
2> perform the measurement configuration procedure as specified in 5.5.2;
1> if the RRCReconfiguration message includes the dedicatedNAS-MessageList:
2> forward each element of the dedicatedNAS-MessageList to upper layers in the same order as listed;
1> if the RRCReconfiguration message includes the dedicatedSIB1-Delivery:
2> perform the action upon reception of SIB1 as specified in 5.2.2.4.2;

NOTE 0: If this RRCReconfiguration is associated to the MCG and includes reconfigurationWithSync in spCellConfig and dedicatedSIB1-Delivery, the UE initiates (if needed) the request to acquire required SIBs, according to clause 5.2.2.3.5, only after the random access procedure towards the target SpCell is completed.

1> if the RRCReconfiguration message includes the dedicatedSystemInformationDelivery:
2> perform the action upon reception of System Information as specified in 5.2.2.4;
1> if the RRCReconfiguration message includes the dedicatedPosSysInfoDelivery:
2> perform the action upon reception of the contained posSIB(s), as specified in sub-clause 5.2.2.4.16;
1> if the RRCReconfiguration message includes the otherConfig:
2> perform the other configuration procedure as specified in 5.3.5.9;
1> if the RRCReconfiguration message includes the bap-Config:
2> perform the BAP configuration procedure as specified in 5.3.5.12;
1> if the RRCReconfiguration message includes the iab-IP-AddressConfigurationList:
2> if iab-IP-AddressToReleaseList is included:
3> perform release of IP address as specified in 5.3.5.12a.1.1;
2> if iab-IP-AddressToAddModList is included:
3> perform IAB IP address addition/updated as specified in 5.3.5.12a.1.2;
1> if the RRCReconfiguration message includes the conditionalReconfiguration:
2> perform conditional reconfiguration as specified in 5.3.5.13;
1> if the RRCReconfiguration message includes the needForGapsConfigNR:
2> if needForGapsConfigNR is set to setup:
3> consider itself to be configured to provide the measurement gap requirement information of NR target bands;
2> else:
3> consider itself not to be configured to provide the measurement gap requirement information of NR target bands;
1> if the RRCReconfiguration message includes the sl-ConfigDedicatedNR:
2> perform the sidelink dedicated configuration procedure as specified in 5.3.5.14;
NOTE 0a: If the sl-ConfigDedicatedNR was received embedded within an E-UTRA RRCConectionReconfiguration message, the UE does not build an NR RRCConectionReconfigurationComplete message for the received sl-ConfigDedicatedNR.

1> if the RRCConection message includes the sl-ConfigDedicatedEUTRA-Info:

2> perform related procedures for V2X sidelink communication in accordance with TS 36.331 [10], clause 5.3.10 and clause 5.5.2;

1> set the content of the RRCConectionComplete message as follows:

2> if the RRCConection includes the masterCellGroup containing the reportUplinkTxDirectCurrent:

3> include the uplinkTxDirectCurrentList for each MCG serving cell with UL;

3> include uplinkDirectCurrentBWP-SUL for each MCG serving cell configured with SUL carrier, if any, within the uplinkTxDirectCurrentList;

2> if the RRCConection includes the secondaryCellGroup containing the reportUplinkTxDirectCurrent:

3> include the uplinkTxDirectCurrentList for each SCG serving cell with UL;

3> include uplinkDirectCurrentBWP-SUL for each SCG serving cell configured with SUL carrier, if any, within the uplinkTxDirectCurrentList;

2> if the RRCConection message includes the mrdc-SecondaryCellGroupConfig with mrdc-SecondaryCellGroup set to eutra-SCG:

3> include in the eutra-SCG-Response the E-UTRA RRCConectionReconfigurationComplete message in accordance with TS 36.331 [10] clause 5.3.5.3;

2> if the RRCConection message includes the mrdc-SecondaryCellGroupConfig with mrdc-SecondaryCellGroup set to nr-SCG:

3> include in the nr-SCG-Response the RRCConectionComplete message;

2> if the RRCConection message was included in an RRCConection message:

3> include the RRCConectionComplete message in the nr-SCG-Response within the scg-Response in the RRCConectionComplete message;

2> if the RRCConection message was included in E-UTRA RRCConectionResume message:

3> include the RRCConectionComplete message in the E-UTRA MCG RRC message RRCConectionResumeComplete in accordance with TS 36.331 [10], clause 5.3.3.4a;

2> if the UE has logged measurements available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:

3> include the logMeasAvailable in the RRCConectionComplete message;

3> if Bluetooth measurement results are included in the logged measurements the UE has available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:

4> include the logMeasAvailableBT in the RRCConectionComplete message;

3> if WLAN measurement results are included in the logged measurements the UE has available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:

4> include the logMeasAvailableWLAN in the RRCConectionComplete message;

2> if the UE has connection establishment failure or connection resume failure information available in VarConnEstFailReport and if the RPLMN is equal to plmn-Identity stored in VarConnEstFailReport:

3> include connEstFailInfoAvailable in the RRCConectionComplete message;

2> if the RRCConection message was received in response to the MCGFailureInformation message:
3> clear the information included in \textit{VarRLF-Report}, if any;

2> if the UE has radio link failure or handover failure information available in \textit{VarRLF-Report} and if the RPLMN is included in \textit{plmn-IdentityList} stored in \textit{VarRLF-Report}; or

2> if the UE has radio link failure or handover failure information available in \textit{VarRLF-Report} of TS 36.331[10] and if the UE is capable of cross-RAT RLF reporting and if the RPLMN is included in \textit{plmn-IdentityList} stored in \textit{VarRLF-Report} of TS 36.331[10];

3> include \textit{rlf-InfoAvailable} in the \textit{RRCReconfigurationComplete} message;

2> if the \textit{RRCReconfiguration} message was received via SRB1, but not within \textit{mrdc-SecondaryCellGroup} or E-UTRA \textit{RRCConnectionReconfiguration} or E-UTRA \textit{RRCConnectionResume};

3> if the UE is configured to provide the measurement gap requirement information of NR target bands:

4> if the \textit{RRCReconfiguration} message includes the \textit{needForGapsConfigNR}; or

4> if the \textit{NeedForGapsInfoNR} information is changed compared to last time the UE reported this information:

5> include the \textit{NeedForGapsInfoNR} and set the contents as follows:

6> include \textit{intraFreq-needForGap} and set the gap requirement information of intra-frequency measurement for each NR serving cell;

6> if \textit{requestedTargetBandFilterNR} is configured, for each supported NR band that is also included in \textit{requestedTargetBandFilterNR}, include an entry in \textit{interFreq-needForGap} and set the gap requirement information for that band; otherwise, include an entry in \textit{interFreq-needForGap} and set the corresponding gap requirement information for each supported NR band;

1> if the UE is configured with E-UTRA \textit{nr-SecondaryCellGroupConfig} (UE in (NG)EN-DC):

2> if the \textit{RRCReconfiguration} message was received via E-UTRA SRB1 as specified in TS 36.331[10]; or

2> if the \textit{RRCReconfiguration} message was received via E-UTRA RRC message \textit{RRCConnectionReconfiguration} within \textit{MobilityFromNRCommand};

3> if the \textit{RRCReconfiguration} is applied due to a conditional reconfiguration execution:

4> submit the \textit{RRCReconfigurationComplete} message via the E-UTRA MCG embedded in E-UTRA RRC message \textit{ULInformationTransferMRDC} as specified in TS 36.331[10], clause 5.6.2a.

3> else:

4> submit the \textit{RRCReconfigurationComplete} via E-UTRA embedded in E-UTRA RRC message \textit{RRCConnectionReconfigurationComplete} as specified in TS 36.331[10], clause 5.3.5.3/5.3.5.4/5.4.2.3;

3> if \textit{reconfigurationWithSync} was included in \textit{spCellConfig} of an SCG:

4> initiate the Random Access procedure on the SpCell, as specified in TS 38.321[3];

3> else:

4> the procedure ends;

2> if the \textit{RRCReconfiguration} message was received within \textit{nr-SecondaryCellGroupConfig} in \textit{RRCConnectionReconfiguration} message received via SRB3 within \textit{DLInformationTransferMRDC}:

3> submit the \textit{RRCReconfigurationComplete} via E-UTRA embedded in E-UTRA RRC message \textit{RRCConnectionReconfigurationComplete} as specified in TS 36.331[10], clause 5.3.5.3/5.3.5.4;

3> if \textit{reconfigurationWithSync} was included in \textit{spCellConfig} of an SCG:

4> initiate the Random Access procedure on the SpCell, as specified in TS 38.321[3];
else:
    the procedure ends;

NOTE 1: The order the UE sends the **RRCConnectionReconfigurationComplete** message and performs the Random Access procedure towards the SCG is left to UE implementation.

else (RRCReconfiguration was received via SRB3) but not within **DLInformationTransferMRDC**:

submit the **RRCReconfigurationComplete** message via SRB3 to lower layers for transmission using the new configuration;

NOTE 2: In (NG)EN-DC and NR-DC, in the case RRCReconfiguration is received via SRB1 or within DLInformationTransferMRDC via SRB3, the random access is triggered by RRC layer itself as there is not necessarily other UL transmission. In the case RRCReconfiguration is received via SRB3 but not within DLInformationTransferMRDC, the random access is triggered by the MAC layer due to arrival of RRCReconfigurationComplete.

else if the RRCReconfiguration message was received via SRB1 within the nr-SCG within mrdc-SecondaryCellGroup (UE in NR-DC, mrdc-SecondaryCellGroup was received in RRCReconfiguration or RRCResume via SRB1):

if the RRCReconfiguration is applied due to a conditional reconfiguration execution:

submit the **RRCReconfigurationComplete** message via the NR MCG embedded in NR RRC message ULInformationTransferMRDC as specified in clause 5.7.2a.3.

if reconfigurationWithSync was included in spCellConfig in nr-SCG:

initiate the Random Access procedure on the PSCell, as specified in TS 38.321 [3];

else
    the procedure ends;

NOTE 2a: The order in which the UE sends the **RRCReconfigurationComplete** message and performs the Random Access procedure towards the SCG is left to UE implementation.

else if the RRCReconfiguration message was received via SRB3 (UE in NR-DC):

if the RRCReconfiguration message was received within DLInformationTransferMRDC:

if the RRCReconfiguration message was received within the nr-SCG within mrdc-SecondaryCellGroup (NR SCG RRC Reconfiguration):

if reconfigurationWithSync was included in spCellConfig in nr-SCG:

initiate the Random Access procedure on the PSCell, as specified in TS 38.321 [3];

else:
    the procedure ends;

else:
    submit the **RRCReconfigurationComplete** message via SRB1 to lower layers for transmission using the new configuration;

else:
    submit the **RRCReconfigurationComplete** message via SRB3 to lower layers for transmission using the new configuration;

else (RRCReconfiguration was received via SRB1):

submit the **RRCReconfigurationComplete** message via SRB1 to lower layers for transmission using the new configuration;
if this is the first \textit{RRCReconfiguration} message after successful completion of the RRC re-establishment procedure:

resume SRB2 and DRBs that are suspended;

if \textit{reconfigurationWithSync} was included in \textit{spCellConfig} of an MCG or SCG, and when MAC of an NR cell group successfully completes a Random Access procedure triggered above:

stop timer T304 for that cell group;

stop timer T310 for source SpCell if running;

apply the parts of the CSI reporting configuration, the scheduling request configuration and the sounding RS configuration that do not require the UE to know the SFN of the respective target SpCell, if any;

apply the parts of the measurement and the radio resource configuration that require the UE to know the SFN of the respective target SpCell (e.g. measurement gaps, periodic CQI reporting, scheduling request configuration, sounding RS configuration), if any, upon acquiring the SFN of that target SpCell;

for each DRB configured as DAPS bearer, request uplink data switching to the PDCP entity, as specified in TS 38.323 [5];

if the \textit{reconfigurationWithSync} was included in \textit{spCellConfig} of an MCG:

\begin{enumerate}
\item if T390 is running:
  \begin{enumerate}
  \item stop timer T390 for all access categories;
  \item perform the actions as specified in 5.3.14.4.
  \end{enumerate}
\item if T350 is running:
  \begin{enumerate}
  \item stop timer T350;
  \end{enumerate}
\item if \textit{RRCReconfiguration} does not include \textit{dedicatedSIB1-Delivery} and
\item if the active downlink BWP, which is indicated by the \textit{firstActiveDownlinkBWP-Id} for the target SpCell of the MCG, has a common search space configured by \textit{searchSpaceSIB1}:
  \begin{enumerate}
  \item acquire the \textit{SIB1}, which is scheduled as specified in TS 38.213 [13], of the target SpCell of the MCG;
  \item upon acquiring \textit{SIB1}, perform the actions specified in clause 5.2.2.4.2;
  \end{enumerate}
\end{enumerate}

if \textit{reconfigurationWithSync} was included in \textit{spCellConfig} of an MCG; or:

\begin{enumerate}
\item remove all the entries within \textit{VarConditionalReconfig}, if any;
\item for each \textit{measId} of the source SpCell configuration, if the associated \textit{reportConfig} has a \textit{reportType} set to \textit{condTriggerConfig}:
  \begin{enumerate}
  \item for the associated \textit{reportConfigId}:
    \begin{enumerate}
    \item remove the entry with the matching \textit{reportConfigId} from the \textit{reportConfigList} within the \textit{VarMeasConfig};
    \end{enumerate}
  \end{enumerate}
\item if the associated \textit{measObjectId} is only associated to a \textit{reportConfig} with \textit{reportType} set to \textit{condTriggerConfig}:
  \begin{enumerate}
  \item remove the entry with the matching \textit{measObjectId} from the \textit{measObjectList} within the \textit{VarMeasConfig};
  \end{enumerate}
\item remove the entry with the matching \textit{measId} from the \textit{measIdList} within the \textit{VarMeasConfig};
\end{enumerate}
\end{enumerate}

if \textit{reconfigurationWithSync} was included in \textit{masterCellGroup} or \textit{secondaryCellGroup}; and
2> if the UE initiated transmission of a \textit{UEAssistanceInformation} message for the corresponding cell group during the last 1 second, and the UE is still configured to provide the concerned UE assistance information for the corresponding cell group:

3> initiate transmission of a \textit{UEAssistanceInformation} message for the corresponding cell group in accordance with clause 5.7.4.3 to provide the concerned UE assistance information;

3> start or restart the prohibit timer (if exists) associated with the concerned UE assistance information with the timer value set to the value in corresponding configuration;

2> if \textit{SIB12} is provided by the target PCell; and the UE initiated transmission of a \textit{SidelinkUEInformationNR} message indicating a change of NR sidelink communication related parameters relevant in target PCell (i.e. change of \textit{sl-RxInterestedFreqList} or \textit{sl-TxResourceReqList}) during the last 1 second preceding reception of the \textit{RRCReconfiguration} message including \textit{reconfigurationWithSync} in \textit{spCellConfig} of an MCG:

3> initiate transmission of the \textit{SidelinkUEInformationNR} message in accordance with 5.8.3.3;

2> the procedure ends.

\textbf{NOTE 3:} The UE is only required to acquire broadcasted \textit{SIB1} if the UE can acquire it without disrupting unicast data reception, i.e. the broadcast and unicast beams are quasi co-located.

\textbf{NOTE 4:} The UE sets the content of \textit{UEAssistanceInformation} according to latest configuration (i.e. the configuration after applying the \textit{RRCReconfiguration} message) and latest UE preference. The UE may include more than the concerned UE assistance information within the \textit{UEAssistanceInformation} according to 5.7.4.2. Therefore, the content of \textit{UEAssistanceInformation} message might not be the same as the content of the previous \textit{UEAssistanceInformation} message.

5.3.5.4 Secondary cell group release

The UE shall:

1> as a result of SCG release triggered by E-UTRA (i.e. (NG)EN-DC case) or NR (i.e. NR-DC case):

2> reset SCG MAC, if configured;

2> for each RLC bearer that is part of the SCG configuration:

3> perform RLC bearer release procedure as specified in 5.3.5.5.3;

2> for each BH RLC channel that is part of the SCG configuration:

3> perform BH RLC channel release procedure as specified in 5.3.5.5.10;

2> release the SCG configuration;

2> if CPC was configured,

3> remove all the entries within \textit{VarConditionalReconfig}, if any;

2> stop timer T310 for the corresponding SpCell, if running;

2> stop timer T312 for the corresponding SpCell, if running;

2> stop timer T304 for the corresponding SpCell, if running.

\textbf{NOTE:} Release of cell group means only release of the lower layer configuration of the cell group but the \textit{RadioBearerConfig} may not be released.

5.3.5.5 Cell Group configuration

5.3.5.5.1 General

The network configures the UE with Master Cell Group (MCG), and zero or one Secondary Cell Group (SCG). In (NG)EN-DC, the MCG is configured as specified in TS 36.331 [10], and for NE-DC, the SCG is configured as
specified in TS 36.331 [10]. The network provides the configuration parameters for a cell group in the `CellGroupConfig` IE.

The UE performs the following actions based on a received `CellGroupConfig` IE:

1. if the `CellGroupConfig` contains the `spCellConfig` with `reconfigurationWithSync`:
   2. perform Reconfiguration with sync according to 5.3.5.5.2;
   2. resume all suspended radio bearers and resume SCG transmission for all radio bearers, if suspended;
1. if the `CellGroupConfig` contains the `rlc-BearerToReleaseList`:
   2. perform RLC bearer release as specified in 5.3.5.5.3;
1. if the `CellGroupConfig` contains the `rlc-BearerToAddModList`:
   2. perform the RLC bearer addition/modification as specified in 5.3.5.5.4;
1. if the `CellGroupConfig` contains the `mac-CellGroupConfig`:
   2. configure the MAC entity of this cell group as specified in 5.3.5.5.5;
1. if the `CellGroupConfig` contains the `sCellToReleaseList`:
   2. perform SCell release as specified in 5.3.5.5.8;
1. if the `CellGroupConfig` contains the `spCellConfig`:
   2. configure the SpCell as specified in 5.3.5.5.7;
1. if the `CellGroupConfig` contains the `sCellToAddModList`:
   2. perform SCell addition/modification as specified in 5.3.5.5.9;
1. if the `CellGroupConfig` contains the `bh-RLC-ChannelToReleaseList`:
   2. perform BH RLC channel release as specified in 5.3.5.5.10;
1. if the `CellGroupConfig` contains the `bh-RLC-ChannelToAddModList`:
   2. perform the BH RLC channel addition/modification as specified in 5.3.5.5.11;

5.3.5.5.2 Reconfiguration with sync

The UE shall perform the following actions to execute a reconfiguration with sync.

1. if the AS security is not activated, perform the actions upon going to RRC_IDLE as specified in 5.3.11 with the release cause 'other' upon which the procedure ends;
1. if no DAPS bearer is configured:
   2. stop timer T310 for the corresponding SpCell, if running;
1. if this procedure is executed for the MCG:
   2. if timer T316 is running;
      3. stop timer T316;
      3. clear the information included in `VarRLF-Report`, if any;
   2. resume MCG transmission, if suspended.
1. stop timer T312 for the corresponding SpCell, if running;
1. start timer T304 for the corresponding SpCell with the timer value set to `t304`, as included in the `reconfigurationWithSync`;
1> if the frequencyInfoDL is included:

2> consider the target SpCell to be one on the SSB frequency indicated by the frequencyInfoDL with a physical cell identity indicated by the physCellId;

1> else:

2> consider the target SpCell to be one on the SSB frequency of the source SpCell with a physical cell identity indicated by the physCellId;

1> start synchronising to the DL of the target SpCell;

1> apply the specified BCCH configuration defined in 9.1.1.1 for the target SpCell;

1> acquire the MIB of the target SpCell, which is scheduled as specified in TS 38.213 [13];

NOTE 1: The UE should perform the reconfiguration with sync as soon as possible following the reception of the RRC message triggering the reconfiguration with sync, which could be before confirming successful reception (HARQ and ARQ) of this message.

NOTE 2: The UE may omit reading the MIB if the UE already has the required timing information, or the timing information is not needed for random access.

NOTE 2a: A UE with DAPS bearer does not monitor for system information updates in the source PCell.

1> If any DAPS bearer is configured:

2> create a MAC entity for the target cell group with the same configuration as the MAC entity for the source cell group;

2> for each DAPS bearer:

3> establish an RLC entity or entities for the target cell group, with the same configurations as for the source cell group;

3> establish the logical channel for the target cell group, with the same configurations as for the source cell group;

NOTE 2b: In order to understand if a DAPS bearer is configured, the UE needs to check the presence of the field daps-Config within the RadioBearerConfig IE received in radioBearerConfig or radioBearerConfig2.

2> for each SRB:

3> establish an RLC entity for the target cell group, with the same configurations as for the source cell group;

3> establish the logical channel for the target cell group, with the same configurations as for the source cell group;

2> suspend SRBs for the source cell group;

NOTE 3: Void

2> apply the value of the newUE-Identity as the C-RNTI in the target cell group;

2> configure lower layers for the target SpCell in accordance with the received spCellConfigCommon;

2> configure lower layers for the target SpCell in accordance with any additional fields, not covered in the previous, if included in the received reconfigurationWithSync.

1> else:

2> reset the MAC entity of this cell group;

2> consider the SCell(s) of this cell group, if configured, that are not included in the SCellToAddModList in the RRCReconfiguration message, to be in deactivated state;
2> apply the value of the newUE-Identity as the C-RNTI for this cell group;
2> configure lower layers in accordance with the received spCellConfigCommon;
2> configure lower layers in accordance with any additional fields, not covered in the previous, if included in the received reconfigurationWithSync.

5.3.5.5.3 RLC bearer release

The UE shall:

1> for each logicalChannelIdentity value included in the rlc-BearerToReleaseList that is part of the current UE configuration within the same cell group (LCH release); or
1> for each logicalChannelIdentity value that is to be released as the result of an SCG release according to 5.3.5.4:
   2> release the RLC entity or entities as specified in TS 38.322 [4], clause 5.1.3;
   2> release the corresponding logical channel.

5.3.5.5.4 RLC bearer addition/modification

For each RLC-BearerConfig received in the rlc-BearerToAddModList IE the UE shall:

1> if the UE’s current configuration contains an RLC bearer with the received logicalChannelIdentity within the same cell group:
   2> if the RLC bearer is associated with an DAPS bearer:
      3> reconfigure the RLC entity or entities for the target cell group in accordance with the received rlc-Config;
      3> reconfigure the logical channel for the target cell group in accordance with the received mac-LogicalChannelConfig;
   2> else:
      3> if reestablishRLC is received:
         4> re-establish the RLC entity as specified in TS 38.322 [4];
      3> reconfigure the RLC entity or entities in accordance with the received rlc-Config;
      3> reconfigure the logical channel in accordance with the received mac-LogicalChannelConfig;

NOTE: The network does not re-associate an already configured logical channel with another radio bearer. Hence servedRadioBearer is not present in this case.

1> else (a logical channel with the given logicalChannelIdentity is not configured within the same cell group, including the case when full configuration option is used):
   2> if the servedRadioBearer associates the logical channel with an SRB and rlc-Config is not included:
      3> establish an RLC entity in accordance with the default configuration defined in 9.2 for the corresponding SRB;
   2> else:
      3> establish an RLC entity in accordance with the received rlc-Config;
   2> if the servedRadioBearer associates the logical channel with an SRB and if mac-LogicalChannelConfig is not included:
      3> configure this MAC entity with a logical channel in accordance to the default configuration defined in 9.2 for the corresponding SRB;
   2> else:
3> configure this MAC entity with a logical channel in accordance to the received \textit{mac-LogicalChannelConfig};

2> associate this logical channel with the PDCP entity identified by \textit{servedRadioBearer}.

5.3.5.5.5 MAC entity configuration

The UE shall:

1> if SCG MAC is not part of the current UE configuration (i.e. SCG establishment):

2> create an SCG MAC entity;

1> if any DAPS bearer is configured:

2> reconfigure the MAC main configuration for the target cell group in accordance with the received \textit{mac-CellGroupConfig} excluding \textit{tag-ToReleaseList} and \textit{tag-ToAddModList};

1> else:

2> reconfigure the MAC main configuration of the cell group in accordance with the received \textit{mac-CellGroupConfig} excluding \textit{tag-ToReleaseList} and \textit{tag-ToAddModList};

1> if the received \textit{mac-CellGroupConfig} includes the \textit{tag-ToReleaseList}:

2> for each \textit{TAG-Id} value included in the \textit{tag-ToReleaseList} that is part of the current UE configuration:

3> release the TAG indicated by \textit{TAG-Id};

1> if the received \textit{mac-CellGroupConfig} includes the \textit{tag-ToAddModList}:

2> for each \textit{tag-Id} value included in \textit{tag-ToAddModList} that is not part of the current UE configuration (TAG addition):

3> add the TAG, corresponding to the \textit{tag-Id}, in accordance with the received \textit{timeAlignmentTimer};

2> for each \textit{tag-Id} value included in \textit{tag-ToAddModList} that is part of the current UE configuration (TAG modification):

3> reconfigure the TAG, corresponding to the \textit{tag-Id}, in accordance with the received \textit{timeAlignmentTimer}.

5.3.5.5.6 RLF Timers & Constants configuration

The UE shall:

1> if the received \textit{rlf-TimersAndConstants} is set to \textit{release}:

2> if any DAPS bearer is configured:

3> use values for timers T301, T310, T311 and constants N310, N311 for the target cell group, as included in \textit{ue-TimersAndConstants} received in \textit{SIB1};

2> else:

3> use values for timers T301, T310, T311 and constants N310, N311, as included in \textit{ue-TimersAndConstants} received in \textit{SIB1};

1> else:

2> if any DAPS bearer is configured:

3> configure the value of timers and constants for the target cell group in accordance with received \textit{rlf-TimersAndConstants};

2> else:

3> (re-)configure the value of timers and constants in accordance with received \textit{rlf-TimersAndConstants};
5.3.5.5.7 SpCell Configuration

The UE shall:

1> if the SpCellConfig contains the rlf-TimersAndConstants:
   2> configure the RLF timers and constants for this cell group as specified in 5.3.5.5.6;

1> else if rlf-TimersAndConstants is not configured for this cell group:
   2> if any DAPS bearer is configured:
      3> use values for timers T301, T310, T311 and constants N310, N311 for the target cell group, as included in ue-TimersAndConstants received in SIB1;
   2> else
      3> use values for timers T301, T310, T311 and constants N310, N311, as included in ue-TimersAndConstants received in SIB1;

1> if the SpCellConfig contains spCellConfigDedicated:
   2> configure the SpCell in accordance with the spCellConfigDedicated;
   2> consider the bandwidth part indicated in firstActiveUplinkBWP-Id if configured to be the active uplink bandwidth part;
   2> consider the bandwidth part indicated in firstActiveDownlinkBWP-Id if configured to be the active downlink bandwidth part;
   2> if any of the reference signal(s) that are used for radio link monitoring are reconfigured by the received spCellConfigDedicated:
      3> stop timer T310 for the corresponding SpCell, if running;
      3> stop timer T312 for the corresponding SpCell, if running;
      3> reset the counters N310 and N311.

5.3.5.5.8 SCell Release

The UE shall:

1> if the release is triggered by reception of the sCellToReleaseList:
   2> for each sCellIndex value included in the sCellToReleaseList:
      3> if the current UE configuration includes an SCell with value sCellIndex:
         4> release the SCell.

5.3.5.5.9 SCell Addition/Modification

The UE shall:

1> for each sCellIndex value included in the sCellToAddModList that is not part of the current UE configuration (SCell addition):
   2> add the SCell, corresponding to the sCellIndex, in accordance with the sCellConfigCommon and sCellConfigDedicated;
if the sCellState is included:
  configure lower layers to consider the SCell to be in activated state;
else:
  configure lower layers to consider the SCell to be in deactivated state;
for each measId included in the measIdList within VarMeasConfig:
  if SCells are not applicable for the associated measurement; and
  if the concerned SCell is included in cellsTriggeredList defined within the VarMeasReportList for this measId:
    remove the concerned SCell from cellsTriggeredList defined within the VarMeasReportList for this measId;
for each sCellIndex value included in the sCellToAddModList that is part of the current UE configuration (SCell modification):
  modify the SCell configuration in accordance with the sCellConfigDedicated;
  if the sCellToAddModList was received in an RRCReconfiguration message including reconfigurationWithSync embedded in an RRCResume message or embedded in an E-UTRA RRCConnectionResume message:
    if the sCellState is included:
      configure lower layers to consider the SCell to be in activated state;
    else:
      configure lower layers to consider the SCell to be in deactivated state.

5.3.5.5.10 BH RLC channel release
The IAB-node shall:
  for each BH-RLC-ChannelID value included in the bh-RLC-ChannelToReleaseList that is part of the current IAB-node configuration within the same cell group (LCH release); or
  for each BH-RLC-ChannelID value that is to be released as the result of an SCG release according to 5.3.5.4:
    release the RLC entity or entities as specified in TS 38.322 [4], clause 5.1.3;
    release the corresponding logical channel.

5.3.5.5.11 BH RLC channel addition/modification
For each BH-RLC-ChannelConfig received in the bh-RLC-ChannelToAddModList IE the IAB-node shall:
  if the current configuration contains a BH RLC Channel with the received bh-RLC-ChannelID within the same cell group:
    if reestablishRLC is received:
      re-establish the RLC entity as specified in TS 38.322 [4];
    reconfigure the RLC entity or entities in accordance with the received rlc-Config;
    reconfigure the logical channel in accordance with the received mac-LogicalChannelConfig;
  else (a backhaul logical channel with the given BH-RLC-ChannelID was not configured before within the same cell group):
    establish an RLC entity in accordance with the received rlc-Config;
configure this MAC entity with a logical channel in accordance to the received `mac-LogicalChannelConfig`.

5.3.5.6 Radio Bearer configuration

5.3.5.6.1 General

The UE shall perform the following actions based on a received `RadioBearerConfig` IE:

1. if the `RadioBearerConfig` includes the `srb3-ToRelease`:
   2. perform the SRB release as specified in 5.3.5.6.2;

1. if the `RadioBearerConfig` includes the `srb-ToAddModList` or if any DAPS bearer is configured:
   2. perform the SRB addition or reconfiguration as specified in 5.3.5.6.3;

1. if the `RadioBearerConfig` includes the `drb-ToReleaseList`:
   2. perform DRB release as specified in 5.3.5.6.4;

1. if the `RadioBearerConfig` includes the `drb-ToAddModList`:
   2. perform DRB addition or reconfiguration as specified in 5.3.5.6.5.

1. release all SDAP entities, if any, that have no associated DRB as specified in TS 37.324 [24] clause 5.1.2, and indicate the release of the user plane resources for PDU Sessions associated with the released SDAP entities to upper layers.

5.3.5.6.2 SRB release

The UE shall:

1. release the PDCP entity and the `srb-Identity` of the SRB3.

5.3.5.6.3 SRB addition/modification

The UE shall:

1. If any DAPS bearer is configured for each SRB:
   2. establish a PDCP entity for the target cell group as specified in TS 38.323 [5], with the same configuration as the PDCP entity for the source cell group;
   2. if the `masterKeyUpdate` is received:
      3. configure the PDCP entity with the security algorithms according to `securityConfig` and apply the keys (KRRCenc and KRRCint) associated with the master key (KgNB);
   2. else:
      3. configure the PDCP entity for the target cell group with state variables continuation as specified in TS 38.323 [5], the state variables and security configuration as the PDCP entity for the source cell group;

1. for each `srb-Identity` value included in the `srb-ToAddModList` that is not part of the current UE configuration (SRB establishment or reconfiguration from E-UTRA PDCP to NR PDCP):
   2. establish a PDCP entity;
   2. if AS security has been activated:
      3. if target RAT of handover is E-UTRA/5GC; or
      3. if the UE is connected to E-UTRA/5GC:
         4. if the UE is capable of E-UTRA/5GC, but not capable of NGEN-DC:
5> configure the PDCP entity with the security algorithms and keys (K_RRCenc and K_RRCint) configured/derived as specified in TS 36.331 [10];

4> else (i.e., UE capable of NGEN-DC):

5> configure the PDCP entity with the security algorithms according to securityConfig and apply the keys (K_RRCenc and K_RRCint) associated with the master key (K_{NB}) or secondary key (S-K_{NB}) as indicated in keyToUse, if applicable;

3> else (i.e., UE connected to NR or UE in EN-DC):

4> configure the PDCP entity with the security algorithms according to securityConfig and apply the keys (K_RRCenc and K_RRCint) associated with the master key (K_{NB}/ K_{NB}) or secondary key (S-K_{NB}) as indicated in keyToUse, if applicable;

2> if the current UE configuration as configured by E-UTRA in TS 36.331 [10] includes an SRB identified with the same srb-Identity value:

3> associate the E-UTRA RLC entity and DCCH of this SRB with the NR PDCP entity;

3> release the E-UTRA PDCP entity of this SRB;

2> if the pdcp-Config is included:

3> configure the PDCP entity in accordance with the received pdcp-Config;

2> else:

3> configure the PDCP entity in accordance with the default configuration defined in 9.2.1 for the corresponding SRB;

1> if any DAPS bearer is configured, for each srb-Identity value included in the srb-ToAddModList that is part of the current UE configuration:

2> if the pdcp-Config is included:

3> reconfigure the PDCP entity for the target cell group in accordance with the received pdcp-Config;

1> else, for each srb-Identity value included in the srb-ToAddModList that is part of the current UE configuration:

2> if the reestablishPDCP is set:

3> if target RAT of handover is E-UTRA/5GC; or

3> if the UE is connected to E-UTRA/5GC:

4> if the UE is capable of E-UTRA/5GC, but not capable of NGEN-DC:

5> configure the PDCP entity to apply the integrity protection algorithm and K_RRCint key configured/derived as specified in TS 36.331 [10], i.e. the integrity protection configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

5> configure the PDCP entity to apply the ciphering algorithm and K_RRCenc key configured/derived as specified in TS 36.331 [10], i.e. the ciphering configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

4> else (i.e., a UE capable of NGEN-DC):

5> configure the PDCP entity to apply the integrity protection algorithm and K_{NBC} key associated with the master key (K_{NB}) or secondary key (S-K_{NB}), as indicated in keyToUse, i.e. the integrity protection configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

5> configure the PDCP entity to apply the ciphering algorithm and K_{NBC} key associated with the master key (K_{NB}) or secondary key (S-K_{NB}) as indicated in keyToUse, i.e. the ciphering
configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

3> else (i.e., UE connected to NR or UE in EN-DC):

4> configure the PDCP entity to apply the integrity protection algorithm and $K_{RRCh}$ key associated with the master key ($K_{NB}/K_{NB}$) or secondary key ($S-K_{NB}$) as indicated in keyToUse, i.e., the integrity protection configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

4> configure the PDCP entity to apply the ciphering algorithm and $K_{RRCenc}$ key associated with the master key ($K_{NB}/K_{NB}$) or secondary key ($S-K_{NB}$) as indicated in keyToUse, i.e., the ciphering configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

3> re-establish the PDCP entity of this SRB as specified in TS 38.323 [5];

2> else, if the discardOnPDCP is set:

3> trigger the PDCP entity to perform SDU discard as specified in TS 38.323 [5];

2> if the pdcp-Config is included:

3> reconfigure the PDCP entity in accordance with the received pdcp-Config.

5.3.5.6.4 DRB release

The UE shall:

1> for each $drb-Identity$ value included in the $drb-ToReleaseList$ that is part of the current UE configuration; or

1> for each $drb-Identity$ value that is to be released as the result of full configuration according to 5.3.5.11:

2> release the PDCP entity and the $drb-Identity$;

2> if SDAP entity associated with this DRB is configured:

3> indicate the release of the DRB to SDAP entity associated with this DRB (TS 37.324 [24], clause 5.3.3);

2> if the DRB is associated with an eps-BearerIdentity:

3> if a new bearer is not added either with NR or E-UTRA with same eps-BearerIdentity:

4> indicate the release of the DRB and the eps-BearerIdentity of the released DRB to upper layers.

NOTE 1: The UE does not consider the message as erroneous if the $drb-ToReleaseList$ includes any $drb-Identity$ value that is not part of the current UE configuration.

NOTE 2: Whether or not the RLC and MAC entities associated with this PDCP entity are reset or released is determined by the CellGroupConfig.

5.3.5.6.5 DRB addition/modification

The UE shall:

1> for each $drb-Identity$ value included in the $drb-ToAddModList$ that is not part of the current UE configuration (DRB establishment including the case when full configuration option is used):

2> establish a PDCP entity and configure it in accordance with the received pdcp-Config;

2> if the PDCP entity of this DRB is not configured with cipheringDisabled:

3> if target RAT of handover is E-UTRA/5GC; or

3> if the UE is connected to E-UTRA/5GC:
4> if the UE is capable of E-UTRA/5GC but not capable of NGEN-DC:

5> configure the PDCP entity with the ciphering algorithm and $K_{\text{UPenc}}$ key configured/derived as specified in TS 36.331 [10];

4> else (i.e., a UE capable of NGEN-DC):

5> configure the PDCP entity with the ciphering algorithms according to $\text{securityConfig}$ and apply the key ($K_{\text{UPenc}}$) associated with the master key ($K_{\text{gNB}}$) or secondary key ($S-K_{\text{gNB}}$) as indicated in $\text{keyToUse}$, if applicable;

3> else (i.e., UE connected to NR or UE connected to E-UTRA/EPC):

4> configure the PDCP entity with the ciphering algorithm according to $\text{securityConfig}$ and apply the $K_{\text{UPenc}}$ key associated with the master key ($K_{\text{gNB}}$) or the secondary key ($S-K_{\text{gNB}}$) as indicated in $\text{keyToUse}$;

2> if the PDCP entity of this DRB is configured with $\text{integrityProtection}$:

3> configure the PDCP entity with the integrity protection algorithms according to $\text{securityConfig}$ and apply the $K_{\text{UPint}}$ key associated with the master ($K_{\text{gNB}}$) or the secondary key ($S-K_{\text{gNB}}$) as indicated in $\text{keyToUse}$;

2> if an $\text{sdap-Config}$ is included:

3> if an SDAP entity with the received pdu-Session does not exist:

4> establish an SDAP entity as specified in TS 37.324 [24] clause 5.1.1;

4> if an SDAP entity with the received pdu-Session did not exist prior to receiving this reconfiguration:

5> indicate the establishment of the user plane resources for the pdu-Session to upper layers;

3> configure the SDAP entity in accordance with the received $\text{sdap-Config}$ as specified in TS 37.324 [24] and associate the DRB with the SDAP entity;

2> if the DRB is associated with an $\text{eps-BearerIdentity}$:

3> if the DRB was configured with the same $\text{eps-BearerIdentity}$ either by NR or E-UTRA prior to receiving this reconfiguration:

4> associate the established DRB with the corresponding $\text{eps-BearerIdentity}$;

3> else:

4> indicate the establishment of the DRB(s) and the $\text{eps-BearerIdentity}$ of the established DRB(s) to upper layers;

1> for each $\text{drb-Identity}$ value included in the $\text{drb-ToAddModList}$ that is part of the current UE configuration and configured as DAPS bearer:

2> reconfigure the PDCP entity to configure DAPS with the ciphering function, integrity protection function and ROHC function of the target cell group as specified in TS 38.323 [5] and configure it in accordance with the received $\text{pdcp-Config}$;

2> if the $\text{masterKeyUpdate}$ is received:

3> if the ciphering function of the target cell group PDCP entity is not configured with $\text{cipheringDisabled}$:

4> configure the ciphering function of the target cell group PDCP entity with the ciphering algorithm according to $\text{securityConfig}$ and apply the $K_{\text{UPenc}}$ key associated with the master key ($K_{\text{gNB}}$), as indicated in $\text{keyToUse}$, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received from the target cell group and sent to the target cell group by the UE;

3> if the integrity protection function of the target cell group PDCP entity is configured with $\text{integrityProtection}$:
4> configure the integrity protection function of the target cell group PDCP entity with the integrity protection algorithms according to securityConfig and apply the $K_{UPint}$ key associated with the master key ($K_{gNB}$) as indicated in keyToUse;

2> else:

3> configure the ciphering function and the integrity protection function of the target cell group PDCP entity with the same security configuration as the PDCP entity for the source cell group;

2> if the sdap-Config is included and when indication of successful completion of random access towards target cell is received from lower layers as specified in [3]:

3> reconfigure the SDAP entity in accordance with the received sdap-Config as specified in TS 37.324 [24];

3> for each QFI value added in mappedQoS-FlowsToAdd, if the QFI value is previously configured, the QFI value is released from the old DRB;

1> for each drb-Identity value included in the drb-ToAddModList that is part of the current UE configuration and not configured as DAPS bearer:

2> if the reestablishPDCP is set:

3> if target RAT of handover is E-UTRA/5GC; or

3> if the UE is connected to E-UTRA/5GC:

4> if the PDCP entity of this DRB is not configured with cipheringDisabled:

5> configure the PDCP entity with the ciphering algorithm and $K_{UPenc}$ key configured/derived as specified in TS 36.331 [10], clause 5.4.2.3, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

4> else (i.e., a UE capable of NGEN-DC):

5> configure the PDCP entity with the ciphering algorithm and $K_{UPenc}$ key associated with the master key ($K_{gNB}$) or the secondary key ($S-K_{gNB}$), as indicated in keyToUse, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

3> else (i.e., UE connected to NR or UE in EN-DC):

4> if the PDCP entity of this DRB is not configured with cipheringDisabled:

5> configure the PDCP entity with the ciphering algorithm and $K_{UPenc}$ key associated with the master key ($K_{gNB}$) or the secondary key ($S-K_{gNB}$), as indicated in keyToUse, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

4> if the PDCP entity of this DRB is configured with integrityProtection:

5> configure the PDCP entity with the integrity protection algorithms according to securityConfig and apply the $K_{UPint}$ key associated with the master key ($K_{gNB}$) or the secondary key ($S-K_{gNB}$) as indicated in keyToUse;

3> if drb-ContinueROHC is included in pdcp-Config:

4> indicate to lower layer that drb-ContinueROHC is configured;

3> if drb-ContinueEHC-DL is included in pdcp-Config:

4> indicate to lower layer that drb-ContinueEHC-DL is configured;

3> if drb-ContinueEHC-UL is included in pdcp-Config:
4> indicate to lower layer that *drb-ContinueEHC-UL* is configured;
3> re-establish the PDCP entity of this DRB as specified in TS 38.323 [5], clause 5.1.2;
2> else, if the *recoverPDCP* is set:
3> trigger the PDCP entity of this DRB to perform data recovery as specified in TS 38.323 [5];
2> if the *pdcp-Config* is included:
3> reconfigure the PDCP entity in accordance with the received *pdcp-Config*.
2> if the *sdap-Config* is included:
3> reconfigure the SDAP entity in accordance with the received *sdap-Config* as specified in TS37.324 [24];
3> for each QFI value added in *mappedQos-FlowsToAdd*, if the QFI value is previously configured, the QFI value is released from the old DRB;

**NOTE 1:** Void.

**NOTE 2:** When determining whether a *drb-Identity* value is part of the current UE configuration, the UE does not distinguish which *RadioBearerConfig* and *DRB-ToAddModList* that DRB was originally configured in. To re-associate a DRB with a different key (K_{eNB} to S-K_{gNB}, K_{gNB} to S-K_{eNB}, or vice versa), the network provides the *drb-Identity* value in the (target) *drb-ToAddModList* and sets the *reestablishPDCP* flag. The network does not list the *drb-Identity* in the (source) *drb-ToReleaseList*.

**NOTE 3:** When setting the *reestablishPDCP* flag for a radio bearer, the network ensures that the RLC receiver entities do not deliver old PDCP PDUs to the re-established PDCP entity. It does that e.g. by triggering a reconfiguration with sync of the cell group hosting the old RLC entity or by releasing the old RLC entity.

**NOTE 4:** In this specification, UE configuration refers to the parameters configured by NR RRC unless otherwise stated.

**NOTE 5:** Ciphering and integrity protection can be enabled or disabled for a DRB. The enabling/disabling of ciphering or integrity protection can be changed only by releasing and adding the DRB.

### 5.3.5.7 AS Security key update

The UE shall:

1> if UE is connected to E-UTRA/EPC or E-UTRA/5GC:
2> upon reception of *sk-Counter* as specified in TS 36.331 [10]:
3> update the S-K_{eNB} key based on the K_{eNB} key and using the received *sk-Counter* value, as specified in TS 33.401 [30] for EN-DC, or TS 33.501 [11] for NGEN-DC;
3> derive the K_{RRCenc} and K_{UPenc} keys as specified in TS 33.401 [30] for EN-DC, or TS 33.501 [11] for NGEN-DC;
3> derive the K_{RRCint} and K_{UPint} keys as specified in TS 33.401 [30] for EN-DC or TS 33.501 [11] for NGEN-DC.
1> else if this procedure was initiated due to reception of the *masterKeyUpdate*:
2> if the *nas-Container* is included in the received *masterKeyUpdate*:
3> forward the *nas-Container* to the upper layers;
2> if the *keySetChangeIndicator* is set to *true*:
3> derive or update the K_{eNB} key based on the K_{AMF} key, as specified in TS 33.501 [11];
2> else:
3> derive or update the $K_{	ext{gNB}}$ key based on the current $K_{	ext{gNB}}$ key or the NH, using the nextHopChainingCount value indicated in the received masterKeyUpdate, as specified in TS 33.501 [11];

2> store the nextHopChainingCount value;

2> derive the keys associated with the $K_{	ext{gNB}}$ key as follows:

3> if the securityAlgorithmConfig is included in SecurityConfig:

4> derive the $K_{	ext{RRCenc}}$ and $K_{	ext{UPenc}}$ keys associated with the cipheringAlgorithm indicated in the securityAlgorithmConfig, as specified in TS 33.501 [11];

4> derive the $K_{	ext{RRCint}}$ and $K_{	ext{UPint}}$ keys associated with the integrityProtAlgorithm indicated in the securityAlgorithmConfig, as specified in TS 33.501 [11];

3> else:

4> derive the $K_{	ext{RRCenc}}$ and $K_{	ext{UPenc}}$ keys associated with the current cipheringAlgorithm, as specified in TS 33.501 [11];

4> derive the $K_{	ext{RRCint}}$ and $K_{	ext{UPint}}$ keys associated with the current integrityProtAlgorithm, as specified in TS 33.501 [11].

NOTE 1: Ciphering and integrity protection are optional to configure for the DRBs.

1> else if this procedure was initiated due to reception of the sk-Counter (UE is in NE-DC, or NR-DC, or is configured with SN terminated bearer(s)):

2> derive or update the secondary key (S-$K_{	ext{gNB}}$ or S-$K_{	ext{eNB}}$) based on the KgNB key and using the received sk-Counter value, as specified in TS 33.501 [11];

2> derive the $K_{	ext{RRCenc}}$ key and the $K_{	ext{UPenc}}$ key as specified in TS 33.501 [11] using the ciphering algorithms indicated in the RadioBearerConfig associated with the secondary key ($S-K_{	ext{gNB}}$ or S-$K_{	ext{eNB}}$) as indicated by keyToUse;

2> derive the $K_{	ext{RRCint}}$ key and the $K_{	ext{UPint}}$ key as specified in TS 33.501 [11] using the integrity protection algorithms indicated in the RadioBearerConfig associated with the secondary key ($S-K_{	ext{gNB}}$ or S-$K_{	ext{eNB}}$) as indicated by keyToUse;

NOTE 2: If the UE has no radio bearer configured with keyToUse set to secondary and receives the sk-Counter without any RadioBearerConfig with keyToUse set to secondary, the UE does not consider it as an invalid reconfiguration.

5.3.5.8 Reconfiguration failure

5.3.5.8.1 Void

5.3.5.8.2 Inability to comply with RRCReconfiguration

The UE shall:

1> if the UE is in (NG)EN-DC:

2> if the UE is unable to comply with (part of) the configuration included in the RRCReconfiguration message received over SRB3;

3> continue using the configuration used prior to the reception of RRCReconfiguration message;

3> if MCG transmission is not suspended:

4> initiate the SCG failure information procedure as specified in subclause 5.7.3 to report SCG reconfiguration error, upon which the connection reconfiguration procedure ends;

3> else:
4> initiate the connection re-establishment procedure as specified in TS 36.331 [10], clause 5.3.7, upon which the connection reconfiguration procedure ends;

2> else, if the UE is unable to comply with (part of) the configuration included in the RRCReconfiguration message received over SRB1;

3> continue using the configuration used prior to the reception of RRCReconfiguration message;

3> initiate the connection re-establishment procedure as specified in TS 36.331 [10], clause 5.3.7, upon which the connection reconfiguration procedure ends.

1> else if RRCReconfiguration is received via NR (i.e., NR standalone, NE-DC, or NR-DC):

2> if the UE is unable to comply with (part of) the configuration included in the RRCReconfiguration message received over SRB3;

NOTE 0: This case does not apply in NE-DC.

3> continue using the configuration used prior to the reception of RRCReconfiguration message;

3> if MCG transmission is not suspended:

4> initiate the SCG failure information procedure as specified in subclause 5.7.3 to report SCG reconfiguration error, upon which the connection reconfiguration procedure ends;

3> else:

4> initiate the connection re-establishment procedure as specified in clause 5.3.7, upon which the connection reconfiguration procedure ends;

2> else if the UE is unable to comply with (part of) the configuration included in the RRCReconfiguration message received over the SRB1 or if the upper layers indicate that the nas-Container is invalid:

NOTE 0a: The compliance also covers the SCG configuration carried within octet strings e.g. field mrdc-SecondaryCellGroupConfig. I.e. the failure behaviour defined also applies in case the UE cannot comply with the embedded SCG configuration or with the combination of (parts of) the MCG and SCG configurations.

NOTE 0b: The compliance also covers the E-UTRA sidelink configuration carried within an octet string, e.g. field sl-ConfigDedicatedEUTRA. I.e. the failure behaviour defined also applies in case the UE cannot comply with the embedded E-UTRA sidelink configuration.

3> continue using the configuration used prior to the reception of RRCReconfiguration message;

3> if AS security has not been activated:

4> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause ‘other’

3> else if AS security has been activated but SRB2 and at least one DRB or, for IAB, SRB2, have not been setup:

4> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause ‘RRC connection failure’;

3> else:

4> initiate the connection re-establishment procedure as specified in 5.3.7, upon which the reconfiguration procedure ends;

1> else if RRCReconfiguration is received via other RAT (Handover to NR failure):

2> if the UE is unable to comply with any part of the configuration included in the RRCReconfiguration message or if the upper layers indicate that the nas-Container is invalid:

3> perform the actions defined for this failure case as defined in the specifications applicable for the other RAT.
NOTE 1: The UE may apply above failure handling also in case the \textit{RRCReconfiguration} message causes a protocol error for which the generic error handling as defined in clause 10 specifies that the UE shall ignore the message.

NOTE 2: If the UE is unable to comply with part of the configuration, it does not apply any part of the configuration, i.e. there is no partial success/failure.

NOTE 3: It is up to UE implementation whether the compliance check for an \textit{RRCReconfiguration} received as part of \textit{ConditionalReconfiguration} is performed upon the reception of the message or upon CHO and CPC execution (when the message is required to be applied).

5.3.5.8.3 T304 expiry (Reconfiguration with sync Failure)

The UE shall:

1> if T304 of the MCG expires:

2> release dedicated preambles provided in \textit{rach-ConfigDedicated} if configured;

2> release dedicated msgA PUSCH resources provided in \textit{rach-ConfigDedicated} if configured;

2> if any DAPS bearer is configured, and radio link failure is not detected in the source PCell, according to subclause 5.3.10.3:

3> reset MAC for the target PCell and release the MAC configuration for the target PCell;

3> for each DAPS bearer:

   4> release the RLC entity or entities as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the target PCell;

   4> reconfigure the PDCP entity to release DAPS as specified in TS 38.323 [5];

3> for each SRB:

   4> if the \textit{masterKeyUpdate} was not received:

      5> configure the PDCP entity for the source PCell with state variables continuation as specified in TS 38.323 [5], the state variables as the PDCP entity for the target PCell;

   4> release the PDCP entity for the target PCell;

   4> release the RLC entity as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the target PCell;

   4> trigger the PDCP entity for the source PCell to perform SDU discard as specified in TS 38.323 [5];

   4> re-establish the RLC entity for the source PCell;

3> release the physical channel configuration for the target PCell;

3> revert back to the SDAP configuration used in the source PCell;

3> discard the keys used in target PCell (the \(K_{gNB}\) key, the \(K_{RRCenc}\) key, the \(K_{RRCint}\) key, the \(K_{UPint}\) key and the \(K_{UPenc}\) key), if any;

3> resume suspended SRBs in the source PCell;

3> for each non DAPS bearer:

   4> revert back to the UE configuration used for the DRB in the source PCell, includes PDCP, RLC states variables, the security configuration and the data stored in transmission and reception buffers in PDCP and RLC entities;

3> revert back to the UE measurement configuration used in the source PCell;

3> initiate the failure information procedure as specified in subclause 5.7.5 to report DAPS handover failure.
else:
  revert back to the UE configuration used in the source PCell;
  store the handover failure information in VarRLF-Report as described in the subclause 5.3.10.5;
  initiate the connection re-establishment procedure as specified in subclause 5.3.7.

NOTE 1: In the context above, “the UE configuration” includes state variables and parameters of each radio bearer.

else if T304 of a secondary cell group expires:
  if MCG transmission is not suspended:
    release dedicated preambles provided in rach-ConfigDedicated, if configured;
    initiate the SCG failure information procedure as specified in subclause 5.7.3 to report SCG reconfiguration with sync failure, upon which the RRC reconfiguration procedure ends;
  else:
    if the UE is in NR-DC:
      initiate the connection re-establishment procedure as specified in subclause 5.3.7;
    else (the UE is in (NG) EN-DC):
      initiate the connection re-establishment procedure as specified in TS 36.331 [10], subclause 5.3.7;

else if T304 expires when RRCReconfiguration is received via other RAT (HO to NR failure):
  reset MAC;
  perform the actions defined for this failure case as defined in the specifications applicable for the other RAT.

NOTE 2: In this clause, the term 'handover failure' has been used to refer to 'reconfiguration with sync failure'.

5.3.5.9 Other configuration

The UE shall:

1> if the received otherConfig includes the delayBudgetReportingConfig:
  2> if delayBudgetReportingConfig is set to setup:
    3> consider itself to be configured to send delay budget reports in accordance with 5.7.4;
  2> else:
    3> consider itself not to be configured to send delay budget reports and stop timer T342, if running.

1> if the received otherConfig includes the overheatingAssistanceConfig:
  2> if overheatingAssistanceConfig is set to setup:
    3> consider itself to be configured to provide overheating assistance information in accordance with 5.7.4;
  2> else:
    3> consider itself not to be configured to provide overheating assistance information and stop timer T345, if running;

1> if the received otherConfig includes the idc-AssistanceConfig:
  2> if idc-AssistanceConfig is set to setup:
    3> consider itself to be configured to provide IDC assistance information in accordance with 5.7.4;
if the received otherConfig includes the drx-PreferenceConfig:

if drx-PreferenceConfig is set to setup:

consider itself to be configured to provide its preference on DRX parameters for power saving for the cell group in accordance with 5.7.4;

else:

consider itself not to be configured to provide its preference on DRX parameters for power saving for the cell group and stop timer T346a associated with the cell group, if running;

if the received otherConfig includes the maxBW-PreferenceConfig:

if maxBW-PreferenceConfig is set to setup:

consider itself to be configured to provide its preference on the maximum aggregated bandwidth for power saving for the cell group in accordance with 5.7.4;

else:

consider itself not to be configured to provide its preference on the maximum aggregated bandwidth for power saving for the cell group and stop timer T346b associated with the cell group, if running;

if the received otherConfig includes the maxCC-PreferenceConfig:

if maxCC-PreferenceConfig is set to setup:

consider itself to be configured to provide its preference on the maximum number of secondary component carriers for power saving for the cell group in accordance with 5.7.4;

else:

consider itself not to be configured to provide its preference on the maximum number of secondary component carriers for power saving for the cell group and stop timer T346c associated with the cell group, if running;

if the received otherConfig includes the maxMIMO-LayerPreferenceConfig:

if maxMIMO-LayerPreferenceConfig is set to setup:

consider itself to be configured to provide its preference on the maximum number of MIMO layers for power saving for the cell group in accordance with 5.7.4;

else:

consider itself not to be configured to provide its preference on the maximum number of MIMO layers for power saving for the cell group and stop timer T346d associated with the cell group, if running;

if the received otherConfig includes the minSchedulingOffsetPreferenceConfig:

if minSchedulingOffsetPreferenceConfig is set to setup:

consider itself to be configured to provide its preference on the minimum scheduling offset for cross-slot scheduling for power saving for the cell group in accordance with 5.7.4;

else:

consider itself not to be configured to provide its preference on the minimum scheduling offset for cross-slot scheduling for power saving for the cell group and stop timer T346e associated with the cell group, if running;
if releasePreferenceConfig is set to setup:

consider itself to be configured to provide assistance information to transition out of RRC_CONNECTED in accordance with 5.7.4;

else:

consider itself not to be configured to provide assistance information to transition out of RRC_CONNECTED and stop timer T346f, if running.

if the received otherConfig includes the obtainCommonLocation:

include available detailed location information for any subsequent measurement report or any subsequent RLF report, CEF report and SCGFailureInformation;

NOTE 1: The UE is requested to attempt to have valid detailed location information available whenever sending a measurement report for which it is configured to include available detailed location information. The UE may not succeed e.g. because the user manually disabled the GPS hardware, due to no/poor satellite coverage. Further details, e.g. regarding when to activate GNSS, are up to UE implementation.

if the received otherConfig includes the BT-NameList:

if BT-NameList is set to setup, include available Bluetooth measurement results for any subsequent measurement report or any subsequent RLF report, CEF report and SCGFailureInformation;

if the received otherConfig includes the WLAN-NameList:

if WLAN-NameList is set to setup, include available WLAN measurement results for any subsequent measurement report or any subsequent RLF report, CEF report and SCGFailureInformation;

NOTE 2: The UE is requested to attempt to have valid Bluetooth measurements and WLAN measurements whenever sending a measurement report for which it is configured to include these measurements. The UE may not succeed e.g. because the user manually disabled the WLAN or Bluetooth hardware. Further details, e.g. regarding when to activate WLAN or Bluetooth, are up to UE implementation.

if the received otherConfig includes the Sensor-NameList:

if Sensor-NameList is set to setup, include available Sensor measurement results for any subsequent measurement report or any subsequent RLF report, CEF report and SCGFailureInformation;

if the received otherConfig includes the sl-AssistanceConfigNR:

consider itself to be configured to provide configured grant assistance information for NR sidelink communication in accordance with 5.7.4;

if the received otherConfig includes the referenceTimePreferenceReporting:

consider itself to be configured to provide UE reference time assistance information in accordance with 5.7.4;

else:

consider itself not to be configured to provide UE reference time assistance information;

5.3.5.10 MR-DC release

The UE shall:

as a result of MR-DC release triggered by E-UTRA or NR:

release SRB3, if established, as specified in 5.3.5.6.2;

release measConfig associated with SCG;

if the UE is configured with NR SCG:

release the SCG configuration as specified in clause 5.3.5.4;
3GPP TS 38.331 version 16.3.1 Release 16

3> release otherConfig associated with the SCG, if configured;
3> stop timers T346a, T346b, T346c, T346d and T346e associated with the SCG, if running;
3> release bap-Config associated with the SCG, if configured;
3> release iab-IP-AddressConfigurationList associated with the SCG, if configured;

2> else if the UE is configured with E-UTRA SCG:
3> release the SCG configuration as specified in TS 36.331 [10], clause 5.3.10.19 to release the E-UTRA SCG;

5.3.5.11 Full configuration

The UE shall:

1> release/ clear all current dedicated radio configurations except for the following:
   - the MCG C-RNTI;
   - the AS security configurations associated with the master key;

NOTE 1: Radio configuration is not just the resource configuration but includes other configurations like MeasConfig. In case NR-DC or NE-DC is configured, this also includes the entire NR or E-UTRA SCG configuration which are released according to the MR-DC release procedure as specified in 5.3.5.10. The radio configuration does not include SRB1/SRB2 configurations and DRB configurations as configured by radioBearerConfig or radioBearerConfig2.

NOTE 1a: For NR sidelink communication, the radio configuration includes the sidelink RRC configuration received from the network, but does not include the sidelink RRC reconfiguration and sidelink UE capability received from other UEs via PC5-RRC. In addition, the UE considers the new NR sidelink configurations as full configuration, in case of state transition and change of system information used for NR sidelink communication.

1> if the spCellConfig in the masterCellGroup includes the reconfigurationWithSync (i.e., SpCell change):
   2> release/ clear all current common radio configurations;
   2> use the default values specified in 9.2.3 for timers T310, T311 and constants N310, N311;

1> else (full configuration after re-establishment or during RRC resume):
   2> use values for timers T301, T310, T311 and constants N310, N311, as included in ue-TimersAndConstants received in SIB1;

1> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the following:
   - parameters for which values are provided in SIB1;

1> apply the default MAC Cell Group configuration as specified in 9.2.2;

1> for each srb-Identity value included in the srb-ToAddModList (SRB reconfiguration):
   2> apply the default SRB configuration defined in 9.2.1 for the corresponding SRB;

NOTE 2: This is to get the SRBs (SRB1 and SRB2 for reconfiguration with sync and SRB2 for resume and reconfiguration after re-establishment) to a known state from which the reconfiguration message can do further configuration.

1> for each pdu-Session that is part of the current UE configuration:
   2> release the SDAP entity (clause 5.1.2 in TS 37.324 [24]);
   2> release each DRB associated to the pdu-Session as specified in 5.3.5.6.4;
NOTE 3: This will retain the pdu-Session but remove the DRBs including drb-identity of these bearers from the current UE configuration. Setup of the DRBs within the AS is described in clause 5.3.5.6.5 using the new configuration. The pdu-Session acts as the anchor for associating the released and re-setup DRB. In the AS the DRB re-setup is equivalent with a new DRB setup (including new PDCP and logical channel configurations).

1> for each pdu-Session that is part of the current UE configuration but not added with same pdu-Session in the drb-ToAddModList:

2> if the procedure was triggered due to reconfiguration with sync:

3> indicate the release of the user plane resources for the pdu-Session to upper layers after successful reconfiguration with sync;

2> else:

3> indicate the release of the user plane resources for the pdu-Session to upper layers immediately;

5.3.5.12 BAP configuration

The IAB-MT shall:

1> if the bap-Config is set to setup:

2> if no BAP entity is established:

3> establish a BAP entity as specified in TS 38.340 [47];

2> if bap-address is included:

3> configure the BAP entity to use the bap-Address as this node's BAP address;

2> if defaultUL-BAP-RoutingID is included:

3> configure the BAP entity to apply the default UL BAP routing ID according to the configuration;

2> if defaultUL-BH-RLC-Channel is included

3> configure the BAP entity to apply the default UL BH RLC channel according to the configuration;

2> if flowControlFeedbackType is included:

3> configure the BAP entity to apply the flow control feedback according to the configuration;

1> if the bap-Config is set to release:

2> release the BAP entity as specified in TS 38.340 [47].

5.3.5.12a IAB Other Configuration

5.3.5.12a.1 IP address management

5.3.5.12a.1.1 IP Address Release

The IAB-MT shall:

1> if the release is triggered by reception of the iab-IP-AddressToReleaseList:

2> for each iab-IP-AddressIndex value included in iab-IP-AddressToReleaseList:

3> release the corresponding IAB-IP-AddressConfiguration.

5.3.5.12a.1.2 IP Address Addition/Modification

The IAB-MT shall:
for each iab-IP-AddressIndex value included in the iab-IP-AddressToAddModList that is not part of the current IAB-MT configuration:

2> add the IP address indicated in iab-IP-Address, corresponding to the iab-IP-AddressIndex.

2> if added IP address is IPv4-Address:

3> if iab-IP-Usage is set to f1-C:

4> store the received IPv4 address for F1-C traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

3> else if iab-IP-Usage is set to f1-U:

4> store the received IPv4 address for F1-U traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

3> else if iab-IP-Usage is set to non-F1:

4> store the received IPv4 address for non-F1 traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

3> else:

4> store the received IPv4 address for all traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

2> else if IPv6-Address is included:

3> if iab-IP-Usage is set to f1-C:

4> store the received IPv6 address for F1-C traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

3> else if iab-IP-Usage is set to f1-U:

4> store the received IPv6 address for F1-U traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

3> else if iab-IP-Usage is set to non-F1:

4> store the received IPv6 address for non-F1 traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

3> else:

4> store the received IPv6 address for all traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

2> else if IPv6-Prefix is included in iab-IP-AddressToAddModList:

3> if iab-IP-Usage is set to f1-C:

4> store the received IPv6 address prefix for F1-C traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

3> else if iab-IP-Usage is set to f1-U:

4> store the received IPv6 address prefix for F1-U traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

3> else if iab-IP-Usage is set to non-F1:

4> store the received IPv6 address prefix for non-F1 traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

3> else:
4> store the received IPv6 address prefix for all traffic together with the IAB-donor-DU BAP address corresponding to the iab-IP-AddressIndex.

1> for each iab-IP-AddressIndex value included in the iab-IP-AddressToAddModList that is part of the current IAB-MT configuration:

2> modify the IP address configuration(s) in accordance with the IAB-IP-AddressConfiguration corresponding to the iab-IP-AddressIndex.

5.3.5.13 Conditional Reconfiguration

5.3.5.13.1 General

The network configures the UE with one or more candidate target SpCells in the conditional reconfiguration. The UE evaluates the condition of each configured candidate target SpCell. The UE applies the conditional reconfiguration associated with one of the target SpCells which fulfils associated execution condition. The network provides the configuration parameters for the target SpCell in the ConditionalReconfiguration IE.

The UE performs the following actions based on a received ConditionalReconfiguration IE:

1> if the ConditionalReconfiguration contains the condReconfigToRemoveList:

2> perform conditional reconfiguration removal procedure as specified in 5.3.5.13.2;

1> if the ConditionalReconfiguration contains the condReconfigToAddModList:

2> perform conditional reconfiguration addition/modification as specified in 5.3.5.13.3;

5.3.5.13.2 Conditional reconfiguration removal

The UE shall:

1> for each condReconfigId value included in the condReconfigToRemoveList that is part of the current UE conditional reconfiguration in VarConditionalReconfig:

2> remove the entry with the matching condReconfigId from the VarConditionalReconfig;

NOTE: The UE does not consider the message as erroneous if the condReconfigToRemoveList includes any condReconfigId value that is not part of the current UE configuration.

5.3.5.13.3 Conditional reconfiguration addition/modification

For each condReconfigId received in the condReconfigToAddModList IE the UE shall:

1> if an entry with the matching condReconfigId exists in the condReconfigToAddModList within the VarConditionalReconfig:

2> if the entry in condReconfigToAddModList includes an condExecutionCond;

3> replace the entry with the value received for this condReconfigId;

2> if the entry in condReconfigToAddModList includes an condRRCReconfig;

2> replace the entry with the value received for this condReconfigId;

1> else:

2> add a new entry for this condReconfigId within the VarConditionalReconfig;

1> perform conditional reconfiguration evaluation as specified in 5.3.5.13.4;

5.3.5.13.4 Conditional reconfiguration evaluation

The UE shall:
1> for each condReconfigId within the VarConditionalReconfig:

2> consider the cell which has a physical cell identity matching the value indicated in the
   ServingCellConfigCommon included in the reconfigurationWithSync in the received condRRCReconfig to be
   applicable cell;

2> for each measId included in the measIdList within VarMeasConfig indicated in the condExecutionCond
   associated to condReconfigId:

3> if the entry condition(s) applicable for this event associated with the condReconfigId, i.e. the event
   corresponding with the condEventId(s) of the corresponding condTriggerConfig within
   VarConditionalReconfig, is fulfilled for the applicable cells for all measurements after layer 3 filtering
   taken during the corresponding timeToTrigger defined for this event within the VarConditionalReconfig:

4> consider the event associated to that measId to be fulfilled;

3> if the leaving condition(s) applicable for this event associated with the condReconfigId, i.e. the event
   corresponding with the condEventId(s) of the corresponding condTriggerConfig within
   VarConditionalReconfig, is fulfilled for the applicable cells for all measurements after layer 3 filtering
   taken during the corresponding timeToTrigger defined for this event within the VarConditionalReconfig:

4> consider the event associated to that measId to be not fulfilled;

2> if event(s) associated to all measId(s) within condTriggerConfig for a target candidate cell within the stored
   condRRCReconfig are fulfilled:

3> consider the target candidate cell within the stored condRRCReconfig, associated to that condReconfigId,
   as a triggered cell;

3> initiate the conditional reconfiguration execution, as specified in 5.3.5.13.5;

NOTE: Up to 2 MeasId can be configured for each condReconfigId. The conditional reconfiguration event of the
2 MeasId may have the same or different event conditions, triggering quantity, time to trigger, and
triggering threshold.

5.3.5.13.5 Conditional reconfiguration execution

The UE shall:

1> if more than one triggered cell exists:

2> select one of the triggered cells as the selected cell for conditional reconfiguration execution;

1> for the selected cell of conditional reconfiguration execution:

2> apply the stored condRRCReconfig of the selected cell and perform the actions as specified in 5.3.5.3;

NOTE: If multiple NR cells are triggered in conditional reconfiguration execution, it is up to UE implementation
which one to select, e.g. the UE considers beams and beam quality to select one of the triggered cells for
execution.

5.3.5.14 Sidelink dedicated configuration

Upon initiating the procedure, the UE shall:

1> if sl-FreqInfoToReleaseList is included in sl-ConfigDedicatedNR within RRCReconfiguration:

2> for each entry included in the received sl-FreqInfoToReleaseList that is part of the current UE configuration:

3> release the related configurations from the stored NR sidelink communication configurations;

1> if sl-FreqInfoToAddModList is included in sl-ConfigDedicatedNR within RRCReconfiguration:

2> if configured to receive NR sidelink communication:
3> use the resource pool(s) indicated by \textit{sl-RxPool} for NR sidelink communication reception, as specified in 5.8.7;

2> if configured to transmit NR sidelink communication:

3> use the resource pool(s) indicated by \textit{sl-TxPoolSelectedNormal}, \textit{sl-TxPoolScheduling} or \textit{sl-TxPoolExceptional} for NR sidelink communication transmission, as specified in 5.8.8;

2> perform CBR measurement on the transmission resource pools indicated by \textit{sl-TxPoolSelectedNormal}, \textit{sl-TxPoolScheduling} or \textit{sl-TxPoolExceptional} for NR sidelink communication transmission, as specified in 5.5.3;

2> use the synchronization configuration parameters for NR sidelink communication on frequencies included in \textit{sl-FreqInfoToAddModList}, as specified in 5.8.5;

1> if \textit{sl-RadioBearerToReleaseList} is included in \textit{sl-ConfigDedicatedNR} within \textit{RRCReconfiguration}:

2> perform sidelink DRB release as specified in 5.8.9.1.a.1;

1> if \textit{sl-RadioBearerToAddModList} or \textit{sl-RLC-BearerToAddModList} is included in \textit{sl-ConfigDedicatedNR} within \textit{RRCReconfiguration}:

2> perform sidelink DRB addition/modification as specified in 5.8.9.1.a.2;

1> if \textit{sl-ScheduledConfig} is included in \textit{sl-ConfigDedicatedNR} within \textit{RRCReconfiguration}:

2> configure the MAC entity parameters, which are to be used for NR sidelink communication, in accordance with the received \textit{sl-ScheduledConfig};

1> if \textit{sl-UE-SelectedConfig} is included in \textit{sl-ConfigDedicatedNR} within \textit{RRCReconfiguration}:

2> configure the parameters, which are to be used for NR sidelink communication, in accordance with the received \textit{sl-UE-SelectedConfig};

1> if \textit{sl-MeasConfigInfoToReleaseList} is included in \textit{sl-ConfigDedicatedNR} within \textit{RRCReconfiguration}:

2> for each \textit{sl-DestinationIndex} included in the received \textit{sl-MeasConfigInfoToReleaseList} that is part of the current UE configuration:

3> remove the entry with the matching \textit{sl-DestinationIndex} from the stored NR sidelink measurement configuration information;

1> if \textit{sl-MeasConfigInfoToAddModList} is included in \textit{sl-ConfigDedicatedNR} within \textit{RRCReconfiguration}:

2> for each \textit{sl-DestinationIndex} included in the received \textit{sl-MeasConfigInfoToAddModList} that is part of the current stored NR sidelink measurement configuration:

3> reconfigure the entry according to the value received for this \textit{sl-DestinationIndex} from the stored NR sidelink measurement configuration information;

2> for each \textit{sl-DestinationIndex} included in the received \textit{sl-MeasConfigInfoToAddModList} that is not part of the current stored NR sidelink measurement configuration:

3> add a new entry for this \textit{sl-DestinationIndex} to the stored NR sidelink measurement configuration.
5.3.6 Counter check

5.3.6.1 General

The counter check procedure is used by the network to request the UE to verify the amount of data sent/received on each DRB. More specifically, the UE is requested to check if, for each DRB, the most significant bits of the COUNT match with the values indicated by the network.

NOTE: The procedure enables the network to detect packet insertion by an intruder (a 'man in the middle').

5.3.6.2 Initiation

The network initiates the procedure by sending a CounterCheck message.

NOTE: The network may initiate the procedure when any of the COUNT values reaches a specific value.

5.3.6.3 Reception of the CounterCheck message by the UE

Upon receiving the CounterCheck message, the UE shall:

1> for each DRB that is established:
   2> if no COUNT exists for a given direction (uplink or downlink) because it is a uni-directional bearer configured only for the other direction:
      3> assume the COUNT value to be 0 for the unused direction;
   2> if the drb-Identity is not included in the drb-CountMSB-InfoList:
      3> include the DRB in the drb-CountInfoList in the CounterCheckResponse message by including the drb-Identity, the count-Uplink and the count-Downlink set to the value of TX_NEXT – 1 and RX_NEXT – 1 (specified in TS 38.323 [5]), respectively;
   2> else if, for at least one direction, the most significant bits of the COUNT are different from the value indicated in the drb-CountMSB-InfoList:
      3> include the DRB in the drb-CountInfoList in the CounterCheckResponse message by including the drb-Identity, the count-Uplink and the count-Downlink set to the value of TX_NEXT – 1 and RX_NEXT – 1 (specified in TS 38.323 [5]), respectively;
1> for each DRB that is included in the drb-CountMSB-InfoList in the CounterCheck message that is not established:
   2> include the DRB in the drb-CountInfoList in the CounterCheckResponse message by including the drb-Identity, the count-Uplink and the count-Downlink with the most significant bits set identical to the corresponding values in the drb-CountMSB-InfoList and the least significant bits set to zero;
1> submit the CounterCheckResponse message to lower layers for transmission upon which the procedure ends.

Figure 5.3.6.1-1: Counter check procedure

The counter check procedure is used by the network to request the UE to verify the amount of data sent/received on each DRB. More specifically, the UE is requested to check if, for each DRB, the most significant bits of the COUNT match with the values indicated by the network.

NOTE: The procedure enables the network to detect packet insertion by an intruder (a 'man in the middle').
5.3.7    RRC connection re-establishment

5.3.7.1    General

The purpose of this procedure is to re-establish the RRC connection. A UE in RRC_CONNECTED, for which AS security has been activated with SRB2 and at least one DRB setup or, for IAB, SRB2, may initiate the procedure in order to continue the RRC connection. The connection re-establishment succeeds if the network is able to find and verify a valid UE context or, if the UE context cannot be retrieved, and the network responds with an RRCSetup according to clause 5.3.3.4.

The network applies the procedure e.g as follows:

- When AS security has been activated and the network retrieves or verifies the UE context:
  - to re-activate AS security without changing algorithms;
  - to re-establish and resume the SRB1;
- When UE is re-establishing an RRC connection, and the network is not able to retrieve or verify the UE context:
  - to discard the stored AS Context and release all RBs;
  - to fallback to establish a new RRC connection.

If AS security has not been activated, the UE shall not initiate the procedure but instead moves to RRC_IDLE directly, with release cause 'other'. If AS security has been activated, but SRB2 and at least one DRB or, for IAB, SRB2, are not setup, the UE does not initiate the procedure but instead moves to RRC_IDLE directly, with release cause 'RRC connection failure'.

5.3.7.2    Initiation

The UE initiates the procedure when one of the following conditions is met:
Upon initiation of the procedure, the UE shall:

1> stop timer T310, if running;
1> stop timer T312, if running;
1> stop timer T304, if running;
1> start timer T311;
1> stop timer T316, if running;
1> if UE is not configured with conditionalReconfiguration:
   2> reset MAC;
   2> release spCellConfig, if configured;
   2> suspend all RBs, except SRB0;
   2> release the MCG SCell(s), if configured;
   2> if MR-DC is configured:
      3> perform MR-DC release, as specified in clause 5.3.5.10;
   2> release delayBudgetReportingConfig, if configured and stop timer T342, if running;
   2> release overheatingAssistanceConfig, if configured and stop timer T345, if running;
   2> release idc-AssistanceConfig, if configured;
   2> release btNameList, if configured;
   2> release wlanNameList, if configured;
2> release sensorNameList, if configured;
2> release drx-PreferenceConfig for the MCG, if configured and stop timer T346a associated with the MCG, if running;
2> release maxBW-PreferenceConfig for the MCG, if configured and stop timer T346b associated with the MCG, if running;
2> release maxCC-PreferenceConfig for the MCG, if configured and stop timer T346c associated with the MCG, if running;
2> release maxMIMO-LayerPreferenceConfig for the MCG, if configured and stop timer T346d associated with the MCG, if running;
2> release minSchedulingOffsetPreferenceConfig for the MCG, if configured stop timer T346e associated with the MCG, if running;
2> release releasePreferenceConfig, if configured stop timer T346f, if running;
2> release onDemandSIB-Request if configured, and stop timer T350, if running;
1> if any DAPS bearer is configured:
2> reset the source MAC and release the source MAC configuration;
2> for each DAPS bearer:
3> release the RLC entity or entities as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the source SpCell;
3> reconfigure the PDCP entity to release DAPS as specified in TS 38.323 [5];
2> for each SRB:
3> release the PDCP entity for the source SpCell;
3> release the RLC entity as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the source SpCell;
2> release the physical channel configuration for the source SpCell;
2> discard the keys used in the source SpCell (the $K_{pNB}$ key, the $K_{RRCenc}$ key, the $K_{RRCint}$ key, the $K_{UPdu}$ key and the $K_{UPsi}$ key), if any;
1> perform cell selection in accordance with the cell selection process as specified in TS 38.304 [20], clause 5.2.6.

5.3.7.3 Actions following cell selection while T311 is running

Upon selecting a suitable NR cell, the UE shall:

1> ensure having valid and up to date essential system information as specified in clause 5.2.2.2;
1> stop timer T311;
1> if T390 is running:
2> stop timer T390 for all access categories;
2> perform the actions as specified in 5.3.14.4;
1> if the cell selection is triggered by detecting radio link failure of the MCG or re-configuration with sync failure of the MCG, and
1> if attemptCondReconfig is configured; and
1> if the selected cell is one of the candidate cells for which the reconfigurationWithSync is included in the masterCellGroup in VarConditionalReconfig:
apply the stored `condRRCReconfig` associated to the selected cell and perform actions as specified in 5.3.5.3;

else:

if UE is configured with `conditionalReconfiguration`:

reset MAC;
release `spCellConfig`, if configured;
release the MCG SCell(s), if configured;
release `delayBudgetReportingConfig`, if configured and stop timer T342, if running;
release `overheatingAssistanceConfig`, if configured and stop timer T345, if running;
if MR-DC is configured:
perform MR-DC release, as specified in clause 5.3.5.10;
release `idc-AssistanceConfig`, if configured;
release `btNameList`, if configured;
release `wlanNameList`, if configured;
release `sensorNameList`, if configured;
release `drx-PreferenceConfig` for the MCG, if configured and stop timer T346a associated with the MCG, if running;
release `maxBW-PreferenceConfig` for the MCG, if configured and stop timer T346b associated with the MCG, if running;
release `maxCC-PreferenceConfig` for the MCG, if configured and stop timer T346c associated with the MCG, if running;
release `maxMIMO-LayerPreferenceConfig` for the MCG, if configured and stop timer T346d associated with the MCG, if running;
release `minSchedulingOffsetPreferenceConfig` for the MCG, if configured and stop timer T346e associated with the MCG, if running;
release `releasePreferenceConfig`, if configured and stop timer T346f, if running;
suspend all RBs, except SRB0;
remove all the entries within `VarConditionalReconfig`, if any;
for each `measId`, if the associated `reportConfig` has a `reportType` set to `condTriggerConfig`:
for the associated `reportConfigId`:
remove the entry with the matching `reportConfigId` from the `reportConfigList` within the `VarMeasConfig`;
if the associated `measObjectId` is only associated to a `reportConfig` with `reportType` set to `condTriggerConfig`:
remove the entry with the matching `measObjectId` from the `measObjectList` within the `VarMeasConfig`;
remove the entry with the matching `measId` from the `measIdList` within the `VarMeasConfig`;
start timer T301;
apply the default L1 parameter values as specified in corresponding physical layer specifications except for the parameters for which values are provided in SIB1;

apply the default MAC Cell Group configuration as specified in 9.2.2;

apply the CCCH configuration as specified in 9.1.1.2;

apply the timeAlignmentTimerCommon included in SIB1;

initiate transmission of the RRCReestablishmentRequest message in accordance with 5.3.7.4;

NOTE: This procedure applies also if the UE returns to the source PCell.

Upon selecting an inter-RAT cell, the UE shall:

1> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause 'RRC connection failure'.

5.3.7.4 Actions related to transmission of RRCReestablishmentRequest message

The UE shall set the contents of RRCReestablishmentRequest message as follows:

1> if the procedure was initiated due to radio link failure as specified in 5.3.10.3 or handover failure as specified in 5.3.5.8.3:

2> set the reestablishmentCellId in the VarRLF-Report to the global cell identity of the selected cell;

1> set the ue-Identity as follows:

2> set the c-RNTI to the C-RNTI used in the source PCell (reconfiguration with sync or mobility from NR failure) or used in the PCell in which the trigger for the re-establishment occurred (other cases);

2> set the physCellId to the physical cell identity of the source PCell (reconfiguration with sync or mobility from NR failure) or of the PCell in which the trigger for the re-establishment occurred (other cases);

2> set the shortMAC-I to the 16 least significant bits of the MAC-I calculated:

3> over the ASN.1 encoded as per clause 8 (i.e., a multiple of 8 bits) VarShortMAC-Input;

3> with the K_{RRCint} key and integrity protection algorithm that was used in the source PCell (reconfiguration with sync or mobility from NR failure) or of the PCell in which the trigger for the re-establishment occurred (other cases); and

3> with all input bits for COUNT, BEARER and DIRECTION set to binary ones;

1> set the reestablishmentCause as follows:

2> if the re-establishment procedure was initiated due to reconfiguration failure as specified in 5.3.5.8.2:

3> set the reestablishmentCause to the value reconfigurationFailure;

2> else if the re-establishment procedure was initiated due to reconfiguration with sync failure as specified in 5.3.5.8.3 (intra-NR handover failure) or 5.4.3.5 (inter-RAT mobility from NR failure):

3> set the reestablishmentCause to the value handoverFailure;

2> else:

3> set the reestablishmentCause to the value otherFailure;

1> re-establish PDCP for SRB1;

1> re-establish RLC for SRB1;

1> apply the specified configuration defined in 9.2.1 for SRB1;

1> configure lower layers to suspend integrity protection and ciphering for SRB1;
NOTE: Ciphering is not applied for the subsequent RRCReestablishment message used to resume the connection. An integrity check is performed by lower layers, but merely upon request from RRC.

1> resume SRB1;
1> submit the RRCReestablishmentRequest message to lower layers for transmission.

5.3.7.5 Reception of the RRCReestablishment by the UE

The UE shall:

1> stop timer T301;
1> consider the current cell to be the PCell;
1> store the nextHopChainingCount value indicated in the RRCReestablishment message;
1> update the K_{gNB} key based on the current K_{gNB} key or the NH, using the stored nextHopChainingCount value, as specified in TS 33.501 [11];
1> derive the K_{RRCenc} and K_{UPenc} keys associated with the previously configured cipheringAlgorithm, as specified in TS 33.501 [11];
1> derive the K_{RRCint} and K_{UPint} keys associated with the previously configured integrityProtAlgorithm, as specified in TS 33.501 [11];
1> request lower layers to verify the integrity protection of the RRCReestablishment message, using the previously configured algorithm and the K_{RRCint} key;
1> if the integrity protection check of the RRCReestablishment message fails:
   2> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause ‘RRC connection failure’, upon which the procedure ends;
1> configure lower layers to resume integrity protection for SRB1 using the previously configured algorithm and the K_{RRCint} key immediately, i.e., integrity protection shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;
1> configure lower layers to resume ciphering for SRB1 using the previously configured algorithm and, the K_{RRCenc} key immediately, i.e., ciphering shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;
1> release the measurement gap configuration indicated by the measGapConfig, if configured;
1> set the content of RRCReestablishmentComplete message as follows:
   2> if the UE has logged measurements available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:
      3> include the logMeasAvailable in the RRCReestablishmentComplete message;
   3> if Bluetooth measurement results are included in the logged measurements the UE has available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:
      4> include the logMeasAvailableBT in the RRCReestablishmentComplete message;
   3> if WLAN measurement results are included in the logged measurements the UE has available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:
      4> include the logMeasAvailableWLAN in the RRCReestablishmentComplete message;
   2> if the UE has connection establishment failure or connection resume failure information available in VarConnEstFailReport and if the RPLMN is equal to plmn-Identity stored in VarConnEstFailReport:
      3> include connEstFailInfoAvailable in the RRCReestablishmentComplete message;
if the UE has radio link failure or handover failure information available in VarRLF-Report and if the RPLMN is included in plmn-IdentityList stored in VarRLF-Report; or

2> if the UE has radio link failure or handover failure information available in VarRLF-Report of TS 36.331 [10] and if the UE is capable of cross-RAT RLF reporting and if the RPLMN is included in plmn-IdentityList stored in VarRLF-Report of TS 36.331 [10]:

3> include rlf-InfoAvailable in the RRCReestablishmentComplete message;

1> submit the RRCReestablishmentComplete message to lower layers for transmission;

1> the procedure ends.

5.3.7.6 T311 expiry

Upon T311 expiry, the UE shall:

1> if the procedure was initiated due to radio link failure or handover failure:

2> set the noSuitableCellFound in the VarRLF-Report to true;

1> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause 'RRC connection failure'.

5.3.7.7 T301 expiry or selected cell no longer suitable

The UE shall:

1> if timer T301 expires; or

1> if the selected cell becomes no longer suitable according to the cell selection criteria as specified in TS 38.304 [20]:

2> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause 'RRC connection failure'.

5.3.7.8 Reception of the RRCSetup by the UE

The UE shall:

1> perform the RRC connection establishment procedure as specified in 5.3.3.4.

5.3.8 RRC connection release

5.3.8.1 General

The purpose of this procedure is:

- to release the RRC connection, which includes the release of the established radio bearers as well as all radio resources; or

- to suspend the RRC connection only if SRB2 and at least one DRB or, for IAB, SRB2, are setup, which includes the suspension of the established radio bearers.
5.3.8.2 Initiation

The network initiates the RRC connection release procedure to transit a UE in RRC_CONNECTED to RRC_IDLE; or to transit a UE in RRC_CONNECTED to RRC_INACTIVE only if SRB2 and at least one DRB or, for IAB, SRB2, is setup in RRC_CONNECTED; or to transit a UE in RRC_INACTIVE back to RRC_INACTIVE when the UE tries to resume; or to transit a UE in RRC_INACTIVE to RRC_IDLE when the UE tries to resume. The procedure can also be used to release and redirect a UE to another frequency.

5.3.8.3 Reception of the RRCRelease by the UE

The UE shall:

1> delay the following actions defined in this sub-clause 60 ms from the moment the RRCRelease message was received or optionally when lower layers indicate that the receipt of the RRCRelease message has been successfully acknowledged, whichever is earlier;

1> stop timer T380, if running;

1> stop timer T320, if running;

1> if timer T316 is running:

2> stop timer T316;

2> clear the information included in VarRLF-Report, if any;

1> stop timer T350, if running;

1> if the AS security is not activated:

2> ignore any field included in RRCRelease message except waitTime;

2> perform the actions upon going to RRC_IDLE as specified in 5.3.11 with the release cause ‘other’ upon which the procedure ends;

1> if the RRCRelease message includes redirectedCarrierInfo indicating redirection to eutra:

2> if cnType is included:

3> after the cell selection, indicate the available CN Type(s) and the received cnType to upper layers;

NOTE 1: Handling the case if the E-UTRA cell selected after the redirection does not support the core network type specified by the cnType, is up to UE implementation.

2> if voiceFallbackIndication is included:

3> consider the RRC connection release was for EPS fallback for IMS voice (see TS 23.502 [43]);

1> if the RRCRelease message includes the cellReselectionPriorities:

2> store the cell reselection priority information provided by the cellReselectionPriorities;

2> if the t320 is included:

3> start timer T320, with the timer value set according to the value of t320;

1> else:

2> apply the cell reselection priority information broadcast in the system information;

1> if deprioritisationReq is included and the UE supports RRC connection release with deprioritisation:

2> start or restart timer T325 with the timer value set to the deprioritisationTimer signalled;

2> store the deprioritisationReq until T325 expiry;

1> if the RRCRelease includes the measIdleConfig:
if T331 is running:

- stop timer T331;
- perform the actions as specified in 5.7.8.3;

if the `measIdleConfig` is set to setup:

- store the received `measIdleDuration` in `VarMeasIdleConfig`;
- start timer T331 with the value set to `measIdleDuration`;
- if the `measIdleConfig` contains `measIdleCarrierListNR`:
  - store the received `measIdleCarrierListNR` in `VarMeasIdleConfig`;
- if the `measIdleConfig` contains `measIdleCarrierListEUTRA`:
  - store the received `measIdleCarrierListEUTRA` in `VarMeasIdleConfig`;
- if the `measIdleConfig` contains `validityAreaList`:
  - store the received `validityAreaList` in `VarMeasIdleConfig`;

if the `RRCRelease` includes `suspendConfig`:

- apply the received `suspendConfig`;
- remove all the entries within `VarConditionalReconfig`, if any;
- for each `measId`, if the associated `reportConfig` has a `reportType` set to `condTriggerConfig`:
  - for the associated `reportConfigId`:
    - remove the entry with the matching `reportConfigId` from the `reportConfigList` within the `VarMeasConfig`;
  - if the associated `measObjectId` is only associated to a `reportConfig` with `reportType` set to `condTriggerConfig`:
    - remove the entry with the matching `measObjectId` from the `measObjectList` within the `VarMeasConfig`;
  - remove the entry with the matching `measId` from the `measIdList` within the `VarMeasConfig`;
- reset MAC and release the default MAC Cell Group configuration, if any;
- re-establish RLC entities for SRB1;
- if the `RRCRelease` message with `suspendConfig` was received in response to an `RRCResumeRequest` or an `RRCResumeRequest1`:
  - stop the timer T319 if running;
  - in the stored UE Inactive AS context:
    - replace the `K_{gNB}` and `K_{RRCint}` keys with the current `K_{gNB}` and `K_{RRCint}` keys;
    - replace the C-RNTI with the temporary C-RNTI in the cell the UE has received the `RRCRelease` message;
    - replace the `cellIdentity` with the `cellIdentity` of the cell the UE has received the `RRCRelease` message;
    - replace the physical cell identity with the physical cell identity of the cell the UE has received the `RRCRelease` message;
- else:
3> store in the UE Inactive AS Context the current \( K_{\text{NB}} \) and \( K_{\text{RRCint}} \) keys, the ROHC state, the stored QoS flow to DRB mapping rules, the C-RNTI used in the source PCell, the cell Identity and the physical cell identity of the source PCell, the spCellConfigCommon within ReconfigurationWithSync of the NR PCell (if configured) and all other parameters configured except for:
- parameters within ReconfigurationWithSync of the PCell;
- parameters within ReconfigurationWithSync of the NR PCell, if configured;
- parameters within MobilityControlInfoSCG of the E-UTRA PCell, if configured;
- servingCellConfigCommonSIB;

NOTE 2: NR sidelink communication related configurations and logged measurement configuration are not stored as UE Inactive AS Context, when UE enters RRC_INACTIVE.

2> suspend all SRB(s) and DRB(s), except SRB0;
2> indicate PDCP suspend to lower layers of all DRBs;
2> if the \( t_{380} \) is included:
3> start timer T380, with the timer value set to \( t_{380} \);
2> if the RRCRelease message is including the waitTime:
3> start timer T302 with the value set to the waitTime;
3> inform upper layers that access barring is applicable for all access categories except categories '0' and '2';
2> if T390 is running:
3> stop timer T390 for all access categories;
3> perform the actions as specified in 5.3.14.4;
2> indicate the suspension of the RRC connection to upper layers;
2> enter RRC_INACTIVE and perform cell selection as specified in TS 38.304 [20];
1> else
2> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with the release cause 'other'.

5.3.8.4 T320 expiry

The UE shall:
1> if T320 expires:
2> if stored, discard the cell reselection priority information provided by the cellReselectionPriorities or inherited from another RAT;
2> apply the cell reselection priority information broadcast in the system information.

5.3.8.5 UE actions upon the expiry of DataInactivityTimer

Upon receiving the expiry of DataInactivityTimer from lower layers while in RRC_CONNECTED, the UE shall:
1> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause 'RRC connection failure'.

ETSİ
5.3.9   RRC connection release requested by upper layers

5.3.9.1   General

The purpose of this procedure is to release the RRC connection. Access to the current PCell may be barred as a result of this procedure.

5.3.9.2   Initiation

The UE initiates the procedure when upper layers request the release of the RRC connection as specified in TS 24.501 [23]. The UE shall not initiate the procedure for power saving purposes.

The UE shall:

1> if the upper layers indicate barring of the PCell:
   2> treat the PCell used prior to entering RRC_IDLE as barred according to TS 38.304 [20];
1> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause 'other'.

5.3.10   Radio link failure related actions

5.3.10.1   Detection of physical layer problems in RRC_CONNECTED

The UE shall:

1> if any DAPS bearer is configured, upon receiving N310 consecutive "out-of-sync" indications for the source SpCell from lower layers and T304 is running:
   2> start timer T310 for the source SpCell.
1> upon receiving N310 consecutive "out-of-sync" indications for the SpCell from lower layers while neither T300, T301, T304, T311, T316 nor T319 are running:
   2> start timer T310 for the corresponding SpCell.

5.3.10.2   Recovery of physical layer problems

Upon receiving N311 consecutive "in-sync" indications for the SpCell from lower layers while T310 is running, the UE shall:

1> stop timer T310 for the corresponding SpCell.
1> stop timer T312 for the corresponding SpCell, if running.

NOTE 1: In this case, the UE maintains the RRC connection without explicit signalling, i.e. the UE maintains the entire radio resource configuration.

NOTE 2: Periods in time where neither "in-sync" nor "out-of-sync" is reported by L1 do not affect the evaluation of the number of consecutive "in-sync" or "out-of-sync" indications.

5.3.10.3   Detection of radio link failure

The UE shall:

1> if any DAPS bearer is configured and T304 is running:
   2> upon T310 expiry in source SpCell; or
   2> upon random access problem indication from source MCG MAC; or
   2> upon indication from source MCG RLC that the maximum number of retransmissions has been reached; or
2> upon consistent uplink LBT failure indication from source MCG MAC:

3> consider radio link failure to be detected for the source MCG i.e. source RLF;

3> suspend the transmission and reception of all DRBs in the source MCG;

3> reset MAC for the source MCG;

3> release the source connection.

1> else:

2> during a DAPS handover: the following only applies for the target PCell;

2> upon T310 expiry in PCell; or

2> upon T312 expiry in PCell; or

2> upon random access problem indication from MCG MAC while neither T300, T301, T304, T311 nor T319 are running; or

2> upon indication from MCG RLC that the maximum number of retransmissions has been reached; or

2> if connected as an IAB-node, upon BH RLF indication received on BAP entity from the MCG; or

2> upon consistent uplink LBT failure indication from MCG MAC while T304 is not running:

3> if the indication is from MCG RLC and CA duplication is configured and activated for MCG, and for the corresponding logical channel allowedServingCells only includes SCell(s):

4> initiate the failure information procedure as specified in 5.7.5 to report RLC failure.

3> else:

4> consider radio link failure to be detected for the MCG, i.e. MCG RLF;

4> discard any segments of segmented RRC messages stored according to 5.7.6.3;

NOTE: Void.

4> if AS security has not been activated:

5> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause 'other';-

4> else if AS security has been activated but SRB2 and at least one DRB or, for IAB, SRB2, have not been setup:

5> store the radio link failure information in the VarRLF-Report as described in subclause 5.3.10.5;

5> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';

4> else:

5> store the radio link failure information in the VarRLF-Report as described in subclause 5.3.10.5;

5> if T316 is configured; and

5> if SCG transmission is not suspended; and

5> if PSCell change is not ongoing (i.e. timer T304 for the NR PSCell is not running in case of NR-DC or timer T307 of the E-UTRA PSCell is not running as specified in TS 36.331 [10], clause 5.3.10.10, in NE-DC):

6> initiate the MCG failure information procedure as specified in 5.7.3b to report MCG radio link failure.

5> else:
6> initiate the connection re-establishment procedure as specified in 5.3.7.

The UE may discard the radio link failure information, i.e. release the UE variable VarRLF-Report, 48 hours after the radio link failure is detected.

The UE shall:

1> upon T310 expiry in PSCell; or
2> upon T312 expiry in PSCell; or
3> upon random access problem indication from SCG MAC; or
4> upon indication from SCG RLC that the maximum number of retransmissions has been reached; or
5> if connected as an IAB-node, upon BH RLF indication received on BAP entity from the SCG; or
6> upon consistent uplink LBT failure indication from SCG MAC:

2> if the indication is from SCG RLC and CA duplication is configured and activated for SCG, and for the corresponding logical channel allowedServingCells only includes SCell(s):
3> initiate the failure information procedure as specified in 5.7.5 to report RLC failure.

2> else:

3> consider radio link failure to be detected for the SCG, i.e. SCG RLF;
4> if MCG transmission is not suspended:
5> initiate the SCG failure information procedure as specified in 5.7.3 to report SCG radio link failure.
5> else:

6> if the UE is in NR-DC:
5> initiate the connection re-establishment procedure as specified in 5.3.7;

6> else (the UE is in (NG)EN-DC):
5> initiate the connection re-establishment procedure as specified in TS 36.331 [10], clause 5.3.7;

5.3.10.4 RLF cause determination

The UE shall set the rlf-Cause in the VarRLF-Report as follows:

1> if the UE declares radio link failure due to T310 expiry:
2> set the rlf-Cause as t310-Expiry;

1> else if the UE declares radio link failure due to the random access problem indication from MCG MAC:
2> if the random access procedure was initiated for beam failure recovery:
3> set the rlf-Cause as beamFailureRecoveryFailure;
2> else:
3> set the rlf-Cause as randomAccessProblem;

1> else if the UE declares radio link failure due to the reaching of maximum number of retransmissions from the MCG RLC:
2> set the rlf-Cause as rlc-MaxNumRetx;

1> else if the UE declares radio link failure due to consistent uplink LBT failures:
2> set the rlf-Cause as lbtFailure;
else if the IAB-MT declares radio link failure due to the reception of a BH RLF indication on BAP entity:

set the rlf-Cause as bh-rlfRecoveryFailure.

5.3.10.5 RLF report content determination

The UE shall determine the content in the VarRLF-Report as follows:

1> clear the information included in VarRLF-Report, if any;
1> set the plmn-IdentityList to include the list of EPLMs stored by the UE (i.e. includes the RPLMN);
1> set the measResultLastServCell to include the cell level RSRP, RSRQ and the available SINR, of the source PCell(in case HO failure) or PCell (in case RLF) based on the available SSB and CSI-RS measurements collected up to the moment the UE detected failure;

1> if the SS/PBCH block-based measurement quantities are available:
2> set the rsIndexResults in measResultLastServCell to include all the available measurement quantities of the source PCell (in case HO failure) or PCell (in case RLF), ordered such that the highest SS/PBCH block RSRP is listed first if SS/PBCH block RSRP measurement results are available, otherwise the highest SS/PBCH block RSRQ is listed first if SS/PBCH block RSRQ measurement results are available, otherwise the highest SS/PBCH block SINR is listed first, based on the available SS/PBCH block based measurements collected up to the moment the UE detected failure;

1> if the CSI-RS based measurement quantities are available:
2> set the rsIndexResults in measResultLastServCell to include all the available measurement quantities of the source PCell (in case HO failure) or PCell (in case RLF), ordered such that the highest CSI-RS RSRP is listed first if CSI-RS RSRP measurement results are available, otherwise the highest CSI-RS RSRQ is listed first if CSI-RS RSRQ measurement results are available, otherwise the highest CSI-RS SINR is listed first, based on the available CSI-RS based measurements collected up to the moment the UE detected failure;
1> set the ssbRLMConfigBitmap and/or csi-rsRLMConfigBitmap in measResultLastServCell to include the radio link monitoring configuration of the source PCell(in case HO failure) or PCell (in case RLF);

1> for each of the configured measObjectNR in which measurements are available:
2> if the SS/PBCH block-based measurement quantities are available:
3> set the measResultListNR in measResultNeighCells to include all the available measurement quantities of the best measured cells, other than the source PCell (in case HO failure) or PCell (in case RLF), ordered such that the cell with highest SS/PBCH block RSRP is listed first if SS/PBCH block RSRP measurement results are available, otherwise the cell with highest SS/PBCH block RSRQ is listed first if SS/PBCH block RSRQ measurement results are available, otherwise the cell with highest SS/PBCH block SINR is listed first, based on the available SS/PBCH block based measurements collected up to the moment the UE detected failure;
4> for each neighbour cell included, include the optional fields that are available;

2> if the CSI-RS based measurement quantities are available:
3> set the measResultListNR in measResultNeighCells to include all the available measurement quantities of the best measured cells, other than the source PCell, ordered such that the cell with highest CSI-RS RSRP is listed first if CSI-RS RSRP measurement results are available, otherwise the cell with highest CSI-RS RSRQ is listed first if CSI-RS RSRQ measurement results are available, otherwise the cell with highest CSI-RS SINR is listed first, based on the available CSI-RS based measurements collected up to the moment the UE detected radio link failure;
4> for each neighbour cell included, include the optional fields that are available;

2> for each of the configured EUTRA frequencies in which measurements are available:
3> set the measResultListEUTRA in measResultNeighCells to include the best measured cells ordered such that the cell with highest RSRP is listed first if RSRP measurement results are available, otherwise the
cell with highest RSRQ is listed first, and based on measurements collected up to the moment the UE
detected failure;

4> for each neighbour cell included, include the optional fields that are available;

NOTE 1: The measured quantities are filtered by the L3 filter as configured in the mobility measurement
configuration. The measurements are based on the time domain measurement resource restriction, if
configured. Blacklisted cells are not required to be reported.

1> set the c-RNTI to the C-RNTI used in the source PCell(in case HO failure) or PCell (in case RLF);

1> if the failure is detected due to reconfiguration with sync failure as described in 5.3.5.8.3, set the fields in
VarRLF-report as follows:

2> set the connectionFailureType to hof;

2> if last RRCReconfiguration message including reconfigurationWithSync concerned a failed intra-RAT
handover (NR to NR):

3> set the nrFailedPCellId in failedPCellId to the global cell identity and tracking area code, if available,
and otherwise to the physical cell identity and carrier frequency of the target PCell of the failed handover;

2> else if last MobilityFromNRCommand concerned a failed inter-RAT handover from NR to E-UTRA and if
the UE supports Radio Link Failure Report for Inter-RAT MRO (NR to EUTRA):

3> set the eutraFailedPCellId in failedPCellId to the global cell identity and tracking area code, if available,
and otherwise to the physical cell identity and carrier frequency of the target PCell of the failed handover;

2> include nrPreviousCell in previousPCellId and set it to the global cell identity and tracking area code of the
PCell where the last RRCReconfiguration message including reconfigurationWithSync was received;

2> set the timeConnFailure to the elapsed time since reception of the last RRCReconfiguration message
including the reconfigurationWithSync;

1> else if the failure is detected due to radio link failure as described in 5.3.10.3, set the fields in VarRLF-report as
follows:

2> set the connectionFailureType to rlf;

2> set the rlf-Cause to the trigger for detecting radio link failure in accordance with clause 5.3.10.4;

2> set the nrFailedPCellId in failedPCellId to the global cell identity and the tracking area code, if available,
and otherwise to the physical cell identity and carrier frequency of the PCell where radio link failure is
detected;

2> if an RRCReconfiguration message including the reconfigurationWithSync was received before the
connection failure:

3> if the last RRCReconfiguration message including the reconfigurationWithSync concerned an intra NR
handover:

4> include the nrPreviousCell in previousPCellId and set it to the global cell identity and the tracking
area code of the PCell where the last RRCReconfiguration message including reconfigurationWithSync was received;

4> set the timeConnFailure to the elapsed time since reception of the last RRCReconfiguration message
including the reconfigurationWithSync;

3> else if the last RRCReconfiguration message including the reconfigurationWithSync concerned a
handover to NR from E-UTRA and if the UE supports Radio Link Failure Report for Inter-RAT MRO:

4> include the eutraPreviousCell in previousPCellId and set it to the global cell identity and the tracking
area code of the E-UTRA PCell where the last RRCReconfiguration message including reconfigurationWithSync was received embedded in E-UTRA RRC message
MobilityFromEUTRACCommand message as specified in TS 36.331 [10] clause 5.4.3.3;
4> set the `timeConnFailure` to the elapsed time since reception of the last `RRCReconfiguration` message including the `reconfigurationWithSync` embedded in E-UTRA RRC message `MobilityFromEUTRACommand` message as specified in TS 36.331 [10] clause 5.4.3.3;

1> if `connectionFailureType` is `rlf` and the `rlf-Cause` is set to `randomAccessProblem` or `beamFailureRecoveryFailure`; or

1> if `connectionFailureType` is `hof`;

2> set the `ra-InformationCommon` to include the random-access related information as described in subclause 5.7.10.5;

1> if location information is available, set the content of `locationInfo` as follows:

2> if available, set the `commonLocationInfo` to include the detailed location information;

2> if available, set the `bt-LocationInfo` in `locationInfo` to include the Bluetooth measurement results, in order of decreasing RSSI for Bluetooth beacons;

2> if available, set the `wlan-LocationInfo` in `locationInfo` to include the WLAN measurement results, in order of decreasing RSSI for WLAN APs;

2> if available, set the `sensor-LocationInfo` in `locationInfo` to include the sensor measurement results;

The UE may discard the radio link failure information or handover failure information, i.e. release the UE variable `VarRLF-Report`, 48 hours after the radio link failure/handover failure is detected.

NOTE 2: In this clause, the term 'handover failure' has been used to refer to 'reconfiguration with sync failure'.

### 5.3.11 UE actions upon going to RRC_IDLE

The UE shall:

1> reset MAC;

1> set the variable `pendingRNA-Update` to false, if that is set to true;

1> if going to RRC_IDLE was triggered by reception of the `RRCRelease` message including a `waitTime`:

2> if T302 is running:

3> stop timer T302;

2> start timer T302 with the value set to the `waitTime`;

2> inform upper layers that access barring is applicable for all access categories except categories '0' and '2'.

1> else:

2> if T302 is running:

3> stop timer T302;

3> perform the actions as specified in 5.3.14.4;

1> if T390 is running:

2> stop timer T390 for all access categories;

2> perform the actions as specified in 5.3.14.4;

1> if the UE is leaving RRC_INACTIVE:

2> if going to RRC_IDLE was not triggered by reception of the `RRCRelease` message:

3> if stored, discard the cell reselection priority information provided by the `cellReselectionPriorities`;
5.3.12 UE actions upon PUCCH/SRS release request

Upon receiving a PUCCH release request from lower layers, for all bandwidth parts of an indicated serving cell the UE shall:

1> release PUCCH-CSI-Resources configured in CSI-ReportConfig;

1> release SchedulingRequestResourceConfig instances configured in PUCCH-Config.

Upon receiving an SRS release request from lower layers, for all bandwidth parts of an indicated serving cell the UE shall:

1> release SRS-Resource instances configured in SRS-Config.
5.3.13 RRC connection resume

5.3.13.1 General

---

**Figure 5.3.13.1-1:** RRC connection resume, successful

UE

```
RRCResumeRequest/RRCResumeRequest1
```

```
RRCResume
```

```
RRCResumeComplete
```

Network

---

**Figure 5.3.13.1-2:** RRC connection resume fallback to RRC connection establishment, successful

UE

```
RRCResumeRequest/RRCResumeRequest1
```

```
RRCSetup
```

```
RRCSetupComplete
```

Network

---

**Figure 5.3.13.1-3:** RRC connection resume followed by network release, successful

UE

```
RRCResumeRequest/RRCResumeRequest1
```

```
RRCRelease
```

Network

---

**Figure 5.3.13.1-4:** RRC connection resume followed by network suspend, successful

UE

```
RRCResumeRequest/RRCResumeRequest1
```

```
RRCRelease with suspend configuration
```

Network
The purpose of this procedure is to resume a suspended RRC connection, including resuming SRB(s) and DRB(s) or perform an RNA update.

5.3.13.1a Conditions for resuming RRC Connection for sidelink communication

For NR sidelink communication an RRC connection is resumed only in the following cases:

1. if configured by upper layers to transmit NR sidelink communication and related data is available for transmission;
2. if the frequency on which the UE is configured to transmit NR sidelink communication is included in \(sl-FreqInfoList\) within \(SIB12\) provided by the cell on which the UE camps; and if the valid version of \(SIB12\) does not include \(sl-TxPoolSelectedNormal\) for the concerned frequency;

For V2X sidelink communication an RRC connection resume is initiated only when the conditions specified for V2X sidelink communication in subclause 5.3.3.1a of TS 36.331 [10] are met.

\[\text{NOTE: Upper layers initiate an RRC connection resume. The interaction with NAS is left to UE implementation.}\]

5.3.13.2 Initiation

The UE initiates the procedure when upper layers or AS (when responding to RAN paging, upon triggering RNA updates while the UE is in RRC_INACTIVE, or for sidelink communication as specified in sub-clause 5.3.13.1a) requests the resume of a suspended RRC connection.

The UE shall ensure having valid and up to date essential system information as specified in clause 5.2.2.2 before initiating this procedure.

Upon initiation of the procedure, the UE shall:

1. if the resumption of the RRC connection is triggered by response to NG-RAN paging:
   2. select '0' as the Access Category;
   2. perform the unified access control procedure as specified in 5.3.14 using the selected Access Category and one or more Access Identities provided by upper layers;
   3. if the access attempt is barred, the procedure ends;
1. else if the resumption of the RRC connection is triggered by upper layers:
   2. if the upper layers provide an Access Category and one or more Access Identities:
      3. perform the unified access control procedure as specified in 5.3.14 using the Access Category and Access Identities provided by upper layers;
      4. if the access attempt is barred, the procedure ends;
   2. set the \(resumeCause\) in accordance with the information received from upper layers;
1. else if the resumption of the RRC connection is triggered due to an RNA update as specified in 5.3.13.8:
2> if an emergency service is ongoing:

NOTE: How the RRC layer in the UE is aware of an ongoing emergency service is up to UE implementation.

3> select '2' as the Access Category;
3> set the resumeCause to emergency;

2> else:
3> select '8' as the Access Category;

2> perform the unified access control procedure as specified in 5.3.14 using the selected Access Category and one or more Access Identities to be applied as specified in TS 24.501 [23];

3> if the access attempt is barred:
4> set the variable pendingRNA-Update to true;
4> the procedure ends;

1> if the UE is in NE-DC or NR-DC:
2> if the UE does not support maintaining SCG configuration upon connection resumption:
3> release the MR-DC related configurations (i.e., as specified in 5.3.5.10) from the UE Inactive AS context, if stored;

1> if the UE does not support maintaining the MCG SCell configurations upon connection resumption:
2> release the MCG SCell(s) from the UE Inactive AS context, if stored;

1> apply the default L1 parameter values as specified in corresponding physical layer specifications, except for the parameters for which values are provided in SIB1;
1> apply the default SRB1 configuration as specified in 9.2.1;
1> apply the default MAC Cell Group configuration as specified in 9.2.2;
1> release delayBudgetReportingConfig from the UE Inactive AS context, if stored;
1> stop timer T342, if running;
1> release overheatingAssistanceConfig from the UE Inactive AS context, if stored;
1> stop timer T345, if running;
1> release idc-AssistanceConfig from the UE Inactive AS context, if stored;
1> release drx-PreferenceConfig for all configured cell groups from the UE Inactive AS context, if stored;
1> stop all instances of timer T346a, if running;
1> release maxBW-PreferenceConfig for all configured cell groups from the UE Inactive AS context, if stored;
1> stop all instances of timer T346b, if running;
1> release maxCC-PreferenceConfig for all configured cell groups from the UE Inactive AS context, if stored;
1> stop all instances of timer T346c, if running;
1> release maxMIMO-LayerPreferenceConfig for all configured cell groups from the UE Inactive AS context, if stored;
1> stop all instances of timer T346d, if running;
1> release minSchedulingOffsetPreferenceConfig for all configured cell groups from the UE Inactive AS context, if stored;
1> stop all instances of timer T346e, if running;
1> release releasePreferenceConfig from the UE Inactive AS context, if stored;
1> stop timer T346f, if running;
1> apply the CCCH configuration as specified in 9.1.1.2;
1> apply the timeAlignmentTimerCommon included in SIB1;
1> start timer T319;
1> set the variable pendingRNA-Update to false;
1> initiate transmission of the RRCResumeRequest message or RRCResumeRequest1 in accordance with 5.3.13.3.

5.3.13.3 Actions related to transmission of RRCResumeRequest or RRCResumeRequest1 message

The UE shall set the contents of RRCResumeRequest or RRCResumeRequest1 message as follows:

1> if field useFullResumeID is signalled in SIB1:
   2> select RRCResumeRequest1 as the message to use;
   2> set the resumeIdentity to the stored fullI-RNTI value;
1> else:
   2> select RRCResumeRequest as the message to use;
   2> set the resumeIdentity to the stored shortI-RNTI value;
1> restore the RRC configuration, RoHC state, the stored QoS flow to DRB mapping rules and the $K_{gNB}$ and $K_{RRCh}$ keys from the stored UE Inactive AS context except for the following:
   - masterCellGroup;
   - mrdc-SecondaryCellGroup, if stored; and
   - pdcp-Config;
1> set the resumeMAC-I to the 16 least significant bits of the MAC-I calculated:
   2> over the ASN.1 encoded as per clause 8 (i.e., a multiple of 8 bits) VarResumeMAC-Input;
   2> with the $K_{RRCh}$ key in the UE Inactive AS Context and the previously configured integrity protection algorithm; and
   2> with all input bits for COUNT, BEARER and DIRECTION set to binary ones;
1> derive the $K_{gNB}$ key based on the current $K_{gNB}$ key or the NH, using the stored nextHopChainingCount value, as specified in TS 33.501 [11];
1> derive the $K_{RRCe}$ key, the $K_{RRCh}$ key, the $K_{UPe}$ key and the $K_{UPe}$ key;
1> configure lower layers to apply integrity protection for all radio bearers except SRB0 using the configured algorithm and the $K_{RRCh}$ key and $K_{UPe}$ key derived in this subclause immediately, i.e., integrity protection shall be applied to all subsequent messages received and sent by the UE;

NOTE 1: Only DRBs with previously configured UP integrity protection shall resume integrity protection.

1> configure lower layers to apply ciphering for all radio bearers except SRB0 and to apply the configured ciphering algorithm, the $K_{RRCe}$ key and the $K_{UPe}$ key derived in this subclause, i.e. the ciphering configuration shall be applied to all subsequent messages received and sent by the UE;
1> re-establish PDCP entities for SRB1;
resume SRB1;

submit the selected message \textit{RRCResumeRequest} or \textit{RRCResumeRequest1} for transmission to lower layers.

\textbf{NOTE 2:} Only DRBs with previously configured UP ciphering shall resume ciphering.

If lower layers indicate an integrity check failure while T319 is running, perform actions specified in 5.3.13.5.

The UE shall continue cell re-selection related measurements as well as cell re-selection evaluation. If the conditions for cell re-selection are fulfilled, the UE shall perform cell re-selection as specified in 5.3.13.6.

\subsection*{5.3.13.4 Reception of the \textit{RRCResume} by the UE}

The UE shall:

1> stop timer T319;

1> stop timer T380, if running;

1> if T331 is running:

2> stop timer T331;

2> perform the actions as specified in 5.7.8.3;

1> if the \textit{RRCResume} includes the \textit{fullConfig}:

2> perform the full configuration procedure as specified in 5.3.5.11;

1> else:

2> if the \textit{RRCResume} does not include the \textit{restoreMCG-SCells}:

3> release the MCG SCell(s) from the UE Inactive AS context, if stored;

2> if the \textit{RRCResume} does not include the \textit{restoreSCG}:

3> release the MR-DC related configurations (i.e., as specified in 5.3.5.10) from the UE Inactive AS context, if stored;

2> restore the \textit{masterCellGroup}, \textit{mrdc-SecondaryCellGroup}, if stored, and \textit{pdcp-Config} from the UE Inactive AS context;

2> configure lower layers to consider the restored MCG and SCG SCell(s) (if any) to be in deactivated state;

1> discard the UE Inactive AS context;

1> release the \textit{suspendConfig} except the \textit{ran-NotificationAreaInfo};

1> if the \textit{RRCResume} includes the \textit{masterCellGroup}:

2> perform the cell group configuration for the received \textit{masterCellGroup} according to 5.3.5.5;

1> if the \textit{RRCResume} includes the \textit{mrdc-SecondaryCellGroup}:

2> if the received \textit{mrdc-SecondaryCellGroup} is set to \textit{nr-SCG}:

3> perform the RRC reconfiguration according to 5.3.5.3 for the \textit{RRCReconfiguration} message included in \textit{nr-SCG};

2> if the received \textit{mrdc-SecondaryCellGroup} is set to \textit{eutra-SCG}:

3> perform the RRC connection reconfiguration as specified in TS 36.331 [10], clause 5.3.5.3 for the \textit{RRCConnectionReconfiguration} message included in \textit{eutra-SCG};

1> if the \textit{RRCResume} includes the \textit{radioBearerConfig}:

2> perform the radio bearer configuration according to 5.3.5.6;
1> if the **RRCResume** message includes the *sk-Counter*:
   2> perform security key update procedure as specified in 5.3.5.7;

1> if the **RRCResume** message includes the *radioBearerConfig2*:
   2> perform the radio bearer configuration according to 5.3.5.6;

1> if the **RRCResume** message includes the *needForGapsConfigNR*:
   2> if *needForGapsConfigNR* is set to *setup*:
      3> consider itself to be configured to provide the measurement gap requirement information of NR target bands;
   2> else:
      3> consider itself not to be configured to provide the measurement gap requirement information of NR target bands;

1> resume SRB2, SRB3 (if configured), and all DRBs;

1> if stored, discard the cell reselection priority information provided by the *cellReselectionPriorities* or inherited from another RAT;

1> stop timer T320, if running;

1> if the **RRCResume** message includes the *measConfig*:
   2> perform the measurement configuration procedure as specified in 5.5.2;

1> resume measurements if suspended;

1> if T390 is running:
   2> stop timer T390 for all access categories;
   2> perform the actions as specified in 5.3.14.4;

1> if T302 is running:
   2> stop timer T302;
   2> perform the actions as specified in 5.3.14.4;

1> enter RRC_CONNECTED;

1> indicate to upper layers that the suspended RRC connection has been resumed;

1> stop the cell re-selection procedure;

1> consider the current cell to be the PCell;

1> set the content of the of **RRCResumeComplete** message as follows:
   2> if the upper layer provides NAS PDU, set the *dedicatedNAS-Message* to include the information received from upper layers;
   2> if upper layers provides a PLMN and UE is either allowed or instructed to access the PLMN via a cell for which at least one CAG ID is broadcast:
      3> set the *selectedPLMN-Identity* from the *npn-IdentityInfoList*;
   2> else:
      3> set the *selectedPLMN-Identity* to the PLMN selected by upper layers from the *plmn-IdentityList*;
   2> if the *masterCellGroup* contains the *reportUplinkTxDirectCurrent*:
3> include the uplinkTxDirectCurrentList for each MCG serving cell with UL;
3> include uplinkDirectCurrentBWP-SUL for each MCG serving cell configured with SUL carrier, if any, within the uplinkTxDirectCurrentList;

2> if the UE has idle/inactive measurement information concerning cells other than the PCell available in VarMeasIdleReport:
3> if the idleModeMeasurementReq is included in the RRCResume message:
   4> set the measResultIdleEUTRA in the RRCResumeComplete message to the value of measReportIdleEUTRA in the VarMeasIdleReport, if available;
   4> set the measResultIdleNR in the RRCResumeComplete message to the value of measReportIdleNR in the VarMeasIdleReport, if available;
   4> discard the VarMeasIdleReport upon successful delivery of the RRCResumeComplete message is confirmed by lower layers;
3> else:
   4> if the SIB1 contains idleModeMeasurementsNR and the UE has NR idle/inactive measurement information concerning cells other than the PCell available in VarMeasIdleReport; or
   4> if the SIB1 contains idleModeMeasurementsEUTRA and the UE has E-UTRA idle/inactive measurement information available in VarMeasIdleReport:
      5> include the idleMeasAvailable;

2> if the RRCResume message includes the mrdc-SecondaryCellGroupConfig with mrdc-SecondaryCellGroup set to eutra-SCG:
3> include in the eutra-SCG-Response the E-UTRA RRCCONNECTIONReconfigurationComplete message in accordance with TS 36.331 [10] clause 5.3.5.3;
2> if the RRCResume message includes the mrdc-SecondaryCellGroupConfig with mrdc-SecondaryCellGroup set to nr-SCG:
3> include in the nr-SCG-Response the SCG RRCCONNECTIONReconfigurationComplete message;
2> if the UE has logged measurements available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:
3> include the logMeasAvailable in the RRCResumeComplete message;
3> if Bluetooth measurement results are included in the logged measurements the UE has available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:
   4> include the logMeasAvailableBT in the RRCResumeComplete message;
3> if WLAN measurement results are included in the logged measurements the UE has available for NR and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:
   4> include the logMeasAvailableWLAN in the RRCResumeComplete message;
2> if the UE has connection establishment failure or connection resume failure information available in VarConnEstFailReport and if the RPLMN is equal to plmn-Identity stored in VarConnEstFailReport:
3> include connEstFailInfoAvailable in the RRCResumeComplete message;
2> if the UE has radio link failure or handover failure information available in VarRLF-Report and if the RPLMN is included in plmn-IdentityList stored in VarRLF-Report; or
2> if the UE has radio link failure or handover failure information available in VarRLF-Report of TS 36.331 [10] and if the UE is capable of cross-RAT RLF reporting and if the RPLMN is included in plmn-IdentityList stored in VarRLF-Report of TS 36.331 [10]:
3> include rlf-InfoAvailable in the RRCResumeComplete message;

2> if the UE supports storage of mobility history information and the UE has mobility history information available in VarMobilityHistoryReport:

3> include the mobilityHistoryAvail in the RRCResumeComplete message;

2> if speedStateReselectionPars is configured in the SIB2:

3> include the mobilityState in the RRCResumeComplete message and set it to the mobility state (as specified in TS 38.304 [20]) of the UE just prior to entering RRC_CONNECTED state;

2> if the UE is configured to provide the measurement gap requirement information of NR target bands:

3> include the NeedForGapsInfoNR and set the contents as follows:

4> include intraFreq-needForGap and set the gap requirement information of intra-frequency measurement for each NR serving cell;

4> if requestedTargetBandFilterNR is configured, for each supported NR band that is also included in requestedTargetBandFilterNR, include an entry in interFreq-needForGap and set the gap requirement information for that band; otherwise, include an entry in interFreq-needForGap and set the corresponding gap requirement information for each supported NR band;

1> submit the RRCResumeComplete message to lower layers for transmission;

1> the procedure ends.

5.3.13.5 T319 expiry or Integrity check failure from lower layers while T319 is running

The UE shall:

1> if timer T319 expires or upon receiving Integrity check failure indication from lower layers while T319 is running:

2> if the UE has connection establishment failure information or connection resume failure information available in VarConnEstFailReport and if the RPLMN is not equal to plmn-identity stored in VarConnEstFailReport; or

2> if the cell identity of current cell is not equal to the cell identity stored in measResultFailedCell in VarConnEstFailReport:

3> reset the numberOfConnFail to 0;

2> clear the content included in VarConnEstFailReport except for the numberOfConnFail, if any;

2> store the following connection resume failure information in the VarConnEstFailReport by setting its fields as follows:

3> set the plmn-Identity to the PLMN selected by upper layers (see TS 24.501 [23]) from the PLMN(s) included in the plmn-IdentityList in SIB1;

3> set the measResultFailedCell to include the global cell identity, tracking area code, the cell level and SS/PBCH block level RSRP, and RSRQ, and SS/PBCH block indexes, of the failed cell based on the available SSB measurements collected up to the moment the UE detected connection resume failure;

3> if available, set the measResultNeighCells, in order of decreasing ranking-criterion as used for cell reselection, to include neighbouring cell measurements for at most the following number of neighbouring cells: 6 intra-frequency and 3 inter-frequency neighbours per frequency as well as 3 inter-RAT neighbours, per frequency/ set of frequencies per RAT and according to the following:

4> for each neighbour cell included, include the optional fields that are available;

NOTE: The UE includes the latest results of the available measurements as used for cell reselection evaluation, which are performed in accordance with the performance requirements as specified in TS 38.133 [14].
3> if available, set the *locationInfo* as in 5.3.3.7;

3> set *perRAInfoList* to indicate random access failure information as specified in 5.7.10.5;

3> if *numberOfConnFail* is smaller than 8:
   4> increment the *numberOfConnFail* by 1;
   2> perform the actions upon going to RRC_IDLE as specified in 5.3.11 with release cause 'RRC Resume failure'.

The UE may discard the connection resume failure or connection establishment failure information, i.e. release the UE variable *VarConnEstFailReport*, 48 hours after the last connection resume failure is detected.

5.3.13.6 Cell re-selection or cell selection while T390, T319 or T302 is running (UE in RRC_INACTIVE)

The UE shall:

1> if cell reselection occurs while T319 or T302 is running:
   2> perform the actions upon going to RRC_IDLE as specified in 5.3.11 with release cause 'RRC Resume failure';

1> else if cell selection or reselection occurs while T390 is running:
   2> stop T390 for all access categories;
   2> perform the actions as specified in 5.3.14.4.

5.3.13.7 Reception of the *RRCSetup* by the UE

The UE shall:

1> perform the RRC connection setup procedure as specified in 5.3.3.4.

5.3.13.8 RNA update

In RRC_INACTIVE state, the UE shall:

1> if T380 expires; or

1> if RNA Update is triggered at reception of SIB1, as specified in 5.2.2.4.2:
   2> initiate RRC connection resume procedure in 5.3.13.2 with *resumeCause* set to *rna-Update*;

1> if barring is alleviated for Access Category '8' or Access Category '2', as specified in 5.3.14.4:
   2> if upper layers do not request RRC the resumption of an RRC connection, and
   2> if the variable *pendingRNA-Update* is set to *true*:
      3> initiate RRC connection resume procedure in 5.3.13.2 with *resumeCause* value set to *rna-Update*.

If the UE in RRC_INACTIVE state fails to find a suitable cell and camps on the acceptable cell to obtain limited service as defined in TS 38.304 [20], the UE shall:

1> perform the actions upon going to RRC_IDLE as specified in 5.3.11 with release cause 'other'.

**NOTE:** It is left to UE implementation how to behave when T380 expires while the UE is camped neither on a suitable nor on an acceptable cell.

5.3.13.9 Reception of the *RRCRelease* by the UE

The UE shall:
5.3.13.10 Reception of the \textit{RRCReject} by the UE

The UE shall:

1> perform the actions as specified in 5.3.8.

5.3.13.11 Inability to comply with \textit{RRCResume}

The UE shall:

1> if the UE is unable to comply with (part of) the configuration included in the \textit{RRCResume} message;

2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with release cause 'RRC Resume failure'.

NOTE 1: The UE may apply above failure handling also in case the \textit{RRCResume} message causes a protocol error for which the generic error handling as defined in 10 specifies that the UE shall ignore the message.

NOTE 2: If the UE is unable to comply with part of the configuration, it does not apply any part of the configuration, i.e. there is no partial success/failure.

5.3.13.12 Inter RAT cell reselection

Upon reselecting to an inter-RAT cell, the UE shall:

1> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'other'.

5.3.14 Unified Access Control

5.3.14.1 General

The purpose of this procedure is to perform access barring check for an access attempt associated with a given Access Category and one or more Access Identities upon request from upper layers according to TS 24.501 [23] or the RRC layer. This procedure does not apply to IAB-MT.

After a PCell change in RRC\_CONNECTED the UE shall defer access barring checks until it has obtained \textit{SIB1} (as specified in 5.2.2.2) from the target cell.

5.3.14.2 Initiation

Upon initiation of the procedure, the UE shall:

1> if timer T390 is running for the Access Category:

2> consider the access attempt as barred;

1> else if timer T302 is running and the Access Category is neither '2' nor '0':

2> consider the access attempt as barred;

1> else:

2> if the Access Category is '0':

3> consider the access attempt as allowed;

2> else:

3> if \textit{SIB1} includes \textit{uac-BarringPerPLMN\_List} that contains a \textit{UAC-BarringPerPLMN} for the selected PLMN or SNPN:
3GPP TS 38.331 version 16.3.1 Release 16

122

ETSI TS 138 331 V16.3.1 (2021-01)

if the procedure in 5.2.2.4.2 for a selected PLMN resulted in use of information in npn-IdentityInfoList and UAC-BarringPerPLMN has an entry with the plmn-IdentityIndex corresponding to used information in this list:

select the UAC-BarringPerPLMN entry with the plmn-IdentityIndex corresponding to used information in the npn-IdentityInfoList;

else:

select the UAC-BarringPerPLMN entry with the plmn-IdentityIndex corresponding to the selected PLMN and the PLMN-IdentityInfo, if any, or the selected SNPN and the npn-IdentityInfoList;

if any UAC-BarringPerPLMN entry is selected:

in the remainder of this procedure, use the selected UAC-BarringPerPLMN entry (i.e. presence or absence of access barring parameters in this entry) irrespective of the uac-BarringForCommon included in SIB1;

else if SIB1 includes uac-BarringForCommon:

in the remainder of this procedure use the uac-BarringForCommon (i.e. presence or absence of these parameters) included in SIB1;

else:

consider the access attempt as allowed;

if uac-BarringForCommon is applicable or the uac-ACBarringListType indicates that uac-ExplicitACBarringList is used:

if the corresponding UAC-BarringPerCatList contains a UAC-BarringPerCat entry corresponding to the Access Category:

select the UAC-BarringPerCat entry;

if the uac-BarringInfoSetList contains a UAC-BarringInfoSet entry corresponding to the selected uac-barringInfoSetIndex in the UAC-BarringPerCat:

select the UAC-BarringInfoSet entry;

perform access barring check for the Access Category as specified in 5.3.14.5, using the selected UAC-BarringInfoSet as "UAC barring parameter";

else:

consider the access attempt as allowed;

else:

consider the access attempt as allowed;

else if the uac-ACBarringListType indicates that uac-ImplicitACBarringList is used:

select the uac-BarringInfoSetIndex corresponding to the Access Category in the uac-ImplicitACBarringList;

if the uac-BarringInfoSetList contains the UAC-BarringInfoSet entry corresponding to the selected uac-BarringInfoSetIndex:

select the UAC-BarringInfoSet entry;

perform access barring check for the Access Category as specified in 5.3.14.5, using the selected UAC-BarringInfoSet as "UAC barring parameter";

else:

consider the access attempt as allowed;
else:
    consider the access attempt as allowed;

if the access barring check was requested by upper layers:
    if the access attempt is considered as barred:
        if timer T302 is running:
            if timer T390 is running for Access Category '2':
                inform the upper layer that access barring is applicable for all access categories except categories '0', upon which the procedure ends;
            else
                inform the upper layer that access barring is applicable for all access categories except categories '0' and '2', upon which the procedure ends;
        else:
            inform upper layers that the access attempt for the Access Category is barred, upon which the procedure ends;
    else:
        inform upper layers that the access attempt for the Access Category is allowed, upon which the procedure ends;
else:
    the procedure ends.

5.3.14.3 Void

5.3.14.4 T302, T390 expiry or stop (Barring alleviation)

The UE shall:

if timer T302 expires or is stopped:
    for each Access Category for which T390 is not running:
        consider the barring for this Access Category to be alleviated;
else if timer T390 corresponding to an Access Category other than '2' expires or is stopped, and if timer T302 is not running:
    consider the barring for this Access Category to be alleviated;
else if timer T390 corresponding to the Access Category '2' expires or is stopped:
    consider the barring for this Access Category to be alleviated;
when barring for an Access Category is considered being alleviated:
    if the Access Category was informed to upper layers as barred:
        inform upper layers about barring alleviation for the Access Category.
    if barring is alleviated for Access Category '8':
        perform actions specified in 5.3.13.8;
5.3.14.5 Access barring check

The UE shall:

1> if one or more Access Identities are indicated according to TS 24.501 [23], and

1> if for at least one of these Access Identities the corresponding bit in the \texttt{uac-BarringForAccessIdentity} contained in "UAC barring parameter" is set to zero:

2> consider the access attempt as allowed;

1> else:

   2> draw a random number \texttt{rand} uniformly distributed in the range: $0 \leq \texttt{rand} < 1$;

   2> if \texttt{rand} is lower than the value indicated by \texttt{uac-BarringFactor} included in "UAC barring parameter":

      3> consider the access attempt as allowed;

   2> else:

      3> consider the access attempt as barred;

1> if the access attempt is considered as barred:

   2> draw a random number \texttt{rand} that is uniformly distributed in the range $0 \leq \texttt{rand} < 1$;

   2> start timer \texttt{T390} for the Access Category with the timer value calculated as follows, using the \texttt{uac-BarringTime} included in "AC barring parameter":

   \[
   \texttt{T390} = (0.7 + 0.6 \times \texttt{rand}) \times \texttt{uac-BarringTime}.
   \]

5.3.15 RRC connection reject

5.3.15.1 Initiation

The UE initiates the procedure upon the reception of \texttt{RRCReject} when the UE tries to establish or resume an RRC connection.

5.3.15.2 Reception of the \texttt{RRCReject} by the UE

The UE shall:

1> stop timer \texttt{T300}, if running;

1> stop timer \texttt{T319}, if running;

1> stop timer \texttt{T302}, if running;

1> reset MAC and release the default MAC Cell Group configuration;

1> if \texttt{waitTime} is configured in the \texttt{RRCReject}:

   2> start timer \texttt{T302}, with the timer value set to the \texttt{waitTime};

1> if \texttt{RRCReject} is received in response to a request from upper layers:

   2> inform the upper layer that access barring is applicable for all access categories except categories '0' and '2';

1> if \texttt{RRCReject} is received in response to an \texttt{RRCSetupRequest}:

   2> inform upper layers about the failure to setup the RRC connection, upon which the procedure ends;

1> else if \texttt{RRCReject} is received in response to an \texttt{RRCResumeRequest} or an \texttt{RRCResumeRequest1}:

   2> if resume is triggered by upper layers:
3GPP TS 38.331 version 16.3.1 Release 16

5.4 Inter-RAT mobility

5.4.1 Introduction

Network controlled inter-RAT mobility between NR and E-UTRA is supported, where E-UTRA can be connected to either EPC or 5GC.

5.4.2 Handover to NR

5.4.2.1 General

The purpose of this procedure is to, under the control of the network, transfer a connection between the UE and another Radio Access Network (e.g. E-UTRAN) to NR.

The handover to NR procedure applies when SRBs, possibly in combination with DRBs, are established in another RAT. Handover from E-UTRA to NR applies only after integrity has been activated in E-UTRA.

5.4.2.2 Initiation

The RAN using another RAT initiates the handover to NR procedure, in accordance with the specifications applicable for the other RAT, by sending the RRCReconfiguration message via the radio access technology from which the inter-RAT handover is performed.

The network applies the procedure as follows:

- to activate ciphering, possibly using NULL algorithm, if not yet activated in the other RAT;
- to re-establish SRBs and one or more DRBs;

5.4.2.3 Reception of the RRCReconfiguration by the UE

The UE shall:

3> inform upper layers about the failure to resume the RRC connection;
2> if resume is triggered due to an RNA update:
3> set the variable pendingRNA-Update to true;
2> discard the current K_{gNB} key, the K_{RRChenc} key, the K_{RRClint} key, the K_{UPint} key and the K_{UPenc} key derived in accordance with 5.3.13.3;
2> suspend SRB1, upon which the procedure ends;

The RRC_INACTIVE UE shall continue to monitor paging while the timer T302 is running.

NOTE: If timer T331 is running, the UE continues to perform idle/inactive measurements according to 5.7.8.
1> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the parameters for which values are provided in SIB1;

1> apply the default MAC Cell Group configuration as specified in 9.2.2;

1> perform RRC reconfiguration procedure as specified in 5.3.5;

NOTE: If the UE is connected to 5GC of the source E-UTRA cell, the delta configuration for PDCP and SDAP can be used for intra-system inter-RAT handover. For other cases, source RAT configuration is not considered when the UE applies the reconfiguration message of target RAT.

5.4.3 Mobility from NR

5.4.3.1 General

![Figure 5.4.3.1-1: Mobility from NR, successful](image)

The purpose of this procedure is to move a UE in RRC_CONNECTED to a cell using other RAT, e.g. E-UTRA, UTRA-FDD. The mobility from NR procedure covers the following type of mobility:

- handover, i.e. the MobilityFromNRCommand message includes radio resources that have been allocated for the UE in the target cell;

5.4.3.2 Initiation

The network initiates the mobility from NR procedure to a UE in RRC_CONNECTED, possibly in response to a MeasurementReport or an MCGFailureInformation message, by sending a MobilityFromNRCommand message. The network applies the procedure as follows:

- the procedure is initiated only when AS security has been activated, and SRB2 with at least one DRB are setup and not suspended;

- the procedure is not initiated if any DAPS bearer is configured;

5.4.3.3 Reception of the MobilityFromNRCommand by the UE

The UE shall:

1> stop timer T310, if running;

1> stop timer T312, if running;
1> if T316 is running:
   2> stop timer T316;
   2> clear the information included in VarRLF-Report, if any;

1> if T390 is running:
   2> stop timer T390 for all access categories;
   2> perform the actions as specified in 5.3.14.4;

1> if the targetRAT-Type is set to eutra:
   2> consider inter-RAT mobility as initiated towards E-UTRA;
   2> forward the nas-SecurityParamFromNR to the upper layers, if included;

1> else if the targetRAT-Type is set to utra-fdd:
   2> consider inter-RAT mobility as initiated towards UTRA-FDD;
   2> forward the nas-SecurityParamFromNR to the upper layers, if included;

1> access the target cell indicated in the inter-RAT message in accordance with the specifications of the target RAT.

5.4.3.4 Successful completion of the mobility from NR

Upon successfully completing the handover, at the source side the UE shall:

1> reset MAC;

1> stop all timers that are running except T400;

1> release ran-NotificationAreaInfo, if stored;

1> release the AS security context including the K_{RRCenc} key, the K_{RRCint} key, the K_{UPint} key and the K_{UPenc} key, if stored;

1> release all radio resources, including release of the RLC entity and the MAC configuration;

1> release the associated PDCP entity and SDAP entity for all established RBs;

NOTE: PDCP and SDAP configured by the source RAT prior to the handover that are reconfigured and re-used by target RAT when delta signalling (i.e., during inter-RAT intra-system handover when fullConfig is not present) is used, are not released as part of this procedure.

1> if the targetRAT-Type is set to eutra and the nas-SecurityParamFromNR is included; or

1> if the targetRAT-Type is set to utra-fdd:

   2> indicate the release of the RRC connection to upper layers together with the release cause 'other'.

5.4.3.5 Mobility from NR failure

The UE shall:

1> if the UE does not succeed in establishing the connection to the target radio access technology:

   2> if the UE supports Radio Link Failure Report for Inter-RAT MRO:

      3> store handover failure information in VarRLF-Report according to 5.3.10.5;

   2> if voiceFallbackIndication is included in the MobilityFromNRCommand message:

      3> attempt to select an E-UTRA cell:
if a suitable E-UTRA cell is selected:

4> perform the actions upon going to RRC_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';

4> else:

5> revert back to the configuration used in the source PCell;

5> initiate the connection re-establishment procedure as specified in subclause 5.3.7;

2> else:

3> revert back to the configuration used in the source PCell;

3> initiate the connection re-establishment procedure as specified in subclause 5.3.7;

1> else if the UE is unable to comply with any part of the configuration included in the MobilityFromNRCommand message; or

1> if there is a protocol error in the inter RAT information included in the MobilityFromNRCommand message, causing the UE to fail the procedure according to the specifications applicable for the target RAT:

2> revert back to the configuration used in the source PCell;

2> initiate the connection re-establishment procedure as specified in subclause 5.3.7.

5.5 Measurements

5.5.1 Introduction

The network may configure an RRC_CONNECTED UE to perform measurements. The network may configure the UE to report them in accordance with the measurement configuration or perform conditional reconfiguration evaluation in accordance with the conditional reconfiguration. The measurement configuration is provided by means of dedicated signalling i.e. using the RRCReconfiguration or RRCResume.

The network may configure the UE to perform the following types of measurements:

- NR measurements;
- Inter-RAT measurements of E-UTRA frequencies.
- Inter-RAT measurements of UTRA-FDD frequencies.

The network may configure the UE to report the following measurement information based on SS/PBCH block(s):

- Measurement results per SS/PBCH block;
- Measurement results per cell based on SS/PBCH block(s);
- SS/PBCH block(s) indexes.

The network may configure the UE to report the following measurement information based on CSI-RS resources:

- Measurement results per CSI-RS resource;
- Measurement results per cell based on CSI-RS resource(s);
- CSI-RS resource measurement identifiers.

The network may configure the UE to perform the following types of measurements for sidelink:

- CBR measurements.

The network may configure the UE to report the following CLI measurement information based on SRS resources:
- Measurement results per SRS resource;
- SRS resource(s) indexes.

The network may configure the UE to report the following CLI measurement information based on CLI-RSSI resources:

- Measurement results per CLI-RSSI resource;
- CLI-RSSI resource(s) indexes.

The measurement configuration includes the following parameters:

1. **Measurement objects**: A list of objects on which the UE shall perform the measurements.
   - For intra-frequency and inter-frequency measurements a measurement object indicates the frequency/time location and subcarrier spacing of reference signals to be measured. Associated with this measurement object, the network may configure a list of cell specific offsets, a list of 'blacklisted' cells and a list of 'whitelisted' cells. Blacklisted cells are not applicable in event evaluation or measurement reporting. Whitelisted cells are the only ones applicable in event evaluation or measurement reporting.
   - The `measObjectId` of the MO which corresponds to each serving cell is indicated by `servingCellMO` within the serving cell configuration.
   - For inter-RAT E-UTRA measurements a measurement object is a single E-UTRA carrier frequency. Associated with this E-UTRA carrier frequency, the network can configure a list of cell specific offsets, a list of 'blacklisted' cells and a list of 'whitelisted' cells. Blacklisted cells are not applicable in event evaluation or measurement reporting. Whitelisted cells are the only ones applicable in event evaluation or measurement reporting.
   - For inter-RAT UTRA-FDD measurements a measurement object is a set of cells on a single UTRA-FDD carrier frequency.
   - For CBR measurement of NR sidelink communication, a measurement object is a set of transmission resource pool(s) on a single carrier frequency for NR sidelink communication.
   - For CLI measurements a measurement object indicates the frequency/time location of SRS resources and/or CLI-RSSI resources, and subcarrier spacing of SRS resources to be measured.

2. **Reporting configurations**: A list of reporting configurations where there can be one or multiple reporting configurations per measurement object. Each measurement reporting configuration consists of the following:
   - Reporting criterion: The criterion that triggers the UE to send a measurement report. This can either be periodical or a single event description.
   - RS type: The RS that the UE uses for beam and cell measurement results (SS/PBCH block or CSI-RS).
   - Reporting format: The quantities per cell and per beam that the UE includes in the measurement report (e.g. RSRP) and other associated information such as the maximum number of cells and the maximum number beams per cell to report.

   In case of conditional reconfiguration, each configuration consists of the following:
   - Execution criteria: The criteria the UE uses for conditional reconfiguration execution.
   - RS type: The RS that the UE uses for obtaining beam and cell measurement results (SS/PBCH block-based or CSI-RS-based), used for evaluating conditional reconfiguration execution condition.

3. **Measurement identities**: For measurement reporting, a list of measurement identities where each measurement identity links one measurement object with one reporting configuration. By configuring multiple measurement identities, it is possible to link more than one measurement object to the same reporting configuration, as well as to link more than one reporting configuration to the same measurement object. The measurement identity is also included in the measurement report that triggered the reporting, serving as a reference to the network. For conditional reconfiguration triggering, one measurement identity links to exactly one conditional reconfiguration trigger configuration. And up to 2 measurement identities can be linked to one conditional reconfiguration execution condition.
4. **Quantity configurations:** The quantity configuration defines the measurement filtering configuration used for all event evaluation and related reporting, and for periodical reporting of that measurement. For NR measurements, the network may configure up to 2 quantity configurations with a reference in the NR measurement object to the configuration that is to be used. In each configuration, different filter coefficients can be configured for different measurement quantities, for different RS types, and for measurements per cell and per beam.

5. **Measurement gaps:** Periods that the UE may use to perform measurements.

A UE in RRC_CONNECTED maintains a measurement object list, a reporting configuration list, and a measurement identities list according to signalling and procedures in this specification. The measurement object list possibly includes NR measurement object(s), CLI measurement object(s) and inter-RAT objects. Similarly, the reporting configuration list includes NR and inter-RAT reporting configurations. Any measurement object can be linked to any reporting configuration of the same RAT type. Some reporting configurations may not be linked to a measurement object. Likewise, some measurement objects may not be linked to a reporting configuration.

The measurement procedures distinguish the following types of cells:

1. The NR serving cell(s) – these are the SpCell and one or more SCells.
2. Listed cells – these are cells listed within the measurement object(s).
3. Detected cells – these are cells that are not listed within the measurement object(s) but are detected by the UE on the SSB frequency(ies) and subcarrier spacing(s) indicated by the measurement object(s).

For NR measurement object(s), the UE measures and reports on the serving cell(s), listed cells and/or detected cells. For inter-RAT measurements object(s) of E-UTRA, the UE measures and reports on listed cells and detected cells and, for RSSI and channel occupancy measurements, the UE measures and reports on the configured resources on the indicated frequency. For inter-RAT measurements object(s) of UTRA-FDD, the UE measures and reports on listed cells. For CLI measurement object(s), the UE measures and reports on configured measurement resources (i.e. SRS resources and/or CLI-RSSI resources).

Whenever the procedural specification, other than contained in sub-clause 5.5.2, refers to a field it concerns a field included in the VarMeasConfig unless explicitly stated otherwise i.e. only the measurement configuration procedure covers the direct UE action related to the received measConfig.

In NR-DC, the UE may receive two independent measConfig:

- a measConfig, associated with MCG, that is included in the RRCReconfiguration message received via SRB1; and
- a measConfig, associated with SCG, that is included in the RRCReconfiguration message received via SRB3, or, alternatively, included within a RRCReconfiguration message embedded in a RRCReconfiguration message received via SRB1.

In this case, the UE maintains two independent VarMeasConfig and VarMeasReportList, one associated with each measConfig, and independently performs all the procedures in clause 5.5 for each measConfig and the associated VarMeasConfig and VarMeasReportList, unless explicitly stated otherwise.

The configurations related to CBR measurments are only included in the measConfig associated with MCG.

5.5.2 **Measurement configuration**

5.5.2.1 **General**

The network applies the procedure as follows:

- to ensure that, whenever the UE has a measConfig associated with a CG, it includes a measObject for the SpCell and for each NR SCell of the CG to be measured;
- to configure at most one measurement identity across all CGs using a reporting configuration with the reportType set to reportCGI;
- to configure at most one measurement identity per CG using a reporting configuration with the ul-DelayValueConfig;

- to ensure that, in the measConfig associated with a CG:
  - for all SSB based measurements there is at most one measurement object with the same ssbFrequency;
  - an smtc1 included in any measurement object with the same ssbFrequency has the same value and that an smtc2 included in any measurement object with the same ssbFrequency has the same value;
  - to ensure that all measurement objects configured in this specification and in TS 36.331 [10] with the same ssbFrequency have the same ssbSubcarrierSpacing;
  - to ensure that, if a measurement object associated with the MCG has the same ssbFrequency as a measurement object associated with the SCG:
    - for that ssbFrequency, the measurement window according to the smtc1 configured by the MCG includes the measurement window according to the smtc1 configured by the SCG, or vice-versa, with an accuracy of the maximum receive timing difference specified in TS 38.133 [14].
    - if both measurement objects are used for RSSI measurements, bits in measurementSlots in both objects corresponding to the same slot are set to the same value. Also, the endSymbol is the same in both objects.
- when the UE is in NE-DC, NR-DC, or NR standalone, to configure at most one measurement identity across all CGs using a reporting configuration with the reportType set to reportSFTD;

For CSI-RS resources, the network applies the procedure as follows:

- to ensure that all CSI-RS resources configured in each measurement object have the same center frequency, 
  \[(startPRB+\text{floor}(\text{nrofPRBs}/2))\]
- to ensure that the total number of CSI-RS resources configured in each measurement object does not exceed the maximum number specified in TS 38.214 [19].

The UE shall:

1> if the received measConfig includes the measObjectToRemoveList:
   2> perform the measurement object removal procedure as specified in 5.5.2.4;

1> if the received measConfig includes the measObjectToAddModList:
   2> perform the measurement object addition/modification procedure as specified in 5.5.2.5;

1> if the received measConfig includes the reportConfigToRemoveList:
   2> perform the reporting configuration removal procedure as specified in 5.5.2.6;

1> if the received measConfig includes the reportConfigToAddModList:
   2> perform the reporting configuration addition/modification procedure as specified in 5.5.2.7;

1> if the received measConfig includes the quantityConfig:
   2> perform the quantity configuration procedure as specified in 5.5.2.8;

1> if the received measConfig includes the measIdToRemoveList:
2> perform the measurement identity removal procedure as specified in 5.5.2.2;

1> if the received measConfig includes the measIdToRemoveList:
   2> perform the measurement identity addition/modification procedure as specified in 5.5.2.3;

1> if the received measConfig includes the measGapConfig:
   2> perform the measurement gap configuration procedure as specified in 5.5.2.9;

1> if the received measConfig includes the measGapSharingConfig:
   2> perform the measurement gap sharing configuration procedure as specified in 5.5.2.11;

1> if the received measConfig includes the s-MeasureConfig:
   2> if s-MeasureConfig is set to ssb-RSRP, set parameter ssb-RSRP of s-MeasureConfig within VarMeasConfig to the lowest value of the RSRP ranges indicated by the received value of s-MeasureConfig;
   2> else, set parameter csi-RSRP of s-MeasureConfig within VarMeasConfig to the lowest value of the RSRP ranges indicated by the received value of s-MeasureConfig.

### 5.5.2.2 Measurement identity removal

The UE shall:

1> for each measId included in the received measIdToRemoveList that is part of the current UE configuration in VarMeasConfig:
   2> remove the entry with the matching measId from the measIdList within the VarMeasConfig;
   2> remove the measurement reporting entry for this measId from the VarMeasReportList, if included;
   2> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. timeToTrigger) for this measId.

NOTE: The UE does not consider the message as erroneous if the measIdToRemoveList includes any measId value that is not part of the current UE configuration.

### 5.5.2.3 Measurement identity addition/modification

The network applies the procedure as follows:

- configure a measId only if the corresponding measurement object, the corresponding reporting configuration and the corresponding quantity configuration, are configured.

The UE shall:

1> for each measId included in the received measIdToAddModList:
   2> if an entry with the matching measId exists in the measIdList within the VarMeasConfig:
      3> replace the entry with the value received for this measId;
   2> else:
      3> add a new entry for this measId within the VarMeasConfig;
   2> remove the measurement reporting entry for this measId from the VarMeasReportList, if included;
   2> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. timeToTrigger) for this measId;
   2> if the reportType is set to reportCGI in the reportConfig associated with this measId:
      3> if the measObject associated with this measId concerns E-UTRA:
4> if the `useAutonomousGaps` is included in the `reportConfig` associated with this `measId`:
   5> start timer T321 with the timer value set to [FFS] for this `measId`;
4> else:
   5> start timer T321 with the timer value set to 1 second for this `measId`;
3> if the `measObject` associated with this `measId` concerns NR:
   4> if the `measObject` associated with this `measId` concerns FR1:
      5> if the `useAutonomousGaps` is included in the `reportConfig` associated with this `measId`:
         6> start timer T321 with the timer value set to 2 seconds for this `measId`;
      5> else:
         6> start timer T321 with the timer value set to 2 seconds for this `measId`;
   4> if the `measObject` associated with this `measId` concerns FR2:
      5> if the `useAutonomousGaps` is included in the `reportConfig` associated with this `measId`:
         6> start timer T321 with the timer value set to 5 seconds for this `measId`;
      5> else:
         6> start timer T321 with the timer value set to 16 seconds for this `measId`.
2> if the `reportType` is set to `reportSFTD` in the `reportConfigNR` associated with this `measId` and the `drx-SFTD-NeighMeas` is included:
   3> if the `measObject` associated with this `measId` concerns FR1:
      4> start timer T322 with the timer value set to 3 seconds for this `measId`;
   3> if the `measObject` associated with this `measId` concerns FR2:
      4> start timer T322 with the timer value set to 24 seconds for this `measId`.

5.5.2.4 Measurement object removal

The UE shall:
1> for each `measObjectId` included in the received `measObjectToRemoveList` that is part of `measObjectList` in `VarMeasConfig`:
   2> remove the entry with the matching `measObjectId` from the `measObjectList` within the `VarMeasConfig`;
   2> remove all `measId` associated with this `measObjectId` from the `measIdList` within the `VarMeasConfig`, if any;
   2> if a `measId` is removed from the `measIdList`:
      3> remove the measurement reporting entry for this `measId` from the `VarMeasReportList`, if included;
      3> stop the periodical reporting timer or timer T321 or timer T322, whichever is running, and reset the associated information (e.g. `timeToTrigger`) for this `measId`.

NOTE: The UE does not consider the message as erroneous if the `measObjectToRemoveList` includes any `measObjectId` value that is not part of the current UE configuration.

5.5.2.5 Measurement object addition/modification

The UE shall:
1> for each `measObjectId` included in the received `measObjectToAddModList`:
2> if an entry with the matching measObjectId exists in the measObjectList within the VarMeasConfig, for this entry:

3> reconfigure the entry with the value received for this measObject, except for the fields cellsToAddModList, blackCellsToAddModList, whiteCellsToAddModList, cellsToRemoveList, blackCellsToRemoveList and whiteCellsToRemoveList;

3> if the received measObject includes the cellsToRemoveList:
   4> for each physCellId included in the cellsToRemoveList:
      5> remove the entry with the matching physCellId from the cellsToAddModList;

3> if the received measObject includes the cellsToAddModList:
   4> for each physCellId value included in the cellsToAddModList:
      5> if an entry with the matching physCellId exists in the cellsToAddModList:
         6> replace the entry with the value received for this physCellId;
      5> else:
         6> add a new entry for the received physCellId to the cellsToAddModList;

3> if the received measObject includes the blackCellsToRemoveList:
   4> for each pci-RangeIndex included in the blackCellsToRemoveList:
      5> remove the entry with the matching pci-RangeIndex from the blackCellsToAddModList;

NOTE 1: For each pci-RangeIndex included in the blackCellsToRemoveList that concerns overlapping ranges of cells, a cell is removed from the blacklist of cells only if all PCI ranges containing it are removed.

3> if the received measObject includes the blackCellsToAddModList:
   4> for each pci-RangeIndex included in the blackCellsToAddModList:
      5> if an entry with the matching pci-RangeIndex is included in the blackCellsToAddModList:
         6> replace the entry with the value received for this pci-RangeIndex;
      5> else:
         6> add a new entry for the received pci-RangeIndex to the blackCellsToAddModList;

3> if the received measObject includes the whiteCellsToRemoveList:
   4> for each pci-RangeIndex included in the whiteCellsToRemoveList:
      5> remove the entry with the matching pci-RangeIndex from the whiteCellsToAddModList;

NOTE 2: For each pci-RangeIndex included in the whiteCellsToRemoveList that concerns overlapping ranges of cells, a cell is removed from the whitelist of cells only if all PCI ranges containing it are removed.

3> if the received measObject includes the whiteCellsToAddModList:
   4> for each pci-RangeIndex included in the whiteCellsToAddModList:
      5> if an entry with the matching pci-RangeIndex is included in the whiteCellsToAddModList:
         6> replace the entry with the value received for this pci-RangeIndex;
      5> else:
         6> add a new entry for the received pci-RangeIndex to the whiteCellsToAddModList

3> for each measId associated with this measObjectId in the measIdList within the VarMeasConfig, if any:
4> remove the measurement reporting entry for this measId from the VarMeasReportList, if included;
4> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. timeToTrigger) for this measId;
3> if the received measObject includes the tx-PoolMeasToRemoveList:
4> for each transmission resource pool indicated in tx-PoolMeasToRemoveList:
5> remove the entry with the matching identity of the transmission resource pool from the tx-PoolMeasToAddModList;
3> if the received measObject includes the tx-PoolMeasToAddModList:
4> for each transmission resource pool indicated in tx-PoolMeasToAddModList:
5> if an entry with the matching identity of the transmission resource pool exists in the tx-PoolMeasToAddModList:
6> replace the entry with the value received for this transmission resource pool;
5> else:
6> add a new entry for the received identity of the transmission resource pool to the tx-PoolMeasToAddModList;
3> if the received measObject includes the ssb-PositionQCL-CellsToRemoveList:
4> for each physCellId included in the ssb-PositionQCL-CellsToRemoveList:
5> remove the entry with the matching physCellId from the ssb-PositionQCL-CellsToAddModList;
3> if the received measObject includes the ssb-PositionQCL-CellsToAddModList:
4> for each physCellId included in the ssb-PositionQCL-CellsToAddModList:
5> if an entry with the matching physCellId exists in the ssb-PositionQCL-CellsToAddModList:
6> replace the entry with the value received for this physCellId;
5> else:
6> add a new entry for the received physCellId to the ssb-PositionQCL-CellsToAddModList;
2> else:
3> add a new entry for the received measObject to the measObjectList within VarMeasConfig.

5.5.2.6 Reporting configuration removal

The UE shall:
1> for each reportConfigId included in the received reportConfigToRemoveList that is part of the current UE configuration in VarMeasConfig:
2> remove the entry with the matching reportConfigId from the reportConfigList within the VarMeasConfig;
2> remove all measId associated with the reportConfigId from the measIdList within the VarMeasConfig, if any;
2> if a measId is removed from the measIdList:
3> remove the measurement reporting entry for this measId from the VarMeasReportList, if included;
3> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. timeToTrigger) for this measId.
NOTE: The UE does not consider the message as erroneous if the reportConfigToRemoveList includes any reportConfigId value that is not part of the current UE configuration.

5.5.2.7 Reporting configuration addition/modification

The UE shall:

1> for each reportConfigId included in the received reportConfigToAddModList:

2> if an entry with the matching reportConfigId exists in the reportConfigList within the VarMeasConfig, for this entry:

3> reconfigure the entry with the value received for this reportConfig;

3> for each measId associated with this reportConfigId included in the measIdList within the VarMeasConfig, if any:

4> remove the measurement reporting entry for this measId from the VarMeasReportList, if included;

4> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. timeToTrigger) for this measId;

2> else:

3> add a new entry for the received reportConfig to the reportConfigList within the VarMeasConfig.

5.5.2.8 Quantity configuration

The UE shall:

1> for each RAT for which the received quantityConfig includes parameter(s):

2> set the corresponding parameter(s) in quantityConfig within VarMeasConfig to the value of the received quantityConfig parameter(s);

1> for each measId included in the measIdList within VarMeasConfig:

2> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. timeToTrigger) for this measId.

5.5.2.9 Measurement gap configuration

The UE shall:

1> if gapFR1 is set to setup:

2> if an FR1 measurement gap configuration is already setup, release the FR1 measurement gap configuration;

2> setup the FR1 measurement gap configuration indicated by the measGapConfig in accordance with the received gapOffset, i.e., the first subframe of each gap occurs at an SFN and subframe meeting the following condition:

SFN mod $T = \text{FLOOR}(\text{gapOffset}/10)$;

subframe = gapOffset mod 10;

with $T = \text{MGRP}/10$ as defined in TS 38.133 [14];

2> apply the specified timing advance mgta to the gap occurrences calculated above (i.e. the UE starts the measurement mgta ms before the gap subframe occurrences);

1> else if gapFR1 is set to release:

2> release the FR1 measurement gap configuration;
if gapFR2 is set to setup:

1> if an FR2 measurement gap configuration is already setup, release the FR2 measurement gap configuration;

2> setup the FR2 measurement gap configuration indicated by the measGapConfig in accordance with the received gapOffset, i.e., the first subframe of each gap occurs at an SFN and subframe meeting the following condition:

\[
\text{SFN mod } T = \text{FLOOR}(\text{gapOffset}/10);
\]

\[
\text{subframe} = \text{gapOffset} \text{ mod } 10;
\]

with \( T = \text{MGRP}/10 \) as defined in TS 38.133 [14];

2> apply the specified timing advance mgta to the gap occurrences calculated above (i.e. the UE starts the measurement mgta ms before the gap subframe occurrences);

else if gapFR2 is set to release:

1> release the FR2 measurement gap configuration;

if gapUE is set to setup:

1> if a per UE measurement gap configuration is already setup, release the per UE measurement gap configuration;

2> setup the per UE measurement gap configuration indicated by the measGapConfig in accordance with the received gapOffset, i.e., the first subframe of each gap occurs at an SFN and subframe meeting the following condition:

\[
\text{SFN mod } T = \text{FLOOR}(\text{gapOffset}/10);
\]

\[
\text{subframe} = \text{gapOffset} \text{ mod } 10;
\]

with \( T = \text{MGRP}/10 \) as defined in TS 38.133 [14];

2> apply the specified timing advance mgta to the gap occurrences calculated above (i.e. the UE starts the measurement mgta ms before the gap subframe occurrences);

else if gapUE is set to release:

1> release the per UE measurement gap configuration.

NOTE 1: For gapFR2 configuration with synchronous CA, for the UE in NE-DC or NR-DC, the SFN and subframe of the serving cell indicated by the refServCellIndicator in gapFR2 is used in the gap calculation. Otherwise, the SFN and subframe of a serving cell on FR2 frequency is used in the gap calculation.

NOTE 2: For gapFR1 or gapUE configuration, for the UE in NE-DC or NR-DC, the SFN and subframe of the serving cell indicated by the refServCellIndicator in corresponding gapFR1 or gapUE is used in the gap calculation. Otherwise, the SFN and subframe of the PCell is used in the gap calculation.

NOTE 3: For gapFR2 configuration with asynchronous CA, for the UE in NE-DC or NR-DC, the SFN and subframe of the serving cell indicated by the refServCellIndicator and refFR2ServCellAsyncCA in gapFR2 is used in the gap calculation. Otherwise, the SFN and subframe of a serving cell on FR2 frequency indicated by the refFR2ServCellAsyncCA in gapFR2 is used in the gap calculation.

### 5.5.2.10 Reference signal measurement timing configuration

The UE shall setup the first SS/PBCH block measurement timing configuration (SMTC) in accordance with the received periodicityAndOffset parameter (providing Periodicity and Offset value for the following condition) in the smtc1 configuration. The first subframe of each SMTC occasion occurs at an SFN and subframe of the NR SpCell meeting the following condition:

\[
\text{SFN mod } T = \text{FLOOR} \left( \frac{\text{Offset}}{10} \right);
\]
if the *Periodicity* is larger than sf5:

\[
\text{subframe} = \text{Offset} \mod 10;
\]

else:

\[
\text{subframe} = \text{Offset} \text{ or } (\text{Offset }+ 5);
\]

with \( T = \text{CEIL}(\text{Periodicity}/10) \).

If `smtc2` is present, for cells indicated in the `pci-List` parameter in `smtc2` in the same `MeasObjectNR`, the UE shall setup an additional SS/PBCH block measurement timing configuration (SMTC) in accordance with the received *periodicity* parameter in the `smtc2` configuration and use the `Offset` (derived from parameter `periodicityAndOffset`) and `duration` parameter from the `smtc1` configuration. The first subframe of each SMTC occasion occurs at an SFN and subframe of the NR SpCell meeting the above condition.

If `smtc2-LP` is present, for cells indicated in the `pci-List` parameter in `smtc2-LP` in the same frequency (for intra frequency cell reselection) or different frequency (for inter frequency cell reselection), the UE shall setup an additional SS/PBCH block measurement timing configuration (SMTC) in accordance with the received *periodicity* parameter in the `smtc2-LP` configuration and use the `Offset` (derived from parameter `periodicityAndOffset`) and `duration` parameter from the `smtc` configuration for that frequency. The first subframe of each SMTC occasion occurs at an SFN and subframe of the NR SpCell or serving cell (for cell reselection) meeting the above condition.

If `smtc3list` is present, for cells indicated in the `pci-List` parameter in each `SSB-MTC3` element of the list in the same `MeasObjectNR`, the IAB-MT shall setup an additional SS block measurement timing configuration in accordance with the received `periodicityAndOffset` parameter (using same condition as `smtc1` to identify the SFN and the subframe for SMTC occasion) in each SSB-MTC3 configuration and use the `duration` and `ssb-ToMeasure` parameters from each SSB-MTC3 configuration.

On the indicated `ssbFrequency`, the UE shall not consider SS/PBCH block transmission in subframes outside the SMTC occasion for RRM measurements based on SS/PBCH blocks and for RRM measurements based on CSI-RS except for SFTD measurement (see TS 38.133 [14], subclause 9.3.8).

### 5.5.2.10a RSSI measurement timing configuration

The UE shall setup the RSSI measurement timing configuration (RMTC) in accordance with the received `rmrtc-Periodicity` and, if configured, with `rmrtc-SubframeOffset` i.e. the first symbol of each RMTC occasion occurs at first symbol of an SFN and subframe of the NR SpCell meeting the following condition:

\[
\text{SFN} \mod T = \text{FLOOR}(\text{rmrtc-SubframeOffset}/10);
\]

\[
\text{subframe} = \text{rmrtc-SubframeOffset} \mod 10;
\]

with \( T = \text{rmrtc-Periodicity}/10 \);

On the frequency configured by `rmrtc-Frequency`, the UE shall not consider RSSI measurements outside the configured RMTC occasion which lasts for `measDuration` for RSSI and channel occupancy measurements.

The UE derives the RSSI measurement duration from a combination of `measDurationSymbols` and `ref-SCS-CP`. At least for RSSI measurement confined within the active DL BWP, the UE performs RSSI measurement using the numerology of the active DL BWP during the derived measurement duration. Otherwise, the numerology used by the UE for measurements is up to UE implementation.

### 5.5.2.11 Measurement gap sharing configuration

The UE shall:

1> if `gapSharingFR1` is set to `setup`:

2> if an FR1 measurement gap sharing configuration is already setup:

3> release the FR1 measurement gap sharing configuration;

2> setup the FR1 measurement gap sharing configuration indicated by the `measGapSharingConfig` in accordance with the received `gapSharingFR1` as defined in TS 38.133 [14];
else if `gapSharingFR1` is set to `release`:

2> release the FR1 measurement gap sharing configuration;

1> if `gapSharingFR2` is set to `setup`:

2> if an FR2 measurement gap sharing configuration is already setup:

3> release the FR2 measurement gap sharing configuration;

2> setup the FR2 measurement gap sharing configuration indicated by the `measGapSharingConfig` in accordance with the received `gapSharingFR2` as defined in TS 38.133 [14];

1> else if `gapSharingFR2` is set to `release`:

2> release the FR2 measurement gap sharing configuration.

1> if `gapSharingUE` is set to `setup`:

2> if a per UE measurement gap sharing configuration is already setup:

3> release the per UE measurement gap sharing configuration;

2> setup the per UE measurement gap sharing configuration indicated by the `measGapSharingConfig` in accordance with the received `gapSharingUE` as defined in TS 38.133 [14];

1> else if `gapSharingUE` is set to `release`:

2> release the per UE measurement gap sharing configuration.

5.5.3 Performing measurements

5.5.3.1 General

An RRC_CONNECTED UE shall derive cell measurement results by measuring one or multiple beams associated per cell as configured by the network, as described in 5.5.3.3. For all cell measurement results, except for RSSI, and CLI measurement results in RRC_CONNECTED, the UE applies the layer 3 filtering as specified in 5.5.3.2, before using the measured results for evaluation of reporting criteria, measurement reporting or the criteria to trigger conditional reconfiguration execution. For cell measurements, the network can configure RSRP, RSRQ, SINR, RSCP or EcN0 as trigger quantity. For CLI measurements, the network can configure SRS-RSRP or CLI-RSSI as trigger quantity. For cell and beam measurements, reporting quantities can be any combination of quantities (i.e. only RSRP; only RSRQ; only SINR; RSRP and RSRQ; RSRP and SINR; RSRQ and SINR; RSRP, RSRQ and SINR; only RSCP; only EcN0; RSCP and EcN0), irrespective of the trigger quantity, and for CLI measurements, reporting quantities can be either SRS-RSRP or CLI-RSSI. For conditional reconfiguration execution, the network can configure up to 2 quantities, both using same RS type. The UE does not apply the layer 3 filtering as specified in 5.5.3.2 to derive the CBR measurements.

The network may also configure the UE to report measurement information per beam (which can either be measurement results per beam with respective beam identifier(s) or only beam identifier(s)), derived as described in 5.5.3.3a. If beam measurement information is configured to be included in measurement reports, the UE applies the layer 3 beam filtering as specified in 5.5.3.2. On the other hand, the exact L1 filtering of beam measurements used to derive cell measurement results is implementation dependent.

The UE shall:

1> whenever the UE has a `measConfig`, perform RSRP and RSRQ measurements for each serving cell for which `servingCellMO` is configured as follows:

2> if the `reportConfig` associated with at least one `measId` included in the `measIdList` within `VarMeasConfig` contains an `rsType` set to `ssb` and `ssb-ConfigMobility` is configured in the `measObject` indicated by the `servingCellMO`:

3> if the `reportConfig` associated with at least one `measId` included in the `measIdList` within `VarMeasConfig` contains a `reportQuantityRS-Indexes` and `maxNrofRS-IndexesToReport` and contains an `rsType` set to `ssb`:
4> derive layer 3 filtered RSRP and RSRQ per beam for the serving cell based on SS/PBCH block, as described in 5.5.3.3a;
3> derive serving cell measurement results based on SS/PBCH block, as described in 5.5.3.3;
2> if the reportConfig associated with at least one measId included in the measIdList within VarMeasConfig contains an rsType set to csi-rs and CSI-RS-ResourceConfigMobility is configured in the_measObject indicated by the servingCellMO:
3> if the reportConfig associated with at least one measId included in the measIdList within VarMeasConfig contains a reportQuantityRS-Indexes and maxNrofRS-IndexesToReport and contains an rsType set to csi-rs:
4> derive layer 3 filtered RSRP and RSRQ per beam for the serving cell based on CSI-RS, as described in 5.5.3.3a;
3> derive serving cell measurement results based on CSI-RS, as described in 5.5.3.3;
1> for each serving cell for which servingCellMO is configured, if the reportConfig associated with at least one measId included in the measIdList within VarMeasConfig contains SINR as trigger quantity and/or reporting quantity:
2> if the reportConfig contains rsType set to ssb and ssb-ConfigMobility is configured in the servingCellMO:
3> if the reportConfig contains a reportQuantityRS-Indexes and maxNrofRS-IndexesToReport:
4> derive layer 3 filtered SINR per beam for the serving cell based on SS/PBCH block, as described in 5.5.3.3a;
3> derive serving cell SINR based on SS/PBCH block, as described in 5.5.3.3;
2> if the reportConfig contains rsType set to csi-rs and CSI-RS-ResourceConfigMobility is configured in the servingCellMO:
3> if the reportConfig contains a reportQuantityRS-Indexes and maxNrofRS-IndexesToReport:
4> derive layer 3 filtered SINR per beam for the serving cell based on CSI-RS, as described in 5.5.3.3a;
3> derive serving cell SINR based on CSI-RS, as described in 5.5.3.3;
1> for each measId included in the measIdList within VarMeasConfig:
2> if the reportType for the associated reportConfig is set to reportCGI and timer T321 is running:
3> if useAutonomousGaps is configured for the associated reportConfig:
4> perform the corresponding measurements on the frequency and RAT indicated in the associated measObject using autonomous gaps as necessary;
3> else:
4> perform the corresponding measurements on the frequency and RAT indicated in the associated measObject using available idle periods;
3> if the cell indicated by reportCGI field for the associated measObject is an NR cell and that indicated cell is broadcasting SIB1 (see TS 38.213 [13], clause 13):
4> try to acquire SIB1 in the concerned cell;
3> if the cell indicated by reportCGI field is an E-UTRA cell:
4> try to acquire SystemInformationBlockType1 in the concerned cell;
2> if the ul-DelayValueConfig is configured for the associated reportConfig:
3> ignore the measObject;
for each of the configured DRBs, configure the PDCP layer to perform corresponding average UL PDCP packet delay measurement per DRB;

if the reportType for the associated reportConfig is periodical, eventTriggered or condTriggerConfig:

if a measurement gap configuration is setup, or

if the UE does not require measurement gaps to perform the concerned measurements:

if s-MeasureConfig is not configured, or

if s-MeasureConfig is set to ssb-RSRP and the NR SpCell RSRP based on SS/PBCH block, after layer 3 filtering, is lower than ssb-RSRP, or

if s-MeasureConfig is set to csi-RSRP and the NR SpCell RSRP based on CSI-RS, after layer 3 filtering, is lower than csi-RSRP:

if the measObject is associated to NR and the rsType is set to csi-rs:

if reportQuantityRS-Indexes and maxNrofRS-IndexesToReport for the associated reportConfig are configured:

derive layer 3 filtered beam measurements only based on CSI-RS for each measurement quantity indicated in reportQuantityRS-Indexes, as described in 5.5.3.3a;

derive cell measurement results based on CSI-RS for the trigger quantity and each measurement quantity indicated in reportQuantityCell using parameters from the associated measObject, as described in 5.5.3.3;

if the measObject is associated to NR and the rsType is set to ssb:

if reportQuantityRS-Indexes and maxNrofRS-IndexesToReport for the associated reportConfig are configured:

derive layer 3 beam measurements only based on SS/PBCH block for each measurement quantity indicated in reportQuantityRS-Indexes, as described in 5.5.3.3a;

derive cell measurement results based on SS/PBCH block for the trigger quantity and each measurement quantity indicated in reportQuantityCell using parameters from the associated measObject, as described in 5.5.3.3;

if the measObject is associated to E-UTRA:

perform the corresponding measurements associated to neighbouring cells on the frequencies indicated in the concerned measObject, as described in 5.5.3.2;

if the measObject is associated to UTRA-FDD:

perform the corresponding measurements associated to neighbouring cells on the frequencies indicated in the concerned measObject, as described in 5.5.3.2;

if the measRSSI-ReportConfig is configured in the associated reportConfig:

perform the RSSI and channel occupancy measurements on the frequency indicated in the associated measObject;

if the reportType for the associated reportConfig is set to reportSFTD and the numberOfReportsSent as defined within the VarMeasReportList for this measId is less than one:

if the reportSFTD-Meas is set to true:

if the measObject is associated to E-UTRA:

perform SFTD measurements between the PCell and the E-UTRA PSCell;

if the reportRSRP is set to true;
6> perform RSRP measurements for the E-UTRA PSCell;
4> else if the measObject is associated to NR:
5> perform SFTD measurements between the PCell and the NR PSCell;
5> if the reportRSRP is set to true;
6> perform RSRP measurements for the NR PSCell based on SSB;
3> else if the reportSFTD-NeighMeas is included:
4> if the measObject is associated to NR:
5> if the drx-SFTD-NeighMeas is included:
6> perform SFTD measurements between the PCell and the NR neighbouring cell(s) detected based on parameters in the associated measObject using available idle periods;
5> else:
6> perform SFTD measurements between the PCell and the NR neighbouring cell(s) detected based on parameters in the associated measObject;
5> if the reportRSRP is set to true:
6> perform RSRP measurements based on SSB for the NR neighbouring cell(s) detected based on parameters in the associated measObject;

2> if the reportType for the associated reportConfig is cli-Periodical or cli-EventTriggered:
3> perform the corresponding measurements associated to CLI measurement resources indicated in the concerned measObjectCLI;
2> perform the evaluation of reporting criteria as specified in 5.5.4, except if reportConfig is condTriggerConfig.

NOTE 1: The evaluation of conditional reconfiguration execution criteria is specified in 5.3.5.13.

The UE capable of CBR measurement when configured to transmit NR sidelink communication shall:
1> If the frequency used for NR sidelink communication is included in sl-FreqInfoToAddModList in sl-ConfigDedicatedNR within RRCReconfiguration message or included in sl-ConfigCommonNR within SIB12:
2> if the UE is in RRC_IDLE or in RRC_INACTIVE:
3> if the cell chosen for NR sidelink communication provides SIB12 which includes sl-TxPoolSelectedNormal or sl-TxPoolExceptional for the concerned frequency:
4> perform CBR measurement on pools in sl-TxPoolSelectedNormal and sl-TxPoolExceptional for the concerned frequency in SIB12;
2> if the UE is in RRC_CONNECTED:
3> if tx-PoolMeasToAddModList is included in VarMeasConfig:
4> perform CBR measurements on each transmission resource pool indicated in the tx-PoolMeasToAddModList;
3> if sl-TxPoolSelectedNormal, sl-TxPoolScheduling or sl-TxPoolExceptional is included in sl-ConfigDedicatedNR for the concerned frequency within RRCReconfiguration:
4> perform CBR measurement on pools in sl-TxPoolSelectedNormal, sl-TxPoolScheduling or sl-TxPoolExceptional if included in sl-ConfigDedicatedNR for the concerned frequency within RRCReconfiguration;
else if the cell chosen for NR sidelink communication provides SIB12 which includes sl-TxPoolSelectedNormal or sl-TxPoolExceptional for the concerned frequency:

4> perform CBR measurement on pools in sl-TxPoolSelectedNormal and sl-TxPoolExceptional for the concerned frequency in SIB12;

1> else:

2> perform CBR measurement on pools in sl-TxPoolSelectedNormal and sl-TxPoolExceptional in SidelinkPreconfigNR for the concerned frequency.

NOTE 2: In case the configurations for NR sidelink communication and CBR measurement are acquired via the E-UTRA, configurations for NR sidelink communication in SIB12, sl-ConfigDedicatedNR within RRCReconfiguration used in this subclause are provided by the configurations in SystemInformationBlockType28, sl-ConfigDedicatedNR within RRCConnectionReconfiguration as specified in TS 36.331[10], respectively.

NOTE 3: If a UE that is configured by upper layers to transmit V2X sidelink communication is configured by NR with transmission resource pool(s) and the measurement objects concerning V2X sidelink communication (i.e. by sl-ConfigDedicatedEUTRA-Info), it shall perform CBR measurement as specified in subclause 5.5.3 of TS 36.331[10], based on the transmission resource pool(s) and the measurement object(s) concerning V2X sidelink communication configured by NR.

NOTE 4: For V2X sidelink communication, each of the CBR measurement results is associated with a resource pool, as indicated by the poolReportId (see TS 36.331[10]), that refers to a pool as included in sl-ConfigDedicatedEUTRA-Info or SIB13.

5.5.3.2 Layer 3 filtering

The UE shall:

1> for each cell measurement quantity, each beam measurement quantity, each sidelink measurement quantity as needed in sub-clause 5.8.10, and for each CLI measurement quantity that the UE performs measurements according to 5.5.3.1:

2> filter the measured result, before using for evaluation of reporting criteria or for measurement reporting, by the following formula:

\[ F_n = (1 - a) \times F_{n-1} + a \times M_n \]

where

- \( M_n \) is the latest received measurement result from the physical layer;
- \( F_n \) is the updated filtered measurement result, that is used for evaluation of reporting criteria or for measurement reporting;
- \( F_{n-1} \) is the old filtered measurement result, where \( F_0 \) is set to \( M_1 \) when the first measurement result from the physical layer is received; and for MeasObjectNR, \( a = 1/2^{k_i/4} \), where \( k_i \) is the filterCoefficient for the corresponding measurement quantity of the \( i \)th QuantityConfigNR in quantityConfigNR-List, and \( i \) is indicated by quantityConfigIndex in MeasObjectNR; for other measurements, \( a = 1/2^{k/4} \), where \( k \) is the filterCoefficient for the corresponding measurement quantity received by the quantityConfig; for UTRA-FDD, \( a = 1/2^{k/4} \), where \( k \) is the filterCoefficient for the corresponding measurement quantity received by quantityConfigUTRA-FDD in the QuantityConfig;

2> adapt the filter such that the time characteristics of the filter are preserved at different input rates, observing that the filterCoefficient \( k \) assumes a sample rate equal to X ms; The value of X is equivalent to one intra-frequency L1 measurement period as defined in TS 38.133 [14] assuming non-DRX operation, and depends on frequency range.

NOTE 1: If \( k \) is set to 0, no layer 3 filtering is applicable.

NOTE 2: The filtering is performed in the same domain as used for evaluation of reporting criteria or for measurement reporting, i.e., logarithmic filtering for logarithmic measurements.
NOTE 3: The filter input rate is implementation dependent, to fulfil the performance requirements set in TS 38.133 [14]. For further details about the physical layer measurements, see TS 38.133 [14].

NOTE 4: For CLI-RSSI measurement, it is up to UE implementation whether to reset filtering upon BWP switch.

5.5.3.3 Derivation of cell measurement results

The network may configure the UE in RRC_CONNECTED to derive RSRP, RSRQ and SINR measurement results per cell associated to NR measurement objects based on parameters configured in the measObject (e.g. maximum number of beams to be averaged and beam consolidation thresholds) and in the reportConfig (rsType to be measured, SS/PBCH block or CSI-RS).

The network may configure the UE in RRC_IDLE or in RRC_INACTIVE to derive RSRP and RSRQ measurement results per cell associated to NR carriers based on parameters configured in measIdleCarrierListNR within VarMeasIdleConfig for measurements performed according to 5.7.8.2a.

The UE shall:

1> for each cell measurement quantity to be derived based on SS/PBCH block:
   2> if nrofSS-BlocksToAverage is not configured in the associated measObject in RRC_CONNECTED or in the associated entry in measIdleCarrierListNR within VarMeasIdleConfig in RRC_IDLE/RRC_INACTIVE; or
   2> if absThreshSS-BlocksConsolidation is not configured in the associated measObject in RRC_CONNECTED or in the associated entry in measIdleCarrierListNR within VarMeasIdleConfig in RRC_IDLE/RRC_INACTIVE; or
   2> if the highest beam measurement quantity value is below or equal to absThreshSS-BlocksConsolidation:
      3> derive each cell measurement quantity based on SS/PBCH block as the highest beam measurement quantity value, where each beam measurement quantity is described in TS 38.215 [9];
   2> else:
      3> derive each cell measurement quantity based on SS/PBCH block as the linear power scale average of the highest beam measurement quantity values above absThreshSS-BlocksConsolidation where the total number of averaged beams shall not exceed nrofSS-BlocksToAverage;
   2> if in RRC_CONNECTED, apply layer 3 cell filtering as described in 5.5.3.2;

1> for each cell measurement quantity to be derived based on CSI-RS:
   2> consider a CSI-RS resource to be applicable for deriving cell measurements when the concerned CSI-RS resource is included in the csi-rs-CellMobility including the physCellId of the cell in the CSI-RS-ResourceConfigMobility in the associated measObject;
   2> if nrofCSI-RS-ResourcesToAverage in the associated measObject is not configured; or
   2> if absThreshCSI-RS-Consolidation in the associated measObject is not configured; or
   2> if the highest beam measurement quantity value is below or equal to absThreshCSI-RS-Consolidation:
      3> derive each cell measurement quantity based on applicable CSI-RS resources for the cell as the highest beam measurement quantity value, where each beam measurement quantity is described in TS 38.215 [9];
   2> else:
      3> derive each cell measurement quantity based on CSI-RS as the linear power scale average of the highest beam measurement quantity values above absThreshCSI-RS-Consolidation where the total number of averaged beams shall not exceed nrofCSI-RS-ResourcesToAverage;
   2> apply layer 3 cell filtering as described in 5.5.3.2.
5.5.3.3a Derivation of layer 3 beam filtered measurement

The UE shall:

1> for each layer 3 beam filtered measurement quantity to be derived based on SS/PBCH block:

2> derive each configured beam measurement quantity based on SS/PBCH block as described in TS 38.215[9], and apply layer 3 beam filtering as described in 5.5.3.2;

1> for each layer 3 beam filtered measurement quantity to be derived based on CSI-RS:

2> derive each configured beam measurement quantity based on CSI-RS as described in TS 38.215 [9], and apply layer 3 beam filtering as described in 5.5.3.2.

5.5.4 Measurement report triggering

5.5.4.1 General

If AS security has been activated successfully, the UE shall:

1> for each measId included in the measIdList within VarMeasConfig:

2> if the corresponding reportConfig includes a reportType set to eventTriggered or periodical:

3> if the corresponding measObject concerns NR:

4> if the eventA1 or eventA2 is configured in the corresponding reportConfig:

5> consider only the serving cell to be applicable;

4> if the eventA3 or eventA5 is configured in the corresponding reportConfig:

5> if a serving cell is associated with a measObjectNR and neighbours are associated with another measObjectNR, consider any serving cell associated with the other measObjectNR to be a neighbouring cell as well;

4> if corresponding reportConfig includes reportType set to periodical; or

4> for measurement events other than eventA1 or eventA2:

5> if useWhiteCellList is set to true:

6> consider any neighbouring cell detected based on parameters in the associated measObjectNR to be applicable when the concerned cell is included in the whiteCellsToAddModList defined within the VarMeasConfig for this measId;

5> else:

6> consider any neighbouring cell detected based on parameters in the associated measObjectNR to be applicable when the concerned cell is not included in the blackCellsToAddModList defined within the VarMeasConfig for this measId;

3> else if the corresponding measObject concerns E-UTRA:

4> if eventB1 or eventB2 is configured in the corresponding reportConfig:

5> consider a serving cell, if any, on the associated E-UTRA frequency as neighbour cell;

4> else:

5> consider any neighbouring cell detected on the associated frequency to be applicable when the concerned cell is not included in the blackCellsToAddModListEUTRAN defined within the VarMeasConfig for this measId;

3> else if the corresponding measObject concerns UTRA-FDD:
4> if \textit{eventB1-UTRA-FDD} or \textit{eventB2-UTRA-FDD} is configured in the corresponding \texttt{reportConfig}; or
4> if corresponding \texttt{reportConfig} includes \texttt{reportType} set to \texttt{periodical};
5> consider a neighbouring cell on the associated frequency to be applicable when the concerned cell is included in the \texttt{cellsToAddModList} defined within the \texttt{VarMeasConfig} for this \texttt{measId};

2> else if the corresponding \texttt{reportConfig} includes a \texttt{reportType} set to \texttt{reportCGI}:
3> consider the cell detected on the associated \texttt{measObject} which has a physical cell identity matching the value of the \texttt{cellForWhichToReportCGI} included in the corresponding \texttt{reportConfig} within the \texttt{VarMeasConfig} to be applicable;

2> else if the corresponding \texttt{reportConfig} includes a \texttt{reportType} set to \texttt{reportSFTD}:
3> if the corresponding \texttt{measObject} concerns NR:
4> if the \texttt{reportSFTD-Meas} is set to \texttt{true}:
5> consider the NR PSCell to be applicable;
4> else if the \texttt{reportSFTD-NeighMeas} is included:
5> if \texttt{cellsForWhichToReportSFTD} is configured in the corresponding \texttt{reportConfig}:
6> consider any NR neighbouring cell detected on the associated \texttt{measObjectNR} which has a physical cell identity that is included in the \texttt{cellsForWhichToReportSFTD} to be applicable;
5> else:
6> consider up to 3 strongest NR neighbouring cells detected based on parameters in the associated \texttt{measObjectNR} to be applicable when the concerned cells are not included in the \texttt{blackCellsToAddModList} defined within the \texttt{VarMeasConfig} for this \texttt{measId};
3> else if the corresponding \texttt{measObject} concerns E-UTRA:
4> if the \texttt{reportSFTD-Meas} is set to \texttt{true}:
5> consider the E-UTRA PSCell to be applicable;
2> else if the corresponding \texttt{reportConfig} includes \texttt{measRSSI-ReportConfig}:
3> consider the resource indicated by the \texttt{rmtc-Config} on the associated frequency to be applicable;
2> else if the corresponding \texttt{reportConfig} includes a \texttt{reportType} set to \texttt{cli-Periodical} or \texttt{cli-EventTriggered}:
3> consider all CLI measurement resources included in the corresponding \texttt{measObject} to be applicable;
2> if the corresponding \texttt{reportConfig} concerns the reporting for NR sidelink communication (i.e. \texttt{reportConfigNR-SL}):
3> consider the transmission resource pools indicated by the \texttt{tx-PoolMeasToAddModList} defined within the \texttt{VarMeasConfig} for this \texttt{measId} to be applicable;
2> if the \texttt{reportType} is set to \texttt{eventTriggered} and if the entry condition applicable for this event, i.e. the event corresponding with the \texttt{eventId} of the corresponding \texttt{reportConfig} within \texttt{VarMeasConfig}, is fulfilled for one or more applicable cells for all measurements after layer 3 filtering taken during \texttt{timeToTrigger} defined for this event within the \texttt{VarMeasConfig}, while the \texttt{VarMeasReportList} does not include a measurement reporting entry for this \texttt{measId} (a first cell triggers the event):
3> include a measurement reporting entry within the \texttt{VarMeasReportList} for this \texttt{measId};
3> set the \texttt{numberOfReportsSent} defined within the \texttt{VarMeasReportList} for this \texttt{measId} to 0;
3> include the concerned cell(s) in the \texttt{cellsTriggeredList} defined within the \texttt{VarMeasReportList} for this \texttt{measId};
if useT312 is set to true in reportConfig for this event:

if T310 for the corresponding SpCell is running: and

if T312 is not running for corresponding SpCell:

start timer T312 for the corresponding SpCell with the value of T312 configured in the corresponding measObjectNR;

initiate the measurement reporting procedure, as specified in 5.5.5;

else if the reportType is set to eventTriggered and if the entry condition applicable for this event, i.e. the event corresponding with the eventId of the corresponding reportConfig within VarMeasConfig, is fulfilled for one or more applicable cells not included in the cellsTriggeredList for all measurements after layer 3 filtering taken during timeToTrigger defined for this event within the VarMeasConfig (a subsequent cell triggers the event):

set the numberOfReportsSent defined within the VarMeasReportList for this measId to 0;

include the concerned cell(s) in the cellsTriggeredList defined within the VarMeasReportList for this measId;

if useT312 is set to true in reportConfig for this event:

if T310 for the corresponding SpCell is running: and

if T312 is not running for corresponding SpCell:

start timer T312 for the corresponding SpCell with the value of T312 configured in the corresponding measObjectNR;

initiate the measurement reporting procedure, as specified in 5.5.5;

else if the reportType is set to eventTriggered and if the leaving condition applicable for this event is fulfilled for one or more of the cells included in the cellsTriggeredList defined within the VarMeasReportList for this measId for all measurements after layer 3 filtering taken during timeToTrigger defined within the VarMeasConfig for this event:

remove the concerned cell(s) in the cellsTriggeredList defined within the VarMeasReportList for this measId;

if reportOnLeave is set to true for the corresponding reporting configuration:

initiate the measurement reporting procedure, as specified in 5.5.5;

if the cellsTriggeredList defined within the VarMeasReportList for this measId is empty:

remove the measurement reporting entry within the VarMeasReportList for this measId;

stop the periodical reporting timer for this measId, if running;

else if the reportType is set to eventTriggered and if the entry condition applicable for this event, i.e. the event corresponding with the eventId of the corresponding reportConfig within VarMeasConfig, is fulfilled for one or more applicable transmission resource pools for all measurements taken during timeToTrigger defined for this event within the VarMeasConfig, while the VarMeasReportList does not include an measurement reporting entry for this measId (a first transmission resource pool triggers the event):

include a measurement reporting entry within the VarMeasReportList for this measId;

set the numberOfReportsSent defined within the VarMeasReportList for this measId to 0;

include the concerned transmission resource pool(s) in the poolsTriggeredList defined within the VarMeasReportList for this measId;

initiate the measurement reporting procedure, as specified in 5.5.5;
else if the reportType is set to eventTriggered and if the entry condition applicable for this event, i.e. the event corresponding with the eventId of the corresponding reportConfig within VarMeasConfig, is fulfilled for one or more applicable transmission resource pools not included in the poolsTriggeredList for all measurements taken during timeToTrigger defined for this event within the VarMeasConfig (a subsequent transmission resource pool triggers the event):

3> set the numberOfReportsSent defined within the VarMeasReportList for this measId to 0;

3> include the concerned transmission resource pool(s) in the poolsTriggeredList defined within the VarMeasReportList for this measId;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

else if the reportType is set to eventTriggered and if the leaving condition applicable for this event is fulfilled for one or more applicable transmission resource pools included in the poolsTriggeredList defined within the VarMeasReportList for this measId for all measurements taken during timeToTrigger defined within the VarMeasConfig for this event:

3> remove the concerned transmission resource pool(s) in the poolsTriggeredList defined within the VarMeasReportList for this measId;

3> if the poolsTriggeredList defined within the VarMeasReportList for this measId is empty:

4> remove the measurement reporting entry within the VarMeasReportList for this measId;

4> stop the periodical reporting timer for this measId, if running

NOTE 1: Void.

if reportType is set to periodical and if a (first) measurement result is available:

3> include a measurement reporting entry within the VarMeasReportList for this measId;

3> set the numberOfReportsSent defined within the VarMeasReportList for this measId to 0;

3> if the corresponding reportConfig includes measRSSI-ReportConfig:

4> initiate the measurement reporting procedure as specified in 5.5.5 immediately when RSSI sample values are reported by the physical layer after the first L1 measurement duration;

3> else if the reportAmount exceeds 1:

4> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the NR SpCell;

3> else (i.e. the reportAmount is equal to 1):

4> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the NR SpCell and for the strongest cell among the applicable cells;

else if the corresponding reportConfig concerns the reporting for NR sidelink communication, reportType is set to periodical and if a (first) measurement result is available:

3> include a measurement reporting entry within the VarMeasReportList for this measId;

3> set the numberOfReportsSent defined within the VarMeasReportList for this measId to 0;

3> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the NR SpCell and CBR measurement results become available;

if the reportType is set to cli-EventTriggered and if the entry condition applicable for this event, i.e. the event corresponding with the eventId of the corresponding reportConfig within VarMeasConfig, is fulfilled for one or more applicable CLI measurement resources for all measurements after layer 3 filtering taken during timeToTrigger defined for this event within the VarMeasConfig, while the VarMeasReportList does not include a measurement reporting entry for this measId (a first CLI measurement resource triggers the event):

3> include a measurement reporting entry within the VarMeasReportList for this measId;
3> set the `numberOfReportsSent` defined within the `VarMeasReportList` for this `measId` to 0;

3> include the concerned CLI measurement resource(s) in the `cli-TriggeredList` defined within the `VarMeasReportList` for this `measId`;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

2> else if the `reportType` is set to `cli-EventTriggered` and if the entry condition applicable for this event, i.e. the event corresponding with the `eventId` of the corresponding `reportConfig` within `VarMeasConfig`, is fulfilled for one or more CLI measurement resources not included in the `cli-TriggeredList` for all measurements after layer 3 filtering taken during `timeToTrigger` defined for this event within the `VarMeasConfig` (a subsequent CLI measurement resource triggers the event):

3> set the `numberOfReportsSent` defined within the `VarMeasReportList` for this `measId` to 0;

3> include the concerned CLI measurement resource(s) in the `cli-TriggeredList` defined within the `VarMeasReportList` for this `measId`;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

2> else if the `reportType` is set to `cli-EventTriggered` and if the leaving condition applicable for this event is fulfilled for one or more of the CLI measurement resources included in the `cli-TriggeredList` defined within the `VarMeasReportList` for this `measId` for all measurements after layer 3 filtering taken during `timeToTrigger` defined within the `VarMeasConfig` for this event:

3> remove the concerned CLI measurement resource(s) in the `cli-TriggeredList` defined within the `VarMeasReportList` for this `measId`;

3> if `reportOnLeave` is set to `true` for the corresponding reporting configuration:

4> initiate the measurement reporting procedure, as specified in 5.5.5;

3> if the `cli-TriggeredList` defined within the `VarMeasReportList` for this `measId` is empty:

4> remove the measurement reporting entry within the `VarMeasReportList` for this `measId`;

4> stop the periodical reporting timer for this `measId`, if running;

2> if `reportType` is set to `cli-Periodical` and if a (first) measurement result is available:

3> include a measurement reporting entry within the `VarMeasReportList` for this `measId`;

3> set the `numberOfReportsSent` defined within the `VarMeasReportList` for this `measId` to 0;

3> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for at least one CLI measurement resource;

2> upon expiry of the periodical reporting timer for this `measId`:

3> initiate the measurement reporting procedure, as specified in 5.5.5.

2> if the corresponding `reportConfig` includes a `reportType` is set to `reportSFTD`:

3> if the corresponding `measObject` concerns NR:

4> if the `drx-SFTD-NeighMeas` is included:

5> if the quantity to be reported becomes available for each requested pair of PCell and NR cell:

6> stop timer T322;

6> initiate the measurement reporting procedure, as specified in 5.5.5;

4> else
5> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for each requested pair of PCell and NR cell or the maximal measurement reporting delay as specified in TS 38.133 [14];

3> else if the corresponding measObject concerns E-UTRA:

4> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the pair of PCell and E-UTRA PSCell or the maximal measurement reporting delay as specified in TS 38.133 [14];

2> if reportType is set to reportCGI:

3> if the UE acquired the SIB1 or SystemInformationBlockType1 for the requested cell; or

3> if the UE detects that the requested NR cell is not transmitting SIB1 (see TS 38.213 [13], clause 13):

4> stop timer T321;

4> include a measurement reporting entry within the VarMeasReportList for this measId;

4> set the numberOfReportsSent defined within the VarMeasReportList for this measId to 0;

4> initiate the measurement reporting procedure, as specified in 5.5.5;

2> if the corresponding reportConfig includes the ul-DelayValueConfig:

3> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after a first measurement result is provided by all lower layers of the associated DRB identity;

2> upon the expiry of T321 for this measId:

3> include a measurement reporting entry within the VarMeasReportList for this measId;

3> set the numberOfReportsSent defined within the VarMeasReportList for this measId to 0;

3> initiate the measurement reporting procedure, as specified in 5.5.5.

2> upon the expiry of T322 for this measId:

3> initiate the measurement reporting procedure, as specified in 5.5.5.

5.5.4.2 Event A1 (Serving becomes better than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A1-2, as specified below, is fulfilled;

1> for this measurement, consider the NR serving cell corresponding to the associated measObjectNR associated with this event.

Inequality A1-1 (Entering condition)

\[ Ms - Hys > Thresh \]

Inequality A1-2 (Leaving condition)

\[ Ms + Hys < Thresh \]

The variables in the formula are defined as follows:

\( Ms \) is the measurement result of the serving cell, not taking into account any offsets.

\( Hys \) is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigNR for this event).

\( Thresh \) is the threshold parameter for this event (i.e. a1-Threshold as defined within reportConfigNR for this event).
**Ms** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

**Hys** is expressed in dB.

**Threshold** is expressed in the same unit as **Ms**.

### 5.5.4.3 Event A2 (Serving becomes worse than threshold)

The UE shall:

1. consider the entering condition for this event to be satisfied when condition A2-1, as specified below, is fulfilled;
2. consider the leaving condition for this event to be satisfied when condition A2-2, as specified below, is fulfilled;
3. for this measurement, consider the serving cell indicated by the *measObjectNR* associated to this event.

**Inequality A2-1** (Entering condition)

\[ Ms + Hys < Thresh \]

**Inequality A2-2** (Leaving condition)

\[ Ms - Hys > Thresh \]

The variables in the formula are defined as follows:

- **Ms** is the measurement result of the serving cell, not taking into account any offsets.
- **Hys** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).
- **Threshold** is the threshold parameter for this event (i.e. *a2-Threshold* as defined within *reportConfigNR* for this event).
- **Ms** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.
- **Hys** is expressed in dB.
- **Threshold** is expressed in the same unit as **Ms**.

### 5.5.4.4 Event A3 (Neighbour becomes offset better than SpCell)

The UE shall:

1. consider the entering condition for this event to be satisfied when condition A3-1, as specified below, is fulfilled;
2. consider the leaving condition for this event to be satisfied when condition A3-2, as specified below, is fulfilled;
3. use the SpCell for **Mn**, **Ofn** and **Ocn**.

**NOTE 1:** The cell(s) that triggers the event has reference signals indicated in the *measObjectNR* associated to this event which may be different from the NR SpCell *measObjectNR*.

**Inequality A3-1** (Entering condition)

\[ Mn + Ofn + Ocn - Hys > Mp + Ofp + Ocp + Off \]

**Inequality A3-2** (Leaving condition)

\[ Mn + Ofn + Ocn + Hys < Mp + Ofp + Ocp + Off \]

The variables in the formula are defined as follows:

- **Mn** is the measurement result of the neighbouring cell, not taking into account any offsets.
- **Ofn** is the measurement object specific offset of the reference signal of the neighbour cell (i.e. *offsetMO* as defined within *measObjectNR* corresponding to the neighbour cell).
Ocn is the cell specific offset of the neighbour cell (i.e. cellIndividualOffset as defined within measObjectNR corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell.

Mp is the measurement result of the SpCell, not taking into account any offsets.

Ofp is the measurement object specific offset of the SpCell (i.e. offsetMO as defined within measObjectNR corresponding to the SpCell).

Ocp is the cell specific offset of the SpCell (i.e. cellIndividualOffset as defined within measObjectNR corresponding to the SpCell), and is set to zero if not configured for the SpCell.

Hys is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigNR for this event).

Off is the offset parameter for this event (i.e. a3-Offset as defined within reportConfigNR for this event).

Mn, Mp are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Ofn, Ocn, Ofp, Ocp, Hys, Off are expressed in dB.

NOTE 2: The definition of Event A3 also applies to CondEvent A3.

5.5.4.5 Event A4 (Neighbour becomes better than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A4-1, as specified below, is fulfilled;
1> consider the leaving condition for this event to be satisfied when condition A4-2, as specified below, is fulfilled.

Inequality A4-1 (Entering condition)

\[ Mn + Ofn + Ocn – Hys > Thresh \]

Inequality A4-2 (Leaving condition)

\[ Mn + Ofn + Ocn + Hys < Thresh \]

The variables in the formula are defined as follows:

Mn is the measurement result of the neighbouring cell, not taking into account any offsets.

Ofn is the measurement object specific offset of the neighbour cell (i.e. offsetMO as defined within measObjectNR corresponding to the neighbour cell).

Ocn is the measurement object specific offset of the neighbour cell (i.e. cellIndividualOffset as defined within measObjectNR corresponding to the neighbour cell), and set to zero if not configured for the neighbour cell.

Hys is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigNR for this event).

Thresh is the threshold parameter for this event (i.e. a4-Threshold as defined within reportConfigNR for this event).

Mn is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Ofn, Ocn, Hys are expressed in dB.

Thresh is expressed in the same unit as Mn.

5.5.4.6 Event A5 (SpCell becomes worse than threshold1 and neighbour becomes better than threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both condition A5-1 and condition A5-2, as specified below, are fulfilled;
> consider the leaving condition for this event to be satisfied when condition A5-3 or condition A5-4, i.e. at least one of the two, as specified below, is fulfilled;

> use the SpCell for \( M_p \).

NOTE 1: The parameters of the reference signal(s) of the cell(s) that triggers the event are indicated in the \( \text{measObjectNR} \) associated to the event which may be different from the \( \text{measObjectNR} \) of the NR SpCell.

Inequality A5-1 (Entering condition 1)
\[
M_p + \text{Hys} < \text{Thresh1}
\]
Inequality A5-2 (Entering condition 2)
\[
M_n + O_{fn} + O_{cn} - \text{Hys} > \text{Thresh2}
\]
Inequality A5-3 (Leaving condition 1)
\[
M_p - \text{Hys} > \text{Thresh1}
\]
Inequality A5-4 (Leaving condition 2)
\[
M_n + O_{fn} + O_{cn} + \text{Hys} < \text{Thresh2}
\]
The variables in the formula are defined as follows:

\( M_p \) is the measurement result of the NR SpCell, not taking into account any offsets.

\( M_n \) is the measurement result of the neighbouring cell, not taking into account any offsets.

\( O_{fn} \) is the measurement object specific offset of the neighbour cell (i.e. \( \text{offsetMO} \) as defined within \( \text{measObjectNR} \) corresponding to the neighbour cell).

\( O_{cn} \) is the cell specific offset of the neighbour cell (i.e. \( \text{cellIndividualOffset} \) as defined within \( \text{measObjectNR} \) corresponding to the neighbour cell), and set to zero if not configured for the neighbour cell.

\( \text{Hys} \) is the hysteresis parameter for this event (i.e. \( \text{hysteresis} \) as defined within \( \text{reportConfigNR} \) for this event).

\( \text{Thresh1} \) is the threshold parameter for this event (i.e. \( a5\text{-Threshold1} \) as defined within \( \text{reportConfigNR} \) for this event).

\( \text{Thresh2} \) is the threshold parameter for this event (i.e. \( a5\text{-Threshold2} \) as defined within \( \text{reportConfigNR} \) for this event).

\( M_n, M_p \) are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

\( O_{fn}, O_{cn}, \text{Hys} \) are expressed in dB.

\( \text{Thresh1} \) is expressed in the same unit as \( M_p \).

\( \text{Thresh2} \) is expressed in the same unit as \( M_n \).

NOTE 2: The definition of Event A5 also applies to CondEvent A5.

5.5.4.7 Event A6 (Neighbour becomes offset better than SCell)
The UE shall:

> consider the entering condition for this event to be satisfied when condition A6-1, as specified below, is fulfilled;

> consider the leaving condition for this event to be satisfied when condition A6-2, as specified below, is fulfilled;

> for this measurement, consider the (secondary) cell corresponding to the \( \text{measObjectNR} \) associated to this event to be the serving cell.

NOTE: The reference signal(s) of the neighbour(s) and the reference signal(s) of the SCell are both indicated in the associated \( \text{measObjectNR} \).
Inequality A6-1 (Entering condition)

\[M_n + Ocn - Hys > Ms + Ocs + Off\]

Inequality A6-2 (Leaving condition)

\[M_n + Ocn + Hys < Ms + Ocs + Off\]

The variables in the formula are defined as follows:

- **Mn** is the measurement result of the neighbouring cell, not taking into account any offsets.
- **Ocn** is the cell specific offset of the neighbour cell (i.e. `cellIndividualOffset` as defined within the associated `measObjectNR`), and set to zero if not configured for the neighbour cell.
- **Ms** is the measurement result of the serving cell, not taking into account any offsets.
- **Ocs** is the cell specific offset of the serving cell (i.e. `cellIndividualOffset` as defined within the associated `measObjectNR`), and is set to zero if not configured for the serving cell.
- **Hys** is the hysteresis parameter for this event (i.e. `hysteresis` as defined within `reportConfigNR` for this event).
- **Off** is the offset parameter for this event (i.e. `a6-Offset` as defined within `reportConfigNR` for this event).

**Mn, Ms** are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

**Ocn, Ocs, Hys, Off** are expressed in dB.

5.5.4.8 Event B1 (Inter RAT neighbour becomes better than threshold)

The UE shall:

1. consider the entering condition for this event to be satisfied when condition B1-1, as specified below, is fulfilled;
2. consider the leaving condition for this event to be satisfied when condition B1-2, as specified below, is fulfilled.

Inequality B1-1 (Entering condition)

\[M_n + Ofn + Ocn - Hys > Thresh\]

Inequality B1-2 (Leaving condition)

\[M_n + Ofn + Ocn + Hys < Thresh\]

The variables in the formula are defined as follows:

- **Mn** is the measurement result of the inter-RAT neighbour cell, not taking into account any offsets.
- **Ofn** is the measurement object specific offset of the frequency of the inter-RAT neighbour cell (i.e. `eutra-Q-OffsetRange` as defined within the `measObjectEUTRA` corresponding to the frequency of the neighbour inter-RAT cell, `utra-FDD-Q-OffsetRange` as defined within the `measObjectUTRA-FDD` corresponding to the frequency of the neighbour inter-RAT cell).
- **Ocn** is the cell specific offset of the inter-RAT neighbour cell (i.e. `cellIndividualOffset` as defined within the `measObjectEUTRA` corresponding to the neighbour inter-RAT cell), and set to zero if not configured for the neighbour cell.
- **Hys** is the hysteresis parameter for this event (i.e. `hysteresis` as defined within `reportConfigInterRAT` for this event).
- **Thresh** is the threshold parameter for this event (i.e. `b1-ThresholdEUTRA` as defined within `reportConfigInterRAT` for this event, `b1-ThresholdUTRA-FDD` as defined for UTRA-FDD within `reportConfigInterRAT` for this event).

**Mn** is expressed in dBm or in dB, depending on the measurement quantity of the inter-RAT neighbour cell.

**Ofn, Ocn, Hys** are expressed in dB.

**Thresh** is expressed in the same unit as **Mn**.
5.5.4.9 Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both condition B2-1 and condition B2-2, as specified below, are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition B2-3 or condition B2-4, i.e. at least one of the two, as specified below, is fulfilled;

Inequality B2-1 (Entering condition 1)

\[ M_p + H_{ys} < T_{hresh1} \]

Inequality B2-2 (Entering condition 2)

\[ M_n + O_{fn} + O_{cn} - H_{ys} > T_{hresh2} \]

Inequality B2-3 (Leaving condition 1)

\[ M_p - H_{ys} > T_{hresh1} \]

Inequality B2-4 (Leaving condition 2)

\[ M_n + O_{fn} + O_{cn} + H_{ys} < T_{hresh2} \]

The variables in the formula are defined as follows:

\( M_p \) is the measurement result of the PCell, not taking into account any offsets.

\( M_n \) is the measurement result of the inter-RAT neighbour cell, not taking into account any offsets.

\( O_{fn} \) is the measurement object specific offset of the frequency of the inter-RAT neighbour cell (i.e. eutra-Q-OffsetRange as defined within the measObjectEUTRA corresponding to the frequency of the inter-RAT neighbour cell,utra-FDD-Q-OffsetRange as defined within the measObjectUTRA-FDD corresponding to the frequency of the neighbour inter-RAT cell).

\( O_{cn} \) is the cell specific offset of the inter-RAT neighbour cell (i.e. cellIndividualOffset as defined within the measObjectEUTRA corresponding to the neighbour inter-RAT cell), and set to zero if not configured for the neighbour cell.

\( H_{ys} \) is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigInterRAT for this event).

\( T_{hresh1} \) is the threshold parameter for this event (i.e. b2-Threshold1 as defined within reportConfigInterRAT for this event).

\( T_{hresh2} \) is the threshold parameter for this event (i.e. b2-Threshold2EUTRA as defined within reportConfigInterRAT for this event, b2-Threshold2UTRA-FDD as defined for UTRA-FDD within reportConfigInterRAT for this event).

\( M_p \) is expressed in dBm in case of RSRP, or in dB in case of RSRQ and SINR.

\( M_n \) is expressed in dBm or dB, depending on the measurement quantity of the inter-RAT neighbour cell.

\( O_{fn}, O_{cn}, H_{ys} \) are expressed in dB.

\( T_{hresh1} \) is expressed in the same unit as \( M_p \).

\( T_{hresh2} \) is expressed in the same unit as \( M_n \).

5.5.4.10 Event I1 (Interference becomes higher than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition I1-1, as specified below, is fulfilled;
1> consider the leaving condition for this event to be satisfied when condition I1-2, as specified below, is fulfilled.

Inequality I1-1 (Entering condition)

\[ M_i - Hys > \text{Thresh} \]

Inequality I1-2 (Leaving condition)

\[ M_i + Hys < \text{Thresh} \]

The variables in the formula are defined as follows:

- \( M_i \) is the measurement result of the interference, not taking into account any offsets.
- \( Hys \) is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigNR for this event).
- \( \text{Thresh} \) is the threshold parameter for this event (i.e. il-Threshold as defined within reportConfigNR for this event).

\( M_i, \text{Thresh} \) are expressed in dBm.

\( Hys \) is expressed in dB.

5.5.4.11 Event C1 (The NR sidelink channel busy ratio is above a threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition C1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition C1-2, as specified below, is fulfilled;

Inequality C1-1 (Entering condition)

\[ \text{Thresh}_{HysMs} > - \]

Inequality C1-2 (Leaving condition)

\[ \text{Thresh}_{HysMs} < + \]

The variables in the formula are defined as follows:

- \( Ms \) is the measurement result of channel busy ratio of the transmission resource pool, not taking into account any offsets.
- \( Hys \) is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigNR-SL for this event).
- \( \text{Thresh} \) is the threshold parameter for this event (i.e. c1-Threshold as defined within reportConfigNR-SL for this event).

\( Ms \), \( \text{Thresh} \) are expressed in decimal from 0 to 1 in steps of 0.01.

\( Hys \) is expressed in the same unit as \( Ms \).

\( \text{Thresh} \) is expressed in the same unit as \( Ms \).

5.5.4.12 Event C2 (The NR sidelink channel busy ratio is below a threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition C2-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition C2-2, as specified below, is fulfilled;

Inequality C2-1 (Entering condition)

\[ Ms + Hys < \text{Thresh} \]

Inequality C2-2 (Leaving condition)
Ms − Hys > Thresh

The variables in the formula are defined as follows:

- **Ms** is the measurement result of channel busy ratio of the transmission resource pool, not taking into account any offsets.
- **Hys** is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigNR-SL for this event).
- **Thresh** is the threshold parameter for this event (i.e. c2-Threshold as defined within reportConfigNR-SL for this event).

**Ms** is expressed in decimal from 0 to 1 in steps of 0.01.

**Hys** is expressed in the same unit as **Ms**.

**Thresh** is expressed in the same unit as **Ms**.

5.5.4.13 Void

5.5.4.14 Void

5.5.5 Measurement reporting

5.5.5.1 General

The purpose of this procedure is to transfer measurement results from the UE to the network. The UE shall initiate this procedure only after successful AS security activation.

For the **measId** for which the measurement reporting procedure was triggered, the UE shall set the **measResults** within the **MeasurementReport** message as follows:

1> set the **measId** to the measurement identity that triggered the measurement reporting;

1> for each serving cell configured with **servingCellMO**:

2> if the **reportConfig** associated with the **measId** that triggered the measurement reporting includes **rsType**:

3> if the serving cell measurements based on the **rsType** included in the **reportConfig** that triggered the measurement report are available:

4> set the **measResultServingCell** within **measResultServingMOList** to include RSRP, RSRQ and the available SINR of the serving cell, derived based on the **rsType** included in the **reportConfig** that triggered the measurement report;

2> else:

3> if SSB based serving cell measurements are available:

4> set the **measResultServingCell** within **measResultServingMOList** to include RSRP, RSRQ and the available SINR of the serving cell, derived based on SSB;

3> else if CSI-RS based serving cell measurements are available:
4> set the `measResultServingCell` within `measResultServingMOList` to include RSRP, RSRQ and the available SINR of the serving cell, derived based on CSI-RS;

1> set the `servCellId` within `measResultServingMOList` to include each NR serving cell that is configured with `servingCellMO`, if any;

1> if the `reportConfig` associated with the `measId` that triggered the measurement reporting includes `reportQuantityRS-Indexes` and `maxNrofRS-IndexesToReport`:
   2> for each serving cell configured with `servingCellMO`, include beam measurement information according to the associated `reportConfig` as described in 5.5.5.2;

1> if the `reportConfig` associated with the `measId` that triggered the measurement reporting includes `reportAddNeighMeas`:
   2> for each `measObjectId` referenced in the `measIdList` which is also referenced with `servingCellMO`, other than the `measObjectId` corresponding with the `measId` that triggered the measurement reporting:
      3> if the `measObjectNR` indicated by the `servingCellMO` includes the RS resource configuration corresponding to the `rsType` indicated in the `reportConfig`:
         4> set the `measResultBestNeighCell` within `measResultServingMOList` to include the `physCellId` and the available measurement quantities based on the `reportQuantityCell` and `rsType` indicated in `reportConfig` of the non-serving cell corresponding to the concerned `measObjectNR` with the highest measured RSRP if RSRP measurement results are available for cells corresponding to this `measObjectNR`, otherwise with the highest measured RSRQ if RSRQ measurement results are available for cells corresponding to this `measObjectNR`, otherwise with the highest measured SINR;
      4> if the `reportConfig` associated with the `measId` that triggered the measurement reporting includes `reportQuantityRS-Indexes` and `maxNrofRS-IndexesToReport`:
         5> for each best non-serving cell included in the measurement report:
            6> include beam measurement information according to the associated `reportConfig` as described in 5.5.5.2;

1> if the `reportConfig` associated with the `measId` that triggered the measurement reporting is set to `eventTriggered` and `eventID` is set to `eventA3`, or `eventA4`, or `eventA5`, or `eventB1`, or `eventB2`:
   2> if the UE is in NE-DC and the measurement configuration that triggered this measurement report is associated with the MCG:
      3> set the `measResultServFreqListEUTRA-SCG` to include an entry for each E-UTRA SCG serving frequency with the following:
         4> include `carrierFreq` of the E-UTRA serving frequency;
      4> set the `measResultServingCell` to include the available measurement quantities that the UE is configured to measure by the measurement configuration associated with the SCG;
      4> if `reportConfig` associated with the `measId` that triggered the measurement reporting includes `reportAddNeighMeas`:
         5> set the `measResultServFreqListEUTRA-SCG` to include within `measResultBestNeighCell` the quantities of the best non-serving cell, based on RSRP, on the concerned serving frequency;

1> if `reportConfig` associated with the `measId` that triggered the measurement reporting is set to `eventTriggered` and `eventID` is set to `eventA3`, or `eventA4`, or `eventA5`:
   2> if the UE is in NR-DC and the measurement configuration that triggered this measurement report is associated with the MCG:
      3> set the `measResultServFreqListNR-SCG` to include for each NR SCG serving cell that is configured with `servingCellMO`, if any, the following:
4> if the `reportConfig` associated with the `measId` that triggered the measurement reporting includes `rsType`:  

5> if the serving cell measurements based on the `rsType` included in the `reportConfig` that triggered the measurement report are available according to the measurement configuration associated with the SCG:  

6> set the `measResultServingCell` within `measResultServFreqListNR-SCG` to include RSRP, RSRQ and the available SINR of the serving cell, derived based on the `rsType` included in the `reportConfig` that triggered the measurement report;  

4> else:  

5> if SSB based serving cell measurements are available according to the measurement configuration associated with the SCG:  

6> set the `measResultServingCell` within `measResultServFreqListNR-SCG` to include RSRP, RSRQ and the available SINR of the serving cell, derived based on SSB;  

5> else if CSI-RS based serving cell measurements are available according to the measurement configuration associated with the SCG:  

6> set the `measResultServingCell` within `measResultServFreqListNR-SCG` to include RSRP, RSRQ and the available SINR of the serving cell, derived based on CSI-RS;  

4> if results for the serving cell derived based on SSB are included:  

5> include the `ssbFrequency` to the value indicated by `ssbFrequency` as included in the `MeasObjectNR` of the serving cell;  

4> if results for the serving cell derived based on CSI-RS are included:  

5> include the `refFreqCSI-RS` to the value indicated by `refFreqCSI-RS` as included in the `MeasObjectNR` of the serving cell;  

4> if the `reportConfig` associated with the `measId` that triggered the measurement reporting includes `reportQuantityRS-Indexes` and `maxNrofRS-IndexesToReport`:  

5> for each serving cell configured with `servingCellMO`, include beam measurement information according to the associated `reportConfig` as described in 5.5.5.2, where availability is considered according to the measurement configuration associated with the SCG;  

4> if `reportConfig` associated with the `measId` that triggered the measurement reporting includes `reportAddNeighMeas`:  

5> if the `measObjectNR` indicated by the `servingCellMO` includes the RS resource configuration corresponding to the `rsType` indicated in the `reportConfig`:  

6> set the `measResultBestNeighCellListNR` within `measResultServFreqListNR-SCG` to include one entry with the `physCellId` and the available measurement quantities based on the `reportQuantityCell` and `rsType` indicated in `reportConfig` of the non-serving cell corresponding to the concerned `measObjectNR` with the highest measured RSRP if RSRP measurement results are available for cells corresponding to this `measObjectNR`, otherwise with the highest measured RSRQ if RSRQ measurement results are available for cells corresponding to this `measObjectNR`, otherwise with the highest measured SINR, where availability is considered according to the measurement configuration associated with the SCG;  

7> if the `reportConfig` associated with the `measId` that triggered the measurement reporting includes `reportQuantityRS-Indexes` and `maxNrofRS-IndexesToReport`:  

8> for each best non-serving cell included in the measurement report:  

9> include beam measurement information according to the associated `reportConfig` as described in 5.5.5.2, where availability is considered according to the measurement configuration associated with the SCG;
1> if the measRSSI-ReportConfig is configured within the corresponding reportConfig for this measId:

2> set the rss-i-Result to the average of sample value(s) provided by lower layers in the reportInterval;

2> set the channelOccupancy to the rounded percentage of sample values which are beyond the channelOccupancyThreshold within all the sample values in the reportInterval;

1> if there is at least one applicable neighbouring cell to report:

2> if the reportType is set to eventTriggered or periodical:

3> set the measResultNeighCells to include the best neighbouring cells up to maxReportCells in accordance with the following:

4> if the reportType is set to eventTriggered:

5> include the cells included in the cellsTriggeredList as defined within the VarMeasReportList for this measId;

4> else:

5> include the applicable cells for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;

4> for each cell that is included in the measResultNeighCells, include the physCellId;

4> if the reportType is set to eventTriggered or periodical:

5> for each included cell, include the layer 3 filtered measured results in accordance with the reportConfig for this measId, ordered as follows:

6> if the measObject associated with this measId concerns NR:

7> if rsType in the associated reportConfig is set to ssb:

8> set resultsSSB-Cell within the measResult to include the SS/PBCH block based quantity(ies) indicated in the reportQuantityCell within the concerned reportConfig, in decreasing order of the sorting quantity, determined as specified in 5.5.5.3, i.e. the best cell is included first;

8> if reportQuantityRS-Indexes and maxNrofRS-IndexesToReport are configured, include beam measurement information as described in 5.5.5.2;

7> else if rsType in the associated reportConfig is set to csi-rs:

8> set resultsCSI-RS-Cell within the measResult to include the CSI-RS based quantity(ies) indicated in the reportQuantityCell within the concerned reportConfig, in decreasing order of the sorting quantity, determined as specified in 5.5.5.3, i.e. the best cell is included first;

8> if reportQuantityRS-Indexes and maxNrofRS-IndexesToReport are configured, include beam measurement information as described in 5.5.5.2;

6> if the measObject associated with this measId concerns E-UTRA:

7> set the measResult to include the quantity(ies) indicated in the reportQuantity within the concerned reportConfigInterRAT in decreasing order of the sorting quantity, determined as specified in 5.5.5.3, i.e. the best cell is included first;

6> if the measObject associated with this measId concerns UTRA-FDD and if ReportConfigInterRAT includes the reportQuantityUTRA-FDD:

7> set the measResult to include the quantity(ies) indicated in the reportQuantityUTRA-FDD within the concerned reportConfigInterRAT in decreasing order of the sorting quantity, determined as specified in 5.5.5.3, i.e. the best cell is included first;

2> else:
if the cell indicated by cellForWhichToReportCGI is an NR cell:

- if plmn-IdentityInfoList of the cgi-Info for the concerned cell has been obtained:
  - include the plmn-IdentityInfoList including plmn-IdentityList, trackingAreaCode (if available), ranac (if available), cellIdentity and cellReservedForOperatorUse for each entry of the plmn-IdentityInfoList;
  - include frequencyBandList if available;
- if nr-CGI-Reporting-NPN is supported by the UE and npn-IdentityInfoList of the cgi-Info for the concerned cell has been obtained:
  - include the npn-IdentityInfoList including npn-IdentityList, trackingAreaCode, ranac (if available), cellIdentity and cellReservedForOperatorUse for each entry of the npn-IdentityInfoList;
- else if MIB indicates the SIB1 is not broadcast:
  - include the noSIB1 including the ssb-SubcarrierOffset and pdcch-ConfigSIB1 obtained from MIB of the concerned cell;

if the cell indicated by cellForWhichToReportCGI is an E-UTRA cell:

- if all mandatory fields of the cgi-Info-EPC for the concerned cell have been obtained:
  - include in the cgi-Info-EPC the fields broadcasted in E-UTRA SystemInformationBlockType1 associated to EPC;
- if the UE is E-UTRA/5GC capable and all mandatory fields of the cgi-Info-5GC for the concerned cell have been obtained:
  - include in the cgi-Info-5GC the fields broadcasted in E-UTRA SystemInformationBlockType1 associated to 5GC;
- if the mandatory present fields of the cgi-Info for the cell indicated by the cellForWhichToReportCGI in the associated measObject have been obtained:
  - include the freqBandIndicator;
  - if the cell broadcasts the multiBandInfoList, include the multiBandInfoList;
  - if the cell broadcasts the freqBandIndicatorPriority, include the freqBandIndicatorPriority;

if the corresponding measObject concerns NR:

- if the reportSFTD-Meas is set to true within the corresponding reportConfigNR for this measId:
  - set the measResultSFTD-NR in accordance with the following:
    - set sfn-OffsetResult and frameBoundaryOffsetResult to the measurement results provided by lower layers;
    - if the reportRSRP is set to true:
      - set rsrp-Result to the RSRP of the NR PSCell derived based on SSB;
- else if the reportSFTD-NeighMeas is included within the corresponding reportConfigNR for this measId:
  - for each applicable cell which measurement results are available, include an entry in the measResultCellListSFTD-NR and set the contents as follows:
    - set physCellId to the physical cell identity of the concerned NR neighbour cell.
    - set sfn-OffsetResult and frameBoundaryOffsetResult to the measurement results provided by lower layers;
  - if the reportRSRP is set to true:
5> set $rsrp-Result$ to the RSRP of the concerned cell derived based on SSB;

1> else if the corresponding $measObject$ concerns E-UTRA:

2> if the $reportSFTD-Meas$ is set to true within the corresponding $reportConfigInterRAT$ for this $measId$:

3> set the $measResultSFTD-EUTRA$ in accordance with the following:

4> set $sfn-OffsetResult$ and $frameBoundaryOffsetResult$ to the measurement results provided by lower layers;

4> if the $reportRSRP$ is set to true;

5> set $rsrpResult-EUTRA$ to the RSRP of the EUTRA PSCell;

1> if average uplink PDCP delay values are available:

2> set the $ul-PDCP-DelayValueResultList$ to include the corresponding average uplink PDCP delay values;

1> if the $includeCommonLocationInfo$ is configured in the corresponding $reportConfig$ for this $measId$ and detailed location information that has not been reported is available, set the content of $commonLocationInfo$ of the $locationInfo$ as follows:

2> include the $locationTimestamp$;

2> include the $locationCoordinate$, if available;

2> include the $velocityEstimate$, if available;

2> include the $locationError$, if available;

2> include the $locationSource$, if available;

2> if available, include the $gnss-TOD-msec$;

1> if the $includeWLAN-Meas$ is configured in the corresponding $reportConfig$ for this $measId$, set the $wlan-LocationInfo$ of the $locationInfo$ in the $measResults$ as follows:

2> if available, include the $LogMeasResultWLAN$, in order of decreasing RSSI for WLAN APs;

1> if the $includeBT-Meas$ is configured in the corresponding $reportConfig$ for this $measId$, set the $BT-LocationInfo$ of the $locationInfo$ in the $measResults$ as follows:

2> if available, include the $LogMeasResultBT$, in order of decreasing RSSI for Bluetooth beacons;

1> if the $includeSensor-Meas$ is configured in the corresponding $reportConfig$ for this $measId$, set the $sensor-LocationInfo$ of the $locationInfo$ in the $measResults$ as follows:

2> if available, include the $sensor-MeasurementInformation$;

2> if available, include the $sensor-MotionInformation$;

1> if there is at least one applicable transmission resource pool for NR sidelink communication (for $measResultsSL$):

2> set the $measResultsListSL$ to include the CBR measurement results in accordance with the following:

3> if the $reportType$ is set to eventTriggered:

4> include the transmission resource pools included in the $poolsTriggeredList$ as defined within the $VarMeasReportList$ for this $measId$;

3> else:

4> include the applicable transmission resource pools for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;
if the corresponding measObject concerns NR sidelink communication, then for each transmission resource pool to be reported:

set the sl-poolReportIdentity to the identity of this transmission resource pool;

set the sl-CBR-ResultsNR to the CBR measurement results on PSSCH and PSCCH of this transmission resource pool provided by lower layers, if available;

NOTE 1: Void.

if there is at least one applicable CLI measurement resource to report:

if the reportType is set to cli-EventTriggered or cli-Periodical:

set the measResultCLI to include the most interfering SRS resources or most interfering CLI-RSSI resources up to maxReportCLI in accordance with the following:

if the reportType is set to cli-EventTriggered:

if trigger quantity is set to srs-RSRP i.e. il-Threshold is set to srs-RSRP:

include the SRS resource included in the cli-TriggeredList as defined within the VarMeasReportList for this measId;

if trigger quantity is set to cli-RSSI i.e. il-Threshold is set to cli-RSSI:

include the CLI-RSSI resource included in the cli-TriggeredList as defined within the VarMeasReportList for this measId;

else:

if reportQuantityCLI is set to srs-rsrp:

include the applicable SRS resources for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;

else:

include the applicable CLI-RSSI resources for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;

for each SRS resource that is included in the measResultCLI:

include the srs-ResourceId;

set srs-RSRP-Result to include the layer 3 filtered measured results in decreasing order, i.e. the most interfering SRS resource is included first;

for each CLI-RSSI resource that is included in the measResultCLI:

include the rssi-ResourceId;

set cli-RSSI-Result to include the layer 3 filtered measured results in decreasing order, i.e. the most interfering CLI-RSSI resource is included first;

increment the numberOfReportsSent as defined within the VarMeasReportList for this measId by 1;

stop the periodical reporting timer, if running;

if the numberOfReportsSent as defined within the VarMeasReportList for this measId is less than the reportAmount as defined within the corresponding reportConfig for this measId:

start the periodical reporting timer with the value of reportInterval as defined within the corresponding reportConfig for this measId;

else:

if the reportType is set to periodical or cli-Periodical:
3> remove the entry within the VarMeasReportList for this measId;
3> remove this measId from the measIdList within VarMeasConfig;

1> if the measurement reporting was configured by a sl-ConfigDedicatedNR received within the RRCConnectionReconfiguration:

2> submit the MeasurementReport message to lower layers for transmission via SRB1, embedded in E-UTRA RRC message ULInformationTransferIRAT as specified TS 36.331 [10], clause 5.6.28;

1> else if the UE is in (NG)EN-DC:

2> if SRB3 is configured:

3> submit the MeasurementReport message via SRB3 to lower layers for transmission, upon which the procedure ends;

2> else:

3> submit the MeasurementReport message via E-UTRA embedded in E-UTRA RRC message ULInformationTransferMRDC as specified in TS 36.331 [10].

1> else if the UE is in NR-DC:

2> if the measurement configuration that triggered this measurement report is associated with the SCG:

3> if SRB3 is configured:

4> submit the MeasurementReport message via SRB3 to lower layers for transmission, upon which the procedure ends;

3> else:

4> submit the MeasurementReport message via SRB1 embedded in NR RRC message ULInformationTransferMRDC as specified in 5.7.2a.3;

2> else:

3> submit the MeasurementReport message via SRB1 to lower layers for transmission, upon which the procedure ends;

1> else:

2> submit the MeasurementReport message to lower layers for transmission, upon which the procedure ends.

5.5.5.2 Reporting of beam measurement information

For beam measurement information to be included in a measurement report the UE shall:

1> if reportType is set to eventTriggered:

2> consider the trigger quantity as the sorting quantity if available, otherwise RSRP as sorting quantity if available, otherwise RSRQ as sorting quantity if available, otherwise SINR as sorting quantity;

1> if reportType is set to periodical:

2> if a single reporting quantity is set to true in reportQuantityRS-Indexes;

3> consider the configured single quantity as the sorting quantity;

2> else:

3> if rsrp is set to true;

4> consider RSRP as the sorting quantity;

3> else:
4> consider RSRQ as the sorting quantity;

1> set rsIndexResults to include up to maxNrofRS-IndexesToReport SS/PBCH block indexes or CSI-RS indexes in order of decreasing sorting quantity as follows:

2> if the measurement information to be included is based on SS/PBCH block:

3> include within resultsSSB-Indexes the index associated to the best beam for that SS/PBCH block sorting quantity and if absThreshSS-BlocksConsolidation is included in the VarMeasConfig for the measObject associated to the cell for which beams are to be reported, the remaining beams whose sorting quantity is above absThreshSS-BlocksConsolidation;

3> if includeBeamMeasurements is configured, include the SS/PBCH based measurement results for the quantities in reportQuantityRS-Indexes set to true for each SS/PBCH block index;

2> else if the beam measurement information to be included is based on CSI-RS:

3> include within resultsCSI-RS-Indexes the index associated to the best beam for that CSI-RS sorting quantity and, if absThreshCSI-RS-Consolidation is included in the VarMeasConfig for the measObject associated to the cell for which beams are to be reported, the remaining beams whose sorting quantity is above absThreshCSI-RS-Consolidation;

3> if includeBeamMeasurements is configured, include the CSI-RS based measurement results for the quantities in reportQuantityRS-Indexes set to true for each CSI-RS index.

5.5.5.3 Sorting of cell measurement results

The UE shall determine the sorting quantity according to parameters of the reportConfig associated with the measId that triggered the reporting:

1> if the reportType is set to eventTriggered:

2> for an NR cell, consider the quantity used in the aN-Threshold (for eventA1, eventA2 and eventA4) or in the a5-Threshold2 (for eventA5) or in the aN-Offset (for eventA3 and eventA6) as the sorting quantity;

2> for an E-UTRA cell, consider the quantity used in the bN-ThresholdEUTRA as the sorting quantity;

2> for an UTRA-FDD cell, consider the quantity used in the bN-ThresholdUTRA-FDD as the sorting quantity;

1> if the reportType is set to periodical:

2> determine the sorting quantity according to reportQuantityCell for an NR cell, and according to reportQuantity for an E-UTRA cell, as below:

3> if a single quantity is set to true:

4> consider this quantity as the sorting quantity;

3> else:

4> if rsrp is set to true;

5> consider RSRP as the sorting quantity;

4> else:

5> consider RSRQ as the sorting quantity;

2> determine the sorting quantity according to reportQuantityUTRA-FDD for UTRA-FDD cell, as below:

3> if a single quantity is set to true:

4> consider this quantity as the sorting quantity;

3> else:

4> consider RSCP as the sorting quantity.
5.5.6 Location measurement indication

5.5.6.1 General

The purpose of this procedure is to indicate to the network that the UE is going to start/stop location related measurements towards E-UTRA or NR (eutra-RSTD, nr-RSTD, nr-UE-RxTxTimeDiff, nr-PRS-RSRP) which require measurement gaps or start/stop detection of subframe and slot timing towards E-UTRA (eutra-FineTimingDetection) which requires measurement gaps. UE shall initiate this procedure only after successful AS security activation.

NOTE: It is a network decision to configure the measurement gap.

5.5.6.2 Initiation

The UE shall:

1> if and only if upper layers indicate to start performing location measurements towards E-UTRA or NR or start subframe and slot timing detection towards E-UTRA, and the UE requires measurement gaps for these operations while measurement gaps are either not configured or not sufficient:

2> initiate the procedure to indicate start;

NOTE 1: The UE verifies the measurement gap situation only upon receiving the indication from upper layers. If at this point in time sufficient gaps are available, the UE does not initiate the procedure. Unless it receives a new indication from upper layers, the UE is only allowed to further repeat the procedure in the same PCell once per frequency of the target RAT if the provided measurement gaps are insufficient.

1> if and only if upper layers indicate to stop performing location measurements towards E-UTRA or NR or stop subframe and slot timing detection towards E-UTRA:

2> initiate the procedure to indicate stop.

NOTE 2: The UE may initiate the procedure to indicate stop even if it did not previously initiate the procedure to indicate start.

5.5.6.3 Actions related to transmission of LocationMeasurementIndication message

The UE shall set the contents of LocationMeasurementIndication message as follows:

1> if the procedure is initiated to indicate start of location related measurements:

2> if the procedure is initiated for RSTD measurements towards E-UTRA:

3> set the measurementIndication to the eutra-RSTD according to the information received from upper layers;

2> else if the procedure is initiated for positioning measurement towards NR:

3> set the measurementIndication to the nr-PRS-Measurement according to the information received from upper layers;

1> else if the procedure is initiated to indicate stop of location related measurements:

2> set the measurementIndication to the value release;
if the procedure is initiated to indicate start of subframe and slot timing detection towards E-UTRA:
  > set the measurementIndication to the value eutra-FineTimingDetection;

else if the procedure is initiated to indicate stop of subframe and slot timing detection towards E-UTRA:
  > set the measurementIndication to the value release;

submit the LocationMeasurementIndication message to lower layers for transmission, upon which the procedure ends.

5.5a Logged Measurements

5.5a.1 Logged Measurement Configuration

5.5a.1.1 General

Figure 5.5a.1.1-1: Logged measurement configuration

The purpose of this procedure is to configure the UE to perform logging of measurement results while in RRC_IDLE and RRC_INACTIVE. The procedure applies to logged measurements capable UEs that are in RRC_CONNECTED.

NOTE: NG-RAN may retrieve stored logged measurement information by means of the UE information procedure.

5.5a.1.2 Initiation

NG-RAN initiates the logged measurement configuration procedure to UE in RRC_CONNECTED by sending the LoggedMeasurementConfiguration message.

5.5a.1.3 Reception of the LoggedMeasurementConfiguration by the UE

Upon receiving the LoggedMeasurementConfiguration message the UE shall:

1> discard the logged measurement configuration as well as the logged measurement information as specified in 5.5a.2;

1> store the received loggingDuration, reportType and areaConfiguration, if included, in VarLogMeasConfig;

1> if the LoggedMeasurementConfiguration message includes plmn-IdentityList:
  > set plmn-IdentityList in VarLogMeasReport to include the RPLMN as well as the PLMNs included in plmn-IdentityList;

1> else:
  > set plmn-IdentityList in VarLogMeasReport to include the RPLMN;
1> store the received `absoluteTimeInfo`, `traceReference`, `traceRecordingSessionRef`, and `tce-Id` in `VarLogMeasReport`;
1> store the received `bt-NameList`, if included, in `VarLogMeasConfig`;
1> store the received `wlan-Namelist`, if included, in `VarLogMeasConfig`;
1> store the received `sensor-Namelist`, if included, in `VarLogMeasConfig`;
1> start timer T330 with the timer value set to the `loggingDuration`;

5.5a.1.4 T330 expiry

Upon expiry of T330 the UE shall:

1> release `VarLogMeasConfig`;

The UE is allowed to discard stored logged measurements, i.e. to release `VarLogMeasReport`, 48 hours after T330 expiry.

5.5a.2 Release of Logged Measurement Configuration

5.5a.2.1 General

The purpose of this procedure is to release the logged measurement configuration as well as the logged measurement information.

5.5a.2.2 Initiation

The UE shall initiate the procedure upon receiving a logged measurement configuration in another RAT. The UE shall also initiate the procedure upon power off or detach.

The UE shall:

1> stop timer T330, if running;
1> if stored, discard the logged measurement configuration as well as the logged measurement information, i.e. release the UE variables `VarLogMeasConfig` and `VarLogMeasReport`.

5.5a.3 Measurements logging

5.5a.3.1 General

This procedure specifies the logging of available measurements by a UE in RRC_IDLE and RRC_INACTIVE that has a logged measurement configuration. The actual process of logging within the UE, takes place in RRC IDLE state could continue in RRC INACTIVE state or vice versa.

5.5a.3.2 Initiation

While T330 is running, the UE shall:

1> perform the logging in accordance with the following:
   2> if the `reportType` is set to `periodical` in the `VarLogMeasConfig`;
   3> if the UE is in camped normally state on an NR cell and if the RPLMN is included in `plmn-IdentityList` stored in `VarLogMeasReport` and, if the cell is part of the area indicated by `areaConfiguration` if configured in `VarLogMeasConfig`;
   4> perform the logging at regular time intervals, as defined by the `loggingInterval` in the `VarLogMeasConfig`;
else if the reportType is set to eventTriggered, and eventType is set to outOfCoverage:

3> perform the logging at regular time intervals as defined by the loggingInterval in VarLogMeasConfig only when the UE is in any cell selection state;

3> perform the logging immediately upon transitioning from the any cell selection state to the camped normally state;

else if the reportType is set to eventTriggered and eventType is set to eventL1:

3> if the UE is in camped normally state on an NR cell and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport and, if the cell is part of the area indicated by areaConfiguration if configured in VarLogMeasConfig:

4> perform the logging at regular time intervals as defined by the loggingInterval in VarLogMeasConfig only when the conditions indicated by the eventL1 are met;

2> when performing the logging:

3> set the relativeTimeStamp to indicate the elapsed time since the moment at which the logged measurement configuration was received;

3> if detailed location information became available during the last logging interval, set the content of the locationInfo as in 5.3.3.7:

3> if the UE is in any cell selection state (as specified in TS 38.304 [20]):

4> set anyCellSelectionDetected to indicate the detection of no suitable or no acceptable cell found;

4> set the servCellIdentity to indicate global cell identity of the last logged cell that the UE was camping on;

4> set the measResultServingCell to include the quantities of the last logged cell the UE was camping on;

3> else:

4> set the servCellIdentity to indicate global cell identity of the cell the UE is camping on;

4> set the measResultServingCell to include the quantities of the cell the UE is camping on;

4> if available, set the measResultNeighCells, in order of decreasing ranking-criterion as used for cell re-selection, to include neighbouring cell measurements that became available during the last logging interval for at most the following number of neighbouring cells: 6 intra-frequency and 3 inter-frequency neighbours per frequency as well as 3 inter-RAT neighbours, per frequency per RAT and according to the following:

5> for each neighbour cell included, include the optional fields that are available;

NOTE: The UE includes the latest results of the available measurements as used for cell reselection evaluation in RRC_IDLE or RRC_INACTIVE, which are performed in accordance with the performance requirements as specified in TS 38.133 [14].

2> when the memory reserved for the logged measurement information becomes full, stop timer T330 and perform the same actions as performed upon expiry of T330, as specified in 5.5a.1.4.

5.6 UE capabilities

5.6.1 UE capability transfer

5.6.1.1 General

This clause describes how the UE compiles and transfers its UE capability information upon receiving a UECapabilityEnquiry from the network.
5.6.1.2 Initiation

The network initiates the procedure to a UE in RRC_CONNECTED when it needs (additional) UE radio access capability information. The network should retrieve UE capabilities only after AS security activation. Network does not forward UE capabilities that were retrieved before AS security activation to the CN.

5.6.1.3 Reception of the UECapabilityEnquiry by the UE

The UE shall set the contents of UECapabilityInformation message as follows:

1> if the ue-CapabilityRAT-RequestList contains a UE-CapabilityRAT-Request with rat-Type set to nr:
   2> include in the ue-CapabilityRAT-ContainerList a UE-CapabilityRAT-Container of the type UE-NR-Capability and with the rat-Type set to nr;
   2> include the supportedBandCombinationList, featureSets and featureSetCombinations as specified in clause 5.6.1.4;

1> if the ue-CapabilityRAT-RequestList contains a UE-CapabilityRAT-Request with rat-Type set to eutra-nr:
   2> if the UE supports (NG)EN-DC or NE-DC:
      3> include in the ue-CapabilityRAT-ContainerList a UE-CapabilityRAT-Container of the type UE-MRDC-Capability and with the rat-Type set to eutra-nr;
      3> include the supportedBandCombinationList and featureSetCombinations as specified in clause 5.6.1.4;

1> if the ue-CapabilityRAT-RequestList contains a UE-CapabilityRAT-Request with rat-Type set to eutra:
   2> if the UE supports E-UTRA:
      3> include in the ue-CapabilityRAT-ContainerList a ue-CapabilityRAT-Container of the type UE-EUTRA-Capability and with the rat-Type set to eutra as specified in TS 36.331 [10], clause 5.6.3.3, according to the capabilityRequestFilter, if received;

1> if the ue-CapabilityRAT-RequestList contains a UE-CapabilityRAT-Request with rat-Type set to utra-fdd:
   2> if the UE supports UTRA-FDD:
      3> include the UE radio access capabilities for UTRA-FDD within a ue-CapabilityRAT-Container and with the rat-Type set to utra-fdd;

1> if the RRC message segmentation is enabled based on the field rrc-SegAllowed received, and the encoded RRC message is larger than the maximum supported size of a PDCP SDU specified in TS 38.323 [5]:
   2> initiate the UL message segment transfer procedure as specified in clause 5.7.7;

1> else:
   2> submit the UECapabilityInformation message to lower layers for transmission, upon which the procedure ends.
5.6.1.4 Setting band combinations, feature set combinations and feature sets supported by the UE

The UE invokes the procedures in this clause if the NR or E-UTRA network requests UE capabilities for **nr**, **eutra-nr** or **eutra**. This procedure is invoked once per requested **rat-Type** (see clause 5.6.1.3 for capability enquiry by the NR network; see TS 36.331 [10], clause 5.6.3.3 for capability enquiry by the E-UTRA network). The UE shall ensure that the feature set IDs are consistent across feature sets, feature set combinations and band combinations in all three UE capability containers that the network queries with the same fields with the same values, i.e. **UE-CapabilityRequestFilterNR**, **UE-CapabilityRequestFilterCommon** and fields in **UECapabilityEnquiry** message (i.e. **requestedFreqBandsNR-MRDC**, **requestedCapabilityNR**, **eutra-nr-only** flag, and **requestedCapabilityCommon**) as defined in TS 36.333, where applicable.

**NOTE 1:** Capability enquiry without **frequencyBandListFilter** is not supported.

**NOTE 2:** In EN-DC, the gNB needs the capabilities for RAT types **nr** and **eutra-nr** and it uses the **featureSets** in the **UE-NR-Capability** together with the **featureSetCombinations** in the **UE-MRDC-Capability** to determine the NR UE capabilities for the supported MRDC band combinations. Similarly, the eNB needs the capabilities for RAT types **eutra** and **eutra-nr** and it uses the **featureSetsEUTRA** in the **UE-EUTRA-Capability** together with the **featureSetCombinations** in the **UE-MRDC-Capability** to determine the E-UTRA UE capabilities for the supported MRDC band combinations. Hence, the IDs used in the **featureSets** must match the IDs referred to in **featureSetCombinations** across all three containers. The requirement on consistency implies that there are no undefined feature sets and feature set combinations.

**NOTE 3:** If the UE cannot include all feature sets and feature set combinations due to message size or list size constraints, it is up to UE implementation which feature sets and feature set combinations it prioritizes.

The UE shall:

1> compile a list of "candidate band combinations" according to the filter criteria in **capabilityRequestFilterCommon** (if included), only consisting of bands included in **frequencyBandListFilter**, and prioritized in the order of **frequencyBandListFilter** (i.e. first include band combinations containing the first-listed band, then include remaining band combinations containing the second-listed band, and so on), where for each band in the band combination, the parameters of the band do not exceed **maxBandwidthRequestedDL**, **maxBandwidthRequestedUL**, **maxCarriersRequestedDL**, **maxCarriersRequestedUL**, **ca-BandwidthClassDL-EUTRA** or **ca-BandwidthClassUL-EUTRA**, whichever are received;

1> for each band combination included in the list of "candidate band combinations":

2> if the network (E-UTRA) included the **eutra-nr-only** field, or

2> if the requested **rat-Type** is **eutra**:

3> remove the NR-only band combination from the list of "candidate band combinations";

**NOTE 4:** The (E-UTRA) network may request capabilities for **nr** but indicate with the **eutra-nr-only** flag that the UE shall not include any NR band combinations in the **UE-NR-Capability**. In this case the procedural text above removes all NR-only band combinations from the candidate list and thereby also avoids inclusion of corresponding feature set combinations and feature sets below.

2> if it is regarded as a fallback band combination with the same capabilities of another band combination included in the list of "candidate band combinations", and

2> if this fallback band combination is generated by releasing at least one SCell or uplink configuration of SCell according to TS 38.306 [26]:

3> remove the band combination from the list of "candidate band combinations";

**NOTE 5:** Even if the network requests (only) capabilities for **nr**, it may include E-UTRA band numbers in the **frequencyBandListFilter** to ensure that the UE includes all necessary feature sets needed for subsequently requested **eutra-nr** capabilities. At this point of the procedure the list of "candidate band combinations" contains all NR- and/or E-UTRA-NR band combinations that match the filter (**frequencyBandListFilter**) provided by the NW and that match the **eutra-nr-only** flag (if **rat-Type** **nr** is requested by E-UTRA). In the following, this candidate list is used to derive the band combinations, feature set combinations and feature sets to be reported in the requested capability container.
1> if the requested rat-Type is nr:
   2> include into supportedBandCombinationList as many NR-only band combinations as possible from the list of
      "candidate band combinations", starting from the first entry;
   3> if srs-SwitchingTimeRequest is received:
      4> if SRS carrier switching is supported;
      5> include srs-SwitchingTimesListNR for each band combination;
      4> set srs-SwitchingTimeRequested to true;
   2> include, into featureSetCombinations, the feature set combinations referenced from the supported band
      combinations as included in supportedBandCombinationList according to the previous;
   2> compile a list of "candidate feature set combinations" referenced from the list of "candidate band
      combinations" excluding entries (rows in feature set combinations) for fallback band combinations with same
      or lower capabilities;
   2> if uplinkTxSwitchRequest is received:
      3> include into supportedBandCombinationList-UplinkTxSwitch as many NR-only band combinations that
         supported UL TX switching as possible from the list of "candidate band combinations", starting from the
         first entry;
      4> if srs-SwitchingTimeRequest is received:
         5> if SRS carrier switching is supported;
         6> include srs-SwitchingTimesListNR for each band combination;
         5> set srs-SwitchingTimeRequested to true;
      3> include, into featureSetCombinations, the feature set combinations referenced from the supported band
         combinations as included in supportedBandCombinationList-UplinkTxSwitch according to the previous;

NOTE 6: This list of "candidate feature set combinations" contains the feature set combinations used for NR-only
      as well as E-UTRA-NR band combinations. It is used to derive a list of NR feature sets referred to from
      the feature set combinations in the UE-NR-Capability and from the feature set combinations in a UE-
      MRDC-Capability container.

2> include into featureSets the feature sets referenced from the "candidate feature set combinations" excluding
   entries (feature sets per CC) for fallback band combinations with same or lower capabilities and may exclude
   the feature sets with the parameters that exceed any of maxBandwidthRequestedDL, maxBandwidthRequestedUL, maxCarriersRequestedDL or maxCarriersRequestedUL, whichever are
   received;
1> else, if the requested rat-Type is eutra-nr:
   2> include into supportedBandCombinationList and/or supportedBandCombinationListNEDC-Only as many E-
      UTRA-NR band combinations as possible from the list of "candidate band combinations", starting from the
      first entry;
   3> if srs-SwitchingTimeRequest is received:
      4> if SRS carrier switching is supported;
      5> include srs-SwitchingTimesListNR and srs-SwitchingTimesListEUTRA for each band combination;
      4> set srs-SwitchingTimeRequested to true;
   2> include, into featureSetCombinations, the feature set combinations referenced from the supported band
      combinations as included in supportedBandCombinationList according to the previous;
   2> if uplinkTxSwitchRequest is received:
3> include into supportedBandCombinationList-UplinkTxSwitch as many E-UTRA-NR band combinations that supported UL TX switching as possible from the list of "candidate band combinations", starting from the first entry;

4> if srs-SwitchingTimeRequest is received:

5> if SRS carrier switching is supported;

6> include srs-SwitchingTimesListNR and srs-SwitchingTimesListEUTRA for each band combination;

5> set srs-SwitchingTimeRequested to true;

3> include, into featureSetCombinations, the feature set combinations referenced from the supported band combinations as included in supportedBandCombinationList-UplinkTxSwitch according to the previous;

1> else (if the requested rat-Type is eutra):

2> compile a list of "candidate feature set combinations" referenced from the list of "candidate band combinations" excluding entries (rows in feature set combinations) for fallback band combinations with same or lower capabilities;

NOTE 7: This list of "candidate feature set combinations" contains the feature set combinations used for E-UTRA-NR band combinations. It is used to derive a list of E-UTRA feature sets referred to from the feature set combinations in a UE-MRDC-Capability container.

2> include into featureSetsEUTRA (in the UE-EUTRA-Capability) the feature sets referenced from the "candidate feature set combinations" excluding entries (feature sets per CC) for fallback band combinations with same or lower capabilities and may exclude the feature sets with the parameters that exceed ca-BandwidthClassDL-EUTRA or ca-BandwidthClassUL-EUTRA, whichever are received;

1> include the received frequencyBandListFilter in the field appliedFreqBandListFilter of the requested UE capability, except if the requested rat-Type is nr and the network included the eutra-nr-only field;

1> if the network included ue-CapabilityEnquiryExt:

2> include the received ue-CapabilityEnquiryExt in the field receivedFilters;

5.6.1.5 Void

5.7 Other

5.7.1 DL information transfer

5.7.1.1 General

![Figure 5.7.1.1-1: DL information transfer](image)

The purpose of this procedure is to transfer NAS dedicated information from NG-RAN to a UE in RRC_CONNECTED.
5.7.1.2 Initiation

The network initiates the DL information transfer procedure whenever there is a need to transfer NAS dedicated information. The network initiates the DL information transfer procedure by sending the DLInformationTransfer message.

5.7.1.3 Reception of the DLInformationTransfer by the UE

Upon receiving DLInformationTransfer message, the UE shall:

1> if dedicatedNAS-Message is included:
   2> forward dedicatedNAS-Message to upper layers.

1> if referenceTimeInfo is included:
   2> calculate the reference time based on the time, referenceSFN and timeInfoType if it is included;
   2> calculate the uncertainty of the reference time based on the uncertainty, if uncertainty is included;
   2> inform upper layers of the reference time and, if uncertainty is included, of the uncertainty.

5.7.1a DL information transfer for MR-DC

5.7.1a.1 General

The purpose of this procedure is to transfer RRC messages from the network to the UE over SRB3 (e.g. an NR or E-UTRA RRC connection reconfiguration, an RRC connection release, a MobilityFromNRCommand, or a MobilityFromEUTRACommand message) during fast MCG link recovery.

5.7.1a.2 Initiation

The network initiates this procedure whenever there is a need to transfer an RRC message during fast MCG link recovery.

5.7.1a.3 Actions related to reception of DLInformationTransferMRDC message

Upon receiving the DLInformationTransferMRDC, the UE shall:

1> if the RRCReconfiguration message is included in dl-DCCH-MessageNR:
   2> perform the RRC reconfiguration procedure according to 5.3.5.3;

1> else if the RRCRelease message is included in dl-DCCH-MessageNR:
   2> perform the RRC release procedure according to 5.3.8;

1> else if the MobilityFromNRCommand message is included in the dl-DCCH-MessageNR:
   2> perform the mobility from NR procedure according to 5.4.3.3;

1> else if the E-UTRA RRCConnectionReconfiguration message is included in dl-DCCH-MessageEUTRA:
2> perform the RRC connection reconfiguration procedure as specified in TS 36.331 [10], clause 5.3.5.3;
1> else if the E-UTRA \textit{RRCConnectionRelease} message is included in \textit{dl-DCCH-MessageEUTRA}:
2> perform the RRC connection release as specified in TS 36.331 [10], clause 5.3.8;
1> else if the \textit{MobilityFromEUTRACommand} message is included in the \textit{dl-DCCH-MessageEUTRA}:
2> perform the mobility from E-UTRA procedure as specified in TS 36.331 [10], clause 5.4.3.3;

5.7.2 UL information transfer

5.7.2.1 General

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{ul-information-transfer.png}
\caption{UL information transfer}
\end{figure}

The purpose of this procedure is to transfer NAS dedicated information from the UE to the network.

5.7.2.2 Initiation

A UE in RRC\_CONNECTED initiates the UL information transfer procedure whenever there is a need to transfer NAS dedicated information. The UE initiates the UL information transfer procedure by sending the \texttt{ULInformationTransfer} message.

5.7.2.3 Actions related to transmission of \texttt{ULInformationTransfer} message

The UE shall set the contents of the \texttt{ULInformationTransfer} message as follows:

1> if the upper layer provides NAS PDU:
2> set the \texttt{dedicatedNAS-Message} to include the information received from upper layers
1> submit the \texttt{ULInformationTransfer} message to lower layers for transmission, upon which the procedure ends.

5.7.2.4 Failure to deliver \texttt{ULInformationTransfer} message

The UE shall:

1> if AS security is not started and radio link failure occurs before the successful delivery of \texttt{ULInformationTransfer} messages has been confirmed by lower layers; or

1> if PDCP re-establishment or release/addition (e.g. due to key refresh upon PCell or PSCell change, or RRC connection re-establishment) occurs on an SRB on which \texttt{ULInformationTransfer} messages were submitted for transmission but successful delivery of these messages was not confirmed by lower layers:
2> inform upper layers about the possible failure to deliver the information contained in the concerned \texttt{ULInformationTransfer} messages.
5.7.2a UL information transfer for MR-DC

5.7.2a.1 General

The purpose of this procedure is to transfer MR-DC dedicated information from the UE to the network e.g. the NR or E-UTRA RRC MeasurementReport, FailureInformation, UEAssistanceInformation, RRCReconfigurationComplete or MCGFailureInformation message.

5.7.2a.2 Initiation

A UE in RRC_CONNECTED initiates the UL information transfer for MR-DC procedure whenever there is a need to transfer MR-DC dedicated information. I.e. the procedure is not used during an RRC connection reconfiguration involving NR or E-UTRA connection reconfiguration, in which case the MR DC information is piggybacked to the RRCReconfigurationComplete message.

5.7.2a.3 Actions related to transmission of ULInformationTransferMRDC message

The UE shall set the contents of the ULInformationTransferMRDC message as follows:

1. if there is a need to transfer MR-DC dedicated information related to NR:
   2. set the ul-DCCH-MessageNR to include the NR MR-DC dedicated information to be transferred (e.g., NR RRC MeasurementReport, UEAssistanceInformation, FailureInformation, RRCReconfigurationComplete or MCGFailureInformation message);

1. else if there is a need to transfer MR-DC dedicated information related to E-UTRA:
   2. set the ul-DCCH-MessageEUTRA to include the E-UTRA MR-DC dedicated information to be transferred (e.g., E-UTRA RRC MeasurementReport, or MCGFailureInformation message);

1. submit the ULInformationTransferMRDC message to lower layers for transmission, upon which the procedure ends.

5.7.2b UL transfer of IRAT information

5.7.2b.1 General

The purpose of this procedure is to transfer from the UE to NR MCG dedicated information terminated at the NR MCG but specified by another RAT e.g. the E-UTRA MeasurementReport message, the E-UTRA SidelinkUEInformation message.
message or the E-UTRA UEAssistanceInformation message. The specific information transferred in this message is set in accordance with:

- the procedure specified in 5.6.10 of TS 36.331 [10] for E-UTRA UEAssistanceInformation message;
- the procedure specified in 5.10.2 of TS 36.331 [10] for E-UTRA SidelinkUEInformation message;

5.7.2b.2 Initiation

A UE in RRC_CONNECTED initiates the UL information transfer procedure whenever there is a need to transfer dedicated inter-RAT information as specified in TS 36.331 [10].

5.7.2b.3 Actions related to transmission of ULInformationTransferIRAT message

The UE shall set the contents of the ULInformationTransferIRAT message as follows:

1> if there is a need to transfer dedicated LTE information related to V2X sidelink communications:
   2> set the ul-DCCH-MessageEUTRA to include the V2X sidelink communication information to be transferred (e.g. the E-UTRA RRC MeasurementReport message, the E-UTRA RRC SidelinkUEInformation message, or the E-UTRA RRC UEAssistanceInformation message);
1> submit the ULInformationTransferIRAT message to lower layers for transmission, upon which the procedure ends;

5.7.3 SCG failure information

5.7.3.1 General

![Figure 5.7.3.1-1: SCG failure information]

The purpose of this procedure is to inform E-UTRAN or NR MN about an SCG failure the UE has experienced i.e. SCG radio link failure, failure of SCG reconfiguration with sync, SCG configuration failure for RRC message on SRB3, SCG integrity check failure, and consistent uplink LBT failures on PSCell for operation with shared spectrum channel access.

5.7.3.2 Initiation

A UE initiates the procedure to report SCG failures when neither MCG nor SCG transmission is suspended and when one of the following conditions is met:

1> upon detecting radio link failure for the SCG, in accordance with subclause 5.3.10.3;
1> upon reconfiguration with sync failure of the SCG, in accordance with subclause 5.3.5.8.3;
1> upon SCG configuration failure, in accordance with subclause 5.3.5.8.2;
1> upon integrity check failure indication from SCG lower layers concerning SRB3.

Upon initiating the procedure, the UE shall:
1> suspend SCG transmission for all SRBs, DRBs and, if any, BH RLC channels;
1> reset SCG MAC;
1> stop T304 for the SCG, if running;
1> stop conditional reconfiguration evaluation for CPC, if configured;
1> if the UE is in (NG)EN-DC:
   2> initiate transmission of the SCGFailureInformationNR message as specified in TS 36.331 [10], clause 5.6.13a.
1> else:
   2> initiate transmission of the SCGFailureInformation message in accordance with 5.7.3.5.

5.7.3.3 Failure type determination for (NG)EN-DC

The UE shall set the SCG failure type as follows:
1> if the UE initiates transmission of the SCGFailureInformationNR message due to T310 expiry:
   2> set the failureType as t310-Expiry;
1> else if the UE initiates transmission of the SCGFailureInformationNR message due to T312 expiry:
   2> set the failureType as other and set the failureType-v1610 as t312-Expiry;
1> else if the UE initiates transmission of the SCGFailureInformationNR message to provide reconfiguration with
   sync failure information for an SCG:
   2> set the failureType as synchReconfigFailure-SCG;
1> else if the UE initiates transmission of the SCGFailureInformationNR message to provide random access
   problem indication from SCG MAC:
   2> if the random access procedure was initiated for beam failure recovery:
      3> set the failureType as other and set the failureType-v1610 as beamFailureRecoveryFailure;
   2> else:
      3> set the failureType as randomAccessProblem;
1> else if the UE initiates transmission of the SCGFailureInformationNR message to provide indication from SCG
   RLC that the maximum number of retransmissions has been reached:
   2> set the failureType as rlc-MaxNumRetx;
1> else if the UE initiates transmission of the SCGFailureInformationNR message due to SRB3 integrity check
   failure:
   2> set the failureType as srb3-IntegrityFailure;
1> else if the UE initiates transmission of the SCGFailureInformationNR message due to Reconfiguration failure of
   NR RRC reconfiguration message:
   2> set the failureType as scg-reconfigFailure.
1> else if the UE initiates transmission of the SCGFailureInformationNR message due to consistent uplink LBT
   failures:
   2> set the failureType as other and set the failureType-v1610 as scg-lbtFailure;
1> else if connected as an IAB-node and the SCGFailureInformationNR is initiated due to the reception of a BH
   RLF indication on BAP entity from the SCG:
2> set the failureType as other and set failureType-v1610 as bh-RLF.

5.7.3.4 Setting the contents of MeasResultSCG-Failure

The UE shall set the contents of the MeasResultSCG-Failure as follows:

1> for each MeasObjectNR configured on NR SCG for which a measId is configured and measurement results are available:
   2> include an entry in measResultPerMOList;
   2> if there is a measId configured with the MeasObjectNR and a reportConfig which has rsType set to ssb:
      3> set ssbFrequency to the value indicated by ssbFrequency as included in the MeasObjectNR;
   2> if there is a measId configured with the MeasObjectNR and a reportConfig which has rsType set to csi-rs:
      3> set refFreqCSI-RS to the value indicated by refFreqCSI-RS as included in the associated measurement object;
   2> if a serving cell is associated with the MeasObjectNR:
      3> set measResultServingCell to include the available quantities of the concerned cell and in accordance with the performance requirements in TS 38.133 [14];
   2> set the measResultNeighCellList to include the best measured cells, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected the failure, and set its fields as follows;
      3> ordering the cells with sorting as follows:
         4> based on SS/PBCH block if SS/PBCH block measurement results are available and otherwise based on CSI-RS;
         4> using RSRP if RSRP measurement results are available, otherwise using RSRQ if RSRQ measurement results are available, otherwise using SINR;
      3> for each neighbour cell included:
         4> include the optional fields that are available.

NOTE: The measured quantities are filtered by the L3 filter as configured in the mobility measurement configuration. The measurements are based on the time domain measurement resource restriction, if configured. Blacklisted cells are not required to be reported.

2> if available, set the locationInfo as in 5.3.3.7:

5.7.3.5 Actions related to transmission of SCGFailureInformation message

The UE shall set the contents of the SCGFailureInformation message as follows:

1> if the UE initiates transmission of the SCGFailureInformation message due to T310 expiry:
   2> set the failureType as t310-Expiry;
1> else if the UE initiates transmission of the SCGFailureInformation message due to T312 expiry:
   2> set the failureType as other and set the failureType-v1610 as t312-Expiry;
1> else if the UE initiates transmission of the SCGFailureInformation message to provide reconfiguration with sync failure information for an SCG:
   2> set the failureType as synchReconfigFailure-SCG;
1> else if the UE initiates transmission of the SCGFailureInformation message to provide random access problem indication from SCG MAC:
if the random access procedure was initiated for beam failure recovery:

3> set the failureType as other and set the failureType-v1610 as beamFailureRecoveryFailure;

2> else:

3> set the failureType as randomAccessProblem;

1> else if the UE initiates transmission of the SCGFailureInformation message to provide indication from SCG RLC that the maximum number of retransmissions has been reached:

2> set the failureType as rlc-MaxNumRetx;

1> else if the UE initiates transmission of the SCGFailureInformation message due to SRB3 IP check failure:

2> set the failureType as srb3-IntegrityFailure;

1> else if the UE initiates transmission of the SCGFailureInformation message due to Reconfiguration failure of NR RRC reconfiguration message:

2> set the failureType as scg-reconfigFailure.

1> else if the UE initiates transmission of the SCGFailureInformation message due to consistent uplink LBT failures:

2> set the failureType as other and set the failureType-v1610 as scg-lbtFailure;

1> else if connected as an IAB-node and the SCGFailureInformation is initiated due to the reception of a BH RLF indication on BAP entity from the SCG:

2> set the failureType as other and set failureType-v1610 as bh-RLF;

1> include and set MeasResultSCG-Failure in accordance with 5.7.3.4;

1> for each MeasObjectNR configured by a MeasConfig associated with the MCG, and for which measurement results are available:

2> include an entry in measResultFreqList;

2> if there is a measId configured with the MeasObjectNR and a reportConfig which has rsType set to ssb:

3> set ssbFrequency in measResultFreqList to the value indicated by ssbFrequency as included in the MeasObjectNR;

2> if there is a measId configured with the MeasObjectNR and a reportConfig which has rsType set to csi-rs:

3> set refFreqCSI-RS in measResultFreqList to the value indicated by refFreqCSI-RS as included in the associated measurement object;

2> if a serving cell is associated with the MeasObjectNR:

3> set measResultServingCell in measResultFreqList to include the available quantities of the concerned cell and in accordance with the performance requirements in TS 38.133 [14];

2> set the measResultNeighCellList in measResultFreqList to include the best measured cells, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected the failure, and set its fields as follows;

3> ordering the cells with sorting as follows:

4> based on SS/PBCH block if SS/PBCH block measurement results are available and otherwise based on CSI-RS;

4> using RSRP if RSRP measurement results are available, otherwise using RSRQ if RSRQ measurement results are available, otherwise using SINR;

3> for each neighbour cell included:
The UE shall submit the `SCGFailureInformation` message to lower layers for transmission.

### 5.7.3a EUTRA SCG failure information

#### 5.7.3a.1 General

The purpose of this procedure is to inform NR MN about an SCG failure on E-UTRA SN the UE has experienced (e.g. SCG radio link failure, SCG change failure), as specified in TS 36.331 [10] clause 5.6.13.2.

#### 5.7.3a.2 Initiation

A UE initiates the procedure to report EUTRA SCG failures when neither NR MCG nor EUTRA SCG transmission is suspended and in accordance with TS 36.331 [10] clause 5.6.13.2. Actions the UE shall perform upon initiating the procedure, other than related to the transmission of the `SCGFailureInformationEUTRA` message are specified in TS 36.331 [10] clause 5.6.13.2.

#### 5.7.3a.3 Actions related to transmission of `SCGFailureInformationEUTRA` message

The UE shall set the contents of the `SCGFailureInformationEUTRA` message as follows:

1. include `failureType` within `failureReportSCG-EUTRA` and set it to indicate the SCG failure in accordance with TS 36.331 [10] clause 5.6.13.4;

2. include and set `measResultSCG-FailureMRDC` in accordance with TS 36.331 [10] clause 5.6.13.5;

3. for each EUTRA frequency the UE is configured to measure by `measConfig` for which measurement results are available:
   
   2. set the `measResultFreqListMrDC` to include the best measured cells, ordered such that the best cell is listed first using RSRP to order if RSRP measurement results are available for cells on this frequency, otherwise using RSRQ to order if RSRQ measurement results are available for cells on this frequency, otherwise using SINR to order, and based on measurements collected up to the moment the UE detected the failure, and for each cell that is included, include the optional fields that are available;

   NOTE: Field `measResultSCG-FailureMRDC` is used to report available results for E-UTRAN frequencies the UE is configured to measure by E-UTRA RRC signalling.

4. if available, set the `locationInfo` as in 5.3.3.7.:
The UE shall submit the SCGFailureInformationEUTRA message to lower layers for transmission.

5.7.3b MCG failure information

5.7.3b.1 General

The purpose of this procedure is to inform the network about an MCG failure the UE has experienced i.e. MCG radio link failure. A UE in RRC_CONNECTED, for which AS security has been activated with SRB2 and at least one DRB setup or, for IAB, SRB2, may initiate the fast MCG link recovery procedure in order to continue the RRC connection without re-establishment.

5.7.3b.2 Initiation

A UE configured with split SRB1 or SRB3 initiates the procedure to report MCG failures when neither MCG nor SCG transmission is suspended, \textit{t316} is configured, and when the following condition is met:

1> upon detecting radio link failure of the MCG, in accordance with 5.3.10.3, while \textit{T316} is not running.

Upon initiating the procedure, the UE shall:

1> stop timer T310 for the PCell, if running;
1> stop timer T312 for the PCell, if running;
1> suspend MCG transmission for all SRBs, DRBs, except SRB0, and, if any, BH RLC channels;
1> reset MCG MAC;
1> stop conditional reconfiguration evaluation for CHO, if configured;
1> stop conditional reconfiguration evaluation for CPC, if configured;
1> initiate transmission of the \textit{MCGFailureInformation} message in accordance with 5.7.3b.4.

\textbf{NOTE:} The handling of any outstanding UL RRC messages during the initiation of the fast MCG link recovery is left to UE implementation.

5.7.3b.3 Failure type determination

The UE shall set the MCG failure type as follows:

1> if the UE initiates transmission of the \textit{MCGFailureInformation} message due to T310 expiry:
   2> set the failureType as \textit{t310-Expiry};
1> else if the UE initiates transmission of the \textit{MCGFailureInformation} message due to T312 expiry:
   2> set the failureType as \textit{t312-Expiry};
1> else if the UE initiates transmission of the \textit{MCGFailureInformation} message to provide random access problem indication from MCG MAC:
2> if the random access procedure was initiated for beam failure recovery:
   3> set the failureType as beamFailureRecoveryFailure;
2> else:
   3> set the failureType as randomAccessProblem;
1> else if the UE initiates transmission of the MCGFailureInformation message to provide indication from MCG RLC that the maximum number of retransmissions has been reached:
   2> set the failureType as rlc-MaxNumRetx:
1> else if the UE initiates transmission of the MCGFailureInformation message due to consistent uplink LBT failures on the MCG:
   2> set the failureType as lbt-Failure;
1> else if connected as an IAB-node and the MCGFailureInformation message is initiated due to the reception of a BH RLF indication on BAP entity from the MCG:
   2> set the failureType as bh-RLF.

5.7.3b.4 Actions related to transmission of MCGFailureInformation message

The UE shall set the contents of the MCGFailureInformation message as follows:
1> include and set failureType in accordance with 5.7.3b.3;
1> for each MeasObjectNR configured by a measConfig associated with the MCG, and for which measurement results are available:
   2> include an entry in measResultFreqList;
   2> if there is a measId configured with the MeasObjectNR and a reportConfig which has rsType set to ssb:
      3> set ssbFrequency in measResultFreqList to the value indicated by ssbFrequency as included in the MeasObjectNR;
   2> if there is a measId configured with the MeasObjectNR and a reportConfig which has rsType set to csi-rs:
      3> set refFreqCSI-RS in measResultFreqList to the value indicated by refFreqCSI-RS as included in the associated measurement object;
   2> if a serving cell is associated with the MeasObjectNR:
      3> set measResultServingCell in measResultFreqList to include the available quantities of the concerned cell and in accordance with the performance requirements in TS 38.133 [14];
   2> set the measResultNeighCellList in measResultFreqList to include the best measured cells, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected the failure, and set its fields as follows;
      3> ordering the cells with sorting as follows:
         4> based on SS/PBCH block if SS/PBCH block measurement results are available and otherwise based on CSI-RS;
         4> using RSRP if RSRP measurement results are available, otherwise using RSRQ if RSRQ measurement results are available, otherwise using SINR;
      3> for each neighbour cell included:
         4> include the optional fields that are available.
1> for each EUTRA frequency the UE is configured to measure by measConfig for which measurement results are available:
2> set the measResultFreqListEUTRA to include the best measured cells, ordered such that the best cell is listed first using RSRP to order the cells if RSRP measurement results are available for cells on this frequency, otherwise using RSRQ to order the cells if RSRQ measurement results are available for cells on this frequency, otherwise using SINR to order the cells, based on measurements collected up to the moment the UE detected the failure, and for each cell that is included, include the optional fields that are available;  

1> for each UTRA-FDD frequency the UE is configured to measure by measConfig for which measurement results are available:

2> set the measResultFreqListUTRA-FDD to include the best measured cells, ordered such that the best cell is listed first using RSCP to order the cells if RSCP measurement results are available for cells on this frequency, otherwise using EcN0 to order the cells, based on measurements collected up to the moment the UE detected the failure, and for each cell that is included, include the optional fields that are available;  

1> if the UE is in NR-DC:

2> include and set measResultSCG in accordance with 5.7.3.4;  

1> if the UE is in NE-DC:

2> include and set measResultSCG-EUTRA in accordance with TS 36.331 [10] clause 5.6.13.5;  

NOTE 1: The measured quantities are filtered by the L3 filter as configured in the mobility measurement configuration. The measurements are based on the time domain measurement resource restriction, if configured. Blacklisted cells are not required to be reported.  

NOTE 2: Field measResultSCG-Failure is used to report available results for NR frequencies the UE is configured to measure by SCG RRC signalling.  

NOTE 3: Field measResultSCG-EUTRA is used to report available results for E-UTRAN frequencies the UE is configured to measure by E-UTRA RRC signalling.  

1> if SRB1 is configured as split SRB and pdcp-Duplication is not configured:

2> if the primaryPath for the PDCP entity of SRB1 refers to the MCG:

3> set the primaryPath to refer to the SCG.  

The UE shall:

1> start timer T316;  

1> if SRB1 is configured as split SRB:

2> submit the MCGFailureInformation message to lower layers for transmission via SRB1, upon which the procedure ends;  

1> else (i.e. SRB3 configured):

2> submit the MCGFailureInformation message to lower layers for transmission embedded in NR RRC message ULInformationTransferMRDC via SRB3 as specified in 5.7.2a.3.  

5.7.3b.5 T316 expiry

The UE shall:

1> if T316 expires:

2> initiate the connection re-establishment procedure as specified in 5.3.7.
5.7.4 UE Assistance Information

5.7.4.1 General

The purpose of this procedure is for the UE to inform the network of:

- its delay budget report carrying desired increment/decrement in the connected mode DRX cycle length, or;
- its overheating assistance information, or;
- its IDC assistance information, or;
- its preference on DRX parameters for power saving, or;
- its preference on the maximum aggregated bandwidth for power saving, or;
- its preference on the maximum number of secondary component carriers for power saving, or;
- its preference on the maximum number of MIMO layers for power saving, or;
- its preference on the minimum scheduling offset for cross-slot scheduling for power saving, or;
- its preference on the RRC state, or;
- configured grant assistance information for NR sidelink communication, or;
- its preference in being provisioned with reference time information.

5.7.4.2 Initiation

A UE capable of providing delay budget report in RRC_CONNECTED may initiate the procedure in several cases, including upon being configured to provide delay budget report and upon change of delay budget preference.

A UE capable of providing overheating assistance information in RRC_CONNECTED may initiate the procedure if it was configured to do so, upon detecting internal overheating, or upon detecting that it is no longer experiencing an overheating condition.

A UE capable of providing IDC assistance information in RRC_CONNECTED may initiate the procedure if it was configured to do so, upon detecting IDC problem if the UE did not transmit an IDC assistance information since it was configured to provide IDC indications, or upon change of IDC problem information.

A UE capable of providing its preference on DRX parameters of a cell group for power saving in RRC_CONNECTED may initiate the procedure in several cases, if it was configured to do so, including upon having a preference on DRX parameters and upon change of its preference on DRX parameters.

A UE capable of providing its preference on the maximum aggregated bandwidth of a cell group for power saving in RRC_CONNECTED may initiate the procedure in several cases, if it was configured to do so, including upon having a maximum aggregated bandwidth preference and upon change of its maximum aggregated bandwidth preference.
A UE capable of providing its preference on the maximum number of secondary component carriers of a cell group for power saving in RRC_CONNECTED may initiate the procedure in several cases, if it was configured to do so, including upon having a maximum number of secondary component carriers preference and upon change of its maximum number of secondary component carriers preference.

A UE capable of providing its preference on the maximum number of MIMO layers of a cell group for power saving in RRC_CONNECTED may initiate the procedure in several cases, if it was configured to do so, including upon having a maximum number of MIMO layers preference and upon change of its maximum number of MIMO layers preference.

A UE capable of providing its preference on the minimum scheduling offset for cross-slot scheduling of a cell group for power saving in RRC_CONNECTED may initiate the procedure in several cases, if it was configured to do so, including upon having a minimum scheduling offset preference and upon change of its minimum scheduling offset preference.

A UE capable of providing assistance information to transition out of RRC_CONNECTED state may initiate the procedure if it was configured to do so, upon determining that it prefers to transition out of RRC_CONNECTED state, or upon change of its preferred RRC state.

A UE capable of providing configured grant assistance information for NR sidelink communication in RRC_CONNECTED may initiate the procedure in several cases, including upon being configured to provide traffic pattern information and upon change of traffic patterns.

A UE capable of providing an indication of its preference in being provisioned with reference time information may initiate the procedure upon being configured to provide this indication, or if it was configured to provide this indication and upon change of its preference.

Upon initiating the procedure, the UE shall:

1. if configured to provide delay budget report:
   2. if the UE did not transmit a UEAssistanceInformation message with delayBudgetReport since it was configured to provide delay budget report; or
   2. if the current delay budget is different from the one indicated in the last transmission of the UEAssistanceInformation message including delayBudgetReport and timer T342 is not running:
      3. start or restart timer T342 with the timer value set to the delayBudgetReportingProhibitTimer;
      3. initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide a delay budget report;

1. if configured to provide overheating assistance information:
   2. if the overheating condition has been detected and T345 is not running; or
   2. if the current overheating assistance information is different from the one indicated in the last transmission of the UEAssistanceInformation message including overheatingAssistance and timer T345 is not running:
      3. start timer T345 with the timer value set to the overheatingIndicationProhibitTimer;
      3. initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide overheating assistance information;

1. if configured to provide IDC assistance information:
   2. if the UE did not transmit a UEAssistanceInformation message with idc-Assistance since it was configured to provide IDC assistance information:
      3. if on one or more frequencies included in candidateServingFreqListNR, the UE is experiencing IDC problems that it cannot solve by itself; or
      3. if on one or more supported UL CA combination comprising of carrier frequencies included in candidateServingFreqListNR, the UE is experiencing IDC problems that it cannot solve by itself:
         4. initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide IDC assistance information;
else if the current IDC assistance information is different from the one indicated in the last transmission of the  
UEAssistanceInformation message:

initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide IDC 
assistance information;

NOTE 1: The term "IDC problems" refers to interference issues applicable across several subframes/slots where not 
necessarily all the subframes/slots are affected.

NOTE 2: For the frequencies on which a serving cell or serving cells is configured that is activated, IDC problems 
consist of interference issues that the UE cannot solve by itself, during either active data exchange or 
upcoming data activity which is expected in up to a few hundred milliseconds. 
For frequencies on which a SCell or SCells is configured that is deactivated, reporting IDC problems 
indicates an anticipation that the activation of the SCell or SCells would result in interference issues that 
the UE would not be able to solve by itself. 
For a non-serving frequency, reporting IDC problems indicates an anticipation that if the non-serving 
frequency or frequencies became a serving frequency or serving frequencies then this would result in 
interference issues that the UE would not be able to solve by itself.

1> if configured to provide its preference on DRX parameters of a cell group for power saving:

2> if the UE has a preference on DRX parameters of the cell group and the UE did not transmit a 
UEAssistanceInformation message with drx-Preference for the cell group since it was configured to provide 
its preference on DRX parameters of the cell group for power saving; or 

2> if the current drx-Preference information for the cell group is different from the one indicated in the last 
transmission of the UEAssistanceInformation message including drx-Preference for the cell group and timer 
T346a associated with the cell group is not running:

3> start the timer T346a with the timer value set to the drx-PreferenceProhibitTimer of the cell group;

3> initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide the 
current drx-Preference;

1> if configured to provide its preference on the maximum aggregated bandwidth of a cell group for power saving:

2> if the UE has a preference on the maximum aggregated bandwidth of the cell group and the UE did not 
transmit a UEAssistanceInformation message with maxBW-Preference for the cell group since it was configured to provide 
its preference on the maximum aggregated bandwidth of the cell group for power saving; or 

2> if the current maxBW-Preference information for the cell group is different from the one indicated in the last 
transmission of the UEAssistanceInformation message including maxBW-Preference for the cell group and timer 
T346b associated with the cell group is not running:

3> start the timer T346b with the timer value set to the maxBW-PreferenceProhibitTimer of the cell group;

3> initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide the 
current maxBW-Preference;

1> if configured to provide its preference on the maximum number of secondary component carriers of a cell group 
for power saving:

2> if the UE has a preference on the maximum number of secondary component carriers of the cell group and the UE did not 
transmit a UEAssistanceInformation message with maxCC-Preference for the cell group since it was configured to provide 
its preference on the maximum number of secondary component carriers of the cell group for power saving; or 

2> if the current maxCC-Preference information for the cell group is different from the one indicated in the last 
transmission of the UEAssistanceInformation message including maxCC-Preference for the cell group and timer 
T346c associated with the cell group is not running:

3> start the timer T346c with the timer value set to the maxCC-PreferenceProhibitTimer of the cell group;

3> initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide the 
current maxCC-Preference;
if configured to provide its preference on the maximum number of MIMO layers of a cell group for power saving:

2> if the UE has a preference on the maximum number of MIMO layers of the cell group and the UE did not transmit a UEAssistanceInformation message with maxMIMO-LayerPreference for the cell group since it was configured to provide its preference on the maximum number of MIMO layers of the cell group for power saving; or

2> if the current maxMIMO-LayerPreference information for the cell group is different from the one indicated in the last transmission of the UEAssistanceInformation message including maxMIMO-LayerPreference for the cell group and timer T346d associated with the cell group is not running:

3> start the timer T346d with the timer value set to the maxMIMO-LayerPreferenceProhibitTimer of the cell group;

3> initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide the current maxMIMO-LayerPreference;

1> if configured to provide its preference on the minimum scheduling offset for cross-slot scheduling of a cell group for power saving:

2> if the UE has a preference on the minimum scheduling offset for cross-slot scheduling of the cell group and the UE did not transmit a UEAssistanceInformation message with minSchedulingOffsetPreference for the cell group since it was configured to provide its preference on the minimum scheduling offset for cross-slot scheduling of the cell group for power saving; or

2> if the current minSchedulingOffsetPreference information for the cell group is different from the one indicated in the last transmission of the UEAssistanceInformation message including minSchedulingOffsetPreference for the cell group and timer T346e associated with the cell group is not running:

3> start the timer T346e with the timer value set to the minSchedulingOffsetPreferenceProhibitTimer of the cell group;

3> initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide the current minSchedulingOffsetPreference;

1> if configured to provide its release preference and timer T346f is not running:

2> if the UE determines that it would prefer to transition out of RRC_CONNECTED state; or

2> if the UE is configured with connectedReporting and the UE determines that it would prefer to revert an earlier indication to transition out of RRC_CONNECTED state:

3> start timer T346f with the timer value set to the releasePreferenceProhibitTimer;

3> initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide the release preference;

1> if configured to provide configured grant assistance information for NR sidelink communication:

2> initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide configured grant assistance information for NR sidelink communication;

1> if configured to provide preference in being provisioned with reference time information:

2> if the UE did not transmit a UEAssistanceInformation message with referenceTimeInfoPreference since it was configured to provide preference; or

2> if the UE's preference changed from the last time UE initiated transmission of the UEAssistanceInformation message including referenceTimeInfoPreference:

3> initiate transmission of the UEAssistanceInformation message in accordance with 5.7.4.3 to provide preference in being provisioned with reference time information.
5.7.4.3 Actions related to transmission of *UEAssistanceInformation* message

The UE shall set the contents of the *UEAssistanceInformation* message as follows:

1. if transmission of the *UEAssistanceInformation* message is initiated to provide a delay budget report according to 5.7.4.2 or 5.3.5.3;
   1. set `delayBudgetReport` to `type1` according to a desired value;
2. if transmission of the *UEAssistanceInformation* message is initiated to provide overheating assistance information according to 5.7.4.2 or 5.3.5.3;
   1. if the UE experiences internal overheating:
      1. if the UE prefers to temporarily reduce the number of maximum secondary component carriers:
         1. include `reducedMaxCCs` in the OverheatingAssistance IE;
         2. set `reducedCCsDL` to the number of maximum SCells the UE prefers to be temporarily configured in downlink;
         3. set `reducedCCsUL` to the number of maximum SCells the UE prefers to be temporarily configured in uplink;
      2. if the UE prefers to temporarily reduce maximum aggregated bandwidth of FR1:
         1. include `reducedMaxBW-FR1` in the OverheatingAssistance IE;
         2. set `reducedBW-DL` to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all downlink carriers of FR1;
         3. set `reducedBW-UL` to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all uplink carriers of FR1;
      3. if the UE prefers to temporarily reduce maximum aggregated bandwidth of FR2:
         1. include `reducedMaxBW-FR2` in the OverheatingAssistance IE;
         2. set `reducedBW-DL` to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all downlink carriers of FR2;
         3. set `reducedBW-UL` to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all uplink carriers of FR2;
      4. if the UE prefers to temporarily reduce the number of maximum MIMO layers of each serving cell operating on FR1:
         1. include `reducedMaxMIMO-LayersFR1` in the OverheatingAssistance IE;
         2. set `reducedMIMO-LayersFR1-DL` to the number of maximum MIMO layers of each serving cell operating on FR1 the UE prefers to be temporarily configured in downlink;
         3. set `reducedMIMO-LayersFR1-UL` to the number of maximum MIMO layers of each serving cell operating on FR1 the UE prefers to be temporarily configured in uplink;
      5. if the UE prefers to temporarily reduce the number of maximum MIMO layers of each serving cell operating on FR2:
         1. include `reducedMaxMIMO-LayersFR2` in the OverheatingAssistance IE;
         2. set `reducedMIMO-LayersFR2-DL` to the number of maximum MIMO layers of each serving cell operating on FR2 the UE prefers to be temporarily configured in downlink;
         3. set `reducedMIMO-LayersFR2-UL` to the number of maximum MIMO layers of each serving cell operating on FR2 the UE prefers to be temporarily configured in uplink;
   2. else (if the UE no longer experiences an overheating condition):
3> do not include reducedMaxCCs, reducedMaxBW-FR1, reducedMaxBW-FR2, reducedMaxMIMO-LayersFR1 and reducedMaxMIMO-LayersFR2 in OverheatingAssistance IE;

1> if transmission of the **UEAssistanceInformation** message is initiated to provide IDC assistance information according to 5.7.4.2 or 5.3.5.3:

2> if there is at least one carrier frequency included in candidateServingFreqListNR, the UE is experiencing IDC problems that it cannot solve by itself:

3> include the field affectedCarrierFreqList with an entry for each affected carrier frequency included in candidateServingFreqListNR;

3> for each carrier frequency included in the field affectedCarrierFreqList, include interferenceDirection and set it accordingly;

2> if there is at least one supported UL CA combination comprising of carrier frequencies included in candidateServingFreqListNR, the UE is experiencing IDC problems that it cannot solve by itself:

3> include victimSystemType for each UL CA combination included in affectedCarrierFreqCombList;

3> if the UE sets victimSystemType to wlan or bluetooth:

4> include affectedCarrierFreqCombList with an entry for each supported UL CA combination comprising of carrier frequencies included in candidateServingFreqListNR, that is affected by IDC problems;

3> else:

4> optionally include affectedCarrierFreqCombList with an entry for each supported UL CA combination comprising of carrier frequencies included in candidateServingFreqListNR, that is affected by IDC problems;

NOTE 1: When sending an **UEAssistanceInformation** message to inform the IDC problems, the UE includes all IDC assistance information (rather than providing e.g. the changed part(s) of the IDC assistance information).

NOTE 2: Upon not anymore experiencing a particular IDC problem that the UE previously reported, the UE provides an IDC indication with the modified contents of the **UEAssistanceInformation** message (e.g. by not including the IDC assistance information in the idc-Assistance field).

1> if transmission of the **UEAssistanceInformation** message is initiated to provide *drx-Preference* of a cell group for power saving according to 5.7.4.2 or 5.3.5.3:

2> include *drx-Preference* in the **UEAssistanceInformation** message;

2> if the UE has a preference on DRX parameters for the cell group:

3> if the UE has a preference for the long DRX cycle:

4> include preferredDRX-LongCycle in the **DRX-Preference** IE and set it to the preferred value;

3> if the UE has a preference for the DRX inactivity timer:

4> include preferredDRX-InactivityTimer in the **DRX-Preference** IE and set it to the preferred value;

3> if the UE has a preference for the short DRX cycle:

4> include preferredDRX-ShortCycle in the **DRX-Preference** IE and set it to the preferred value;

3> if the UE has a preference for the short DRX timer:

4> include preferredDRX-ShortCycleTimer in the **DRX-Preference** IE and set it to the preferred value;

2> else (if the UE has no preference on DRX parameters for the cell group):

3> do not include preferredDRX-LongCycle, preferredDRX-InactivityTimer, preferredDRX-ShortCycle and preferredDRX-ShortCycleTimer in the **DRX-Preference** IE;
1> if transmission of the *UEAssistanceInformation* message is initiated to provide *maxBW-Preference* of a cell group for power saving according to 5.7.4.2 or 5.3.5.3:

2> include *maxBW-Preference* in the *UEAssistanceInformation* message;

2> if the UE has a preference on the maximum aggregated bandwidth for the cell group:

3> if the UE prefers to reduce the maximum aggregated bandwidth of FR1:

4> include *reducedMaxBW-FR1* in the *MaxBW-Preference* IE;

4> set *reducedBW-DL* to the maximum aggregated bandwidth the UE desires to have configured across all downlink carriers of FR1 in the cell group;

4> set *reducedBW-UL* to the maximum aggregated bandwidth the UE desires to have configured across all uplink carriers of FR1 in the cell group;

3> if the UE prefers to reduce the maximum aggregated bandwidth of FR2:

4> include *reducedMaxBW-FR2* in the *MaxBW-Preference* IE;

4> set *reducedBW-DL* to the maximum aggregated bandwidth the UE desires to have configured across all downlink carriers of FR2 in the cell group;

4> set *reducedBW-UL* to the maximum aggregated bandwidth the UE desires to have configured across all uplink carriers of FR2 in the cell group;

2> else (if the UE has no preference on the maximum aggregated bandwidth for the cell group):

3> do not include *reducedMaxBW-FR1* and *reducedMaxBW-FR2* in the *MaxBW-Preference* IE;

1> if transmission of the *UEAssistanceInformation* message is initiated to provide *maxCC-Preference* of a cell group for power saving according to 5.7.4.2 or 5.3.5.3:

2> include *maxCC-Preference* in the *UEAssistanceInformation* message;

2> if the UE has a preference on the maximum number of secondary component carriers for the cell group:

3> include *reducedMaxCCs* in the *MaxCC-Preference* IE;

3> set *reducedCCsDL* to the number of maximum SCells the UE desires to have configured in downlink in the cell group;

3> set *reducedCCsUL* to the number of maximum SCells the UE desires to have configured in uplink in the cell group;

2> else (if the UE has no preference on the maximum number of secondary component carriers for the cell group):

3> do not include *reducedMaxCCs* in the *MaxCC-Preference* IE;

NOTE 3: The UE can implicitly indicate a preference for NR SCG release by reporting the maximum aggregated bandwidth preference for power saving of the cell group, if configured, as zero for both FR1 and FR2, and by reporting the maximum number of secondary component carriers for power saving of the cell group, if configured, as zero for both uplink and downlink.

1> if transmission of the *UEAssistanceInformation* message is initiated to provide *maxMIMO-LayerPreference* of a cell group for power saving according to 5.7.4.2 or 5.3.5.3:

2> include *maxMIMO-LayerPreference* in the *UEAssistanceInformation* message;

2> if the UE has a preference on the maximum number of MIMO layers for the cell group:

3> if the UE prefers to reduce the number of maximum MIMO layers of each serving cell operating on FR1:

4> include *reducedMaxMIMO-LayersFR1* in the *MaxMIMO-LayerPreference* IE;
4> set reducedMIMO-LayersFR1-DL to the preferred maximum number of downlink MIMO layers of each BWP of each FR1 serving cell that the UE operates on in the cell group;

4> set reducedMIMO-LayersFR1-UL to the preferred maximum number of uplink MIMO layers of each FR1 serving cell that the UE operates on in the cell group;

3> if the UE prefers to reduce the number of maximum MIMO layers of each serving cell operating on FR2:

4> include reducedMaxMIMO-LayersFR2 in the MaxMIMO-LayerPreference IE;

4> set reducedMIMO-LayersFR2-DL to the preferred maximum number of downlink MIMO layers of each BWP of each FR2 serving cell that the UE operates on in the cell group;

4> set reducedMIMO-LayersFR2-UL to the preferred maximum number of uplink MIMO layers of each FR2 serving cell that the UE operates on in the cell group;

2> else (if the UE has no preference on the maximum number of MIMO layers for the cell group):

3> do not include reducedMaxMIMO-LayersFR1 and reducedMaxMIMO-LayersFR2 in the MaxMIMO-LayerPreference IE;

1> if transmission of the UEAssistanceInformation message is initiated to provide minSchedulingOffsetPreference of a cell group for power saving according to 5.7.4.2 or 5.3.5.3:

2> include minSchedulingOffsetPreference in the UEAssistanceInformation message;

2> if the UE has a preference on the minimum scheduling offset for cross-slot scheduling for the cell group:

3> if the UE has a preference for the value of $K_0$ (TS 38.214 [19], clause 5.1.2.1) for cross-slot scheduling with 15 kHz SCS:

4> include preferredK0-SCS-15kHz in the MinSchedulingOffsetPreference IE and set it to the desired value of $K_0$;

3> if the UE has a preference for the value of $K_0$ for cross-slot scheduling with 30 kHz SCS:

4> include preferredK0-SCS-30kHz in the MinSchedulingOffsetPreference IE and set it to the desired value of $K_0$;

3> if the UE has a preference for the value of $K_0$ for cross-slot scheduling with 60 kHz SCS:

4> include preferredK0-SCS-60kHz in the MinSchedulingOffsetPreference IE and set it to the desired value of $K_0$;

3> if the UE has a preference for the value of $K_0$ for cross-slot scheduling with 120 kHz SCS:

4> include preferredK0-SCS-120kHz in the MinSchedulingOffsetPreference IE and set it to the desired value of $K_0$;

3> if the UE has a preference for the value of $K_2$ (TS 38.214 [19], clause 6.1.2.1) for cross-slot scheduling with 15 kHz SCS:

4> include preferredK2-SCS-15kHz in the MinSchedulingOffsetPreference IE and set it to the desired value of $K_2$;

3> if the UE has a preference for the value of $K_2$ for cross-slot scheduling with 30 kHz SCS:

4> include preferredK2-SCS-30kHz in the MinSchedulingOffsetPreference IE and set it to the desired value of $K_2$;

3> if the UE has a preference for the value of $K_2$ for cross-slot scheduling with 60 kHz SCS:

4> include preferredK2-SCS-60kHz in the MinSchedulingOffsetPreference IE and set it to the desired value of $K_2$;

3> if the UE has a preference for the value of $K_2$ for cross-slot scheduling with 120 kHz SCS:
4> include preferredK2-SCS-120kHz in the MinSchedulingOffsetPreference IE and set it to the desired value of $K_2$;

2> else (if the UE has no preference on the minimum scheduling offset for cross-slot scheduling for the cell group):

3> do not include preferredK0 and preferredK2 in the MinSchedulingOffsetPreference IE;

1> if transmission of the UEAssistanceInformation message is initiated to provide a release preference according to 5.7.4.2 or 5.3.5.3:

2> include releasePreference in the UEAssistanceInformation message;

2> set preferredRRC-State to the desired RRC state on transmission of the UEAssistanceInformation message;

1> if transmission of the UEAssistanceInformation message is initiated to provide an indication of preference in being provisioned with reference time information according to 5.7.4.2 or 5.3.5.3:

2> if the UE has a preference in being provisioned with reference time information:

3> set referenceTimeInfoPreference to true;

2> else:

3> set referenceTimeInfoPreference to false.

The UE shall set the contents of the UEAssistanceInformation message for configured grant assistance information for NR sidelink communication:

1> if configured to provide configured grant assistance information for NR sidelink communication:

2> include the sl-UE-AssistanceInformationNR;

NOTE 4: It is up to UE implementation when and how to trigger configured grant assistance information for NR sidelink communication.

The UE shall:

1> if the procedure was triggered to provide configured grant assistance information for NR sidelink communication by an NR RRCReconfiguration message that was embedded within an E-UTRA RRCConnectionReconfiguration:

2> submit the UEAssistanceInformation to lower layers via SRB1, embedded in E-UTRA RRC message ULInformationTransferIRAT as specified in TS 36.331 [10], clause 5.6.28;

1> else if the UE is in (NG)EN-DC:

2> if SRB3 is configured:

3> submit the UEAssistanceInformation message via SRB3 to lower layers for transmission;

2> else:

3> submit the UEAssistanceInformation message via the E-UTRA MCG embedded in E-UTRA RRC message ULInformationTransferMRDC as specified in TS 36.331 [10].

1> else if the UE is in NR-DC:

2> if the UE assistance configuration that triggered this UE assistance information is associated with the SCG:

3> if SRB3 is configured:

4> submit the UEAssistanceInformation message via SRB3 to lower layers for transmission;

3> else:

4> submit the UEAssistanceInformation message via the NR MCG embedded in NR RRC message ULInformationTransferMRDC as specified in 5.7.2a.3;
else:
    submit the **UEAssistanceInformation** message via SRB1 to lower layers for transmission;

else:
    submit the **UEAssistanceInformation** message to lower layers for transmission.

### 5.7.4.3a Setting the contents of **OverheatingAssistance** IE

The UE shall set the contents of **OverheatingAssistance** IE if initiated to provide overheating assistance indication for SCG in (NG)EN-DC according to clause 5.6.10.3 as specified in TS 36.331 [10]:

1. if the UE prefers to temporarily reduce the number of maximum secondary component carriers for SCG:
   2. include **reducedMaxCCs** in the **OverheatingAssistance** IE;
      2. set **reducedCCsDL** to the number of maximum SCells of the SCG the UE prefers to be temporarily configured in downlink;
      2. set **reducedCCsUL** to the number of maximum SCells of the SCG the UE prefers to be temporarily configured in uplink;

1. if the UE prefers to temporarily reduce maximum aggregated bandwidth of FR1 for SCG:
   2. include **reducedMaxBW-FR1** in the **OverheatingAssistance** IE;
      2. set **reducedBW-FR1-DL** to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all downlink carriers of FR1 of the SCG;
      2. set **reducedBW-FR1-UL** to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all uplink carriers of FR1 of the SCG;

1. if the UE prefers to temporarily reduce maximum aggregated bandwidth of FR2 for SCG:
   2. include **reducedMaxBW-FR2** in the **OverheatingAssistance** IE;
      2. set **reducedBW-FR2-DL** to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all downlink carriers of FR2 of the SCG;
      2. set **reducedBW-FR2-UL** to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all uplink carriers of FR2 of the SCG;

1. if the UE prefers to temporarily reduce the number of maximum MIMO layers of each serving cell operating on FR1 for SCG:
   2. include **reducedMaxMIMO-LayersFR1** in the **OverheatingAssistance** IE;
      2. set **reducedMIMO-LayersFR1-DL** to the number of maximum MIMO layers of each serving cell operating on FR1 of the SCG the UE prefers to be temporarily configured in downlink;
      2. set **reducedMIMO-LayersFR1-UL** to the number of maximum MIMO layers of each serving cell operating on FR1 of the SCG the UE prefers to be temporarily configured in uplink;

1. if the UE prefers to temporarily reduce the number of maximum MIMO layers of each serving cell operating on FR2 for SCG:
   2. include **reducedMaxMIMO-LayersFR2** in the **OverheatingAssistance** IE;
      2. set **reducedMIMO-LayersFR2-DL** to the number of maximum MIMO layers of each serving cell operating on FR2 of the SCG the UE prefers to be temporarily configured in downlink;
      2. set **reducedMIMO-LayersFR2-UL** to the number of maximum MIMO layers of each serving cell operating on FR2 of the SCG the UE prefers to be temporarily configured in uplink;
5.7.4a Void

5.7.5 Failure information

5.7.5.1 General

The purpose of this procedure is to inform the network about a failure detected by the UE.

5.7.5.2 Initiation

A UE initiates the procedure when there is a need inform the network about a failure detected by the UE. In particular, the UE initiates the procedure when the following condition is met:

1. upon detecting failure for an RLC bearer, in accordance with 5.3.10.3;
2. upon detecting DAPS handover failure, in accordance with 5.3.5.8.3;

Upon initiating the procedure, the UE shall:

1. initiate transmission of the $\text{FailureInformation}$ message as specified in 5.7.5.3;

5.7.5.3 Actions related to transmission of $\text{FailureInformation}$ message

The UE shall:

1. if initiated to provide RLC failure information, set $\text{FailureInfoRLC-Bearer}$ as follows:
   2. set $\text{logicalChannelIdentity}$ to the logical channel identity of the failing RLC bearer;
   3. set $\text{cellGroupId}$ to the cell group identity of the failing RLC bearer;
   4. set the $\text{failureType}$ as $\text{rlc-failure}$;

1. if initiated to provide DAPS failure information, set $\text{FailureInfoDAPS}$ as follows:
   2. set the $\text{failureType}$ as $\text{daps-failure}$;

1. if used to inform the network about a failure for an MCG RLC bearer or DAPS failure information:
   2. submit the $\text{FailureInformation}$ message to lower layers for transmission via SRB1;

1. else if used to inform the network about a failure for an SCG RLC bearer:
   2. if SRB3 is configured:
      3. submit the $\text{FailureInformation}$ message to lower layers for transmission via SRB3;
   2. else:
      3. if the UE is in (NG)EN-DC:
         4. submit the $\text{FailureInformation}$ message via E-UTRA SRB1 embedded in E-UTRA RRC message $\text{ULInformationTransferMRDC}$ as specified in TS 36.331 [10].
else if the UE is in NR-DC:

submit the FailureInformation message via SRB1 embedded in NR RRC message
ULInformationTransferMRDC as specified in clause 5.7.2a.3.

5.7.6  DL message segment transfer

5.7.6.1  General

Figure 5.7.6.1-1: DL message segment transfer

The purpose of this procedure is to transfer segments of DL DCCH messages from the network to the UE.

NOTE: The segmentation of DL DCCH message is only applicable to RRCReconfiguration and RRCResume messages in this release.

5.7.6.2  Initiation

The network initiates the DL Dedicated Message Segment transfer procedure whenever the encoded RRC message PDU exceeds the maximum PDCP SDU size. The network initiates the DL Dedicated Message Segment transfer procedure by sending the DL DedicatedMessageSegment message.

5.7.6.3  Reception of DL DedicatedMessageSegment by the UE

Upon receiving DL DedicatedMessageSegment message, the UE shall:

1> store the segment included in rrc-MessageSegmentContainer;

2> assemble the message from the received segments and process the message according to 5.3.5.5 for the RRCReconfiguration message or 5.3.13.4 for the RRCResume message;

2> discard all segments.

5.7.7  UL message segment transfer

5.7.7.1  General

Figure 5.7.7.1-1: UL message segment transfer

The purpose of this procedure is to transfer segments of UL DCCH messages from UE to a NG-RAN in RRC_CONNECTED.

NOTE: The segmentation of UL DCCH message is only applicable to UECapabilityInformation in this release.
5.7.7.2 Initiation

A UE capable of UL RRC message segmentation in RRC_CONNECTED will initiate the procedure when the following conditions are met:

1. if the RRC message segmentation is enabled based on the field rrc-SegAllowed received, and
2. if the encoded RRC message is larger than the maximum supported size of a PDCP SDU specified in TS 38.323 [5];

Upon initiating the procedure, the UE shall:

1. initiate transmission of the ULDedicatedMessageSegment message as specified in 5.7.7.3;

5.7.7.3 Actions related to transmission of ULDedicatedMessageSegment message

The UE shall segment the encoded RRC PDU based on the maximum supported size of a PDCP SDU specified in TS 38.323 [5]. UE shall minimize the number of segments and set the contents of the ULDedicatedMessageSegment messages as follows:

1. For each new UL DCCH message, set the segmentNumber to 0 for the first message segment and increment the segmentNumber for each subsequent RRC message segment;
2. set rrc-MessageSegmentContainer to include the segment of the UL DCCH message corresponding to the segmentNumber;
3. if the segment included in the rrc-MessageSegmentContainer is the last segment of the UL DCCH message:
   2. set the rrc-MessageSegmentType to lastSegment;
4. else:
   2. set the rrc-MessageSegmentType to notLastSegment;
5. submit all the ULDedicatedMessageSegment messages generated for the segmented RRC message to lower layers for transmission in ascending order based on the segmentNumber, upon which the procedure ends.

5.7.8 Idle/inactive Measurements

5.7.8.1 General

This procedure specifies the measurements to be performed and stored by a UE in RRC_IDLE and RRC_INACTIVE when it has an idle/inactive measurement configuration.

5.7.8.1a Measurement configuration

The purpose of this procedure is to update the idle/inactive measurement configuration.

The UE initiates this procedure while T331 is running and one of the following conditions is met:

1. upon selecting a cell when entering RRC_IDLE or RRC-INACTIVE from RRC_CONNECTED; or
2. upon update of system information (SIB4, or SIB11), e.g. due to intra-RAT cell (re)selection;

While in RRC_IDLE or RRC_INACTIVE, and T331 is running, the UE shall:

1. if VarMeasIdleConfig includes neither a measIdleCarrierListEUTRA nor a measIdleCarrierListNR received from the RRCRelease message:
2. if the UE supports idleInactiveEUTRA-MeasReport:
   3. if the SIB11 includes the measIdleConfigSIB and contains measIdleCarrierListEUTRA:
4> store or replace the measIdleCarrierListEUTRA of measIdleConfigSIB of SIB11 within VarMeasIdleConfig;

3> else:
    4> remove the measIdleCarrierListEUTRA in VarMeasIdleConfig, if stored;

2> if the UE supports idleInactiveNR-MeasReport:
    3> if SIB11 includes the measIdleConfigSIB and contains measIdleCarrierListNR:
        4> store or replace the measIdleCarrierListNR of measIdleConfigSIB of SIB11 within VarMeasIdleConfig;
    3> else:
        4> remove the measIdleCarrierListNR in VarMeasIdleConfig, if stored;

1> for each entry in the measIdleCarrierListNR within VarMeasIdleConfig that does not contain an ssb-MeasConfig received from the RRCRelease message:

2> if there is an entry in measIdleCarrierListNR in measIdleConfigSIB of SIB11 that has the same carrier frequency and subcarrier spacing as the entry in the measIdleCarrierListNR within VarMeasIdleConfig and that contains ssb-MeasConfig:
    3> delete the ssb-MeasConfig of the corresponding entry in the measIdleCarrierListNR within VarMeasIdleConfig;
    3> store the SSB measurement configuration from SIB11 into nrofSS-BlocksToAverage, absThreshSS-BlocksConsolidation, smtc, ssb-ToMeasure, deriveSSB-IndexFromCell, and ss-RSSI-Measurement within ssb-MeasConfig of the corresponding entry in the measIdleCarrierListNR within VarMeasIdleConfig;

2> else if there is an entry in interFreqCarrierFreqList of SIB4 with the same carrier frequency and subcarrier spacing as the entry in measIdleCarrierListNR within VarMeasIdleConfig:
    3> delete the ssb-MeasConfig of the corresponding entry in the measIdleCarrierListNR within VarMeasIdleConfig;
    3> store the SSB measurement configuration from SIB4 into nrofSS-BlocksToAverage, absThreshSS-BlocksConsolidation, smtc, ssb-ToMeasure, deriveSSB-IndexFromCell, and ss-RSSI-Measurement within ssb-MeasConfig of the corresponding entry in the measIdleCarrierListNR within VarMeasIdleConfig;

2> else:
    3> remove the ssb-MeasConfig of the corresponding entry in the measIdleCarrierListNR within VarMeasIdleConfig, if stored;

1> perform measurements according to 5.7.8.2a.

5.7.8.2 Void

5.7.8.2a Performing measurements

When performing measurements on NR carriers according to this clause, the UE shall derive the cell quality as specified in 5.5.3.3 and consider the beam quality to be the value of the measurement results of the concerned beam, where each result is averaged as described in TS 38.215 [9].

While in RRC_IDLE or RRC_INACTIVE, and T331 is running, the UE shall:

1> perform the measurements in accordance with the following:

2> if the VarMeasIdleConfig includes the measIdleCarrierListEUTRA and the SIB1 contains idleModeMeasurementsEUTRA:
    3> for each entry in measIdleCarrierListEUTRA within VarMeasIdleConfig:
if UE supports NE-DC between the serving carrier and the carrier frequency indicated by `carrierFreqEUTRA` within the corresponding entry:

perform measurements in the carrier frequency and bandwidth indicated by `carrierFreqEUTRA` and `allowedMeasBandwidth` within the corresponding entry;

if the `reportQuantitiesEUTRA` is set to `rsrq`:

consider RSRQ as the sorting quantity;

else:

consider RSRP as the sorting quantity;

if the `measCellListEUTRA` is included:

consider cells identified by each entry within the `measCellListEUTRA` to be applicable for idle/inactive mode measurement reporting;

else:

consider up to `maxCellMeasIdle` strongest identified cells, according to the sorting quantity, to be applicable for idle/inactive measurement reporting;

for all cells applicable for idle/inactive measurement reporting, derive measurement results for the measurement quantities indicated by `reportQuantitiesEUTRA`;

store the derived measurement results as indicated by `reportQuantitiesEUTRA` within the `measReportIdleEUTRA` in `VarMeasIdleReport` in decreasing order of the sorting quantity, i.e. the best cell is included first, as follows:

if `qualityThresholdEUTRA` is configured:

include the measurement results from the cells applicable for idle/inactive measurement reporting whose RSRP/RSRQ measurement results are above the value(s) provided in `qualityThresholdEUTRA`;

else:

include the measurement results from all cells applicable for idle/inactive measurement reporting;

if the `VarMeasIdleConfig` includes the `measIdleCarrierListNR` and the SIB1 contains `idleModeMeasurementsNR`:

for each entry in `measIdleCarrierListNR` within `VarMeasIdleConfig` that contains `ssb-MeasConfig`:

if UE supports carrier aggregation or NR-DC between serving carrier and the carrier frequency and subcarrier spacing indicated by `carrierFreq` and `ssbSubCarrierSpacing` within the corresponding entry:

perform measurements in the carrier frequency and subcarrier spacing indicated by `carrierFreq` and `ssbSubCarrierSpacing` within the corresponding entry;

if the `reportQuantities` is set to `rsrq`:

consider RSRQ as the cell sorting quantity;

else:

consider RSRP as the cell sorting quantity;

if the `measCellListNR` is included:

consider cells identified by each entry within the `measCellListNR` to be applicable for idle/inactive measurement reporting;
else:

6> consider up to $\text{maxCellMeasIdle}$ strongest identified cells, according to the sorting quantity, to be applicable for idle/inactive measurement reporting;

5> for all cells applicable for idle/inactive measurement reporting and for the serving cell, derive cell measurement results for the measurement quantities indicated by $\text{reportQuantities}$;

5> store the derived cell measurement results as indicated by $\text{reportQuantities}$ for the serving cell within $\text{measResultServingCell}$ in the $\text{measReportIdleNR}$ in $\text{VarMeasIdleReport}$;

5> store the derived cell measurement results as indicated by $\text{reportQuantities}$ for cells applicable for idle/inactive measurement reporting within $\text{measResultsPerCarrierListIdleNR}$ in the $\text{measReportIdleNR}$ in $\text{VarMeasIdleReport}$ in decreasing order of the cell sorting quantity, i.e. the best cell is included first, as follows:

6> if $\text{qualityThreshold}$ is configured:

7> include the measurement results from the cells applicable for idle/inactive measurement reporting whose RSRP/RSRQ measurement results are above the value(s) provided in $\text{qualityThreshold}$;

6> else:

7> include the measurement results from all cells applicable for idle/inactive measurement reporting;

5> if $\text{beamMeasConfigIdle}$ is included in the associated entry in $\text{measIdleCarrierListNR}$, for each cell in the measurement results:

6> derive beam measurements based on SS/PBCH block for each measurement quantity indicated in $\text{reportQuantityRS-Indexes}$, as described in TS 38.215 [9];

6> if the $\text{reportQuantityRS-Indexes}$ is set to rsrq:

7> consider RSRQ as the beam sorting quantity;

6> else:

7> consider RSRP as the beam sorting quantity;

6> set $\text{resultsSSB-Indexes}$ to include up to $\text{maxNrofRS-IndexesToReport}$ SS/PBCH block indexes in order of decreasing beam sorting quantity as follows:

7> include the index associated to the best beam for the sorting quantity and if $\text{absThreshSS-BlocksConsolidation}$ is included, the remaining beams whose sorting quantity is above $\text{absThreshSS-BlocksConsolidation}$;

6> if the $\text{includeBeamMeasurements}$ is set to true:

7> include the beam measurement results as indicated by $\text{reportQuantityRS-Indexes}$;

NOTE 1: The fields $\text{s-NonIntraSearchP}$ and $\text{s-NonIntraSearchQ}$ in $\text{SIB2}$ do not affect the idle/inactive UE measurement procedures. How the UE performs idle/inactive measurements is up to UE implementation as long as the requirements in TS 38.133 [14] are met for measurement reporting.

NOTE 2: The UE is not required to perform idle/inactive measurements on a given carrier if the SSB configuration of that carrier provided via dedicated signaling is different from the SSB configuration broadcasted in the serving cell, if any.

NOTE 3: How the UE prioritizes which frequencies to measure or report (in case it is configured with more frequencies than it can measure or report) is left to UE implementation.

5.7.8.3 T331 expiry or stop

The UE shall:
1> if T331 expires or is stopped:
   2> release the VarMeasIdleConfig.

NOTE: It is up to UE implementation whether to continue idle/inactive measurements according to SIB11 and SIB4 configurations after T331 has expired or stopped.

5.7.8.4 Cell re-selection or cell selection while T331 is running

The UE shall:

1> if intra-RAT cell selection or reselection occurs while T331 is running:
   2> if validityAreaList is configured in VarMeasIdleConfig:
      3> if the serving frequency does not match with the carrierFreq of an entry in the validityAreaList; or
      3> if the serving frequency matches with the carrierFreq of an entry in the validityAreaList, the validityCellList is included in that entry, and the physical cell identity of the serving cell does not match with any entry in validityCellList:
         4> stop timer T331;
         4> perform the actions as specified in 5.7.8.3, upon which the procedure ends.
   1> else if inter-RAT cell selection or reselection occurs while T331 is running:
      2> stop timer T331;
      2> perform the actions as specified in 5.7.8.3;

5.7.9 Mobility history information

5.7.9.1 General

This procedure specifies how the mobility history information is stored by the UE, covering RRC_IDLE, RRC_INACTIVE and RRC_CONNECTED.

5.7.9.2 Initiation

If the UE supports storage of mobility history information, the UE shall:

1> Upon change of suitable cell, consisting of PCell in RRC_CONNECTED or serving cell in RRC_INACTIVE (for NR cell) or in RRC_IDLE (for NR or E-UTRA cell), to another NR or E-UTRA cell, or when entering any cell selection’ state from 'camped normally' state in NR or LTE:

   2> include an entry in variable VarMobilityHistoryReport possibly after removing the oldest entry, if necessary, according to following:

      3> if the global cell identity of the previous PCell/serving cell is available:
         4> include the global cell identity of that cell in the field visitedCellId of the entry;
      3> else:
         4> include the physical cell identity and carrier frequency of that cell in the field visitedCellId of the entry;

      3> set the field timeSpent of the entry as the time spent in the previous PCell/serving cell;

1> upon entering camped normally state in NR (in RRC_IDLE, RRC_INACTIVE or RRC_CONNECTED) or E-UTRA (in RRC_IDLE or RRC_CONNECTED) while previously in 'any cell selection' state or 'camped on any cell' state in NR or LTE:
include an entry in variable VarMobilityHistoryReport possibly after removing the oldest entry, if necessary, according to following:

- set the field timeSpent of the entry as the time spent in 'any cell selection' state and/or 'camped on any cell' state in NR or LTE.

5.7.10 UE Information

5.7.10.1 General

The UE information procedure is used by the network to request the UE to report information.

5.7.10.2 Initiation

The network initiates the procedure by sending the UEInformationRequest message. The network should initiate this procedure only after successful security activation.

5.7.10.3 Reception of the UEInformationRequest message

Upon receiving the UEInformationRequest message, the UE shall, only after successful security activation:

1. if the idleModeMeasurementReq is included in the UEInformationRequest and the UE has stored VarMeasIdleReport that contains measurement information concerning cells other than the PCell:
   2. set the measResultIdleEUTRA in the UEInformationResponse message to the value of measReportIdleEUTRA in the VarMeasIdleReport, if available;
   2. set the measResultIdleNR in the UEInformationResponse message to the value of measReportIdleNR in the VarMeasIdleReport, if available;
   2. discard the VarMeasIdleReport upon successful delivery of the UEInformationResponse message confirmed by lower layers;
1. if the logMeasReportReq is present and if the RPLMN is included in plmn-IdentityList stored in VarLogMeasReport:
   2. if VarLogMeasReport includes one or more logged measurement entries, set the contents of the logMeasReport in the UEInformationResponse message as follows:
      3. include the absoluteTimeStamp and set it to the value of absoluteTimeInfo in the VarLogMeasReport;
      3. include the traceReference and set it to the value of traceReference in the VarLogMeasReport;
      3. include the traceRecordingSessionRef and set it to the value of traceRecordingSessionRef in the VarLogMeasReport;
      3. include the tce-Id and set it to the value of tce-Id in the VarLogMeasReport;
3> include the \texttt{logMeasInfoList} and set it to include one or more entries from the \texttt{VarLogMeasReport} starting from the entries logged first, and for each entry of the \texttt{logMeasInfoList} that is included, include all information stored in the corresponding \texttt{logMeasInfoList} entry in \texttt{VarLogMeasReport};

3> if the \texttt{VarLogMeasReport} includes one or more additional logged measurement entries that are not included in the \texttt{logMeasInfoList} within the \texttt{UEInformationResponse} message:

4> include the \texttt{logMeasAvailable};

4> if \texttt{bt-LocationInfo} is included in \texttt{locationInfo} of one or more of the additional logged measurement entries in \texttt{VarLogMeasReport} that are not included in the \texttt{logMeasInfoList} within the \texttt{UEInformationResponse} message:

5> include the \texttt{logMeasAvailableBT};

4> if \texttt{wlan-LocationInfo} is included in \texttt{locationInfo} of one or more of the additional logged measurement entries in \texttt{VarLogMeasReport} that are not included in the \texttt{logMeasInfoList} within the \texttt{UEInformationResponse} message:

5> include the \texttt{logMeasAvailableWLAN};

1> if \texttt{ra-ReportReq} is set to \texttt{true} and the UE has random access related information available in \texttt{VarRA-Report} and if the RPLMN is included in \texttt{plmn-IdentityList} stored in \texttt{VarRA-Report}:

2> set the \texttt{ra-ReportList} in the \texttt{UEInformationResponse} message to the value of \texttt{ra-ReportList} in \texttt{VarRA-Report};

2> discard the \texttt{ra-ReportList} from \texttt{VarRA-Report} upon successful delivery of the \texttt{UEInformationResponse} message confirmed by lower layers;

1> if \texttt{rlf-ReportReq} is set to \texttt{true}:

2> if the UE has radio link failure information or handover failure information available in \texttt{VarRLF-Report} and if the RPLMN is included in \texttt{plmn-IdentityList} stored in \texttt{VarRLF-Report}:

3> set \texttt{timeSinceFailure} in \texttt{VarRLF-Report} to the time that elapsed since the last radio link or handover failure in NR;

3> set the \texttt{rlf-Report} in the \texttt{UEInformationResponse} message to the value of \texttt{rlf-Report} in \texttt{VarRLF-Report};

3> discard the \texttt{rlf-Report} from \texttt{VarRLF-Report} upon successful delivery of the \texttt{UEInformationResponse} message confirmed by lower layers;

2> else if the UE is capable of cross-RAT RLF reporting as defined in TS 38.306 [26] and has radio link failure information or handover failure information available in \texttt{VarRLF-Report} of TS 36.331 [10] and if the RPLMN is included in \texttt{plmn-IdentityList} stored in \texttt{VarRLF-Report} of TS 36.331 [10]:

3> set \texttt{timeSinceFailure} in \texttt{VarRLF-Report} of TS 36.331 [10] to the time that elapsed since the last radio link or handover failure in EUTRA;

3> set the \texttt{measResult-RLF-Report-EUTRA} in the \texttt{rlf-Report} in the \texttt{UEInformationResponse} message to the value of \texttt{rlf-Report} in \texttt{VarRLF-Report} of TS 36.331 [10];

3> discard the \texttt{rlf-Report} from \texttt{VarRLF-Report} of TS 36.331 [10] upon successful delivery of the \texttt{UEInformationResponse} message confirmed by lower layers;

1> if \texttt{connEstFailReportReq} is set to \texttt{true} and the UE has connection establishment failure or connection resume failure information in \texttt{VarConnEstFailReport} and if the RPLMN is equal to \texttt{plmn-Identity} stored in \texttt{VarConnEstFailReport}:

2> set \texttt{timeSinceFailure} in \texttt{VarConnEstFailReport} to the time that elapsed since the last connection establishment failure or connection resume failure in NR;

2> set the \texttt{connEstFailReport} in the \texttt{UEInformationResponse} message to the value of \texttt{connEstFailReport} in \texttt{VarConnEstFailReport};
2> discard the connEstFailReport from VarConnEstFailReport upon successful delivery of the UEInformationResponse message confirmed by lower layers;

1> if the mobilityHistoryReportReq is set to true:

2> include the mobilityHistoryReport and set it to include entries from VarMobilityHistoryReport;

2> include in the mobilityHistoryReport an entry for the current cell, possibly after removing the oldest entry if required, and set its fields as follows:

3> set visitedCellId to the global cell identity of the current cell;

3> set field timeSpent to the time spent in the current cell;

1> if the logMeasReport is included in the UEInformationResponse:

2> submit the UEInformationResponse message to lower layers for transmission via SRB2;

2> discard the logged measurement entries included in the logMeasInfoList from VarLogMeasReport upon successful delivery of the UEInformationResponse message confirmed by lower layers;

1> else:

2> submit the UEInformationResponse message to lower layers for transmission via SRB1.

5.7.10.4 Actions upon successful completion of random-access procedure

Upon successfully performing 4 step random access procedure, the UE shall:

1> if the number of RA-Report entries stored in the ra-ReportList in VarRA-Report is less than maxRAReport:

2> if the number of PLMN entries in plmn-IdentityList stored in VarRA-Report is less than maxPLMN; or

2> if the number of PLMN entries in plmn-IdentityList stored in VarRA-Report is equal to maxPLMN and the list of EPLMNs is subset of or equal to the plmn-IdentityList stored in VarRA-Report:

3> append the following contents associated to the successfully completed random-access procedure as a new entry in the VarRA-Report:

4> if the list of EPLMNs has been stored by the UE:

5> if the RPLMN is included in plmn-IdentityList stored in VarRA-Report:

6> set the plmn-IdentityList to include the list of EPLMNs stored by the UE (i.e. includes the RPLMN) without exceeding the limit of maxPLMN;

5> else:

6> clear the information included in VarRA-Report;

6> set the plmn-IdentityList to the list of EPLMNs stored by the UE (i.e. includes the RPLMN);

4> else:

5> set the plmn-Identity, in plmn-IdentityList, to the PLMN selected by upper layers from the PLMN(s) included in the plmn-IdentityList in SIB1;

4> set the cellId to the global cell identity and the tracking area code, if available, otherwise to the physical cell identity and carrier frequency of the cell in which the corresponding random-access preamble was transmitted;

4> set the raPurpose to include the purpose of triggering the random-access procedure;

4> set the ra-InformationCommon-r16 as specified in subclause 5.7.10.5.

The UE may discard the random access report information, i.e. release the UE variable VarRA-Report, 48 hours after the last successful random access procedure related information is added to the VarRA-Report.
NOTE 1: The UE does not log the RA information in the RA report if the triggering event of the random access is consistent UL LBT on SpCell as specified in TS 38.321 [6].

5.7.10.5 RA information determination for RA report and RLF report

The UE shall set the content in ra-InformationCommon as follows:

1> set the absoluteFrequencyPointA to indicate the absolute frequency of the reference resource block associated to the random-access resources used in the random-access procedure;

1> set the locationAndBandwidth and subcarrierSpacing associated to the UL BWP of the random-access resources used in the random-access procedure;

1> set the msg1-FrequencyStart, msg1-FDM and msg1-SubcarrierSpacing associated to the contention based random-access resources if used in the random-access procedure;

1> set the msg1-FrequencyStartCFRA, msg1-FDMCFRA and msg1-SubcarrierSpacingCFRA associated to the contention free random-access resources if used in the random-access procedure;

1> set the parameters associated to individual random-access attempt in the chronological order of attempts in the perRAInfoList as follows:

2> if the random-access resource used is associated to a SS/PBCH block, set the associated random-access parameters for the successive random-access attempts associated to the same SS/PBCH block for one or more random-access attempts as follows:

3> set the ssb-Index to include the SS/PBCH block index associated to the used random-access resource;

3> set the numberOfPreamblesSentOnSSB to indicate the number of successive random-access attempts associated to the SS/PBCH block;

3> for each random-access attempt performed on the random-access resource, include the following parameters in the chronological order of the random-access attempt:

4> if the random-access attempt is performed on the contention based random-access resource and if raPurpose is not equal to 'requestForOtherSI', include contentionDetected as follows:

5> if contention resolution was not successful as specified in TS 38.321 [6] for the transmitted preamble:

6> set the contentionDetected to true;

5> else:

6> set the contentionDetected to false;

4> if the random-access attempt is performed on the contention free random-access resource and if the random-access procedure was initiated due to the PDCCH ordering:

5> if the SS/PBCH block RSRP of the SS/PBCH block corresponding to the random-access resource used in the random-access attempt is above rsrp-ThresholdSSB:

6> set the dlRSRPAboveThreshold to true;

5> else:

6> set the dlRSRPAboveThreshold to false;

2> else if the random-access resource used is associated to a CSI-RS, set the associated random-access parameters for the successive random-access attempts associated to the same CSI-RS for one or more random-access attempts as follows:

3> set the csi-RS-Index to include the CSI-RS index associated to the used random-access resource;
3> set the numberOfPreamblesSentOnCSI-RS to indicate the number of successive random-access attempts associated to the CSI-RS.

NOTE 1: Void.

5.7.12 IAB Other Information

5.7.12.1 General

The IAB Other Information procedure is used by IAB-MT to request the IAB-donor-CU to allocate IP address or inform the IAB-donor-CU of the IP address for the collocated IAB-DU.

5.7.12.2 Initiation

Upon initiation of the procedure, the IAB-MT shall:

1> initiate transmission of the IABOtherInformation message in accordance with 5.7.12.3;

5.7.12.3 Actions related to transmission of IABOtherInformation message

The IAB-MT shall set the contents of IABOtherInformation message as follows:

1> if the procedure is used to request IP addresses:

2> if IPv4 addresses are requested:

3> set the iab-IPv4-AddressNumReq to the number of IPv4 addresses requested per specific usage;

2> if IPv6 addresses or IPv6 address prefixes are requested:

3> if IPv6 addresses are requested:

4> set the iab-IPv6-AddressNumReq to the number of IPv6 addresses requested per specific usage;

3> else if IPv6 address prefixes are requested:

4> set the iab-IPv6-AddressPrefixReq to true per specific usage;

1> if the procedure is used to report IP addresses:

2> if IPv4 addresses are reported:

3> include IPv4-Address in iab-IPv4-AddressReport, and for each IP address included:

4> if IPv4 addresses are used for F1-C traffic:

5> include these addresses in f1-C-Traffic-IP-Address.

4> if IPv4 addresses are used for F1-U traffic:
include these addresses in \textit{f1-U-Traffic-IP-Address}.

if IPv4 address are used for non-F1 traffic:

include these addresses in \textit{non-f1-Traffic-IP-Address}.

if IPv4 addresses are used for all traffic:

include these addresses in \textit{all-Traffic-IAB-IP-Address}.

if IPv6 addresses or IPv6 address prefixes are reported:

include \textit{iPv6-Address} in \textit{iab-IPv6-AddressReport}, and for each IP address included;

if IPv6 addresses are used for F1-C traffic:

include these addresses in \textit{f1-C-Traffic-IP-Address}.

if IPv6 addresses are used for F1-U traffic:

include these addresses in \textit{f1-U-Traffic-IP-Address}.

if IPv6 addresses are used for non-F1 traffic:

include these addresses in \textit{non-f1-Traffic-IP-Address}.

if IPv6 addresses are used for all traffic:

include these addresses in \textit{all-Traffic-IAB-IP-Address}.

else if IPv6 address prefixes are reported:

include these \textit{iPv6-Prefix} in \textit{iab-IPv6-PrefixReport}, and for each IP address prefix included;

if this IPv6 address prefix is used for F1-C traffic:

include this prefix in \textit{f1-C-Traffic-IP-Address}.

if this IPv6 address prefix is used for F1-U traffic:

include this prefix in \textit{f1-U-Traffic-IP-Address}.

if this IPv6 address prefix is used for non-F1 traffic:

include this prefix in \textit{non-f1-Traffic-IP-Address}.

if this IPv6 address prefix is used for all traffic:

include this prefix in \textit{all-Traffic-IAB-IP-Address}.

if the IAB-MT is in (NG)EN-DC:

if SRB3 is configured:

submit the \textit{IABOtherInformation} message via SRB3 to lower layers for transmission;

else:

submit the \textit{IABOtherInformation} message via the E-UTRA MCG embedded in E-UTRA RRC message \textit{ULInformationTransferMRDC} as specified in TS 36.331 [10].

else:

submit the \textit{IABOtherInformation} message to lower layers for transmission.
5.8 Sidelink

5.8.1 General

NR sidelink communication consists of unicast, groupcast and broadcast. For unicast, the PC5-RRC connection is a logical connection between a pair of a Source Layer-2 ID and a Destination Layer-2 ID in the AS. The PC5-RRC signalling, as specified in sub-clause 5.8.9, can be initiated after its corresponding PC5 unicast link establishment (TS 23.287 [55]). The PC5-RRC connection and the corresponding sidelink SRBs and sidelink DRB(s) are released when the PC5 unicast link is released as indicated by upper layers.

For each PC5-RRC connection of unicast, one sidelink SRB (i.e. SL-SRB0) is used to transmit the PC5-S message(s) before the PC5-S security has been established. One sidelink SRB (i.e. SL-SRB1) is used to transmit the PC5-S messages to establish the PC5-S security. One sidelink SRB (i.e. SL-SRB2) is used to transmit the PC5-S messages after the PC5-S security has been established, which is protected. One sidelink SRB (i.e. SL-SRB3) is used to transmit the PC5-RRC signalling, which is protected and only sent after the PC5-S security has been established.

For unicast of NR Sidelink communication, AS security comprises of integrity protection and ciphering of PC5 signaling (SL-SRB2 and SL-SRB3) and user data (SL-DRBs). The ciphering and integrity protection algorithms and parameters for a PC5 unicast link are exchanged by PC5-S messages in the upper layers as specified in TS 33.536 [60], and apply to the corresponding PC5-RRC connection in the AS. Once AS security is activated for a PC5 unicast link in the upper layers as specified in TS 33.536 [60], all messages on SL-SRB2 and SL-SRB3 and/or user data on SL-DRBs of the corresponding PC5-RRC connection are integrity protected and/or ciphered by the PDCP.

For unicast of NR Sidelink communication, if the change of the key is indicated by the upper layers as specified in TS 33.536 [60], UE re-establishes the PDCP entity of the SL-SRB1, SL-SRB2, SL-SRB3 and SL-DRBs on the corresponding PC5-RRC connection.

NOTE 1: In case the configurations for NR sidelink communication are acquired via the E-UTRA, the configurations for NR sidelink communication in SIB12 and sl-ConfigDedicatedNR within RRCReconfiguration used in subclause 5.8 are provided by the configurations in SystemInformationBlockType28 and sl-ConfigDedicatedNR within RRCConnectionReconfiguration as specified in TS 36.331 [10], respectively.

NOTE 2: In this release, there is one-to-one correspondence between the PC5-RRC connection and the PC5 unicast link as specified in TS 38.300[2].

NOTE 3: All SL-DRBs related to the same PC5-RRC connection have the same activation/deactivation setting for ciphering and the same activation/deactivation setting for integrity protection as in TS 33.536 [60].

5.8.2 Conditions for NR sidelink communication operation

The UE shall perform NR sidelink communication operation only if the conditions defined in this clause are met:

1> if the UE’s serving cell is suitable (RRC_IDLE or RRC_INACTIVE or RRC_CONNECTED); and if either the selected cell on the frequency used for NR sidelink communication operation belongs to the registered or equivalent PLMN as specified in TS 24.587 [57] or the UE is out of coverage on the frequency used for NR sidelink communication operation as defined in TS 38.304 [20] and TS 36.304 [27]; or

1> if the UE’s serving cell (RRC_IDLE or RRC_CONNECTED) fulfils the conditions to support NR sidelink communication in limited service state as specified in TS 23.287 [55]; and if either the serving cell is on the frequency used for NR sidelink communication operation or the UE is out of coverage on the frequency used for NR sidelink communication operation as defined in TS 38.304 [20] and TS 36.304 [27]; or

1> if the UE has no serving cell (RRC_IDLE);
5.8.3 Sidelink UE information for NR sidelink communication

5.8.3.1 General

![Diagram of Sidelink UE information for NR sidelink communication](image)

**Figure 5.8.3.1-1: Sidelink UE information for NR sidelink communication**

The purpose of this procedure is to inform the network that the UE:

- is interested or no longer interested to receive or transmit NR sidelink communication,
- is requesting assignment or release of transmission resource for NR sidelink communication,
- is reporting QoS parameters and QoS profile(s) related to NR sidelink communication,
- is reporting that a sidelink radio link failure or sidelink RRC reconfiguration failure has been detected,
- is reporting the sidelink UE capability information of the associated peer UE for unicast communication,
- is reporting the RLC mode information of the sidelink data radio bearer(s) received from the associated peer UE for unicast communication.

5.8.3.2 Initiation

A UE capable of NR sidelink communication that is in RRC_CONNECTED may initiate the procedure to indicate it is (interested in) receiving or transmitting NR sidelink communication in several cases including upon successful connection establishment or resuming, upon change of interest, upon changing QoS profiles, upon receiving **UECapabilityInformationSidelink** from the associated peer UE, upon RLC mode information updated from the associated peer UE or upon change to a PCell providing **SIB12** including **sl-ConfigCommonNR**. A UE capable of NR sidelink communication may initiate the procedure to request assignment of dedicated sidelink DRB configuration and transmission resources for NR sidelink communication transmission. A UE capable of NR sidelink communication may initiate the procedure to report to the network that a sidelink radio link failure or sidelink RRC reconfiguration failure has been declared.

Upon initiating this procedure, the UE shall:

1> if **SIB12** including **sl-ConfigCommonNR** is provided by the PCell:

2> ensure having a valid version of **SIB12** for the PCell;

3> if configured by upper layers to receive NR sidelink communication on the frequency included in **sl-FreqInfoList** in **SIB12** of the PCell:

4> initiate transmission of the **SidelinkUEInformationNR** message in accordance with 5.8.3.3;
if the last transmission of the \textit{SidelinkUEInformationNR} message included \textit{sl-RxInterestedFreqList}: 

4> initiate transmission of the \textit{SidelinkUEInformationNR} message to indicate it is no longer interested in NR sidelink communication reception in accordance with 5.8.3.3;

else:

3> if configured by upper layers to transmit NR sidelink communication on the frequency included in \textit{sl-FreqInfoList} in SIB12 of the PCell:

3> if the UE did not transmit a \textit{SidelinkUEInformationNR} message since last entering RRC\_CONNECTED state; or

3> if since the last time the UE transmitted a \textit{SidelinkUEInformationNR} message the UE connected to a PCell not providing SIB12 including \textit{sl-ConfigCommonNR}; or

3> if the last transmission of the \textit{SidelinkUEInformationNR} message did not include \textit{sl-TxResourceReqList}; or if the information carried by the \textit{sl-TxResourceReqList} has changed since the last transmission of the \textit{SidelinkUEInformationNR} message:

4> initiate transmission of the \textit{SidelinkUEInformationNR} message to indicate the NR sidelink communication transmission resources required by the UE in accordance with 5.8.3.3;

else:

3> if the last transmission of the \textit{SidelinkUEInformationNR} message included \textit{sl-TxResourceReqList}:

4> initiate transmission of the \textit{SidelinkUEInformationNR} message to indicate it no longer requires NR sidelink communication transmission resources in accordance with 5.8.3.3.

5.8.3.3 Actions related to transmission of \textit{SidelinkUEInformationNR} message

The UE shall set the contents of the \textit{SidelinkUEInformationNR} message as follows:

1> if the UE initiates the procedure to indicate it is (no more) interested to receive NR sidelink communication or to request (configuration/ release) of NR sidelink communication transmission resources or to report to the network that a sidelink radio link failure or sidelink RRC reconfiguration failure has been declared (i.e. UE includes all concerned information, irrespective of what triggered the procedure):

2> if SIB12 including \textit{sl-ConfigCommonNR} is provided by the PCell:

3> if configured by upper layers to receive NR sidelink communication:

4> include \textit{sl-RxInterestedFreqList} and set it to the frequency for NR sidelink communication reception;

3> if configured by upper layers to transmit NR sidelink communication:

4> include \textit{sl-TxResourceReqList} and set its fields (if needed) as follows for each destination for which it requests network to assign NR sidelink communication resource:

5> set \textit{sl-DestinationIdentity} to the destination identity configured by upper layer for NR sidelink communication transmission;

5> set \textit{sl-CastType} to the cast type of the associated destination identity configured by the upper layer for the NR sidelink communication transmission;

5> set \textit{sl-RLC-ModeIndication} to include the RLC mode(s) and optionally QoS profile(s) of the sidelink QoS flow(s) of the associated RLC mode(s), if the associated bi-directional sidelink DRB has been established due to the configuration by RRC\_ReconfigurationSidelink;

5> set \textit{sl-QoS-InfoList} to include QoS profile(s) of the sidelink QoS flow(s) of the associated destination configured by the upper layer for the NR sidelink communication transmission;

5> set \textit{sl-InterestedFreqList} to indicate the frequency of the associated destination for NR sidelink communication transmission;
5> set sl-TypeTxSyncList to the current synchronization reference type used on the associated sl-InterestedFreqList for NR sidelink communication transmission.

5> set sl-CapabilityInformationSidelink to include UECapabilityInformationSidelink message, if any, received from peer UE.

4> if a sidelink radio link failure or a sidelink RRC reconfiguration failure has been declared, according to clauses 5.8.9.3 and 5.8.9.1.8, respectively;

5> include sl-FailureList and set its fields as follows for each destination for which it reports the NR sidelink communication failure:

6> set sl-DestinationIdentity to the destination identity configured by upper layer for NR sidelink communication transmission;

6> if the sidelink RLF is detected as specified in sub-clause 5.8.9.3:

7> set sl-Failure as rlf for the associated destination for the NR sidelink communication transmission;

6> else if RRCReconfigurationFailureSidelink is received:

7> set sl-Failure as configFailure for the associated destination for the NR sidelink communication transmission;

1> if the UE initiates the procedure while connected to an E-UTRA PCell:

2> submit the SidelinkUEInformationNR to lower layers via SRB1, embedded in E-UTRA RRC message ULInformationTransferIRAT as specified in TS 36.331 [10], clause 5.6.28;

1> else:

2> submit the SidelinkUEInformationNR message to lower layers for transmission.

5.8.4 Void

5.8.5 Sidelink synchronisation information transmission for NR sidelink communication

5.8.5.1 General

![Diagram of synchronisation information transmission for NR sidelink communication](image)

*Figure 5.8.5.1-1: Synchronisation information transmission for NR sidelink communication, in (partial) coverage*
The purpose of this procedure is to provide synchronisation information to a UE.

### 5.8.5.2 Initiation

A UE capable of NR sidelink communication and SLSS/PSBCH transmission shall, when transmitting NR sidelink communication, and if the conditions for NR sidelink communication operation are met and when the following conditions are met:

1. if in coverage on the frequency used for NR sidelink communication, as defined in TS 38.304 [20]; and has selected GNSS or the cell as synchronization reference as defined in 5.8.6.3; or

2. if out of coverage on the frequency used for NR sidelink communication, and the frequency used to transmit NR sidelink communication is included in sl-FreqInfoToAddModList in sl-ConfigDedicatedNR within RRCReconfiguration message or included in sl-FreqInfoList within SIB12; and has selected GNSS or the cell as synchronization reference as defined in 5.8.6.3:

   1. if in RRC_CONNECTED; and if networkControlledSyncTx is configured and set to on; or

   2. if networkControlledSyncTx is not configured; and for the concerned frequency syncTxThreshIC is configured; and the RSRP measurement of the reference cell, selected as defined in 5.8.6.3, for NR sidelink communication transmission is below the value of syncTxThreshIC:

3. transmit sidelink SSB on the frequency used for NR sidelink communication in accordance with 5.8.5.3 and TS 38.211 [16], including the transmission of SLSS as specified in 5.8.5.3 and transmission of MasterInformationBlockSidelink as specified in 5.8.9.4.3;

1. else:

   2. for the frequency used for NR sidelink communication, if syncTxThreshOoC is included in SidelinkPreconfigNR; and the UE is not directly synchronized to GNSS, and the UE has no selected SyncRef UE or the PSBCH-RSRP measurement result of the selected SyncRef UE is below the value of syncTxThreshOoC; or

   2. for the frequency used for NR sidelink communication, if the UE selects GNSS as the synchronization reference source:

   3. transmit sidelink SSB on the frequency used for NR sidelink communication in accordance with TS 38.211 [16], including the transmission of SLSS as specified in 5.8.5.3 and transmission of MasterInformationBlockSidelink as specified in 5.8.9.4.3;

### 5.8.5.3 Transmission of SLSS

The UE shall select the SLSSID and the slot in which to transmit SLSS as follows:

1. if triggered by NR sidelink communication and in coverage on the frequency used for NR sidelink communication, as defined in TS 38.304 [20]; or

1. if triggered by NR sidelink communication, and out of coverage on the frequency used for NR sidelink communication, and the concerned frequency is included in sl-FreqInfoToAddModList in sl-ConfigDedicatedNR within RRCReconfiguration message or included in sl-FreqInfoList within SIB12:
2> if the UE has selected GNSS as synchronization reference in accordance with 5.8.6.2:

3> select SLSSID 0;
3> use $sl-$SSB-TimeAllocation1$ included in the entry of configured $sl-$SyncConfigList$ corresponding to the concerned frequency, that includes $txParameters$ and $gnss-Sync$;
3> select the slot(s) indicated by $sl-$SSB-TimeAllocation1$;

2> if the UE has selected a cell as synchronization reference in accordance with 5.8.6.2:

3> select the SLSSID included in the entry of configured $sl-$SyncConfigList$ corresponding to the concerned frequency, that includes $txParameters$ and does not include $gnss-Sync$;
3> select the slot(s) indicated by $sl-$SSB-TimeAllocation1$;

1> else if triggered by NR sidelink communication and the UE has GNSS as the synchronization reference:

2> select SLSSID 0;
2> if $sl-$SSB-TimeAllocation3$ is configured for the frequency used in $SidelinkPreconfigNR$:
3> select the slot(s) indicated by $sl-$SSB-TimeAllocation3$;
2> else:
3> select the slot(s) indicated by $sl-$SSB-TimeAllocation1$;

1> else:

2> select the synchronisation reference UE (i.e. SyncRef UE) as defined in 5.8.6;
2> if the UE has a selected SyncRef UE and $inCoverage$ in the $MasterInformationBlockSidelink$ message received from this UE is set to $true$; or
2> if the UE has a selected SyncRef UE and $inCoverage$ in the $MasterInformationBlockSidelink$ message received from this UE is set to $false$ while the SLSS from this UE is part of the set defined for out of coverage, see TS 38.211 [16]:

3> select the same SLSSID as the SLSSID of the selected SyncRef UE;
3> select the slot in which to transmit the SLSS according to the $sl-$SSB-TimeAllocation1$ or $sl-$SSB-TimeAllocation2$ included in the preconfigured sidelink parameters corresponding to the concerned frequency, such that the timing is different from the SLSS of the selected SyncRef UE;

2> else if the UE has a selected SyncRef UE and the SLSS from this UE was transmitted on the slot(s) indicated $sl-$SSB-TimeAllocation3$, which is configured for the frequency used in $SidelinkPreconfigNR$:

3> select SLSSID 337;
3> select the slot(s) indicated by $sl-$SSB-TimeAllocation2$;

2> else if the UE has a selected SyncRef UE:

3> select the SLSSID from the set defined for out of coverage having an index that is 336 more than the index of the SLSSID of the selected SyncRef UE, see TS 38.211 [16];
3> select the slot in which to transmit the SLSS according to $sl-$SSB-TimeAllocation1$ or $sl-$SSB-TimeAllocation2$ included in the preconfigured sidelink parameters corresponding to the concerned frequency, such that the timing is different from the SLSS of the selected SyncRef UE;

2> else (i.e. no SyncRef UE selected):

3> if the UE has not randomly selected an SLSSID:

4> randomly select, using a uniform distribution, an SLSSID from the set of sequences defined for out of coverage except SLSSID 336 and 337, see TS 38.211 [16];
4> select the slot in which to transmit the SLSS according to the \textit{sl-SSB-TimeAllocation1} or \textit{sl-SSB-TimeAllocation2} (arbitrary selection between these) included in the preconfigured sidelink parameters in \textit{SidelinkPreconfigNR} corresponding to the concerned frequency;

5.8.5a Sidelink synchronisation information transmission for V2X sidelink communication

5.8.5a.1 General

The purpose of this procedure is to provide synchronisation information to a UE.

5.8.5a.2 Initiation

A UE capable of V2X sidelink communication initiates the transmission of SLSS and \textit{MasterInformationBlock-SL-V2X} according to the conditions and the procedures specified for V2X sidelink communication in subclause 5.10.7 of TS 36.331 [10].

\textbf{NOTE 1:} When applying the procedure in this subclause, \textit{SIB13} and \textit{SIB14} correspond to \textit{SystemInformationBlockType21} and \textit{SystemInformationBlockType26} specified in TS 36.331 [10] respectively.

5.8.6 Sidelink synchronisation reference

5.8.6.1 General

The purpose of this procedure is to select a synchronisation reference and used when transmitting NR sidelink communication.

5.8.6.2 Selection and reselection of synchronisation reference

The UE shall:
1> if the frequency used for NR sidelink communication is included in sl-FreqInfoToAddModList in sl-ConfigDedicatedNR within RRCReconfiguration message or included in sl-ConfigCommonNR within SIB12, and sl-SyncPriority is configured for the concerned frequency and set to gnbEnb:

2> select a cell as the synchronization reference source as defined in 5.8.6.3;

1> else if the frequency used for NR sidelink communication is included in sl-FreqInfoToAddModList in sl-ConfigDedicatedNR within RRCReconfiguration message or included in sl-ConfigCommonNR within SIB12, and sl-SyncPriority for the concerned frequency is not configured or is set to gnss, and GNSS is reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14]:

2> select GNSS as the synchronization reference source;

1> else if the frequency used for NR sidelink communication is included in PreconfigurationNR, and sl-SyncPriority in SidelinkPreconfigNR is set to gnss and GNSS is reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14]:

2> select GNSS as the synchronization reference source;

1> else:

2> perform a full search (i.e. covering all subframes and all possible SLSSIDs) to detect candidate SLSS, in accordance with TS 38.133 [14]

2> when evaluating the one or more detected SLSSIDs, apply layer 3 filtering as specified in 5.5.3.2 using the preconfigured sl-filterCoefficient, before using the PSBCH-RSRP measurement results;

2> if the UE has selected a SyncRef UE:

3> if the PSBCH-RSRP of the strongest candidate SyncRef UE exceeds the minimum requirement TS 38.133 [14] by sl-SyncRefMinHyst and the strongest candidate SyncRef UE belongs to the same priority group as the current SyncRef UE and the PSBCH-RSRP of the strongest candidate SyncRef UE exceeds the PSBCH-RSRP of the current SyncRef UE by syncRefDiffHyst; or

3> if the PSBCH-RSRP of the candidate SyncRef UE exceeds the minimum requirement TS 38.133 [14] by sl-SyncRefMinHyst and the candidate SyncRef UE belongs to a higher priority group than the current SyncRef UE; or

3> if GNSS becomes reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14], and GNSS belongs to a higher priority group than the current SyncRef UE; or

3> if a cell is detected and gNB/eNB (if sl-NbAsSync is set to true) belongs to a higher priority group than the current SyncRef UE; or

3> if the PSBCH-RSRP of the current SyncRef UE is less than the minimum requirement defined in TS 38.133 [14]:

4> consider no SyncRef UE to be selected;

2> if the UE has selected GNSS as the synchronization reference for NR sidelink communication:

3> if the PSBCH-RSRP of the candidate SyncRef UE exceeds the minimum requirement defined in TS 38.133 [14] by sl-SyncRefMinHyst and the candidate SyncRef UE belongs to a higher priority group than GNSS; or

3> if GNSS becomes not reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14]:

4> consider GNSS not to be selected;

2> if the UE has selected cell as the synchronization reference for NR sidelink communication:

3> if the PSBCH-RSRP of the candidate SyncRef UE exceeds the minimum requirement defined in TS 38.133 [14] by sl-SyncRefMinHyst and the candidate SyncRef UE belongs to a higher priority group than gNB/eNB; or

3> if the selected cell is not detected:
4> consider the cell not to be selected;

2> if the UE has not selected any synchronization reference:

3> if the UE detects one or more SLSSIDs for which the PSBCH-RSRP exceeds the minimum requirement defined in TS 38.133 [14] by sl-SyncRefMinHyst and for which the UE received the corresponding MasterInformationBlockSidelink message (candidate SyncRef UEs), or if the UE detects GNSS that is reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14], or if the UE detects a cell, select a synchronization reference according to the following priority group order:

4> if sl-SyncPriority corresponding to the concerned frequency is set to gnbEnb:

5> UEs of which SLSSID is part of the set defined for in coverage, and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to true, starting with the UE with the highest PSBCH-RSRP result (priority group 1);

5> UE of which SLSSID is part of the set defined for in coverage, and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to false, starting with the UE with the highest PSBCH-RSRP result (priority group 2);

5> GNSS that is reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14] (priority group 3);

5> UEs of which SLSSID is 0, and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to true, or of which SLSSID is 0 and SLSS is transmitted on slot(s) indicated by sl-SSB-TimeAllocation3, starting with the UE with the highest PSBCH-RSRP result (priority group 4);

5> UEs of which SLSSID is 0 and SLSS is not transmitted on slot(s) indicated by sl-SSB-TimeAllocation3, and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to false, starting with the UE with the highest PSBCH-RSRP result (priority group 5);

5> UEs of which SLSSID is 337 and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to false, starting with the UE with the highest PSBCH-RSRP result (priority group 5);

5> Other UEs, starting with the UE with the highest PSBCH-RSRP result (priority group 6);

4> if sl-SyncPriority corresponding to the concerned frequency is set to gnss, and sl-NbAsSync is set to true:

5> UEs of which SLSSID is 0, and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to true, or of which SLSSID is 0 and SLSS is transmitted on slot(s) indicated by sl-SSB-TimeAllocation3, starting with the UE with the highest PSBCH-RSRP result (priority group 1);

5> UEs of which SLSSID is 0 and SLSS is not transmitted on slot(s) indicated by sl-SSB-TimeAllocation3, and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to false, starting with the UE with the highest PSBCHS-RSRP result (priority group 2);

5> UEs of which SLSSID is 337 and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to false, starting with the UE with the highest PSBCH-RSRP result (priority group 2);

5> the cell detected by the UE as defined in 5.8.6.3 (priority group 3);

5> UEs of which SLSSID is part of the set defined for in coverage, and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to true, starting with the UE with the highest PSBCH-RSRP result (priority group 4);

5> UE of which SLSSID is part of the set defined for in coverage, and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to false, starting with the UE with the highest PSBCH-RSRP result (priority group 5);

5> Other UEs, starting with the UE with the highest S-RSRP result (priority group 6);
4> if sl-SyncPriority corresponding to the concerned frequency is set to gnss, and sl-NbAsSync is set to false:

5> UEs of which SLSSID is 0, and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to true, or of which SLSSID is 0 and SLSS is transmitted on slot(s) indicated by sl-SSB-TimeAllocation3, starting with the UE with the highest PSBCH-RSRP result (priority group 1);

5> UEs of which SLSSID is 0 and SLSS is not transmitted on slot(s) indicated by sl-SSB-TimeAllocation3, and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to false, starting with the UE with the highest PSBCHS-RSRP result (priority group 2);

5> UEs of which SLSSID is 337 and inCoverage, included in the MasterInformationBlockSidelink message received from this UE, is set to false, starting with the UE with the highest PSBCH-RSRP result (priority group 2);

5> Other UEs, starting with the UE with the highest PSBCH-RSRP result (priority group 3);

NOTE: How the UE achieves subframe boundary alignment between V2X sidelink communication and NR sidelink communication (if both are performed by the UE) is as specified in TS 38.213, clause 16.7.

5.8.6.3 Sidelink communication transmission reference cell selection

A UE capable of NR sidelink communication that is configured by upper layers to transmit NR sidelink communication shall:

1> for the frequency used to transmit NR sidelink communication, select a cell to be used as reference for synchronization in accordance with the following:

2> if the frequency concerns the primary frequency:

3> use the PCell or the serving cell as reference;

2> else if the frequency concerns a secondary frequency:

3> use the concerned SCell as reference;

2> else if the UE is in coverage of the concerned frequency:

3> use the DL frequency paired with the one used to transmit NR sidelink communication as reference;

2> else (i.e., out of coverage on the concerned frequency):

3> use the PCell or the serving cell as reference, if needed;

5.8.7 Sidelink communication reception

A UE capable of NR sidelink communication that is configured by upper layers to receive NR sidelink communication shall:

1> if the conditions for NR sidelink communication operation as defined in 5.8.2 are met:

2> if the frequency used for NR sidelink communication is included in sl-FreqInfoToAddModList in RRCReconfiguration message or sl-FreqInfoList included in SIB12:

3> if the UE is configured with sl-RxPool included in RRCReconfiguration message with reconfigwithSync (i.e. handover):

4> configure lower layers to monitor sidelink control information and the corresponding data using the pool of resources indicated by sl-RxPool;

3> else if the cell chosen for NR sidelink communication transmission provides SIB12:
4> configure lower layers to monitor sidelink control information and the corresponding data using the pool of resources indicated by sl-RxPool in SIB12;

2> else:

3> configure lower layers to monitor sidelink control information and the corresponding data using the pool of resources that were preconfigured by sl-RxPool in SL-PreconfigurationNR, as defined in sub-clause 9.3;

5.8.8 Sidelink communication transmission

A UE capable of NR sidelink communication that is configured by upper layers to transmit NR sidelink communication and has related data to be transmitted shall:

1> if the conditions for NR sidelink communication operation as defined in 5.8.2 are met:

2> if the frequency used for NR sidelink communication is included in sl-FreqInfoToAddModList in sl-ConfigDedicatedNR within RRCReconfiguration message or included in sl-ConfigCommonNR within SIB12:

3> if the UE is in RRC_CONNECTED and uses the frequency included in sl-ConfigDedicatedNR within RRCReconfiguration message:

4> if the UE is configured with sl-ScheduledConfig:

5> if T310 for MCG or T311 is running; and if sl-TxPoolExceptional is included in sl-FreqInfoList for the concerned frequency in SIB12 or included in sl-ConfigDedicatedNR in RRCReconfiguration; or

5> if T316 is running; and if sl-TxPoolExceptional is included in sl-FreqInfoList for the concerned frequency in SIB12 or included in sl-ConfigDedicatedNR in RRCReconfiguration; or

5> if T301 is running and the cell on which the UE initiated RRC connection re-establishment provides SIB12 including sl-TxPoolExceptional for the concerned frequency; or

5> if T304 for MCG is running and the UE is configured with sl-TxPoolExceptional included in sl-ConfigDedicatedNR for the concerned frequency in RRCReconfiguration:

6> configure lower layers to perform the sidelink resource allocation mode 2 based on random selection using the pool of resources indicated by sl-TxPoolExceptional as defined in TS 38.321 [3];

5> else:

6> configure lower layers to perform the sidelink resource allocation mode 1 for NR sidelink communication;

5> if T311 is running, configure the lower layers to release the resources indicated by rrc-ConfiguredSidetlinkGrant (if any);

4> if the UE is configured with sl-UE-SelectedConfig:

5> if a result of sensing on the resources configured in sl-TxPoolSelectedNormal for the concerned frequency included in sl-ConfigDedicatedNR within RRCReconfiguration is not available in accordance with TS 38.214 [19];

6> if sl-TxPoolExceptional for the concerned frequency is included in RRCReconfiguration; or

6> if the PCell provides SIB12 including sl-TxPoolExceptional in sl-FreqInfoList for the concerned frequency:

7> configure lower layers to perform the sidelink resource allocation mode 2 based on random selection using the pool of resources indicated by sl-TxPoolExceptional as defined in TS 38.321 [3];
else, if the sl-TxPoolSelectedNormal for the concerned frequency is included in the sl-ConfigDedicatedNR within RRCReconfiguration:

configure lower layers to perform the sidelink resource allocation mode 2 based on sensing (as defined in TS 38.321 [3] and TS 38.214 [19]) using the resource pools indicated by sl-TxPoolSelectedNormal for the concerned frequency;

else:

if the cell chosen for NR sidelink communication transmission provides SIB12:

if SIB12 includes sl-TxPoolSelectedNormal for the concerned frequency, and a result of sensing on the resources configured in the sl-TxPoolSelectedNormal is available in accordance with TS 38.214 [19]

configure lower layers to perform the sidelink resource allocation mode 2 based on sensing using the pool of resources indicated by sl-TxPoolSelectedNormal for the concerned frequency as defined in TS 38.321 [3];

else if SIB12 includes sl-TxPoolExceptional for the concerned frequency:

from the moment the UE initiates RRC connection establishment or RRC connection resume, until receiving an RRCReconfiguration including sl-ConfigDedicatedNR, or receiving an RRCRelease or an RRCReject; or

if a result of sensing on the resources configured in sl-TxPoolSelectedNormal for the concerned frequency in SIB12 is not available in accordance with TS 38.214 [19]:

configure lower layers to perform the sidelink resource allocation mode 2 based on random selection (as defined in TS 38.321 [3] and TS 38.214 [19]) using one of the resource pools indicated by sl-TxPoolExceptional for the concerned frequency;

else:

configure lower layers to perform the sidelink resource allocation mode 2 based on sensing (as defined in TS 38.321 [3] and TS 38.213 [13]) using the resource pool indicated by sl-TxPoolSelectedNormal in SidelinkPreconfigNR for the concerned frequency.

The UE capable of NR sidelink communication that is configured by upper layers to transmit NR sidelink communication shall perform sensing on all pools of resources which may be used for transmission of the sidelink control information and the corresponding data. The pools of resources are indicated by SidelinkPreconfigNR, sl-TxPoolSelectedNormal in sl-ConfigDedicatedNR, or sl-TxPoolSelectedNormal in SIB12 for the concerned frequency, as configured above.
5.8.9 Sidelink RRC procedure

5.8.9.1 Sidelink RRC reconfiguration

5.8.9.1.1 General

The purpose of this procedure is to modify a PC5-RRC connection, e.g. to establish/modify/release sidelink DRBs, to configure NR sidelink measurement and reporting, to configure sidelink CSI reference signal resources and CSI reporting latency bound.

The UE may initiate the sidelink RRC reconfiguration procedure and perform the operation in sub-clause 5.8.9.1.2 on the corresponding PC5-RRC connection in following cases:

- the release of sidelink DRBs associated with the peer UE, as specified in sub-clause 5.8.9.1a.1;
- the establishment of sidelink DRBs associated with the peer UE, as specified in sub-clause 5.8.9.1a.2;
- the modification for the parameters included in SLRB-Config of sidelink DRBs associated with the peer UE, as specified in sub-clause 5.8.9.1a.2;
- the configuration of the peer UE to perform NR sidelink measurement and report.
- the configuration of the sidelink CSI reference signal resources and CSI reporting latency bound.

In RRC_CONNECTED, the UE applies the NR sidelink communications parameters provided in RRCReconfiguration (if any). In RRC_IDLE or RRC_INACTIVE, the UE applies the NR sidelink communications parameters provided in system information (if any). For other cases, UEs apply the NR sidelink communications parameters provided in SidelinkPreconfigNR (if any). When UE performs state transition between above three cases, the UE applies the NR sidelink communications parameters provided in the new state, after acquisition of the new configurations. Before acquisition of the new configurations, UE continues applying the NR sidelink communications parameters provided in the old state.

5.8.9.1.2 Actions related to transmission of RRCReconfigurationSidelink message

The UE shall set the contents of RRCReconfigurationSidelink message as follows:

- the release of sidelink DRBs associated with the peer UE, as specified in sub-clause 5.8.9.1a.1;
- the establishment of sidelink DRBs associated with the peer UE, as specified in sub-clause 5.8.9.1a.2;
- the modification for the parameters included in SLRB-Config of sidelink DRBs associated with the peer UE, as specified in sub-clause 5.8.9.1a.2;
- the configuration of the peer UE to perform NR sidelink measurement and report.
- the configuration of the sidelink CSI reference signal resources and CSI reporting latency bound.
for each sidelink DRB that is to be released, according to sub-clause 5.8.9.1a.1.1, due to configuration by sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR or by upper layers:

2> set the SLRB-PC5-ConfigIndex included in the slrb-ConfigToReleaseList corresponding to the sidelink DRB;

for each sidelink DRB that is to be established or modified, according to sub-clause 5.8.9.1a.2.1, due to receiving sl-ConfigDedicatedNR, SIB12 or SidelinkPreconfigNR:

2> set the SLRB-Config included in the slrb-ConfigToAddModList, according to the received sl-RadioBearerConfig and sl-RLC-BearerConfig corresponding to the sidelink DRB;

set the sl-MeasConfig as follows:

2> If the frequency used for NR sidelink communication is included in sl-FreqInfoToAddModList in sl-ConfigDedicatedNR within RRCReconfiguration message or included in sl-ConfigCommonNR within SIB12:

3> if UE is in RRC_CONNECTED:

4> set the sl-MeasConfig according to stored NR sidelink measurement configuration information for this destination;

3> if UE is in RRC_IDLE or RRC_INACTIVE:

4> set the sl-MeasConfig according to stored NR sidelink measurement received from SIB12;

2> else:

3> set the sl-MeasConfig according to the sl-MeasPreconfig in SidelinkPreconfigNR;

start timer T400 for the destination associated with the sidelink DRB;

set the sl-CSI-RS-Config;

set the sl-LatencyBoundCSI-Report;

NOTE 1: How to set the parameters included in sl-CSI-RS-Config and sl-LatencyBoundCSI-Report is up to UE implementation.

The UE shall submit the RRCReconfigurationSidelink message to lower layers for transmission.

5.8.9.1.3 Reception of an RRCReconfigurationSidelink by the UE

The UE shall perform the following actions upon reception of the RRCReconfigurationSidelink:

1> if the RRCReconfigurationSidelink includes the sl-ResetConfig:

2> perform the sidelink reset configuration procedure as specified in 5.8.9.1.10;

1> if the RRCReconfigurationSidelink includes the slrb-ConfigToReleaseList:

2> for each SLRB-PC5-ConfigIndex value included in the slrb-ConfigToReleaseList that is part of the current UE sidelink configuration;

3> perform the sidelink DRB release procedure, according to sub-clause 5.8.9.1a.1;

1> if the RRCReconfigurationSidelink includes the slrb-ConfigToAddModList:

2> for each slrb-PC5-ConfigIndex value included in the slrb-ConfigToAddModList that is not part of the current UE sidelink configuration:

3> if sl-MappedQoS-FlowsToAddList is included:

4> apply the SL-PQFI included in sl-MappedQoS-FlowsToAddList;

3> perform the sidelink DRB addition procedure, according to sub-clause 5.8.9.1a.2;
for each $slrb-PC5-ConfigIndex$ value included in the $slrb-ConfigToAddModList$ that is part of the current UE sidelink configuration:

3> if $sl-MappedQoS-FlowsToAddList$ is included:
   4> add the $SL-PQFI$ included in $sl-MappedQoS-FlowsToAddList$ to the corresponding sidelink DRB;

3> if $sl-MappedQoS-FlowsToReleaseList$ is included:
   4> remove the $SL-PQFI$ included in $sl-MappedQoS-FlowsToReleaseList$ from the corresponding sidelink DRB;

3> if the sidelink DRB release conditions as described in sub-clause 5.8.9.1a.1.1 are met:
   4> perform the sidelink DRB release procedure according to sub-clause 5.8.9.1a.1.2;

3> else if the sidelink DRB modification conditions as described in sub-clause 5.8.9.1a.2.1 are met:
   4> perform the sidelink DRB modification procedure according to sub-clause 5.8.9.1a.2.2;

1> if the $RRCReconfigurationSidelink$ message includes the $sl-MeasConfig$:

   2> perform the sidelink measurement configuration procedure as specified in 5.8.10;

1> if the $RRCReconfigurationSidelink$ message includes the $sl-CSI-RS-Config$:

   2> apply the sidelink CSI-RS configuration;

1> if the $RRCReconfigurationSidelink$ message includes the $sl-LatencyBoundCSI-Report$:

   2> apply the configured sidelink CSI report latency bound;

1> if the UE is unable to comply with (part of) the configuration included in the $RRCReconfigurationSidelink$ (i.e. sidelink RRC reconfiguration failure):

   2> continue using the configuration used prior to the reception of the $RRCReconfigurationSidelink$ message;

   2> set the content of the $RRCReconfigurationFailureSidelink$ message;

   3> submit the $RRCReconfigurationFailureSidelink$ message to lower layers for transmission;

1> else:

   2> set the content of the $RRCReconfigurationCompleteSidelink$ message;

   3> submit the $RRCReconfigurationCompleteSidelink$ message to lower layers for transmission;

NOTE 1: When the same logical channel is configured with different RLC mode by another UE, the UE handles the case as sidelink RRC reconfiguration failure.

5.8.9.1.4 Void
5.8.9.1.5 Void
5.8.9.1.6 Void
5.8.9.1.7 Void
5.8.9.1.8 Reception of an $RRCReconfigurationFailureSidelink$ by the UE

The UE shall perform the following actions upon reception of the $RRCReconfigurationFailureSidelink$:

1> stop timer T400, if running;

1> continue using the configuration used prior to corresponding $RRCReconfigurationSidelink$ message;
if UE is in RRC_CONNECTED:

1> perform the sidelink UE information for NR sidelink communication procedure, as specified in 5.8.3.3 or sub-clause 5.10.15 in TS 36.331 [10];

5.8.9.1.9 Reception of an RRCReconfigurationCompleteSidelink by the UE

The UE shall perform the following actions upon reception of the RRCReconfigurationCompleteSidelink:

1> stop timer T400, if running;

1> consider the configurations in the corresponding RRCReconfigurationSidelink message to be applied.

5.8.9.1.10 Sidelink reset configuration

The UE shall:

1> release/clear all current sidelink radio configuration of this destination;

1> release the sidelink DRBs of this destination, in accordance to sub-clause 5.8.9.1a.1;

1> reset the sidelink specific MAC of this destination.

NOTE: Sidelink radio configuration is not just the resource configuration but may include other configurations included in the RRCReconfigurationSidelink message except the sidelink DRBs of this destination.

5.8.9.1a Sidelink radio bearer management

5.8.9.1a.1 Sidelink DRB release

5.8.9.1a.1.1 Sidelink DRB release conditions

For NR sidelink communication, a sidelink DRB release is initiated in the following cases:

1> for groupcast, broadcast and unicast, if slrb-Uu-ConfigIndex (if any) of the sidelink DRB is included in sl-RadioBearerToReleaseList in sl-ConfigDedicatedNR; or

1> for groupcast and broadcast, if no sidelink QoS flow with data indicated by upper layers is mapped to the sidelink DRB for transmission, which is (re)configured by receiving SIB12 or SidelinkPreconfigNR; or

1> for unicast, if no sidelink QoS flow with data indicated by upper layers is mapped to the sidelink DRB for transmission, which is (re)configured by receiving SIB12 or SidelinkPreconfigNR, and if no sidelink QoS flow mapped to the sidelink DRB, which is (re)configured by receiving RRCReconfigurationSidelink, has data; or

1> for unicast, if SLRB-PC5-ConfigIndex (if any) of the sidelink DRB is included in slrb-ConfigToReleaseList in RRCReconfigurationSidelink or if sl-ResetConfig is included in RRCReconfigurationSidelink;

1> for unicast, when the corresponding PC5-RRC connection is released due to sidelink RLF being detected, according to clause 5.8.9.3.

5.8.9.1a.1.2 Sidelink DRB release operations

For each sidelink DRB, whose sidelink DRB release conditions are met as in sub-clause 5.8.9.1a.1.1, the UE capable of NR sidelink communication that is configured by upper layers to perform NR sidelink communication shall:

1> for groupcast and broadcast; or

1> for unicast, if the sidelink DRB release was triggered after the reception of the RRCReconfigurationSidelink message; or

1> for unicast, after receiving the RRCReconfigurationCompleteSidelink message, if the sidelink DRB release was triggered due to the configuration received within the sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR or indicated by upper layers:
2> release the PDCP entity for NR sidelink communication associated with the sidelink DRB;

2> if SDAP entity for NR sidelink communication associated with this sidelink DRB is configured:

3> indicate the release of the sidelink DRB to the SDAP entity associated with this sidelink DRB (TS 37.324 [24], clause 5.3.3);

2> release SDAP entities for NR sidelink communication, if any, that have no associated sidelink DRB as specified in TS 37.324 [24] clause 5.1.2;

1> for groupcast and broadcast; or

1> for unicast, after receiving the \textit{RRCReconfigurationCompleteSidelink} message, if the sidelink DRB release was triggered due to the configuration received within the \textit{sl-ConfigDedicatedNR}:

2> for each \textit{sl-RLC-BearerConfigIndex} included in the received \textit{sl-RLC-BearerToReleaseList} that is part of the current UE sidelink configuration:

3> release the RLC entity and the corresponding logical channel for NR sidelink communication, associated with the \textit{sl-RLC-BearerConfigIndex}.

1> for unicast, if the sidelink DRB release was triggered due to the reception of the \textit{RRCReconfigurationSidetlink} message; or

1> for unicast, after receiving the \textit{RRCReconfigurationCompleteSidelink} message, if the sidelink DRB release was triggered due to the configuration received within the \textit{SIB12, SidelinkPreconfigNR} or indicated by upper layers:

2> release the RLC entity and the corresponding logical channel for NR sidelink communication associated with the sidelink DRB;

2> perform the sidelink UE information procedure in sub-clause 5.8.3 for unicast if needed.

\subsection*{5.8.9.1a.2 Sidelink DRB addition/modification}

\subsubsection*{5.8.9.1a.2.1 Sidelink DRB addition/modification conditions}

For NR sidelink communication, a sidelink DRB addition is initiated only in the following cases:

1> if any sidelink QoS flow is (re)configured by \textit{sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR} and is to be mapped to one sidelink DRB, which is not established; or

1> if any sidelink QoS flow is (re)configured by \textit{RRCReconfigurationSidetlink} and is to be mapped to a sidelink DRB, which is not established;

For NR sidelink communication, a sidelink DRB modification is initiated only in the following cases:

1> if any of the sidelink DRB related parameters is changed by \textit{sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR} or \textit{RRCReconfigurationSidetlink} for one sidelink DRB, which is established;

\subsubsection*{5.8.9.1a.2.2 Sidelink DRB addition/modification operations}

For the sidelink DRB, whose sidelink DRB addition conditions are met as in sub-clause 5.8.9.1a.2.1, the UE capable of NR sidelink communication that is configured by upper layers to perform NR sidelink communication shall:

1> for groupcast and broadcast; or

1> for unicast, if the sidelink DRB addition was triggered due to the reception of the \textit{RRCReconfigurationSidetlink} message; or

1> for unicast, after receiving the \textit{RRCReconfigurationCompleteSidelink} message, if the sidelink DRB addition was triggered due to the configuration received within the \textit{sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR} or indicated by upper layers:

2> if an SDAP entity for NR sidelink communication associated with the destination and the cast type of the sidelink DRB does not exist:
3> establish an SDAP entity for NR sidelink communication as specified in TS 37.324 [24] clause 5.1.1;

2> (re)configure the SDAP entity in accordance with the sl-SDAP-ConfigPC5 received in the RRCReconfigurationSidelink or sl-SDAP-Config received in sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR, associated with the sidelink DRB;

2> establish a PDCP entity for NR sidelink communication and configure it in accordance with the sl-PDCP-ConfigPC5 received in the RRCReconfigurationSidelink or sl-PDCP-Config received in sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR, associated with the sidelink DRB;

2> establish a RLC entity for NR sidelink communication and configure it in accordance with the sl-RLC-ConfigPC5 received in the RRCReconfigurationSidelink or sl-RLC-Config received in sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR, associated with sidelink DRB;

2> if this procedure was due to the reception of a RRCReconfigurationSidelink message:

3> configure the MAC entity with a logical channel in accordance with the sl-MAC-LogicalChannelConfigPC5 received in the RRCReconfigurationSidelink associated with the sidelink DRB, and perform the sidelink UE information procedure in sub-clause 5.8.3 for unicast if need;

2> else:

3> configure the MAC entity with a logical channel associated with the sidelink DRB, by assigning a new logical channel identity, in accordance with the sl-MAC-LogicalChannelConfig received in the sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR.

NOTE 1: When a sidelink DRB addition is due to the configuration by RRCReconfigurationSidelink, it is up to UE implementation to select the sidelink DRB configuration as necessary transmitting parameters for the sidelink DRB, from the received sl-ConfigDedicatedNR (if in RRC_CONNECTED), SIB12 (if in RRC_IDLE/INACTIVE), SidelinkPreconfigNR (if out of coverage) with the same RLC mode as the one configured in RRCReconfigurationSidelink.

For the sidelink DRB, whose sidelink DRB modification conditions are met as in sub-clause 5.8.9.1a.2.1, the UE capable of NR sidelink communication that is configured by upper layers to perform NR sidelink communication shall:

1> for groupcast and broadcast; or

1> for unicast, if the sidelink DRB modification was triggered due to the reception of the RRCReconfigurationSidelink message; or

1> for unicast, after receiving the RRCReconfigurationCompleteSidelink message, if the sidelink DRB modification was triggered due to the configuration received within the sl-ConfigDedicatedNR, SIB12 or SidelinkPreconfigNR:

2> reconfigure the SDAP entity of the sidelink DRB, in accordance with the sl-SDAP-ConfigPC5 received in the RRCReconfigurationSidelink or sl-SDAP-Config received in sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR, if included;

2> reconfigure the PDCP entity of the sidelink DRB, in accordance with the sl-PDCP-ConfigPC5 received in the RRCReconfigurationSidelink or sl-PDCP-Config received in sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR, if included;

2> reconfigure the RLC entity of the sidelink DRB, in accordance with the sl-RLC-ConfigPC5 received in the RRCReconfigurationSidelink or sl-RLC-Config received in sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR, if included;

2> reconfigure the logical channel of the sidelink DRB, in accordance with the sl-MAC-LogicalChannelConfigPC5 received in the RRCReconfigurationSidelink or sl-MAC-LogicalChannelConfig received in sl-ConfigDedicatedNR, SIB12, SidelinkPreconfigNR, if included.

5.8.9.1a.3 Sidelink SRB release

The UE shall:

1> if a PC5-RRC connection release for a specific destination is requested by upper layers; or
1> if the sidelink radio link failure is detected for a specific destination:
   2> release the PDCP entity, RLC entity and the logical channel of the sidelink SRB for PC5-RRC message of
     the specific destination;
   2> consider the PC5-RRC connection is released for the destination.
1> if PC5-S transmission for a specific destination is terminated in upper layers:
   2> release the PDCP entity, RLC entity and the logical channel of the sidelink SRB(s) for PC5-S message of the
     specific destination;

5.8.9.1a.4 Sidelink SRB addition

The UE shall:
1> if transmission of PC5-S message for a specific destination is requested by upper layers for sidelink SRB:
   2> establish PDCP entity, RLC entity and the logical channel of a sidelink SRB for PC5-S message, as specified
      in sub-clause 9.1.1.4;
1> if a PC5-RRC connection establishment for a specific destination is indicated by upper layers:
   2> establish PDCP entity, RLC entity and the logical channel of a sidelink SRB for PC5-RRC message of the
      specific destination, as specified in sub-clause 9.1.1.4;
   2> consider the PC5-RRC connection is established for the destination.

5.8.9.2 Sidelink UE capability transfer

5.8.9.2.1 General

This clause describes how the UE compiles and transfers its sidelink UE capability information for unicast to the
initiating UE.

![Diagram of Sidelink UE capability transfer]

Figure 5.8.9.2.1-1: Sidelink UE capability transfer

5.8.9.2.2 Initiation

The UE may initiate the sidelink UE capability transfer procedure upon indication from upper layer when it needs
(additional) UE radio access capability information.

5.8.9.2.3 Actions related to transmission of the $UECapabilityEnquirySidelink$ by the UE

The initiating UE shall set the contents of $UECapabilityEnquirySidelink$ message as follows:

1> include in UE radio access capabilities for sidelink within $ue-CapabilityInformationSidelink$, if needed;

NOTE 1: It is up to initiating UE to decide whether $ue-CapabilityInformationSidelink$ should be included.

1> set $frequencyBandListFilterSidelink$ to include frequency bands for which the peer UE is requested to provide
   supported bands and band combinations;
NOTE 2: The initiating UE is not allowed to send the `UECapabilityEnquirySidelink` message without including the field `frequencyBandListFilterSidelink`.

1> submit the `UECapabilityEnquirySidelink` message to lower layers for transmission.

### 5.8.9.2.4 Actions related to reception of the `UECapabilityEnquirySidelink` by the UE

The peer UE shall set the contents of `UECapabilityInformationSidelink` message as follows:

1> include UE radio access capabilities for sidelink within `ue-CapabilityInformationSidelink`;

1> compile a list of "candidate band combinations" only consisting of bands included in `frequencyBandListFilter`, and prioritized in the order of `frequencyBandListFilterSidelink` (i.e. first include band combinations containing the first-listed band, then include remaining band combinations containing the second-listed band, and so on).

1> include into `supportedBandCombinationListSidelinkNR` as many band combinations as possible from the list of "candidate band combinations", starting from the first entry;

1> include the received `frequencyBandListFilter` in the field `appliedFreqBandListFilter` of the requested UE capability;

1> submit the `UECapabilityInformationSidelink` message to lower layers for transmission.

NOTE: If the UE cannot include all band combinations due to message size or list size constraints, it is up to UE implementation which band combinations it prioritizes.

### 5.8.9.3 Sidelink radio link failure related actions

The UE shall:

1> upon indication from sidelink RLC entity that the maximum number of retransmissions for a specific destination has been reached; or

1> upon T400 expiry for a specific destination; or

1> upon indication from sidelink MAC entity that the maximum number of consecutive HARQ DTX for a specific destination has been reached; or

1> upon integrity check failure indication from sidelink PDCP entity concerning SL-SRB2 or SL-SRB3 for a specific destination:

2> consider sidelink radio link failure to be detected for this destination;

2> release the DRBs of this destination, in according to sub-clause 5.8.9.1a.1;

2> release the SRBs of this destination, in according to sub-clause 5.8.9.1a.3;

2> discard the NR sidelink communication related configuration of this destination;

2> reset the sidelink specific MAC of this destination;

2> consider the PC5-RRC connection is released for the destination;

2> indicate the release of the PC5-RRC connection to the upper layers for this destination (i.e. PC5 is unavailable);

2> if UE is in RRC_CONNECTED:

3> perform the sidelink UE information for NR sidelink communication procedure, as specified in 5.8.3.3;

NOTE: It is up to UE implementation on whether and how to indicate to upper layers to maintain the keep-alive procedure [55].
5.8.9.4 Sidelink common control information

5.8.9.4.1 General

The sidelink common control information is carried by MasterInformationBlockSidelink. The sidelink common control information may change at any transmission, i.e. neither a modification period nor a change notification mechanism is used.

A UE configured to receive or transmit NR sidelink communication shall:

1> if the UE has a selected SyncRef UE, as specified in 5.8.6:

2> ensure having a valid version of the MasterInformationBlockSidelink message of that SyncRef UE;

5.8.9.4.2 Actions related to reception of MasterInformationBlockSidelink message

Upon receiving MasterInformationBlockSidelink, the UE shall:

1> apply the values included in the received MasterInformationBlockSidelink message.

5.8.9.4.3 Transmission of MasterInformationBlockSidelink message

The UE shall set the contents of the MasterInformationBlockSidelink message as follows:

1> if in coverage on the frequency used for the NR sidelink communication as defined in TS 38.304 [20].

2> set inCoverage to true;

2> if tdd-UL-DL-ConfigurationCommon is included in the received SIB1:

3> set sl-TDD-Config to the value representing the same meaning as that is included in tdd-UL-DL-ConfigurationCommon, as described in TS 38.213, clause 16.1 [13];

2> else:

3> set sl-TDD-Config to the value as specified in TS 38.213 [13], clause 16.1;

2> if syncInfoReserved is included in an entry of configured sl-SyncConfigList corresponding to the concerned frequency from the received SIB12:

3> set reservedBits to the value of syncInfoReserved in the received SIB12;

2> else:

3> set all bits in reservedBits to 0;

1> else if out of coverage on the frequency used for NR sidelink communication as defined in TS 38.304 [20] and the concerned frequency is included in sl-FreqInfoToAddModList in RRCReconfiguration or in sl-FreqInfoList within SIB12, or the UE selects GNSS timing as the synchronization reference source:

2> set inCoverage to true;

2> set reservedBits to the value of the corresponding field included in the preconfigured sidelink parameters (i.e. sl-PreconfigGeneral in SidelinkPreconfigNR defined in 9.3);

2> set sl-TDD-Config to the value representing the same meaning as that is included in the corresponding field included in the preconfigured sidelink parameters (i.e. sl-PreconfigGeneral in SL-PreconfigurationNR defined in 9.3) as described in TS 38.213, clause 16.1 [13];

1> else if out of coverage on the frequency used for NR sidelink communication as defined in TS 38.304 [20] and the UE selects GNSS as the synchronization reference and sl-SSB-TimeAllocation3 is not configured for the frequency used in SidelinkPreconfigNR:

2> set inCoverage to true;
2> set reservedBits to the value of the corresponding field included in the preconfigured sidelink parameters (i.e. sl-PreconfigGeneral in SidelinkPreconfigNR defined in 9.3);

2> set sl-TDD-Config to the value representing the same meaning as that is included in the corresponding field included in the preconfigured sidelink parameters (i.e. sl-PreconfigGeneral in SL-PreconfigurationNR defined in 9.3) as described in TS 38.213, clause 16.1 [13];

1> else if the UE has a selected SyncRef UE (as defined in 5.8.6):

2> set inCoverage to false;

2> set sl-TDD-Config and reservedBits to the value of the corresponding field included in the received MasterInformationBlockSidelink;

1> else:

2> set inCoverage to false;

2> set reservedBits to the value of the corresponding field included in the preconfigured sidelink parameters (i.e. sl-PreconfigGeneral in SidelinkPreconfigNR defined in 9.3);

2> set sl-TDD-Config to the value representing the same meaning as that is included in the corresponding field included in the preconfigured sidelink parameters (i.e. sl-PreconfigGeneral in SL-PreconfigurationNR defined in 9.3) as described in TS 38.213, clause 16.1 [13];

1> set directFrameNumber and slotIndex according to the slot used to transmit the SLSS, as specified in 5.8.5.3;

1> submit the MasterInformationBlockSidelink to lower layers for transmission upon which the procedure ends;

5.8.9.5 Actions related to PC5-RRC connection release requested by upper layers

The UE shall:

1> if the PC5-RRC connection release for the specific destination is requested by upper layers:

2> discard the NR sidelink communication related configuration of this destination;

2> release the DRBs of this destination, in according to sub-clause 5.8.9.1a.1;

2> release the SRBs of this destination, in according to sub-clause 5.8.9.1a.3;

2> reset the sidelink specific MAC of this destination.

2> consider the PC5-RRC connection is released for the destination;

5.8.10 Sidelink measurement

5.8.10.1 Introduction

The UE may configure the associated peer UE to perform NR sidelink measurement and report on the corresponding PC5-RRC connection in accordance with the NR sidelink measurement configuration for unicast by RRCReconfigurationSidelink message.

The NR sidelink measurement configuration includes the following parameters for a PC5-RRC connection:

1. NR sidelink measurement objects: Object(s) on which the associated peer UE shall perform the NR sidelink measurements.
   - For NR sidelink measurement, a NR sidelink measurement object indicates the NR sidelink frequency of reference signals to be measured.

2. NR sidelink reporting configurations: NR sidelink measurement reporting configuration(s) where there can be one or multiple NR sidelink reporting configurations per NR sidelink measurement object. Each NR sidelink reporting configuration consists of the following:
- Reporting criterion: The criterion that triggers the UE to send a NR sidelink measurement report. This can either be periodical or a single event description.

- RS type: The RS that the UE uses for NR sidelink measurement results. In this release, only DMRS is supported for NR sidelink measurement.

- Reporting format: The quantities that the UE includes in the measurement report. In this release, only RSRP measurement is supported.

3. **NR sidelink measurement identities:** A list of NR sidelink measurement identities where each NR sidelink measurement identity links one NR sidelink measurement object with one NR sidelink reporting configuration. By configuring multiple NR sidelink measurement identities, it is possible to link more than one NR sidelink measurement object to the same NR sidelink reporting configuration, as well as to link more than one NR sidelink reporting configuration to the same NR sidelink measurement object. The NR sidelink measurement identity is also included in the NR sidelink measurement report that triggered the reporting, serving as a reference to the network.

4. **NR sidelink quantity configurations:** The NR sidelink quantity configuration defines the NR sidelink measurement filtering configuration used for all event evaluation and related reporting, and for periodical reporting of that NR sidelink measurement. In each configuration, different filter coefficients can be configured for different NR sidelink measurement quantities.

Both UEs of the PC5-RRC connection maintains a NR sidelink measurement object list, a NR sidelink reporting configuration list, and a NR sidelink measurement identities list according to signalling and procedures in this specification.

### 5.8.10.2 Sidetlink measurement configuration

#### 5.8.10.2.1 General

The UE shall:

1. if the received `sl-MeasConfig` includes the `sl-MeasObjectToRemoveList` in the `RRCReconfigurationSidetlink`:
   2. perform the sidelink measurement object removal procedure as specified in 5.8.10.2.4;

1. if the received `sl-MeasConfig` includes the `sl-MeasObjectToAddModList` in the `RRCReconfigurationSidetlink`:
   2. perform the sidelink measurement object addition/modification procedure as specified in 5.8.10.2.5;

1. if the received `sl-MeasConfig` includes the `sl-ReportConfigToRemoveList` in the `RRCReconfigurationSidetlink`:
   2. perform the sidelink reporting configuration removal procedure as specified in 5.8.10.2.6;

1. if the received `sl-MeasConfig` includes the `sl-ReportConfigToAddModList` in the `RRCReconfigurationSidetlink`:
   2. perform the sidelink reporting configuration addition/modification procedure as specified in 5.8.10.2.7;

1. if the received `sl-MeasConfig` includes the `sl-MeasId.ToRemoveList` in the `RRCReconfigurationSidetlink`:
   2. perform the sidelink measurement identity removal procedure as specified in 5.8.10.2.2;

1. if the received `sl-MeasConfig` includes the `sl-MeasIdToAddModList` in the `RRCReconfigurationSidetlink`:
   2. perform the sidelink measurement identity addition/modification procedure as specified in 5.8.10.2.3;

#### 5.8.10.2.2 Sidetlink measurement identity removal

The UE shall:
5.8.10.2.3 Sidelink measurement identity addition/modification

The UE shall:

1> for each sl-MeasId included in the received sl-MeasIdToRemoveList that is part of the current UE configuration in VarMeasConfigSL:

2> remove the entry with the matching sl-MeasId from the sl-MeasIdList within the VarMeasConfigSL;

2> remove the NR sidelink measurement reporting entry for this sl-MeasId from the VarMeasReportListSL, if included;

2> stop the periodical reporting timer and reset the associated information (e.g. sl-TimeToTrigger) for this sl-MeasId.

NOTE: The UE does not consider the message as erroneous if the sl-MeasIdToRemoveList includes any sl-MeasId value that is not part of the current UE configuration.

5.8.10.2.4 Sidelink measurement object removal

The UE shall:

1> for each sl-MeasObjectId included in the received sl-MeasObjectToRemoveList that is part of sl-MeasObjectList in VarMeasConfigSL:

2> remove the entry with the matching sl-MeasObjectId from the sl-MeasObjectList within the VarMeasConfigSL;

2> remove all sl-MeasId associated with this sl-MeasObjectId from the sl-MeasIdList within the VarMeasConfigSL, if any;

2> if a sl-MeasId is removed from the sl-MeasIdList:

3> remove the measurement reporting entry for this sl-MeasId from the VarMeasReportListSL, if included;

3> stop the periodical reporting timer and reset the associated information (e.g. sl-TimeToTrigger) for this sl-MeasId.

NOTE: The UE does not consider the message as erroneous if the sl-MeasObjectToRemoveList includes any sl-MeasObjectId value that is not part of the current UE configuration.

5.8.10.2.5 Sidelink measurement object addition/modification

The UE shall:

1> for each sl-MeasObjectId included in the received sl-MeasObjectToAddModList:

2> if an entry with the matching sl-MeasObjectId exists in the sl-MeasObjectList within the VarMeasConfigSL:

3> replace the entry with the value received for this sl-MeasObjectId;

2> else:

3> add a new entry for this sl-MeasObjectId within the VarMeasConfigSL;

2> remove the measurement reporting entry for this sl-MeasId from the VarMeasReportListSL, if included;

2> stop the periodical reporting timer and reset the associated information (e.g. sl-TimeToTrigger) for this sl-MeasId;

3> reconfigure the entry with the value received for this sl-MeasObject;
else:

add a new entry for the received sl-MeasObject to the sl-MeasObjectList within VarMeasConfigSL.

5.8.10.2.6 Sidelink reporting configuration removal

The UE shall:

1> for each sl-ReportConfigId included in the received sl-ReportConfigToRemoveList that is part of the current UE configuration in VarMeasConfigSL:

2> remove the entry with the matching sl-ReportConfigId from the sl-ReportConfigList within the VarMeasConfigSL;

2> remove all sl-MeasId associated with the sl-ReportConfigId from the sl-MeasIdList within the VarMeasConfigSL, if any;

2> if a sl-MeasId is removed from the sl-MeasIdList:

3> remove the measurement reporting entry for this sl-MeasId from the VarMeasReportListSL, if included;

3> stop the periodical reporting timer and reset the associated information (e.g. sl-TimeToTrigger) for this sl-MeasId.

NOTE: The UE does not consider the message as erroneous if the sl-ReportConfigToRemoveList includes any sl-ReportConfigId value that is not part of the current UE configuration.

5.8.10.2.7 Sidelink reporting configuration addition/modification

The UE shall:

1> for each sl-ReportConfigId included in the received sl-ReportConfigToAddModList:

2> if an entry with the matching sl-ReportConfigId exists in the sl-ReportConfigList within the VarMeasConfigSL, for this entry:

3> reconfigure the entry with the value received for this sl-ReportConfig;

3> for each sl-MeasId associated with this sl-ReportConfigId included in the sl-MeasIdList within the VarMeasConfigSL, if any:

4> remove the measurement reporting entry for this sl-MeasId from the VarMeasReportListSL, if included;

4> stop the periodical reporting timer and reset the associated information (e.g. sl-TimeToTrigger) for this sl-MeasId;

2> else:

3> add a new entry for the received sl-ReportConfig to the sl-ReportConfigList within the VarMeasConfigSL.

5.8.10.2.8 Sidelink quantity configuration

The UE shall:

1> for each received sl-QuantityConfig:

2> set the corresponding parameter(s) in sl-QuantityConfig within VarMeasConfigSL to the value of the received sl-QuantityConfig parameter(s);

1> for each sl-MeasId included in the sl-MeasIdList within VarMeasConfigSL:

2> remove the measurement reporting entry for this sl-MeasId from the VarMeasReportListSL, if included;

2> stop the periodical reporting timer and reset the associated information (e.g. sl-TimeToTrigger) for this sl-MeasId.
5.8.10.3 Performing NR sidelink measurements

5.8.10.3.1 General

A UE shall derive NR sidelink measurement results by measuring one or multiple DMRS associated per PC5-RRC connection as configured by the peer UE associated, as described in 5.8.10.3.2. For all NR sidelink measurement results the UE applies the layer 3 filtering as specified in sub-clause 5.5.3.2, before using the measured results for evaluation of reporting criteria and measurement reporting. In this release, only NR sidelink RSRP can be configured as trigger quantity and reporting quantity.

The UE shall:

1> for each sl-MeasId included in the sl-MeasIdList within VarMeasConfigSL:
   
   2> if the sl-MeasObject is associated to NR sidelink and the sl-RS-Type is set to dmrs:
      
      3> derive the layer 3 filtered NR sidelink measurement result based on DMRS for the trigger quantity and each measurement quantity indicated in sl-ReportQuantity using parameters from the associated sl-MeasObject, as described in 5.8.10.3.2.

2> perform the evaluation of reporting criteria as specified in 5.8.10.4.

5.8.10.3.2 Derivation of NR sidelink measurement results

The UE may be configured by the peer UE associated to derive NR sidelink RSRP measurement results per PC5-RRC connection associated to the NR sidelink measurement objects based on parameters configured in the sl-MeasObject and in the sl-ReportConfig.

The UE shall:

1> for each NR sidelink measurement quantity to be derived based on NR sidelink DMRS:
   
   2> derive the corresponding measurement of NR sidelink frequency indicated quantity based on DMRS as described in TS 38.215 [9] in the concerned sl-MeasObject;

   3> apply layer 3 filtering as described in 5.5.3.2;

5.8.10.4 Sidelink measurement report triggering

5.8.10.4.1 General

The UE shall:

1> for each sl-MeasId included in the sl-MeasIdList within VarMeasConfigSL:
   
   2> if the sl-ReportType is set to sl-EventTriggered and if the entry condition applicable for this event, i.e. the event corresponding with the sl-EventId of the corresponding sl-ReportConfig within VarMeasConfigSL, is fulfilled for NR sidelink frequency for all NR sidelink measurements after layer 3 filtering taken during sl-TimeToTrigger defined for this event within the VarMeasConfigSL, while the VarMeasReportListSL does not include a NR sidelink measurement reporting entry for this sl-MeasId (a first NR sidelink frequency triggers the event):
      
      3> include a NR sidelink measurement reporting entry within the VarMeasReportListSL for this sl-MeasId;

   3> set the sl-NumberOfReportsSent defined within the VarMeasReportListSL for this sl-MeasId to 0;

   3> include the concerned NR sidelink frequency in the sl-FrequencyTriggeredList defined within the VarMeasReportListSL for this sl-MeasId;

   3> initiate the NR sidelink measurement reporting procedure, as specified in 5.8.10.5;

2> else if the sl-ReportType is set to sl-EventTriggered and if the entry condition applicable for this event, i.e. the event corresponding with the sl-EventId of the corresponding sl-ReportConfig within VarMeasConfigSL, is fulfilled for NR sidelink frequency not included in the sl-FrequencyTriggeredList for all NR sidelink
measurements after layer 3 filtering taken during sl-TimeToTrigger defined for this event within the VarMeasConfigSL (a subsequent NR sidelink frequency triggers the event):

3> set the sl-NumberOfReportsSent defined within the VarMeasReportListSL for this sl-MeasId to 0;

3> include the concerned NR sidelink frequency in the sl-FrequencyTriggeredList defined within the VarMeasReportListSL for this sl-MeasId;

3> initiate the NR sidelink measurement reporting procedure, as specified in 5.8.10.5;

2> else if the sl-ReportType is set to sl-EventTriggered and if the leaving condition applicable for this event is fulfilled for NR sidelink frequency included in the sl-FrequencyTriggeredList defined within the VarMeasReportListSL for this sl-MeasId for all NR sidelink measurements after layer 3 filtering taken during sl-TimeToTrigger defined within the VarMeasConfigSL for this event:

3> remove the concerned NR sidelink frequency in the sl-FrequencyTriggeredList defined within the VarMeasReportListSL for this sl-MeasId;

3> if sl-ReportOnLeave is set to true for the corresponding reporting configuration:

4> initiate the NR sidelink measurement reporting procedure, as specified in 5.8.10.5;

3> if the sl-FrequencyTriggeredList defined within the VarMeasReportListSL for this sl-MeasId is empty:

4> remove the NR sidelink measurement reporting entry within the VarMeasReportListSL for this sl-MeasId;

4> stop the periodical reporting timer for this sl-MeasId, if running;

2> if sl-ReportType is set to sl-Periodical and if a (first) NR sidelink measurement result is available:

3> include a NR sidelink measurement reporting entry within the VarMeasReportListSL for this sl-MeasId;

3> set the sl-NumberOfReportsSent defined within the VarMeasReportListSL for this sl-MeasId to 0;

3> initiate the NR sidelink measurement reporting procedure, as specified in 5.8.10.5, immediately after the quantity to be reported becomes available for the NR sidelink frequency:

2> upon expiry of the periodical reporting timer for this sl-MeasId:

3> initiate the NR sidelink measurement reporting procedure, as specified in 5.8.10.5.

5.8.10.4.2 Event S1 (Serving becomes better than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition S1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition S1-2, as specified below, is fulfilled;

1> for this NR sidelink measurement, consider the NR sidelink frequency corresponding to the associated sl-MeasObject associated with this event.

Inequality S1-1 (Entering condition)

\[ Ms - Hys > Thresh \]

Inequality S1-2 (Leaving condition)

\[ Ms + Hys < Thresh \]

The variables in the formula are defined as follows:

Ms is the NR sidelink measurement result of the NR sidelink frequency, not taking into account any offsets.

Hys is the hysteresis parameter for this event (i.e. sl-Hysteresis as defined within sl-ReportConfig for this event).
\[ \text{Thresh} \] is the threshold parameter for this event (i.e. \textit{s1-Threshold} as defined within \textit{s1-ReportConfig} for this event).

\( M_s \) is expressed in dBm in case of RSRP.

\( Hys \) is expressed in dB.

\( \text{Thresh} \) is expressed in the same unit as \( M_s \).

5.8.10.4.3 Event S2 (Serving becomes worse than threshold)

The UE shall:

1. consider the entering condition for this event to be satisfied when condition S2-1, as specified below, is fulfilled;
2. consider the leaving condition for this event to be satisfied when condition S2-2, as specified below, is fulfilled;
3. for this NR sidelink measurement, consider the NR sidelink frequency indicated by the \( \text{sl-MeasObject} \) associated to this event.

Inequality S2-1 (Entering condition)

\[ M_s + Hys < \text{Thresh} \]

Inequality S2-2 (Leaving condition)

\[ M_s - Hys > \text{Thresh} \]

The variables in the formula are defined as follows:

\( M_s \) is the NR sidelink measurement result of the NR sidelink frequency, not taking into account any offsets.

\( Hys \) is the hysteresis parameter for this event (i.e. \textit{sl-Hysteresis} as defined within \textit{sl-ReportConfig} for this event).

\( \text{Thresh} \) is the threshold parameter for this event (i.e. \textit{s2-Threshold} as defined within \textit{sl-ReportConfig} for this event).

\( M_s \) is expressed in dBm in case of RSRP.

\( Hys \) is expressed in dB.

\( \text{Thresh} \) is expressed in the same unit as \( M_s \).

5.8.10.5 Sidelink measurement reporting

5.8.10.5.1 General

![Figure 5.8.10.5.1-1: NR sidelink measurement reporting](#)

The purpose of this procedure is to transfer measurement results from the UE to the peer UE associated.

For the \( \text{sl-MeasId} \) for which the NR sidelink measurement reporting procedure was triggered, the UE shall set the \( \text{sl-MeasResults} \) within the \textit{MeasurementReportSidelink} message as follows:

1. set the \( \text{sl-MeasId} \) to the measurement identity that triggered the NR sidelink measurement reporting;
2. if the \( \text{sl-ReportConfig} \) associated with the \( \text{sl-MeasId} \) that triggered the NR sidelink measurement reporting is set to \( \text{sl-EventTriggered} \) or \( \text{sl-Periodical} \):
2> set sl-ResultDMRS within sl-MeasResult to include the NR sidelink DMRS based quantity indicated in the sl-
ReportQuantity within the concerned sl-ReportConfig;

1> increment the sl-NumberOfReportsSent as defined within the VarMeasReportListSSL for this sl-MeasId by 1;

1> stop the periodical reporting timer, if running;

1> if the sl-NumberOfReportsSent as defined within the VarMeasReportListSL for this sl-MeasId is less than the sl-
ReportAmount as defined within the corresponding sl-ReportConfig for this sl-MeasId:

2> start the periodical reporting timer with the value of sl-ReportInterval as defined within the corresponding sl-
ReportConfig for this sl-MeasId;

1> else:

2> if the sl-ReportType is set to sl-Periodical:

3> remove the entry within the VarMeasReportListSL for this sl-MeasId;

3> remove this sl-MeasId from the sl-MeasIdList within VarMeasConfigSL;

1> submit the MeasurementReportSidelink message to lower layers for transmission, upon which the procedure
ends.

5.8.11 Zone identity calculation

The UE shall determine an identity of the zone (i.e. Zone_id) in which it is located using the following formulae, if sl-
ZoneConfig is configured:

\[ x_1 = \text{Floor} \left( \frac{x}{L} \right) \mod 64; \]
\[ y_1 = \text{Floor} \left( \frac{y}{L} \right) \mod 64; \]
\[ \text{Zone}_id = y_1 \times 64 + x_1. \]

The parameters in the formulae are defined as follows:

- \( L \) is the value of sl-ZoneLength included in sl-ZoneConfig;
- \( x \) is the geodesic distance in longitude between UE’s current location and geographical coordinates (0, 0) according
to WGS84 model [58] and it is expressed in meters;
- \( y \) is the geodesic distance in latitude between UE’s current location and geographical coordinates (0, 0) according
to WGS84 model [58] and it is expressed in meters.

NOTE: How the calculated zone_id is used is specified in TS 38.321 [3].

5.8.12 DFN derivation from GNSS

When the UE selects GNSS as the synchronization reference source, the DFN, the subframe number within a frame and
slot number within a frame used for NR sidelink communication are derived from the current UTC time, by the
following formulae:

\[ \text{DFN} = \text{Floor} \left( 0.1 \times(T_{\text{current}} - T_{\text{ref}} - \text{OffsetDFN}) \right) \mod 1024 \]
\[ \text{SubframeNumber} = \text{Floor} \left( T_{\text{current}} - T_{\text{ref}} - \text{OffsetDFN} \right) \mod 10 \]
\[ \text{SlotNumber} = \text{Floor} \left( (T_{\text{current}} - T_{\text{ref}} - \text{OffsetDFN}) \times 2^8 \right) \mod (10 \times 2^8) \]

Where:

- \( T_{\text{current}} \) is the current UTC time that obtained from GNSS. This value is expressed in milliseconds;
- \( T_{\text{ref}} \) is the reference UTC time 00:00:00 on Gregorian calendar date 1 January, 1900 (midnight between Thursday,
December 31, 1899 and Friday, January 1, 1900). This value is expressed in milliseconds;
**OffsetDFN** is the value sl-OffsetDFN if configured, otherwise it is zero. This value is expressed in milliseconds.

μ=0/1/2/3 corresponding to the 15/30/60/120 kHz of SCS for SL, respectively.

NOTE 1: In case of leap second change event, how UE obtains the scheduled time of leap second change to adjust T_{current} correspondingly is left to UE implementation. How UE handles to avoid the sudden discontinuity of DFN is left to UE implementation.

NOTE 2: Void.
6 Protocol data units, formats and parameters (ASN.1)

6.1 General

6.1.1 Introduction

The contents of each RRC message is specified in sub-clause 6.2 using ASN.1 to specify the message syntax and using tables when needed to provide further detailed information about the fields specified in the message syntax. The syntax of the information elements that are defined as stand-alone abstract types is further specified in a similar manner in sub-clause 6.3.

Usage of the text “Network always configures the UE with a value for this field” in the field description indicates that the network has to provide a value for the field in this or in a previous message based on delta configuration (for an optional field with Need M). It does not imply a mandatory presence of the field.

6.1.2 Need codes and conditions for optional downlink fields

The need for fields to be present in a message or an abstract type, i.e., the ASN.1 fields that are specified as OPTIONAL in the abstract notation (ASN.1), is specified by means of comment text tags attached to the OPTIONAL statement in the abstract syntax. All comment text tags are available for use in the downlink direction only. The meaning of each tag is specified in table 6.1.2-1.

If conditions are used, a conditional presence table is provided for the message or information element specifying the need of the field for each condition case. The table also specifies whether UE maintains or releases the value in case the field is absent. The conditions clarify what the UE may expect regarding the setting of the message by the network. Violation of conditions is regarded as invalid network behaviour, which the UE is not required to cope with. Hence the general error handling defined in 10.4 does not apply in case a field is absent although it is mandatory according to the CondC or CondM condition.

For guidelines on the use of need codes and conditions, see Annex A.6 and A.7.
### Table 6.1.2-1: Meaning of abbreviations used to specify the need for fields to be present

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cond conditionTag</td>
<td>Conditionally present&lt;br&gt;Purpose: Specifies the field is specified in a tabular form following the ASN.1 segment.</td>
</tr>
<tr>
<td>CondC conditionTag</td>
<td>Configuration condition&lt;br&gt;Purpose: Presence of the field is conditional to other configuration settings.</td>
</tr>
<tr>
<td>CondM conditionTag</td>
<td>Message condition&lt;br&gt;Purpose: Presence of the field is conditional to other fields included in the message.</td>
</tr>
<tr>
<td>Need S</td>
<td>Specified&lt;br&gt;Purpose: Used for (configuration) fields, whose field description or procedure specifies the UE behavior performed upon receiving a message with the field absent (and not if field description or procedure specifies the UE behavior when field is not configured).</td>
</tr>
<tr>
<td>Need M</td>
<td>Maintain&lt;br&gt;Purpose: Used for (configuration) fields that are stored by the UE i.e. not one-shot. Upon receiving a message with the field absent, the UE maintains the current value.</td>
</tr>
<tr>
<td>Need N</td>
<td>No action (one-shot configuration that is not maintained)&lt;br&gt;Purpose: Used for (configuration) fields that are not stored and whose presence causes a one-time action by the UE. Upon receiving a message with the field absent, the UE takes no action.</td>
</tr>
<tr>
<td>Need R</td>
<td>Release&lt;br&gt;Purpose: Used for (configuration) fields that are stored by the UE i.e. not one-shot. Upon receiving a message with the field absent, the UE releases the current value.</td>
</tr>
</tbody>
</table>

**NOTE:** In this version of the specification, the condition tags CondC and CondM are not used. Any field with Need M or Need N in system information shall be interpreted as Need R.

The need code used within a CondX definition only applies for the case (part of the condition) where it is defined: A condition may have different need codes for different parts of the condition. In particular, the CondX definition may contain the following "otherwise the field is absent" parts:

- "Otherwise, the field is absent": The field is not relevant or should not be configured when this part of the condition applies. In particular, the UE behaviour is not defined when the field is configured via another part of the condition and is reconfigured to this part of the condition. A need code is not provided when the transition from another part of the condition to this part of the condition is not supported, when the field clearly is a one-shot or there is no difference whether UE maintains or releases the value (e.g., in case the field is mandatory present according to the other part of the condition).
- "Otherwise, the field is absent, Need R": The field is released if absent when this part of the condition applies. This handles UE behaviour in case the field is configured via another part of the condition and this part of the condition applies (which means that network can assume UE releases the field if this part of the condition is valid).
- "Otherwise, the field is absent, Need M": The UE retains the field if it was already configured when this part of the condition applies. This means the network cannot release the field, but UE retains the previously configured value.

Use of different Need codes in different parts of a condition should be avoided.

For downlink messages, the need codes, conditions and ASN.1 defaults specified for a particular (child) field only apply in case the (parent) field including the particular field is present. Thus, if the parent is absent the UE shall not release the field unless the absence of the parent field implies that.
For (parent) fields without need codes in downlink messages, if the parent field is absent, UE shall follow the need codes of the child fields. Thus, if parent field is absent, the need code of each child field is followed (i.e. Need R child fields are released, Need M child fields are not modified and the actions for Need S child fields depend on the specified conditions of each field). Examples of (parent) fields in downlink messages without need codes where this rule applies are:

- `nonCriticalExtension` fields at the end of a message using empty SEQUENCE extension mechanism,
- groups of non-critical extensions using double brackets (referred to as extension groups), and
- non-critical extensions at the end of a message or at the end of a structure, contained in a BIT STRING or OCTET STRING (referred to as parent extension fields).

The handling of need codes as specified in the previous is illustrated by means of an example, as shown in the following ASN.1.

```asn1
RRCMessage-IEs ::= SEQUENCE {
  field1                            InformationElement1 OPTIONAL, -- Need M
  field2                            InformationElement2 OPTIONAL, -- Need R
  nonCriticalExtension              RRCMessage-v1570-IEs OPTIONAL
}

RRCMessage-v1570-IEs ::= SEQUENCE {
  field3                            InformationElement3 OPTIONAL, -- Need M
  nonCriticalExtension              RRCMessage-v1640-IEs OPTIONAL
}

RRCMessage-v1640-IEs ::= SEQUENCE {
  field4                            InformationElement4 OPTIONAL, -- Need R
  nonCriticalExtension              SEQUENCE {} OPTIONAL
}

InformationElement1 ::= SEQUENCE {
  field11                           InformationElement11 OPTIONAL, -- Need M
  field12                           InformationElement12 OPTIONAL, -- Need R
  ...
  [ [ field13                           InformationElement13 OPTIONAL, -- Need R
    field14                           InformationElement14 OPTIONAL -- Need M
  ] ]
}

InformationElement2 ::= SEQUENCE {
  field21                           InformationElement11 OPTIONAL, -- Need M
  ...
}
```

The handling of need codes as specified in the previous implies that:

- if `field1` in `RRCMessage-IEs` is absent, UE does not modify any child fields configured within `field1` (regardless of their need codes);
- if field2 in RRCMessage-IEs is absent, UE releases the field2 (and also its child field field21);
- if field1 or field2 in RRCMessage-IEs is present, UE retains or releases their child fields according to the child field presence conditions;
- if field1 in RRCMessage-IEs is present but the extension group containing field13 and field14 is absent, the UE releases field13 but does not modify field14;
- if nonCriticalExtension defined by IE RRCMessage-v1570-IEs is absent, the UE does not modify field3 but releases field4;

6.1.3 General rules

In the ASN.1 of this specification, the first bit of a bit string refers to the leftmost bit, unless stated otherwise.

Upon reception of a list not using ToAddModList and ToReleaseList structure, the UE shall delete all entries of the list currently in the UE configuration before applying the received list and shall consider each entry as newly created. This applies also to lists whose size is extended (i.e. with a second list structure in the ASN.1 comprising additional entries). This implies that Need M should not be used for fields in the entries of these lists; if used, UE will handle such fields equivalent to a Need R.

6.2 RRC messages

6.2.1 General message structure

– NR-RRC-Definitions

This ASN.1 segment is the start of the NR RRC PDU definitions.

-- ASN1START
-- TAG-NR-RRC-DEFINITIONS-START

NR-RRC-Definitions DEFINITIONS AUTOMATIC TAGS ::= BEGIN

-- TAG-NR-RRC-DEFINITIONS-STOP
-- ASN1STOP

– BCCH-BCH-Message

The BCCH-BCH-Message class is the set of RRC messages that may be sent from the network to the UE via BCH on the BCCH logical channel.

-- ASN1START
-- TAG-BCCH-BCH-MESSAGE-START

BCCH-BCH-Message ::= SEQUENCE {
  message BCCH-BCH-MessageType

  -- ASN1STOP
-- TAG-BCCH-BCH-MESSAGE-STOP
-- ASN1STOP
BCCH-DL-SCH-Message

The BCCH-DL-SCH-Message class is the set of RRC messages that may be sent from the network to the UE via DL-SCH on the BCCH logical channel.

DL-CCCH-Message

The DL-CCCH-Message class is the set of RRC messages that may be sent from the Network to the UE on the downlink CCCH logical channel.
The **DL-DCCH-Message** class is the set of RRC messages that may be sent from the network to the UE on the downlink DCCH logical channel.

```
DL-DCCH-Message ::= SEQUENCE {
  message                               DL-DCCH-MessageType
}
DL-DCCH-MessageType ::= CHOICE {
  rrcReconfiguration                  RRCReconfiguration,
  rrcResume                             RRCResume,
  rrcRelease                           RRCRelease,
  rrcReestablishment                  RRCReestablishment,
  securityModeCommand                 SecurityModeCommand,
  dlInformationTransfer               DLInformationTransfer,
  ueCapabilityEnquiry                 UECapabilityEnquiry,
  counterCheck                         CounterCheck,
  mobilityFromNRCommand               MobilityFromNRCommand,
  dlDedicatedMessageSegment-r16       DLDedicatedMessageSegment-r16,
  ueInformationRequest-r16            UEInformationRequest-r16,
  dlInformationTransferMRDC-r16       DLInformationTransferMRDC-r16,
  loggedMeasurementConfiguration-r16  LoggedMeasurementConfiguration-r16,
  spare3 NULL, spare2 NULL, spare1 NULL
}
```

The **PCCH-Message** class is the set of RRC messages that may be sent from the Network to the UE on the PCCH logical channel.

```
PCCH-Message ::= SEQUENCE {
  messageClassExtension  SEQUENCE {}
}
```
The **UL-CCCH-Message** class is the set of 48-bits RRC messages that may be sent from the UE to the Network on the uplink CCCH logical channel.

The **UL-CCCH1-Message** class is the set of 64-bits RRC messages that may be sent from the UE to the Network on the uplink CCCH1 logical channel.
The **UL-DCCH-Message** class is the set of RRC messages that may be sent from the UE to the network on the uplink DCCH logical channel.

---

### UL-DCCH-Message

The **UL-DCCH-Message** class is the set of RRC messages that may be sent from the UE to the network on the uplink DCCH logical channel.

---

```
UL-DCCH-Message ::= SEQUENCE {
  message  UL-DCCH-MessageType
}
UL-DCCH-MessageType ::= CHOICE {
  c1 CHOICE {
    measurementReport  MeasurementReport,
    rrcReconfigurationComplete  RRCReconfigurationComplete,
    rrcSetupComplete  RRCSetupComplete,
    rrcReestablishmentComplete  RRCReestablishmentComplete,
    rrcResumeComplete  RRCResumeComplete,
    securityModeComplete  SecurityModeComplete,
    securityModeFailure  SecurityModeFailure,
    ulInformationTransfer  ULInformationTransfer,
    locationMeasurementIndication  LocationMeasurementIndication,
    ueCapabilityInformation  UECapabilityInformation,
    counterCheckResponse  CounterCheckResponse,
    ueAssistanceInformation  UEAssistanceInformation,
    failureInformation  FailureInformation,
    ulInformationTransferMRDC  ULInformationTransferMRDC,
    scgFailureInformation  SCGFailureInformation,
    scgFailureInformationEUTRA  SCGFailureInformationEUTRA,
  },
  messageClassExtension  CHOICE {
    c2 CHOICE {
      uIDedicatedMessageSegment-r16  ULDedicatedMessageSegment-r16,
      dedicatedSIBRequest-r16  DedicatedSIBRequest-r16,
      mcgFailureInformation-r16  MCGFailureInformation-r16,
      ueInformationResponse-r16  UEInformationResponse-r16,
    }
  }
}
```
sidelinkUEInformationNR-r16, ulInformationTransferIRAT-r16, IABOtherInformation-r16, spare9 NULL, spare8 NULL, spare7 NULL, spare6 NULL, spare5 NULL, spare4 NULL, spare3 NULL, spare2 NULL, spare1 NULL,

messageClassExtensionFuture-r16

-- TAG-UL-DCCH-MESSAGE-STOP
-- ASN1STOP
6.2.2 Message definitions

CounterCheck

The CounterCheck message is used by the network to indicate the current COUNT MSB values associated to each DRB and to request the UE to compare these to its COUNT MSB values and to report the comparison results to the network.

Signalling radio bearer: SRB1
RLC-SAP: AM
Logical channel: DCCH
Direction: Network to UE

CounterCheck message

```asn1
CounterCheck ::= SEQUENCE {
    rrc-TransactionIdentifier            RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        counterCheck                    CounterCheck-IEs,
        criticalExtensionsFuture        SEQUENCE {},
    }
}

CounterCheck-IEs ::= SEQUENCE {
    drb-CountMSB-InfoList               DRB-CountMSB-InfoList,
    lateNonCriticalExtension           OCTET STRING OPTIONAL,
    nonCriticalExtension               SEQUENCE {} OPTIONAL
}

DRB-CountMSB-InfoList ::= SEQUENCE (SIZE (1..maxDRB)) OF DRB-CountMSB-Info

DRB-CountMSB-Info ::= SEQUENCE {
    drb-Identity                        DRB-Identity,
    countMSB-Uplink                      INTEGER(0..33554431),
    countMSB-Downlink                    INTEGER(0..33554431)
}
```
CounterCheck-IEs field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>drb-CountMSB-InfoList</code></td>
<td>Indicates the MSBs of the COUNT values of the DRBs.</td>
</tr>
</tbody>
</table>

DRB-CountMSB-Info field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>countMSB-Downlink</code></td>
<td>Indicates the value of 25 MSBs from RX_NEXT – 1 (specified in TS 38.323 [5]) associated to this DRB.</td>
</tr>
<tr>
<td><code>countMSB-Uplink</code></td>
<td>Indicates the value of 25 MSBs from TX_NEXT – 1 (specified in TS 38.323 [5]) associated to this DRB.</td>
</tr>
</tbody>
</table>

CounterCheckResponse

The `CounterCheckResponse` message is used by the UE to respond to a `CounterCheck` message.

- Signalling radio bearer: SRB1
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to Network

CounterCheckResponse message

```asn1
-- ASN1START
-- TAG-COUNTERCHECKRESPONSE-START

CounterCheckResponse ::= SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                 CHOICE {
        counterCheckResponse            CounterCheckResponse-IEs,
        criticalExtensionsFuture        SEQUENCE {} }
}

CounterCheckResponse-IEs ::= SEQUENCE {
    drb-CountInfoList                 DRB-CountInfoList,
    lateNonCriticalExtension          OCTET STRING OPTIONAL,
    nonCriticalExtension              SEQUENCE {} OPTIONAL
}

DRB-CountInfoList ::= SEQUENCE (SIZE (0..maxDRB)) OF DRB-CountInfo

DRB-CountInfo ::= SEQUENCE {
    drb-Identity                      DRB-Identity,
    count-Uplink                      INTEGER (0..4294967295),
}
```

```
CounterCheckResponse-IEs field descriptions

drb-CountInfoList
Indicates the COUNT values of the DRBs.

DRB-CountInfo field descriptions

count-Downlink
Indicates the value of RX\_NEXT – 1 (specified in TS 38.323 [5]) associated to this DRB.
count-Uplink
Indicates the value of TX\_NEXT – 1 (specified in TS 38.323 [5]) associated to this DRB.

– DedicatedSIBRequest

The DedicatedSIBRequest message is used to request SIB(s) required by the UE in RRC\_CONNECTED as specified in clause 5.2.2.3.5.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

DedicatedSIBRequest message

`DedicatedSIBRequest-r16 ::= SEQUENCE { dedicatedSIBRequest-r16的选择 { criticalExtensions Future, dedicatedSIBRequest-r16-IEs, criticalExtensionsFuture SEQUENCE { } } }

DedicatedSIBRequest-r16-IEs ::= SEQUENCE { onDemandSIB-RequestList-r16 SEQUENCE { requestedSIB-List-r16 SEQUENCE { SIZE (1..maxOnDemandSIB-r16) } OF SIB-ReqInfo-r16, requestedPosSIB-List-r16 SEQUENCE { SIZE (1..maxOnDemandPosSIB-r16) } OF PosSIB-ReqInfo-r16 } } OPTIONAL,`
DedicatedSIBRequest field descriptions

requestedSIB-List
Contains a list of SIB(s) the UE requests while in RRC_CONNECTED.

requestedPosSIB-List
Contains a list of posSIB(s) the UE requests while in RRC_CONNECTED.

PosSIB-ReqInfo field descriptions

gnss-id
The presence of this field indicates that the request positioning SIB type is for a specific GNSS. Indicates a specific GNSS (see also TS 37.355 [49]).

sbas-id
The presence of this field indicates that the request positioning SIB type is for a specific SBAS. Indicates a specific SBAS (see also TS 37.355 [49]).

— DL DedicatedMessageSegment

The DL DedicatedMessageSegment message is used to transfer one segment of the RRCResume or RRCReconfiguration messages.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE
**DL Dedicated Message Segment message**

---

**segmentNumber**
Identifies the sequence number of a segment within the encoded DL DCCH message. The network transmits the segments with continuously increasing segmentNumber order so that the UE's RRC layer may expect to obtain them from lower layers in the correct order. Hence, the UE is not required to perform segment re-ordering on RRC level.

**rrc-MessageSegmentContainer**
Includes a segment of the encoded DL DCCH message. The size of the included segment in this container should be small enough so the resulting encoded RRC message PDU is less than or equal to the PDCP SDU size limit.

**rrc-MessageSegmentType**
Indicates whether the included DL DCCH message segment is the last segment of the message or not.

---

**DL Information Transfer**

The DL Information Transfer message is used for the downlink transfer of NAS dedicated information and timing information for the 5G internal system clock.

Signalling radio bearer: SRB2 or SRB1 (only if SRB2 not established yet. If SRB2 is suspended, the network does not send this message until SRB2 is resumed.)

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE
**DLInformationTransfer message**

```
DLInformationTransfer ::= SEQUENCE {
  rrc-TransactionIdentifier RRC-TransactionIdentifier,
  criticalExtensions CHOICE {
    dlInformationTransfer DLInformationTransfer-IEs,
    criticalExtensionsFuture SEQUENCE {}
  }
}
DLInformationTransfer-IEs ::= SEQUENCE {
  dedicatedNAS-Message DedicatedNAS-Message OPTIONAL, -- Need N
  lateNonCriticalExtension OCTET STRING OPTIONAL,
  nonCriticalExtension DLInformationTransfer-v1610-IEs OPTIONAL
}
DLInformationTransfer-v1610-IEs ::= SEQUENCE {
  referenceTimeInfo-r16 ReferenceTimeInfo-r16 OPTIONAL, -- Need R
  nonCriticalExtension SEQUENCE {} OPTIONAL
}
```

**DLInformationTransferMRDC**

The **DLInformationTransferMRDC** message is used for the downlink transfer of RRC messages during fast MCG link recovery.

- Signalling radio bearer: SRB3
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: Network to UE

```
DLInformationTransferMRDC ::= SEQUENCE {
  criticalExtensions CHOICE {
    c1 CHOICE {
      dlInformationTransferMRDC-r16 DLInformationTransferMRDC-r16-IEs,
      spare3 NULL, spare2 NULL, spare1 NULL
    },
  }
}
```

---

ETSI TS 138 331 V16.3.1 (2021-01)
DLInformationTransferMRDC field descriptions

**dl-DCCH-MessageNR**
Includes the DL-DCCH-Message. In this version of the specification, the field is only used to transfer the NR RRCReconfiguration, RRCRelease, and MobilityFromNRCommand messages.

**dl-DCCH-MessageEUTRA**
Includes the DL-DCCH-Message. In this version of the specification, the field is only used to transfer the E-UTRA RRCConnectionReconfiguration, RRCConnectionRelease, and MobilityFromEUTRACCommand messages as specified in TS 36.331 [10].

**FailureInformation**
The FailureInformation message is used to inform the network about a failure detected by the UE.

- Signalling radio bearer: SRB1 or SRB3
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to network

**FailureInformation message**
FailureInformation-IEs ::=  SEQUENCE {
  failureInfoRLC-Bearer           FailureInfoRLC-Bearer        OPTIONAL,
  lateNonCriticalExtension       OCTET STRING                 OPTIONAL,
  nonCriticalExtension           FailureInformation-v1610-IEs OPTIONAL
}

FailureInfoRLC-Bearer ::=      SEQUENCE {
  cellGroupId                    CellGroupId,
  logicalChannelIdentity         LogicalChannelIdentity,
  failureType                    ENUMERATED {rlc-failure, spare3, spare2, spare1}
}

FailureInformation-v1610-IEs ::= SEQUENCE {
  failureInfoDAPS-r16              FailureInfoDAPS-r16        OPTIONAL,
  nonCriticalExtension             SEQUENCE {}                OPTIONAL }

FailureInfoDAPS-r16 ::=          SEQUENCE {
  failureType-r16                  ENUMERATED {daps-failure, spare3, spare2, spare1}
}

-- TAG-FAILUREINFORMATION-STOP
-- ASN1STOP

-- IABOtherInformation

The IABOtherInformation message is used by IAB-MT to request the network to allocate IP addresses for the collocated IAB-DU or inform the network about IP addresses allocated to the collocated IAB-DU.

Signalling radio bearer: SRB1 or SRB3

RLC-SAP: AM

Logical channel: DCCH

Direction: IAB-MT to Network

IABOtherInformation message

-- ASN1START
-- TAG-IABOTHERINFORMATION-START

IABOtherInformation-r16 ::=      SEQUENCE {
  rrc-TransactionIdentifier       RRC-TransactionIdentifier,
  criticalExtensions              CHOICE {
    iabOtherInformation-r16        IABOtherInformation-r16-IEs,
    criticalExtensionsFuture       SEQUENCE {}
  }
}

-- TAG-IABOTHERINFORMATION-STOP
-- ASN1STOP

IABOtherInformation-r16-IEs ::= SEQUENCE {
  failureInfoDAPS-r16              FailureInfoDAPS-r16        OPTIONAL,
  nonCriticalExtension             SEQUENCE {}                OPTIONAL }

FailureInfoDAPS-r16 ::=          SEQUENCE {
  failureType-r16                  ENUMERATED {daps-failure, spare3, spare2, spare1}
}

-- TAG-FAILUREINFORMATION-STOP
-- ASN1STOP
IABOtherInformation-r16-IEs ::= SEQUENCE {
  ip-InfoType-r16  CHOICE {
    iab-IP-Request-r16  SEQUENCE {
      iab-IPv4-AddressNumReq-r16  IAB-IP-AddressNumReq-r16  OPTIONAL,
      iab-IPv6-AddressReq-r16  CHOICE {
        iab-IPv6-AddressNumReq-r16  IAB-IP-AddressNumReq-r16  OPTIONAL,
        iab-IPv6-AddressPrefixReq-r16  IAB-IP-AddressPrefixReq-r16,
        ...
      },
      iab-IP-Report-r16  SEQUENCE {
        iab-IPv4-AddressReport-r16  IAB-IP-AddressAndTraffic-r16  OPTIONAL,
        iab-IPv6-Report-r16  CHOICE {
          iab-IPv6-AddressReport-r16  IAB-IP-AddressAndTraffic-r16  OPTIONAL,
          iab-IPv6-PrefixReport-r16  IAB-IP-PrefixAndTraffic-r16,
          ...
        },
      }
    },
    iab-IP-Report-r16  SEQUENCE {
      iab-IPv4-AddressReport-r16  IAB-IP-AddressAndTraffic-r16  OPTIONAL,
      iab-IPv6-Report-r16  CHOICE {
        iab-IPv6-AddressReport-r16  IAB-IP-AddressAndTraffic-r16,  
        iab-IPv6-PrefixReport-r16  IAB-IP-PrefixAndTraffic-r16,
        ...
      },
    }
  },
  lateNonCriticalExtension  OCTET STRING  OPTIONAL,
  nonCriticalExtension  SEQUENCE ()  OPTIONAL
}

IAB-IP-AddressNumReq-r16 ::= SEQUENCE {
  all-Traffic-NumReq-r16  INTEGER (1..8)  OPTIONAL,
  f1-C-Traffic-NumReq-r16  INTEGER (1..8)  OPTIONAL,
  f1-U-Traffic-NumReq-r16  INTEGER (1..8)  OPTIONAL,
  ...
}

IAB-IP-AddressPrefixReq-r16 ::= SEQUENCE {
  all-Traffic-PrefixReq-r16  ENUMERATED {true}  OPTIONAL,
  f1-C-Traffic-PrefixReq-r16  ENUMERATED {true}  OPTIONAL,
  f1-U-Traffic-PrefixReq-r16  ENUMERATED {true}  OPTIONAL,
  ...
}

IAB-IP-AddressAndTraffic-r16 ::= SEQUENCE {
  all-Traffic-IAB-IP-Address-r16  SEQUENCE (SIZE(1..8)) OF IAB-IP-Address16  OPTIONAL,
  f1-C-Traffic-IAB-IP-Address-r16  SEQUENCE (SIZE(1..8)) OF IAB-IP-Address16  OPTIONAL,
  f1-U-Traffic-IAB-IP-Address-r16  SEQUENCE (SIZE(1..8)) OF IAB-IP-Address16  OPTIONAL,
  ...
}

IAB-IP-PrefixAndTraffic-r16 ::= SEQUENCE {
  all-Traffic-IAB-IP-Address-r16  SEQUENCE (SIZE(1..8)) OF IAB-IP-Address16  OPTIONAL,
  f1-C-Traffic-IAB-IP-Address-r16  SEQUENCE (SIZE(1..8)) OF IAB-IP-Address16  OPTIONAL,
  f1-U-Traffic-IAB-IP-Address-r16  SEQUENCE (SIZE(1..8)) OF IAB-IP-Address16  OPTIONAL,
  ...
}

### IABOtherInformation-IEs field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>iab-IPv4-AddressNumReq</strong></td>
<td>This field is used to request the numbers of IPv4 address per specific usage. The specific usages include F1-C traffic, F1-U traffic, non-F1 traffic and all traffic.</td>
</tr>
<tr>
<td><strong>iab-IPv4-AddressReport</strong></td>
<td>This field is used to report the numbers of IPv4 address per specific usage assigned by OAM for IAB-DU. The specific usages include F1-C traffic, F1-U traffic, non-F1 traffic and all traffic.</td>
</tr>
<tr>
<td><strong>iab-IPv6-AddressNumReq</strong></td>
<td>This field is used to request the numbers of IPv6 address per specific usage. The specific usages include F1-C traffic, F1-U traffic, non-F1 traffic and all traffic.</td>
</tr>
<tr>
<td><strong>iab-IPv6-AddressPrefixReq</strong></td>
<td>This field is used to request the prefix of IPv6 address per specific usage. The specific usages include F1-C traffic, F1-U traffic, non-F1 traffic and all traffic.</td>
</tr>
<tr>
<td><strong>iab-IPv6-AddressReport</strong></td>
<td>This field is used to report the numbers of the IPv6 address per specific usage assigned by OAM for IAB-DU. The specific usages include F1-C traffic, F1-U traffic, non-F1 traffic and all traffic.</td>
</tr>
<tr>
<td><strong>iab-IPv6-PrefixReport</strong></td>
<td>This field is used to report the prefix of IPv6 address per specific usage assigned by OAM for IAB-DU. The specific usages include F1-C traffic, F1-U traffic, non-F1 traffic and all traffic.</td>
</tr>
</tbody>
</table>

### IAB-IP-AddressNumReq-IEs field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>all-Traffic-NumReq</strong></td>
<td>This field is used to request the numbers of IP address for all traffic.</td>
</tr>
<tr>
<td><strong>f1-C-Traffic-NumReq</strong></td>
<td>This field is used to request the numbers of IP address for F1-C traffic.</td>
</tr>
<tr>
<td><strong>f1-U-Traffic-NumReq</strong></td>
<td>This field is used to request the numbers of IP address for F1-U traffic.</td>
</tr>
<tr>
<td><strong>non-F1-Traffic-NumReq</strong></td>
<td>This field is used to request the numbers of IP address for non-F1 traffic.</td>
</tr>
</tbody>
</table>

### IAB-IP-AddressPrefixReq-IEs field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>all-Traffic-PrefixReq</strong></td>
<td>This field is used to request the IPv6 address prefix for all traffic. The length of allocated IPv6 prefix is fixed to 64.</td>
</tr>
<tr>
<td><strong>f1-C-Traffic-PrefixReq</strong></td>
<td>This field is used to request the IPv6 address prefix for F1-C traffic. The length of allocated IPv6 prefix is fixed to 64.</td>
</tr>
<tr>
<td><strong>f1-U-Traffic-PrefixReq</strong></td>
<td>This field is used to request the IPv6 address prefix for F1-U traffic. The length of allocated IPv6 prefix is fixed to 64.</td>
</tr>
<tr>
<td><strong>non-F1-Traffic-PrefixReq</strong></td>
<td>This field is used to request the IPv6 address prefix for non-F1 traffic. The length of allocated IPv6 prefix is fixed to 64.</td>
</tr>
</tbody>
</table>
### IAB-IP-AddressAndTraffic-IEs field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>all-Traffic-IAB-IP-Address</strong></td>
<td>This field is used to report to IAB-donor-CU the IPv4 address(es) or IPv6 address prefix for all traffic.</td>
</tr>
<tr>
<td><strong>f1-C-Traffic-IP-Address</strong></td>
<td>This field is used to report to IAB-donor-CU the IP address(es) or IPv6 address prefix for F1-C traffic.</td>
</tr>
<tr>
<td><strong>f1-U-Traffic-IP-Address</strong></td>
<td>This field is used to report to IAB-donor-CU the IP address(es) or IPv6 address prefix for F1-U traffic.</td>
</tr>
<tr>
<td><strong>non-F1-Traffic-IP-Address</strong></td>
<td>This field is used to report to IAB-donor-CU the IP address(es) or IPv6 address prefix for non-F1 traffic.</td>
</tr>
</tbody>
</table>

---

**LocationMeasurementIndication**

The *LocationMeasurementIndication* message is used to indicate that the UE is going to either start or stop location related measurement which requires measurement gaps.

- Signalling radio bearer: SRB1
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to Network

#### LocationMeasurementIndication message

```
-- ASN1START
-- TAG-LOCATIONMEASUREMENTINDICATION-START

LocationMeasurementIndication ::= SEQUENCE {
    criticalExtensions
        CHOICE {
            locationMeasurementIndication               LocationMeasurementIndication-IEs,
            criticalExtensionsFuture                    SEQUENCE {}
        }
}

LocationMeasurementIndication-IEs ::= SEQUENCE {
    measurementIndication                       SetupRelease {LocationMeasurementInfo},
    lateNonCriticalExtension                    OCTET STRING OPTIONAL,
    nonCriticalExtension                        SEQUENCE{}
}

-- TAG-LOCATIONMEASUREMENTINDICATION-STOP
-- ASN1STOP
```
The **LoggedMeasurementConfiguration** message is used to perform logging of measurement results while in RRC_IDLE or RRC_INACTIVE. It is used to transfer the logged measurement configuration for network performance optimisation.

**Signalling radio bearer:** SRB1

**RLC-SAP:** AM

**Logical channel:** DCCH

**Direction:** Network to UE

### LoggedMeasurementConfiguration message

```asn1
LoggedMeasurementConfiguration-r16 ::= SEQUENCE {
  criticalExtensions                      CHOICE {
    loggedMeasurementConfiguration-r16      LoggedMeasurementConfiguration-r16-IEs,
    criticalExtensionsFuture                SEQUENCE {},
  }
}

LoggedMeasurementConfiguration-r16-IEs ::= SEQUENCE {
  traceReference-r16                          TraceReference-r16,
  traceRecordingSessionRef-r16                OCTET STRING {SIZE (2)},
  tce-Id-r16                                  OCTET STRING {SIZE (1)},
  absoluteTimeInfo-r16                        AbsoluteTimeInfo-r16,
  areaConfiguration-r16                       AreaConfiguration-r16, OPTIONAL, --Need R
  plmn-IdentityList-r16                       PLMN-IdentityList2-r16, OPTIONAL, --Need R
  bt-NameList-r16                              SetupRelease {BT-NameList-r16}, OPTIONAL, --Need M
  wlan-NameList-r16                           SetupRelease {WLAN-NameList-r16}, OPTIONAL, --Need M
  sensor-NameList-r16                         SetupRelease {Sensor-NameList-r16}, OPTIONAL, --Need M
  loggingDuration-r16                         LoggingDuration-r16,
  reportType                                  CHOICE {
    periodical                               LoggedPeriodicalReportConfig-r16,
    eventTriggered                           LoggedEventTriggerConfig-r16,
    ...
  },
  lateNonCriticalExtension                    OCTET STRING OPTIONAL,
  nonCriticalExtension                       SEQUENCE {}, OPTIONAL
}

LoggedPeriodicalReportConfig-r16 ::= SEQUENCE {
  loggingInterval-r16                          LoggingInterval-r16,
  ...
}

LoggedEventTriggerConfig-r16 ::= SEQUENCE {
  eventType-r16                                   EventType-r16,
  ...
}
```
loggingInterval-r16 ::= LoggingInterval-r16,
...

EventType-r16 ::= CHOICE {
  outOfCoverage     NULL,
  eventL1           SEQUENCE {
    ll-Threshold      MeasTriggerQuantity,         
    hysteresis        Hysteresis,               
    timeToTrigger     TimeToTrigger
  },
...
}

-- TAG-LOGGEDMEASUREMENTCONFIGURATION-STOP
-- ASN1STOP

--- LoggedMeasurementConfiguration field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>absoluteTimeInfo</td>
<td>Indicates the absolute time in the current cell.</td>
</tr>
<tr>
<td>areaConfiguration</td>
<td>Used to restrict the area in which the UE performs measurement logging to cells broadcasting either one of the included cell identities or one of the included tracking area codes/ frequencies.</td>
</tr>
<tr>
<td>eventType</td>
<td>The value outOfCoverage indicates the UE to perform logging of measurements when the UE enters any cell selection state, and the value eventL1 indicates the UE to perform logging of measurements when the triggering condition (similar as event A2 as specified in 5.5.4.3) as configured in the event is met for the camping cell in camped normally state.</td>
</tr>
<tr>
<td>plmn-IdentityList</td>
<td>Indicates a set of PLMNs defining when the UE performs measurement logging as well as the associated status indication and information retrieval i.e. the UE performs these actions when the RPLMN is part of this set of PLMNs.</td>
</tr>
<tr>
<td>tce-Id</td>
<td>Parameter Trace Collection Entity Id: See TS 32.422 [52].</td>
</tr>
<tr>
<td>traceRecordingSessionRef</td>
<td>Parameter Trace Recording Session Reference: See TS 32.422 [52].</td>
</tr>
<tr>
<td>reportType</td>
<td>Parameter configures the type of MDT configuration, specifically Periodic MDT configuration or Event Triggered MDT configuration.</td>
</tr>
</tbody>
</table>

--- MCGFailureInformation

The *MCGFailureInformation* message is used to provide information regarding NR MCG failures detected by the UE.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH
Direction: UE to Network

**MCGFailureInformation message**

```asn1
-- ASN1START
-- TAG-MCGFAILUREINFORMATION-START

MCGFailureInformation-r16 ::= SEQUENCE {
criticalExtensions           CHOICE {
  mcgFailureInformation-r16   MCGFailureInformation-r16-IEs,
criticalExtensionsFuture    SEQUENCE {}
}
}

MCGFailureInformation-r16-IEs ::= SEQUENCE {
  failureReportMCG-r16        FailureReportMCG-r16 OPTIONAL,
  lateNonCriticalExtension   OCTET STRING OPTIONAL,
  nonCriticalExtension       SEQUENCE {}
}

FailureReportMCG-r16 ::= SEQUENCE {
  failureType-r16             ENUMERATED {t310-Expiry, randomAccessProblem, rlc-MaxNumRetx,
                                      t312-Expiry-r16, lbt-Failure-r16, beamFailureRecoveryFailure-r16,
                                      bh-RLF-r16, spare1} OPTIONAL,
  measResultFreqList-r16      MeasResultList2NR OPTIONAL,
  measResultFreqListEUTRA-r16 MeasResultList2EUTRA OPTIONAL,
  measResultSCG-r16           OCTET STRING (CONTAINING MeasResultSCG-Failure) OPTIONAL,
  measResultSCG-EUTRA-r16     OCTET STRING OPTIONAL,
  measResultFreqListUTRA-FDD-r16 MeasResultList2UTRA FDD-r16 OPTIONAL,
  ...
}

MeasResultList2UTRA ::= SEQUENCE (SIZE (1..maxFreq)) OF MeasResult2UTRA-FDD-r16

MeasResult2UTRA-FDD-r16 ::= SEQUENCE {
carrierFreq-r16             ARFCN-ValueUTRA-FDD-r16,
  measResultNeighCellList-r16 MeasResultListUTRA-FDD-r16
}

MeasResultList2EUTRA ::= SEQUENCE (SIZE (1..maxFreq)) OF MeasResult2EUTRA-r16

-- TAG-MCGFAILUREINFORMATION-STOP
-- ASN1STOP
```
**MeasurementReport**

The *MeasurementReport* message is used for the indication of measurement results.

- Signalling radio bearer: SRB1, SRB3
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to Network

### MeasurementReport message

```
-- ASN1START
-- TAG-MEASUREMENTREPORT-START

MeasurementReport ::= SEQUENCE {
  criticalExtensions  CHOICE {
    measurementReport               MeasurementReport-IEs,
    criticalExtensionsFuture         SEQUENCE {}       
  }
}

MeasurementReport-IEs ::= SEQUENCE {
  measResults          MeasResults,
  lateNonCriticalExtension   OCTET STRING OPTIONAL,
  nonCriticalExtension     SEQUENCE{}          OPTIONAL
}

-- TAG-MEASUREMENTREPORT-STOP
-- ASN1STOP
```

**MCGFailureInformation field descriptions**

- **measResultFreqList**
The field contains available results of measurements on NR frequencies the UE is configured to measure by the `measConfig` associated with the MCG.

- **measResultFreqListEUTRA**
The field contains available results of measurements on E-UTRA frequencies the UE is configured to measure by `measConfig` associated with the MCG.

- **measResultFreqListUTRA-FDD**
The field contains available results of measurements on UTRA FDD frequencies the UE is configured to measure by `measConfig` associated with the MCG.

- **measResultSCG**
The field contains the MeasResultSCG-Failure IE which includes available measurement results on NR frequencies the UE is configured to measure by the `measConfig` associated with the SCG.

- **measResultSCG-EUTRA**
The field contains the EUTRA MeasResultSCG-FailureMRDC IE which includes available results of measurements on E-UTRA frequencies the UE is configured to measure by the E-UTRA `RRCConnectionReconfiguration` message as specified in TS 36.331 [10].
The MIB includes the system information transmitted on BCH.

- Signalling radio bearer: N/A
- RLC-SAP: TM
- Logical channel: BCCH
- Direction: Network to UE

```asn1
MIB ::= SEQUENCE {
    systemFrameNumber BIT STRING (SIZE (6)),
    subCarrierSpacingCommon ENUMERATED {scs15or60, scs30or120},
    ssb-SubcarrierOffset INTEGER (0..15),
    dmrs-TypeA-Position ENUMERATED {pos2, pos3},
    pdcch-ConfigSIB1, PDCCH-ConfigSIB1,
    cellBarred ENUMERATED {barred, notBarred},
    intraFreqReselection ENUMERATED {allowed, notAllowed},
    spare BIT STRING (SIZE (1))
}
```

### MIB field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cellBarred</td>
<td>Value <code>barred</code> means that the cell is barred, as defined in TS 38.304 [20]. This field is ignored by IAB-MT.</td>
</tr>
<tr>
<td>dmrs-TypeA-Position</td>
<td>Position of (first) DM-RS for downlink (see TS 38.211 [16], clause 7.4.1.1.2) and uplink (see TS 38.211 [16], clause 6.4.1.1.3).</td>
</tr>
<tr>
<td>intraFreqReselection</td>
<td>Controls cell selection/reselection to intra-frequency cells when the highest ranked cell is barred, or treated as barred by the UE, as specified in TS 38.304 [20]. This field is ignored by IAB-MT.</td>
</tr>
<tr>
<td>pdcch-ConfigSIB1</td>
<td>Determines a common ControlResourceSet (CORESET), a common search space and necessary PDCCH parameters. If the field ssb-SubcarrierOffset indicates that SIB1 is absent, the field pdcch-ConfigSIB1 indicates the frequency positions where the UE may find SS/PBCH block with SIB1 or the frequency range where the network does not provide SS/PBCH block with SIB1 (see TS 38.213 [13], clause 13).</td>
</tr>
<tr>
<td>ssb-SubcarrierOffset</td>
<td>Corresponds to $k_{SSB}$ (see TS 38.213 [13]), which is the frequency domain offset between SSB and the overall resource block grid in number of subcarriers. (See TS 38.211 [16], clause 7.4.3.1). For operation with shared spectrum channel access (see 37.213 [48]), this field corresponds to $k_{SSB}$ and $k_{SSB}$ is obtained from $k_{SSB}$ (see TS 38.211 [16], clause 7.4.3.1); the LSB of this field is used also for deriving the QCL relation between SS/PBCH blocks as specified in TS 38.213 [13], clause 4.1. The value range of this field may be extended by an additional most significant bit encoded within PBCH as specified in TS 38.213 [13]. This field may indicate that this cell does not provide SIB1 and that there is hence no CORESET#0 configured in MIB (see TS 38.213 [13], clause 13). In this case, the field pdcch-ConfigSIB1 may indicate the frequency positions where the UE may (not) find a SS/PBCH with a control resource set and search space for SIB1 (see TS 38.213 [13], clause 13).</td>
</tr>
<tr>
<td>subCarrierSpacingCommon</td>
<td>Subcarrier spacing for SIB1, Msg.2/4 for initial access, paging and broadcast SI-messages. If the UE acquires this MIB on an FR1 carrier frequency, the value $scs_{15or60}$ corresponds to 15 kHz and the value $scs_{30or120}$ corresponds to 30 kHz. If the UE acquires this MIB on an FR2 carrier frequency, the value $scs_{15or60}$ corresponds to 60 kHz and the value $scs_{30or120}$ corresponds to 120 kHz. For operation with shared spectrum channel access (see 37.213 [48]), the subcarrier spacing for SIB1 is same as that for the corresponding SSB and this field instead is used for deriving the QCL relation between SS/PBCH blocks as specified in TS 38.213 [13], clause 4.1.</td>
</tr>
<tr>
<td>systemFrameNumber</td>
<td>The 6 most significant bits (MSB) of the 10-bit System Frame Number (SFN). The 4 LSB of the SFN are conveyed in the PBCH transport block as part of channel coding (i.e. outside the MIB encoding), as defined in clause 7.1 in TS 38.212 [17].</td>
</tr>
</tbody>
</table>

---

**MobilityFromNRCommand**

The *MobilityFromNRCommand* message is used to command handover from NR to E-UTRA/EPC, E-UTRA/5GC or UTRA-FDD.

- Signalling radio bearer: SRB1
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: Network to UE

---

**MobilityFromNRCommand message**
MobilityFromNRCommand ::= SEQUENCE {
  rrc-TransactionIdentifier         RRC-TransactionIdentifier,
  criticalExtensions               CHOICE {
    mobilityFromNRCommand           MobilityFromNRCommand-IEs,
    criticalExtensionsFuture        SEQUENCE {}   -- Cond HO-ToEPCUTRAN
  }
}

MobilityFromNRCommand-IEs ::= SEQUENCE {
  targetRAT-Type                   ENUMERATED { eutra, utra-fdd-v1610, spare2, spare1, ...},
  targetRAT-MessageContainer       OCTET STRING,             OPTIONAL,   -- Cond HO-ToEPCUTRAN
  nas-SecurityParamFromNR          OCTET STRING,             OPTIONAL,   -- Cond HO-ToEPCUTRAN
  lateNonCriticalExtension         OCTET STRING,             OPTIONAL,   -- Cond HO-ToEPCUTRAN
  nonCriticalExtension             MobilityFromNRCommand-v1610-IEs
}

MobilityFromNRCommand-v1610-IEs ::= SEQUENCE {
  voiceFallbackIndication-r16      ENUMERATED { true}                            OPTIONAL,   -- Need N
  nonCriticalExtension             SEQUENCE {}                            OPTIONAL
}

-- TAG-MOBILITYFROMNRCOMMAND-STOP
-- ASN1STOP

**MobilityFromNRCommand-IEs field descriptions**

**nas-SecurityParamFromNR**
If targetRAT-Type is eutra, this field is used to deliver the key synchronisation and Key freshness for the NR to LTE/EPC handovers and a part of the downlink NAS COUNT as specified in TS 33.501 [11]. If targetRAT-Type is utra-fdd, this field is used to deliver the key synchronisation and Key freshness for the NR to FDD UTRAN handover and a part of the downlink NAS COUNT as specified in TS 33.501 [11].

**targetRAT-MessageContainer**
The field contains a message specified in another standard, as indicated by the targetRAT-Type, and carries information about the target cell identifier(s) and radio parameters relevant for the target radio access technology. A complete message is included, as specified in the other standard. See NOTE 1

**targetRAT-Type**
Indicates the target RAT type.

**voiceFallbackIndication**
Indicates the handover is triggered by EPS fallback for IMS voice as specified in TS 23.502 [43].

NOTE 1: The correspondence between the value of the targetRAT-Type, the standard to apply, and the message contained within the targetRAT-MessageContainer is shown in the table below:

<table>
<thead>
<tr>
<th>targetRAT-Type</th>
<th>Standard to apply</th>
<th>targetRAT-MessageContainer</th>
</tr>
</thead>
<tbody>
<tr>
<td>eutra</td>
<td>TS 36.331 [10] (clause 5.4.2)</td>
<td>DL-DCCH-Message including the RRCCConnectionReconfiguration</td>
</tr>
<tr>
<td>utra-fdd</td>
<td>TS 25.331 [45] (clause 10.2.16a)</td>
<td>Handover TO UTRAN command</td>
</tr>
</tbody>
</table>
### HO-ToEPCUTRAN
This field is mandatory present in case of inter system handover to “EPC” or “FDD UTRAN2”. Otherwise it is absent.

---

## Paging

The **Paging** message is used for the notification of one or more UEs.

- **Signalling radio bearer:** N/A
- **RLC-SAP:** TM
- **Logical channel:** PCCH
- **Direction:** Network to UE

### Paging message

```asn1
Paging ::= SEQUENCE {
  pagingRecordList                    PagingRecordList                                                        OPTIONAL, -- Need N
  lateNonCriticalExtension            OCTET STRING                                                            OPTIONAL,
  nonCriticalExtension                SEQUENCE{}                                                              OPTIONAL
}

PagingRecordList ::= SEQUENCE (SIZE(1..maxNrofPageRec)) OF PagingRecord

PagingRecord ::= SEQUENCE {
  ue-Identity                         PagingUE-Identity,
  accessType                          ENUMERATED {non3GPP}    OPTIONAL,   -- Need N
  ...
}

PagingUE-Identity ::= CHOICE {
  ng-5G-S-TMSI                        NG-5G-S-TMSI,
  fullI-RNTI                          I-RNTI-Value,
  ...
}
```

### PagingRecord field descriptions

- **accessType**
  Indicates whether the **Paging** message is originated due to the PDU sessions from the non-3GPP access.
**RRCReestablishment**

The **RRCReestablishment** message is used to re-establish SRB1.

- Signalling radio bearer: SRB1
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: Network to UE

**RRCReestablishment message**

```asn1
RRCReestablishment ::= SEQUENCE {
  rrc-TransactionIdentifier            RRC-TransactionIdentifier,
  criticalExtensions                  CHOICE {
    rrcReestablishment                  RRCReestablishment-IEs,
    criticalExtensionsFuture            SEQUENCE {} } }
RRCReestablishment-IEs ::= SEQUENCE {
  nextHopChainingCount                NextHopChainingCount,
  lateNonCriticalExtension            OCTET STRING                        OPTIONAL,
  nonCriticalExtension                SEQUENCE {}                         OPTIONAL }
```

**RRCReestablishmentComplete**

The **RRCReestablishmentComplete** message is used to confirm the successful completion of an RRC connection re-establishment.

- Signalling radio bearer: SRB1
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to Network
RRCReestablishmentComplete message

The RRCReestablishmentComplete message is used to request the reestablishment of an RRC connection.

Signalling radio bearer: SRB0
RLC-SAP: TM
Logical channel: CCCH
Direction: UE to Network

RRCReestablishmentRequest message
RRCReestablishmentRequest-IEs

field descriptions

reestablishmentCause
Indicates the failure cause that triggered the re-establishment procedure. gNB is not expected to reject a RRCReestablishmentRequest due to unknown cause value being used by the UE.

ue-Identity
UE identity included to retrieve UE context and to facilitate contention resolution by lower layers.

-- RRCReconfiguration

The RRCReconfiguration message is the command to modify an RRC connection. It may convey information for measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) and AS security configuration.

Signalling radio bearer: SRB1 or SRB3
RLC-SAP: AM
Logical channel: DCCH
Direction: Network to UE

RRCReconfiguration message

-- ASN1START
-- TAG-RRCRECONFIGURATION-START

RRCReconfiguration ::= SEQUENCE {

}
RRCReconfiguration-IEs ::= SEQUENCE {  
radioBearerConfig RadioBearerConfig OPTIONAL, -- Need M  
secondaryCellGroup OCTET STRING (CONTAINING CellGroupConfig) OPTIONAL, -- Cond SCG  
measConfig MeanConfig OPTIONAL, -- Need M  
lateNonCriticalExtension OCTET STRING OPTIONAL, -- Need M  
nonCriticalExtension RRCReconfiguration-v1530-IEs OPTIONAL }  
RRCReconfiguration-v1530-IEs ::= SEQUENCE {  
masterCellGroup OCTET STRING (CONTAINING CellGroupConfig) OPTIONAL, -- Need M  
fullConfig ENUMERATED {true} OPTIONAL, -- Cond FullConfig  
dedicatedNAS-MessageList SEQUENCE (SIZE(1..maxDRB)) OF DedicatedNAS-Message OPTIONAL, -- Cond nonHO  
masterKeyUpdate MasterKeyUpdate OPTIONAL, -- Cond  
MasterKeyChange dedicatedSIB1-Delivery OCTET STRING (CONTAINING SIB1) OPTIONAL, -- Need N  
dedicatedSystemInformationDelivery OCTET STRING (CONTAINING SystemInformation) OPTIONAL, -- Need N  
otherConfig OtherConfig OPTIONAL, -- Need M  
nonCriticalExtension RRCReconfiguration-v1540-IEs OPTIONAL }  
RRCReconfiguration-v1540-IEs ::= SEQUENCE {  
otherConfig-v1540 OtherConfig-v1540 OPTIONAL, -- Need M  
nonCriticalExtension RRCReconfiguration-v1540-IEs OPTIONAL }  
RRCReconfiguration-v1560-IEs ::= SEQUENCE {  
mrdc-SecondaryCellGroupConfig SetupRelease { MRDC-SecondaryCellGroupConfig } OPTIONAL, -- Need M  
radioBearerConfig2 OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL, -- Need M  
sk-Counter SK-Counter OPTIONAL, -- Need N  
nonCriticalExtension RRCReconfiguration-v1610-IEs OPTIONAL }  
RRCReconfiguration-v1610-IEs ::= SEQUENCE {  
otherConfig-v1610 OtherConfig-v1610 OPTIONAL, -- Need M  
bap-Config-r16 SetupRelease { BAP-Config-r16 } OPTIONAL, -- Need M  
ib-IP-AddressConfigurationList-r16 IAB-IP-AddressConfigurationList-r16 OPTIONAL, -- Need M  
conditionalReconfiguration-r16 ConditionalReconfiguration-r16 OPTIONAL, -- Need M  
daps-SourceRelease-r16 ENUMERATED {true} OPTIONAL, -- Need M  
t316-r16 SetupRelease {T316-r16} OPTIONAL, -- Need M  
needForGapsConfigNR-r16 SetupRelease {NeedForGapsConfigNR-r16} OPTIONAL, -- Need M  
onDemandSIB-Request-r16 SetupRelease { OnDemandSIB-Request-r16 } OPTIONAL, -- Need M  
dedicatedPosSysInfoDelivery-r16 OCTET STRING (CONTAINING PosSystemInformation-r16-IEs) OPTIONAL, -- Need N  
sl-ConfigDedicatedNR-r16 SetupRelease {SL-ConfigDedicatedNR-r16} OPTIONAL, -- Need N  
sl-ConfigDedicatedEUTRA-Info-r16 SetupRelease {SL-ConfigDedicatedEUTRA-Info-r16} OPTIONAL, -- Need N  
targetCellSMTCE-SCG-r16 SSB-MTC OPTIONAL, -- Need S  
nonCriticalExtension SEQUENCE {} }
MRDC-SecondaryCellGroupConfig ::= SEQUENCE {
    mrdc-ReleaseAndAdd ENUMERATED {true} OPTIONAL, -- Need N
    mrdc-SecondaryCellGroup OCTET STRING (CONTAINING RRCReconfiguration),
    nr-SCG OCTET STRING
}

BAP-Config-r16 ::= SEQUENCE {
    bap-Address-r16 BIT STRING (SIZE (10)) OPTIONAL, -- Need M
    defaultUL-BAP-RoutingID-r16 BAP-RoutingID-r16 OPTIONAL, -- Need M
    defaultUL-BH-RLC-Channel-r16 BH-RLC-ChannelID-r16 OPTIONAL, -- Need M
    flowControlFeedbackType-r16 ENUMERATED {perBH-RLC-Channel, perRoutingID, both} OPTIONAL, -- Need R
}

MasterKeyUpdate ::= SEQUENCE {
    keySetChangeIndicator BOOLEAN,
    nextHopChainingCount NextHopChainingCount,
    nas-Container OCTET STRING OPTIONAL, -- Cond securityNAS-C
}

OnDemandSIB-Request-r16 ::= SEQUENCE {
    onDemandSIB-RequestProhibitTimer-r16 ENUMERATED {s0, s0dot5, s1, s2, s5, s10, s20, s30}
}

T316-r16 ::= ENUMERATED {ms50, ms100, ms200, ms300, ms400, ms500, ms600, ms1000, ms1500, ms2000}

IAB-IP-AddressConfigurationList-r16 ::= SEQUENCE {
    iab-IP-AddressToAddModList-r16 SEQUENCE (SIZE(1..maxIAB-IP-Address-r16)) OF IAB-IP-AddressConfiguration-r16 OPTIONAL, -- Need N
    iab-IP-AddressToReleaseList-r16 SEQUENCE (SIZE(1..maxIAB-IP-Address-r16)) OF IAB-IP-AddressIndex-r16 OPTIONAL, -- Need N
}

IAB-IP-AddressConfiguration-r16 ::= SEQUENCE {
    iab-IP-AddressIndex-r16 IAB-IP-AddressIndex-r16,
    iab-IP-Address-r16 IAB-IP-Address-r16 OPTIONAL, -- Need M
    iab-IP-Usage-r16 IAB-IP-Usage-r16 OPTIONAL, -- Need M
    iab-donor-DU-BAP-Address-r16 BIT STRING (SIZE(10)) OPTIONAL, -- Need M
}

SL-ConfigDedicatedEUTRA-Info-r16 ::= SEQUENCE {
    sl-ConfigDedicatedEUTRA-r16 OCTET STRING OPTIONAL, -- Need M
    sl-TimeOffsetEUTRA-List-r16 SEQUENCE (SIZE (8)) OF SL-TimeOffsetEUTRA-r16 OPTIONAL -- Need M
}

SL-TimeOffsetEUTRA-r16 ::= ENUMERATED {ms0, ms0dot25, ms0dot5, ms0dot75, ms1, ms1dot25, ms1dot5, ms1dot75, ms2, ms2dot5, ms3, ms4, ms5, ms6, ms8, ms10, ms20}

-- TAG-RRCReconfiguration-STOP
-- ASN1STOP
### RRCReconfiguration-IEs field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bap-Config</strong></td>
<td>This field is used to configure the BAP entity for IAB nodes.</td>
</tr>
<tr>
<td><strong>bap-Address</strong></td>
<td>Indicates the BAP address of an IAB-node.</td>
</tr>
<tr>
<td><strong>conditionalReconfiguration</strong></td>
<td>Configuration of candidate target SpCell(s) and execution condition(s) for conditional handover or conditional PSCell change. For conditional PSCell change, this field may only be present in an RRCReconfiguration message for intra-SN PSCell change. The network does not configure a UE with both conditional PCell change and conditional PSCell change simultaneously. The field is absent if any DAPS bearer is configured or if the masterCellGroup includes ReconfigurationWithSync. For conditional PSCell change, the field is absent if the secondaryCellGroup includes ReconfigurationWithSync. The RRCReconfiguration message contained in DLInformationTransferMRDC cannot contain the field conditionalReconfiguration for conditional PSCell change.</td>
</tr>
<tr>
<td><strong>daps-SourceRelease</strong></td>
<td>Indicates to UE that the source cell part of DAPS operation is to be stopped and the source cell part of DAPS configuration is to be released.</td>
</tr>
<tr>
<td><strong>dedicatedNAS-MessageList</strong></td>
<td>This field is used to transfer UE specific NAS layer information between the network and the UE. The RRC layer is transparent for each PDU in the list.</td>
</tr>
<tr>
<td><strong>dedicatedPosSysInfoDelivery</strong></td>
<td>This field is used to transfer SIBPos to the UE in RRC_CONNECTED.</td>
</tr>
<tr>
<td><strong>dedicatedSIB1-Delivery</strong></td>
<td>This field is used to transfer SIB1 to the UE. The field has the same values as the corresponding configuration in servingCellConfigCommon.</td>
</tr>
<tr>
<td><strong>dedicatedSystemInformationDelivery</strong></td>
<td>This field is used to transfer SIB6, SIB7, SIB8 to the UE with an active BWP with no common search space configured. For UEs in RRC_CONNECTED, this field is used to transfer the SIBs requested on-demand.</td>
</tr>
<tr>
<td><strong>defaultUL-BAP-RoutingID</strong></td>
<td>This field is used for IAB-node to configure the default uplink Routing ID, which is used by IAB-node during IAB-node bootstrapping, migration, IAB-MT RRC resume and IAB-MT RRC re-establishment for F1-C and non-F1 traffic. The defaultUL-BAP-RoutingID can be (re-)configured when IAB-node IP address for F1-C related traffic changes. This field is mandatory only for IAB-node bootstrapping and change of IP address for IAB-node cases.</td>
</tr>
<tr>
<td><strong>defaultUL-BH-RLC-Channel</strong></td>
<td>This field is used for IAB-nodes to configure the default uplink BH RLC channel, which is used by IAB-node during IAB-node bootstrapping, migration, IAB-MT RRC resume and IAB-MT RRC re-establishment for F1-C and non-F1 traffic. The defaultUL-BH-RLC-Channel can be (re-)configured when IAB-node IP address for F1-C related traffic changes, and the new IP address is anchored at a different IAB-donor-DU. This field is mandatory for IAB-node bootstrapping and change of IP address for IAB-node cases. If the IAB-MT is operating in EN-DC, the default uplink BH RLC channel is referring to an RLC channel on the SCG; Otherwise, it is referring to an RLC channel on the MCG.</td>
</tr>
<tr>
<td><strong>flowControlFeedbackType</strong></td>
<td>This field is only used for IAB-node that support hop-by-hop flow control to configure the type of flow control feedback. Value perBH-RLC-Channel indicates that the IAB-node shall provide flow control feedback per BH RLC channel, value perRoutingID indicates that the IAB-node shall provide flow control feedback per routing ID, and value both indicates that the IAB-node shall provide flow control feedback both per BH RLC channel and per routing ID.</td>
</tr>
<tr>
<td><strong>fullConfig</strong></td>
<td>Indicates that the full configuration option is applicable for the RRCReconfiguration message for intra-system intra-RAT HO. For inter-RAT HO from E-UTRA to NR, fullConfig indicates whether or not delta signalling of SDAP/PDCP from source RAT is applicable. This field is absent if any DAPS bearer is configured or when the RRCReconfiguration message is transmitted on SRB3, and in an RRCReconfiguration message contained in another RRCReconfiguration message (or RRCConnectionReconfiguration message, see TS 36.331 [10]) transmitted on SRB1.</td>
</tr>
<tr>
<td><strong>iab-IP-Address</strong></td>
<td>This field is used to provide the IP address information for IAB-node.</td>
</tr>
<tr>
<td><strong>iab-IP-AddressIndex</strong></td>
<td>This field is used to identify a configuration of an IP address.</td>
</tr>
<tr>
<td><strong>iab-IP-AddressToAddModList</strong></td>
<td>List of IP addresses allocated for IAB-node to be added and modified.</td>
</tr>
<tr>
<td><strong>iab-IP-AddressToReleaseList</strong></td>
<td>List of IP address allocated for IAB-node to be released.</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td><strong>iab-IP-Usage</strong></td>
<td>This field is used to indicate the usage of the assigned IP address. If this field is absent, the assigned IP address is used for all traffic.</td>
</tr>
<tr>
<td><strong>iab-donor-DU-BAP-Address</strong></td>
<td>This field is used to indicate the BAP address of the IAB-donor-DU where the IP address is anchored.</td>
</tr>
<tr>
<td><strong>keySetChangeIndicator</strong></td>
<td>Indicates whether UE shall derive a new $K_{gNB}$. If reconfigurationWithSync is included, value <em>true</em> indicates that a $K_{gNB}$ key is derived from a $K_{AMF}$ key taken into use through the latest successful NAS SMC procedure, or N2 handover procedure with KAMF change, as described in TS 33.501 [11] for $K_{gNB}$ re-keying. Value <em>false</em> indicates that the new $K_{gNB}$ key is obtained from the current $K_{gNB}$ key or from the NH as described in TS 33.501 [11].</td>
</tr>
<tr>
<td><strong>masterCellGroup</strong></td>
<td>Configuration of master cell group.</td>
</tr>
<tr>
<td><strong>mrdc-ReleaseAndAdd</strong></td>
<td>This field indicates that the current SCG configuration is released and a new SCG is added at the same time.</td>
</tr>
<tr>
<td><strong>mrdc-SecondaryCellGroup</strong></td>
<td>Includes an RRC message for SCG configuration in NR-DC or NE-DC. For NR-DC (nr-SCG), <strong>mrdc-SecondaryCellGroup</strong> contains the <strong>RRCReconfiguration</strong> message as generated (entirely) by SN gNB. In this version of the specification, the RRC message can only include fields <strong>secondaryCellGroup</strong>, <strong>otherConfig</strong>, <strong>conditionalReconfiguration</strong> and <strong>measConfig</strong>. For NE-DC (eutra-SCG), <strong>mrdc-SecondaryCellGroup</strong> includes the E-UTRA <strong>RRCConnectionReconfiguration</strong> message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field <strong>scg-Configuration</strong>.</td>
</tr>
<tr>
<td><strong>nas-Container</strong></td>
<td>This field is used to transfer UE specific NAS layer information between the network and the UE. The RRC layer is transparent for this field, although it affects activation of AS security after inter-system handover to NR. The content is defined in TS 24.501 [23].</td>
</tr>
<tr>
<td><strong>needForGapsConfigNR</strong></td>
<td>Configuration for the UE to report measurement gap requirement information of NR target bands in the <strong>RRCReconfigurationComplete</strong> and <strong>RRCResumeComplete</strong> message.</td>
</tr>
<tr>
<td><strong>nextHopChainingCount</strong></td>
<td>Parameter NCC; See TS 33.501 [11]</td>
</tr>
<tr>
<td><strong>onDemandSIB-Request</strong></td>
<td>If the field is present, the UE is allowed to request SIB(s) on-demand while in RRC_CONNECTED according to clause 5.2.2.3.5.</td>
</tr>
<tr>
<td><strong>onDemandSIB-RequestProhibitTimer</strong></td>
<td>Prohibit timer for requesting SIB(s) on-demand while in RRC_CONNECTED according to clause 5.2.2.3.5. Value in seconds. Value s0 means prohibit timer is set to 0 seconds, value s0.05 means prohibit timer is set to 0.5 seconds, value s1 means prohibit timer is set to 1 second and so on.</td>
</tr>
<tr>
<td><strong>otherConfig</strong></td>
<td>Contains configuration related to other configurations. When configured for the SCG, only fields <strong>drx-PreferenceConfig</strong>, <strong>maxBW-PreferenceConfig</strong>, <strong>maxCC-PreferenceConfig</strong>, <strong>maxMIMO-LayerPreferenceConfig</strong> and <strong>minSchedulingOffsetPreferenceConfig</strong> can be included.</td>
</tr>
<tr>
<td><strong>radioBearerConfig</strong></td>
<td>Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP. In EN-DC this field may only be present if the <strong>RRCReconfiguration</strong> is transmitted over SRB3.</td>
</tr>
<tr>
<td><strong>radioBearerConfig2</strong></td>
<td>Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP. This field can only be used if the UE supports NR-DC or NE-DC.</td>
</tr>
<tr>
<td><strong>secondaryCellGroup</strong></td>
<td>Configuration of secondary cell group ((NG)EN-DC or NR-DC).</td>
</tr>
<tr>
<td><strong>sk-Counter</strong></td>
<td>A counter used upon initial configuration of S-KgNB or S-KeNB, as well as upon refresh of S-KgNB or S-KeNB. This field is always included either upon initial configuration of an NR SCG or upon configuration of the first RB with <strong>keyToUse</strong> set to secondary, whichever happens first. This field is absent if there is neither any NR SCG nor any RB with <strong>keyToUse</strong> set to secondary.</td>
</tr>
<tr>
<td><strong>si-ConfigDedicatedNR</strong></td>
<td>This field is used to provide the dedicated configurations for NR sidelink communication.</td>
</tr>
</tbody>
</table>
This field includes the E-UTRA RRCConnectionReconfiguration as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRCConnectionReconfiguration can only includes sidelink related fields for V2X sidelink communication, i.e. sl-V2X-ConfigDedicated, sl-V2X-SPS-Config, measConfig and/or otherConfig.

This field indicates the possible time offset to (de)activation of V2X sidelink transmission after receiving DCI format 3_1 used for scheduling V2X sidelink communication. Value ms0 corresponds to 0.75ms, ms1 corresponds to 1ms and so on. The network includes this field only when sl-ConfigDedicatedEUTRA is configured.

The SSB periodicity/offset/duration configuration of target cell for NR PCell addition and SN change. When UE receives this field, UE applies the configuration based on the timing reference of NR PCell for PCell addition and PCell change. If both this field and the smtc in secondaryCellGroup -> SpCellConfig -> reconfigurationWithSync are absent, the UE uses the SMT in the measObjectNR having the same SSB frequency and subcarrier spacing, as configured before the reception of the RRC message.

This field indicates the value for timer T316 as described in clause 7.1. Value ms50 corresponds to 50 ms, value ms100 corresponds to 100 ms and so on. This field can be configured only if the UE is configured with split SRB1 or SRB3.

---

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>nonHO</td>
<td>The field is absent in case of reconfiguration with sync within NR or to NR; otherwise it is optionally present, need N.</td>
</tr>
<tr>
<td>securityNASC</td>
<td>This field is mandatory present in case masterCellGroup includes ReconfigurationWithSync and RadioBearerConfig includes SecurityConfig with SecurityAlgorithmConfig, indicating a change of the AS security algorithms associated to the master key.</td>
</tr>
<tr>
<td>MasterKeyChange</td>
<td>This field is mandatory present in case masterCellGroup includes ReconfigurationWithSync and masterCellGroup includes SecurityConfig with SecurityAlgorithmConfig, indicating a change of the AS security algorithms associated to the master key.</td>
</tr>
<tr>
<td>FullConfig</td>
<td>The field is mandatory present in case of inter-system handover from E-UTRA/EPC to NR. It is optionally present, Need N, during reconfiguration with sync and also in first reconfiguration after reestablishment; or for intra-system handover from E-UTRA/5GC to NR. It is absent otherwise.</td>
</tr>
<tr>
<td>SCG</td>
<td>The field is optional present, Need M, in:</td>
</tr>
<tr>
<td></td>
<td>- an RRCReconfiguration message transmitted on SRB3,</td>
</tr>
<tr>
<td></td>
<td>- an RRCReconfiguration message contained in another RRCReconfiguration message (or in an RRCConnectionReconfiguration message, see TS 36.331 [10]) transmitted on SRB1</td>
</tr>
<tr>
<td></td>
<td>- an RRCReconfiguration message transmitted in another RRCReconfiguration message (or in an RRCConnectionReconfiguration message, see TS 36.331 [10]) which is contained in DLInformationTransferMRDC transmitted on SRB3 (as a response to ULInformationTransferMRDC including an MCGFailureInformation)</td>
</tr>
<tr>
<td></td>
<td>- in an RRCReconfiguration message contained in an RRCResume message (or in an RRCConnectionResume message, see TS 36.331 [10]).</td>
</tr>
<tr>
<td></td>
<td>Otherwise, the field is absent</td>
</tr>
</tbody>
</table>

**RRCReconfigurationComplete**

The RRCReconfigurationComplete message is used to confirm the successful completion of an RRC connection reconfiguration.

Signalling radio bearer: SRB1 or SRB3

RLC-SAP: AM

Logical channel: DCCH
Direction: UE to Network

RRCReconfigurationComplete message

```
-- ASN1START
-- TAG-RRCRECONFIGURATIONCOMPLETE-START

RRCReconfigurationComplete ::= SEQUENCE {
  rrc-TransactionIdentifier                 RRC-TransactionIdentifier,
  criticalExtensions                       CHOICE {
    rrcReconfigurationComplete               RRCReconfigurationComplete-IEs,
    criticalExtensionsFuture                SEQUENCE {}
  }
}

RRCReconfigurationComplete-IEs ::= SEQUENCE {
  lateNonCriticalExtension                 OCTET STRING OPTIONAL,
  nonCriticalExtension                     RRCReconfigurationComplete-v1530-IEs OPTIONAL
}

RRCReconfigurationComplete-v1530-IEs ::= SEQUENCE {
  uplinkTxDirectCurrentList                UplinkTxDirectCurrentList OPTIONAL,
  nonCriticalExtension                     RRCReconfigurationComplete-v1560-IEs OPTIONAL
}

RRCReconfigurationComplete-v1560-IEs ::= SEQUENCE {
  scg-Response                             CHOICE {
    nr-SCG-Response                          OCTET STRING (CONTAINING RRCReconfigurationComplete),
    eutra-SCG-Response                        OCTET STRING
  } OPTIONAL,
  nonCriticalExtension                     RRCReconfigurationComplete-v1610-IEs OPTIONAL
}

RRCReconfigurationComplete-v1610-IEs ::= SEQUENCE {
  ue-MeasurementsAvailable-r16             UEMeasurementsAvailable-r16 OPTIONAL,
  needForGapsInfoNR-r16                    NEEDFORGAPSINFORNR-r16 OPTIONAL,
  nonCriticalExtension                     SEQUENCE {}
}

-- TAG-RRCRECONFIGURATIONCOMPLETE-STOP
-- ASN1STOP
```
needForGapsInfoNR
This field is used to indicate the measurement gap requirement information of the UE for NR target bands.

scg-Response
In case of NR-DC (nr-SCG-Response), this field includes the RRCReconfigurationComplete message. In case of NE-DC (utra-SCG-Response), this field includes the E-UTRA RRCConnectionReconfigurationComplete message as specified in TS 36.331 [10].

uplinkTxDirectCurrentList
The Tx Direct Current locations for the configured serving cells and BWPs if requested by the NW (see reportUplinkTxDirectCurrent in CellGroupConfig).

---

**RRCReject**

The RRCReject message is used to reject an RRC connection establishment or an RRC connection resumption.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: Network to UE

**RRCReject message**

```asn1
RRCReject ::= SEQUENCE {
  criticalExtensions CHOICE {
    rrcReject RRCReject-IEs,
    criticalExtensionsFuture SEQUENCE {}
  }
}
```

**RRCReject-IEs field descriptions**

- `waitTime`:
  Wait time value in seconds. The field is always included.
The **RRCRelease** message is used to command the release of an RRC connection or the suspension of the RRC connection.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

**RRCRelease message**

```asn1
RRCRelease ::= SEQUENCE {
  rrc-TransactionIdentifier RRC-TransactionIdentifier,
  criticalExtensions CHOICE {
    rrcRelease RRCRelease-IEs,
    criticalExtensionsFuture SEQUENCE {}
  }
}
```

**RRCRelease-IEs ::=**

```asn1
SEQUENCE {
  redirectedCarrierInfo RedirectedCarrierInfo OPTIONAL, -- Need N
  cellReselectionPriorities CellReselectionPriorities OPTIONAL, -- Need R
  suspendConfig SuspendConfig OPTIONAL, -- Need R
  deprioritisationReq SEQUENCE {
    deprioritisationType ENUMERATED {frequency, nr},
    deprioritisationTimer ENUMERATED {min5, min10, min15, min30}
  } OPTIONAL, -- Need N
  lateNonCriticalExtension OCTET STRING OPTIONAL,
  nonCriticalExtension RRCRelease-v1540-IEs OPTIONAL
}
```

**RRCRelease-v1540-IEs ::=**

```asn1
SEQUENCE {
  waitTime RejectWaitTime OPTIONAL, -- Need N
  nonCriticalExtension RRCRelease-v1610-IEs OPTIONAL
}
```

**RRCRelease-v1610-IEs ::=**

```asn1
SEQUENCE {
  voiceFallbackIndication-r16 ENUMERATED {true} OPTIONAL, -- Need N
  measIdleConfig-r16 SetupRelease {MeasIdleConfigDedicated-r16} OPTIONAL, -- Need M
  nonCriticalExtension SEQUENCE {} OPTIONAL
}
```

**RedirectedCarrierInfo ::=**

```asn1
CHOICE {
  nr CarrierInfoNR,
  eutra RedirectedCarrierInfo-EUTRA,
  ...
}
```
RedirectedCarrierInfo-EUTRA ::= SEQUENCE {
  eutraFrequency                     ARFCN-ValueEUTRA,  
  cnType                             ENUMERATED {epc,fiveGC} OPTIONAL -- Need N
}
CarrierInfoNR ::= SEQUENCE {
  carrierFreq                        ARFCN-ValueNR,  
  ssbSubcarrierSpacing               SubcarrierSpacing,  
  smtc                               SSB-MTC OPTIONAL, -- Need S
  ...
}
SuspendConfig ::= SEQUENCE {
  fullI-RNTI                         I-RNTI-Value,  
  shortI-RNTI                        ShortI-RNTI-Value,  
  ran-PagingCycle                    PagingCycle,  
  ran-NotificationAreaInfo           RAN-NotificationAreaInfo OPTIONAL, -- Need M  
  t380                               PeriodicRNAU-TimerValue OPTIONAL, -- Need R  
  nextHopChainingCount               NextHopChainingCount, 
  ...
}
PeriodicRNAU-TimerValue ::= ENUMERATED { min5, min10, min20, min30, min60, min120, min360, min720 }
CellReselectionPriorities ::= SEQUENCE {
  freqPriorityListEUTRA              FreqPriorityListEUTRA OPTIONAL, -- Need M  
  freqPriorityListNR                 FreqPriorityListNR OPTIONAL, -- Need M  
  t320                               ENUMERATED {min5, min10, min20, min30, min60, min120, min180, spare1} OPTIONAL, -- Need R  
  ...
}
PagingCycle ::= ENUMERATED { rf32, rf64, rf128, rf256 }
FreqPriorityListEUTRA ::= SEQUENCE {SIZE (1..maxFreq)} OF FreqPriorityEUTRA
FreqPriorityListNR ::= SEQUENCE {SIZE (1..maxFreq)} OF FreqPriorityNR
FreqPriorityEUTRA ::= SEQUENCE {
  carrierFreq                        ARFCN-ValueEUTRA,  
  cellReselectionPriority            CellReselectionPriority,  
  cellReselectionSubPriority         CellReselectionSubPriority OPTIONAL -- Need R
}
FreqPriorityNR ::= SEQUENCE {
  carrierFreq                        ARFCN-ValueNR,  
  cellReselectionPriority            CellReselectionPriority,  
  cellReselectionSubPriority         CellReselectionSubPriority OPTIONAL -- Need R
}
RAN-NotificationAreaInfo ::= CHOICE {
  cellList                           PLMN-RAN-AreaCellList, 
  ...}
PLMN-RAN-AreaCellList ::= SEQUENCE (SIZE (1..maxPLMNIdentities)) OF PLMN-RAN-AreaCell

PLMN-RAN-AreaCell ::= SEQUENCE {
  plmn-Identity               PLMN-Identity                                                       OPTIONAL,   -- Need S
  ran-AreaCells                SEQUENCE (SIZE (1..32)) OF  CellIdentity
}

PLMN-RAN-AreaConfigList ::= SEQUENCE (SIZE (1..maxPLMNIdentities)) OF PLMN-RAN-AreaConfig

PLMN-RAN-AreaConfig ::= SEQUENCE {
  plmn-Identity               PLMN-Identity                                                       OPTIONAL,   -- Need S
  ran-Area                    SEQUENCE (SIZE (1..16)) OF  RAN-AreaConfig
}

RAN-AreaConfig ::= SEQUENCE {
  trackingAreaCode            TrackingAreaCode,
  ran-AreaCodeList             SEQUENCE (SIZE (1..32)) OF  RAN-AreaCode
}

--- TAG-RRCRELEASE-STOP
--- ASN1STOP

<table>
<thead>
<tr>
<th>cnType</th>
<th>Indicate that the UE is redirected to EPC or 5GC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>depriorityisationReq</td>
<td>Indicates whether the current frequency or RAT is to be de-prioritised.</td>
</tr>
<tr>
<td>depriorityisationTimer</td>
<td>Indicates the period for which either the current carrier frequency or NR is deprioritised. Value ( minN ) corresponds to ( N ) minutes.</td>
</tr>
<tr>
<td>measIdleConfig</td>
<td>Indicates measurement configuration to be stored and used by the UE while in RRC_IDLE or RRC_INACTIVE.</td>
</tr>
<tr>
<td>suspendConfig</td>
<td>Indicates configuration for the RRC_INACTIVE state. The network does not configure suspendConfig when the network redirect the UE to an inter-RAT carrier frequency or if the UE is configured with a DAPS bearer.</td>
</tr>
<tr>
<td>redirectedCarrierInfo</td>
<td>Indicates a carrier frequency (downlink for FDD) and is used to redirect the UE to an NR or an inter-RAT carrier frequency, by means of cell selection at transition to RRC_IDLE or RRC_INACTIVE as specified in TS 38.304 [20]. In this release of specification, redirectedCarrierInfo is not included in an RRCRelease message with suspendConfig if this message is in response to an RRCResumeRequest or an RRCResumeRequest1 which is triggered by the NAS layer.</td>
</tr>
<tr>
<td>voiceFallbackIndication</td>
<td>Indicates the RRC release is triggered by EPS fallback for IMS voice as specified in TS 23.502 [43].</td>
</tr>
</tbody>
</table>
**CarrierInfoNR field descriptions**

- **carrierFreq**
  Indicates the redirected NR frequency.

- **ssbSubcarrierSpacing**
  Subcarrier spacing of SSB in the redirected SSB frequency. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.

- **smtc**
  The SSB periodicity/offset/duration configuration for the redirected SSB frequency. It is based on timing reference of PCell. If the field is absent, the UE uses the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing.

**RAN-NotificationAreaInfo field descriptions**

- **cellList**
  A list of cells configured as RAN area.

- **ran-AreaConfigList**
  A list of RAN area codes or RA code(s) as RAN area.

**PLMN-RAN-AreaConfig field descriptions**

- **plmn-Identity**
  PLMN Identity to which the cells in ran-Area belong. If the field is absent the UE uses the ID of the registered PLMN.

- **ran-AreaCodeList**
  The total number of RAN-AreaCodes of all PLMNs does not exceed 32.

- **ran-Area**
  Indicates whether TA code(s) or RAN area code(s) are used for the RAN notification area. The network uses only TA code(s) or both TA code(s) and RAN area code(s) to configure a UE. The total number of TACs across all PLMNs does not exceed 16.

**PLMN-RAN-AreaCell field descriptions**

- **plmn-Identity**
  PLMN Identity to which the cells in ran-AreaCells belong. If the field is absent the UE uses the ID of the registered PLMN.

- **ran-AreaCells**
  The total number of cells of all PLMNs does not exceed 32.

**SuspendConfig field descriptions**

- **ran-NotificationAreaInfo**
  Network ensures that the UE in RRC_INACTIVE always has a valid ran-NotificationAreaInfo.

- **ran-PagingCycle**
  Refers to the UE specific cycle for RAN-initiated paging. Value rf32 corresponds to 32 radio frames, value rf64 corresponds to 64 radio frames and so on.

- **t380**
  Refers to the timer that triggers the periodic RNAU procedure in UE. Value min5 corresponds to 5 minutes, value min10 corresponds to 10 minutes and so on.

**RRCResume**

The **RRCResume** message is used to resume the suspended RRC connection.
Signalling radio bearer: SRB1
RLC-SAP: AM
Logical channel: DCCH
Direction: Network to UE

RRCResume message

-- ASN1START
-- TAG-RRCRESUME-START

RRCResume ::= SEQUENCE {
  rrc-TransactionIdentifier RRC-TransactionIdentifier,
  criticalExtensions CHOICE {
    rrcResume RRCResume-IEs,
    criticalExtensionsFuture SEQUENCE {}
  }
}

RRCResume-IEs ::= SEQUENCE {
  radioBearerConfig RadioBearerConfig OPTIONAL, -- Need M
  masterCellGroup OCTET STRING (CONTAINING CellGroupConfig) OPTIONAL, -- Need M
  measConfig MeasConfig OPTIONAL, -- Need M
  fullConfig ENUMERATED {true} OPTIONAL, -- Need N
  lateNonCriticalExtension OCTET STRING OPTIONAL,
  nonCriticalExtension RRCResume-v1560-IEs OPTIONAL
}

RRCResume-v1560-IEs ::= SEQUENCE {
  radioBearerConfig2 OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL, -- Need M
  sk-Counter SK-Counter OPTIONAL, -- Need N
  nonCriticalExtension RRCResume-v1610-IEs OPTIONAL
}

RRCResume-v1610-IEs ::= SEQUENCE {
  idleModeMeasurementReq-r16 ENUMERATED {true} OPTIONAL, -- Need N
  restoreMCG-SCells-r16 ENUMERATED {true} OPTIONAL, -- Need N
  restoreSCG-r16 ENUMERATED {true} OPTIONAL, -- Need N
  mrdc-SecondaryCellGroup-r16 CHOICE {
    nr-SCG-r16 OCTET STRING (CONTAINING RRCReconfiguration),
    eutra-SCG-r16 OCTET STRING
  } OPTIONAL, -- Cond RestoreSCG
  needForGapsConfigNR-r16 SetupRelease {NeedForGapsConfigNR-r16} OPTIONAL, -- Need M
  nonCriticalExtension SEQUENCE{}
}

-- TAG-RRCRESUME-STOP
-- ASN1STOP
### RRCResume-IEs field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IdleModeMeasurementReq</td>
<td>This field indicates that the UE shall report the idle/inactive measurements, if available, to the network in the RRCResumeComplete message.</td>
</tr>
<tr>
<td>masterCellGroup</td>
<td>Configuration of the master cell group.</td>
</tr>
<tr>
<td>mrdc-SecondaryCellGroup</td>
<td>Includes an RRC message for SCG configuration in NR-DC or NE-DC. For NR-DC (nr-SCG), mrdc-SecondaryCellGroup contains the RRCReconfiguration message as generated (entirely) by SN gNB. In this version of the specification, the RRC message only includes fields secondaryCellGroup, with at least reconfigurationWithSync, otherConfig and measConfig. For NE-DC (eutra-SCG), mrdc-SecondaryCellGroup includes the E-UTRA RRCConnectionReconfiguration message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message only include the field scg-Configuration with at least mobilityControlInfoSCG.</td>
</tr>
<tr>
<td>needForGapsConfigNR</td>
<td>Configuration for the UE to report measurement gap requirement information of NR target bands in the RRCReconfigurationComplete and RRCResumeComplete message.</td>
</tr>
<tr>
<td>radioBearerConfig</td>
<td>Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP.</td>
</tr>
<tr>
<td>radioBearerConfig2</td>
<td>Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP. This field can only be used if the UE supports NR-DC or NE-DC.</td>
</tr>
<tr>
<td>restoreMCG-SCells</td>
<td>Indicates that the UE shall restore the MCG SCells from the UE Inactive AS Context, if stored.</td>
</tr>
<tr>
<td>restoreSCG</td>
<td>Indicates that the UE shall restore the SCG configurations from the UE Inactive AS Context, if stored.</td>
</tr>
<tr>
<td>sk-Counter</td>
<td>A counter used to derive S-KgNB or S-KeNB based on the newly derived KgNB during RRC Resume. The field is only included when there is one or more RB with keyToUse set to secondary or mrdc-SecondaryCellGroup is included.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RestoreSCG</td>
<td>The field is mandatory present if restoreSCG is included. It is optionally present, Need M, otherwise.</td>
</tr>
</tbody>
</table>

--- **RRCResumeComplete**

The RRCResumeComplete message is used to confirm the successful completion of an RRC connection resumption.

**Signalling radio bearer:** SRB1

**RLC-SAP:** AM

**Logical channel:** DCCH

**Direction:** UE to Network

--- **ASN1START**

```asn1
-- TAG-RRCRESUMECOMPLETE-START
```
RRCResumeComplete ::= SEQUENCE {
    rrc-TransactionIdentifier   RRC-TransactionIdentifier,
    criticalExtensions          CHOICE {
        rrcResumeComplete   RRCResumeComplete-IEs,
        criticalExtensionsFuture
                           SEQUENCE {}
    }
}

RRCResumeComplete-IEs ::= SEQUENCE {
    dedicatedNAS-Message        DedicatedNAS-Message OPTIONAL,
    selectedPLMN-Identity       INTEGER (1..maxPLMN) OPTIONAL,
    uplinkTxDirectCurrentList   UplinkTxDirectCurrentList OPTIONAL,
    lateNonCriticalExtension    OCTET STRING OPTIONAL,
    nonCriticalExtension       RRCResumeComplete-v1610-IEs OPTIONAL
}

RRCResumeComplete-v1610-IEs ::= SEQUENCE {
    idleMeasAvailable-r16       ENUMERATED {true} OPTIONAL,
    measResultIdleEUTRA-r16    MeasResultIdleEUTRA-r16 OPTIONAL,
    measResultIdleNR-r16       MeasResultIdleNR-r16 OPTIONAL,
    scg-Response-r16           CHOICE {
        nr-SCG-Response     OCTET STRING (CONTAINING RRCReconfigurationComplete),
        eutra-SCG-Response  OCTET STRING
    } OPTIONAL,
    ue-MeasurementsAvailable-r16 UE-MeasurementsAvailable-r16 OPTIONAL,
    mobilityHistoryAvail-r16   ENUMERATED {true} OPTIONAL,
    mobilityState-r16          ENUMERATED {normal, medium, high, spare} OPTIONAL,
    needForGapsInfoNR-r16      NeedForGapsInfoNR-r16 OPTIONAL,
    nonCriticalExtension       SEQUENCE{}
}

--- TAG-RRCRESUMECOMPLETE-STOP
--- ASN1STOP

**RRCResumeComplete-IEs field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>idleMeasAvailable</td>
<td>Indication that the UE has idle/inactive measurement report available.</td>
</tr>
<tr>
<td>measResultIdleEUTRA</td>
<td>EUTRA measurement results performed during RRC_INACTIVE.</td>
</tr>
<tr>
<td>measResultIdleNR</td>
<td>NR measurement results performed during RRC_INACTIVE.</td>
</tr>
<tr>
<td>needForGapsInfoNR</td>
<td>This field is used to indicate the measurement gap requirement information of the UE for NR target bands.</td>
</tr>
<tr>
<td>selectedPLMN-Identity</td>
<td>Index of the PLMN selected by the UE from the plmn-IdentityList or npn-IdentityInfoList fields included in SIB1.</td>
</tr>
<tr>
<td>uplinkTxDirectCurrentList</td>
<td>The Tx Direct Current locations for the configured serving cells and BWPs if requested by the NW (see reportUplinkTxDirectCurrent in CellGroupConfig).</td>
</tr>
</tbody>
</table>
The **RRCResumeRequest** message is used to request the resumption of a suspended RRC connection or perform an RNA update.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: UE to Network

---

**RRCResumeRequest message**

```asn1
RRCResumeRequest ::= SEQUENCE {
  rrcResumeRequest            RRCResumeRequest-IEs
}

RRCResumeRequest-IEs ::= SEQUENCE {
  resumeIdentity                  ShortI-RNTI-Value,
  resumeMAC-I                     BIT STRING (SIZE (16)),
  resumeCause                     ResumeCause,
  spare                           BIT STRING (SIZE (1))
}
```

---

**RRCResumeRequest-IEs field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>resumeCause</td>
<td>Provides the resume cause for the RRC connection resume request as provided by the upper layers or RRC. The network is not expected to reject an RRCResumeRequest due to unknown cause value being used by the UE.</td>
</tr>
<tr>
<td>resumeIdentity</td>
<td>UE identity to facilitate UE context retrieval at gNB.</td>
</tr>
<tr>
<td>resumeMAC-I</td>
<td>Authentication token to facilitate UE authentication at gNB. The 16 least significant bits of the MAC-I calculated using the AS security configuration as specified in 5.3.13.3.</td>
</tr>
</tbody>
</table>

---

**RRCResumeRequest1**

The **RRCResumeRequest1** message is used to request the resumption of a suspended RRC connection or perform an RNA update.

Signalling radio bearer: SRB0
RLC-SAP: TM
Logical channel: CCCH1
Direction: UE to Network

**RRCResumeRequest1 message**

```asn1
RRCResumeRequest1 ::= SEQUENCE {
  rrcResumeRequest1 RRCResumeRequest1-IEs
}

RRCResumeRequest1-IEs ::= SEQUENCE {
  resumeIdentity               I-RNTI-Value,     
  resumeMAC-I                  BIT STRING (SIZE (16)),
  resumeCause                  ResumeCause,
  spare                        BIT STRING (SIZE (1))
}
```

**RRCResumeRequest1-IEs field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>resumeCause</td>
<td>Provides the resume cause for the RRCResumeRequest1 as provided by the upper layers or RRC. A gNB is not expected to reject an RRCResumeRequest1 due to unknown cause value being used by the UE.</td>
</tr>
<tr>
<td>resumeIdentity</td>
<td>UE identity to facilitate UE context retrieval at gNB.</td>
</tr>
<tr>
<td>resumeMAC-I</td>
<td>Authentication token to facilitate UE authentication at gNB. The 16 least significant bits of the MAC-I calculated using the AS security configuration as specified in 5.3.13.3.</td>
</tr>
</tbody>
</table>

---

**RRCSetup**

The **RRCSetup** message is used to establish SRB1.

  - Signalling radio bearer: SRB0
  - RLC-SAP: TM
  - Logical channel: CCCH
  - Direction: Network to UE
**RRCSetup message**

```asn1
RRCSetup ::=                        SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        rrcSetup                            RRCSetup-IEs,
        criticalExtensionsFuture            SEQUENCE {} }
}

RRCSetup-IEs ::=                    SEQUENCE {
    radioBearerConfig                   RadioBearerConfig,
    masterCellGroup                     OCTET STRING (CONTAINING CellGroupConfig),
    lateNonCriticalExtension            OCTET STRING                                                            OPTIONAL,
    nonCriticalExtension                SEQUENCE{}                                                              OPTIONAL
}
```

**RRCSetup-IEs field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>masterCellGroup</td>
<td>The network configures only the RLC bearer for the SRB1, <code>mac-CellGroupConfig</code>, <code>physicalCellGroupConfig</code> and <code>spCellConfig</code>.</td>
</tr>
<tr>
<td>radioBearerConfig</td>
<td>Only SRB1 can be configured in RRC setup.</td>
</tr>
</tbody>
</table>

---

**RRCSetupComplete**

The `RRCSetupComplete` message is used to confirm the successful completion of an RRC connection establishment.

- Signalling radio bearer: SRB1
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to Network

```asn1
RRCSetupComplete ::=                SEQUENCE {
    ...
}
```
RRC-TransactionIdentifier ::= RRC-TransactionIdentifier, criticalExtensions
                    CHOICE {
                      rrcSetupComplete          RRCSetupComplete-IEs, criticalExtensionsFuture
                      SEQUENCE {} }

RRCSetupComplete-IEs ::= SEQUENCE {
                        selectedPLMN-Identity  INTEGER (1..maxPLMN),
                        registeredAMF          RegisteredAMF OPTIONAL,
                        guami-Type              ENUMERATED {native, mapped} OPTIONAL,
                        s-NSSAI-List            SEQUENCE (SIZE (1..maxNrofS-NSSAI)) OF S-NSSAI OPTIONAL,
                        dedicatedNAS-Message     DedicatedNAS-Message,
                        ng-5G-S-TMSI-Value      CHOICE {
                                                  ng-5G-S-TMSI,          NG-5G-S-TMSI,
                                                  ng-5G-S-TMSI-Part2      BIT STRING (SIZE (9)) OPTIONAL,
                                                  lateNonCriticalExtension OCTET STRING OPTIONAL,
                                                  nonCriticalExtension    RRCSetupComplete-v1610-IEs OPTIONAL}

RRCSetupComplete-v1610-IEs ::= SEQUENCE {
                          iab-NodeIndication-r16 ENUMERATED {true} OPTIONAL,
                          idleMeasAvailable-r16  ENUMERATED {true} OPTIONAL,
                          ue-MeasurementsAvailable-r16 UE-MeasurementsAvailable-r16 OPTIONAL,
                          mobilityHistoryAvail-r16 ENUMERATED {true} OPTIONAL,
                          mobilityState-r16      ENUMERATED {normal, medium, high, spare} OPTIONAL,
                          nonCriticalExtension   SEQUENCE {} OPTIONAL}

RegisteredAMF ::= SEQUENCE {
                     plmn-Identity        PLMN-Identity OPTIONAL,
                     amf-Identifier       AMF-Identifier }

-- TAG-RRCSETUPCOMPLETE-STOP
-- ASN1STOP
**RRCSetupComplete-IEs field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>guami-Type</td>
<td>This field is used to indicate whether the GUAMI included is native (derived from native 5G-GUTI) or mapped (from EPS, derived from EPS GUTI) as specified in TS 24.501 [23].</td>
</tr>
<tr>
<td>iab-NodeIndication</td>
<td>This field is used to indicate that the connection is being established by an IAB-node as specified in TS 38.300 [2].</td>
</tr>
<tr>
<td>idleMeasAvailable</td>
<td>Indication that the UE has idle/inactive measurement report available.</td>
</tr>
<tr>
<td>mobilityState</td>
<td>This field indicates the UE mobility state (as defined in TS 38.304 [20], clause 5.2.4.3) just prior to UE going into RRC_CONNECTED state. The UE indicates the value of medium and high when being in Medium-mobility and High-mobility states respectively. Otherwise the UE indicates the value normal.</td>
</tr>
<tr>
<td>ng-5G-S-TMSI-Part2</td>
<td>The leftmost 9 bits of 5G-S-TMSI.</td>
</tr>
<tr>
<td>registeredAMF</td>
<td>This field is used to transfer the GUAMI of the AMF where the UE is registered, as provided by upper layers, see TS 23.003 [21].</td>
</tr>
<tr>
<td>selectedPLMN-Identity</td>
<td>Index of the PLMN or SNPN selected by the UE from the plmn-IdentityList or npn-IdentityInfoList fields included in SIB1.</td>
</tr>
</tbody>
</table>

**RRCSetupRequest**

The `RRCSetupRequest` message is used to request the establishment of an RRC connection.

- Signalling radio bearer: SRB0
- RLC-SAP: TM
- Logical channel: CCCH
- Direction: UE to Network

**RRCSetupRequest message**

```asn1
RRCSetupRequest ::=                  SEQUENCE {
  rrcSetupRequest                     RRCSetupRequest-IEs
}

RRCSetupRequest-IEs ::=             SEQUENCE {
  ue-Identity                         InitialUE-Identity,
  establishmentCause                  EstablishmentCause,
  spare                                BIT STRING (SIZE (1))
}

InitialUE-Identity ::=              CHOICE {
  ng-5G-S-TMSI-Part1                  BIT STRING (SIZE (39)),
```
establishmentCause ::=
  ENUMERATED {
    emergency, highPriorityAccess, mt-Access, mo-Signalling,
    mo-Data, mo-VoiceCall, mo-VideoCall, mo-SMS, mps-PriorityAccess, mcs-PriorityAccess,
    spare6, spare5, spare4, spare3, spare2, spare1}

ue-Identity ::=
  SEQUENCE {
    ng-5G-S-TMSI-Part1 OCTET STRING (SIZE (39))
    randomValue BIT STRING (SIZE (39))
  }

...
-- TAG-RRCSYSTEMINFOREQUEST-STOP
-- ASN1STOP

**RRCSystemInfoRequest-IEs field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>requested-SI-List</strong></td>
<td>Contains a list of requested SI messages. According to the order of entry in the list of SI messages configured by schedulingInfoList in si-SchedulingInfo in SIB1, first bit corresponds to first/leftmost listed SI message, second bit corresponds to second listed SI message, and so on.</td>
</tr>
<tr>
<td><strong>requestedPosSI-List</strong></td>
<td>Contains a list of requested SI messages. According to the order of entry in the list of SI messages configured by posSchedulingInfoList in posSI-SchedulingInfo in SIB1, first bit corresponds to first/leftmost listed SI message, second bit corresponds to second listed SI message, and so on.</td>
</tr>
</tbody>
</table>

---

**SCGFailureInformation**

The **SCGFailureInformation** message is used to provide information regarding NR SCG failures detected by the UE.

- Signalling radio bearer: SRB1
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to Network

---

**SCGFailureInformation message**

```asn1
SCGFailureInformation ::= SEQUENCE {
  criticalExtensions CHOICE {
    scgFailureInformation SCGFailureInformation-IEs,
  }
}
```

---

**TAG-SCGFAIlUREINFORMATION-START**


```plaintext
criticalExtensionsFuture
  SEQUENCE {}
}

SCGFailureInformation-IEs ::= SEQUENCE {
  failureReportSCG
    FailureReportSCG OPTIONAL,
  nonCriticalExtension
    SCGFailureInformation-v1590-IEs OPTIONAL
}

SCGFailureInformation-v1590-IEs ::= SEQUENCE {
  lateNonCriticalExtension
    OCTET STRING OPTIONAL,
  nonCriticalExtension
    SEQUENCE {} OPTIONAL
}

FailureReportSCG ::= SEQUENCE {
  failureType
    ENUMERATED {
      t310-Expiry,
      randomAccessProblem,
      rlc-MaxNumRetx,
      synchReconfigFailureSCG,
      scg-ReconfigFailure,
      srb3-IntegerFailure,
      other-r16,
      spare1
    } OPTIONAL,
  measResultFreqList
    MeasResultFreqList OPTIONAL,
  measResultSCG-Failure
    OCTET STRING (CONTAINING MeasResultSCG-Failure) OPTIONAL,
  ...
  locationInfo-r16
    LocationInfo-r16 OPTIONAL,
  failureType-v1610
    ENUMERATED {scg-lbtFailure-r16, beamFailureRecoveryFailure-r16,
      t312-Expiry-r16, bh-RLF-r16, spare4, spare3, spare2, spare1} OPTIONAL
]
}

MeasResultFreqList ::= SEQUENCE (SIZE (1..maxFreq)) OF MeasResult2NR

-- TAG-SCGFailureInformationSTOP
-- ASN1STOP

--- SCGFailureInformation field descriptions ---

**measResultFreqList**
The field contains available results of measurements on NR frequencies the UE is configured to measure by *measConfig*.

**measResultSCG-Failure**
The field contains the *MeasResultSCG-Failure* IE which includes available results of measurements on NR frequencies the UE is configured to measure by the NR SCG *RRCReconfiguration* message.

--- SCGFailureInformationEUTRA ---
The *SCGFailureInformationEUTRA* message is used to provide information regarding E-UTRA SCG failures detected by the UE.

Signalling radio bearer: SRB1

--- ETSI ---
RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

**SCGFailureInformationEUTRA message**

```asn1
-- ASN1START
-- TAG-SCGFAILUREINFORMATIONEUTRA-START

SCGFailureInformationEUTRA ::= SEQUENCE {
criticalExtensions CHOICE {
scgFailureInformationEUTRA SCGFailureInformationEUTRA-IEs,
criticalExtensionsFuture SEQUENCE {}
}
}

SCGFailureInformationEUTRA-IEs ::= SEQUENCE {
failureReportSCG-EUTRA FailureReportSCG-EUTRA OPTIONAL,
nonCriticalExtension SCGFailureInformationEUTRA-v1590-IEs OPTIONAL
}

SCGFailureInformationEUTRA-v1590-IEs ::= SEQUENCE {
lateNonCriticalExtension OCTET STRING OPTIONAL,
nonCriticalExtension SEQUENCE {} OPTIONAL
}

FailureReportSCG-EUTRA ::= SEQUENCE {
failureType ENUMERATED {
t313-Expiry, randomAccessProblem, rlc-MaxNumRetx, scg-ChangeFailure, scg-lbtFailure-r16, beamFailureRecoveryFailure-r16, t312-Expiry-r16, spare},
measResultFreqListMRDC MeasResultFreqListFailMRDC OPTIONAL,
measResultSCG-FailureMRDC OCTET STRING OPTIONAL,
...,
[lateNonCriticalExtension OCTET STRING]
...,
[nonCriticalExtension SEQUENCE {}]
}

MeasResultFreqListFailMRDC ::= SEQUENCE (SIZE (1.. maxFreq)) OF MeasResult2EUTRA

-- TAG-SCGFAILUREINFORMATIONEUTRA-STOP
-- ASN1STOP

-- ASN1END
```
**SCGFailureInformationEUTRA field descriptions**

**measResultFreqListMRDC**
The field contains available results of measurements on E-UTRA frequencies the UE is configured to measure by `measConfig`.

**measResultSCG-FailureMRDC**
Includes the E-UTRA `MeasResultSCG-FailureMRDC` IE as specified in TS 36.331 [10]. The field contains available results of measurements on E-UTRA frequencies the UE is configured to measure by the E-UTRA `RRCConnectionReconfiguration` message.

---

**SecurityModeCommand**
The `SecurityModeCommand` message is used to command the activation of AS security.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

---

**SecurityModeCommand message**

-- ASN1START
-- TAG--SECURITYMODECOMMAND--START

```plaintext
SecurityModeCommand ::=             SEQUENCE {
  rrc-TransactionIdentifier           RRC-TransactionIdentifier,     
  criticalExtensions                  CHOICE {
    securityModeCommand                 SecurityModeCommand-IEs,      
    criticalExtensionsFuture            SEQUENCE {}                  
  }                                          
}                                          
```

---

**SecurityModeCommand-IEs**

```plaintext
SecurityModeCommand-IEs ::=         SEQUENCE {
  securityConfigSMC                   SecurityConfigSMC,               
  lateNonCriticalExtension            OCTET STRING OPTIONAL, 
  nonCriticalExtension                SEQUENCE{} OPTIONAL          
}                                          
```

---

**SecurityConfigSMC**

```plaintext
SecurityConfigSMC ::=               SEQUENCE {
  securityAlgorithmConfig             SecurityAlgorithmConfig,       
  ...                                     
}                                          
```

---

-- TAG--SECURITYMODECOMMAND--STOP
-- ASN1STOP
The **SecurityModeComplete** message is used to confirm the successful completion of a security mode command.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

**SecurityModeComplete message**

```asn1
SecurityModeComplete ::=            SEQUENCE {
  rrc-TransactionIdentifier           RRC-TransactionIdentifier,
  criticalExtensions                  CHOICE {
    securityModeComplete                SecurityModeComplete-IEs,
    criticalExtensionsFuture            SEQUENCE {}
  }
}
```

**SecurityModeComplete-IEs ::=**

```asn1
SecurityModeComplete-IEs ::=        SEQUENCE {
  lateNonCriticalExtension            OCTET STRING                                                            OPTIONAL,
  nonCriticalExtension                SEQUENCE{}                                                              OPTIONAL
}
```

The **SecurityModeFailure** message is used to indicate an unsuccessful completion of a security mode command.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network
SecurityModeFailure message

-- TAG-SECURITYMODEFAILURE-START
SecurityModeFailure ::=             SEQUENCE {
  rrc-TransactionIdentifier           RRC-TransactionIdentifier,
  criticalExtensions                  CHOICE {
    securityModeFailure                 SecurityModeFailure-IEs,
    criticalExtensionsFuture            SEQUENCE {} }
}

SecurityModeFailure-IEs ::=         SEQUENCE {
  lateNonCriticalExtension            OCTET STRING                                                            OPTIONAL,
  nonCriticalExtension                SEQUENCE{ }
}
-- TAG-SECURITYMODEFAILURE-STOP
-- ASN1STOP

-- SIB1

SIB1 contains information relevant when evaluating if a UE is allowed to access a cell and defines the scheduling of other system information. It also contains radio resource configuration information that is common for all UEs and barring information applied to the unified access control.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channels: BCCH

Direction: Network to UE

SIB1 message

-- TAG-SIB1-START
SIB1 ::=        SEQUENCE {
  cellSelectionInfo                   SEQUENCE {
    q-RxLevMin                          Q-RxLevMin,
    q-RxLevMinOffset                    INTEGER (1..8)                                              OPTIONAL,   -- Need S
    q-RxLevMinSUL                       Q-RxLevMin                                                  OPTIONAL,   -- Need R
    q-QualMin                           Q-QualMin                                                   OPTIONAL,   -- Need S
    q-QualMinOffset                     INTEGER (1..8)                                              OPTIONAL    -- Cond Standalone
  }
  cellAccessRelatedInfo               CellAccessRelatedInfo,
  connEstFailureControl               ConnEstFailureControl                                           OPTIONAL,   -- Need R
}
-- ASN1STOP
si-SchedulingInfo  \(\text{SI-SchedulingInfo}\)  OPTIONAL, -- Need R
servingCellConfigCommon  \(\text{ServingCellConfigCommonSIB}\)  OPTIONAL, -- Need R
ims-EmergencySupport  \(\text{ENUMERATED}\{\text{true}\}\)  OPTIONAL, -- Need R
eCallOverIMS-Support  \(\text{ENUMERATED}\{\text{true}\}\)  OPTIONAL, -- Need R
ue-TimersAndConstants  \(\text{UE-TimersAndConstants}\)  OPTIONAL, -- Need R

uac-BarringInfo  \(\text{SEQUENCE}\{
\text{uac-BarringForCommon}  \(\text{UAC-BarringPerCatList}\)  OPTIONAL, -- Need S
\text{uac-BarringPerPLMN-List}  \(\text{UAC-BarringPerPLMN-List}\)  OPTIONAL, -- Need S
\text{uac-BarringInfoSetList}  \(\text{UAC-BarringInfoSetList}\),
\text{uac-AccessCategory1-SelectionAssistanceInfo}  \(\text{CHOICE}\{
\text{plmnCommon}  \(\text{UAC-AccessCategory1-SelectionAssistanceInfo}\),
\text{individualPLMNList}  \(\text{SEQUENCE}\) \(\text{SIZE}\) \(\{2..\max\text{PLMN}\}\) \(\text{OF}\) \(\text{UAC-AccessCategory1-SelectionAssistanceInfo}\)
\})  OPTIONAL    -- Need S
\text{useFullResumeID}  \(\text{ENUMERATED}\{\text{true}\}\)  OPTIONAL, -- Need R
\text{lateNonCriticalExtension}  \(\text{OCTET STRING}\)  OPTIONAL,
\text{nonCriticalExtension}  \(\text{SIB1-v1610-IEs}\)  OPTIONAL
\}\)

SIB1-v1610-IEs ::=  \(\text{SEQUENCE}\{
\text{idleModeMeasurementsEUTRA-r16}  \(\text{ENUMERATED}\{\text{true}\}\)  OPTIONAL, -- Need R
\text{idleModeMeasurementsNR-r16}  \(\text{ENUMERATED}\{\text{true}\}\)  OPTIONAL, -- Need R
\text{posSI-SchedulingInfo-r16}  \(\text{PosSI-SchedulingInfo-r16}\)  OPTIONAL, -- Need R
\text{nonCriticalExtension}  \(\text{SIB1-v1630-IEs}\)  OPTIONAL
\}\)

SIB1-v1630-IEs ::=  \(\text{SEQUENCE}\{\n\text{uac-BarringInfo-v1630}  \(\text{SEQUENCE}\{\n\text{uac-AC1-SelectAssistInfo-r16}  \(\text{SEQUENCE}\) \(\text{SIZE}\) \(\{2..\max\text{PLMN}\}\) \(\text{OF}\) \(\text{UAC-AC1-SelectAssistInfo-r16}\)
\})  OPTIONAL, -- Need R
\text{nonCriticalExtension}  \(\text{SEQUENCE}\) \{\}
\}\)

UAC-AccessCategory1-SelectionAssistanceInfo ::=  \(\text{ENUMERATED}\{a, b, c\}\)

UAC-AC1-SelectAssistInfo-r16 ::=  \(\text{ENUMERATED}\{a, b, c, notConfigured\}\)

-- TAG-SIB1-STOP
-- ASN1STOP
**SIB1 field descriptions**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cellSelectionInfo</strong></td>
<td>Parameters for cell selection related to the serving cell.</td>
</tr>
<tr>
<td><strong>eCallOverIMS-Support</strong></td>
<td>Indicates whether the cell supports eCall over IMS services as defined in TS 23.501 [32]. If absent, eCall over IMS is not supported by the network in the cell.</td>
</tr>
<tr>
<td><strong>idleModeMeasurementsEUTRA</strong></td>
<td>This field indicates that a UE that is configured for EUTRA idle/inactive measurements shall perform the measurements while camping in this cell and report availability of these measurements when establishing or resuming a connection in this cell. If absent, a UE is not required to perform EUTRA idle/inactive measurements.</td>
</tr>
<tr>
<td><strong>idleModeMeasurementsNR</strong></td>
<td>This field indicates that a UE that is configured for NR idle/inactive measurements shall perform the measurements while camping in this cell and report availability of these measurements when establishing or resuming a connection in this cell. If absent, a UE is not required to perform NR idle/inactive measurements.</td>
</tr>
<tr>
<td><strong>ims-EmergencySupport</strong></td>
<td>Indicates whether the cell supports IMS emergency bearer services for UEs in limited service mode. If absent, IMS emergency call is not supported by the network in the cell for UEs in limited service mode.</td>
</tr>
<tr>
<td><strong>q-QualMin</strong></td>
<td>Parameter &quot;Qualmin&quot; in TS 38.304 [20], applicable for serving cell. If the field is absent, the UE applies the (default) value of negative infinity for Qualmin.</td>
</tr>
<tr>
<td><strong>q-QualMinOffset</strong></td>
<td>Parameter &quot;Qualminoffset&quot; in TS 38.304 [20]. Actual value Qualminoffset = field value [dB]. If the field is absent, the UE applies the (default) value of 0 dB for Qualminoffset. Affects the minimum required quality level in the cell.</td>
</tr>
<tr>
<td><strong>q-RxLevMin</strong></td>
<td>Parameter &quot;Qrxlevmin&quot; in TS 38.304 [20], applicable for serving cell.</td>
</tr>
<tr>
<td><strong>q-RxLevMinOffset</strong></td>
<td>Parameter &quot;Qrxlevminoffset&quot; in TS 38.304 [20]. Actual value Qrxlevminoffset = field value * 2 [dB]. If absent, the UE applies the (default) value of 0 dB for Qrxlevminoffset. Affects the minimum required Rx level in the cell.</td>
</tr>
<tr>
<td><strong>q-RxLevMinSUL</strong></td>
<td>Parameter &quot;Qrxlevmin&quot; in TS 38.304 [20], applicable for serving cell.</td>
</tr>
<tr>
<td><strong>servingCellConfigCommon</strong></td>
<td>Configuration of the serving cell.</td>
</tr>
<tr>
<td><strong>uac-AccessCategory1-SelectionAssistanceInfo</strong></td>
<td>Information used to determine whether Access Category 1 applies to the UE, as defined in TS 22.261 [25]. If plmnCommon is chosen, the UAC-AccessCategory1-SelectionAssistanceInfo is applicable to all the PLMNs in plmn-IdentityList. If individualPLMNList is chosen, the 1st entry in the list corresponds to the first PLMN in plmn-IdentityList, the 2nd entry in the list corresponds to the second PLMN in plmn-IdentityList and so on. If uac-AC1-SelectAssistInfo-r16 is present, the UE shall ignore the uac-AccessCategory1-SelectionAssistanceInfo.</td>
</tr>
<tr>
<td><strong>uac-AC1-SelectAssistInfo</strong></td>
<td>Information used to determine whether Access Category 1 applies to the UE, as defined in TS 22.261 [25]. The 1st entry in the list corresponds to the first PLMN in plmn-IdentityList, the 2nd entry in the list corresponds to the second PLMN in plmn-IdentityList and so on. Value notConfigured indicates that Access Category1 is not configured for the corresponding PLMN.</td>
</tr>
<tr>
<td><strong>uac-BarringForCommon</strong></td>
<td>Common access control parameters for each access category. Common values are used for all PLMNs, unless overwritten by the PLMN specific configuration provided in uac-BarringPerPLMN-List. The parameters are specified by providing an index to the set of configurations (uac-BarringInfoSetList). UE behaviour upon absence of this field is specified in clause 5.3.14.2.</td>
</tr>
<tr>
<td><strong>ue-TimersAndConstants</strong></td>
<td>Timer and constant values to be used by the UE. The cell operating as PCell always provides this field.</td>
</tr>
<tr>
<td><strong>useFullResumeID</strong></td>
<td>Indicates which resume identifier and Resume request message should be used. UE uses full-RNTI and RRCResumeRequest1 if the field is present, or shortl-RNTI and RRCResumeRequest if the field is absent.</td>
</tr>
</tbody>
</table>
---

**Conditional Presence**

| Standalone | The field is mandatory present in a cell that supports standalone operation, otherwise it is absent. |

---

**SidetlinkUEInformationNR**

The *SidetlinkUEInformationNR* message is used for the indication of NR sidelink UE information to the network.

- Signalling radio bearer: SRB1
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to Network

**SidetlinkUEInformationNR message**

```asn1
--- ASN1START
--- TAG-SIDELINKUEINFORMATIONNR-START

SidetlinkUEInformationNR-r16 ::= SEQUENCE {
criticalExtensions                  CHOICE {
sidelinkUEInformationNR-r16         SidelinkUEInformationNR-r16-IEs,
criticalExtensionsFuture            SEQUENCE {} }
}

SidelinkUEInformationNR-r16-IEs ::= SEQUENCE {
  sl-RxInterestedFreqList-r16         SL-InterestedFreqList-r16           OPTIONAL,
  sl-TxResourceReqList-r16           SL-TxResourceReqList-r16            OPTIONAL,
  sl-FailureList-r16                 SL-FailureList-r16                   OPTIONAL,
lateNonCriticalExtension            OCTET STRING                        OPTIONAL,
  nonCriticalExtension               SEQUENCE {}                         OPTIONAL
}

SL-InterestedFreqList-r16 ::= SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF INTEGER (1..maxNrofFreqSL-r16)

SL-TxResourceReqList-r16 ::= SEQUENCE (SIZE (1..maxNrofSL-Dest-r16)) OF SL-TxResourceReq-r16

SL-TxResourceReq-r16 ::= SEQUENCE {
  sl-DestinationIdentity-r16         SL-DestinationIdentity-r16,
  sl-CastType-r16                   ENUMERATED {broadcast, groupcast, unicast, spare1},
  sl-RLC-ModeIndicationList-r16     SEQUENCE (SIZE (1..maxNrofSL-QoS-Info-r16)) OF SL-RLC-ModeIndication-r16          OPTIONAL,
  sl-QoS-InfoList-r16                SEQUENCE (SIZE (1..maxNrofFreqSL-QoS-InfoList-r16)) OF SL-QoS-Info-r16          OPTIONAL,
  sl-TypeTxSyncList-r16              SEQUENCE (SIZE (1..maxNrofFreqSL-TypeTxSync-r16)) OF SL-TypeTxSync-r16         OPTIONAL,
  sl-TxInterestedFreqList-r16       SL-TxInterestedFreqList-r16
  sl-CapabilityInformationSidelink-r16 OCTET STRING
}

--- ASN1END
```
SidelinkUEinformationNR field descriptions

**si-RxInterestedFreqList**  
Indicates the index of frequency on which the UE is interested to receive NR sidelink communication. The value 1 corresponds to the frequency of first entry in *si-FreqInfoList* broadcast in *SIB12*, the value 2 corresponds to the frequency of second entry in *si-FreqInfoList* broadcast in *SIB12* and so on. In this release, only value 1 can be included in the interested frequency list.

**si-TxResourceReq**  
Parameters to request the transmission resources for NR sidelink communication to the network in the Sidelink UE Information report.
**SL-TxResourceReq field descriptions**

- **sl-CapabilityInformationSidelink**
  Includes the `UECapabilityInformationSidelink` message (which can be also included in `ueCapabilityInformationSidelink-r16` in `UECapabilityEnquirySidelink` from peer UE) received from the peer UE.

- **sl-CastType**
  Indicates the cast type for the corresponding destination for which to request the resource.

- **sl-DestinationIdentity**
  Indicates the destination for which the TX resource request and allocation from the network are concerned.

- **sl-QoS-InfoList**
  Includes the QoS profile of the sidelink QoS flow as specified in TS 23.287 [55]

- **sl-QoS-FlowIdentity**
  This identity uniquely identifies one sidelink QoS flow between the UE and the network in the scope of UE, which is unique for different destination and cast type.

- **sl-RLC-ModeIndication**
  This field indicates the RLC mode and optionally the related QoS profiles for the sidelink radio bearer, which has not been configured by the network and is initiated by another UE in unicast. The RLC mode for one sidelink radio bearer is aligned between UE and NW by the `sl-QoS-FlowIdentity`.

- **sl-TxInterestedFreqList**
  Each entry of this field indicates the index of frequency on which the UE is interested to transmit NR sidelink communication. The value 1 corresponds to the frequency of first entry in `sl-FreqInfoList` broadcast in SIB12, the value 2 corresponds to the frequency of second entry in `sl-FreqInfoList` broadcast in SIB12 and so on. In this release, only value 1 can be included in the interested frequency list. In this release, only one entry can be included in the list.

- **sl-TypeTxSyncList**
  A list of synchronization reference used by the UE. The UE shall include the same number of entries, listed in the same order, as in `sl-TxInterestedFreqList`, i.e. one for each carrier frequency included in `sl-TxInterestedFreqList`.

**SL-Failure field descriptions**

- **sl-DestinationIdentity**
  Indicates the destination for which the SL failure is reporting for unicast.

- **sl-Failure**
  Indicates the sidelink failure cause for the sidelink RLF (value rlf) and sidelink AS configuration failure (value configFailure) for the associated destination for unicast.

---

**SystemInformation**

The `SystemInformation` message is used to convey one or more System Information Blocks or Positioning System Information Blocks. All the SIBs or posSIBs included are transmitted with the same periodicity.

- Signalling radio bearer: N/A
- RLC-SAP: TM
- Logical channels: BCCH
- Direction: Network to UE
SystemInformation message

-- ASN1START
-- TAG-SYSTEMINFORMATION-START

SystemInformation ::= SEQUENCE {
    criticalExtensions CHOICE {
        systemInformation SystemInformation-IEs,
        criticalExtensionsFuture-r16 CHOICE {
            posSystemInformation-r16 PosSystemInformation-r16-IEs,
            criticalExtensionsFuture SEQUENCE {}
        }
    }
}

SystemInformation-IEs ::= SEQUENCE {
    sib-TypeAndInfo SEQUENCE (SIZE (1..maxSIB)) OF CHOICE {
        sib2 SIB2,
        sib3 SIB3,
        sib4 SIB4,
        sib5 SIB5,
        sib6 SIB6,
        sib7 SIB7,
        sib8 SIB8,
        sib9 SIB9,
        ...
        sib10-v1610 SIB10-r16,
        sib11-v1610 SIB11-r16,
        sib12-v1610 SIB12-r16,
        sib13-v1610 SIB13-r16,
        sib14-v1610 SIB14-r16
    },
    lateNonCriticalExtension OCTET STRING OPTIONAL,
    nonCriticalExtension SEQUENCE {} OPTIONAL
}

-- TAG-SYSTEMINFORMATION-STOP
-- ASN1STOP

---

UEAssistanceInformation

The **UEAssistanceInformation** message is used for the indication of UE assistance information to the network.

Signalling radio bearer: SRB1, SRB3

RLC-SAP: AM

Logical channel: DCCH
**Direction: UE to Network**

**UEAssistanceInformation message**

---

```asn1
UEAssistanceInformation ::= SEQUENCE {
criticalExtensions                CHOICE {
ueAssistanceInformation             UEAssistanceInformation-IEs,
criticalExtensionsFuture            SEQUENCE {}
}
}

UEAssistanceInformation-IEs ::= SEQUENCE {
delayBudgetReport                   DelayBudgetReport                   OPTIONAL,
lateNonCriticalExtension            OCTET STRING                        OPTIONAL,
nonCriticalExtension                UEAssistanceInformation-v1540-IEs   OPTIONAL
}

DelayBudgetReport ::= CHOICE {
type1                               ENUMERATED {
msMinus1280, msMinus640, msMinus320, msMinus160, msMinus80, msMinus60, msMinus40,
msMinus20, ms0, ms20, ms40, ms60, ms80, ms160, ms320, ms640, ms1280},
...                                 
}

UEAssistanceInformation-v1540-IEs ::= SEQUENCE {
overheatingAssistance               OverheatingAssistance               OPTIONAL,
nonCriticalExtension                UEAssistanceInformation-v1610-IEs   OPTIONAL
}

OverheatingAssistance ::= SEQUENCE {
reducedMaxCCs                        ReducedMaxCCs-r16                      OPTIONAL,
reducedMaxBW-FR1                      ReducedMaxBW-FR1-r16                    OPTIONAL,
reducedMaxBW-FR2                      ReducedMaxBW-FR2-r16                    OPTIONAL,
reducedMaxMIMO-LayersFR1             ReducedMaxMIMO-LayersFR1-DL            MIMO-LayersDL,
reducedMaxMIMO-LayersFR1-UL           MIMO-LayersUL
OPTIONAL,
reducedMaxMIMO-LayersFR2             ReducedMaxMIMO-LayersFR2-DL            MIMO-LayersDL,
reducedMaxMIMO-LayersFR2-UL           MIMO-LayersUL
OPTIONAL
}

ReducedAggregatedBandwidth ::= ENUMERATED {mhz0, mhz10, mhz20, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100, mhz200, mhz300, mhz400}

UEAssistanceInformation-v1610-IEs ::= SEQUENCE {
idc-Assistance-r16                   IDC-Assistance-r16                      OPTIONAL,
drx-Preference-r16                   DRX-Preference-r16                      OPTIONAL,
maxBW-Preference-r16                  MaxBW-Preference-r16                     OPTIONAL,
maxCC-Preference-r16                  MaxCC-Preference-r16                     OPTIONAL,

```
maxMIMO-LayerPreference-r16 MaxMIMO-LayerPreference-r16 OPTIONAL,
minSchedulingOffsetPreference-r16 MinSchedulingOffsetPreference-r16 OPTIONAL,
releasePreference-r16 ReleasePreference-r16 OPTIONAL,
sl-UE-AssistanceInformationNR-r16 SL-UE-AssistanceInformationNR-r16 OPTIONAL,
referenceTimeInfoPreference-r16 BOOLEAN OPTIONAL,
nonCriticalExtension SEQUENCE {} OPTIONAL

IDC-Assistance-r16 ::= SEQUENCE {
  affectedCarrierFreqList-r16 AffectedCarrierFreqList-r16 OPTIONAL,
  affectedCarrierFreqCombList-r16 AffectedCarrierFreqCombList-r16 OPTIONAL,
  ...
}

AffectedCarrierFreqList-r16 ::= SEQUENCE (SIZE (1..maxFreqIDC-r16)) OF AffectedCarrierFreq-r16

AffectedCarrierFreq-r16 ::= SEQUENCE {
  carrierFreq-r16 ARFCN-ValueNR,
  interferenceDirection-r16 ENUMERATED {nr, other, both, spare}
}

AffectedCarrierFreqCombList-r16 ::= SEQUENCE (SIZE (1..maxCombIDC-r16)) OF AffectedCarrierFreqComb-r16

AffectedCarrierFreqComb-r16 ::= SEQUENCE {
  affectedCarrierFreqComb-r16 SEQUENCE (SIZE (2..maxNrofServingCells)) OF ARFCN-ValueNR OPTIONAL,
  victimSystemType-r16 VictimSystemType-r16
}

VictimSystemType-r16 ::= SEQUENCE {
  gps-r16 ENUMERATED {true} OPTIONAL,
  glonass-r16 ENUMERATED {true} OPTIONAL,
  bds-r16 ENUMERATED {true} OPTIONAL,
  galileo-r16 ENUMERATED {true} OPTIONAL,
  navIC-r16 ENUMERATED {true} OPTIONAL,
  wlan-r16 ENUMERATED {true} OPTIONAL,
  bluetooth-r16 ENUMERATED {true} OPTIONAL,
  ...
}

DRX-Preference-r16 ::= SEQUENCE {
  preferredDRX-InactivityTimer-r16 ENUMERATED {
    ms0, ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60, ms80,
    ms100, ms200, ms300, ms500, ms750, ms1280, ms1920, ms2560, ms4096, ms8192, spare9,
    spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 } OPTIONAL,
  preferredDRX-LongCycle-r16 ENUMERATED {
    ms10, ms20, ms32, ms40, ms60, ms70, ms80, ms128, ms160, ms256, ms320, ms512,
    ms640, ms1024, ms1280, ms2048, ms4048, ms8096, ms16384, ms32768, spare12, spare11,
    spare10, spare9, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 } OPTIONAL,
  preferredDRX-ShortCycle-r16 ENUMERATED {
    ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms14, ms16, ms20, ms30, ms32,
    ms35, ms40, ms64, ms80, ms128, ms160, ms256, ms320, ms512, ms640, spare9,
    spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 } OPTIONAL,
  preferredDRX-ShortCycleTimer-r16 INTEGER (1..16) OPTIONAL
}
ETSI

ETSI TS 138 331 V16.3.1 (2021-01)

3GPP TS 38.331 version 16.3.1 Release 16

MaxBW-Preference-r16 ::= SEQUENCE {
  reducedMaxBW-FR1-r16 ReducedMaxBW-FRx-r16 OPTIONAL,
  reducedMaxBW-FR2-r16 ReducedMaxBW-FRx-r16 OPTIONAL
}

MaxCC-Preference-r16 ::= SEQUENCE {
  reducedMaxCCs-r16 ReducedMaxCCs-r16 OPTIONAL
}

MaxMIMO-LayerPreference-r16 ::= SEQUENCE {
  reducedMaxMIMO-LayersFR1-r16 SEQUENCE {
    reducedMIMO-LayersFR1-DL-r16 INTEGER (1..8),
    reducedMIMO-LayersFR1-UL-r16 INTEGER (1..4)
  } OPTIONAL,
  reducedMaxMIMO-LayersFR2-r16 SEQUENCE {
    reducedMIMO-LayersFR2-DL-r16 INTEGER (1..8),
    reducedMIMO-LayersFR2-UL-r16 INTEGER (1..4)
  } OPTIONAL
}

MinSchedulingOffsetPreference-r16 ::= SEQUENCE {
  preferredK0-r16 SEQUENCE {
    preferredK0-SCS-15kHz-r16 ENUMERATED {s11, s12, s14, s16} OPTIONAL,
    preferredK0-SCS-30kHz-r16 ENUMERATED {s11, s12, s14, s16} OPTIONAL,
    preferredK0-SCS-60kHz-r16 ENUMERATED {s12, s14, s18, s12} OPTIONAL,
    preferredK0-SCS-120kHz-r16 ENUMERATED {s12, s14, s18, s12} OPTIONAL
  } OPTIONAL,
  preferredK2-r16 SEQUENCE {
    preferredK2-SCS-15kHz-r16 ENUMERATED {s11, s12, s14, s16} OPTIONAL,
    preferredK2-SCS-30kHz-r16 ENUMERATED {s11, s12, s14, s16} OPTIONAL,
    preferredK2-SCS-60kHz-r16 ENUMERATED {s12, s14, s18, s12} OPTIONAL,
    preferredK2-SCS-120kHz-r16 ENUMERATED {s12, s14, s18, s12} OPTIONAL
  } OPTIONAL
}

ReleasePreference-r16 ::= SEQUENCE {
  preferredRRC-State-r16 ENUMERATED {idle, inactive, connected, outOfConnected}
}

ReducedMaxBW-FRx-r16 ::= SEQUENCE {
  reducedBW-DL-r16 ReducedAggregatedBandwidth,
  reducedBW-UL-r16 ReducedAggregatedBandwidth
}

ReducedMaxCCs-r16 ::= SEQUENCE {
  reducedCCsDL-r16 INTEGER (0..31),
  reducedCCsUL-r16 INTEGER (0..31)
}

SL-UE-AssistanceInformationNR-r16 ::= SEQUENCE (SIZE (1..maxNrofTrafficPattern-r16)) OF SL-TrafficPatternInfo-r16

SL-TrafficPatternInfo-r16 ::= SEQUENCE {
  trafficPeriodicity-r16 ENUMERATED {ms20, ms50, ms100, ms200, ms300, ms400, ms500, ms600, ms700, ms800, ms900, ms1000},
  MAXIMUM_LENGTH +
}
timingOffset-r16
messageSize-r16
sl-QoS-FlowIdentity-r16

-- TAG-UEASSISTANCEINFORMATION-STOs
-- ASN1STOp
<table>
<thead>
<tr>
<th><strong>UEAssistanceInformation field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>affectedCarrierFreqList</strong></td>
</tr>
<tr>
<td>Indicates a list of NR carrier frequencies that are affected by IDC problem.</td>
</tr>
<tr>
<td><strong>affectedCarrierFreqCombList</strong></td>
</tr>
<tr>
<td>Indicates a list of NR carrier frequency combinations that are affected by IDC problems due to Inter-Modulation Distortion and harmonics from NR when configured with UL CA.</td>
</tr>
<tr>
<td><strong>delayBudgetReport</strong></td>
</tr>
<tr>
<td>Indicates the UE-preferred adjustment to connected mode DRX.</td>
</tr>
<tr>
<td><strong>interferenceDirection</strong></td>
</tr>
<tr>
<td>Indicates the direction of IDC interference. Value <code>nr</code> indicates that only NR is victim of IDC interference, value <code>other</code> indicates that only another radio is victim of IDC interference and value <code>both</code> indicates that both NR and another radio are victims of IDC interference. The other radio refers to either the ISM radio or GNSS (see TR 36.816 [44]).</td>
</tr>
<tr>
<td><strong>minSchedulingOffsetPreference</strong></td>
</tr>
<tr>
<td>Indicates the UE's preferences on minimumSchedulingOffset of cross-slot scheduling for power saving.</td>
</tr>
<tr>
<td><strong>preferredDRX-InactivityTimer</strong></td>
</tr>
<tr>
<td>Indicates the UE's preferred DRX inactivity timer length for power saving. Value in ms (milliSecond). ms0 corresponds to 0, ms1 corresponds to 1 ms, ms2 corresponds to 2 ms, and so on. If the field is absent from the DRX-Preference IE, it is interpreted as the UE having no preference for the DRX inactivity timer. If secondary DRX group is configured, the preferredDRX-InactivityTimer only applies to the default DRX group.</td>
</tr>
<tr>
<td><strong>preferredDRX-LongCycle</strong></td>
</tr>
<tr>
<td>Indicates the UE's preferred long DRX cycle length for power saving. Value in ms. ms10 corresponds to 10ms, ms20 corresponds to 20 ms, ms32 corresponds to 32 ms, and so on. If preferredDRX-ShortCycle is provided, the value of preferredDRX-LongCycle shall be a multiple of the preferredDRX-ShortCycle value. If the field is absent from the DRX-Preference IE, it is interpreted as the UE having no preference for the long DRX cycle.</td>
</tr>
<tr>
<td><strong>preferredDRX-ShortCycle</strong></td>
</tr>
<tr>
<td>Indicates the UE's preferred short DRX cycle length for power saving. Value in ms. ms2 corresponds to 2ms, ms3 corresponds to 3 ms, ms4 corresponds to 4 ms, and so on. If the field is absent from the DRX-Preference IE, it is interpreted as the UE having no preference for the short DRX cycle.</td>
</tr>
<tr>
<td><strong>preferredDRX-ShortCycleTimer</strong></td>
</tr>
<tr>
<td>Indicates the UE's preferred short DRX cycle timer for power saving. Value in multiples of preferredDRX-ShortCycle. A value of 1 corresponds to preferredDRX-ShortCycle, a value of 2 corresponds to 2 * preferredDRX-ShortCycle and so on. If the field is absent from the DRX-Preference IE, it is interpreted as the UE having no preference for the short DRX cycle timer. A preference for the short DRX cycle is indicated when a preference for the short DRX cycle timer is indicated.</td>
</tr>
<tr>
<td><strong>preferredK0</strong></td>
</tr>
<tr>
<td>Indicates the UE's preferred value of k0 (slot offset between DCI and its scheduled PDSCH - see TS 38.214 [19], clause 5.1.2.1) for cross-slot scheduling for power saving. Value is defined for each subcarrier spacing (numerology) in units of slots. sl1 corresponds to 1 slot, sl2 corresponds to 2 slots, sl4 corresponds to 4 slots, and so on. If a value for a subcarrier spacing is absent, it is interpreted as the UE having no preference on k0 for cross-slot scheduling for that subcarrier spacing. If the field is absent from the MinSchedulingOffsetPreference IE, it is interpreted as the UE having no preference on k0 for cross-slot scheduling.</td>
</tr>
<tr>
<td><strong>preferredK2</strong></td>
</tr>
<tr>
<td>Indicates the UE's preferred value of k2 (slot offset between DCI and its scheduled PUSCH - see TS 38.214 [19], clause 6.1.2.1) for cross-slot scheduling for power saving. Value is defined for each subcarrier spacing (numerology) in units of slots. sl1 corresponds to 1 slot, sl2 corresponds to 2 slots, sl4 corresponds to 4 slots, and so on. If a value for a subcarrier spacing is absent, it is interpreted as the UE having no preference on k2 for cross-slot scheduling for that subcarrier spacing. If the field is absent from the MinSchedulingOffsetPreference IE, it is interpreted as the UE having no preference on k2 for cross-slot scheduling.</td>
</tr>
<tr>
<td><strong>preferredRRC-State</strong></td>
</tr>
<tr>
<td>Indicates the UE's preferred RRC state. The value <code>idle</code> is indicated if the UE prefers to be released from RRC_CONNECTED and transition to RRC_IDLE. The value <code>inactive</code> is indicated if the UE prefers to be released from RRC_CONNECTED and transition to RRC_INACTIVE. The value <code>connected</code> is indicated if the UE prefers to revert an earlier indication to leave RRC_CONNECTED state. The value <code>outOfConnected</code> is indicated if the UE prefers to be released from RRC_CONNECTED and has no preferred RRC state to transition to. The value <code>connected</code> can only be indicated if the UE is configured with connectedReporting.</td>
</tr>
<tr>
<td>Field Descriptions</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td><strong>reducedBW-FR1</strong></td>
</tr>
<tr>
<td><strong>reducedBW-FR2</strong></td>
</tr>
<tr>
<td><strong>reducedCCsDL</strong></td>
</tr>
<tr>
<td><strong>reducedCCsUL</strong></td>
</tr>
<tr>
<td><strong>reducedMIMO-LayersFR1-DL</strong></td>
</tr>
<tr>
<td><strong>reducedMIMO-LayersFR1-UL</strong></td>
</tr>
</tbody>
</table>
### UEAssistanceInformation field descriptions

**reducedMIMO-LayersFR2-DL**  
Indicates the UE's preference on reduced configuration corresponding to the maximum number of downlink MIMO layers of each serving cell operating on FR2 indicated by the field, to address overheating or power saving. This field is allowed to be reported only when UE is configured with serving cells operating on FR2. The maximum number of downlink MIMO layers can only range up to the maximum number of MIMO layers configured across all activated downlink carrier(s) of FR2 in the cell group when indicated to address power savings.

**reducedMIMO-LayersFR2-UL**  
Indicates the UE's preference on reduced configuration corresponding to the maximum number of uplink MIMO layers of each serving cell operating on FR2 indicated by the field, to address overheating or power saving. This field is allowed to be reported only when UE is configured with serving cells operating on FR2. The maximum number of uplink MIMO layers can only range up to the maximum number of MIMO layers configured across all activated uplink carrier(s) of FR2 in the cell group when indicated to address power savings.

**referenceTimeInfoPreference**  
Indicates whether the UE prefers being provisioned with the timing information specified in the IE `ReferenceTimeInfo`.

**sl-QoS-FlowIdentity**  
This identity uniquely identifies one sidelink QoS flow between the UE and the network in the scope of UE, which is unique for different destination and cast type.

**sl-UE-AssistanceInformationNR**  
Indicates the traffic characteristic of sidelink logical channel(s), specified in the IE `SL-TrafficPatternInfo`, that are setup for NR sidelink communication.

**type1**  
Indicates the preferred amount of increment/decrement to the long DRX cycle length with respect to the current configuration. Value in number of milliseconds. Value `ms40` corresponds to 40 milliseconds, `msMinus40` corresponds to -40 milliseconds and so on.

**victimSystemType**  
Indicate the list of victim system types to which IDC interference is caused from NR when configured with UL CA. Value `gps`, `glonass`, `bds`, `galileo` and `navIC` indicates the type of GNSS. Value `wlan` indicates WLAN and value `bluetooth` indicates Bluetooth.

### SL-TrafficPatternInfo field descriptions

**messageSize**  
Indicates the maximum TB size based on the observed traffic pattern. The value refers to the index of TS 38.321 [3], table 6.1.3.1-2.

**timingOffset**  
This field indicates the estimated timing for a packet arrival in a sidelink logical channel. Specifically, the value indicates the timing offset with respect to subframe#0 of SFN#0 in milliseconds.

**trafficPeriodicity**  
This field indicates the estimated data arrival periodicity in a sidelink logical channel. Value `ms20` corresponds to 20 ms, `ms50` corresponds to 50 ms and so on.

---

**UECapabilityEnquiry**

The `UECapabilityEnquiry` message is used to request UE radio access capabilities for NR as well as for other RATs.

Signalling radio bearer: SRB1  
RLC-SAP: AM  
Logical channel: DCCH  
Direction: Network to UE
**UECapabilityEnquiry message**

```asn1
UECapabilityEnquiry ::= SEQUENCE {
  rrc-TransactionIdentifier             RRC-TransactionIdentifier,
  criticalExtensions                  CHOICE {
    ueCapabilityEnquiry                 UECapabilityEnquiry-IEs,
    criticalExtensionsFuture            SEQUENCE {}       
  }
}

UECapabilityEnquiry-IEs ::= SEQUENCE {
  ue-CapabilityRAT-RequestList        UE-CapabilityRAT-RequestList,
  lateNonCriticalExtension           OCTET STRING                OPTIONAL,
  ue-CapabilityEnquiryExt            OCTET STRING (CONTAINING UECapabilityEnquiry-v1560-IEs) OPTIONAL
}

UECapabilityEnquiry-v1560-IEs ::= SEQUENCE {
  capabilityRequestFilterCommon       UE-CapabilityRequestFilterCommon OPTIONAL,
  nonCriticalExtension                UECapabilityEnquiry-v1610-IEs OPTIONAL
}

UECapabilityEnquiry-v1610-IEs ::= SEQUENCE {
  rrc-SegAllowed-r16                   ENUMERATED {enabled}          OPTIONAL,
  nonCriticalExtension                SEQUENCE {}                      OPTIONAL
}
```

**UECapabilityInformation message**

The IE **UECapabilityInformation** message is used to transfer UE radio access capabilities requested by the network.

- Signalling radio bearer: SRB1
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to Network

```asn1
UECapabilityInformation ::= SEQUENCE {
  ue-CapabilityInformation            SEQUENCE {
    capabilityRequestFilterCommon       UE-CapabilityRequestFilterCommon OPTIONAL,
    rrc-SegAllowed-r16                   ENUMERATED {enabled}          OPTIONAL
  }
}
```
UEInformationRequest

The **UEInformationRequest** message is used by the network to retrieve information from the UE.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

**UEInformationRequest message**

```asn1
UEInformationRequest-r16 ::= SEQUENCE {
      rrc-TransactionIdentifier RRC-TransactionIdentifier,
      criticalExtensions CHOICE {
        ueInformationRequest-r16 IEs,  -- Need N
        criticalExtensionsFuture SEQUENCE {}  -- Need N
      }
}

UEInformationRequest-r16-IEs ::= SEQUENCE {
      idleModeMeasurementReq-r16 ENUMERATED{true} OPTIONAL,  -- Need N
      logMeasReportReq-r16 ENUMERATED{(true)} OPTIONAL,  -- Need N
      connEstFailReportReq-r16 ENUMERATED{(true)} OPTIONAL,  -- Need N
      ra-ReportReq-r16 ENUMERATED{(true)} OPTIONAL,  -- Need N
      rlf-ReportReq-r16 ENUMERATED{(true)} OPTIONAL,  -- Need N
      mobilityHistoryReportReq-r16 ENUMERATED{(true)} OPTIONAL,  -- Need N
      lateNonCriticalExtension OCTET STRING OPTIONAL,
      lateNonCriticalExtensionContainerList OCTET STRING OPTIONAL,
      nonCriticalExtension SEQUENCE {} OPTIONAL
    }
```
UEInformationRequest-IEs field descriptions

connEstFailReportReq
This field is used to indicate whether the UE shall report information about the connection failure.

idleModeMeasurementReq
This field indicates that the UE shall report the idle/inactive measurement information, if available, to the network in the UEInformationResponse message.

logMeasReportReq
This field is used to indicate whether the UE shall report information about logged measurements.

mobilityHistoryReportReq
This field is used to indicate whether the UE shall report information about mobility history information.

ra-ReportReq
This field is used to indicate whether the UE shall report information about the random access procedure.

rlf-ReportReq
This field is used to indicate whether the UE shall report information about the radio link failure.

---

**UEInformationResponse**

The **UEInformationResponse** message is used by the UE to transfer information requested by the network.

- Signalling radio bearer: SRB1 or SRB2 (when logged measurement information is included)
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to network

---

**UEInformationResponse message**

```asn1
UEInformationResponse-r16 ::=        SEQUENCE {
  rrc-TransactionIdentifier            RRC-TransactionIdentifier,
  criticalExtensions                   CHOICE {
    ueInformationResponse-r16            UEInformationResponse-r16-IEs,
    criticalExtensionsFuture             SEQUENCE {}   
  }
}

UEInformationResponse-r16-IEs ::=    SEQUENCE {
  nonCriticalExtension     SEQUENCE {} OPTIONAL
}
```
LogMeasReport-r16 ::= SEQUENCE {
 _measResultIdleEUTRA-r16 MeasResultIdleEUTRA-r16 OPTIONAL,
 _measResultIdleNR-r16 MeasResultIdleNR-r16 OPTIONAL,
 _logMeasReport-r16 LogMeasReport-r16 OPTIONAL,
 _connEstFailReport-r16 ConnEstFailReport-r16 OPTIONAL,
 _ra-ReportList-r16 RA-ReportList-r16 OPTIONAL,
 RLF-Report-r16 RLF-Report-r16 OPTIONAL,
  mobilityHistoryReport-r16 MobilityHistoryReport-r16 OPTIONAL,
  lateNonCriticalExtension OCTET STRING OPTIONAL,
  nonCriticalExtension SEQUENCE {} OPTIONAL
}

LogMeasReport-r16 ::= SEQUENCE {
  absoluteTimeStamp-r16 AbsoluteTimeInfo-r16,
  traceReference-r16 TraceReference-r16,
  traceRecordingSessionRef-r16 OCTET STRING (SIZE (2)),
  tce-Id-r16 OCTET STRING (SIZE (1)),
  logMeasInfoList-r16 LogMeasInfoList-r16,
  logMeasAvailable-r16 ENUMERATED {true} OPTIONAL,
  logMeasAvailableBT-r16 ENUMERATED {true} OPTIONAL,
  logMeasAvailableWLAN-r16 ENUMERATED {true} OPTIONAL,
  ...}

LogMeasInfoList-r16 ::= SEQUENCE (SIZE (1..maxLogMeasReport-r16)) OF LogMeasInfo-r16

LogMeasInfo-r16 ::= SEQUENCE {
  locationInfo-r16 LocationInfo-r16 OPTIONAL,
  relativeTimeStamp-r16 INTEGER (0..7200),
  servCellIdentity-r16 CGI-Info-Logging-r16 OPTIONAL,
  measResultServingCell-r16 MeasResultServingCell-r16 OPTIONAL,
  measResultNeighborCells-r16 SEQUENCE {
    measResultNeighborCellListNR MeasResultListLogging2NR-r16 OPTIONAL,
    measResultNeighborCellListEUTRA MeasResultList2EUTRA-r16 OPTIONAL
  },
  anyCellSelectionDetected-r16 ENUMERATED {true} OPTIONAL
}

ConnEstFailReport-r16 ::= SEQUENCE {
  measResultFailedCell-r16 MeasResultFailedCell-r16,
  locationInfo-r16 LocationInfo-r16 OPTIONAL,
  measResultNeighborCells-r16 SEQUENCE {
    measResultNeighborCellListNR MeasResultList2NR-r16 OPTIONAL,
    measResultNeighborCellListEUTRA MeasResultList2EUTRA-r16 OPTIONAL
  },
  numberOfConnFail-r16 INTEGER (1..8),
  perRAInfoList-r16 PerRAInfoList-r16,
  timeSinceFailure-r16 TimeSinceFailure-r16,
  ...}

MeasResultServingCell-r16 ::= SEQUENCE {
  resultsSSB-Cell MeasQuantityResults,
  resultsSSB SEQUENCE {
    _best-ssb-Index SSB-Index,
  }
}
MeasResultFailedCell-r16 ::= SEQUENCE {
cgi-info              CGI-Info-Logging-r16,
measResult-r16        SEQUENCE {
    cellResults-r16      SEQUENCE {
        resultsSSB-Cell-r16 MeasQuantityResults,
    },
    rsIndexResults-r16   SEQUENCE {
        resultsSSB-indexes-r16 ResultsPerSSB-IndexList
    }
}
}
RA-ReportList-r16 ::= SEQUENCE (SIZE (1..maxRAReport-r16)) OF RA-Report-r16
RA-Report-r16 ::= SEQUENCE {
cellId-r16          CHOICE {
    cellGlobalId-r16    CGI-Info-Logging-r16,
    pci-arfcn-r16       SEQUENCE {
        physCellId-r16       PhysCellId,
        carrierFreq-r16      ARFCN-ValueNR
    }
},
raInformationCommon-r16 RA-InformationCommon-r16,
raPurpose-r16        ENUMERATED {
    accessRelated, beamFailureRecovery, reconfigurationWithSync, ulUnSynchronized,
    schedulingRequestFailure, noPUCCHResourceAvailable, requestForOtherSI,
    spare9, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1
}
}
RA-InformationCommon-r16 ::= SEQUENCE {
    absoluteFrequencyPointA-r16          ARFCN-ValueNR,
    locationAndBandwidth-r16             INTEGER (0..37949),
    subcarrierSpacing-r16                SubcarrierSpacing,
    msg1-FrequencyStart-r16              INTEGER (0..maxNrofPhysicalResourceBlocks-1) OPTIONAL,
    msg1-FrequencyStartCFRA-r16          INTEGER (0..maxNrofPhysicalResourceBlocks-1) OPTIONAL,
    msg1-SubcarrierSpacing-r16           SubcarrierSpacing OPTIONAL,
    msg1-SubcarrierSpacingCFRA-r16       SubcarrierSpacing OPTIONAL,
    msg1-FDMCFRA-r16                     ENUMERATED {one, two, four, eight} OPTIONAL,
    perRAInfoList-r16                    PerRAInfoList-r16
}
PerRAInfoList-r16 ::= SEQUENCE (SIZE (1..200)) OF PerRAInfo-r16
PerRAInfo-r16 ::= CHOICE {
    perRASSBInfoList-r16                 PerRASSBInfo-r16,
    perRACSI-RSInfoList-r16              PerRACSI-RSInfo-r16
}
PerRASSBInfo-r16 ::= SEQUENCE {
ssb-Index-r16 ::= SSB-Index,
numberOfPreamblesSentOnSSB-r16 ::= INTEGER (1..200),
perRAAttemptInfoList-r16 ::= PerRAAttemptInfoList-r16

PerRACSI-RSInfo-r16 ::= SEQUENCE {
csi-RS-Index-r16 ::= CSI-RS-Index,
umberOfPreamblesSentOnCSI-RS-r16 ::= INTEGER (1..200)
}

PerRAAttemptInfoList-r16 ::= SEQUENCE (SIZE (1..200)) OF PerRAAttemptInfo-r16

PerRAAttemptInfo-r16 ::= SEQUENCE {
contentionDetected-r16 ::= BOOLEAN OPTIONAL,
dlRSRPAboveThreshold-r16 ::= BOOLEAN OPTIONAL,
...}

RLF-Report-r16 ::= CHOICE {
nr-RLF-Report-r16 ::= SEQUENCE {
measResultLastServCell-r16 ::= MeasResultRLFNR-r16,
measResultNeighborCells-r16 ::= MeasResultListNR-r16 OPTIONAL,
measResultECGIList-r16 ::= MeasResultList2NR-r16 OPTIONAL,
}
c-RNTI-r16 ::= RNTI-Value,
previousPCellId-r16 ::= CHOICE {
nrPreviousCell-r16 ::= CGI-Info-Logging-r16,
eutraPreviousCell-r16 ::= CGI-InfoEUTRALogging
}
failedPCellId-r16 ::= CHOICE {
nrFailedPCellId-r16 ::= CGI-Info-Logging-r16,
eutraFailedPCellId-r16 ::= CGI-InfoEUTRALogging
}

cellIdGlobalId-r16 ::= SEQUENCE {
physCellId-r16 ::= PhysCellId,
carrierFreq-r16 ::= ARFCN-ValueNR
}

pcic-arfcn-r16 ::= SEQUENCE {
physCellId-r16 ::= EUTRA-PhysCellId,
carrierFreq-r16 ::= ARFCN-ValueEUTRA
}

reconnectCellId-r16 ::= CHOICE {
nrReconnectCellId-r16 ::= CGI-Info-Logging-r16,
eutraReconnectCellId-r16 ::= CGI-InfoEUTRALogging
}

TimeUntilReconnection-r16 ::= TimeUntilReconnection-r16
reestablishmentCellId-r16 ::= CGI-Info-Logging-r16 OPTIONAL,
timeConnFailure-r16 ::= INTEGER (0..1023) OPTIONAL,
timeSinceFailure-r16 ::= TimeSinceFailure-r16,
connectionFailureType-r16 ENUMERATED {rlf, hof},
rlf-Cause-r16 ENUMERATED {t310-Expiry, randomAccessProblem, rlc-MaxNumRetx, beamFailureRecoveryFailure, lbtFailure-r16, bh-rlfRecoveryFailure, spare2, spare1},
locationInfo-r16 LocationInfo-r16 OPTIONAL,
nosuitableCellFound-r16 ENUMERATED {true} OPTIONAL,
ra-informationCommon-r16 RA-InformationCommon-r16 OPTIONAL,
...,
eutra-RLF-Report-r16 SEQUENCE {
failedPCellId-EUTRA CGI-InfoEUTRALogging,
measResult-RLF-Report-EUTRA-r16 OCTET STRING,
...,
}
MeasResultList2NR-r16 ::= SEQUENCE{SIZE (1..maxFreq)} OF MeasResult2NR-r16
MeasResultList2EUTRA-r16 ::= SEQUENCE{SIZE (1..maxFreq)} OF MeasResult2EUTRA-r16
MeasResult2NR-r16 ::= SEQUENCE {
ssbFrequency-r16 ARFCN-ValueNR OPTIONAL,
refFreqCSI-RS-r16 ARFCN-ValueNR OPTIONAL,
measResultList-r16 MeasResultListNR
}
MeasResultList2EUTRA-r16 ::= SEQUENCE {
carrierFreq-r16 ARFCN-ValueEUTRA,
measResultList-r16 MeasResultListEUTRA
}
MeasResultList2NR-r16 ::= SEQUENCE{SIZE (1..maxFreq)} OF MeasResultLogging2NR-r16
MeasResultLogging2NR-r16 ::= SEQUENCE {
carrierFreq-r16 ARFCN-ValueNR,
measResultListLoggingNR-r16 MeasResultListLoggingNR-r16
}
MeasResultLoggingNR-r16 ::= SEQUENCE {SIZE (1..maxCellReport)} OF MeasResultLoggingNR-r16
MeasResultLoggingNR-r16 ::= SEQUENCE {
physCellId-r16 PhysCellId,
resultsSSB-Cell-r16 MeasQuantityResults,
nrNumberOfGoodSSB-r16 INTEGER {1..maxNrofSSBs-r16} OPTIONAL
}
MeasResultList2EUTRA-r16 ::= SEQUENCE {
carrierFreq-r16 ARFCN-ValueEUTRA,
measResultList-r16 MeasResultListEUTRA
}
MeasResultRLFNR-r16 ::= SEQUENCE {
measResult-r16 SEQUENCE {
cellResults-r16 RESULTS {SEQUENCE {
resultsSSB-Cell-r16 MeasQuantityResults OPTIONAL,
resultaCSI-RS-Cell-r16 MeasQuantityResults OPTIONAL,
}},
rsIndexResults-r16 RESULTS {SEQUENCE {
resultsSSB-Indexes-r16 ResultsPerSSB-IndexList OPTIONAL,
ssbRlMConfigBitmap-r16 BIT STRING {SIZE (64)} OPTIONAL,
}},
}
resultsCSI-RS-Indexes-r16 ::= RESULTSPerCSI-RS-IndexList OPTIONAL,
csi-rsRLMConfigBitmap-r16 ::= BIT STRING (SIZE (96)) OPTIONAL

TimeSinceFailure-r16 ::= INTEGER (0..172800)

MobilityHistoryReport-r16 ::= VisitedCellInfoList-r16

TimeUntilReconnection-16 ::= INTEGER (0..172800)

UEInformationResponse-IEs field descriptions

logMeasReport
This field is used to provide the measurement results stored by the UE associated to logged MDT.

measResultIdleEUTRA
EUTRA measurement results performed during RRC_INACTIVE or RRC_IDLE.

measResultIdleNR
NR measurement results performed during RRC_INACTIVE or RRC_IDLE.

ra-Report
This field is used to provide the list of RA reports that is stored by the UE for the past upto maxRAReport-r16 number of successful random access procedures.

rlf-Report
This field is used to indicate the RLF report related contents.
### LogMeasReport field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>absoluteTimeStamp</strong></td>
<td>Indicates the absolute time when the logged measurement configuration logging is provided, as indicated by NR within absoluteTimeInfo.</td>
</tr>
<tr>
<td><strong>anyCellSelectionDetected</strong></td>
<td>This field is used to indicate the detection of any cell selection state, as defined in TS 38.304 [20]. The UE sets this field when performing the logging of measurement results in RRC_IDLE or RRC_INACTIVE and there is no suitable cell or no acceptable cell.</td>
</tr>
<tr>
<td><strong>measResultServingCell</strong></td>
<td>This field refers to the log measurement results taken in the Serving cell.</td>
</tr>
<tr>
<td><strong>numberOfGoodSSB</strong></td>
<td>Indicates the number of good beams (beams that are above absThreshSS-BlocksConsolidation, if configured by the network) associated to the cells within the R value range (which is configured by network for cell reselection) of the highest ranked cell as part of the beam level measurements. If the UE has no SSB of a neighbour cell whose measurement quantity is above the absThreshSS-BlocksConsolidation or if the network has not configured the absThreshSS-BlocksConsolidation, then the UE does not include numberOfGoodSSB for the corresponding neighbour cell. If the UE has no SSB of the serving cell whose measurement quantity is above the absThreshSS-BlocksConsolidation or if the network has not configured the absThreshSS-BlocksConsolidation, then the UE shall set the numberOfGoodSSB for the serving cell to one.</td>
</tr>
<tr>
<td><strong>relativeTimeStamp</strong></td>
<td>Indicates the time of logging measurement results, measured relative to the absoluteTimeStamp. Value in seconds.</td>
</tr>
</tbody>
</table>

### ConnEstFailReport field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>measResultFailedCell</strong></td>
<td>This field refers to the last measurement results taken in the cell, where connection establishment failure or connection resume failure happened.</td>
</tr>
<tr>
<td><strong>measResultNeighCells</strong></td>
<td>This field refers to the neighbour cell measurements when connection establishment failure or connection resume failure happened.</td>
</tr>
<tr>
<td><strong>numberOfConnFail</strong></td>
<td>This field is used to indicate the latest number of consecutive failed RRCSetup or RRCResume procedures in the same cell independent of RRC state transition.</td>
</tr>
<tr>
<td><strong>numberOfPreamblesSent</strong></td>
<td>This field is used to indicate the number of random access preambles that were transmitted.</td>
</tr>
<tr>
<td><strong>timeSinceFailure</strong></td>
<td>This field is used to indicate the time that elapsed since the connection (establishment or resume) failure. Value in seconds. The maximum value 172800 means 172800s or longer.</td>
</tr>
</tbody>
</table>
### RA-Report field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>absoluteFrequencyPointA</strong></td>
<td>This field indicates the absolute frequency position of the reference resource block (Common RB 0).</td>
</tr>
<tr>
<td><strong>cellID</strong></td>
<td>This field indicates the CGI of the cell in which the associated random access procedure was performed.</td>
</tr>
<tr>
<td><strong>contentionDetected</strong></td>
<td>This field is used to indicate that contention was detected for the transmitted preamble in the given random access attempt or not. This field is not included when the UE performs random access attempt using contention free random-access resources or when the raPurpose is set to requestForOtherSI.</td>
</tr>
<tr>
<td><strong>csi-RS-Index</strong></td>
<td>This field is used to indicate the CSI-RS index corresponding to the random access attempt.</td>
</tr>
<tr>
<td><strong>dlRSRPAboveThreshold</strong></td>
<td>This field is used to indicate whether the DL beam (SSB) quality associated to the random access attempt was above or below the threshold (rsrp-ThresholdSSB in beamFailureRecoveryConfig in UL BWP configuration of UL BWP selected for random access procedure initiated for beam failure recovery; Otherwise, rsrp-ThresholdSSB in rach-ConfigCommon in UL BWP configuration of UL BWP selected for random access procedure).</td>
</tr>
<tr>
<td><strong>locationAndBandwidth</strong></td>
<td>Frequency domain location and bandwidth of the bandwidth part associated to the random-access resources used by the UE.</td>
</tr>
<tr>
<td><strong>numberOfPreamblesSentOnCSI-RS</strong></td>
<td>This field is used to indicate the total number of successive RA preambles that were transmitted on the corresponding CSI-RS.</td>
</tr>
<tr>
<td><strong>numberOfPreamblesSentOnSSB</strong></td>
<td>This field is used to indicate the total number of successive RA preambles that were transmitted on the corresponding SS/PBCH block.</td>
</tr>
<tr>
<td><strong>perRAAttemptInfoList</strong></td>
<td>This field provides detailed information about a random access attempt.</td>
</tr>
<tr>
<td><strong>perRAInfoList</strong></td>
<td>This field provides detailed information about each of the random access attempts in the chronological order of the random access attempts.</td>
</tr>
<tr>
<td><strong>perRACSI-RSInfoList</strong></td>
<td>This field provides detailed information about the successive random access attempts associated to the same CSI-RS.</td>
</tr>
<tr>
<td><strong>perRASSBInfoList</strong></td>
<td>This field provides detailed information about the successive random access attempts associated to the same SS/PBCH block.</td>
</tr>
<tr>
<td><strong>raPurpose</strong></td>
<td>This field is used to indicate the RA scenario for which the RA report entry is triggered. The RA accesses associated to Initial access from RRC_IDLE, transition from RRC-INACTIVE and the MSG3 based SI request are indicated using the indicator ‘accessRelated’. The indicator beamFailureRecovery is used in case of beam failure recovery failure in the SpCell [3]. The indicator reconfigurationWithSync is used if the UE executes a reconfiguration with sync. The indicator ulUnSynchronized is used if the random access procedure is initiated in a SpCell by DL or UL data arrival during RRC_CONNECTED when the timeAlignmentTimer is not running in the PTAG or in a serving cell by a PDCCH order [3]. The indicator schedulingRequestFailure is used in case of SR failures [3]. The indicator noPUCCHResourceAvailable is used when the UE has no valid SR PUCCH resources configured [3]. The indicator requestForOtherSI is used for MSG1 based on demand SI request.</td>
</tr>
<tr>
<td><strong>ra-InformationCommon</strong></td>
<td>This field is used to indicate the common random-access related information between RA-report and RLF-report. For RA report, this field is mandatory presented. For RLF-report, this field is optionally included when connectionFailureType is set to ‘hot’ or when connectionFailureType is set to ‘rlf’ and the rlf-Cause equals to ‘randomAccessProblem’ or ‘beamRecoveryFailure’; otherwise this field is absent.</td>
</tr>
<tr>
<td><strong>ssb-Index</strong></td>
<td>This field is used to indicate the SS/PBCH index of the SS/PBCH block corresponding to the random access attempt.</td>
</tr>
<tr>
<td><strong>subcarrierSpacing</strong></td>
<td>Subcarrier spacing used in the BWP associated to the random-access resources used by the UE.</td>
</tr>
</tbody>
</table>
### RLF-Report Field Descriptions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>connectionFailureType</td>
<td>This field is used to indicate whether the connection failure is due to radio link failure or handover failure.</td>
</tr>
<tr>
<td>csi-rsRLMConfigBitmap</td>
<td>This field is used to indicate the CSI-RS indexes that are also part of the RLM configurations.</td>
</tr>
<tr>
<td>c-RNTI</td>
<td>This field indicates the C-RNTI used in the PCell upon detecting radio link failure or the C-RNTI used in the source PCell upon handover failure.</td>
</tr>
<tr>
<td>failedPCellId</td>
<td>This field is used to indicate the PCell in which RLF is detected or the target PCell of the failed handover. For intra-NR handover, <code>nrFailedPCellId</code> is included and for the handover from NR to EUTRA, <code>eutraFailedPCellId</code> is included. The UE sets the ARFCN according to the frequency band used for transmission/reception when the failure occurred.</td>
</tr>
<tr>
<td>failedPCellId-EUTRA</td>
<td>This field is used to indicate the PCell in which RLF is detected or the source PCell of the failed handover in an E-UTRA RLF report.</td>
</tr>
<tr>
<td>measResultListEUTRA</td>
<td>This field refers to the last measurement results taken in the neighboring EUTRA Cells, when the radio link failure or handover failure happened.</td>
</tr>
<tr>
<td>measResultListNR</td>
<td>This field refers to the last measurement results taken in the neighboring NR Cells, when the radio link failure or handover failure happened.</td>
</tr>
<tr>
<td>measResultLastServCell</td>
<td>This field refers to the log measurement results taken in the PCell upon detecting radio link failure or the source PCell upon handover failure.</td>
</tr>
<tr>
<td>measResult-RLF-Report-EUTRA</td>
<td>Includes the E-UTRA RLF-Report-r9 IE as specified in TS 36.331 [10].</td>
</tr>
<tr>
<td>noSuitableCellFound</td>
<td>This field is set by the UE when the T311 expires.</td>
</tr>
<tr>
<td>previousPCellId</td>
<td>This field is used to indicate the source PCell of the last handover (source PCell when the last RRCReconfiguration message including reconfigurationWithSync was received). For intra-NR handover, <code>nrPreviousCell</code> is included and for the handover from EUTRA to NR, <code>eutraPreviousCell</code> is included.</td>
</tr>
<tr>
<td>reconnectCellId</td>
<td>This field is used to indicate the cell in which the UE comes back to connected after connection failure and after failing to perform reestablishment. If the UE comes back to RRC CONNECTED in an NR cell then, <code>nrReconnectCellID</code> is included and if the UE comes back to RRC CONNECTED in an LTE cell then, <code>eutraReconnectCellID</code> is included.</td>
</tr>
<tr>
<td>reestablishmentCellId</td>
<td>This field is used to indicate the cell in which the re-establishment attempt was made after connection failure.</td>
</tr>
<tr>
<td>rlf-Cause</td>
<td>This field is used to indicate the cause of the last radio link failure that was detected. In case of handover failure information reporting (i.e., the connectionFailureType is set to 'hoi'), the UE is allowed to set this field to any value.</td>
</tr>
<tr>
<td>ssbRLMConfigBitmap</td>
<td>This field is used to indicate the SS/PBCH block indexes that are also part of the RLM configurations.</td>
</tr>
<tr>
<td>timeConnFailure</td>
<td>This field is used to indicate the time elapsed since the last HO initialization until connection failure. Actual value = field value * 100ms. The maximum value 1023 means 102.3s or longer.</td>
</tr>
<tr>
<td>timeSinceFailure</td>
<td>This field is used to indicate the time that elapsed since the connection (radio link or handover) failure. Value in seconds. The maximum value 172800 means 172800s or longer.</td>
</tr>
<tr>
<td>timeUntilReconnection</td>
<td>This field is used to indicate the time that elapsed between the connection (radio link or handover) failure and the next time the UE comes to RRC CONNECTED in an NR or EUTRA cell. Value in seconds. The maximum value 172800 means 172800s or longer.</td>
</tr>
</tbody>
</table>
The **ULDedicatedMessageSegment** message is used to transfer segments of the **UECapabilityInformation** message.

**Signalling radio bearer:** SRB1

**RLC-SAP:** AM

**Logical channel:** DCCH

**Direction:** UE to Network

### **ULDedicatedMessageSegment** message

```asn1
ULDedicatedMessageSegment-r16 ::=     SEQUENCE {
  criticalExtensions                      CHOICE {
    ulDedicatedMessageSegment-r16           ULDedicatedMessageSegment-r16-IEs,
    criticalExtensionsFuture                SEQUENCE {} }
}

ULDedicatedMessageSegment-r16-IEs ::=     SEQUENCE {
  segmentNumber-r16                         INTEGER (0..15),
  rrc-MessageSegmentContainer-r16           OCTET STRING,
  rrc-MessageSegmentType-r16                ENUMERATED {notLastSegment, lastSegment},
  lateNonCriticalExtension                  OCTET STRING                                  OPTIONAL,
  nonCriticalExtension                      SEQUENCE {}                                   OPTIONAL }
```

### **ULDedicatedMessageSegment** field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>segmentNumber</strong></td>
<td>Identifies the sequence number of a segment within the encoded UL DCCH message.</td>
</tr>
<tr>
<td><strong>rrc-MessageSegmentContainer</strong></td>
<td>Includes a segment of the encoded UL DCCH message. The size of the included segment in this container should be small enough that the resulting encoded RRC message PDU is less than or equal to the PDCP SDU size limit.</td>
</tr>
<tr>
<td><strong>rrc-MessageSegmentType</strong></td>
<td>Indicates whether the included UL DCCH message segment is the last segment or not.</td>
</tr>
</tbody>
</table>
**ULInformationTransfer**

The **ULInformationTransfer** message is used for the uplink transfer of NAS or non-3GPP dedicated information.

- Signalling radio bearer: SRB2 or SRB1 (only if SRB2 not established yet). If SRB2 is suspended, the UE does not send this message until SRB2 is resumed
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to network

**ULInformationTransfer message**

```asn1
ULInformationTransfer ::= SEQUENCE {
  criticalExtensions CHOICE {
    ulInformationTransfer ULInformationTransfer-IEs,
    criticalExtensionsFuture SEQUENCE {}
  }
}

ULInformationTransfer-IEs ::= SEQUENCE {
  dedicatedNAS-Message DedicatedNAS-Message OPTIONAL,
  lateNonCriticalExtension OCTET STRING OPTIONAL,
  nonCriticalExtension SEQUENCE {} OPTIONAL
}
```

**ULInformationTransferIRAT**

The **ULInformationTransferIRAT** message is used for the uplink transfer of information terminated at NR MCG but specified by another RAT. In this version of the specification, the message is used for V2X sidelink communication messages specified in TS 36.331 [10].

- Signalling radio bearer: SRB1
- RLC-SAP: AM
- Logical channel: DCCH
- Direction: UE to network
ULInformationTransferIRAT message

-- ASN1START
-- TAG-ULINFORMATIONTRANSFERIRAT-START

ULInformationTransferIRAT-r16 ::= SEQUENCE {
criticalExtensions                                CHOICE {
c1                                                   CHOICE {
ulInformationTransferIRAT-r16                    ULInformationTransferIRAT-r16-IEs,             spare3 NULL, spare2 NULL, spare1 NULL
},
criticalExtensionsFuture                     SEQUENCE {}}
}

ULInformationTransferIRAT-r16-IEs ::= SEQUENCE {
ul-DCCH-MessageEUTRA-r16                           OCTET STRING             OPTIONAL,
lateNonCriticalExtension                           OCTET STRING              OPTIONAL,
nonCriticalExtension                                 SEQUENCE {}               OPTIONAL
}

-- TAG-ULINFORMATIONTRANSFERIRAT-STOP
-- ASN1STOP

ULInformationTransferIRAT field descriptions

ul-DCCH-MessageEUTRA
Includes the UL-DCCH-Message as defined in TS 36.331 [10]. In this version of the specification, the field is only used to transfer the E-UTRA RRC MeasurementReport, E-UTRA RRC SidelinkUEInformation and the E-UTRA RRC UEAssistanceInformation messages.

ULInformationTransferMRDC

The ULInformationTransferMRDC message is used for the uplink transfer of MR-DC dedicated information (e.g. for transferring the NR or E-UTRA RRC MeasurementReport message, the FailureInformation message, the UEAssistanceInformation message, the RRCReconfigurationComplete message or the MCGFailureInformation message).

Signalling radio bearer: SRB1, SRB3
RLC-SAP: AM
Logical channel: DCCH
Direction: UE to Network

ULInformationTransferMRDC message

-- ASN1START
-- TAG-ULINFORMATIONTRANSFERMRDC-START
6.3 RRC information elements

6.3.0 Parameterized types

– **SetupRelease**

SetupRelease allows the ElementTypeParam to be used as the referenced data type for the setup and release entries. See A.3.8 for guidelines.

---

**ULInformationTransferMRDC field descriptions**

**ul-DCCH-MessageNR**
Includes the UL-DCCH-Message. In this version of the specification, the field is only used to transfer the NR RRC MeasurementReport, RRCReconfigurationComplete, UEAssistanceInformation and FailureInformation messages when sent via SRB1 and to transfer the NR MCGFailureInformation message when sent via SRB3.

**ul-DCCH-MessageEUTRA**
Includes the UL-DCCH-Message. In this version of the specification, the field is only used to transfer the E-UTRA RRC MeasurementReport message when sent via SRB1 and to transfer the E-UTRA MCGFailureInformation message when sent via SRB3.
6.3.1 System information blocks

-- **SIB2**

**SIB2** contains cell re-selection information common for intra-frequency, inter-frequency and/or inter-RAT cell re-selection (i.e. applicable for more than one type of cell re-selection but not necessarily all) as well as intra-frequency cell re-selection information other than neighbouring cell related.

**SIB2 information element**

```asn1
SIB2 ::= SEQUENCE {
    cellReselectionInfoCommon  SEQUENCE {
        nrofSS-BlocksToAverage        INTEGER (2..maxNrofSS-BlocksToAverage) OPTIONAL, -- Need S
        absThreshSS-BlocksConsolidation ThresholdNR OPTIONAL, -- Need S
        rangeToBestCell                RangeToBestCell OPTIONAL, -- Need R
        q-Hyst                         ENUMERATED {
            dB0, dB1, dB2, dB3, dB4, dB5, dB6, dB8, dB10,
            dB12, dB14, dB16, dB18, dB20, dB22, dB24},
        ...                             OPTIONAL, -- Need R
    }                             OPTIONAL, -- Need S

    cellReselectionServingFreqInfo  SEQUENCE {
        s-IntraSearchP                ReselectionThreshold OPTIONAL, -- Need S
        s-IntraSearchQ                ReselectionThresholdQ OPTIONAL, -- Need S
        threshServingLowP             ReselectionThreshold,          threshServingLowQ             ReselectionThresholdQ OPTIONAL, -- Need R
        cellReselectionPriority       CellReselectionPriority,         cellReselectionSubPriority   CellReselectionSubPriority OPTIONAL, -- Need R
        ...                             OPTIONAL, -- Need S
    }                             OPTIONAL, -- Need S

    intraFreqCellReselectionInfo  SEQUENCE {
        q-RxLevMin                    Q-RxLevMin, OPTIONAL, -- Need R
        q-QualMin                     Q-QualMin, OPTIONAL, -- Need R
        s-IntraSearchP                ReselectionThreshold,          s-IntraSearchQ                ReselectionThresholdQ OPTIONAL, -- Need S
        t-ReselectionNR               T-Reselection,                frequencyBandList             MultiFrequencyBandListNR-SIB OPTIONAL, -- Need S
        frequencyBandListSUL          MultiFrequencyBandListNR-SIB OPTIONAL, -- Need R
        p-Max                          P-Max OPTIONAL, -- Need S
    }                             OPTIONAL
}
```
smtc            SSB-MTC            OPTIONAL, -- Need S
ss-RSSI-Measurement     SS-RSSI-Measurement    OPTIONAL, -- Need R
ssb-ToMeasure            SSb-ToMeasure       OPTIONAL, -- Need S
deriveSSB-IndexFromCell  BOOLEAN,
...
[[
t-ReselectionNR-SF
]],[
][
smtc2-LP-r16         SSB-MTC2-LP-r16    OPTIONAL, -- Need R
ssb-PositionQCL-Common-r16  SSB-PositionQCL-Relation-r16  OPTIONAL  -- Cond SharedSpectrum
]]}

SEQUENCE {
  lowMobilityEvaluation-r16
      S-SearchDeltaP-r16
        ENUMERATED { db3, dB6, dB9, dB12, dB15,
                      spare3, spare2, spare1},
      t-SearchDeltaP-r16
        ENUMERATED { s5, s10, s20, s30, s60, s120, s180,
                      s240, s300, spare7, spare6, spare5,
                      spare4, spare3, spare2, spare1}
    )
  cellEdgeEvaluation-r16
    S-SearchThresholdP-r16  ReselectionThreshold,
    s-SearchThresholdQ-r16  ReselectionThresholdQ
    )
  combineRelaxedMeasCondition-r16  ENUMERATED {true}
  highPriorityMeasRelax-r16  ENUMERATED {true}
)}

RangeToBestCell  ::= Q-OffsetRange

-- TAG-SIB2-STOP
-- ASN1STOP

--
### SIB2 field descriptions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>absThreshSS-BlocksConsolidation</td>
<td>Threshold for consolidation of L1 measurements per RS index. If the field is absent, the UE uses the measurement quantity as specified in TS 38.304 [20].</td>
</tr>
<tr>
<td>cellEdgeEvaluation</td>
<td>Indicates the criteria for a UE to detect that it is not at cell edge, in order to relax measurement requirements for cell reselection (see TS 38.304 [20], clause 5.2.4.9.2).</td>
</tr>
<tr>
<td>cellReselectionInfoCommon</td>
<td>Cell re-selection information common for intra-frequency, inter-frequency and/or inter-RAT cell re-selection.</td>
</tr>
<tr>
<td>cellReselectionServingFreqInfo</td>
<td>Information common for non-intra-frequency cell re-selection i.e. cell re-selection to inter-frequency and inter-RAT cells.</td>
</tr>
<tr>
<td>combineRelaxedMeasCondition</td>
<td>When both lowMobilityEvaluation and cellEdgeEvaluation criteria are present in SIB2, this parameter configures the UE to fulfill both criteria in order to relax measurement requirements for cell reselection. If the field is absent, the UE is allowed to relax measurement requirements for cell reselection when either or both of the criteria are met. (See TS 38.304 [20], clause 5.2.4.9.0)</td>
</tr>
<tr>
<td>deriveSSB-IndexFromCell</td>
<td>This field indicates whether the UE can utilize serving cell timing to derive the index of SS block transmitted by neighbor cell. If this field is set to true, the UE assumes SFN and frame boundary alignment across cells on the serving frequency as specified in TS 38.133 [14].</td>
</tr>
<tr>
<td>frequencyBandList</td>
<td>Indicates the list of frequency bands for which the NR cell reselection parameters apply. The UE behavior in case the field is absent is described in subclause 5.2.2.4.3.</td>
</tr>
<tr>
<td>highPriorityMeasRelax</td>
<td>Indicates whether measurements can be relaxed on high priority frequencies (see TS 38.304 [20], clause 5.2.4.9.0). If the field is absent, the UE shall not relax measurements on high priority frequencies beyond &quot;Thigher_priority_search&quot; (see TS 38.133 [14], clause 4.2.2.7).</td>
</tr>
<tr>
<td>intraFreqCellReselectionInfo</td>
<td>Cell re-selection information common for intra-frequency cells.</td>
</tr>
<tr>
<td>lowMobilityEvaluation</td>
<td>Indicates the criteria for a UE to detect low mobility, in order to relax measurement requirements for cell reselection (see TS 38.304 [20], clause 5.2.4.9.1).</td>
</tr>
<tr>
<td>nrofSS-BlocksToAverage</td>
<td>Number of SS blocks to average for cell measurement derivation. If the field is absent the UE uses the measurement quantity as specified in TS 38.304 [20].</td>
</tr>
<tr>
<td>p-Max</td>
<td>Value in dBm applicable for the intra-frequency neighbouring NR cells. If absent the UE applies the maximum power according to TS 38.101-1 [15] in case of an FR1 cell or TS 38.101-2 [39] in case of an FR2 cell. In this release of the specification, if p-Max is present on a carrier frequency in FR2, the UE shall ignore the field and applies the maximum power according to TS 38.101-2 [39]. This field is ignored by IAB-MT. The IAB-MT applies output power and emissions requirements, as specified in TS 38.174 [63].</td>
</tr>
<tr>
<td>q-Hyst</td>
<td>Parameter &quot;Qhyst&quot; in TS 38.304 [20]. Value in dB. Value dB1 corresponds to 1 dB, dB2 corresponds to 2 dB and so on.</td>
</tr>
<tr>
<td>q-HystSF</td>
<td>Parameter &quot;Speed dependent ScalingFactor for Qhyst&quot; in TS 38.304 [20]. The sf-Medium and sf-High concern the additional hysteresis to be applied, in Medium and High Mobility state respectively, to Qhyst as defined in TS 38.304 [20]. In dB. Value dB-6 corresponds to -6dB, dB-4 corresponds to -4dB and so on.</td>
</tr>
<tr>
<td>q-QualMin</td>
<td>Parameter &quot;Qqualmin,&quot; in TS 38.304 [20], applicable for intra-frequency neighbour cells. If the field is absent, the UE applies the (default) value of negative infinity for Qqualmin.</td>
</tr>
<tr>
<td>q-RxLevMin</td>
<td>Parameter &quot;Qrxlevmin&quot; in TS 38.304 [20], applicable for intra-frequency neighbour cells.</td>
</tr>
<tr>
<td>q-RxLevMinSUL</td>
<td>Parameter &quot;Qrxlevmin&quot; in TS 38.304 [20], applicable for intra-frequency neighbour cells.</td>
</tr>
<tr>
<td>rangeToBestCell</td>
<td>Parameter &quot;rangeToBestCell&quot; in TS 38.304 [20]. The network configures only non-negative (in dB) values.</td>
</tr>
<tr>
<td>relaxedMeasurement</td>
<td>Configuration to allow relaxation of RRM measurement requirements for cell reselection (see TS 38.304 [20], clause 5.2.4.9).</td>
</tr>
</tbody>
</table>

**Notes:**
- The values for Qhyst and Qqualmin are specified in dB units, where dB1 corresponds to 1 dB, dB2 corresponds to 2 dB, and so on.
- The parameter "Qrxlevmin" is applicable for intra-frequency neighbour cells and is specified in dB units, with dB-6 corresponding to -6 dB, dB-4 corresponding to -4 dB, and so on.
- The parameter "rangeToBestCell" is only used when configuring non-negative (in dB) values.
- The "relaxedMeasurement" configuration allows for relaxation of RRM measurement requirements for cell reselection.

---

ETSI
### sIB2 field descriptions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>s-IntraSearchP</strong></td>
<td>Parameter “S_intraSearchP” in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of 0 dB for S_intraSearchQ.</td>
</tr>
<tr>
<td><strong>s-IntraSearchQ</strong></td>
<td>Parameter “S_intraSearchQ” in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of 0 dB for S_intraSearchP.</td>
</tr>
<tr>
<td><strong>s-NonIntraSearchP</strong></td>
<td>Parameter “S_nonIntraSearchP” in TS 38.304 [20]. If this field is absent, the UE applies the (default) value of infinity for S_nonIntraSearchP.</td>
</tr>
<tr>
<td><strong>s-NonIntraSearchQ</strong></td>
<td>Parameter “S_nonIntraSearchQ” in TS 38.304 [20]. If this field is absent, the UE applies the (default) value of 0 dB for S_nonIntraSearchQ.</td>
</tr>
<tr>
<td><strong>s-SearchDeltaP</strong></td>
<td>Parameter “S_searchDeltaP” in TS 38.304 [20]. Value dB3 corresponds to 3 dB, dB6 corresponds to 6 dB and so on.</td>
</tr>
<tr>
<td><strong>s-SearchThresholdP</strong></td>
<td>Parameter “S_searchThresholdP” in TS 38.304 [20]. The network configures S_searchThresholdP to be less than or equal to S_intraSearchP and S_nonIntraSearchP.</td>
</tr>
<tr>
<td><strong>s-SearchThresholdQ</strong></td>
<td>Parameter “S_searchThresholdQ” in TS 38.304 [20]. The network configures S_searchThresholdQ to be less than or equal to S_intraSearchQ and S_nonIntraSearchQ.</td>
</tr>
<tr>
<td><strong>smtc</strong></td>
<td>Measurement timing configuration for intra-frequency measurement. If this field is absent, the UE assumes that SSB periodicity is 5 ms for the intra-frequency cells.</td>
</tr>
<tr>
<td><strong>smtc2-LP</strong></td>
<td>Measurement timing configuration for intra-frequency neighbour cells with a Long Periodicity (LP) indicated by periodicity in smtc2-LP. The timing offset and duration are equal to the offset and duration indicated in smtc in intraFreqCellReselectionInfo. The periodicity in smtc2-LP can only be set to a value strictly larger than the periodicity in smtc in intraFreqCellReselectionInfo (e.g. if smtc indicates sf20 the Long Periodicity can only be set to sf40, sf80 or sf160, if smtc indicates sf160, smtc2-LP cannot be configured). The pci-List, if present, includes the physical cell identities of the intra-frequency neighbour cells with Long Periodicity. If smtc2-LP is absent, the UE assumes that there are no intra-frequency neighbour cells with a Long Periodicity.</td>
</tr>
<tr>
<td><strong>ssb-PositionQCL-Common</strong></td>
<td>Indicates the QCL relation between SS/PBCH blocks for intra-frequency neighbor cells as specified in TS 38.213 [13], clause 4.1.</td>
</tr>
<tr>
<td><strong>ssb-ToMeasure</strong></td>
<td>The set of SS blocks to be measured within the SMTC measurement duration (see TS 38.215 [9]). When the field is absent the UE measures on all SS-blocks.</td>
</tr>
<tr>
<td><strong>t-ReselectionNR</strong></td>
<td>Parameter “T_reselectionNR” in TS 38.304 [20].</td>
</tr>
<tr>
<td><strong>t-ReselectionNR-SF</strong></td>
<td>Parameter “Speed dependent ScalingFactor for T_reselectionNR” in TS 38.304 [20]. If the field is absent, the UE behaviour is specified in TS 38.304 [20].</td>
</tr>
<tr>
<td><strong>threshServingLowP</strong></td>
<td>Parameter “ThresholdServing, LowP” in TS 38.304 [20].</td>
</tr>
<tr>
<td><strong>threshServingLowQ</strong></td>
<td>Parameter “ThresholdServing, LowQ” in TS 38.304 [20].</td>
</tr>
<tr>
<td><strong>t-SearchDeltaP</strong></td>
<td>Parameter “T_searchDeltaP” in TS 38.304 [20]. Value in seconds. Value s5 means 5 seconds, value s10 means 10 seconds and so on.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SharedSpectrum</strong></td>
<td>This field is mandatory present if this intra-frequency operates with shared spectrum channel access. Otherwise, it is absent, Need R.</td>
</tr>
</tbody>
</table>
SIB3 contains neighbouring cell related information relevant only for intra-frequency cell re-selection. The IE includes cells with specific re-selection parameters as well as blacklisted cells.

**SIB3 information element**

```asn1
SIB3 ::= SEQUENCE {
  intraFreqNeighCellList          IntraFreqNeighCellList OPTIONAL, -- Need R
  intraFreqBlackCellList          IntraFreqBlackCellList OPTIONAL, -- Need R
  lateNonCriticalExtension       OCTET STRING OPTIONAL,
  ...,[
    intraFreqNeighCellList-v1610   IntraFreqNeighCellList-v1610 OPTIONAL, -- Need R
    intraFreqWhiteCellList-r16     IntraFreqWhiteCellList-r16 OPTIONAL, -- Cond SharedSpectrum2
    intraFreqCAG-CellList-r16      SEQUENCE (SIZE (1..maxPLMN)) OF IntraFreqCAG-CellListPerPLMN-r16 OPTIONAL -- Need R
  ]}
}
IntraFreqNeighCellList ::= SEQUENCE (SIZE (1..maxCellIntra)) OF IntraFreqNeighCellInfo
IntraFreqNeighCellList-v1610 ::= SEQUENCE (SIZE (1..maxCellIntra)) OF IntraFreqNeighCellInfo-v1610
IntraFreqNeighCellInfo ::= SEQUENCE {
  physCellId                        PhysCellId,
  q-OffsetCell                      Q-OffsetRange,
  q-RxLevMinOffsetCell             INTEGER (1..8) OPTIONAL, -- Need R
  q-RxLevMinOffsetCellSUL          INTEGER (1..8) OPTIONAL, -- Need R
  q-QualMinOffsetCell              INTEGER (1..8) OPTIONAL, -- Need R
  ...
}
IntraFreqNeighCellInfo-v1610 ::= SEQUENCE {
  ssb-PositionQCL-r16              SSB-PositionQCL-Relation-r16 OPTIONAL -- Cond SharedSpectrum2
}
IntraFreqBlackCellList ::= SEQUENCE (SIZE (1..maxCellBlack)) OF PCI-Range
IntraFreqWhiteCellList-r16 ::= SEQUENCE (SIZE (1..maxCellWhite)) OF PCI-Range
IntraFreqCAG-CellListPerPLMN-r16 ::= SEQUENCE {
  plmn-IdentityIndex-r16           INTEGER (1..maxPLMN),
  cag-CellList-r16                 SEQUENCE (SIZE (1..maxCAG-Cell-r16)) OF PCI-Range
}
```

---

-- ASN1START
-- TAG-SIB3-START

---

-- TAG-SIB3-STOP
-- ASN1STOP
### SIB3 field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>intraFreqBlackCellList</td>
<td>List of blacklisted intra-frequency neighbouring cells.</td>
</tr>
<tr>
<td>intraFreqCAG-CellList</td>
<td>List of intra-frequency neighbouring CAG cells (as defined in TS 38.304 [20]) per PLMN.</td>
</tr>
<tr>
<td>intraFreqNeighCellList</td>
<td>List of intra-frequency neighbouring cells with specific cell re-selection parameters. If intraFreqNeighCellList-v1610 is present, it shall contain the same number of entries, listed in the same order as in intraFreqNeighCellList (without suffix).</td>
</tr>
<tr>
<td>intraFreqWhiteCellList</td>
<td>List of whitelisted intra-frequency neighbouring cells, see TS 38.304 [20], clause 5.2.4.</td>
</tr>
</tbody>
</table>

**q-OffsetCell**
Parameter “Qoffsets,n” in TS 38.304 [20].

**q-QualMinOffsetCell**
Parameter “Qqualminoffsetcell” in TS 38.304 [20]. Actual value $Q_{\text{qualminoffsetcell}} = \text{field value} \ [\text{dB}]$.

**q-RxLevMinOffsetCell**
Parameter “Qrxlevminoffsetcell” in TS 38.304 [20]. Actual value $Q_{\text{rxlevminoffsetcell}} = \text{field value} \times 2 \ [\text{dB}]$.

**q-RxLevMinOffsetCellSUL**
Parameter “QrxlevminoffsetcellSUL” in TS 38.304 [20]. Actual value $Q_{\text{rxlevminoffsetcellSUL}} = \text{field value} \times 2 \ [\text{dB}]$.

**ssb-PositionQCL**
Indicates the QCL relation between SS/PBCH blocks for a specific intra-frequency neighbor cell as specified in TS 38.213 [13], clause 4.1. If provided, the cell specific value overwrites the value signalled by ssb-PositionQCL-Common in SIB2 for the indicated cell.

### Conditional Presence

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SharedSpectrum2</td>
<td>The field is optional present, Need R, if this intra-frequency or neighbor cell operates with shared spectrum channel access. Otherwise, it is absent, Need R.</td>
</tr>
</tbody>
</table>

---

### SIB4

SIB4 contains information relevant for inter-frequency cell re-selection (i.e. information about other NR frequencies and inter-frequency neighbouring cells relevant for cell re-selection), which can also be used for NR idle/inactive measurements. The IE includes cell re-selection parameters common for a frequency as well as cell specific re-selection parameters.

### SIB4 information element

```
-- Tag-SIB4-START

SIB4 ::= SEQUENCE {
  intraFreqCarrierFreqList      InterFreqCarrierFreqList,
  lateNonCriticalExtension      OCTET STRING                        OPTIONAL,
  ...\[  \]
  [\{  \]
  intraFreqCarrierFreqList-v1610 InterFreqCarrierFreqList-v1610 \ OPTIONAL -- Need R
}
```
InterFreqCarrierFreqList ::= SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo

InterFreqCarrierFreqList-v1610 ::= SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo-v1610

InterFreqCarrierFreqInfo ::= SEQUENCE {
    dl-CarrierFreq                      ARFCN-ValueNR,
    frequencyBandList                   MultiFrequencyBandListNR-SIB                                OPTIONAL,   -- Cond Mandatory
    frequencyBandListSUL                MultiFrequencyBandListNR-SIB                                OPTIONAL,   -- Need R
    nrofSS-BlocksToAverage              INTEGER (2..maxNrofSS-BlocksToAverage) OPTIONAL,   -- Need S
    absThreshSS-BlocksConsolidation     ThresholdNR                                                 OPTIONAL,   -- Need S
    smtc                                SSB-MTC                                                     OPTIONAL,   -- Need S
    ssbSubcarrierSpacing                SubcarrierSpacing,
    ssb-ToMeasure                       SSB-ToMeasure                                               OPTIONAL,   -- Need S
    deriveSSB-IndexFromCell             BOOLEAN,     ss-RSSI-Measurement                 SS-RSSI-Measurement                                         OPTIONAL,   -- Need S
    as-RSSI-Measurement                 SS-RSSI-Measurement                                          OPTIONAL,   -- Need S
    q-RxLevMin                          Q-RxLevMin,     q-RxLevMinSUL                       Q-RxLevMin                                                  OPTIONAL,   -- Need R
    q-QualMin                           Q-QualMin                                                   OPTIONAL,   -- Need S
    p-Max                               P-Max                                                       OPTIONAL,   -- Need S
    t-ReselectionNR                     T-Reselection,     t-ReselectionNR-SF                  SpeedStateScaleFactors                                      OPTIONAL,   -- Need S
    threshX-HighP                       ReselectionThreshold,     threshX-LowP                        ReselectionThreshold,     threshX-Q                           SEQUENCE {
        threshX-HighQ                       ReselectionThresholdQ,
        threshX-LowQ                         ReselectionThresholdQ,
    }                                                                                               OPTIONAL,   -- Cond RSRQ
    cellReselectionPriority             CellReselectionPriority                                     OPTIONAL,   -- Need R
    cellReselectionSubPriority          CellReselectionSubPriority                                  OPTIONAL,   -- Need R
    q-OffsetFreq                        Q-OffsetRange                                               DEFAULT dB0,     interFreqNeighCellList              InterFreqNeighCellList                                      OPTIONAL,   -- Need R
    interFreqBlackCellList              InterFreqBlackCellList                                      OPTIONAL,   -- Need R
    ... }                                                                                               

InterFreqCarrierFreqInfo-v1610 ::= SEQUENCE {
    InterFreqCarrierFreqInfo-v1610     InterFreqCarrierFreqInfo-v1610 OPTIONAL,   -- Need R
    smtc2-LP-r16                        SSB-MTC2-LP-r16                                             OPTIONAL,   -- Need R
    interFreqWhiteCellList-r16         InterFreqWhiteCellList-r16 OPTIONAL,   -- Cond SharedSpectrum2
    ssb-PositionQCL-Common-r16          SSB-PositionQCL-Relation-r16                                OPTIONAL,   -- Cond SharedSpectrum
    interFreqCAG-CellList-r16          SEQUENCE (SIZE (1..maxPLMN)) OF InterFreqCAG-CellListPerPLMN-r16   OPTIONAL     -- Need R
}
...}
InterFreqNeighCellInfo-v1610 ::= SEQUENCE {
    ssb-PositionQCL-r16                     SSB-PositionQCL-Relation-r16 OPTIONAL -- Cond SharedSpectrum2}

InterFreqBlackCellList ::= SEQUENCE (SIZE (1..maxCellBlack)) OF PCI-Range
InterFreqWhiteCellList-r16 ::= SEQUENCE (SIZE (1..maxCellWhite)) OF PCI-Range

InterFreqCAG-CellListPerPLMN-r16 ::= SEQUENCE {
    plmn-IdentityIndex-r16              INTEGER (1..maxPLMN),
    cag-CellList-r16                    SEQUENCE (SIZE (1..maxCAG-Cell-r16)) OF PCI-Range
}

-- TAG-SIB4-STOP
-- ASN1STOP
**SIB4 field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>absThreshSS-BlocksConsolidation</td>
<td>Threshold for consolidation of L1 measurements per RS index. If the field is absent, the UE uses the measurement quantity as specified in TS 38.304 [20].</td>
</tr>
<tr>
<td>deriveSSB-IndexFromCell</td>
<td>This field indicates whether the UE may use the timing of any detected cell on that frequency to derive the SSB index of all neighbour cells on that frequency. If this field is set to true, the UE assumes SFN and frame boundary alignment across cells on the neighbor frequency as specified in TS 38.133 [14].</td>
</tr>
<tr>
<td>df-CarrierFreq</td>
<td>This field indicates center frequency of the SS block of the neighbour cells, where the frequency corresponds to a GSCN value as specified in TS 38.101-1 [15].</td>
</tr>
<tr>
<td>frequencyBandList</td>
<td>Indicates the list of frequency bands for which the NR cell reselection parameters apply.</td>
</tr>
<tr>
<td>interFreqBlackCellList</td>
<td>List of blacklisted inter-frequency neighbouring cells.</td>
</tr>
<tr>
<td>interFreqCAG-CellList</td>
<td>List of inter-frequency neighbouring CAG cells (as defined in TS 38.304 [20] per PLMN.</td>
</tr>
<tr>
<td>interFreqCarrierFreqList</td>
<td>List of neighbouring carrier frequencies and frequency specific cell re-selection information. If interFreqCarrierFreqList-v1610 is present, it shall contain the same number of entries, listed in the same order as in interFreqCarrierFreqList (without suffix).</td>
</tr>
<tr>
<td>interFreqNeighCellList</td>
<td>List of inter-frequency neighbouring cells with specific cell re-selection parameters. If interFreqNeighCellList-v1610 is present, it shall contain the same number of entries, listed in the same order as in interFreqNeighCellList (without suffix).</td>
</tr>
<tr>
<td>interFreqWhiteCellList</td>
<td>List of whitelisted inter-frequency neighbouring cells, see TS 38.304 [20], clause 5.2.4.</td>
</tr>
<tr>
<td>nrofSS-BlocksToAverage</td>
<td>Number of SS blocks to average for cell measurement derivation. If the field is absent, the UE uses the measurement quantity as specified in TS 38.304 [20].</td>
</tr>
<tr>
<td>p-Max</td>
<td>Value in dBm applicable for the neighbouring NR cells on this carrier frequency. If absent the UE applies the maximum power according to TS 38.101-1 [15] in case of an FR1 cell or TS 38.101-2 [39] in case of an FR2 cell. In this release of the specification, if p-Max is present on a carrier frequency in FR2, the UE shall ignore the field and applies the maximum power according to TS 38.101-2 [39]. This field is ignored by IAB-MT. The IAB-MT applies output power and emissions requirements, as specified in TS 38.174 [63].</td>
</tr>
<tr>
<td>q-OffsetCell</td>
<td>Parameter “Qoffsetc,n” in TS 38.304 [20].</td>
</tr>
<tr>
<td>q-OffsetFreq</td>
<td>Parameter “Qoffsetfrequency” in TS 38.304 [20].</td>
</tr>
<tr>
<td>q-QualMin</td>
<td>Parameter “Qqualmin” in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of negative infinity for Qqualmin.</td>
</tr>
<tr>
<td>q-QualMinOffsetCell</td>
<td>Parameter “Qqualminoffsetcell” in TS 38.304 [20]. Actual value Qqualminoffsetcell = field value [dB].</td>
</tr>
<tr>
<td>q-RxLevMin</td>
<td>Parameter “Qrxlevmin” in TS 38.304 [20].</td>
</tr>
<tr>
<td>q-RxLevMinOffsetCell</td>
<td>Parameter “Qrxlevminoffsetcell” in TS 38.304 [20]. Actual value Qrxlevminoffsetcell = field value * 2 [dB].</td>
</tr>
<tr>
<td>q-RxLevMinOffsetCellSUL</td>
<td>Parameter “QrxlevminoffsetcellSUL” in TS 38.304 [20]. Actual value QrxlevminoffsetcellSUL = field value * 2 [dB].</td>
</tr>
<tr>
<td>smtc</td>
<td>Measurement timing configuration for inter-frequency measurement. If this field is absent, the UE assumes that SSB periodicity is 5 ms in this frequency.</td>
</tr>
</tbody>
</table>
### SIB4 field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>smtc2-LP</td>
<td>Measurement timing configuration for inter-frequency neighbour cells with a Long Periodicity (LP) indicated by periodicity in smtc2-LP. The timing offset and duration are equal to the offset and duration indicated in smtc in InterFreqCarrierFreqInfo. The periodicity in smtc2-LP can only be set to a value strictly larger than the periodicity in smtc in InterFreqCarrierFreqInfo (e.g. if smtc indicates sf20 the Long Periodicity can only be set to sf40, sf80 or sf160, if smtc indicates sf160, smtc2-LP cannot be configured). The pci-List, if present, includes the physical cell identities of the inter-frequency neighbour cells with Long Periodicity. If smtc2-LP is absent, the UE assumes that there are no inter-frequency neighbour cells with a Long Periodicity.</td>
</tr>
<tr>
<td>ssm-PositionQCL</td>
<td>Indicates the QCL relation between SS/PBCH blocks for a specific neighbor cell as specified in TS 38.213 [13], clause 4.1. If provided, the cell specific value overwrites the common value signalled by ssm-PositionQCL-Common in SIB4 for the indicated cell.</td>
</tr>
<tr>
<td>ssm-PositionQCL-Common</td>
<td>Indicates the QCL relation between SS/PBCH blocks for inter-frequency neighbor cells as specified in TS 38.213 [13], clause 4.1.</td>
</tr>
<tr>
<td>ssm-ToMeasure</td>
<td>The set of SS blocks to be measured within the SMC measurement duration (see TS 38.215 [9]). When the field is absent the UE measures on all SS-blocks.</td>
</tr>
<tr>
<td>ssmSubcarrierSpacing</td>
<td>Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.</td>
</tr>
<tr>
<td>threshX-HighP</td>
<td>Parameter &quot;ThreshX, HighP&quot; in TS 38.304 [20].</td>
</tr>
<tr>
<td>threshX-HighQ</td>
<td>Parameter &quot;ThreshX, HighQ&quot; in TS 38.304 [20].</td>
</tr>
<tr>
<td>threshX-LowP</td>
<td>Parameter &quot;ThreshX, LowP&quot; in TS 38.304 [20].</td>
</tr>
<tr>
<td>threshX-LowQ</td>
<td>Parameter &quot;ThreshX, LowQ&quot; in TS 38.304 [20].</td>
</tr>
<tr>
<td>t-ReselectionNR</td>
<td>Parameter &quot;TreselectionNR&quot; in TS 38.304 [20].</td>
</tr>
<tr>
<td>t-ReselectionNR-SF</td>
<td>Parameter &quot;Speed dependent ScalingFactor for TreselectionNR&quot; in TS 38.304 [20]. If the field is absent, the UE behaviour is specified in TS 38.304 [20].</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory</td>
<td>The field is mandatory present in SIB4.</td>
</tr>
<tr>
<td>RSRQ</td>
<td>The field is mandatory present if threshServingLowQ is present in SIB2; otherwise it is absent.</td>
</tr>
<tr>
<td>SharedSpectrum</td>
<td>This field is mandatory present if this inter-frequency operates with shared spectrum channel access. Otherwise, it is absent, Need R.</td>
</tr>
<tr>
<td>SharedSpectrum2</td>
<td>The field is optional present, Need R, if this inter-frequency or neighbor cell operates with shared spectrum channel access. Otherwise, it is absent, Need R.</td>
</tr>
</tbody>
</table>

---

### SIB5

SIB5 contains information relevant only for inter-RAT cell re-selection i.e. information about E-UTRA frequencies and E-UTRAs neighbouring cells relevant for cell re-selection. The IE includes cell re-selection parameters common for a frequency.
**SIB5 information element**

```asn1
-- ASN1START
-- TAG-SIB5-START

SIB5 ::= SEQUENCE {
  carrierFreqListEUTRA                CarrierFreqListEUTRA OPTIONAL, -- Need R
t-ReselectionEUTRA                  T-Reselection, t-ReselectionEUTRA-SF SpeedStateScaleFactors OPTIONAL, -- Need S
  lateNonCriticalExtension            OCTET STRING OPTIONAL, ...
  [[
    carrierFreqListEUTRA-v1610      CarrierFreqListEUTRA-v1610 OPTIONAL -- Need R
  ]]
}

CarrierFreqListEUTRA ::= SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA
CarrierFreqListEUTRA-v1610 ::= SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA-v1610

CarrierFreqEUTRA ::= SEQUENCE {
  carrierFreq                         ARFCN-ValueEUTRA,
eutra-multiBandInfoList             EUTRA-MultiBandInfoList OPTIONAL, -- Need R
eutra-FreqNeighCellList             EUTRA-FreqNeighCellList OPTIONAL, -- Need R
eutra-BlackCellList                 EUTRA-BlackCellList OPTIONAL, -- Need R
  allowedMeasBandwidth               EUTRA-AllowedMeasBandwidth,
presenceAntennaPort1                CellReselectionPriority OPTIONAL, -- Need R
cellReselectionSubPriority          CellReselectionSubPriority OPTIONAL, -- Need R
  threshX-High                        ReselectionThreshold,
  threshX-Low                         ReselectionThreshold,
  q-RxLevMin                          INTEGER (-70..-22),
  q-QualMin                           INTEGER (-34..-3),
p-MaxEUTRA                          INTEGER (-30..33),
threshX-Q                            SEQUENCE {
    threshX-HighQ                       ReselectionThresholdQ,
    threshX-LowQ                        ReselectionThresholdQ
  } OPTIONAL -- Cond RSRQ
}

CarrierFreqEUTRA-v1610 ::= SEQUENCE {
  highSpeedEUTRACarrier-r16          ENUMERATED {true} OPTIONAL -- Need R
}

EUTRA-FreqBlackCellList ::= SEQUENCE (SIZE (1..maxEUTRA-CellBlack)) OF EUTRA-PhysCellIdRange
EUTRA-FreqNeighCellList ::= SEQUENCE (SIZE (1..maxCellEUTRA)) OF EUTRA-FreqNeighCellInfo
EUTRA-FreqNeighCellInfo ::= SEQUENCE {
  physCellId                         EUTRA-PhysCellId,
dummy                               EUTRA-Q-OffsetRange,
  q-RxLevMinOffsetCell                INTEGER (1..8) OPTIONAL -- Need R
  q-QualMinOffsetCell                 INTEGER (1..8) OPTIONAL -- Need R
}
```

---

**3GPP TS 38.331 version 16.3.1 Release 16**

---

**ETSI TS 138 331 V16.3.1 (2021-01)**
### SIB5 field descriptions

**carrierFreqListEUTRA**
List of carrier frequencies of E-UTRA. If the `carrierFreqListEUTRA-v1610` is present, it shall contain the same number of entries, listed in the same order as in the `carrierFreqListEUTRA` (without suffix).

**dummy**
This field is not used in the specification. If received it shall be ignored by the UE.

**eutra-BlackCellList**
List of blacklisted E-UTRA neighbouring cells.

**eutra-multiBandInfoList**
Indicates the list of frequency bands in addition to the band represented by `carrierFreq` for which cell reselection parameters are common, and a list of `additionalPmax` and `additionalSpectrumEmission` values, as defined in TS 36.101 [22], table 6.2.4-1, for the frequency bands in `eutra-multiBandInfoList`.

**highSpeedEUTRACarrier**
If the field is present, the UE shall apply the enhanced NR-EUTRA inter-RAT measurement requirements to support high speed up to 500 km/h as specified in TS 38.133 [14] to the E-UTRA carrier.

**p-MaxEUTRA**
The maximum allowed transmission power in dBm on the (uplink) carrier frequency, see TS 36.304 [27].

**q-QualMin**
Parameter "Q_{qualmin}" in TS 36.304 [27]. Actual value $Q_{qualmin} = \text{field value} \, [\text{dB}]$.

**q-QualMinOffsetCell**
Parameter "Q_{qualminoffsetcell}" in TS 36.304 [27]. Actual value $Q_{qualminoffsetcell} = \text{field value} \, [\text{dB}]$.

**q-RxLevMin**
Parameter "Q_{rxlevmin}" in TS 36.304 [27]. Actual value $Q_{rxlevmin} = \text{field value} \, [\text{dB}]$.

**q-RxLevMinOffsetCell**
Parameter "Q_{rxlevminoffsetcell}" in TS 36.304 [27]. Actual value $Q_{rxlevminoffsetcell} = \text{field value} \, [\text{dB}]$.

**t-ReselectionEUTRA**
Parameter "TreselectionEUTRA" in TS 38.304 [20].

**threshX-High**
Parameter "Thresh_{X, HighP}" in TS 38.304 [20].

**threshX-HighQ**
Parameter "Thresh_{X, HighQ}" in TS 38.304 [20].

**threshX-Low**
Parameter "Thresh_{X, LowP}" in TS 38.304 [20].

**threshX-LowQ**
Parameter "Thresh_{X, LowQ}" in TS 38.304 [20].

**t-ReselectionEUTRA-SF**
Parameter "Speed dependent ScalingFactor for TreselectionEUTRA" in TS 38.304 [20]. If the field is absent, the UE behaviour is specified in TS 38.304 [20].

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSRQ</td>
<td>The field is mandatory present if the <code>threshServingLowQ</code> is present in <code>SIB2</code>; otherwise it is absent.</td>
</tr>
</tbody>
</table>
SIB6 contains an ETWS primary notification.

**SIB6 information element**

```asn1
SIB6 ::= SEQUENCE {
  messageIdentifier BIT STRING (SIZE (16)),
  serialNumber BIT STRING (SIZE (16)),
  warningType OCTET STRING (SIZE (2)),
  lateNonCriticalExtension OCTET STRING OPTIONAL,
  ...
}
```

**SIB6 field descriptions**

- **messageIdentifier**
  Identifies the source and type of ETWS notification.

- **serialNumber**
  Identifies variations of an ETWS notification.

- **warningType**
  Identifies the warning type of the ETWS primary notification and provides information on emergency user alert and UE popup.

SIB7 contains an ETWS secondary notification.

**SIB7 information element**

```asn1
SIB7 ::= SEQUENCE {
  messageIdentifier BIT STRING (SIZE (16)),
  serialNumber BIT STRING (SIZE (16)),
  warningMessageSegmentType ENUMERATED {notLastSegment, lastSegment},
  warningMessageSegmentNumber INTEGER (0..63),
  warningMessageSegment OCTET STRING,
  dataCodingScheme OCTET STRING (SIZE (1)) OPTIONAL, -- Cond Segment1
  lateNonCriticalExtension OCTET STRING OPTIONAL,
  ...
}
```
\begin{verbatim}
3GPP TS 38.331 version 16.3.1 Release 16

SIB7 field descriptions

\textbf{dataCodingScheme}
Identifies the alphabet/coding and the language applied variations of an ETWS notification.

\textbf{messageIdentifier}
Identifies the source and type of ETWS notification.

\textbf{serialNumber}
Identifies variations of an ETWS notification.

\textbf{warningMessageSegment}
Carries a segment of the Warning Message Contents IE.

\textbf{warningMessageSegmentNumber}
Segment number of the ETWS warning message segment contained in the SIB. A segment number of zero corresponds to the first segment, A segment number of one corresponds to the second segment, and so on.

\textbf{warningMessageSegmentType}
Indicates whether the included ETWS warning message segment is the last segment or not.

\begin{table}[h]
\centering
\begin{tabular}{|l|l|}
\hline
Conditional Presence & Explanation \\
\hline
Segment1 & The field is mandatory present in the first segment of SIB7, otherwise it is absent. \\
\hline
\end{tabular}
\end{table}

SIB8 contains a CMAS notification.

\begin{verbatim}
SIB8 ::=                        SEQUENCE {
  messageIdentifier               BIT STRING (SIZE (16)),
  serialNumber                    BIT STRING (SIZE (16)),
  warningMessageSegmentType       ENUMERATED {notLastSegment, lastSegment},
  warningMessageSegmentNumber     INTEGER (0..63),
  warningMessageSegment           OCTET STRING,               
  dataCodingScheme                OCTET STRING (SIZE (1))                         OPTIONAL,   -- Cond Segment1
  warningAreaCoordinatesSegment   OCTET STRING                                    OPTIONAL,   -- Need R
  lateNonCriticalExtension        OCTET STRING                                    OPTIONAL,
  ...                              
}
\end{verbatim}

\end{verbatim}
### SIB8 field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>dataCodingScheme</code></td>
<td>Identifies the alphabet/coding and the language applied variations of a CMAS notification.</td>
</tr>
<tr>
<td><code>messageIdentifier</code></td>
<td>Identifies the source and type of CMAS notification.</td>
</tr>
<tr>
<td><code>serialNumber</code></td>
<td>Identifies variations of a CMAS notification.</td>
</tr>
<tr>
<td><code>warningAreaCoordinatesSegment</code></td>
<td>If present, carries a segment, with one or more octets, of the geographical area where the CMAS warning message is valid as defined in [28]. The first octet of the first <code>warningAreaCoordinatesSegment</code> is equivalent to the first octet of Warning Area Coordinates IE defined in and encoded according to TS 23.041 [29] and so on.</td>
</tr>
<tr>
<td><code>warningMessageSegment</code></td>
<td>Carries a segment, with one or more octets, of the Warning Message Contents IE defined in TS 38.413 [42]. The first octet of the Warning Message Contents IE is equivalent to the first octet of the CB data IE defined in and encoded according to TS 23.041 [29], clause 9.4.2.2.5, and so on.</td>
</tr>
<tr>
<td><code>warningMessageSegmentNumber</code></td>
<td>Segment number of the CMAS warning message segment contained in the SIB. A segment number of zero corresponds to the first segment, one corresponds to the second segment, and so on. If warning area coordinates are provided for the warning message, then this field applies to both warning message segment and warning area coordinates segment.</td>
</tr>
<tr>
<td><code>warningMessageSegmentType</code></td>
<td>Indicates whether the included CMAS warning message segment is the last segment or not. If warning area coordinates are provided for the warning message, then this field applies to both warning message segment and warning area coordinates segment.</td>
</tr>
</tbody>
</table>

#### Conditional Presence

<table>
<thead>
<tr>
<th>Segment1</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The field is mandatory present in the first segment of SIB8, otherwise it is absent.</td>
</tr>
</tbody>
</table>

---

### SIB9

SIB9 contains information related to GPS time and Coordinated Universal Time (UTC). The UE may use the parameters provided in this system information block to obtain the UTC, the GPS and the local time.

**NOTE:** The UE may use the time information for numerous purposes, possibly involving upper layers e.g. to assist GPS initialisation, to synchronise the UE clock.

#### SIB9 information element

```asn1
SIB9 ::= SEQUENCE {
  timeInfo
      SEQUENCE {
        timeInfoUTC            INTEGER (0..549755813887),
        daylightSavingTime     BIT STRING (SIZE (2)) OPTIONAL, -- Need R
        leapSeconds            INTEGER (-127..128) OPTIONAL, -- Need R
        localTimeOffset        INTEGER (-63..64) OPTIONAL, -- Need R
      }
}
```
\[
\begin{align*}
\text{dayLightSavingTime} & \quad \text{Indicates if and how daylight-saving time (DST) is applied to obtain the local time. The semantics are the same as the semantics of the Daylight Saving Time IE in TS 24.501 [23] and TS 24.008 [38]. The first/leftmost bit of the bit string contains the b2 of octet 3 and the second bit of the bit string contains b1 of octet 3 in the value part of the Daylight Saving Time IE in TS 24.008 [38].} \\
\text{leapSeconds} & \quad \text{Number of leap seconds offset between GPS Time and UTC. UTC and GPS time are related i.e. GPS time -leapSeconds = UTC time.} \\
\text{localTimeOffset} & \quad \text{Offset between UTC and local time in units of 15 minutes. Actual value = field value \times 15 minutes. Local time of the day is calculated as UTC time + localTimeOffset.} \\
\text{timeInfoUTC} & \quad \text{Coordinated Universal Time corresponding to the SFN boundary at or immediately after the ending boundary of the SI-window in which SIB9 is transmitted. The field counts the number of UTC seconds in 10 ms units since 00:00:00 on Gregorian calendar date 1 January, 1900 (midnight between Sunday, December 31, 1899 and Monday, January 1, 1900). See NOTE 1. This field is excluded when determining changes in system information, i.e. changes of timeInfoUTC should neither result in system information change notifications nor in a modification of valueTag in SIB1.} \\
\end{align*}
\]

NOTE 1: The UE may use this field together with the \textit{leapSeconds} field to obtain GPS time as follows: GPS Time (in seconds) = timeInfoUTC (in seconds) - 2,524,953,600 (seconds) + leapSeconds, where 2,524,953,600 is the number of seconds between 00:00:00 on Gregorian calendar date 1 January, 1900 and 00:00:00 on Gregorian calendar date 6 January, 1980 (start of GPS time).

---

**SIB10**

SIB10 contains the HRNNs of the NPNs listed in SIB1.

**SIB10 information element**

---

\[
\begin{align*}
\text{hrnn-List-r16} & \quad \text{HRNN-List-r16} \\
\text{lateNonCriticalExtension} & \quad \text{OCTET STRING} \\
\text{lateNonCriticalExtension} & \quad \text{OPTIONAL,} \\
\text{hrnn-List-r16} & \quad \text{HRNN-List-r16} \\
\text{lateNonCriticalExtension} & \quad \text{OPTIONAL,} \\
\end{align*}
\]
SIB10 field descriptions

HRNN-List
The same amount of HRNN elements as the number of NPNs in SIB 1 are included. The n-th entry of HRNN-List contains the human readable network name of the n-th NPN of SIB1. The hrnn in the corresponding entry in HRNN-List is absent if there is no HRNN associated with the given NPN.

-- SIB11

SIB11 contains information related to idle/inactive measurements.

SIB11 information element

-- ASN1START
-- TAG-SIB11-START

SIB11-r16 ::= SEQUENCE {
  measIdleConfigSIB-r16            MeasIdleConfigSIB-r16            OPTIONAL, -- Need S
  lateNonCriticalExtension        OCTET STRING                                OPTIONAL,
  ...}

-- TAG-SIB11-STOP
-- ASN1STOP

SIB11 field descriptions

measIdleConfigSIB
Indicates measurement configuration to be stored and used by the UE while in RRC_IDLE or RRC_INACTIVE.

-- SIB12

SIB12 contains NR sidelink communication configuration.

SIB12 information element

-- ASN1START
-- TAG-SIB12-START

SIB12-r16 ::= SEQUENCE {
  segmentNumber-r16                INTEGER (0..63),
segmentType-r16 ENUMERATED {notLastSegment, lastSegment},
segmentContainer-r16 OCTET STRING
}

SIB12-IEs-r16 ::= SEQUENCE {
    sl-ConfigCommonNR-r16 SL-ConfigCommonNR-r16,
    lateNonCriticalExtension OCTET STRING OPTIONAL,
    ...
}

SL-ConfigCommonNR-r16 ::= SEQUENCE {
    sl-FreqInfoList-r16 SEQUENCE {SIZE (1..maxNrofFreqSL-r16)} OF SL-FreqConfigCommon-r16 OPTIONAL, -- Need R
    sl-UE-SelectedConfig-r16 SL-UE-SelectedConfig-r16 OPTIONAL, -- Need R
    sl-NR-AnchorCarrierFreqList-r16 SL-NR-AnchorCarrierFreqList-r16 OPTIONAL, -- Need R
    sl-EUTRA-AnchorCarrierFreqList-r16 SL-EUTRA-AnchorCarrierFreqList-r16 OPTIONAL, -- Need R
    sl-RadioBearerConfigList-r16 SEQUENCE {SIZE (1..maxNrofSLRB-r16)} OF SL-RadioBearerConfig-r16 OPTIONAL, -- Need R
    sl-RLC-BearerConfigList-r16 SEQUENCE {SIZE (1..maxSL-LCID-r16)} OF SL-RLC-BearerConfig-r16 OPTIONAL, -- Need R
    sl-MeasConfigCommon-r16 SL-MeasConfigCommon-r16 OPTIONAL, -- Need R
    sl-CSI-Acquisition-r16 ENUMERATED {enabled} OPTIONAL, -- Need R
    sl-OffsetDFN-r16 INTEGER (1..1000) OPTIONAL, -- Need R
    t400-r16 ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000} OPTIONAL, -- Need R
    sl-MaxNumConsecutiveDTX-r16 ENUMERATED {n1, n2, n3, n4, n6, n8, n16, n32} OPTIONAL, -- Need R
    sl-SSB-PriorityNR-r16 INTEGER (1..8) OPTIONAL -- Need R
}

SL-NR-AnchorCarrierFreqList-r16 ::= SEQUENCE {SIZE (1..maxFreqSL-NR-r16)} OF ARFCN-ValueNR

SL-EUTRA-AnchorCarrierFreqList-r16 ::= SEQUENCE {SIZE (1..maxFreqSL-EUTRA-r16)} OF ARFCN-ValueEUTRA

-- TAG-SIB12-STOP
-- ASN1STOP
SIB12 field descriptions

**segmentContainer**
This field includes a segment of the encoded SIB12-IEs. The size of the included segment in this container should be small enough that the SIB message size is less than or equal to the maximum size of a NR SI, i.e. 2976 bits when SIB12 is broadcast.

**segmentNumber**
This field identifies the sequence number of a segment of SIB12-IEs. A segment number of zero corresponds to the first segment, A segment number of one corresponds to the second segment, and so on.

**segmentType**
This field indicates whether the included segment is the last segment or not.

**sl-CI-Acquisition**
This field indicates whether CSI reporting is enabled in sidelink unicast. If not set, SL CSI reporting is disabled.

**sl-EUTRA-AnchorCarrierFreqList**
This field indicates the EUTRA anchor carrier frequency list, which can provide the NR sidelink communication configurations.

**sl-FreqInfoList**
This field indicates the NR sidelink communication configuration on some carrier frequency (ies). In this release, only one entry can be configured in the list.

**sl-MaxNumConsecutiveDTX**
This field indicates the maximum number of consecutive HARQ DTX before triggering sidelink RLF. Value n1 corresponds to 1, value n2 corresponds to 2, and so on.

**sl-MeasConfigCommon**
This field indicates the measurement configurations (e.g. RSRP) for NR sidelink communication.

**sl-NR-AnchorCarrierFreqList**
This field indicates the NR anchor carrier frequency list, which can provide the NR sidelink communication configurations.

**sl-OffsetDFN**
Indicates the timing offset for the UE to determine DFN timing when GNSS is used for timing reference. Value 1 corresponds to 0.001 milliseconds, value 2 corresponds to 0.002 milliseconds, and so on.

**sl-RadioBearerConfigList**
This field indicates one or multiple sidelink radio bearer configurations.

**sl-RLC-BearerConfigList**
This field indicates one or multiple sidelink RLC bearer configurations.

**sl-SSB-PriorityNR**
This field indicates the priority of NR sidelink SSB transmission and reception.

**t400**
Indicates the value for timer T400 as described in clause 7.1. Value ms100 corresponds to 100 ms, value ms200 corresponds to 200 ms and so on.

---

SIB13 contains configurations of V2X sidelink communication defined in TS 36.331 [10].

--- ASN1START
--- TAG-SIB13-START

SIB13-r16 ::= SEQUENCE {
  sl-V2X-ConfigCommon-r16 OCTET STRING,
  dummy OCTET STRING,
  tdd-Config-r16 OCTET STRING,
}
SIB13 field descriptions

**dummy**
This field is not used in the specification and the UE ignores the received value.

**sl-V2X-ConfigCommon**
This field includes the E-UTRA SystemInformationBlockType21 message as specified in TS 36.331 [10].

**tdd-Config**
This field includes the tdd-Config in E-UTRA SystemInformationBlockType1 message as specified in TS 36.331 [10].

---

**SIB14**

SIB14 contains configurations of V2X sidelink communication defined in TS 36.331 [10], which can be used jointly with that included in SIB13.

**SIB14 information element**

SIB14-r16 ::= SEQUENCE {
  sl-V2X-ConfigCommonExt-r16          OCTET STRING,
  lateNonCriticalExtension OPTIONAL,
  ...
}

**SIB14 field descriptions**

**sl-V2X-ConfigCommonExt**
This field includes the E-UTRA SystemInformationBlockType26 message as specified in TS 36.331 [10].

---

6.3.1a Positioning System information blocks

---

**PosSystemInformation-r16-IEs**
PosSystemInformation-r16-IEs ::= SEQUENCE {
  posSIB-TypeAndInfo-r16                        SEQUENCE (SIZE (1..maxSIB)) OF CHOICE {
    posSib1-1-r16                        SIBpos-r16,
    posSib1-2-r16                        SIBpos-r16,
    posSib1-3-r16                        SIBpos-r16,
    posSib1-4-r16                        SIBpos-r16,
    posSib1-5-r16                        SIBpos-r16,
    posSib1-6-r16                        SIBpos-r16,
    posSib1-7-r16                        SIBpos-r16,
    posSib1-8-r16                        SIBpos-r16,
    posSib2-1-r16                        SIBpos-r16,
    posSib2-2-r16                        SIBpos-r16,
    posSib2-3-r16                        SIBpos-r16,
    posSib2-4-r16                        SIBpos-r16,
    posSib2-5-r16                        SIBpos-r16,
    posSib2-6-r16                        SIBpos-r16,
    posSib2-7-r16                        SIBpos-r16,
    posSib2-8-r16                        SIBpos-r16,
    posSib2-9-r16                        SIBpos-r16,
    posSib2-10-r16                       SIBpos-r16,
    posSib2-11-r16                       SIBpos-r16,
    posSib2-12-r16                       SIBpos-r16,
    posSib2-13-r16                       SIBpos-r16,
    posSib2-14-r16                       SIBpos-r16,
    posSib2-15-r16                       SIBpos-r16,
    posSib2-16-r16                       SIBpos-r16,
    posSib2-17-r16                       SIBpos-r16,
    posSib2-18-r16                       SIBpos-r16,
    posSib2-19-r16                       SIBpos-r16,
    posSib2-20-r16                       SIBpos-r16,
    posSib2-21-r16                       SIBpos-r16,
    posSib2-22-r16                       SIBpos-r16,
    posSib2-23-r16                       SIBpos-r16,
    posSib3-1-r16                        SIBpos-r16,
    posSib4-1-r16                        SIBpos-r16,
    posSib5-1-r16                        SIBpos-r16,
    posSib6-1-r16                        SIBpos-r16,
    posSib6-2-r16                        SIBpos-r16,
    posSib6-3-r16                        SIBpos-r16,
  },
  lateNonCriticalExtension            OCTET STRING OPTIONAL,
  nonCriticalExtension               SEQUENCE {} OPTIONAL
}

-- TAG-POSSYSTEMINFORMATION-R16-IES-STOP
-- ASN1STOP

PosSI-SchedulingInfo

-- ASN1START

ETSI
PosSI-SchedulingInfo-r16 ::= SEQUENCE {
    posSchedulingInfoList-r16               SEQUENCE (SIZE (1..maxSI-Message)) OF PosSchedulingInfo-r16,
    posSI-RequestConfig-r16                  SI-RequestConfig OPTIONAL, -- Cond MSG-1
    posSI-RequestConfigSUL-r16              SI-RequestConfig OPTIONAL, -- Cond SUL-MSG-1
    ...
}

PosSchedulingInfo-r16 ::= SEQUENCE {
    offsetToSI-Used-r16                     ENUMERATED {true} OPTIONAL, -- Need R
    posSI-Periodicity-r16                   ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},
    posSI-BroadcastStatus-r16               ENUMERATED {broadcasting, notBroadcasting},
    posSIB-MappingInfo-r16                  PosSIB-MappingInfo-r16,
    ...
}

PosSIB-MappingInfo-r16 ::= SEQUENCE {
    encrypted-r16                           ENUMERATED { true } OPTIONAL, -- Need R
    gnss-id-r16                              GNSS-ID-r16 OPTIONAL, -- Need R
    sbas-id-r16                              SBAS-ID-r16 OPTIONAL, -- Need R
    posSibType-r16                           ENUMERATED { posSibType1-1, posSibType1-2, posSibType1-3, posSibType1-4, posSibType1-5, posSibType1-6, posSibType1-7, posSibType1-8, posSibType2-1, posSibType2-2, posSibType2-3, posSibType2-4, posSibType2-5, posSibType2-6, posSibType2-7, posSibType2-8, posSibType2-9, posSibType2-10, posSibType2-11, posSibType2-12, posSibType2-13, posSibType2-14, posSibType2-15, posSibType2-16, posSibType2-17, posSibType2-18, posSibType2-19, posSibType2-20, posSibType2-21, posSibType2-22, posSibType2-23, posSibType3-1, posSibType4-1, posSibType5-1, posSibType6-1, posSibType6-2, posSibType6-3,... },
    areaScope-r16                            ENUMERATED {true} OPTIONAL -- Need S
}

GNSS-ID-r16 ::= SEQUENCE {
    gnss-id-r16                              ENUMERATED {gps, sbas, qzss, galileo, glonass, bds, ...},
    ...
}

SBAS-ID-r16 ::= SEQUENCE {
    sbas-id-r16                              ENUMERATED { waas, egnos, msas, gagan, ...},
    ...
}
### PosSI-SchedulingInfo field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>areaScope</td>
<td>Indicates that a posSIB is area specific. If the field is absent, the posSIB is cell specific.</td>
</tr>
<tr>
<td>encrypted</td>
<td>The presence of this field indicates that the pos-sib-type is encrypted as specified in TS 37.355 [49].</td>
</tr>
<tr>
<td>gnss-Id</td>
<td>The presence of this field indicates that the positioning SIB type is for a specific GNSS. Indicates a specific GNSS (see also TS 37.355 [49]).</td>
</tr>
<tr>
<td>posSI-BroadcastStatus</td>
<td>Indicates if the SI message is being broadcasted or not. Change of posSI-BroadcastStatus should not result in system information change notifications in Short Message transmitted with P-RNTI over DCI (see clause 6.5). The value of the indication is valid until the end of the BCCH modification period when set to broadcasting.</td>
</tr>
<tr>
<td>posSI-RequestConfig</td>
<td>Configuration of Msg1 resources that the UE uses for requesting SI-messages for which posSI-BroadcastStatus is set to notBroadcasting.</td>
</tr>
<tr>
<td>posSI-RequestConfigSUL</td>
<td>Configuration of Msg1 resources that the UE uses for requesting SI-messages for which posSI-BroadcastStatus is set to notBroadcasting.</td>
</tr>
<tr>
<td>pos-SIB-MappingInfo</td>
<td>List of the posSIBs mapped to this SystemInformation message.</td>
</tr>
<tr>
<td>posSibType</td>
<td>The positioning SIB type is defined in TS 37.355 [49].</td>
</tr>
<tr>
<td>posSI-Periodicity</td>
<td>Periodicity of the SI-message in radio frames, such that rf8 denotes 8 radio frames, rf16 denotes 16 radio frames, and so on.</td>
</tr>
<tr>
<td>offsetToSI-Used</td>
<td>This field, if present indicates that the SI messages in pos-SchedulingInfoList are scheduled with an offset of 8 radio frames compared to SI messages in schedulingInfoList. OffsetToSI-Used may be present only if the shortest configured SI message periodicity for SI messages in schedulingInfoList is 80ms.</td>
</tr>
<tr>
<td>sbas-ID</td>
<td>The presence of this field indicates that the positioning SIB type is for a specific SBAS. Indicates a specific SBAS (see also TS 37.355 [49]).</td>
</tr>
</tbody>
</table>

### Conditional presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSG-1</td>
<td>The field is optionally present, Need R, if posSI-BroadcastStatus is set to notBroadcasting for any SI-message included in PosSchedulingInfo. It is absent otherwise.</td>
</tr>
<tr>
<td>SUL-MSG-1</td>
<td>The field is optionally present, Need R, if supplementaryUplink is configured in ServingCellConfigCommonSIB and if posSI-BroadcastStatus is set to notBroadcasting for any SI-message included in PosSchedulingInfo. It is absent otherwise.</td>
</tr>
</tbody>
</table>

---

**SIBpos**

The IE `SIBpos` contains positioning assistance data as defined in TS 37.355 [49].

**SIBpos information element**

```asciidoc
-- ASN1START
-- TAG-SIPOS-START
SIBpos-r16 ::= SEQUENCE {
  assistanceDataSIB-Element-r16 OCTET STRING,
  lateNonCriticalExtension OCTET STRING OPTIONAL,
}
```
**6.3.2 Radio resource control information elements**

- **AdditionalSpectrumEmission**

The IE *AdditionalSpectrumEmission* is used to indicate emission requirements to be fulfilled by the UE (see TS 38.101-1 [15], clause 6.2.3, and TS 38.101-2 [39], clause 6.2.3).

*AdditionalSpectrumEmission* information element

```
  AdditionalSpectrumEmission ::= INTEGER (0..7)
```

- **Alpha**

The IE *Alpha* defines possible values of a the pathloss compensation coefficient for uplink power control. Value *alpha0* corresponds to the value 0, Value *alpha04* corresponds to the value 0.4, Value *alpha05* corresponds to the value 0.5 and so on. Value *alpha1* corresponds to value 1. See also clause 7.1 of TS 38.213 [13].

```
  Alpha ::= ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1}
```

- **AMF-Identifier**

The IE *AMF-Identifier* (AMFI) comprises of an AMF Region ID, an AMF Set ID and an AMF Pointer as specified in TS 23.003 [21], clause 2.10.1.
**AMF-Identifier information element**

```
-- ASN1START
-- TAG-AMF-IDENTIFIER-START

AMF-Identifier ::= BIT STRING (SIZE (24))

-- TAG-AMF-IDENTIFIER-STOP
-- ASN1STOP
```

— **ARFCN-ValueEUTRA**

The IE ARFCN-ValueEUTRA is used to indicate the ARFCN applicable for a downlink, uplink or bi-directional (TDD) E-UTRA carrier frequency, as defined in TS 36.101 [22].

```
-- ASN1START
-- TAG-ARFCN-VALUEEUTRA-START

ARFCN-ValueEUTRA ::= INTEGER (0..maxEARFCN)

-- TAG-ARFCN-VALUEEUTRA-STOP
-- ASN1STOP
```

— **ARFCN-ValueNR**

The IE ARFCN-ValueNR is used to indicate the ARFCN applicable for a downlink, uplink or bi-directional (TDD) NR global frequency raster, as defined in TS 38.101-1 [15] and TS 38.101-2 [39], clause 5.4.2.

```
-- ASN1START
-- TAG-ARFCN-VALUENR-START

ARFCN-ValueNR ::= INTEGER (0..maxNARFCN)

-- TAG-ARFCN-VALUENR-STOP
-- ASN1STOP
```

— **ARFCN-ValueUTRA-FDD**

The IE ARFCN-ValueUTRA-FDD is used to indicate the ARFCN applicable for a downlink (Nd, FDD) UTRA-FDD carrier frequency, as defined in TS 25.331 [45].
3GPP TS 38.331 version 16.3.1 Release 16

ARFCN-ValueUTRA-FDD information element

-- ASN1START
-- TAG-ARFCN-ValueUTRA-FDD-START
ARFCN-ValueUTRA-FDD-r16 ::= INTEGER (0..16383)
-- TAG-ARFCN-ValueUTRA-FDD-STOP
-- ASN1STOP

AvailabilityCombinationsPerCell

The IE AvailabilityCombinationsPerCell is used to configure the AvailabilityCombinations applicable for a serving cell of the IAB-node DU (see TS 38.213 [13], clause 14).

AvailabilityCombinationsPerCell information element

-- ASN1START
-- TAG-AVAILABILITYCOMBINATIONSPERCELL-START
AvailabilityCombinationsPerCell-r16 ::= SEQUENCE {
  availabilityCombinationsPerCellIndex-r16  AvailabilityCombinationsPerCellIndex-r16,
iab-DU-CellIdentity-r16  CellIdentity,
  positionInDCI-AI-r16  INTEGER(0..maxAI-DCI-PayloadSize-r16-1)  OPTIONAL, -- Need M
  availabilityCombinations-r16  SEQUENCE (SIZE (1..maxNrofAvailabilityCombinationsPerSet-r16)) OF AvailabilityCombination-r16, ...
}

AvailabilityCombinationsPerCellIndex-r16 ::= INTEGER(0..maxNrofDUCells-r16)

AvailabilityCombination-r16 ::= SEQUENCE {
  availabilityCombinationId-r16  AvailabilityCombinationId-r16,
  resourceAvailability-r16  SEQUENCE (SIZE (1..maxNrofResourceAvailabilityPerCombination-r16)) OF INTEGER (0..7)
}

AvailabilityCombinationId-r16 ::= INTEGER (0..maxNrofAvailabilityCombinationsPerSet-r16-1)

-- TAG-AVAILABILITYCOMBINATIONSPERCELL-STOP
-- ASN1STOP

AvailabilityCombination field descriptions

resourceAvailability
Indicates the resource availability of soft symbols for a set of consecutive slots in the time domain. The meaning of this field is described in TS 38.213 [13], Table 14.3.

availabilityCombinationId
This ID is used in the DCI Format 2_5 payload to dynamically select this AvailabilityCombination, see TS 38.213 [13], clause 14.
— **AvailabilityIndicator**

The IE *AvailabilityIndicator* is used to configure monitoring a PDCCH for Availability Indicators (AI).

### AvailabilityIndicator information element

```
-- ASN1START
-- TAG-AVAILABILITYINDICATOR-START
AvailabilityIndicator-r16 := SEQUENCE {
    ai-RNTI-r16,   // RNTI-Value
    dci-PayloadSizeAI-r16 INTEGER (1..maxAI-DCI-PayloadSize-r16),
    availableCombToAddModList-r16 SEQUENCE (SIZE(1..maxNrofDUCells-r16)) OF AvailabilityCombinationsPerCell-r16 OPTIONAL, -- Need N
    availableCombToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofDUCells-r16)) OF AvailabilityCombinationsPerCellIndex-r16 OPTIONAL, -- Need N
    ...}
AI-RNTI-r16 ::= RNTI-Value
-- TAG-AVAILABILITYINDICATOR-STOP
-- ASN1STOP
```

### AvailabilityIndicator field descriptions

- **ai-RNTI**
  Used by an IAB-MT for detection of DCI format 2_5 indicating *AvailabilityCombinationId* for an IAB-DU's cells.

- **availableCombToAddModList**
  A list of *availabilityCombinations* to add for the IAB-DU's cells. (see TS 38.213 [13], clause 14).

- **availableCombToReleaseList**
  A list of *availabilityCombinations* to release for the IAB-DU's cells. (see TS 38.213 [13], clause 14).

- **dci-PayloadSizeAI**
  Total length of the DCI payload scrambled with ai-RNTI (see TS 38.213 [13]).

— **BAP-RoutingID**

The IE *BAP-RoutingID* is used for IAB-node to configure the BAP Routing ID.
**BAP-RoutingID information element**

```asn1
BAP-RoutingID-r16 ::= SEQUENCE{
  bap-Address-r16 BIT STRING (SIZE (10)),
  bap-PathId-r16 BIT STRING (SIZE (10))
}
```

---

**BAP-RoutingID field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bap-Address</strong></td>
<td>The ID of a destination IAB-node or IAB-donor-DU used in the BAP header.</td>
</tr>
<tr>
<td><strong>bap-PathId</strong></td>
<td>The ID of a path used in the BAP header.</td>
</tr>
</tbody>
</table>

---

**BeamFailureRecoveryConfig**

The IE *BeamFailureRecoveryConfig* is used to configure the UE with RACH resources and candidate beams for beam failure recovery in case of beam failure detection. See also TS 38.321 [3], clause 5.1.1.

**BeamFailureRecoveryConfig information element**

```asn1
BeamFailureRecoveryConfig ::= SEQUENCE {
  rootSequenceIndex-BFR INTEGER (0..137) OPTIONAL, -- Need M
  rach-ConfigBFR RACH-ConfigGeneric OPTIONAL, -- Need M
  rsrp-ThresholdSSB RSRP-Range OPTIONAL, -- Need M
  candidateBeamRSList SEQUENCE (SIZE(1..maxNrofCandidateBeams)) OF PRACH-ResourceDedicatedBFR OPTIONAL, -- Need M
  ssb-perRACH-Occasion ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen} OPTIONAL, -- Need M
  ra-ssb-OccasionMaskIndex INTEGER (0..15) OPTIONAL, -- Need M
  recoverySearchSpaceId SearchSpaceId OPTIONAL, -- Need M
  ra-Prioritization RA-Prioritization OPTIONAL, -- Need R
  beamFailureRecoveryTimer ENUMERATED {ms10, ms20, ms40, ms60, ms80, ms100, ms150, ms200} OPTIONAL, -- Need M
  ..., [[
    msg1-SubcarrierSpacing SubcarrierSpacing OPTIONAL -- Need M
  ]],
  [[
    ra-PrioritizationTwoStep-r16 RA-Prioritization OPTIONAL, -- Need R
    candidateBeamRSListExt-v1610 SetupRelease{ CandidateBeamRSListExt-r16 } OPTIONAL -- Need M
  ]]
```
PRACH-ResourceDedicatedBFR ::= CHOICE {
  ssb                             BFR-SSB-Resource,
  csi-RS                         BFR-CSIRS-Resource
}

BFR-SSB-Resource ::= SEQUENCE {
  ssb                             SSB-Index,
  ra-PreambleIndex              INTEGER (0..63),
  ...
}

BFR-CSIRS-Resource ::= SEQUENCE {
  csi-RS                         NZP-CSI-RS-ResourceId,
  ra-OccasionList                SEQUENCE (SIZE(1..maxRA-OccasionsPerCSIRS)) OF INTEGER (0..maxRA-Occasions-1) OPTIONAL, -- Need R
  ra-PreambleIndex              INTEGER (0..63) OPTIONAL, -- Need R
  ...
}

CandidateBeamRSListExt-r16::= SEQUENCE (SIZE(1.. maxNrofCandidateBeamsExt-r16)) OF PRACH-ResourceDedicatedBFR

-- TAG-BEAMFAILURERECOVERYCONFIG-STOP
-- ASN1STOP
**BeamFailureRecoveryConfig field descriptions**

<table>
<thead>
<tr>
<th><strong>beamFailureRecoveryTimer</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Timer for beam failure recovery timer. Upon expiration of the timer the UE does not use CFRA for BFR. Value in ms. Value ms10 corresponds to 10 ms, value ms20 corresponds to 20 ms, and so on.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>candidateBeamRSList, candidateBeamRSListExt-v1610</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The list of reference signals (CSI-RS and/or SSB) identifying the candidate beams for recovery and the associated RA parameters. The UE shall consider this list to include all elements of candidateBeamRSList (without suffix) and all elements of candidateBeamRSListExt-v1610. The network configures these reference signals to be within the linked DL BWP (i.e., within the DL BWP with the same <code>bwp-id</code>) of the UL BWP in which the <code>BeamFailureRecoveryConfig</code> is provided.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>msg1-SubcarrierSpacing</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcarrier spacing for contention free beam failure recovery. Only the values 15 kHz or 30 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable. See TS 38.211 [16], clause 5.3.2.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>rsrp-ThresholdSSB</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>L1-RSRP threshold used for determining whether a candidate beam may be used by the UE to attempt contention free random access to recover from beam failure (see TS 38.213 [13], clause 6).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ra-prioritization</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters which apply for prioritized random access procedure for BFR (see TS 38.321 [3], clause 5.1.1).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ra-PrioritizationTwoStep</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters which apply for prioritized 2-step random access procedure for BFR (see TS 38.321 [3], clause 5.1.1).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ra-ssb-OccasionMaskIndex</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicitly signalled PRACH Mask Index for RA Resource selection in TS 38.321 [3]. The mask is valid for all SSB resources.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>rach-ConfigBFR</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration of contention free random access occasions for BFR.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>recoverySearchSpaceId</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Search space to use for BFR RAR. The network configures this search space to be within the linked DL BWP (i.e., within the DL BWP with the same <code>bwp-id</code>) of the UL BWP in which the <code>BeamFailureRecoveryConfig</code> is provided. The CORESET associated with the recovery search space cannot be associated with another search space. Network always configures the UE with a value for this field when contention free random access resources for BFR are configured.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>rootSequenceIndex-BFR</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>PRACH root sequence index (see TS 38.211 [16], clause 6.3.3.1) for beam failure recovery.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ssb-perRACHOccasion</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of SSBs per RACH occasion for CF-BFR, see TS 38.213 [13], clause 8.1.</td>
</tr>
</tbody>
</table>

**BFR-CSIRS-Resource field descriptions**

<table>
<thead>
<tr>
<th><strong>csi-RS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The ID of a NZP-CSI-RS-Resource configured in the <code>CSI-MeasConfig</code> of this serving cell. This reference signal determines a candidate beam for beam failure recovery (BFR).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ra-OccasionList</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>RA occasions that the UE shall use when performing BFR upon selecting the candidate beam identified by this CSI-RS. The network ensures that the RA occasion indexes provided herein are also configured by <code>prach-ConfigurationIndex</code> and <code>msg1-FDM</code>. Each RACH occasion is sequentially numbered, first, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions; second, in increasing order of time resource indexes for time multiplexed PRACH occasions within a PRACH slot and Third, in increasing order of indexes for PRACH slots.</td>
</tr>
</tbody>
</table>

If the field is absent the UE uses the RA occasion associated with the SSB that is QCLed with this CSI-RS. |

<table>
<thead>
<tr>
<th><strong>ra-PreambleIndex</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The RA preamble index to use in the RA occasions associated with this CSI-RS. If the field is absent, the UE uses the preamble index associated with the SSB that is QCLed with this CSI-RS.</td>
</tr>
</tbody>
</table>
### BFR-SSB-Resource field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ra-PreambleIndex</strong></td>
<td>The preamble index that the UE shall use when performing BFR upon selecting the candidate beams identified by this SSB.</td>
</tr>
<tr>
<td><strong>ssb</strong></td>
<td>The ID of an SSB transmitted by this serving cell. It determines a candidate beam for beam failure recovery (BFR).</td>
</tr>
</tbody>
</table>

---

**BeamFailureRecoverySCellConfig**

The IE `BeamFailureRecoverySCellConfig` is used to configure the UE with candidate beams for beam failure recovery in case of beam failure detection in SCell. See also TS 38.321 [3], clause 5.x.x.

#### BeamFailureRecoverySCellConfig information element

```asn
-- ASN1START
-- TAG-BEAM.FAILURE.RECOVERY.SCELLCONFIG-START

BeamFailureRecoverySCellConfig-r16 ::= SEQUENCE {
  rsrp-ThresholdBFR-r16                  RSRP-Range                                                               OPTIONAL, -- Need M
  candidateBeamRSSCellList-r16           SEQUENCE (SIZE(1..maxNrofCandidateBeams-r16)) OF CandidateBeamRS-r16     OPTIONAL, -- Need M
...
}"

CandidateBeamRS-r16 ::=                SEQUENCE {
  candidateBeamConfig-r16                CHOICE {
    ssb-r16                                SSB-Index,
    csi-RS-r16                             NZP-CSI-RS-ResourceId
  },
  servingCellId                          ServCellIndex                                                            OPTIONAL  -- Need R
}"

-- TAG-BEAM.FAILURE.RECOVERY.SCELLCONFIG-STOP
-- ASN1STOP
```

---

**BeamFailureRecoverySCellConfig field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>candidateBeamConfig</td>
<td>Indicates the resource (i.e. SSB or CSI-RS) defining this beam resource.</td>
</tr>
<tr>
<td>candidateBeamRSSCellList</td>
<td>A list of reference signals (CSI-RS and/or SSB) identifying the candidate beams for recovery. The network always configures this parameter in every instance of this IE.</td>
</tr>
<tr>
<td>rsrp-ThresholdBFR</td>
<td>L1-RSRP threshold used for determining whether a candidate beam may be included by the UE be in BFR MAC CE (see TS 38.213 [13], clause X). The network always configures this parameter in every instance of this IE.</td>
</tr>
<tr>
<td>servingCellId</td>
<td>If the field is absent, the RS belongs to the serving cell in which this <code>BeamFailureRecoverySCellConfig</code> is configured</td>
</tr>
</tbody>
</table>
–  **BetaOffsets**

The IE *BetaOffsets* is used to configure beta-offset values, see TS 38.213 [13], clause 9.3.

**BetaOffsets information element**

```asn1
BetaOffsets ::= SEQUENCE {
  betaOffsetACK-Index1                INTEGER (0..31) OPTIONAL, -- Need S
  betaOffsetACK-Index2                INTEGER (0..31) OPTIONAL, -- Need S
  betaOffsetACK-Index3                INTEGER (0..31) OPTIONAL, -- Need S
  betaOffsetCSI-Part1-Index1          INTEGER (0..31) OPTIONAL, -- Need S
  betaOffsetCSI-Part1-Index2          INTEGER (0..31) OPTIONAL, -- Need S
  betaOffsetCSI-Part2-Index1          INTEGER (0..31) OPTIONAL, -- Need S
  betaOffsetCSI-Part2-Index2          INTEGER (0..31) OPTIONAL -- Need S
}
```

**BetaOffsets field descriptions**

- **betaOffsetACK-Index1**
  
  Up to 2 bits HARQ-ACK (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 11.

- **betaOffsetACK-Index2**
  
  Up to 11 bits HARQ-ACK (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 11.

- **betaOffsetACK-Index3**
  
  Above 11 bits HARQ-ACK (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 11.

- **betaOffsetCSI-Part1-Index1**
  
  Up to 11 bits of CSI part 1 bits (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 13.

- **betaOffsetCSI-Part1-Index2**
  
  Above 11 bits of CSI part 1 bits (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 13.

- **betaOffsetCSI-Part2-Index1**
  
  Up to 11 bits of CSI part 2 bits (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 13.

- **betaOffsetCSI-Part2-Index2**
  
  Above 11 bits of CSI part 2 bits (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 13.

–  **BH-LogicalChannelIdentity**

The IE *BH-LogicalChannelIdentity* is used to identify a logical channel between an IAB-node and its parent IAB-node or IAB-donor-DU.

**BH-LogicalChannelIdentity information element**
BH-LogicalChannelIdentity-r16 ::=   CHOICE {
   bh-LogicalChannelIdentity-r16 LogicalChannelIdentity,
   bh-LogicalChannelIdentityExt-r16   BH-LogicalChannelIdentity-Ext-r16
}

-- TAG-BHLOGICALCHANNELIDENTITY-STOP
-- ASN1STOP

### BH-LogicalChannelIdentity field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bh-LogicalChannelIdentity</td>
<td>ID used for the MAC logical channel.</td>
</tr>
<tr>
<td>bh-LogicalChannelIdentityExt</td>
<td>ID used for the MAC logical channel.</td>
</tr>
</tbody>
</table>

---

**BH-LogicalChannelIdentity-Ext**

The IE **BH-LogicalChannelIdentity-Ext** is used to identify a logical channel between an IAB-node and its parent node.

### BH-LogicalChannelIdentity-Ext information element

-- ASN1START
-- TAG-BHLOGICALCHANNELIDENTIEXT-START

BH-LogicalChannelIdentity-Ext-r16 ::=   INTEGER (320.. maxLC-ID-Iab-r16)

-- TAG-BHLOGICALCHANNELIDENTIEXT-STOP
-- ASN1STOP

---

**BH-RLC-ChannelConfig**

The IE **BH-RLC-ChannelConfig** is used to configure an RLC entity, a corresponding logical channel in MAC for BH RLC channel between IAB-node and its parent node.

### BH-RLC-ChannelConfig information element

-- ASN1START
-- TAG-BHRLCCHANNELCONFIG-START

BH-RLC-ChannelConfig-r16 ::=   SEQUENCE {
   bh-LogicalChannelIdentity-r16   BH-LogicalChannelIdentity-r16   OPTIONAL, -- Cond LCH-SetupOnly
   bh-RLC-ChannelID-r16           BH-RLC-ChannelID-r16,           OPTIONAL, -- Cond LCH-Setup
   reestablishRLC-r16             ENUMERATED {true}                 OPTIONAL, -- Need N
   rlc-Config-r16                 RLC-Config                        OPTIONAL, -- Cond LCH-Setup
   mac-LogicalChannelConfig-r16   LogicalChannelConfig              OPTIONAL, -- Cond LCH-Setup
   ...
}

---
BH-RLCChannelConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bh-LogicalChannelIdentity</td>
<td>Indicates the logical channel id for BH RLC channel of the IAB-node.</td>
</tr>
<tr>
<td>bh-RLC-ChannelID</td>
<td>Indicating the BH RLC channel in the link between IAB-MT of the IAB-node and IAB-DU of the parent IAB-node or IAB-donor-DU.</td>
</tr>
<tr>
<td>reestablishRLC</td>
<td>Indicates that RLC should be re-established.</td>
</tr>
<tr>
<td>rlc-Config</td>
<td>Determines the RLC mode (UM, AM) and provides corresponding parameters.</td>
</tr>
</tbody>
</table>

**Conditional Presence**

<table>
<thead>
<tr>
<th>Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCH-Setup</td>
<td>This field is mandatory present upon creation of a new logical channel for a BH RLC channel. It is optionally present, Need M, otherwise.</td>
</tr>
<tr>
<td>LCH-SetupOnly</td>
<td>This field is mandatory present upon creation of a BH RLC channel. It is absent, Need M otherwise.</td>
</tr>
</tbody>
</table>

---

**BH-RLC-ChannelID**

The IE **BH-RLC-ChannelID** is used to identify a BH RLC channel in the link between IAB-MT of the IAB-node and IAB-DU of the parent IAB-node or IAB-donor-DU.

**BH-RLC-ChannelID information element**

```
BH-RLC-ChannelID-r16 ::= BIT STRING (SIZE (16))
```

---

**BSR-Config**

The IE **BSR-Config** is used to configure buffer status reporting.

**BSR-Config information element**

```
BSR-Config ::= SEQUENCE {
```
BSR-Config field descriptions

<table>
<thead>
<tr>
<th>logicalChannelSR-DelayTimer</th>
<th>Value in number of subframes. Value sf20 corresponds to 20 subframes, sf40 corresponds to 40 subframes, and so on.</th>
</tr>
</thead>
<tbody>
<tr>
<td>periodicBSR-Timer</td>
<td>Value in number of subframes. Value sf1 corresponds to 1 subframe, value sf5 corresponds to 5 subframes and so on.</td>
</tr>
<tr>
<td>retxBSR-Timer</td>
<td>Value in number of subframes. Value sf10 corresponds to 10 subframes, value sf20 corresponds to 20 subframes and so on.</td>
</tr>
</tbody>
</table>

—

**BWP**

The IE *BWP* is used to configure generic parameters of a bandwidth part as defined in TS 38.211 [16], clause 4.5, and TS 38.213 [13], clause 12.

For each serving cell the network configures at least an initial downlink bandwidth part and one (if the serving cell is configured with an uplink) or two (if using supplementary uplink (SUL)) initial uplink bandwidth parts. Furthermore, the network may configure additional uplink and downlink bandwidth parts for a serving cell.

The uplink and downlink bandwidth part configurations are divided into common and dedicated parameters.

**BWP information element**

——

---

---

**BWP** :=

SEQUENCE {
  locationAndBandwidth INTEGER (0..37949),
  subcarrierSpacing SubcarrierSpacing,
  cyclicPrefix ENUMERATED { extended } OPTIONAL -- Need R
}

——

---

---

---
**BWP field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cyclicPrefix</strong></td>
<td>Indicates whether to use the extended cyclic prefix for this bandwidth part. If not set, the UE uses the normal cyclic prefix. Extended CP is supported only for 60 kHz subcarrier spacing. (see TS 38.211 [16], clause 4.2)</td>
</tr>
<tr>
<td><strong>locationAndBandwidth</strong></td>
<td>Frequency domain location and bandwidth of this bandwidth part. The value of the field shall be interpreted as resource indicator value (RIV) as defined TS 38.214 [19] with assumptions as described in TS 38.213 [13], clause 12, i.e. setting $N_{BW}^{CP}=275$. The first PRB is a PRB determined by subcarrierSpacing of this BWP and offsetToCarrier (configured in SCS-SpecificCarrier contained within FrequencyInfoDL / FrequencyInfoUL / FrequencyInfoUL-SIB / FrequencyInfoDL-SIB within ServingCellConfigCommon / ServingCellConfigCommonSIB) corresponding to this subcarrier spacing. In case of TDD, a BWP-pair (UL BWP and DL BWP with the same bwp-Id) must have the same center frequency (see TS 38.213 [13], clause 12)</td>
</tr>
<tr>
<td><strong>subcarrierSpacing</strong></td>
<td>Subcarrier spacing to be used in this BWP for all channels and reference signals unless explicitly configured elsewhere. Corresponds to subcarrier spacing according to TS 38.211 [16], table 4.2-1. The value kHz15 corresponds to $\mu=0$, value kHz30 corresponds to $\mu=1$, and so on. Only the values 15 kHz, 30 kHz, or 60 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable. For the initial DL BWP this field has the same value as the field subCarrierSpacingCommon in MIB of the same serving cell.</td>
</tr>
</tbody>
</table>

---

**BWP-Downlink**

The IE *BWP-Downlink* is used to configure an additional downlink bandwidth part (not for the initial BWP).

---

**BWP-Downlink information element**

```
-- ASN1START
-- TAG-BWP-DOWNLINK-START
BWP-Downlink ::=                    SEQUENCE {
  bwp-Id                              BWP-Id,              
  bwp-Common                          BWP-DownlinkCommon                                         OPTIONAL,   -- Cond SetupOtherBWP
  bwp-Dedicated                       BWP-DownlinkDedicated                                      OPTIONAL,   -- Cond SetupOtherBWP
  ... }
-- TAG-BWP-DOWNLINK-STOP
-- ASN1STOP
```

---

**BWP-Downlink field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bwp-Id</strong></td>
<td>An identifier for this bandwidth part. Other parts of the RRC configuration use the BWP-Id to associate themselves with a particular bandwidth part. The network configures the BWPs with consecutive IDs from 1. The Network does not include the value 0, since value 0 is reserved for the initial BWP.</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SetupOtherBWP</td>
<td>The field is mandatory present upon configuration of a new DL BWP. The field is optionally present, Need M, otherwise.</td>
</tr>
</tbody>
</table>
The IE BWP-DownlinkCommon is used to configure the common parameters of a downlink BWP. They are "cell specific" and the network ensures the necessary alignment with corresponding parameters of other UEs. The common parameters of the initial bandwidth part of the PCell are also provided via system information. For all other serving cells, the network provides the common parameters via dedicated signalling.

**BWP-DownlinkCommon information element**

```asn1
BWP-DownlinkCommon ::= SEQUENCE {
    genericParameters                   BWP,
    pdcch-ConfigCommon                  SetupRelease { PDCCH-ConfigCommon } OPTIONAL, -- Need M
    pdsch-ConfigCommon                  SetupRelease { PDSCH-ConfigCommon } OPTIONAL, -- Need M
    ...
}
```

**BWP-DownlinkCommon field descriptions**

- **pdcch-ConfigCommon**: Cell specific parameters for the PDCCH of this BWP. This field is absent for a dormant BWP.

- **pdsch-ConfigCommon**: Cell specific parameters for the PDSCH of this BWP.

---

The IE BWP-DownlinkDedicated is used to configure the dedicated (UE specific) parameters of a downlink BWP.

**BWP-DownlinkDedicated information element**

```asn1
BWP-DownlinkDedicated ::= SEQUENCE {
    pdcch-Config                        SetupRelease { PDCCH-Config } OPTIONAL, -- Need M
    pdsch-Config                        SetupRelease { PDSCH-Config } OPTIONAL, -- Need M
    sps-Config                          SetupRelease { SPS-Config } OPTIONAL, -- Need M
    radioLinkMonitoringConfig           SetupRelease { RadioLinkMonitoringConfig } OPTIONAL, -- Need M
    ...
    sps-ConfigToAddModList-r16          SPS-ConfigToAddModList-r16 OPTIONAL, -- Need N
    sps-ConfigToReleaseList-r16         SPS-ConfigToReleaseList-r16 OPTIONAL, -- Need N
    sps-ConfigDeactivationStateList-r16 SPS-ConfigDeactivationStateList-r16 OPTIONAL, -- Need R
    beamFailureRecoverySCellConfig-r16  SetupRelease {BeamFailureRecoverySCellConfig-r16} OPTIONAL, -- Cond SCellOnly
```

---
### BWP-DownlinkDedicated field descriptions

**beamFailureRecoverySCellConfig**
Configuration of candidate RS for beam failure recovery in SCells.

**pdcch-Config**
UE specific PDCCH configuration for one BWP.

**pdsch-Config**
UE specific PDSCH configuration for one BWP.

**sps-Config**
UE specific SPS (Semi-Persistent Scheduling) configuration for one BWP. Except for reconfiguration with sync, the NW does not reconfigure `sps-Config` when there is an active configured downlink assignment (see TS 38.321 [3]). However, the NW may release the `sps-Config` at any time. Network can only configure SPS in one BWP using either this field or `sps-ConfigToAddModList`.

**sps-ConfigDeactivationStateList**
Indicates a list of the deactivation states in which each state can be mapped to a single or multiple SPS configurations to be deactivated, see clause 10.2 in TS 38.213 [13]. If a state is mapped to multiple SPS configurations, each of these SPS configurations is configured with the same `harq-CodebookID`.

**sps-ConfigToAddModList**
Indicates a list of one or more DL SPS configurations to be added or modified in one BWP. Except for reconfiguration with sync, the NW does not reconfigure a SPS configuration when it is active (see TS 38.321 [3]).

**sps-ConfigToReleaseList**
Indicates a list of one or more DL SPS configurations to be released. The NW may release a SPS configuration at any time.

**radioLinkMonitoringConfig**
UE specific configuration of radio link monitoring for detecting cell- and beam radio link failure occasions. The maximum number of failure detection resources should be limited up to 8 for both cell and beam radio link failure detection. For SCells, only periodic 1-port CSI-RS can be configured in IE `RadioLinkMonitoringConfig`.

**sl-PDCCH-Config**
Indicates the UE specific PDCCH configurations for receiving the SL grants (via SL-RNTI or SL-CS-RNTI) for NR sidelink communication.

**sl-V2X-PDCCH-Config**
Indicates the UE specific PDCCH configurations for receiving SL grants (i.e. sidelink SPS) for V2X sidelink communication.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ScellOnly</td>
<td>The field is optionally present, Need M, in the BWP-DownlinkDedicated of an Scell. It is absent otherwise.</td>
</tr>
</tbody>
</table>
The IE **BWP-Id** is used to refer to Bandwidth Parts (BWP). The initial BWP is referred to by **BWP-Id 0**. The other BWPs are referred to by **BWP-Id 1** to **maxNrofBWPs**.

**BWP-Id information element**

--- ASN1START
--- TAG-BWP-ID-START
BWP-Id ::= INTEGER {0..maxNrofBWPs}
--- TAG-BWP-ID-STOP
--- ASN1STOP

**BWP-Uplink**

The IE **BWP-Uplink** is used to configure an additional uplink bandwidth part (not for the initial BWP).

**BWP-Uplink information element**

--- ASN1START
--- TAG-BWP-UPLINK-START
BWP-Uplink ::= SEQUENCE {
  bwp-Id                  BWP-Id,
  bwp-Common              BWP-UplinkCommon OPTIONAL, -- Cond SetupOtherBWP
  bwp-Dedicated           BWP-UplinkDedicated OPTIONAL, -- Cond SetupOtherBWP
  ...}
--- TAG-BWP-UPLINK-STOP
--- ASN1STOP

**BWP-Uplink field descriptions**

**bwp-Id**
An identifier for this bandwidth part. Other parts of the RRC configuration use the **BWP-Id** to associate themselves with a particular bandwidth part.
The network configures the BWPs with consecutive IDs from 1. The Network does not include the value 0, since value 0 is reserved for the initial BWP.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SetupOtherBWP</td>
<td>The field is mandatory present upon configuration of a new UL BWP. The field is optionally present, Need M, otherwise.</td>
</tr>
</tbody>
</table>
The IE BWP-UplinkCommon is used to configure the common parameters of an uplink BWP. They are "cell specific" and the network ensures the necessary alignment with corresponding parameters of other UEs. The common parameters of the initial bandwidth part of the PCell are also provided via system information. For all other serving cells, the network provides the common parameters via dedicated signalling.

**BWP-UplinkCommon** information element

---

**BWP-UplinkCommon** field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>msgA-ConfigCommon</strong></td>
<td>Configuration of the cell specific PRACH and PUSCH resource parameters for transmission of MsgA in 2-step random access type procedure. The NW can configure msgA-ConfigCommon only for UL BWPs if the linked DL BWPs (same bwp-Id as UL-BWP) are the initial DL BWPs or DL BWPs containing the SSB associated to the initial BL BWP.</td>
</tr>
<tr>
<td><strong>pusch-ConfigCommon</strong></td>
<td>Cell specific parameters for the PUSCH of this BWP.</td>
</tr>
<tr>
<td><strong>pucch-ConfigCommon</strong></td>
<td>Cell specific parameters for the PUSCH of this BWP.</td>
</tr>
<tr>
<td><strong>rach-ConfigCommon</strong></td>
<td>Configuration of cell specific random access parameters which the UE uses for contention based and contention free random access as well as for contention based beam failure recovery in this BWP. The NW configures SSB-based RA (and hence RACH-ConfigCommon) only for UL BWPs if the linked DL BWPs (same bwp-lid as UL-BWP) are the initial DL BWPs or DL BWPs containing the SSB associated to the initial DL BWP. The network configures rach-ConfigCommon, whenever it configures contention free random access (for reconfiguration with sync or for beam failure recovery).</td>
</tr>
<tr>
<td><strong>rach-ConfigCommonIAB</strong></td>
<td>Configuration of cell specific random access parameters for the IAB-MT. The IAB specific IAB RACH configuration is used by IAB-MT, if configured.</td>
</tr>
<tr>
<td><strong>useInterlacePUCCH-PUSCH</strong></td>
<td>If the field is present, the UE uses uplink frequency domain resource allocation Type 2 for cell-specific PUSCH, e.g., PUSCH scheduled by RAR UL grant (see 38.213 clause 8.3 and 38.214 clause 6.1.2.2) and uses interlaced PUCCH Format 0 and 1 for cell-specific PUSCH (see TS 38.213 [13], clause 9.2.1).</td>
</tr>
</tbody>
</table>
### Conditional Presence

<table>
<thead>
<tr>
<th>SpCellOnly2</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The field is optionally present, Need M, in the <strong>BWP-UplinkCommon</strong> of an SpCell. It is absent otherwise.</td>
<td></td>
</tr>
</tbody>
</table>

---

#### BWP-UplinkDedicated

The IE **BWP-UplinkDedicated** is used to configure the dedicated (UE specific) parameters of an uplink BWP.

**BWP-UplinkDedicated** information element

```asn1
-- ASN1START
-- TAG=BWP-UPLINKDEDICATED-START

BWP-UplinkDedicated ::= SEQUENCE {
  pucch-Config                        SetupRelease { PUCCH-Config }                                           OPTIONAL,   -- Need M
  pusch-Config                        SetupRelease { PUSCH-Config }                                           OPTIONAL,   -- Need M
  configuredGrantConfig               SetupRelease { ConfiguredGrantConfig }                                  OPTIONAL,   -- Need M
  srs-Config                          SetupRelease { SRS-Config }                                             OPTIONAL,   -- Need M
  beamFailureRecoveryConfig           SetupRelease { BeamFailureRecoveryConfig }                              OPTIONAL,   -- Cond SpCellOnly
  ...
  ...
  ...
  sl-PUCCH-Config-r16                 SetupRelease { PUCCH-Config }                                           OPTIONAL,   -- Need M
  cp-ExtensionC2-r16                  INTEGER (1..28)                                                         OPTIONAL,   -- Need R
  cp-ExtensionC3-r16                  INTEGER (1..28)                                                         OPTIONAL,   -- Need R
  useInterlacePUCCH-PUSCH-r16         ENUMERATED {enabled}                                                    OPTIONAL,   -- Need R
  pucch-ConfigurationList-r16         SetupRelease { PUCCH-ConfigurationList-r16 }                            OPTIONAL,   -- Need M
  lbt-FailureRecoveryConfig-r16       SetupRelease { LBT-FailureRecoveryConfig-r16 }                          OPTIONAL,   -- Need M
  configuredGrantConfigToAddModList-r16                 ConfiguredGrantConfigToAddModList-r16                 OPTIONAL,   -- Need N
  configuredGrantConfigToReleaseList-r16                ConfiguredGrantConfigToReleaseList-r16                OPTIONAL,   -- Need N
  configuredGrantConfigType2DeactivationStateList-r16   ConfiguredGrantConfigType2DeactivationStateList-r16 OPTIONAL   -- Need R
}

ConfiguredGrantConfigToAddModList-r16 ::= SEQUENCE (SIZE (1..maxNrofConfiguredGrantConfig-r16)) OF ConfiguredGrantConfig

ConfiguredGrantConfigToReleaseList-r16 ::= SEQUENCE (SIZE (1..maxNrofConfiguredGrantConfig-r16)) OF ConfiguredGrantConfigIndex-r16

ConfiguredGrantConfigType2DeactivationState-r16 ::= SEQUENCE (SIZE (1..maxNrofConfiguredGrantConfigType2DeactivationState-r16)) OF ConfiguredGrantConfigType2DeactivationState-r16

-- TAG=BWP-UPLINKDEDICATED-STOP
-- ASN1STOP
```
### BWP-UplinkDedicated field descriptions

**beamFailureRecoveryConfig**
Configuration of beam failure recovery. If `supplementaryUplink` is present, the field is present only in one of the uplink carriers, either UL or SUL.

**configuredGrantConfig**
A `Configured-Grant` of type1 or type2. It may be configured for UL or SUL but in case of type1 not for both at a time. Except for reconfiguration with sync, the NW does not reconfigure `configuredGrantConfig` when there is an active configured uplink grant Type 2 (see TS 38.321 [3]). However, the NW may release the `configuredGrantConfig` at any time. Network can only configure configured grant in one BWP using either this field or `configuredGrantConfigToAddModList`.

**configuredGrantConfigToAddModList**
Indicates a list of one or more configured grant configurations to be added or modified for one BWP. Except for reconfiguration with sync, the NW does not reconfigure a Type 2 configured grant configuration when it is active (see TS 38.321 [3]).

**configuredGrantConfigToReleaseList**
Indicates a list of one or more UL Configured Grant configurations to be released. The NW may release a configured grant configuration at any time.

**configuredGrantConfigType2DeactivationStateList**
Indicates a list of the deactivation states in which each state can be mapped to a single or multiple Configured Grant type 2 configurations to be deactivated when the corresponding deactivation DCI is received, see clause 7.3.1 in TS 38.212 [17] and clause 10.2 in TS 38.213 [13].

**cp.ExtensionC2, cp.ExtensionC3**
Configures the cyclic prefix (CP) extension (see TS 38.211 [16], clause 5.3.1). For 15 and 30 kHz SCS, \{1..28\} are valid for both `cp.ExtensionC2` and `cp.ExtensionC3`. For 30 kHz SCS, \{1..28\} are valid for `cp.ExtensionC2` and \{2..28\} are valid for `cp.ExtensionC3`. For 60 kHz SCS, \{2..28\} are valid for `cp.ExtensionC2` and \{3..28\} are valid for `cp.ExtensionC3`.

**lbt-FailureRecoveryConfig**
Configures parameters used for detection of consistent uplink LBT failures for operation with shared spectrum channel access, as specified in TS 38.321 [3].

**pucch-Config**
PUCCH configuration for one BWP of the normal UL or SUL of a serving cell. If the UE is configured with SUL, the network configures PUCCH only on the BWPs of one of the uplinks (normal UL or SUL). The network configures `PUCCH-Config` at least on non-initial BWP(s) for SpCell and PUCCH SCell. If supported by the UE, the network may configure at most one additional SCell of a cell group with `PUCCH-Config` (i.e. PUCCH SCell).

In (NG)EN-DC and NE-DC, the NW configures at most one serving cell per frequency range with PUCCH. In (NG)EN-DC and NE-DC, if two PUCCH groups are configured, the serving cells of the NR PUCCH group in FR2 use the same numerology. For NR-DC, the maximum number of PUCCH groups in each cell group is one, and only the same numerology is supported for the cell group with carriers only in FR2.

The NW may configure PUCCH for a BWP when setting up the BWP. The network may also add/remove the `pucch-Config` in an RRCReconfiguration with reconfigurationWithSync (for SpCell or PUCCH SCell) or with SCell release and add (for PUCCH SCell) to move the PUCCH between the UL and SUL carrier of one serving cell. In other cases, only modifications of a previously configured `pucch-Config` are allowed.

If one (S)UL BWP of a serving cell is configured with PUCCH, all other (S)UL BWPs must be configured with PUCCH, too.

**pucch-ConfigurationList**
PUCCH configurations for two simultaneously constructed HARQ-ACK codebooks (see TS 38.213 [13], clause 9.1). Different PUCCH Resource IDs are configured in different `PUCCH-Config` within the `pucch-ConfigurationList` if configured.

**pusch-Config**
PUSCH configuration for one BWP of the normal UL or SUL of a serving cell. If the UE is configured with SUL, the network configures PUSCH only on the BWPs of one of the uplinks (normal UL or SUL). The network configures `PUSCH-Config` at least on non-initial BWP(s) for SpCell and PUSCH SCell. If supported by the UE, the network may configure `PUSCH-Config`.

In (NG)EN-DC and NE-DC, the NW configures at most one serving cell per frequency range with PUSCH. In (NG)EN-DC and NE-DC, if two PUSCH groups are configured, the serving cells of the NR PUSCH group in FR2 use the same numerology. For NR-DC, the maximum number of PUSCH groups in each cell group is one, and only the same numerology is supported for the cell group with carriers only in FR2.

The NW may configure PUSCH for a BWP when setting up the BWP. The network may also add/remove the `pusch-Config` in an RRCReconfiguration with reconfigurationWithSync (for SpCell or PUSCH SCell) or with SCell release and add (for PUSCH SCell) to move the PUSCH between the UL and SUL carrier of one serving cell. In other cases, only modifications of a previously configured `pusch-Config` are allowed.

If one (S)UL BWP of a serving cell is configured with PUSCH, all other (S)UL BWPs must be configured with PUSCH, too.

**pusch-ConfigurationList**
PUSCH configurations for two simultaneously constructed HARQ-ACK codebooks (see TS 38.213 [13], clause 9.1). Different PUSCH Resource IDs are configured in different `PUSCH-Config` within the `pusch-ConfigurationList` if configured.

**si-PUCCH-Config**
Indicates the UE specific PUCCH configurations used for the HARQ-ACK feedback reporting for NR sidelink communication.

**srs-Config**
Uplink sounding reference signal configuration.

**useInterlacePUCCH-PUSCH**
If the field is present, the UE uses uplink frequency domain resource allocation Type 2 for PUSCH (see 38.213 clause 8.3 and 38.214 clause 6.1.2.2) and uses interlaced PUCCH Format 0, 1, 2, and 3 for PUCCH (see TS 38.213 [13], clause 9.2.1).
### Conditional Presence

| SpCellOnly | The field is optionally present, Need M, in the BWP-UplinkDedicated of an SpCell. It is absent otherwise. |

**NOTE 1: In case of RRCReconfiguration with reconfigurationWithSync, the UE performs a MAC reset, which involves releasing the PUCCH-CSI/SRS/SR configuration in accordance with clause 5.3.12 and TS 38.321 [6], clauses 5.12 and 5.2. Hence, for these parts of the dedicated radio resource configuration, delta signalling is not supported in the message when reconfigurationWithSync is included.**

---

**CellAccessRelatedInfo**

The IE *CellAccessRelatedInfo* indicates cell access related information for this cell.

**CellAccessRelatedInfo information element**

```
CellAccessRelatedInfo ::= SEQUENCE {
    plmn-IdentityList             PLMN-IdentityInfoList,   -- Need R
    cellReservedForOtherUse       ENUMERATED {true}             OPTIONAL,   -- Need R
    ...,
    [cellReservedForFutureUse-r16 ENUMERATED {true}             OPTIONAL,   -- Need R
     npn-IdentityInfoList-r16     NPN-IdentityInfoList-r16      OPTIONAL    -- Need R
    ]
}
```

---

-- ASN1STOP
-- TAG-CELLACCESSRELATEDINFO-START
### CellAccessRelatedInfo field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cellReservedForFutureUse</td>
<td>Indicates whether the cell is reserved, as defined in 38.304 [20] for future use. The field is applicable to all PLMNs and NPNs. This field is ignored by IAB-MT.</td>
</tr>
<tr>
<td>cellReservedForOtherUse</td>
<td>Indicates whether the cell is reserved, as defined in 38.304 [20]. The field is applicable to all PLMNs. This field is ignored by IAB-MT for cell barring determination, but still considered by NPN capable IAB-MT for determination of an NPN-only cell.</td>
</tr>
</tbody>
</table>
| npn-IdentityInfoList         | The npn-IdentityInfoList is used to configure a set of NPN-IdentityInfo elements. Each of those elements contains a list of one or more NPN Identities and additional information associated with those NPNs. The total number of PLMNs (identified by a PLMN identity in plmn-IdentityList), PNI-NPNs (identified by a PLMN identity and a CAG-ID), and SNPNs (identified by a PLMN identity and a NID) together in the PLMN-IdentityInfoList and NPN-IdentityInfoList does not exceed 12, except for the NPN-only cells. In case of NPN-only cells the PLMN-IdentityList contains a single element that does not count to the limit of 12. The NPN index is defined as $B + c_1 + c_2 + \ldots + c(n-1) + d_1 + d_2 + \ldots + d(m-1)+e(i)$ for the NPN identity included in the $n$-th entry of NPN-IdentityInfoList and in the $m$-th entry of NPN-IdentityList within that npn-IdentityInfoList entry, and the $i$-th entry of its corresponding NPN-Identity, where:  
  - $B$ is the index used for the last PLMN in the PLMN-IdentityInfoList in NPN-only cells $B$ is considered 0;  
  - $c(j)$ is the number of NPN index values used in the $j$-th NPN-IdentityInfoList entry;  
  - $d(k)$ is the number of NPN index values used in the $k$-th npn-IdentityList entry within the $n$-th NPN-IdentityInfoList entry;  
  - $e(i)$ is  
    - 0 if the $n$-th entry of NPN-IdentityInfoList entry is for SNPN(s);  
    - 1 if the $n$-th entry of NPN-IdentityInfoList entry is for PNI-NPN(s). |
| plmn-IdentityList            | The plmn-IdentityList is used to configure a set of PLMN-IdentityInfo elements. Each of those elements contains a list of one or more PLMN Identities and additional information associated with those PLMNs. A PLMN-identity can be included only once, and in only one entry of the PLMN-IdentityInfoList. The PLMN index is defined as $b_1 + b_2 + \ldots + b(n-1)+i$ for the PLMN included at the $n$-th entry of PLMN-IdentityInfoList and the $i$-th entry of its corresponding PLMN-IdentityInfo, where $b(j)$ is the number of PLMN-Identity entries in each PLMN-IdentityInfo, respectively. |

---

### CellAccessRelatedInfo-EUTRA-5GC

The IE CellAccessRelatedInfo-EUTRA-5GC indicates cell access related information for an LTE cell connected to 5GC.

---

### CellAccessRelatedInfo-EUTRA-5GC information element

```asciidoc
CellAccessRelatedInfo-EUTRA-5GC ::= SEQUENCE {
  plmn-IdentityList-eutra-5gc             PLMN-IdentityList-EUTRA-5GC,
  trackingAreaCode-eutra-5gc              TrackingAreaCode,
  ranac-5gc                               RAN-AreaCode                                OPTIONAL,
  cellIdentity-eutra-5gc                  CellIdentity-EUTRA-5GC }

PLMN-IdentityList-EUTRA-5GC ::= SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity-EUTRA-5GC

PLMN-Identity-EUTRA-5GC ::= CHOICE {
  plmn-Identity-EUTRA-5GC                 PLMN-Identity,
  plmn-index                              INTEGER (1..maxPLMN)
}
```

---
CellIdentity-EUTRA-5GC ::= CHOICE {
  cellIdentity-EUTRA BIT STRING (SIZE (28)),
  cellId-index INTEGER (1..maxPLMN)
}

-- TAG-CELLACCESSRELATEDINFOEUTRA-5GC-STOP
-- ASN1STOP

CellAccessRelatedInfo-EUTRA-EPC

The IE CellAccessRelatedInfo-EUTRA-EPC indicates cell access related information for an LTE cell connected to EPC.

CellAccessRelatedInfo-EUTRA-EPC information element

-- ASN1START
-- TAG-CELLACCESSRELATEDINFOEUTRA-EPC-START

CellAccessRelatedInfo-EUTRA-EPC ::= SEQUENCE {
  plmn-IdentityList-eutra-epc PLMN-IdentityList-EUTRA-EPC,
  trackingAreaCode-eutra-epc BIT STRING (SIZE (16)),
  cellIdentity-eutra-epc BIT STRING (SIZE (28))
}

PLMN-IdentityList-EUTRA-EPC ::= SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity

-- TAG-CELLACCESSRELATEDINFOEUTRA-EPC-STOP
-- ASN1STOP

CellGroupConfig

The CellGroupConfig IE is used to configure a master cell group (MCG) or secondary cell group (SCG). A cell group comprises of one MAC entity, a set of logical channels with associated RLC entities and of a primary cell (SpCell) and one or more secondary cells (SCells).

CellGroupConfig information element

-- ASN1START
-- TAG-CELLGROUPCONFIG-START

CellGroupConfig ::= SEQUENCE {
  cellGroupId CellGroupId,
  rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLC-ID)) OF RLC-BearerConfig OPTIONAL, -- Need N
  rlc-BearerToReleaseList SEQUENCE (SIZE(1..maxLC-ID)) OF LogicalChannelIdentity OPTIONAL, -- Need N
  mac-CellGroupConfig MAC-CellGroupConfig OPTIONAL, -- Need M
  physicalCellGroupConfig PhysicalCellGroupConfig OPTIONAL, -- Need M
  spCellConfig SpCellConfig OPTIONAL, -- Need M
}

-- Configuration of one Cell-Group:

-- ASN1START
-- TAG-CELLGROUPCONFIG-END

-- ASN1STOP
sCellToAddModList
SEQUENCE {SIZE (1..maxNrofSCells)) OF SCellConfig
OPTIONAL, -- Need N
sCellToReleaseList
SEQUENCE {SIZE (1..maxNrofSCells)) OF SCellIndex
OPTIONAL, -- Need N
...
[[
reportUplinkTxDirectCurrent
ENUMERATED {true}
OPTIONAL    -- Cond BWP-Reconfig
]],
[[
bap-Address-r16
BIT STRING (SIZE (10))
OPTIONAL,   -- Need M
bh-RLC-ChannelToAddModList-r16
SEQUENCE {SIZE(1..maxBH-RLC-ChannelID-r16)) OF BH-RLC-ChannelConfig-r16
OPTIONAL,   -- Need N
bh-RLC-ChannelToReleaseList-r16
SEQUENCE {SIZE(1..maxBH-RLC-ChannelID-r16)) OF BH-RLC-ChannelID-r16
OPTIONAL,   -- Need N
f1c-TransferPath-r16
ENUMERATED {lte, nr, both}
OPTIONAL,   -- Need M
simultaneousTCI-UpdateList1-r16
SEQUENCE {SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex
OPTIONAL,   -- Need R
simultaneousTCI-UpdateList2-r16
SEQUENCE {SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex
OPTIONAL,   -- Need R
simultaneousSpatial-UpdatedList1-r16
SEQUENCE {SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex
OPTIONAL,   -- Need R
simultaneousSpatial-UpdatedList2-r16
SEQUENCE {SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex
OPTIONAL,   -- Need R
uplinkTxSwitchingOption-r16
ENUMERATED {switchedUL, dualUL}
OPTIONAL,   -- Need R
uplinkTxSwitchingPowerBoosting-r16
ENUMERATED {enabled}
OPTIONAL    -- Need R
]}]

-- Serving cell specific MAC and PHY parameters for a SpCell:
SpCellConfig ::=                        SEQUENCE {  
servCellIndex                       ServCellIndex                                               OPTIONAL,   -- Cond SCG
reconfigurationWithSync             ReconfigurationWithSync                                     OPTIONAL,   -- Cond ReconfWithSync
rlf-TimersAndConstants              SetupRelease { RLF-TimersAndConstants }                     OPTIONAL,   -- Need M
rlmInSyncOutOfSyncThreshold         ENUMERATED {n1}                                             OPTIONAL,   -- Need S
spCellConfigDedicated               ServingCellConfig                                           OPTIONAL,   -- Need M
...  
ReconfigurationWithSync ::=         SEQUENCE {  
spCellConfigCommon                  ServingCellConfigCommon                                     OPTIONAL,   -- Need M
newUE-Identity                      RNTI-Value,     t304                                ENUMERATED {ms50, ms100, ms150, ms200, ms500, ms1000, ms2000, ms10000},
rach-ConfigDedicated                CHOICE {  
uplink                              RACH-ConfigDedicated,
supplementaryUplink
RACH-ConfigDedicated

rach-ConfigDedicated
RACH-ConfigDedicated

...  
[  
smtc                                SSB-MTC                                                     OPTIONAL    -- Need S
  ],
[  
daps-UplinkPowerConfig-r16      DAPS-UplinkPowerConfig-r16                                      OPTIONAL    -- Need N
  ]

DAPS-UplinkPowerConfig-r16 ::=      SEQUENCE {  
p-DAPS-Source-r16                   P-Max,
p-DAPS-Target-r16                   P-Max,
uplinkPowerSharingDAPS-Mode-r16     ENUMERATED {semi-static-model, semi-static-mode2, dynamic }
}

SCellConfig ::=                        SEQUENCE {  
...
sCellIndex          SCellIndex,          OPTIONAL, -- Cond SCellAdd
sCellConfigCommon   ServingCellConfigCommon
sCellConfigDedicated ServingCellConfig
...,
[[
smtc                SSB-MTC
]],
[[
sCellState-r16     ENUMERATED {activated}
secondaryDRX-GroupConfig-r16 ENUMERATED {true}
]]

-- TAG-CELLGROUPCONFIG-STOP
-- ASN1STOP
### CellGroupConfig field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bap-Address</strong></td>
<td>BAP address of the parent node in cell group.</td>
</tr>
<tr>
<td><strong>bh-RLC-ChannelToAddModList</strong></td>
<td>Configuration of the backhaul RLC entities and the corresponding MAC Logical Channels to be added and modified.</td>
</tr>
<tr>
<td><strong>bh-RLC-ChannelToReleaseList</strong></td>
<td>List of the backhaul RLC entities and the corresponding MAC Logical Channels to be released.</td>
</tr>
<tr>
<td><strong>f1c-TransferPath</strong></td>
<td>The F1-C transfer path that an EN-DC IAB-MT should use for transferring F1-C packets to the IAB-donor-CU. If IAB-MT is configured with lte, IAB-MT can only use LTE leg for F1-C transfer. If IAB-MT is configured with nr, IAB-MT can only use NR leg for F1-C transfer. If IAB-MT is configured with both, it is up to IAB-MT to select an LTE leg or a NR leg for F1-C transfer. If the field is not configured, the IAB node uses the NR leg as the default one.</td>
</tr>
<tr>
<td><strong>mac-CellGroupConfig</strong></td>
<td>MAC parameters applicable for the entire cell group.</td>
</tr>
<tr>
<td><strong>rlc-BearerToAddModList</strong></td>
<td>Configuration of the MAC Logical Channel, the corresponding RLC entities and association with radio bearers.</td>
</tr>
<tr>
<td><strong>reportUplinkTxDirectCurrent</strong></td>
<td>Enables reporting of uplink and supplementary uplink Direct Current location information upon BWP configuration and reconfiguration. This field is only present when the BWP configuration is modified or any serving cell is added or removed. This field is absent in the IE CellGroupConfig when provided as part of RRCSetup message. If UE is configured with SUL carrier, UE reports both UL and SUL Direct Current locations.</td>
</tr>
<tr>
<td><strong>rilnSyncOutOfSyncThreshold</strong></td>
<td>BLER threshold pair index for IS/OOS indication generation, see TS 38.133 [14], table 8.1.1-1. n1 corresponds to the value 1. When the field is absent, the UE applies the value 0. Whenever this is reconfigured, UE resets N310 and N311, and stops T310, if running. Network does not include this field.</td>
</tr>
<tr>
<td><strong>sCellState</strong></td>
<td>Indicates whether the SCell shall be considered to be in activated state upon SCell configuration.</td>
</tr>
<tr>
<td><strong>sCellToAddModList</strong></td>
<td>List of secondary serving cells (SCells) to be added or modified.</td>
</tr>
<tr>
<td><strong>sCellToReleaseList</strong></td>
<td>List of secondary serving cells (SCells) to be released.</td>
</tr>
<tr>
<td><strong>secondaryDRX-GroupConfig</strong></td>
<td>The field is used to indicate whether the SCell belongs to the secondary DRX group. All serving cells in the secondary DRX group shall belong to one Frequency Range and all serving cells in the legacy DRX group shall belong to another Frequency Range.</td>
</tr>
<tr>
<td><strong>simultaneousTCI-UpdateList1, simultaneousTCI-UpdateList2</strong></td>
<td>List of serving cells which can be updated simultaneously for TCI relation with a MAC CE. The simultaneousTCI-UpdateList1 and simultaneousTCI-UpdateList2 shall not contain same serving cells. Network should not configure serving cells that are configured with a BWP with two different values for the coresetPoolIndex in these lists.</td>
</tr>
<tr>
<td><strong>simultaneousSpatial-UpdatedList1, simultaneousSpatial-UpdatedList2</strong></td>
<td>List of serving cells which can be updated simultaneously for spatial relation with a MAC CE. The simultaneousSpatial-UpdatedList1 and simultaneousSpatial-UpdatedList2 shall not contain same serving cells. Network should not configure serving cells that are configured with a BWP with two different values for the coresetPoolIndex in these lists.</td>
</tr>
<tr>
<td><strong>spCellConfig</strong></td>
<td>Parameters for the SpCell of this cell group (PCell of MCG or PCell of SCG).</td>
</tr>
<tr>
<td><strong>uplinkTxSwitchingOption</strong></td>
<td>Indicates which option is configured for dynamic UL Tx switching for inter-band UL CA or (NG)EN-DC. The field is set to switchedUL if network configures option 1 as specified in TS 38.214 [19], or dualUL if network configures option 2 as specified in TS 38.214 [19]. Network always configures UE with a value for this field in inter-band UL CA case and (NG)EN-DC case where UE supports dynamic UL TX switching.</td>
</tr>
<tr>
<td><strong>uplinkTxSwitchingPowerBoosting</strong></td>
<td>Indicates whether the UE is allowed to enable 3dB boosting on the maximum output power for transmission on carrier2 under the operation state in which 2-port transmission can be supported on carrier2 for inter-band UL CA case with dynamic UL TX switching as defined in TS 38.101-1 [15]. Network can only configure this field for dynamic UL Tx switching in inter-band UL CA case with power Class 3 as defined in TS 38.101-1 [15].</td>
</tr>
</tbody>
</table>
### DAPS-UplinkPowerConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>p-DAPS-Source</strong></td>
<td>The maximum total transmit power to be used by the UE in the source cell group during DAPS handover.</td>
</tr>
<tr>
<td><strong>p-DAPS-Target</strong></td>
<td>The maximum total transmit power to be used by the UE in the target cell group during DAPS handover.</td>
</tr>
<tr>
<td><strong>uplinkPowerSharingDAPS-Mode</strong></td>
<td>Indicates the uplink power sharing mode that the UE uses in DAPS handover (see TS 38.213 [13]).</td>
</tr>
</tbody>
</table>

### ReconfigurationWithSync field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>rach-ConfigDedicated</strong></td>
<td>Random access configuration to be used for the reconfiguration with sync (e.g. handover). The UE performs the RA according to these parameters in the firstActiveUplinkBWP (see UplinkConfig).</td>
</tr>
<tr>
<td><strong>smtc</strong></td>
<td>The SSB periodicity/offset/duration configuration of target cell for NR PSCell change, NR PCell change and NR PSCell addition. The network sets the periodicityAndOffset to indicate the same periodicity as ssb-peractivityServingCell in spCellConfigCommon. For case of NR PCell change and NR PSCell addition, the smtc is based on the timing reference of (source) PCell. For case of NR PSCell change, it is based on the timing reference of source PSCell. If both this field and targetCellSMT-C-SCG are absent, the UE uses the SMTC in the measObjectNR having the same SSB frequency and subcarrier spacing, as configured before the reception of the RRC message.</td>
</tr>
</tbody>
</table>

### SCellConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>smtc</strong></td>
<td>The SSB periodicity/offset/duration configuration of target cell for NR SCell addition. The network sets the periodicityAndOffset to indicate the same periodicity as ssb-periodicityServingCell in sCellConfigCommon. The smtc is based on the timing of the SpCell of associated cell group. In case of inter-RAT handover to NR, the timing reference is the NR PCell. In case of intra-NR PCell change (standalone NR) or NR PSCell change (EN-DC), the timing reference is the target SpCell. If the field is absent, the UE uses the SMTC in the measObjectNR having the same SSB frequency and subcarrier spacing, as configured before the reception of the RRC message.</td>
</tr>
</tbody>
</table>

### SpCellConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>reconfigurationWithSync</strong></td>
<td>Parameters for the synchronous reconfiguration to the target SpCell.</td>
</tr>
<tr>
<td><strong>rlf-TimersAndConstants</strong></td>
<td>Timers and constants for detecting and triggering cell-level radio link failure. For the SCG, rlf-TimersAndConstants can only be set to setup and is always included at SCG addition.</td>
</tr>
<tr>
<td><strong>servCellIndex</strong></td>
<td>Serving cell ID of a PCell. The PCell of the Master Cell Group uses ID = 0.</td>
</tr>
<tr>
<td>Conditional Presence</td>
<td>Explanation</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>BWP-Reconfig</td>
<td>The field is optionally present, Need N, if the BWP are reconfigured or if serving cells are added or removed. Otherwise it is absent.</td>
</tr>
<tr>
<td>DRX-Config2</td>
<td>The field is optionally present, Need N, if drx-ConfigSecondaryGroup is configured. It is absent otherwise.</td>
</tr>
</tbody>
</table>
| ReconfigWithSync     | The field is mandatory present in the RRCReconfiguration message:  
- in each configured CellGroupConfig for which the SpCell changes,  
- in the masterCellGroup at change of AS security key derived from KgNB,  
- in the secondaryCellGroup at:  
  - PCell addition,  
  - SCG resume with NR-DC or (NG)EN-DC,  
  - update of required SI for PCell,  
  - change of AS security key derived from S-KgNB while the UE is configured with at least one radio bearer with keyToUse set to secondary and that is not released by this RRCReconfiguration message,  
Otherwise, it is optionally present, need M. The field is absent in the masterCellGroup in RRCResume and RRCSetup messages and is absent in the masterCellGroup in RRCReconfiguration messages if source configuration is not released during DAPS handover. |
| SCellAdd             | The field is mandatory present upon SCell addition; otherwise it is absent, Need M. |
| SCellAddMod          | The field is mandatory present upon SCell addition; otherwise it is optionally present, need M. |
| SCellAddSync         | The field is optionally present, Need N, in case of SCell addition, reconfiguration with sync, and resuming an RRC connection. It is absent otherwise. |
| SCG                  | The field is mandatory present in an SpCellConfig for the PCell. It is absent otherwise. |

**NOTE:** In case of change of AS security key derived from S-KgNB/S-KgNB, if reconfigurationWithSync is not included in the masterCellGroup, the network releases all existing MCG RLC bearers associated with a radio bearer with keyToUse set to secondary. In case of change of AS security key derived from KgNB/KgNB, if reconfigurationWithSync is not included in the secondaryCellGroup, the network releases all existing SCG RLC bearers associated with a radio bearer with keyToUse set to primary.

---

**CellGroupId**

The IE CellGroupId is used to identify a cell group. Value 0 identifies the master cell group. Other values identify secondary cell groups. In this version of the specification only values 0 and 1 are supported.

**CellGroupId information element**

```
   -- ASN1START
   -- TAG=CELLGROUPID--START

CellGroupId ::= INTEGER {0..maxSecondaryCellGroups}

   -- TAG=CELLGROUPID--STOP
   -- ASN1STOP
```

---

**ETSI**
**CellIdentity**

The IE *CellIdentity* is used to unambiguously identify a cell within a PLMN.

*CellIdentity* information element

```plaintext
-- ASN1START
-- TAG-CELLIDENTITY-START
CellIdentity ::=               BIT STRING (SIZE (36))
-- TAG-CELLIDENTITY-STOP
-- ASN1STOP
```

**CellReselectionPriority**

The IE *CellReselectionPriority* concerns the absolute priority of the concerned carrier frequency, as used by the cell reselection procedure. Corresponds to parameter "priority" in TS 38.304 [20]. Value 0 means lowest priority. The UE behaviour for the case the field is absent, if applicable, is specified in TS 38.304 [20].

*CellReselectionPriority* information element

```plaintext
-- ASN1START
-- TAG-CELLRESELECTIONPRIORITY-START
CellReselectionPriority ::=            INTEGER (0..7)
-- TAG-CELLRESELECTIONPRIORITY-STOP
-- ASN1STOP
```

**CellReselectionSubPriority**

The IE *CellReselectionSubPriority* indicates a fractional value to be added to the value of *cellReselectionPriority* to obtain the absolute priority of the concerned carrier frequency for E-UTRA and NR. Value *oDot2* corresponds to 0.2, value *oDot4* corresponds to 0.4 and so on.

*CellReselectionSubPriority* information element

```plaintext
-- ASN1START
-- TAG-CELLRESELECTIONSUBPRIORITY-START
CellReselectionSubPriority ::=          ENUMERATED {oDot2, oDot4, oDot6, oDot8}
-- TAG-CELLRESELECTIONSUBPRIORITY-STOP
-- ASN1STOP
```
The IE CGI-InfoEUTRA indicates EUTRA cell access related information, which is reported by the UE as part of E-UTRA report CGI procedure.

**CGI-InfoEUTRA information element**

```asn1
CGI-InfoEUTRA ::=                        SEQUENCE {
    cgi-info-EPC                            SEQUENCE {
        cgi-info-EPC-legacy                 CellAccessRelatedInfo-EUTRA-EPC,
        cgi-info-EPC-list                   SEQUENCE (SIZE (1..maxPLMN)) OF CellAccessRelatedInfo-EUTRA-EPC             OPTIONAL,
    }                                                                                                                   OPTIONAL,
    cgi-info-5GC                            SEQUENCE (SIZE (1..maxPLMN)) OF CellAccessRelatedInfo-EUTRA-5GC             OPTIONAL,
    freqBandIndicator                       FreqBandIndicatorEUTRA,                                      OPTIONAL,
    multiBandInfoList                       MultiBandInfoListEUTRA                                                      OPTIONAL,
    freqBandIndicatorPriority               ENUMERATED {true}                                                           OPTIONAL
}
```

The IE CGI-InfoEUTRALogging indicates EUTRA cell related information, which is reported by the UE as part of RLF reporting procedure.

**CGI-InfoEUTRALogging information element**

```asn1
CGI-InfoEUTRALogging ::=         SEQUENCE {
    plmn-Identity-eutra-5gc          PLMN-Identity                                          OPTIONAL,
    trackingAreaCode-eutra-5gc       TrackingAreaCode                                       OPTIONAL,
    cellIdentity-eutra-5gc           BIT STRING (SIZE (28))                                 OPTIONAL,
    plmn-Identity-eutra-epc          PLMN-Identity                                          OPTIONAL,
    trackingAreaCode-eutra-epc       BIT STRING (SIZE (16))                                     OPTIONAL,
    cellIdentity-eutra-epc           BIT STRING (SIZE (28))                                 OPTIONAL
}
```
<table>
<thead>
<tr>
<th><strong>CGI-InfoEUTRA-Logging field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cellIdentity-eutra-epc, cellIdentity-eutra-5GC</strong></td>
</tr>
<tr>
<td>Unambiguously identify a cell within the context of the PLMN. It belongs the first PLMN entry of <code>plmn-IdentityList</code> (when connected to EPC) or of <code>plmn-IdentityList-r15</code> (when connected to 5GC) in <code>SystemInformationBlockType1</code>.</td>
</tr>
<tr>
<td><strong>plmn-Identity-eutra-epc, plmn-Identity-eutra-5GC</strong></td>
</tr>
<tr>
<td>Identifies the PLMN of the cell for the reported <code>cellIdentity</code>: the first PLMN entry of <code>plmn-IdentityList</code> (when connected to EPC) or of <code>plmn-IdentityList-r15</code> (when connected to 5GC) in <code>SystemInformationBlockType1</code> that contained the reported <code>cellIdentity</code>.</td>
</tr>
<tr>
<td><strong>trackingAreaCode-eutra-epc, trackingAreaCode-eutra-5gc</strong></td>
</tr>
<tr>
<td>Indicates Tracking Area Code to which the cell indicated by <code>cellIdentity-eutra-epc, cellIdentity-eutra-5GC</code> belongs.</td>
</tr>
</tbody>
</table>

---

**CGI-InfoNR**

The IE `CGI-InfoNR` indicates cell access related information, which is reported by the UE as part of report CGI procedure.

**CGI-InfoNR information element**

```asn
CGI-InfoNR ::= SEQUENCE {

  plmn-IdentityInfoList  PLMN-IdentityInfoList OPTIONAL,

  frequencyBandList      MultiFrequencyBandListNR OPTIONAL,

  noSIB1                  SEQUENCE {
    ssb-SubcarrierOffset  INTEGER (0..15),
    pdcch-ConfigSIB1      PDCCCH-ConfigSIB1 OPTIONAL,
  },

  ...,  
  [[
    npn-IdentityInfoList-r16  NPN-IdentityInfoList-r16 OPTIONAL
  ]]

}"
```

---

**CGI-InfoNR field descriptions**

<table>
<thead>
<tr>
<th><strong>noSIB1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains <code>ssb-SubcarrierOffset</code> and <code>pdcch-ConfigSIB1</code> fields acquired by the UE from <code>MIB</code> of the cell for which report CGI procedure was requested by the network in case <code>SIB1</code> was not broadcast by the cell.</td>
</tr>
</tbody>
</table>

---

**CGI-Info-Logging**

The IE `CGI-Info-Logging` indicates the NR Cell Global Identifier (NCGI) for logging purposes (e.g. RLF report), the globally unique identity, and the TAC information of a cell in NR.
**CGI-Info-Logging** information element

```asn1
CGI-Info-Logging-r16 ::= SEQUENCE {
PLMN-Identity-r16 PLMN-Identity, 
cellIdentity-r16 CellIdentity, 
trackingAreaCode-r16 TrackingAreaCode OPTIONAL }
```

**CGI-Info-Logging** field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cellIdentity</td>
<td>Unambiguously identify a cell within the context of the PLMN. It belongs the first PLMN-IdentityInfo IE of PLMN-IdentityInfoList in SIB1.</td>
</tr>
<tr>
<td>plmn-Identity</td>
<td>Identifies the PLMN of the cell for the reported cellIdentity; the first PLMN entry of plmn-IdentityList (in SIB1) in the instance of PLMN-IdentityInfoList that contained the reported cellIdentity.</td>
</tr>
<tr>
<td>trackingAreaCode</td>
<td>Indicates Tracking Area Code to which the cell indicated by cellIdentity field belongs.</td>
</tr>
</tbody>
</table>

---

**CLI-RSSI-Range**

The IE **CLI-RSSI-Range** specifies the value range used in CLI-RSSI measurements and thresholds. The integer value for CLI-RSSI measurements is according to Table [FFS] in TS 38.133 [14].

```asn1
CLI-RSSI-Range-r16 ::= INTEGER(0..76)
```

---

**CodebookConfig**

The IE **CodebookConfig** is used to configure codebooks of Type-I and Type-II (see TS 38.214 [19], clause 5.2.2.2)
**CodebookConfig** information element

```
CodebookConfig ::= SEQUENCE {
  codebookType                                        CHOICE {
    type1                                               SEQUENCE {
      subtype                                             CHOICE {
        typeI-SinglePanel                                   SEQUENCE {
          nrOfAntennaPorts                                    CHOICE {
            two                                                 SEQUENCE {
              twoTX-CodebookSubsetRestriction                     BIT STRING (SIZE (6))
            },
            moreThanTwo                                        SEQUENCE {
              n1-n2                                               CHOICE {
                two-two-TypeI-SinglePanel-Restriction                BIT STRING (SIZE (8)),
                two-two-TypeI-SinglePanel-Restriction                BIT STRING (SIZE (64)),
                three-two-TypeI-SinglePanel-Restriction               BIT STRING (SIZE (96)),
                six-one-TypeI-SinglePanel-Restriction                 BIT STRING (SIZE (24)),
                four-two-TypeI-SinglePanel-Restriction                BIT STRING (SIZE (128)),
                eight-one-TypeI-SinglePanel-Restriction               BIT STRING (SIZE (32)),
                four-three-TypeI-SinglePanel-Restriction              BIT STRING (SIZE (192)),
                six-two-TypeI-SinglePanel-Restriction                 BIT STRING (SIZE (192)),
                twelve-one-TypeI-SinglePanel-Restriction              BIT STRING (SIZE (48)),
                four-four-One-TypeI-SinglePanel-Restriction            BIT STRING (SIZE (16)),
                eight-two-TypeI-SinglePanel-Restriction               BIT STRING (SIZE (256)),
                sixteen-one-TypeI-SinglePanel-Restriction             BIT STRING (SIZE (64))
            },
            typeI-SinglePanel-codebookSubsetRestriction-i2      BIT STRING (SIZE (16))        OPTIONAL    -- Need R
          },
          typeI-SinglePanel-ri-Restriction                    BIT STRING (SIZE (8))
        },
        typeI-MultiPanel                                    SEQUENCE {
          ng-n1-n2                                                CHOICE {
            two-two-one-TypeI-MultiPanel-Restriction                BIT STRING (SIZE (8)),
            two-two-four-One-TypeI-MultiPanel-Restriction            BIT STRING (SIZE (16)),
            four-two-one-TypeI-MultiPanel-Restriction                BIT STRING (SIZE (8)),
            two-two-two-TypeI-MultiPanel-Restriction                 BIT STRING (SIZE (64)),
            two-eight-one-TypeI-MultiPanel-Restriction               BIT STRING (SIZE (32)),
            four-four-one-TypeI-MultiPanel-Restriction              BIT STRING (SIZE (16)),
            two-four-two-TypeI-MultiPanel-Restriction                BIT STRING (SIZE (128)),
            four-two-two-TypeI-MultiPanel-Restriction               BIT STRING (SIZE (64))
          },
          ri-Restriction                          BIT STRING (SIZE (4))
        }
      }
    },
    type2                                   SEQUENCE {
      subtype                                             CHOICE {
      }
    }
  }
  codebookMode                                        INTEGER (1..2)
}
```
CodebookConfig-r16 ::= SEQUENCE {
  codebookType CHOICE {
    type2 SEQUENCE {
      subType CHOICE {
        typeII-r16 SEQUENCE {
          n1-n2-codebookSubsetRestriction-r16 CHOICE {
            two-one BIT STRING (SIZE (16)),
            two-two BIT STRING (SIZE (43)),
            four-one BIT STRING (SIZE (32)),
            three-two BIT STRING (SIZE (59)),
            six-one BIT STRING (SIZE (48)),
            four-two BIT STRING (SIZE (75)),
            eight-one BIT STRING (SIZE (64)),
            four-three BIT STRING (SIZE (107)),
            six-two BIT STRING (SIZE (48)),
            twelve-one BIT STRING (SIZE (139)),
            four-four BIT STRING (SIZE (139)),
            sixteen-one BIT STRING (SIZE (128))
          },
          typeII-RI-Restriction-r16 BIT STRING (SIZE (4))
        },
        typeII-PortSelection-r16 SEQUENCE {
          portSelectionSamplingSize-r16 ENUMERATED {n1, n2, n3, n4} OPTIONAL, -- Need R
        }
      }
    }
  }
}

phaseAlphabetSize ENUMERATED {n4, n8},
subbandAmplitude BOOLEAN,
numberOfBeams ENUMERATED {two, three, four}
typeII-PortSelectionRI-Restriction-r16  BIT STRING (SIZE (4))
}

numberOfPMI-SubbandsPerCQI-Subband-r16  INTEGER (1..2),
paramCombination-r16  INTEGER (1..8)
}
**CodebookConfig field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>codebookMode</td>
<td>CodebookMode as specified in TS 38.214 [19], clause 5.2.2.2.</td>
</tr>
<tr>
<td>codebookType</td>
<td>CodebookType including possibly sub-types and the corresponding parameters for each (see TS 38.214 [19], clause 5.2.2.2).</td>
</tr>
<tr>
<td>n1-n2-codebookSubsetRestriction</td>
<td>Number of antenna ports in first (n1) and second (n2) dimension and codebook subset restriction (see TS 38.214 [19] clause 5.2.2.2.3). Number of bits for codebook subset restriction is CEIL(log2(nchoosek(O1<em>O2,4)))+8</em>n1*n2 where nchoosek(a,b) = a!/(b!(a-b)!).</td>
</tr>
<tr>
<td>n1-n2</td>
<td>Number of antenna ports in first (n1) and second (n2) dimension and codebook subset restriction (see TS 38.214 [19] clause 5.2.2.2.1).</td>
</tr>
<tr>
<td>ng-n1-n2</td>
<td>Codebook subset restriction for Type I Multi-panel codebook (see TS 38.214 [19], clause 5.2.2.2.2).</td>
</tr>
<tr>
<td>numberOfBeams</td>
<td>Number of beams, L, used for linear combination.</td>
</tr>
<tr>
<td>numberOfPMI-SubbandsPerCQI-Subband</td>
<td>Field indicates how PMI subbands are defined per CQI subband according to TS 38.214 [19], clause 5.2.2.2.5.</td>
</tr>
<tr>
<td>paramCombination</td>
<td>Field describes supported parameter combination (L, pθ, β) as specified in TS 38.214.</td>
</tr>
<tr>
<td>phaseAlphabetSize</td>
<td>The size of the PSK alphabet, QPSK or 8-PSK.</td>
</tr>
<tr>
<td>portSelectionSamplingSize</td>
<td>The size of the port selection codebook (parameter d), see TS 38.214 [19] clause 5.2.2.2.6.</td>
</tr>
<tr>
<td>ri-Restriction</td>
<td>Restriction for RI for TypeI-MultiPanel-RI-Restriction (see TS 38.214 [19], clause 5.2.2.2.2).</td>
</tr>
<tr>
<td>subbandAmplitude</td>
<td>If subband amplitude reporting is activated (true).</td>
</tr>
<tr>
<td>twoTX-CodebookSubsetRestriction</td>
<td>Codebook subset restriction for 2TX codebook (see TS 38.214 [19] clause 5.2.2.2.1).</td>
</tr>
<tr>
<td>typeI-SinglePanel-codebookSubsetRestriction-i2</td>
<td>i2 codebook subset restriction for Type I Single-panel codebook used when reportQuantity is CRI/Ri/i1/CQI (see TS 38.214 [19] clause 5.2.2.2.1).</td>
</tr>
<tr>
<td>typeI-SinglePanel-ri-Restriction</td>
<td>Restriction for RI for TypeI-SinglePanel-RI-Restriction (see TS 38.214 [19], clause 5.2.2.2.1).</td>
</tr>
<tr>
<td>typeII-PortSelectionRI-Restriction</td>
<td>Restriction for RI for TypeII-PortSelection-RI-Restriction (see TS 38.214 [19], clauses 5.2.2.2.4 and 5.2.2.2.6).</td>
</tr>
<tr>
<td>typeII-RI-Restriction</td>
<td>Restriction for RI for TypeII-RI-Restriction (see TS 38.214 [19], clauses 5.2.2.2.3 and 5.2.2.2.5).</td>
</tr>
</tbody>
</table>

---

**CommonLocationInfo**

The IE `CommonLocationInfo` is used to transfer detailed location information available at the UE to correlate measurements and UE position information.

---

**CommonLocationInfo information element**
CommonLocationInfo-r16 ::= SEQUENCE {
  gnss-TOD- msec-r16       OCTET STRING     OPTIONAL,
  locationTimestamp-r16    OCTET STRING     OPTIONAL,
  locationCoordinate-r16   OCTET STRING     OPTIONAL,
  locationError-r16        OCTET STRING     OPTIONAL,
  locationSource-r16       OCTET STRING     OPTIONAL,
  velocityEstimate-r16     OCTET STRING     OPTIONAL
}

-- TAG-COMMONLOCATIONINFO-STOP
-- ASN1STOP

<table>
<thead>
<tr>
<th>CommonLocationInfo field descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LocationTimeSta</strong>m<strong>p</strong></td>
</tr>
<tr>
<td>Parameter type DisplacementTimeSta<strong>m</strong>p defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.</td>
</tr>
<tr>
<td><strong>locationCoordinate</strong></td>
</tr>
<tr>
<td>Parameter type LocationCoordinates defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.</td>
</tr>
<tr>
<td><strong>locationError</strong></td>
</tr>
<tr>
<td>Parameter LocationError defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.</td>
</tr>
<tr>
<td><strong>locationSource</strong></td>
</tr>
<tr>
<td>Parameter LocationSource defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.</td>
</tr>
<tr>
<td><strong>velocityEstimate</strong></td>
</tr>
<tr>
<td>Parameter type Velocity defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.</td>
</tr>
</tbody>
</table>

---

**CondReconfigId**

The IE CondReconfigId is used to identify a CHO or CPC configuration.

**CondReconfigId information element**

---

CondReconfigId-r16 ::= INTEGER (1.. maxNrofCondCells-r16)

---

**CondReconfigToAddModList**

The IE CondReconfigToAddModList concerns a list of conditional reconfigurations to add or modify, with for each entry the condReconfigId and the associated condExecutionCond and condRRCReconfig.
**CondReconfigToAddModList information element**

```
-- ASN1START
-- TAG-CONDRECONFIGTOADDMODLIST-START
CondReconfigToAddModList-r16 ::= SEQUENCE (SIZE (1.. maxNrofCondCells-r16)) OF CondReconfigToAddMod-r16
CondReconfigToAddMod-r16 ::= SEQUENCE {
  condReconfigId-r16               CondReconfigId-r16,
  condExecutionCond-r16            SEQUENCE (SIZE (1..2)) OF MeasId OPTIONAL, -- Cond condReconfigAdd
  condRRCReconfig-r16             OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL, -- Cond condReconfigAdd
  ...
}
```

**CondReconfigToAddMod field descriptions**

- **condExecutionCond**
  The execution condition that needs to be fulfilled in order to trigger the execution of a conditional reconfiguration. When configuring 2 triggering events (Meas Ids) for a candidate cell, network ensures that both refer to the same measObject.

- **condRRCReconfig**
  The RRCReconfiguration message to be applied when the condition(s) are fulfilled. The RRCReconfiguration message contained in condRRCReconfig cannot contain the field conditionalReconfiguration or the field daps-Config.

### Conditional Presence

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>condReconfigAdd</td>
<td>The field is mandatory present when a condReconfigId is being added. Otherwise the field is optional, need M.</td>
</tr>
</tbody>
</table>

---

**ConditionalReconfiguration**

The IE **ConditionalReconfiguration** is used to add, modify and release the configuration of conditional reconfiguration.

**ConditionalReconfiguration information element**

```
-- ASN1START
-- TAG-CONDITIONALRECONFIGURATION-START
ConditionalReconfiguration-r16 ::= SEQUENCE {
  attemptCondReconfig-r16         ENUMERATED {true} OPTIONAL, -- Cond CHO
  condReconfigToRemoveList-r16    CondReconfigToRemoveList-r16 OPTIONAL, -- Need N
  condReconfigToAddModList-r16    CondReconfigToAddModList-r16 OPTIONAL, -- Need N
  ...
}
CondReconfigToRemoveList-r16 ::= SEQUENCE (SIZE (1.. maxNrofCondCells-r16)) OF CondReconfigId-r16
```

---
Conditional Reconfiguration field descriptions

attemptCondReconfig
If present, the UE shall perform conditional reconfiguration if selected cell is a target candidate cell and it is the first cell selection after failure as described in clause 5.3.7.3.

condReconfigToAddModList
List of the configuration of candidate SpCells to be added or modified for CHO or CPC.

condReconfigToRemoveList
List of the configuration of candidate SpCells to be removed.

---

**ConfiguredGrantConfig**

The IE ConfiguredGrantConfig is used to configure uplink transmission without dynamic grant according to two possible schemes. The actual uplink grant may either be configured via RRC (type1) or provided via the PDCCH (addressed to CS-RNTI) (type2). Multiple Configured Grant configurations may be configured in one BWP of a serving cell.

---

**ConfiguredGrantConfig** information element

---

```asn1
ConfiguredGrantConfig ::= SEQUENCE {
    frequencyHopping ENUMERATED {intraSlot, interSlot} OPTIONAL, -- Need S
    cg-DMRS-Configuration DMRS-UplinkConfig,              OPTIONAL, -- Need S
    mcs-Table       ENUMERATED {qam256, qam64LowSE}        OPTIONAL, -- Need S
    mcs-TableTransformPrecoder ENUMERATED {qam256, qam64LowSE} OPTIONAL, -- Need S
    uci-OnPUSCH     SetupRelease { CG-UCI-OnPUSCH },       OPTIONAL, -- Need M
    resourceAllocation ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch }, OPTIONAL, -- Need S
    rbg-Size        ENUMERATED {config2} OPTIONAL, -- Need S
    powerControlLoopToUse ENUMERATED {n0, n1},             OPTIONAL, -- Need S
    transformPrecoder ENUMERATED {enabled, disabled}           OPTIONAL, -- Need S
    p0-PUSCH-Alphas P0-PUSCH-AlphaSetId,                    OPTIONAL, -- Need S
    nrofHARQ-Processes INTEGER(1..16),                      OPTIONAL, -- Need S
    repK            ENUMERATED {n1, n2, n4, n8},           OPTIONAL, -- Need R
    repK-BV         ENUMERATED {s1-0231, s2-0303, s3-0000} OPTIONAL, -- Need R
    periodicity     ENUMERATED {sym2, sym7, sym1x14, sym2x14, sym4x14, sym5x14, sym8x14, sym10x14, sym16x14, sym20x14, sym32x14, sym40x14, sym64x14, sym80x14, sym128x14, sym160x14, sym256x14, sym320x14, sym512x14, sym640x14, sym1024x14, sym1280x14} OPTIONAL, -- Need R
    ...}
```
configuredGrantTimer INTEGER (1..64) OPTIONAL, -- Need R

rrc-ConfiguredUplinkGrant SEQUENCE {
timeDomainOffset INTEGER (0..5119),
timeDomainAllocation INTEGER (0..15),
frequencyDomainAllocation BIT STRING (SIZE(18)),
antennaPort INTEGER (0..31),
dmrs-SeqInitialization INTEGER (0..1) OPTIONAL, -- Need R
precodingAndNumberOfLayers INTEGER (0..63),
srs-ResourceIndicator INTEGER (0..15) OPTIONAL, -- Need R
frequencyHoppingOffset INTEGER (1.. maxNrofPhysicalResourceBlocks-1),
pathlossReferenceIndex INTEGER (0..maxNrofPUSCH-PatchlossReferenceRSs-1),
...,
[[
pusch-RepTypeIndicator-r16 ENUMERATED {pusch-RepTypeA, pusch-RepTypeB} OPTIONAL, -- Need M
frequencyHoppingPUSCH-RepTypeB-r16 ENUMERATED {interRepetition, interSlot} OPTIONAL, -- Cond RepTypeB
timeReferenceSFN-r16 ENUMERATED {sfn512} OPTIONAL -- Need S
]]} OPTIONAL, -- Need R

..., [[]
cg-RetransmissionTimer-r16 INTEGER (1..64) OPTIONAL, -- Need R
cg-minDFI-Delay-r16 ENUMERATED {
sym7, sym1x14, sym2x14, sym3x14, sym4x14, sym5x14, sym6x14, sym7x14, sym8x14,
sym9x14, sym10x14, sym11x14, sym12x14, sym13x14, sym14x14, sym15x14, sym16x14
} OPTIONAL, -- Need R
cg-nrofPUSCH-InSlot-r16 INTEGER (1..7) OPTIONAL, -- Need R
cg-nrofSlots-r16 INTEGER (1..40) OPTIONAL, -- Need R
cg-StartingOffsets-r16 CG-StartingOffsets-r16 OPTIONAL, -- Need R
cg-UCI-Multiplexing-r16 ENUMERATED {enabled} OPTIONAL, -- Need R
betaOffsetCG-UCI-r16 INTEGER (0..31) OPTIONAL, -- Need R
cg-COT-SharingList-r16 SEQUENCE (SIZE (1..1709)) OF CG-COT-Sharing-r16 OPTIONAL, -- Need R
harq-ProcID-Offset-r16 INTEGER (0..15) OPTIONAL, -- Need M
harq-ProcID-Offset2-r16 INTEGER (0..65) OPTIONAL, -- Need M
configuredGrantConfigIndex-r16 ConfiguredGrantConfigIndex-r16 OPTIONAL, -- Cond CG-List
configuredGrantConfigIndexMAC-r16 ConfiguredGrantConfigIndexMAC-r16 OPTIONAL, -- Cond CG-IndexMAC
periodicityExt-r16 INTEGER (0..6879) OPTIONAL, -- Need R
startingFromRV0-r16 ENUMERATED {on, off} OPTIONAL, -- Need R
phy-PriorityIndex-r16 ENUMERATED {p0, p1} OPTIONAL, -- Need R
autonomousTx-r16 ENUMERATED {enabled} OPTIONAL -- Cond LCH-BasedPrioritization
}

CG-UCI-OnPUSCH := CHOICE {
dynamic dynamic
semiStatic semiStatic
}

CG-COT-Sharing-r16 := CHOICE {
noCOT-Sharing-r16 NULL,
cot-Sharing-r16 SEQUENCE {
...
duration-r16 INTEGER (1..39),
offset-r16 INTEGER (1..39),
channelAccessPriority-r16 INTEGER (1..4)
}

CG-StartingOffsets-r16 ::= SEQUENCE {
cg-StartingFullBW-InsideCOT-r16 SEQUENCE (SIZE (1..7)) OF INTEGER (0..6) OPTIONAL, -- Need R
cg-StartingFullBW-OutsideCOT-r16 SEQUENCE (SIZE (1..7)) OF INTEGER (0..6) OPTIONAL, -- Need R
cg-StartingPartialBW-InsideCOT-r16 INTEGER (0..6) OPTIONAL, -- Need R
cg-StartingPartialBW-OutsideCOT-r16 INTEGER (0..6) OPTIONAL -- Need R
}

-- TAG-CONFIGUREDGRANTCONFIG-STOP
-- ASN1STOP
<table>
<thead>
<tr>
<th><strong>ConfiguredGrantConfig</strong> field descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>antennaPort</strong></td>
</tr>
<tr>
<td>Indicates the antenna port(s) to be used for this configuration, and the maximum bitwidth is 5. See TS 38.214 [19], clause 6.1.2, and TS 38.212 [17], clause 7.3.1.</td>
</tr>
<tr>
<td><strong>autonomousTx</strong></td>
</tr>
<tr>
<td>If this field is present, the Configured Grant configuration is configured with autonomous transmission, see TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>betaOffsetCG-UCI</strong></td>
</tr>
<tr>
<td>Beta offset for CG-UCI in CG-PUSCH, see TS 38.213 [13], clause 9.3</td>
</tr>
<tr>
<td><strong>cg-COT-SharingList</strong></td>
</tr>
<tr>
<td>Indicates a table for COT sharing combinations (see 37.213 [48], clause 4.1.3). One row of the table can be set to noCOT-Sharing to indicate that there is no channel occupancy sharing.</td>
</tr>
<tr>
<td><strong>cg-COT-SharingOffset</strong></td>
</tr>
<tr>
<td>Indicates the offset from the end of the slot where the COT sharing indication in UCI is enabled where the offset in symbols is equal to 14*n, where n is the signaled value for cg-COT-SharingOffset. Applicable when ul-toDL-COT-SharingED-Threshold-r16 is not configured (see 37.213 [48], clause 4.1.3).</td>
</tr>
<tr>
<td><strong>cg-DMRS-Configuration</strong></td>
</tr>
<tr>
<td>DMRs configuration (see TS 38.214 [19], clause 6.1.2.3).</td>
</tr>
<tr>
<td><strong>cg-minDFI-Delay</strong></td>
</tr>
<tr>
<td>Indicates the minimum duration (in unit of symbols) from the ending symbol of the PUSCH to the starting symbol of the PDCCH containing the downlink feedback indication (DFI) carrying HARQ-ACK for this PUSCH. The HARQ-ACK received before this minimum duration is not considered as valid for this PUSCH (see TS 38.213 [13], clause 10.5). The following minimum duration values are supported, depending on the configured subcarrier spacing [symbols]:</td>
</tr>
<tr>
<td>15 kHz: 7, m*14, where m = {1, 2, 3, 4}</td>
</tr>
<tr>
<td>30 kHz: 7, m*14, where m = {1, 2, 3, 4, 5, 6, 7, 8}</td>
</tr>
<tr>
<td>60 kHz: 7, m*14, where m = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16}</td>
</tr>
<tr>
<td><strong>cg-nrofPUSCH-InSlot</strong></td>
</tr>
<tr>
<td>Indicates the number of consecutive PUSCH configured to CG within a slot where the SLIV indicating the first PUSCH and additional PUSCH appended with the same length (see TS 38.214 [19], clause 6.1.2.3).</td>
</tr>
<tr>
<td><strong>cg-nrofSlots</strong></td>
</tr>
<tr>
<td>Indicates the number of allocated slots in a configured grant periodicity following the time instance of configured grant offset (see TS 38.214 [19], clause 6.1.2.3).</td>
</tr>
<tr>
<td><strong>cg-RetransmissionTimer</strong></td>
</tr>
<tr>
<td>Indicates the initial value of the configured retransmission timer (see TS 38.321 [3]) in multiples of periodicity. The value of cg-RetransmissionTimer is always less than or equal to the value of configuredGrantTimer. This field is always configured for operation with shared spectrum channel access together with harq-ProcID-Offset. This field is not configured for operation in licensed spectrum or simultaneously with harq-ProcID-Offset2.</td>
</tr>
<tr>
<td><strong>cg-UCI-Multiplexing</strong></td>
</tr>
<tr>
<td>If present, this field indicates that in the case of PUCCH overlapping with CG-PUSCH(s) within a PUCCH group, the CG-UCI and HARQ-ACK are jointly encoded (see TS 38.213 [13], clause 9).</td>
</tr>
<tr>
<td><strong>configuredGrantConfigIndex</strong></td>
</tr>
<tr>
<td>Indicates the index of the Configured Grant configurations within the BWP.</td>
</tr>
<tr>
<td><strong>configuredGrantConfigIndexMAC</strong></td>
</tr>
<tr>
<td>Indicates the index of the Configured Grant configurations within the MAC entity.</td>
</tr>
<tr>
<td><strong>configuredGrantTimer</strong></td>
</tr>
<tr>
<td>Indicates the initial value of the configured grant timer (see TS 38.321 [3]) in multiples of periodicity. When cg-RetransmissionTimer is configured, if HARQ processes are shared among different configured grants on the same BWP, configuredGrantTimer * periodicity is set to the same value for the configurations that share HARQ processes on this BWP.</td>
</tr>
<tr>
<td><strong>dmrs-SeqInitialization</strong></td>
</tr>
<tr>
<td>The network configures this field if transformPrecoder is disabled. Otherwise the field is absent.</td>
</tr>
<tr>
<td><strong>frequencyDomainAllocation</strong></td>
</tr>
<tr>
<td>Indicates the frequency domain resource allocation, see TS 38.214 [19], clause 6.1.2, and TS 38.212 [17], clause 7.3.1).</td>
</tr>
</tbody>
</table>
**frequencyHopping**  
The value `intraSlot` enables 'Intra-slot frequency hopping' and the value `interSlot` enables 'Inter-slot frequency hopping'. If the field is absent, frequency hopping is not configured. The field `frequencyHopping` applies to configured grant for 'pusch-RepTypeA' (see TS 38.214 [19], clause 6.3.1).

**frequencyHoppingOffset**  
Frequency hopping offset used when frequency hopping is enabled (see TS 38.214 [19], clause 6.1.2 and clause 6.3).

**frequencyHoppingPUSCH-RepTypeB**  
Indicates the frequency hopping scheme for Type 1 CG when `pusch-RepTypeIndicator` is set to 'pusch-RepTypeB' (see TS 38.214 [19], clause 6.1). The value `interRepetition` enables 'Inter-repetition frequency hopping', and the value `interSlot` enables 'Inter-slot frequency hopping'. If the field is absent, the frequency hopping is not enabled for Type 1 CG.

**harq-ProcID-Offset**  
For operation with shared spectrum channel access, this configures the range of HARQ process IDs which can be used for this configured grant where the UE can select a HARQ process ID within `[harq-procID-offset, ..., (harq-procID-offset + nrofHARQ-Processes − 1)]`.

**harq-ProcID-Offset2**  
Indicates the offset used in deriving the HARQ process IDs, see TS 38.321 [3], clause 5.4.1. This field is not configured for operation with shared spectrum channel access.

**mcs-Table**  
Indicates the MCS table the UE shall use for PUSCH without transform precoding. If the field is absent the UE applies the value `qam64`.

**mcs-TableTransformPrecoder**  
Indicates the MCS table the UE shall use for PUSCH with transform precoding. If the field is absent the UE applies the value `qam64`.

**mcsAndTBS**  
The modulation order, target code rate and TB size (see TS 38.214 [19], clause 6.1.2). The NW does not configure the values 28–31 in this version of the specification.

**nrofHARQ-Processes**  
The number of HARQ processes configured. It applies for both Type 1 and Type 2. See TS 38.321 [3], clause 5.4.1.

**p0-PUSCH-Alpha**  
Index of the `P0-PUSCH-AlphaSet` to be used for this configuration.

**periodicity**  
Periodicity for UL transmission without UL grant for type 1 and type 2 (see TS 38.321 [3], clause 5.8.2). The following periodicities are supported depending on the configured subcarrier spacing [symbols]:

- **15 kHz:** 2, 7, n*14, where n={1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 320, 640}
- **30 kHz:** 2, 7, n*14, where n={1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 256, 320, 640, 1280}
- **60 kHz with normal CP:** 2, 7, n*14, where n={1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 256, 320, 512, 640, 1280, 2560}
- **60 kHz with ECP:** 2, 6, n*12, where n={1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 256, 320, 512, 640, 1280, 2560}
- **120 kHz:** 2, 7, n*14, where n={1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 256, 320, 512, 640, 1024, 1280, 2560, 5120}

**periodicityExt**  
This field is used to calculate the periodicity for UL transmission without UL grant for type 1 and type 2 (see TS 38.321 [3], clause 5.8.2). If this field is present, the field `periodicity` is ignored. The following periodicities are supported depending on the configured subcarrier spacing [symbols]:

- **15 kHz:** `periodicityExt*14`, where `periodicityExt` has a value between 1 and 640.
- **30 kHz:** `periodicityExt*14`, where `periodicityExt` has a value between 1 and 1280.
- **60 kHz with normal CP:** `periodicityExt*14`, where `periodicityExt` has a value between 1 and 2560.
- **60 kHz with ECP:** `periodicityExt*12`, where `periodicityExt` has a value between 1 and 2560.
- **120 kHz:** `periodicityExt*14`, where `periodicityExt` has a value between 1 and 5120.

**phy-PriorityIndex**  
Indicates the PHY priority of CG PUSCH at least for PHY-layer collision handling. Value `p0` indicates low priority and value `p1` indicates high priority.

**powerControlLoopToUse**  
Closed control loop to apply (see TS 38.213 [13], clause 7.1.1).
| **pusch-RepTypeIndicator** | Indicates whether UE follows the behavior for PUSCH repetition type A or the behavior for PUSCH repetition type B for each Type 1 configured grant configuration. The value `pusch-RepTypeA` enables the ‘PUSCH repetition type A’ and the value `pusch-RepTypeB` enables the ‘PUSCH repetition type B’ (see TS 38.214 [19], clause 6.1.2.3). |
| **rbg-Size** | Selection between configuration 1 and configuration 2 for RBG size for PUSCH. The UE does not apply this field if `resourceAllocation` is set to `resourceAllocationType1`. Otherwise, the UE applies the value `config1` when the field is absent. Note: `rbg-Size` is used when the `transformPrecoder` parameter is disabled. |
| **repK** | The redundancy version (RV) sequence to use. See TS 38.214 [19], clause 6.1.2. The network configures this field if repetitions are used, i.e., if `repK` is set to `n2`, `n4` or `n8`. This field is not configured when `cg-RetransmissionTimer` is configured. Otherwise, the field is absent. |
| **repK-RV** | The redundancy version (RV) sequence to use. See TS 38.214 [19], clause 6.1.2. The network configures this field if repetitions are used, i.e., if `repK` is set to `n2`, `n4` or `n8`. This field is not configured when `cg-RetransmissionTimer` is configured. Otherwise, the field is absent. |
| **resourceAllocation** | Configuration of resource allocation type 0 and resource allocation type 1. For Type 1 UL data transmission without grant, `resourceAllocation` should be `resourceAllocationType0` or `resourceAllocationType1`. |
| **rrc-ConfiguredUplinkGrant** | Configuration for “configured grant” transmission with fully RRC-configured UL grant (Type1). If this field is absent the UE uses UL grant configured by DCI addressed to CS-RNTI (Type2). Type 1 configured grant may be configured for UL or SUL, but not for both simultaneously. |
| **srs-ResourceIndicator** | Indicates the SRS resource to be used. |
| **startingFromRV0** | This field is used to determine the initial transmission occasion of a transport block for a given RV sequence, see TS 38.214 [19], clause 6.1.2.3.1. |
| **timeDomainAllocation** | Indicates a combination of start symbol and length and PUSCH mapping type, see TS 38.214 [19], clause 6.1.2 and TS 38.212 [17], clause 7.3.1. |
| **timeDomainOffset** | Offset related to the reference SFN indicated by `timeReferenceSFN`, see TS 38.321 [3], clause 5.8.2. |
| **timeReferenceSFN** | Indicates SFN used for determination of the offset of a resource in time domain. The UE uses the closest SFN with the indicated number preceding the reception of the configured grant configuration, see TS 38.321 [3], clause 5.8.2. If the field `timeReferenceSFN` is not present, the reference SFN is 0. |
| **transformPrecoder** | Enables or disables transform precoding for `type1` and `type2`. If the field is absent, the UE enables or disables transform precoding in accordance with the field `msg3-transformPrecoder` in RACH-ConfigCommon, see TS 38.214 [19], clause 6.1.3. |
| **uci-OnPUSCH** | Selection between and configuration of dynamic and semi-static beta-offset. For Type 1 UL data transmission without grant, `uci-OnPUSCH` should be set to `semiStatic`. |

### CG-COT-Sharing field descriptions

| **channelAccessPriority** | Indicates the Channel Access Priority Class that the gNB can assume when sharing the UE initiated COT (see 37.213 [48], clause 4.1.3). |
| **duration** | Indicates the number of DL transmission slots within UE initiated COT (see 37.213 [48], clause 4.1.3). |
| **offset** | Indicates the number of DL transmission slots from the end of the slot where CG-UCI is detected after which COT sharing can be used (see 37.213 [48], clause 4.1.3). |
### CG-StartingOffsets field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cg-StartingFullBW-InsideCOT</strong></td>
<td>A set of configured grant PUSCH transmission starting offsets which indicates the length of a CP extension of the first symbol that is located before the configured resource when frequency domain resource allocation includes all interlaces in the allocated RB set(s) and the CG PUSCH resource is inside gNB COT (see TS 38.214 [19], clause 6.1.2.3).</td>
</tr>
<tr>
<td><strong>cg-StartingFullBW-OutsideCOT</strong></td>
<td>A set of configured grant PUSCH transmission starting offset indices (see TS 38.211[16], Table 5.3.1-2) which indicates the length of a CP extension of the first symbol that is located before the configured resource when frequency domain resource allocation includes all interlaces in the allocated RB set(s) and the CG PUSCH resource is outside gNB COT (see TS 38.214 [19], clause 6.1.2.3).</td>
</tr>
<tr>
<td><strong>cg-StartingPartialBW-InsideCOT</strong></td>
<td>A set of configured grant PUSCH transmission starting offset index (see TS 38.211[16], Table 5.3.1-2) which indicates the length of a CP extension of the first symbol that is located before the configured resource when frequency domain resource allocation does not include all interlaces in the allocated RB set(s) and the CG PUSCH resource is inside gNB COT (see TS 38.214 [19], clause 6.1.2.3).</td>
</tr>
<tr>
<td><strong>cg-StartingPartialBW-OutsideCOT</strong></td>
<td>A set of configured grant PUSCH transmission starting offset index (see TS 38.211[16], Table 5.3.1-2) which indicates the length of a CP extension of the first symbol that is located before the configured resource when frequency domain resource allocation does not include all interlaces in the allocated RB set(s) and the CG PUSCH resource is outside gNB COT (see TS 38.214 [19], clause 6.1.2.3).</td>
</tr>
</tbody>
</table>

### Conditional Presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCH-BasedPrioritization</td>
<td>This field is optionally present, Need R, if <em>LCH-BasedPrioritization</em> is configured in the MAC entity. It is absent otherwise.</td>
</tr>
<tr>
<td>RepTypeB</td>
<td>The field is optionally present if <em>pusch-RepTypeIndicator</em> is set to <em>pusch-RepTypeB</em>, Need S, and absent otherwise.</td>
</tr>
<tr>
<td>CG-List</td>
<td>The field is mandatory present when included in <em>configuredGrantConfigToAddModList-r16</em>, otherwise the field is absent.</td>
</tr>
<tr>
<td>CG-IndexMAC</td>
<td>The field is mandatory present if at least one configured grant is configured by <em>configuredGrantConfigToAddModList-r16</em> in any BWP of this MAC entity, otherwise it is optionally present, need R.</td>
</tr>
</tbody>
</table>

### ConfiguredGrantConfigIndex

The IE *ConfiguredGrantConfigIndex* is used to indicate the index of one of multiple UL Configured Grant configurations in one BWP.

**ConfiguredGrantConfigIndex information element**

```asn1
-- ASN1START
-- TAG-CONFIGUREDGRANTCONFIGINDEX-START

ConfiguredGrantConfigIndex-r16 ::= INTEGER {0.. maxNrofConfiguredGrantConfig-r16-1}

-- TAG-CONFIGUREDGRANTCONFIGINDEX-STOP
-- ASN1STOP
```

### ConfiguredGrantConfigIndexMAC

The IE *ConfiguredGrantConfigIndexMAC* is used to indicate the unique Configured Grant configurations index per MAC entity.
ConfiguredGrantConfigIndexMAC information element

-- ASN1START
-- TAG-CONFIGUREDGRANTCONFIGINDEXMAC-START
ConfiguredGrantConfigIndexMAC-r16 ::= INTEGER (0.. maxNrofConfiguredGrantConfigMAC-r16-1)
-- TAG-CONFIGUREDGRANTCONFIGINDEXMAC-STOP
-- ASN1STOP

-- ConnEstFailureControl

The IE ConnEstFailureControl is used to configure parameters for connection establishment failure control.

ConnEstFailureControl information element

-- ASN1START
-- TAG-CONNESTFAILURECONTROL-START
ConnEstFailureControl ::=   SEQUENCE {
   connEstFailCount                    ENUMERATED {n1, n2, n3, n4},
   connEstFailOffsetValidity           ENUMERATED {s30, s60, s120, s240, s300, s420, s600, s900},
   connEstFailOffset                   INTEGER (0..15)                                                         OPTIONAL    -- Need S
}
-- TAG-CONNESTFAILURECONTROL-STOP
-- ASN1STOP

-- ConnEstFailureControl field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>connEstFailCount</td>
<td>Number of times that the UE detects T300 expiry on the same cell before applying connEstFailOffset.</td>
</tr>
<tr>
<td>connEstFailOffset</td>
<td>Parameter &quot;Qoffsettemp&quot; in TS 38.304 [20]. If the field is absent, the value of infinity shall be used for &quot;Qoffsettemp&quot;.</td>
</tr>
<tr>
<td>connEstFailOffsetValidity</td>
<td>Amount of time that the UE applies connEstFailOffset before removing the offset from evaluation of the cell. Value s30 corresponds to 30 seconds, value s60 corresponds to 60 seconds, and so on.</td>
</tr>
</tbody>
</table>

ControlResourceSet

The IE ControlResourceSet is used to configure a time/frequency control resource set (CORESET) in which to search for downlink control information (see TS 38.213 [13], clause 10.1).
ControlResourceSet information element

ControlResourceSet ::= SEQUENCE {
    controlResourceSetId ControlResourceSetId,
    frequencyDomainResources BIT STRING (SIZE (45)),
    duration INTEGER (1..maxCoReSetDuration),
    cce-REG-MappingType CHOICE {
        interleaved SEQUENCE {
            reg-BundleSize ENUMERATED {n2, n3, n6},
            interleaverSize ENUMERATED {n2, n3, n6},
            shiftIndex INTEGER(0..maxNrofPhysicalResourceBlocks-1) OPTIONAL -- Need S
        },
        nonInterleaved NULL
    },
    precoderGranularity ENUMERATED {sameAsREG-bundle, allContiguousRBs},
    tci-StatesPDCCH-ToAddList SEQUENCE (SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId OPTIONAL, -- Cond NotSIB1-initialBWP
    tci-StatesPDCCH-ToReleaseList SEQUENCE (SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId OPTIONAL, -- Cond NotSIB1-initialBWP
    tci-PresentInDCI ENUMERATED {enabled} OPTIONAL, -- Need S
    pdcch-DMRS-ScramblingID INTEGER (0..65535) OPTIONAL, -- Need S
    rb-Offset-r16 INTEGER (0..5) OPTIONAL, -- Need S
    tci-PresentDCI-1-2-r16 INTEGER (1..3) OPTIONAL, -- Need S
    coresetPoolIndex-r16 INTEGER (0..1) OPTIONAL, -- Need S
    controlResourceSetId-v1610 ControlResourceSetId-v1610 OPTIONAL -- Need S
}
### ControlResourceSet field descriptions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cc-REG-MappingType</strong></td>
<td>Mapping of Control Channel Elements (CCE) to Resource Element Groups (REG) (see TS 38.211 [16], clauses 7.3.2.2 and 7.4.1.3.2).</td>
</tr>
<tr>
<td><strong>controlResourceSetId</strong></td>
<td>Identifies the instance of the ControlResourceSet IE. Value 0 identifies the common CORESET configured in MIB and in ServingCellConfigCommon (controlResourceSetZero) and is hence not used here in the ControlResourceSet IE. Other values identify CORESETs configured by dedicated signalling or in SIB1. The controlResourceSetId is unique among the BWPs of a serving cell. If the field controlResourceSetId-v1610 is present, the UE shall ignore the controlResourceSetId field (without suffix).</td>
</tr>
<tr>
<td><strong>coresetPoolIndex</strong></td>
<td>The index of the CORESET pool for this CORESET as specified in TS 38.213 [13] (clauses 9 and 10) and TS 38.214 [19] (clauses 5.1 and 6.1). If the field is absent, the UE applies the value 0.</td>
</tr>
<tr>
<td><strong>duration</strong></td>
<td>Contiguous time duration of the CORESET in number of symbols (see TS 38.211 [16], clause 7.3.2.2).</td>
</tr>
<tr>
<td><strong>frequencyDomainResources</strong></td>
<td>Frequency domain resources for the CORESET. Each bit corresponds a group of 6 RBs, with grouping starting from the first RB group in the BWP. When at least one search space is configured with freqMonitorLocation-r16, only the first NBB_Let16 bits are valid (see TS 38.213 [13], clause 10.1). The first (left-most / most significant) bit corresponds to the first RB group in the BWP, and so on. A bit that is set to 1 indicates that this RB group belongs to the frequency domain resource of this CORESET. Bits corresponding to a group of RBs not fully contained in the bandwidth part within which the CORESET is configured are set to zero (see TS 38.211 [16], clause 7.3.2.2).</td>
</tr>
<tr>
<td><strong>interleaverSize</strong></td>
<td>Interleaver size (see TS 38.211 [16], clause 7.3.2.2).</td>
</tr>
<tr>
<td><strong>pdcch-DMRS-ScramblingID</strong></td>
<td>PDCCH DMRS scrambling initialization (see TS 38.211 [16], clause 7.4.1.3.1). When the field is absent the UE applies the value of the physCellId configured for this serving cell.</td>
</tr>
<tr>
<td><strong>precoderGranularity</strong></td>
<td>Precoder granularity in frequency domain (see TS 38.211 [16], clauses 7.3.2.2 and 7.4.1.3.2).</td>
</tr>
<tr>
<td><strong>rb-Offset</strong></td>
<td>Indicates the RB level offset in units of RB from the first RB of the first 6RB group to the first RB of BWP (see TS 38.213 [13], clause 10.1). When the field is absent, the UE applies the value 0.</td>
</tr>
<tr>
<td><strong>reg-BundleSize</strong></td>
<td>Resource Element Groups (REGs) can be bundled to create REG bundles. This parameter defines the size of such bundles (see TS 38.211 [16], clause 7.3.2.2).</td>
</tr>
<tr>
<td><strong>shiftIndex</strong></td>
<td>When the field is absent the UE applies the value of the physCellId configured for this serving cell (see TS 38.211 [16], clause 7.3.2.2).</td>
</tr>
<tr>
<td><strong>tci-PresentInDCI</strong></td>
<td>This field indicates if TCI field is present or absent in DCI format 1_1. When the field is absent the UE considers the TCI to be absent/disabled. In case of cross carrier scheduling, the network sets this field to enabled for the ControlResourceSet used for cross carrier scheduling in the scheduling cell (see TS 38.214 [19], clause 5.1.5).</td>
</tr>
<tr>
<td><strong>tci-PresentDCI-1-2</strong></td>
<td>Configures the number of bits for &quot;Transmission configuration indicator&quot; in DCI format 1_2. When the field is absent the UE applies the value of 0 bit for the &quot;Transmission configuration indicator&quot; in DCI format 1_2 (see TS 38.212, clause 7.3.1 and TS 38.214, clause 5.1.5).</td>
</tr>
<tr>
<td><strong>tci-StatesPDCCH-ToAddList</strong></td>
<td>A subset of the TCI states defined in pdsch-Config included in the BWP-DownlinkDedicated corresponding to the serving cell and to the DL BWP to which the ControlResourceSet belong to. They are used for providing QCL relationships between the DL RS(s) in one RS Set (TCI-State) and the PDCCH DMRS ports (see TS 38.213 [13], clause 6.). The network configures at most maxNrofTCI-StatesPDCCH entries.</td>
</tr>
</tbody>
</table>
### Conditional Presence

<table>
<thead>
<tr>
<th>NotSIB1-initialBWP</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The field is absent in SIB1 and in the PDCCH-ConfigCommon of the initial BWP in ServingCellConfigCommon, if SIB1 is broadcasted. Otherwise, it is optionally present, Need N.</td>
</tr>
</tbody>
</table>

### ControlResourceSetId

The ControlResourceSetId IE concerns a short identity, used to identify a control resource set within a serving cell. The ControlResourceSetId = 0 identifies the ControlResourceSet#0 configured via PBCH (MIB) and in controlResourceSetZero (ServingCellConfigCommon). The ID space is used across the BWPs of a Serving Cell.

**ControlResourceSetId information element**

```asn1
ControlResourceSetId ::= INTEGER (0..maxNrofControlResourceSets-1)
ControlResourceSetId-r16 ::= INTEGER (0..maxNrofControlResourceSets-1-r16)
ControlResourceSetId-v1610 ::= INTEGER (maxNrofControlResourceSets..maxNrofControlResourceSets-1-r16)
```

### ControlResourceSetZero

The IE ControlResourceSetZero is used to configure CORESET#0 of the initial BWP (see TS 38.213 [13], clause 13).

**ControlResourceSetZero information element**

```asn1
ControlResourceSetZero ::= INTEGER (0..15)
```

### CrossCarrierSchedulingConfig

The IE CrossCarrierSchedulingConfig is used to specify the configuration when the cross-carrier scheduling is used in a cell.

**CrossCarrierSchedulingConfig information element**

```asn1
```
CrossCarrierSchedulingConfig field descriptions

**carrierIndicatorSizeDCI-0-2, carrierIndicatorSizeDCI-1-2**
Configures the number of bits for the field of carrier indicator in PDCCH DCI format 0_2/1_2. The field `carrierIndicatorSizeDCI-0-2` refers to DCI format 0_2 and the field `carrierIndicatorSizeDCI-1-2` refers to DCI format 1_2, respectively (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 10.1).

**cif-Presence**
The field is used to indicate whether carrier indicator field is present (value `true`) or not (value `false`) in PDCCH DCI formats, see TS 38.213 [13]. If `cif-Presence` is set to `true`, the CIF value indicating a grant or assignment for this cell is 0.

**cif-InSchedulingCell**
The field indicates the CIF value used in the scheduling cell to indicate a grant or assignment applicable for this cell, see TS 38.213 [13].

**enableDefaultBeamForCCS**
This field indicates whether default beam selection for cross-carrier scheduled PDSCH is enabled, see TS 38.214 [19]. If not present, the default beam selection behaviour is not applied, i.e. Rel-15 behaviour is applied.

**other**
Parameters for cross-carrier scheduling, i.e., a serving cell is scheduled by a PDCCH on another (scheduling) cell. The network configures this field only for SCells.

**own**
Parameters for self-scheduling, i.e., a serving cell is scheduled by its own PDCCH.

**schedulingCellId**
Indicates which cell signals the downlink allocations and uplink grants, if applicable, for the concerned SCell. In case the UE is configured with DC, the scheduling cell is part of the same cell group (i.e. MCG or SCG) as the scheduled cell. If `drx-ConfigSecondaryGroup` is configured in the `MAC-CellGroupConfig` associated with this serving cell, the scheduling cell and the scheduled cell belong to the same Frequency Range.
Conditional Presence | Explanation
--- | ---
CIF-PRESENCE | The field is mandatory present if the cif-Presence is set to true. The field is absent otherwise.

---

CSI-AperiodicTriggerStateList

The CSI-AperiodicTriggerStateList IE is used to configure the UE with a list of aperiodic trigger states. Each codepoint of the DCI field "CSI request" is associated with one trigger state (see TS 38.321 [3], clause 6.1.3.13). Upon reception of the value associated with a trigger state, the UE will perform measurement of CSI-RS, CSI-IM and/or SSB (reference signals) and aperiodic reporting on L1 according to all entries in the associatedReportConfigInfoList for that trigger state.

**CSI-AperiodicTriggerStateList information element**

```asn1
CSI-AperiodicTriggerStateList ::= SEQUENCE (SIZE (1..maxNrOfCSI-AperiodicTriggers)) OF CSI-AperiodicTriggerState

CSI-AperiodicTriggerState ::= SEQUENCE {
  associatedReportConfigInfoList  SEQUENCE (SIZE(1..maxNrofReportConfigPerAperiodicTrigger)) OF CSI-AssociatedReportConfigInfo,
  ...}

CSI-AssociatedReportConfigInfo ::= SEQUENCE {
  reportConfigId                   CSI-ReportConfigId,
  resourcesForChannel              CHOICE {
    nzp-CSI-RS                        SEQUENCE {
      resourceSet                         INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig),
      qcl-info                            SEQUENCE (SIZE(1..maxNrofAP-CSI-RS-ResourcesPerSet)) OF TCI-StateId
    OPTIONAL -- Cond Aperiodic
    },
    csi-SSB-ResourceSet               INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfig)
  },
  csi-IM-ResourcesForInterference    INTEGER(1..maxNrofCSI-IM-ResourceSetsPerConfig) OPTIONAL, -- Cond CSI-IM-ForInterference
  nzp-CSI-RS-ResourcesForInterference INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig) OPTIONAL, -- Cond NZP-CSI-RS-ForInterference
  ...
}
```
CSI-AssociatedReportConfigInfo field descriptions

csi-IM-ResourcesForInterference
CSI-IM-ResourceSet for interference measurement. Entry number in csi-IM-ResourceSetList in the CSI-ResourceConfig indicated by csi-IM-ReportConfig identified by reportConfigId above (value 1 corresponds to the first entry, value 2 to the second entry, and so on). The indicated CSI-IM-ResourceSet should have exactly the same number of resources like the NZP-CSI-RS-ResourceSet indicated in nzp-CSI-RS-ResourcesForChannel.

csi-SSB-ResourceSet
CSI-SSB-ResourceSet for channel measurements. Entry number in csi-SSB-ResourceSetList in the CSI-ResourceConfig indicated by reportConfigId above (value 1 corresponds to the first entry, value 2 to the second entry, and so on).

nzp-CSI-RS-ResourcesForInterference
NZP-CSI-RS-ResourceSet for interference measurement. Entry number in nzp-CSI-RS-ResourceSetList in the CSI-ResourceConfig indicated by nzp-CSI-RS-ReportConfig identified by reportConfigId above (value 1 corresponds to the first entry, value 2 to the second entry, and so on).

qcl-info
List of references to TCI-States for providing the QCL source and QCL type for each NZP-CSI-RS-Resource listed in nzp-CSI-RS-Resources of the NZP-CSI-RS-ResourceSet indicated by nzp-CSI-RS-ReportConfig identified by reportConfigId above; otherwise it is absent.

reportConfigId
The reportConfigId of one of the CSI-ReportConfigToAddMod configured in CSI-MeasConfig.

resourceSet
NZP-CSI-RS-ResourceSet for channel measurements. Entry number in nzp-CSI-RS-ResourceSetList in the CSI-ResourceConfig indicated by nzp-CSI-RS-ReportConfig identified by reportConfigId above (value 1 corresponds to the first entry, value 2 to the second entry, and so on).

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aperiodic</td>
<td>The field is mandatory present if the NZP-CSI-RS-Resources in the associated resourceSet have the resourceType aperiodic. The field is absent otherwise.</td>
</tr>
<tr>
<td>CSI-IM-ForInterference</td>
<td>This field is mandatory present if the CSI-ReportConfig identified by reportConfigId is configured with csi-IM-ResourcesForInterference; otherwise it is absent.</td>
</tr>
<tr>
<td>NZP-CSI-RS-ForInterference</td>
<td>This field is mandatory present if the CSI-ReportConfig identified by reportConfigId is configured with nzp-CSI-RS-ResourcesForInterference; otherwise it is absent.</td>
</tr>
</tbody>
</table>

---

CSI-FrequencyOccupation

The IE CSI-FrequencyOccupation is used to configure the frequency domain occupation of a channel state information measurement resource (e.g. NZP-CSI-RS-Resource, CSI-IM-Resource).

CSI-FrequencyOccupation information element

---

-- ASN1START
-- TAG=CSI-FREQUENCYOCCUPATION--START

CSI-FrequencyOccupation ::= SEQUENCE {
startingRB INTEGER (0..maxNrofPhysicalResourceBlocks-1),
nroFRBs INTEGER (24..maxNrofPhysicalResourceBlocksPlus1),
...
CSI-FrequencyOccupation field descriptions

nrofRBs
Number of PRBs across which this CSI resource spans. Only multiples of 4 are allowed. The smallest configurable number is the minimum of 24 and the width of the associated BWP. If the configured value is larger than the width of the corresponding BWP, the UE shall assume that the actual CSI-RS bandwidth is equal to the width of the BWP.

startingRB
PRB where this CSI resource starts in relation to common resource block #0 (CRB#0) on the common resource block grid. Only multiples of 4 are allowed (0, 4, ...)

CSI-IM-Resource

The IE CSI-IM-Resource is used to configure one CSI Interference Management (IM) resource.

CSI-IM-Resource information element

CSI-IM-Resource ::= SEQUENCE {
  csi-IM-ResourceId            CSI-IM-ResourceId,
  csi-IM-ResourceElementPattern CSI-IM-ResourceElementPattern
    pattern0                  SEQUENCE {
      subcarrierLocation-p0                   ENUMERATED { s0, s2, s4, s6, s8, s10 },
      symbolLocation-p0                      INTEGER (0..12)
    },
    pattern1                  SEQUENCE {
      subcarrierLocation-p1                   ENUMERATED { s0, s4, s8 },
      symbolLocation-p1                      INTEGER (0..13)
    }
  freqBand                     CSI-FrequencyOccupation                         OPTIONAL,  -- Need M
  periodicityAndOffset         CSI-ResourcePeriodicityAndOffset                OPTIONAL,  -- Cond PeriodicOrSemiPersistent
...}

-- TAG-CSI-IM-RESOURCE-STOP
-- ASN1STOP
### CSI-IM-Resource field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>csi-IM-ResourceElementPattern</strong></td>
<td>The resource element pattern (Pattern0 (2,2) or Pattern1 (4,1)) with corresponding parameters (see TS 38.214 [19], clause 5.2.2.4)</td>
</tr>
<tr>
<td><strong>freqBand</strong></td>
<td>Frequency-occupancy of CSI-IM (see TS 38.214 [19], clause 5.2.2.4)</td>
</tr>
<tr>
<td><strong>periodicityAndOffset</strong></td>
<td>Periodicity and slot offset for periodic/semi-persistent CSI-IM. Network always configures the UE with a value for this field for periodic and semi-persistent CSI-IM-Resources (as indicated in CSI-ResourceConfig). A change of configuration between periodic or semi-persistent and aperiodic for a CSI-IM-Resource is not supported without a release and add.</td>
</tr>
<tr>
<td><strong>subcarrierLocation-p0</strong></td>
<td>OFDM subcarrier occupancy of the CSI-IM resource for Pattern0 (see TS 38.214 [19], clause 5.2.2.4)</td>
</tr>
<tr>
<td><strong>subcarrierLocation-p1</strong></td>
<td>OFDM subcarrier occupancy of the CSI-IM resource for Pattern1 (see TS 38.214 [19], clause 5.2.2.4)</td>
</tr>
<tr>
<td><strong>symbolLocation-p0</strong></td>
<td>OFDM symbol location of the CSI-IM resource for Pattern0 (see TS 38.214 [19], clause 5.2.2.4)</td>
</tr>
<tr>
<td><strong>symbolLocation-p1</strong></td>
<td>OFDM symbol location of the CSI-IM resource for Pattern1 (see TS 38.214 [19], clause 5.2.2.4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PeriodicOrSemiPersistent</strong></td>
<td>The field is optionally present, Need M, for periodic and semi-persistent CSI-IM-Resources (as indicated in CSI-ResourceConfig). The field is absent otherwise.</td>
</tr>
</tbody>
</table>

---

**CSI-IM-ResourceId**

The IE **CSI-IM-ResourceId** is used to identify one **CSI-IM-Resource**.

**CSI-IM-ResourceId** information element

```asn1
CSI-IM-ResourceId ::= INTEGER (0..maxNrofCSI-IM-Resources-1)
```

---

**CSI-IM-ResourceSet**

The IE **CSI-IM-ResourceSet** is used to configure a set of one or more CSI Interference Management (IM) resources (their IDs) and set-specific parameters.

**CSI-IM-ResourceSet** information element

```asn1
CSI-IM-ResourceSet ::= ...
```
CSI-IM-ResourceSet field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>csi-IM-Resources</td>
<td>Associated with this CSI-IM-ResourceSet (see TS 38.214 [19], clause 5.2).</td>
</tr>
</tbody>
</table>

- **CSI-IM-ResourceSetId**

  The IE CSI-IM-ResourceSetId is used to identify CSI-IM-ResourceSets.

  **CSI-IM-ResourceSetId** information element

  ```
  -- ASN1START
  -- TAG-CSI-IM-RESOURCESETID-START
  CSI-IM-ResourceSetId ::= INTEGER (0..maxNrofCSI-IM-ResourceSets-1)
  -- TAG-CSI-IM-RESOURCESETID-STOP
  -- ASN1STOP
  ```

- **CSI-MeasConfig**

  The IE CSI-MeasConfig is used to configure CSI-RS (reference signals) belonging to the serving cell in which CSI-MeasConfig is included, channel state information reports to be transmitted on PUCCH on the serving cell in which CSI-MeasConfig is included and channel state information reports on PUSCH triggered by DCI received on the serving cell in which CSI-MeasConfig is included. See also TS 38.214 [19], clause 5.2.

  **CSI-MeasConfig** information element

  ```
  -- ASN1START
  -- TAG-CSI-MEASCONFIG-START
  CSI-MeasConfig ::= SEQUENCE {
    nzp-CSI-RS-ResourceToAddModList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-Resources)) OF NZP-CSI-RS-Resource OPTIONAL, -- Need N
    nzp-CSI-RS-ResourceToReleaseList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-Resources)) OF NZP-CSI-RS-ResourceId OPTIONAL, -- Need N
    nzp-CSI-RS-ResourceSetToAddModList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSets)) OF NZP-CSI-RS-ResourceSet OPTIONAL, -- Need N
    nzp-CSI-RS-ResourceSetToReleaseList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSets)) OF NZP-CSI-RS-ResourceIdId OPTIONAL, -- Need N
  }
  -- TAG-CSI-MEASCONFIG-STOP
  ```
CSI-MeasConfig field descriptions

aperiodicTriggerStateList
Contains trigger states for dynamically selecting one or more aperiodic and semi-persistent reporting configurations and/or triggering one or more aperiodic CSI-RS resource sets for channel and/or interference measurement (see TS 38.214 [19], clause 5.2.1).

csi-IM-ResourceSetToAddModList
Pool of CSI-IM-ResourceSet which can be referred to from CSI-ResourceConfig or from MAC CEs.

csi-IM-ResourceToReleaseList
Pool of CSI-IM-Resource which can be referred to from CSI-ResourceConfig.

csi-ReportConfigToAddModList

csi-ResourceConfigToAddModList
Configured CSI resource settings as specified in TS 38.214 [19] clause 5.2.1.2.

csi-SSB-ResourceSetToAddModList
Pool of CSI-SSB-ResourceSet which can be referred to from CSI-ResourceConfig.

reportTriggerSize, reportTriggerSizeDCI-0-2
Size of CSI request field in DCI (bits) (see TS 38.214 [19], clause 5.2.1.5.1). The field reportTriggerSize applies to DCI format 0_1 and the field reportTriggerSizeDCI-0-2 applies to DCI format 0_2 (see TS 38.214 [19], clause 5.2.1.5.1).
CSI-ReportConfig

The IE CSI-ReportConfig is used to configure a periodic or semi-persistent report sent on PUCCH on the cell in which the CSI-ReportConfig is included, or to configure a semi-persistent or aperiodic report sent on PUSCH triggered by DCI received on the cell in which the CSI-ReportConfig is included (in this case, the cell on which the report is sent is determined by the received DCI). See TS 38.214 [19], clause 5.2.1.

**CSI-ReportConfig information element**

```asn1
CSI-ReportConfig ::= SEQUENCE {
  reportConfigId                          CSI-ReportConfigId,   OPTIONAL,   -- Need S
  carrier                                 ServCellIndex                   OPTIONAL,   -- Need S
  resourcesForChannelMeasurement          CSI-ResourceConfigId,     csi-IM-ResourcesForInterference         CSI-ResourceConfigId            OPTIONAL,   -- Need R
  nzp-CSI-RS-ResourcesForInterference     CSI-ResourceConfigId            OPTIONAL,   -- Need R
  reportConfigType                        CHOICE {
    periodic                                SEQUENCE {
      reportSlotConfig                        CSI-ReportPeriodicityAndOffset,
      pucch-CSI-ResourceList                  SEQUENCE (SIZE (1..maxNrofBWPs)) OF PUCCH-CSI-Resource
    },
    semiPersistentOnPUCCH                   SEQUENCE {
      reportSlotConfig                        CSI-ReportPeriodicityAndOffset,
      pucch-CSI-ResourceList                  SEQUENCE (SIZE (1..maxNrofBWPs)) OF PUCCH-CSI-Resource
    },
    semiPersistentOnPUSCH                   SEQUENCE {
      reportSlotConfig                        ENUMERATED {sl5, sl10, sl20, sl40, sl80, sl160, sl320},
      reportSlotOffsetList                SEQUENCE (SIZE (1..maxNrofUL-Allocations)) OF INTEGER(0..32),
      p0alpha                                 P0-PUSCH-AlphaSetId         }
  },
  aperiodic                               SEQUENCE {
    reportSlotOffsetList                SEQUENCE (SIZE (1..maxNrofUL-Allocations)) OF INTEGER(0..32)
  },
  reportQuantity                          CHOICE {
    none                                    NULL,   OPTIONAL,   -- Need S
    cri-RI-PMI-CQI                          NULL,   OPTIONAL,   -- Need S
    cri-RI-i1-CQI                           NULL,   OPTIONAL,   -- Need S
    cri-RSRP                                 NULL,   OPTIONAL,   -- Need S
    cri-RI-LI-PMI-CQI                       NULL,   OPTIONAL,   -- Need S
    pdusch-BundleSizeForCSI                 ENUMERATED {n2, n4}                                         OPTIONAL    -- Need S
  },
  cqi-FormatIndicator                     ENUMERATED { widebandCQI, subbandCQI }
  pmi-FormatIndicator                     ENUMERATED { widebandPMI, subbandPMI }
  csi-ReportingBand                       CHOICE {
    subbands3
  }
}
```
subbands4 BIT STRING(SIZE(4)),
subbands5 BIT STRING(SIZE(5)),
subbands6 BIT STRING(SIZE(6)),
subbands7 BIT STRING(SIZE(7)),
subbands8 BIT STRING(SIZE(8)),
subbands9 BIT STRING(SIZE(9)),
subbands10 BIT STRING(SIZE(10)),
subbands11 BIT STRING(SIZE(11)),
subbands12 BIT STRING(SIZE(12)),
subbands13 BIT STRING(SIZE(13)),
subbands14 BIT STRING(SIZE(14)),
subbands15 BIT STRING(SIZE(15)),
subbands16 BIT STRING(SIZE(16)),
subbands17 BIT STRING(SIZE(17)),
subbands18 BIT STRING(SIZE(18)),
...,
subbands19-v1530 BIT STRING(SIZE(19))
} OPTIONAL -- Need S
}

} OPTIONAL, -- Need R
timeRestrictionForChannelMeasurements ENUMERATED {configured, notConfigured},
timeRestrictionForInterferenceMeasurements ENUMERATED {configured, notConfigured},
codebookConfig CodebookConfig OPTIONAL, -- Need R
dummy ENUMERATED {n1, n2}

groupBasedBeamReporting CHOICE {
  enabled NULL,
  disabled SEQUENCE {
    nrofReportedRS ENUMERATED {n1, n2, n3, n4} OPTIONAL -- Need S
  }
},
cqi-Table ENUMERATED {table1, table2, table3, spare1} OPTIONAL, -- Need R
subbandSize ENUMERATED {value1, value2},
non-PMI-PortIndication SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerConfig)) OF PortIndexFor8Ranks OPTIONAL, -- Need R
...,
[[
semiPersistentOnPUSCH-v1530 SEQUENCE {
  reportSlotConfig-v1530 ENUMERATED {s14, s18, s116} OPTIONAL -- Need R
}
]},
[[
semiPersistentOnPUSCH-v1610 SEQUENCE {
  reportSlotOffsetListDCI-0-2-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R
  reportSlotOffsetListDCI-0-1-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R
}
aperiodic-v1610 SEQUENCE {
  reportSlotOffsetListDCI-0-2-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R
  reportSlotOffsetListDCI-0-1-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R
}
reportQuantity-r16 CHOICE {
  cri-SINR-r16 NULL,
  ssb-Index-SINR-r16 NULL
} OPTIONAL, -- Need R
} codebookConfig-r16 CodebookConfig-r16 OPTIONAL -- Need R
]}

ETSI
CSI-ReportPeriodicityAndOffset ::= CHOICE {
  slots4                              INTEGER(0..3),
  slots5                              INTEGER(0..4),
  slots8                              INTEGER(0..7),
  slots10                             INTEGER(0..9),
  slots16                             INTEGER(0..15),
  slots20                             INTEGER(0..19),
  slots40                             INTEGER(0..39),
  slots80                             INTEGER(0..79),
  slots160                            INTEGER(0..159),
  slots320                            INTEGER(0..319)
}

PUCCH-CSI-Resource ::=              SEQUENCE {
  uplinkBandwidthPartId               BWP-Id,
  pucch-Resource                      PUCCH-ResourceId
}

PortIndexFor8Ranks ::=              CHOICE {
  portIndex8                          SEQUENCE{
    rank1-8                             PortIndex8                                                      OPTIONAL,   -- Need R
    rank2-8                             SEQUENCE(SIZE(2)) OF PortIndex8                                 OPTIONAL,   -- Need R
    rank3-8                             SEQUENCE(SIZE(3)) OF PortIndex8                                 OPTIONAL,   -- Need R
    rank4-8                             SEQUENCE(SIZE(4)) OF PortIndex8                                 OPTIONAL,   -- Need R
    rank5-8                             SEQUENCE(SIZE(5)) OF PortIndex8                                 OPTIONAL,   -- Need R
    rank6-8                             SEQUENCE(SIZE(6)) OF PortIndex8                                 OPTIONAL,   -- Need R
    rank7-8                             SEQUENCE(SIZE(7)) OF PortIndex8                                 OPTIONAL,   -- Need R
    rank8-8                             SEQUENCE(SIZE(8)) OF PortIndex8                                 OPTIONAL    -- Need R
  },
  portIndex4                          SEQUENCE{
    rank1-4                             PortIndex4                                                      OPTIONAL,   -- Need R
    rank2-4                             SEQUENCE(SIZE(2)) OF PortIndex4                                 OPTIONAL,   -- Need R
    rank3-4                             SEQUENCE(SIZE(3)) OF PortIndex4                                 OPTIONAL,   -- Need R
    rank4-4                             SEQUENCE(SIZE(4)) OF PortIndex4                                 OPTIONAL    -- Need R
  },
  portIndex2                          SEQUENCE{
    rank1-2                             PortIndex2                                                      OPTIONAL,   -- Need R
    rank2-2                             SEQUENCE(SIZE(2)) OF PortIndex2                                 OPTIONAL    -- Need R
  },
  portIndex1                          NULL
}

PortIndex8::=                       INTEGER (0..7)
PortIndex4::=                       INTEGER (0..3)
PortIndex2::=                       INTEGER (0..1)

-- TAG-CSI-REPORTCONFIG-STOP
-- ASN1STOP

ETSI
### CSI-ReportConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>carrier</td>
<td>Indicates in which serving cell the CSI-ResourceConfig indicated below are to be found. If the field is absent, the resources are on the same serving cell as this report configuration.</td>
</tr>
<tr>
<td>codebookConfig</td>
<td>Codebook configuration for Type-1 or Type-2 including codebook subset restriction. Network does not configure codebookConfig and codebookConfig-r16 simultaneously to a UE.</td>
</tr>
<tr>
<td>cqi-FormatIndicator</td>
<td>Indicates whether the UE shall report a single (wideband) or multiple (subband) CQI. (see TS 38.214 [19], clause 5.2.1.4).</td>
</tr>
<tr>
<td>cqi-Table</td>
<td>Which CQI table to use for CQI calculation (see TS 38.214 [19], clause 5.2.2.1).</td>
</tr>
<tr>
<td>csi-IM-ResourcesForInterference</td>
<td>CSI IM resources for interference measurement. csi-ResourceConfigId of a CSI-ResourceConfig included in the configuration of the serving cell indicated with the field &quot;carrier&quot; above. The CSI-ResourceConfig indicated here contains only CSI-IM resources. The bwp-Id in that CSI-ResourceConfig is the same value as the bwp-Id in the CSI-ResourceConfig indicated by resourcesForChannelMeasurement.</td>
</tr>
<tr>
<td>csi-ReportingBand</td>
<td>Indicates a contiguous or non-contiguous subset of subbands in the bandwidth part which CSI shall be reported for. Each bit in the bit-string represents one subband. The right-most bit in the bit string represents the lowest subband in the BWP. The choice determines the number of subbands (subbands3 for 3 subbands, subbands4 for 4 subbands, and so on) (see TS 38.214 [19], clause 5.2.1.4). This field is absent if there are less than 24 PRBs (no sub band) and present otherwise, the number of sub bands can be from 3 (24 PRBs, sub band size 8) to 18 (72 PRBs, sub band size 4).</td>
</tr>
<tr>
<td>dummy</td>
<td>This field is not used in the specification. If received it shall be ignored by the UE.</td>
</tr>
<tr>
<td>groupBasedBeamReporting</td>
<td>Turning on/off group beam based reporting (see TS 38.214 [19], clause 5.2.1.4).</td>
</tr>
<tr>
<td>non-PMI-PortIndication</td>
<td>Port indication for RI/CQI calculation. For each CSI-RS resource in the linked ResourceConfig for channel measurement, a port indication for each rank R, indicating which R ports to use. Applicable only for non-PMI feedback (see TS 38.214 [19], clause 5.2.1.4.2). The first entry in non-PMI-PortIndication corresponds to the NZP-CSI-RS-Resource indicated by the first entry in nzp-CSI-RS-Resources in the NZP-CSI-RS-ResourceSet indicated in the first entry of nzp-CSI-ResourceSetList of the CSI-ResourceConfig whose CSI-ResourceConfigId is indicated in a CSI-_measId together with the above CSI-ReportConfigId; the second entry in non-PMI-PortIndication corresponds to the NZP-CSI-RS-Resource indicated by the second entry in nzp-CSI-RS-Resources in the NZP-CSI-RS-ResourceSet indicated in the first entry of nzp-CSI-ResourceSetList of the same CSI-ResourceConfig, and so on until the NZP-CSI-RS-Resource indicated by the last entry in nzp-CSI-ResourceSetList of the in the NZP-CSI-RS-ResourceSet indicated in the first entry of nzp-CSI-ResourceSetList of the same CSI-ResourceConfig. Then the next entry corresponds to the NZP-CSI-RS-Resource indicated by the first entry in nzp-CSI-ResourceSetList of the same CSI-ResourceConfig and so on.</td>
</tr>
<tr>
<td>nrofReportedRS</td>
<td>The number (N) of measured RS resources to be reported per report setting in a non-group-based report. N &lt;= N_max, where N_max is either 2 or 4 depending on UE capability. (see TS 38.214 [19], clause 5.2.1.4) When the field is absent the UE applies the value 1.</td>
</tr>
<tr>
<td>nzp-CSI-ResourcesForInterference</td>
<td>NZP CSI RS resources for interference measurement. csi-ResourceConfigId of a CSI-ResourceConfig included in the configuration of the serving cell indicated with the field &quot;carrier&quot; above. The CSI-ResourceConfig indicated here contains only NZP-CSI-RS resources. The bwp-Id in that CSI-ResourceConfig is the same value as the bwp-Id in the CSI-ResourceConfig indicated by resourcesForChannelMeasurement.</td>
</tr>
<tr>
<td>p0alpha</td>
<td>Index of the p0-alpha set determining the power control for this CSI report transmission (see TS 38.214 [19], clause 6.2.1.2).</td>
</tr>
<tr>
<td>pdsch-BundleSizeForCSI</td>
<td>PRB bundling size to assume for CQI calculation when reportQuantity is CRI/I/II/CQI. If the field is absent, the UE assumes that no PRB bundling is applied (see TS 38.214 [19], clause 5.2.1.4.2).</td>
</tr>
</tbody>
</table>
**pmi-FormatIndicator**
Indicates whether the UE shall report a single (wideband) or multiple (subband) PMI. (see TS 38.214 [19], clause 5.2.1.4).

**pucch-CSI-ResourceList**
Indicates which PUCCH resource to use for reporting on PUCCH.

**reportConfigType**
Time domain behavior of reporting configuration.

**reportFreqConfiguration**
Reporting configuration in the frequency domain. (see TS 38.214 [19], clause 5.2.1.4).

**reportQuantity**
The CSI related quantities to report. see TS 38.214 [19], clause 5.2.1. If the field `reportQuantity-r16` is present, UE shall ignore `reportQuantity` (without suffix).

**reportSlotConfig**
Periodicity and slot offset (see TS 38.214 [19], clause 5.2.1.4). If the field `reportSlotConfig-v1530` is present, the UE shall ignore the value provided in `reportSlotConfig` (without suffix).

**reportSlotOffsetList, reportSlotOffsetListDCI-0-1, reportSlotOffsetListDCI-0-2**
Timing offset Y for semi persistent reporting using PUSCH. This field lists the allowed offset values. This list must have the same number of entries as the `pusch-TimeDomainAllocationList` in `PUSCH-Config`. A particular value is indicated in DCI. The network indicates in the DCI field of the UL grant, which of the configured report slot offsets the UE shall apply. The DCI value 0 corresponds to the first report slot offset in this list, the DCI value 1 corresponds to the second report slot offset in this list, and so on. The first report is transmitted in slot \(n+Y\), second report in \(n+Y+P\), where P is the configured periodicity. Timing offset Y for aperiodic reporting using PUSCH. This field lists the allowed offset values. This list must have the same number of entries as the `pusch-TimeDomainAllocationList` in `PUSCH-Config`. A particular value is indicated in DCI. The network indicates in the DCI field of the UL grant, which of the configured report slot offsets the UE shall apply. The DCI value 0 corresponds to the first report slot offset in this list, the DCI value 1 corresponds to the second report slot offset in this list, and so on (see TS 38.214 [19], clause 6.1.2.1). The field `reportSlotOffsetList` applies to DCI format 0_0, the field `reportSlotOffsetListDCI-0-1` applies to DCI format 0_1 and the field `reportSlotOffsetListDCI-0-2` applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.2.1).

**resourcesForChannelMeasurement**
Resources for channel measurement. `csi-ResourceConfigId` of a `CSI-ResourceConfig` included in the configuration of the serving cell indicated with the field "carrier" above. The `CSI-ResourceConfig` indicated here contains only NZP-CSI-RS resources and/or SSB resources. This `CSI-ReportConfig` is associated with the DL BWP indicated by `bwp-Id` in that `CSI-ResourceConfig`.

**subbandSize**
Indicates one out of two possible BWP-dependent values for the subband size as indicated in TS 38.214 [19], table 5.2.1.4-2. If `csi-ReportingBand` is absent, the UE shall ignore this field.

**timeRestrictionForChannelMeasurements**
Time domain measurement restriction for the channel (signal) measurements (see TS 38.214 [19], clause 5.2.1.1).

**timeRestrictionForInterferenceMeasurements**
Time domain measurement restriction for interference measurements (see TS 38.214 [19], clause 5.2.1.1).

**PortIndexForRanks field descriptions**

**portIndex8**
Port-Index configuration for up to rank 8. If present, the network configures port indexes for at least one of the ranks.

**portIndex4**
Port-Index configuration for up to rank 4. If present, the network configures port indexes for at least one of the ranks.

**portIndex2**
Port-Index configuration for up to rank 2. If present, the network configures port indexes for at least one of the ranks.

**portIndex1**
Port-Index configuration for rank 1.
**PUCCH-CSI-Resource field descriptions**

**PUCCH-Resource**

PUCCH resource for the associated uplink BWP. Only PUCCH-Resource of format 2, 3 and 4 is supported. The actual PUCCH-Resource is configured in **PUCCH-Config** and referred to by its ID. When two **PUCCH-Config** are configured within **PUCCH-ConfigurationList**, **PUCCH-ResourceId** in a **PUCCH-CSI-Resource** refers to a PUCCH-Resource in the **PUCCH-Config** used for HARQ-ACK with low priority.

---

**CSI-ReportConfigId**

The IE **CSI-ReportConfigId** is used to identify one **CSI-ReportConfig**.

**CSI-ReportConfigId** information element

```asn1
CSI-ReportConfigId ::= INTEGER {0..maxNrofCSI-ReportConfigurations-1}
```

---

**CSI-ResourceConfig**

The IE **CSI-ResourceConfig** defines a group of one or more **NZP-CSI-RS-ResourceSet**, **CSI-IM-ResourceSet** and/or **CSI-SSB-ResourceSet**.

**CSI-ResourceConfig** information element

```asn1
CSI-ResourceConfig ::= SEQUENCE {
  csi-ResourceConfigId                  CSI-ResourceConfigId,
  csi-RS-ResourceSetList                CHOICE {
    nzp-CSI-RS-SSB                        SEQUENCE {
      nzp-CSI-RS-ResourceSetList            SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig)) OF NZP-CSI-RS-ResourceSetId
        OPTIONAL, -- Need R
    },
    csi-SSB-ResourceSetList              SEQUENCE (SIZE (1..maxNrofCSI-SSB-ResourceSetsPerConfig)) OF CSI-SSB-ResourceSetId  OPTIONAL  -- Need R
  },
  csi-IM-ResourceSetList                SEQUENCE (SIZE (1..maxNrofCSI-IM-ResourceSetsPerConfig)) OF CSI-IM-ResourceSetId
  bwp-Id                                BWP-Id,
  resourceType                          ENUMERATED {aperiodic, semiPersistent, periodic },
  ...
}
```

---

**ETSI**
CSI-ResourceConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bwp-Id</td>
<td>The DL BWP which the CSI-RS associated with this CSI-ResourceConfig are located in (see TS 38.214 [19], clause 5.2.1.2).</td>
</tr>
<tr>
<td>csi-IM-ResourceSetList</td>
<td>List of references to CSI-IM resources used for beam measurement and reporting in a CSI-RS resource set. Contains up to maxNrofCSI-IM-ResourceSetsPerConfig resource sets if resourceType is 'aperiodic' and 1 otherwise (see TS 38.214 [19], clause 5.2.1.2).</td>
</tr>
<tr>
<td>csi-ResourceConfigId</td>
<td>Used in CSI-ReportConfig to refer to an instance of CSI-ResourceConfig.</td>
</tr>
<tr>
<td>csi-SSB-ResourceSetList</td>
<td>List of references to SSB resources used for beam measurement and reporting in a CSI-RS resource set (see TS 38.214 [19], clause 5.2.1.2).</td>
</tr>
<tr>
<td>nzp-CSI-RS-ResourceSetList</td>
<td>List of references to NZP CSI-RS resources used for beam measurement and reporting in a CSI-RS resource set. Contains up to maxNrofNZP-CSI-RS-ResourceSetsPerConfig resource sets if resourceType is 'aperiodic' and 1 otherwise (see TS 38.214 [19], clause 5.2.1.2).</td>
</tr>
<tr>
<td>resourceType</td>
<td>Time domain behavior of resource configuration (see TS 38.214 [19], clause 5.2.1.2). It does not apply to resources provided in the csi-SSB-ResourceSetList.</td>
</tr>
</tbody>
</table>

---

CSI-ResourceConfigId

The IE CSI-ResourceConfigId is used to identify a CSI-ResourceConfig.

CSI-ResourceConfigId information element

```asn1
CSI-ResourceConfigId ::= INTEGER {0..maxNrofCSI-ResourceConfigurations-1}
```

---

CSI-ResourcePeriodicityAndOffset

The IE CSI-ResourcePeriodicityAndOffset is used to configure a periodicity and a corresponding offset for periodic and semi-persistent CSI resources, and for periodic and semi-persistent reporting on PUCCH. Both, the periodicity and the offset are given in number of slots. The periodicity value slots4 corresponds to 4 slots, value slots5 corresponds to 5 slots, and so on.

CSI-ResourcePeriodicityAndOffset information element

```asn1
CSI-ResourcePeriodicityAndOffset ::= CHOICE {
```
The IE CSI-RS-ResourceConfigMobility is used to configure CSI-RS based RRM measurements.

CSI-RS-ResourceConfigMobility information element
CSI-RS-CellMobility field descriptions

csi-rs-ResourceList-Mobility
List of CSI-RS resources for mobility. The maximum number of CSI-RS resources that can be configured per measObjectNR depends on the configuration of associatedSSB and the support of increasedNumberofCSIRSPerMO capability (see TS 38.214 [19], clause 5.1.6.1.3).

density
Frequency domain density for the 1-port CSI-RS for L3 mobility. See TS 38.211 [16], clause 7.4.1.
nrofPRBs
Allowed size of the measurement BW in PRBs. See TS 38.211 [16], clause 7.4.1.
startPRB
Starting PRB index of the measurement bandwidth. See TS 38.211 [16], clause 7.4.1.

CSI-RS-ResourceConfigMobility field descriptions

csi-RS-CellList-Mobility
List of cells for CSI-RS based RRM measurements.

refServCellIndex
Indicates the serving cell providing the timing reference for CSI-RS resources without associatedSSB. The field may be present only if there is at least one CSI-RS resource configured without associatedSSB. If this field is absent, the UE shall use the timing of the PCell for measurements on the CSI-RS resources without associatedSSB. The CSI-RS resources and the serving cell indicated by refServCellIndex for timing reference should be located in the same band.

subcarrierSpacing
Subcarrier spacing of CSI-RS. Only the values 15, 30 kHz or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable.
CSI-RS-Resource-Mobility field descriptions

associatedSSB
If this field is present, the UE may base the timing of the CSI-RS resource indicated in CSI-RS-Resource-Mobility on the timing of the cell indicated by the cellId in the CSI-RS-CellMobility. In this case, the UE is not required to monitor that CSI-RS resource if the UE cannot detect the SS/PBCH block indicated by this associatedSSB and cellId. If this field is absent, the UE shall base the timing of the CSI-RS resource indicated in CSI-RS-Resource-Mobility on the timing of the serving cell indicated by refServCellIndex. In this case, the UE is required to measure the CSI-RS resource even if SS/PBCH block(s) with cellId in the CSI-RS-CellMobility are not detected.

CSI-RS resources with and without associatedSSB may be configured in accordance with the rules in TS 38.214 [19], clause 5.1.6.1.3.

csi-RS-Index
CSI-RS resource index associated to the CSI-RS resource to be measured (and used for reporting).

firstOFDSymbolInTimeDomain
Time domain allocation within a physical resource block. The field indicates the first OFDM symbol in the PRB used for CSI-RS, see TS 38.211 [16], clause 7.4.1.5.3. Value 2 is supported only when dmrs-TypeA-Position equals pos3.

csi-RS-Index

timeDomainAllocation
Frequency domain allocation within a physical resource block in accordance with TS 38.211 [16], clause 7.4.1.5.3 including table 7.4.1.5.2-1. The number of bits that may be set to one depend on the chosen row in that table.

isQuasiColocated
Indicates that the CSI-RS resource is quasi co-located with the associated SS/PBCH block, see TS 38.214 [19], clause 5.1.6.1.3.

sequenceGenerationConfig
Scrambling ID for CSI-RS (see TS 38.211 [16], clause 7.4.1.5.2).

slotConfig
Indicates the CSI-RS periodicity (in milliseconds) and for each periodicity the offset (in number of slots). When subcarrierSpacingCSI-RS is set to kHz15, the maximum offset values for periodicities ms4/ms5/ms10/ms20/ms40 are 3/4/9/19/39 slots. When subcarrierSpacingCSI-RS is set to kHz30, the maximum offset values for periodicities ms4/ms5/ms10/ms20/ms40 are 7/9/19/39/79 slots. When subcarrierSpacingCSI-RS is set to kHz60, the maximum offset values for periodicities ms4/ms5/ms10/ms20/ms40 are 15/19/39/79/159 slots. When subcarrierSpacingCSI-RS is set kHz120, the maximum offset values for periodicities ms4/ms5/ms10/ms20/ms40 are 31/39/79/159/319 slots.

CSI-RS-ResourceMapping

The IE CSI-RS-ResourceMapping is used to configure the resource element mapping of a CSI-RS resource in time- and frequency domain.

CSI-RS-ResourceMapping information element

```plaintext
-- ASN1START
-- TAG=CSI-RS-RESOURCEMAPPING-START
CSI-RS-ResourceMapping ::= SEQUENCE {
    frequencyDomainAllocation          CHOICE {
        row1                               BIT STRING (SIZE (4)),
        row2                               BIT STRING (SIZE (12)),
        row4                               BIT STRING (SIZE (3)),
        other                              BIT STRING (SIZE (6))
    },
    nrofPorts                          ENUMERATED {p1,p2,p4,p8,p12,p16,p24,p32},
    firstOFDSymbolInTimeDomain         INTEGER (0..13),
    firstOFDSymbolInTimeDomain2        INTEGER (2..12),
    cdm-Type                            ENUMERATED {noCDM, Ed-CDM2, cdm4-FD2-TD2, cdm8-FD2-TD4},
    density                            CHOICE {
        .dot5                              ENUMERATED {evenPRBs, oddPRBs},
    }
}
```
CSI-RS-ResourceMapping field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cdm-Type</strong></td>
<td>CDM type (see TS 38.214 [19], clause 5.2.2.3.1).</td>
</tr>
<tr>
<td><strong>density</strong></td>
<td>Density of CSI-RS resource measured in RE/port/PRB (see TS 38.211 [16], clause 7.4.1.5.3). Values 0.5 (dot5), 1 (one) and 3 (three) are allowed for X=1, values 0.5 (dot5) and 1 (one) are allowed for X=2, 16, 24 and 32, value 1 (one) is allowed for X=4, 8, 12. For density = 1/2, includes 1-bit indication for RB level comb offset indicating whether odd or even RBs are occupied by CSI-RS.</td>
</tr>
<tr>
<td><strong>freqBand</strong></td>
<td>Wideband or partial band CSI-RS, (see TS 38.214 [19], clause 5.2.2.3.1).</td>
</tr>
<tr>
<td><strong>frequencyDomainAllocation</strong></td>
<td>Frequency domain allocation within a physical resource block in accordance with TS 38.211 [16], clause 7.4.1.5.3. The applicable row number in table 7.4.1.5.3-1 is determined by the frequencyDomainAllocation for rows 1, 2 and 4, and for other rows by matching the values in the column Ports, Density and CDMtype in table 7.4.1.5.3-1 with the values of nrofPorts, cdm-Type and density below and, when more than one row has the 3 values matching, by selecting the row where the column (k bar, l bar) in table 7.4.1.5.3-1 has indexes for k ranging from 0 to 2^n-1 where n is the number of bits set to 1 in frequencyDomainAllocation.</td>
</tr>
<tr>
<td><strong>nrofPorts</strong></td>
<td>Number of ports (see TS 38.214 [19], clause 5.2.2.3.1).</td>
</tr>
</tbody>
</table>

---

**CSI-SemiPersistentOnPUSCH-TriggerStateList**

The **CSI-SemiPersistentOnPUSCH-TriggerStateList** IE is used to configure the UE with list of trigger states for semi-persistent reporting of channel state information on L1. See also TS 38.214 [19], clause 5.2.

**CSI-SemiPersistentOnPUSCH-TriggerStateList** information element

```asn1
CSI-SemiPersistentOnPUSCH-TriggerStateList ::= SEQUENCE SIZE (1..maxNrOfSemiPersistentPUSCH-Triggers) OF CSI-SemiPersistentOnPUSCH-TriggerState
CSI-SemiPersistentOnPUSCH-TriggerState ::= SEQUENCE {
```
CSI-SSB-ResourceSet

The IE **CSI-SSB-ResourceSet** is used to configure one SS/PBCH block resource set which refers to SS/PBCH as indicated in *ServingCellConfigCommon*.

**CSI-SSB-ResourceSet** information element

```asciidoc
CSI-SSB-ResourceSet ::=             SEQUENCE {
    csi-SSB-ResourceSetId               CSI-SSB-ResourceSetId,
    csi-SSB-ResourceList                SEQUENCE (SIZE(1..maxNrofCSI-SSB-ResourcePerSet)) OF SSB-Index,
    ...
}
```

CSI-SSB-ResourceId

The IE **CSI-SSB-ResourceId** is used to identify one SS/PBCH block resource set.

**CSI-SSB-ResourceId** information element

```asciidoc
CSI-SSB-ResourceId ::=           INTEGER (0..maxNrofCSI-SSB-ResourceSets-1)
```

DedicatedNAS-Message

The IE **DedicatedNAS-Message** is used to transfer UE specific NAS layer information between the 5GC CN and the UE. The RRC layer is transparent for this information.
DedicatedNAS-Message information element

```asn1
DedicatedNAS-Message ::= OCTET STRING
```

---

DMRS-DownlinkConfig

The IE `DMRS-DownlinkConfig` is used to configure downlink demodulation reference signals for PDSCH.

DMRS-DownlinkConfig information element

```asn1
DMRS-DownlinkConfig ::= SEQUENCE {
  dmrs-Type                           ENUMERATED {type2} OPTIONAL,   -- Need S
  dmrs-AdditionalPosition             ENUMERATED {pos0, pos1, pos3} OPTIONAL,   -- Need S
  maxLength                           ENUMERATED {len2} OPTIONAL,   -- Need S
  scramblingID0                       INTEGER (0..65535) OPTIONAL,   -- Need S
  scramblingID1                       INTEGER (0..65535) OPTIONAL,   -- Need S
  phaseTrackingRS                     SetupRelease { PTRS-DownlinkConfig  } OPTIONAL,   -- Need M
  ...
  [[
  dmrs-Downlink-r16               ENUMERATED {enabled} OPTIONAL    -- Need R
  ]]
}
```

---
### DMRS-DownlinkConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dmrs-AdditionalPosition</td>
<td>Position for additional DM-RS in DL, see Tables 7.4.1.1.2-3 and 7.4.1.1.2-4 in TS 38.211 [16]. If the field is absent, the UE applies the value pos2. See also clause 7.4.1.1.2 for additional constraints on how the network may set this field depending on the setting of other fields.</td>
</tr>
<tr>
<td>dmrs-Downlink</td>
<td>This field indicates whether low PAPR DMRS is used, as specified in TS38.211 [16], clause 7.4.1.1.1.</td>
</tr>
<tr>
<td>dmrs-Type</td>
<td>Selection of the DMRS type to be used for DL (see TS 38.211 [16], clause 7.4.1.1.1). If the field is absent, the UE uses DMRS type 1.</td>
</tr>
<tr>
<td>maxLength</td>
<td>The maximum number of OFDM symbols for DL front loaded DMRS. len1 corresponds to value 1. len2 corresponds to value 2. If the field is absent, the UE applies value len1. If set to len2, the UE determines the actual number of DM-RS symbols by the associated DCI. (see TS 38.211 [16], clause 7.4.1.1.2).</td>
</tr>
<tr>
<td>phaseTrackingRS</td>
<td>Configures downlink PTRS. If the field is not configured, the UE assumes that downlink PTRS are absent. See TS 38.214 [19] clause 5.1.6.3.</td>
</tr>
<tr>
<td>scramblingID0</td>
<td>DL DMRS scrambling initialization (see TS 38.211 [16], clause 7.4.1.1.1). When the field is absent the UE applies the value physCellId configured for this serving cell.</td>
</tr>
<tr>
<td>scramblingID1</td>
<td>DL DMRS scrambling initialization (see TS 38.211 [16], clause 7.4.1.1.1). When the field is absent the UE applies the value physCellId configured for this serving cell.</td>
</tr>
</tbody>
</table>

---

**DMRS-UplinkConfig**

The IE DMRS-UplinkConfig is used to configure uplink demodulation reference signals for PUSCH.

### DMRS-UplinkConfig information element

```asn1
DMRS-UplinkConfig ::= SEQUENCE {
  dmrs-Type                           ENUMERATED {type2} OPTIONAL, -- Need S
  dmrs-AdditionalPosition             ENUMERATED {pos0, pos1, pos3} OPTIONAL, -- Need S
  phaseTrackingRS                     SetupRelease { PTRS-UplinkConfig } OPTIONAL, -- Need M
  maxLength                           ENUMERATED {len2} OPTIONAL, -- Need S
  transformPrecodingDisabled          SEQUENCE {
    scramblingID0                       INTEGER (0..65535) OPTIONAL, -- Need S
    scramblingID1                       INTEGER (0..65535) OPTIONAL, -- Need S
    ...,
    [ [ dmrs-Uplink-r16                     ENUMERATED {enabled} OPTIONAL, -- Need R ] ]
  }
  transformPrecodingEnabled           SEQUENCE {
    nPUSCH-Identity                     INTEGER(0..1007) OPTIONAL, -- Need S
    sequenceGroupHopping                ENUMERATED {disabled} OPTIONAL, -- Need S
    sequenceHopping                     ENUMERATED {enabled} OPTIONAL, -- Need S
    ...,
    [ [ dmrs-UplinkTransformPrecoding-r16 SetupRelease {DMRS-UplinkTransformPrecoding-r16} OPTIONAL, -- Need M ] ]
}
```
DMRS-UplinkTransformPrecoding-r16 ::= SEQUENCE {
    pi2BPSK-ScramblingID0          INTEGER(0..65535) OPTIONAL, -- Need S
    pi2BPSK-ScramblingID1          INTEGER(0..65535) OPTIONAL
}

-- TAG-DMRS-UPLINKCONFIG-STOP
-- ASN1STOP
### DMRS-UplinkConfig field descriptions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>dmrs-AdditionalPosition</strong></td>
<td>Position for additional DM-RS in UL (see TS 38.211 [16], clause 6.4.1.1.3). If the field is absent, the UE applies the value pos2. See also clause 6.4.1.1.3 for additional constraints on how the network may set this field depending on the setting of other fields.</td>
</tr>
<tr>
<td><strong>dmrs-Type</strong></td>
<td>Selection of the DMRS type to be used for UL (see TS 38.211 [16], clause 6.4.1.1.3). If the field is absent, the UE uses DMRS type 1.</td>
</tr>
<tr>
<td><strong>dmrs-Uplink</strong></td>
<td>This field indicates whether low PAPR DMRS is used, as specified in TS38.211 [16], clause 6.4.1.1.1.1.</td>
</tr>
<tr>
<td><strong>dmrs-UplinkTransformPrecoding</strong></td>
<td>This field indicates whether low PAPR DMRS is used for PUSCH with pi/2 BPSK modulation, as specified in TS38.211 [16], clause 6.4.1.1.1.2. The network configures this field only if <code>tp-pi2BPSK</code> is configured in <code>PUSCH-Config</code>.</td>
</tr>
<tr>
<td><strong>maxLength</strong></td>
<td>The maximum number of OFDM symbols for UL front loaded DMRS. <code>len1</code> corresponds to value 1. <code>len2</code> corresponds to value 2. If the field is absent, the UE applies value <code>len1</code>. If set to <code>len2</code>, the UE determines the actual number of DM-RS symbols by the associated DCI. (see TS 38.211 [16], clause 6.4.1.1.3).</td>
</tr>
<tr>
<td><strong>nPUSCH-Identity</strong></td>
<td>Parameter: N_ID^PUSCH for DFT-s-OFDM DMRS. If the value is absent or released, the UE uses the value Physical cell ID (physCellId). See TS 38.211 [16].</td>
</tr>
<tr>
<td><strong>phaseTrackingRS</strong></td>
<td>Configures uplink PTRS (see TS 38.211 [16]).</td>
</tr>
<tr>
<td><strong>pi2BPSK-ScramblingID0, pi2BPSK-ScramblingID1</strong></td>
<td>UL DMRS scrambling initialization for pi/2 BPSK DMRS for PUSCH (see TS 38.211 [16], Clause 6.4.1.1.2). When the field is absent the UE applies the value Physical cell ID (physCellId) of the serving cell.</td>
</tr>
<tr>
<td><strong>scramblingID0</strong></td>
<td>UL DMRS scrambling initialization for CP-OFDM (see TS 38.211 [16], clause 6.4.1.1.1.1). When the field is absent the UE applies the value Physical cell ID (physCellId).</td>
</tr>
<tr>
<td><strong>scramblingID1</strong></td>
<td>UL DMRS scrambling initialization for CP-OFDM. (see TS 38.211 [16], clause 6.4.1.1.1.1). When the field is absent the UE applies the value Physical cell ID (physCellId).</td>
</tr>
<tr>
<td><strong>sequenceGroupHopping</strong></td>
<td>For DMRS transmission with transform precoder the NW may configure group hopping by the cell-specific parameter <code>groupHoppingEnabledTransformPrecoding</code> in <code>PUSCH-ConfigCommon</code>. In this case, the NW may include this UE specific field to disable group hopping for PUSCH transmission except for Msg3, i.e., to override the configuration in <code>PUSCH-ConfigCommon</code> (see TS 38.211 [16]). If the field is absent, the UE uses the same hopping mode as for Msg3.</td>
</tr>
<tr>
<td><strong>sequenceHopping</strong></td>
<td>Determines if sequence hopping is enabled for DMRS transmission with transform precoder for PUSCH transmission other than Msg3 (sequence hopping is always disabled for Msg3). If the field is absent, the UE uses the same hopping mode as for msg3. The network does not configure simultaneous group hopping and sequence hopping. See TS 38.211 [16], clause 6.4.1.1.1.2.</td>
</tr>
<tr>
<td><strong>transformPrecodingDisabled</strong></td>
<td>DMRS related parameters for Cyclic Prefix OFDM.</td>
</tr>
<tr>
<td><strong>transformPrecodingEnabled</strong></td>
<td>DMRS related parameters for DFT-s-OFDM (Transform Precoding).</td>
</tr>
</tbody>
</table>

---

**DownlinkConfigCommon**

The IE `DownlinkConfigCommon` provides common downlink parameters of a cell.

---

**DownlinkConfigCommon** information element
DownlinkConfigCommon field descriptions

**frequencyInfoDL**
Basic parameters of a downlink carrier and transmission thereon.

**initialDownlinkBWP**
The initial downlink BWP configuration for a serving cell. The network configures the locationAndBandwidth so that the initial downlink BWP contains the entire CORESET#0 of this serving cell in the frequency domain.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>InterFreqHOAndServCellAdd</td>
<td>This field is mandatory present for inter-frequency handover, and upon serving cell (PSCell/SCell) addition. Otherwise, the field is optionally present, Need M.</td>
</tr>
<tr>
<td>ServCellAdd</td>
<td>This field is mandatory present upon serving cell addition (for PSCell and SCell) and upon handover from E-UTRA to NR. It is optionally present, Need M otherwise.</td>
</tr>
</tbody>
</table>

---

**DownlinkConfigCommonSIB**

The IE DownlinkConfigCommonSIB provides common downlink parameters of a cell.

**DownlinkConfigCommonSIB information element**

---

BCCH-Config ::= SEQUENCE {
  modificationPeriodCoeff ENUMERATED {n2, n4, n8, n16},
  ... }


PCCH-Config ::= SEQUENCE {
  defaultPagingCycle     PagingCycle,
  nAndPagingFrameOffset   CHOICE {
    oneT                   NULL,
    halfT                  INTEGER (0..1),
    quarterT               INTEGER (0..3),
    oneEighthT             INTEGER (0..7),
    oneSixteenthT          INTEGER (0..15)
  },
  ns                      ENUMERATED {four, two, one},
  firstPDCCH-MonitoringOccasionOfPO  CHOICE {
    sCS15KHZoneT    SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..139),
    sCS30KHZoneT-SCS15KHZoneHalfT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..279),
    sCS60KHZoneT-SCS30KHZoneHalfT-SCS15KHZoneQuarterT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..559),
    sCS120KHZoneT-SCS60KHZoneHalfT-SCS30KHZoneQuarterT-SCS15KHZoneEighthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..1119),
    sCS120KHZoneHalfT-SCS60KHZoneQuarterT-SCS30KHZoneEighthT-SCS15KHZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..2239),
    sCS120KHZoneQuarterT-SCS60KHZoneEighthT-SCS30KHZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..4479),
    sCS120KHZoneEighthT-SCS60KHZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..8959),
    sCS120KHZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..17919)
  }
}

-- TAG-DOWNLINKCONFIGCOMMONSIB-STOP
-- ASN1STOP

**DownlinkConfigCommonSIB field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bcch-Config</strong></td>
<td>The modification period related configuration.</td>
</tr>
<tr>
<td><strong>frequencyInfoDL-SIB</strong></td>
<td>Basic parameters of a downlink carrier and transmission thereon.</td>
</tr>
<tr>
<td><strong>initialDownlinkBWP</strong></td>
<td>The initial downlink BWP configuration for a PCell. The network configures</td>
</tr>
<tr>
<td></td>
<td>the locationAndBandwidth so that the initial downlink BWP contains the</td>
</tr>
<tr>
<td></td>
<td>entire CORESET#0 of this serving cell in the frequency domain. The UE</td>
</tr>
<tr>
<td></td>
<td>applies the locationAndBandwidth upon reception of this field (e.g. to</td>
</tr>
<tr>
<td></td>
<td>determine the frequency position of signals described in relation to this</td>
</tr>
<tr>
<td></td>
<td>locationAndBandwidth) but it keeps CORESET#0 until after reception of RRCSetup/RRCResume/RRCReestablishment.</td>
</tr>
<tr>
<td><strong>nrofPDCCH-MonitoringOccasionPerSSB-InPO</strong></td>
<td>The number of PDCCH monitoring occasions corresponding to an SSB within a</td>
</tr>
<tr>
<td></td>
<td>Paging Occasion, see TS 38.304 [20], clause 7.1.</td>
</tr>
<tr>
<td><strong>pcch-Config</strong></td>
<td>The paging related configuration.</td>
</tr>
</tbody>
</table>
**BCCH-Config** field descriptions

- **modificationPeriodCoeff**
  Actual modification period, expressed in number of radio frames \( m = \text{modificationPeriodCoeff} \times \text{defaultPagingCycle} \), see clause 5.2.2.2. \( n_2 \) corresponds to value 2, \( n_4 \) corresponds to value 4, and so on.

**PCCH-Config** field descriptions

- **defaultPagingCycle**
  Default paging cycle, used to derive 'T' in TS 38.304 [20]. Value \( rf_{32} \) corresponds to 32 radio frames, value \( rf_{64} \) corresponds to 64 radio frames and so on.

- **firstPDCCH-MonitoringOccasionOfPO**
  Points out the first PDCCH monitoring occasion for paging of each PO of the PF, see TS 38.304 [20].

- **nAndPagingFrameOffset**
  Used to derive the number of total paging frames in T (corresponding to parameter N in TS 38.304 [20]) and paging frame offset (corresponding to parameter PF_offset in TS 38.304 [20]). A value of oneSixteenthT corresponds to T / 16, a value of oneEighthT corresponds to T / 8, and so on.

  If \( \text{pagingSearchSpace} \) is set to zero and if SS/PBCH block and CORESET multiplexing pattern is 2 or 3 (as specified in TS 38.213 [13]):
  - for \( \text{ssb-periodicityServingCell} \) of 5 or 10 ms, N can be set to one of \{oneT, halfT, quarterT, oneEighthT, oneSixteenthT\}
  - for \( \text{ssb-periodicityServingCell} \) of 20 ms, N can be set to one of \{halfT, quarterT, oneEighthT, oneSixteenthT\}
  - for \( \text{ssb-periodicityServingCell} \) of 40 ms, N can be set to one of \{quarterT, oneEighthT, oneSixteenthT\}
  - for \( \text{ssb-periodicityServingCell} \) of 80 ms, N can be set to one of \{oneEighthT, oneSixteenthT\}
  - for \( \text{ssb-periodicityServingCell} \) of 160 ms, N can be set to oneSixteenthT

  If \( \text{pagingSearchSpace} \) is set to zero and if SS/PBCH block and CORESET multiplexing pattern is 1 (as specified in TS 38.213 [13]), N can be set to one of \{halfT, quarterT, oneEighthT, oneSixteenthT\}

  If \( \text{pagingSearchSpace} \) is not set to zero, N can be configured to one of \{oneT, halfT, quarterT, oneEighthT, oneSixteenthT\}

- **ns**
  Number of paging occasions per paging frame.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SharedSpectrum2</td>
<td>The field is optional present, Need R, if this cell operates with shared spectrum channel access. Otherwise, it is absent, Need R.</td>
</tr>
</tbody>
</table>

---

**DownlinkPreemption**

The IE DownlinkPreemption is used to configure the UE to monitor PDCCH for the INT-RNTI (interruption).

**DownlinkPreemption information element**

```asn1
DownlinkPreemption ::= SEQUENCE {
    int-RNTI              RNTI-Value,
    timeFrequencySet      ENUMERATED {set0, set1},
    dci-PayloadSize       INTEGER (0..maxINT-DCI-PayloadSize),
    int-ConfigurationPerServingCell  SEQUENCE (SIZE (1..maxNrofServingCells)) OF INT-ConfigurationPerServingCell,
    ...
}
```

---

**ETS**
INT-ConfigurationPerServingCell ::= SEQUENCE {
  servingCellId            ServCellIndex,
  positionInDCI            INTEGER (0..maxINT-DCI-PayloadSize-1)
}

-- TAG-DOWNLINKPREEMPTION-STOP
-- ASN1STOP

<table>
<thead>
<tr>
<th>DownlinkPreemption field descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>dci-PayloadSize</td>
</tr>
<tr>
<td>Total length of the DCI payload scrambled with INT-RNTI (see TS 38.213 [13], clause 11.2).</td>
</tr>
<tr>
<td>int-ConfigurationPerServingCell</td>
</tr>
<tr>
<td>Indicates (per serving cell) the position of the 14 bit INT values inside the DCI payload (see TS 38.213 [13], clause 11.2).</td>
</tr>
<tr>
<td>int-RNTI</td>
</tr>
<tr>
<td>RNTI used for indication pre-emption in DL (see TS 38.213 [13], clause 10).</td>
</tr>
<tr>
<td>timeFrequencySet</td>
</tr>
<tr>
<td>Set selection for DL-preemption indication (see TS 38.213 [13], clause 11.2) The set determines how the UE interprets the DL preemption DCI payload.</td>
</tr>
</tbody>
</table>

-- TAG-INT-CONFIGURATION-PER-SERVING-CELL-STOP
-- ASN1STOP

<table>
<thead>
<tr>
<th>INT-ConfigurationPerServingCell field descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>positionInDCI</td>
</tr>
<tr>
<td>Starting position (in number of bit) of the 14 bit INT value applicable for this serving cell (servingCellId) within the DCI payload (see TS 38.213 [13], clause 11.2). Must be multiples of 14 (bit).</td>
</tr>
</tbody>
</table>

— DRB-Identity

The IE DRB-Identity is used to identify a DRB used by a UE.

DRB-Identity information element

-- ASN1START
-- TAG-DRB-IDENTITY-START

DRB-Identity ::= INTEGER {1..32}

-- TAG-DRB-IDENTITY-STOP
-- ASN1STOP

— DRX-Config

The IE DRX-Config is used to configure DRX related parameters.
**DRX-Config information element**

---

**ASN1START**

**TAG-DRX-CONFIG-START**

```
DRX-Config ::= SEQUENCE {
  drx-onDurationTimer  
    CHOICE {
      subMilliSeconds  INTEGER (1..31),
      milliSeconds  ENUMERATED {
        ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60,
        ms80, ms100, ms200, ms300, ms400, ms500, ms600, ms800, ms1000, ms1200,
        ms1600, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 }
    },
  drx-InactivityTimer  ENUMERATED {
    ms0, ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60, ms80,
    ms100, ms200, ms300, ms500, ms750, ms1280, ms1920, ms2560, spare9, spare8,
    spare7, spare6, spare5, spare4, spare3, spare2, spare1 },
  drx-HARQ-RTT-TimerDL  INTEGER (0..56),
  drx-HARQ-RTT-TimerUL  INTEGER (0..56),
  drx-RetransmissionTimerDL  ENUMERATED {
    sl0, sl1, sl2, sl4, sl6, sl8, sl16, sl24, sl33, sl40, sl64, sl80, sl100, sl128,
    sl160, sl256, spare15, spare14, spare13, spare12, spare11, spare10, spare9,
    spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 },
  drx-RetransmissionTimerUL  ENUMERATED {
    sl0, sl1, sl2, sl4, sl6, sl8, sl16, sl24, sl33, sl40, sl64, sl80, sl100, sl128,
    sl160, sl256, spare15, spare14, spare13, spare12, spare11, spare10, spare9,
    spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 },
  drx-LongCycleStartOffset  
    CHOICE {
      ms10  INTEGER(0..9),
      ms20  INTEGER(0..19),
      ms30  INTEGER(0..31),
      ms40  INTEGER(0..49),
      ms50  INTEGER(0..59),
      ms60  INTEGER(0..69),
      ms70  INTEGER(0..79),
      ms80  INTEGER(0..89),
      ms90  INTEGER(0..99),
      ms100 INTEGER(0..109),
      ms128 INTEGER(0..127),
      ms512 INTEGER(0..511),
      ms1024 INTEGER(0..1023),
      ms2048 INTEGER(0..2047),
      ms4096 INTEGER(0..4095),
      ms8192 INTEGER(0..8191),
      ms16384 INTEGER(0..16383),
      ms32768 INTEGER(0..32767),
      ms65536 INTEGER(0..65535),
      ms131072 INTEGER(0..131071),
      ms262144 INTEGER(0..262143),
      ms524288 INTEGER(0..524287),
      ms1048576 INTEGER(0..1048575),
    },
  shortDRX  
    SEQUENCE {
      drx-ShortCycle  ENUMERATED {
        ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms14, ms16, ms20, ms30, ms32,
        ms35, ms40, ms48, ms80, ms128, ms160, ms256, ms320, ms512, ms640, spare9,
        spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 }
    },
}
```

---

**ASN1END**
**DRX-Config** field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>drx-HARQ-RTT-TimerDL</strong></td>
<td>Value in number of symbols of the BWP where the transport block was received.</td>
</tr>
<tr>
<td><strong>drx-HARQ-RTT-TimerUL</strong></td>
<td>Value in number of symbols of the BWP where the transport block was transmitted.</td>
</tr>
<tr>
<td><strong>drx-InactivityTimer</strong></td>
<td>Value in multiple integers of 1 ms. ms0 corresponds to 0, ms1 corresponds to 1 ms, ms2 corresponds to 2 ms, and so on.</td>
</tr>
<tr>
<td><strong>drx-LongCycleStartOffset</strong></td>
<td>Value in ms and drx-StartOffset in multiples of 1 ms. If drx-ShortCycle is configured, the value of drx-LongCycle shall be a multiple of the drx-ShortCycle value.</td>
</tr>
<tr>
<td><strong>drx-onDurationTimer</strong></td>
<td>Value in multiples of 1/32 ms (subMilliSeconds) or in ms (milliSecond). For the latter, value ms1 corresponds to 1 ms, value ms2 corresponds to 2 ms, and so on.</td>
</tr>
<tr>
<td><strong>drx-RetransmissionTimerDL</strong></td>
<td>Value in number of slot lengths of the BWP where the transport block was received. Value sl0 corresponds to 0 slots, sl1 corresponds to 1 slot, sl2 corresponds to 2 slots, and so on.</td>
</tr>
<tr>
<td><strong>drx-RetransmissionTimerUL</strong></td>
<td>Value in number of slot lengths of the BWP where the transport block was transmitted. sl0 corresponds to 0 slots, sl1 corresponds to 1 slot, sl2 corresponds to 2 slots, and so on.</td>
</tr>
<tr>
<td><strong>drx-ShortCycleTimer</strong></td>
<td>Value in multiples of drx-ShortCycle. A value of 1 corresponds to drx-ShortCycle, a value of 2 corresponds to 2 * drx-ShortCycle and so on.</td>
</tr>
<tr>
<td><strong>drx-ShortCycle</strong></td>
<td>Value in ms. ms1 corresponds to 1 ms, ms2 corresponds to 2 ms, and so on.</td>
</tr>
<tr>
<td><strong>drx-SlotOffset</strong></td>
<td>Value in 1/32 ms. Value 0 corresponds to 0 ms, value 1 corresponds to 1/32 ms, value 2 corresponds to 2/32 ms, and so on.</td>
</tr>
</tbody>
</table>

---

**DRX-ConfigSecondaryGroup**

The IE **DRX-ConfigSecondaryGroup** is used to configure DRX related parameters for the second DRX group as specified in TS 38.321 [3].

**DRX-ConfigSecondaryGroup information element**

```
DRX-ConfigSecondaryGroup ::= SEQUENCE {
  drx-onDurationTimer             CHOICE {
    subMilliSeconds INTEGER (1..31),
    milliSeconds ENUMERATED {
      ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60,
    }
  }
}
```
--- TAG-DRX-CONFIGSECONDARYGROUP-START
--- ASN1STOP

--- DRX-ConfigSecondaryGroup field descriptions

**drx-InactivityTimer**
Value in multiples of 1 ms. *ms0* corresponds to 0, *ms1* corresponds to 1 ms, *ms2* corresponds to 2 ms, and so on, as specified in TS 38.321 [3]. The network configures a **drx-InactivityTimer** value for the second DRX group that is smaller than the **drx-InactivityTimer** configured for the default DRX group in IE **DRX-Config**.

**drx-onDurationTimer**
Value in multiples of 1/32 ms (subMilliSeconds) or in ms (milliSecond). For the latter, value *ms1* corresponds to 1 ms, value *ms2* corresponds to 2 ms, and so on, as specified in TS 38.321 [3]. The network configures a **drx-onDurationTimer** value for the second DRX group that is smaller than the **drx-onDurationTimer** configured for the default DRX group in IE **DRX-Config**.

--- FilterCoefficient
The IE **FilterCoefficient** specifies the measurement filtering coefficient. Value *fc0* corresponds to *k* = 0, *fc1* corresponds to *k* = 1, and so on.

--- FilterCoefficient information element

--- FreqBandIndicatorNR
The IE **FreqBandIndicatorNR** is used to convey an NR frequency band number as defined in TS 38.101-1 [15] and TS 38.101-2 [39].

--- FreqBandIndicatorNR information element
FrequencyInfoDL

The IE FrequencyInfoDL provides basic parameters of a downlink carrier and transmission thereon.

FrequencyInfoDL information element

---

FrequencyInfoDL ::= SEQUENCE {
  absoluteFrequencySSB               ARFCN-ValueNR, OPTIONAL, -- Cond SpCellAdd
  frequencyBandList                   MultiFrequencyBandListNR,              
  absoluteFrequencyPointA            ARFCN-ValueNR,
  scs-SpecificCarrierList            SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier,
  ...
}

---

FrequencyInfoDL field descriptions

**absoluteFrequencyPointA**
Absolute frequency position of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A (see TS 38.211 [16], clause 4.4.4.2). Note that the lower edge of the actual carrier is not defined by this field but rather in the scs-SpecificCarrierList.

**absoluteFrequencySSB**
Frequency of the SSB to be used for this serving cell. SSB related parameters (e.g. SSB index) provided for a serving cell refer to this SSB frequency unless mentioned otherwise. The cell-defining SSB of the PCell is always on the sync raster. Frequencies are considered to be on the sync raster if they are also identifiable with a GSCN value (see TS 38.101 [15]). If the field is absent, the SSB related parameters should be absent, e.g. ssb-PositionsInBurst, ssb-periodicityServingCell and subcarrierSpacing in ServingCellConfigCommon IE. If the field is absent, the UE obtains timing reference from the SpCell. This is only supported in case the SCell is in the same frequency band as the SpCell.

**frequencyBandList**
List containing only one frequency band to which this carrier(s) belongs. Multiple values are not supported.

**scs-SpecificCarrierList**
A set of carriers for different subcarrier spacings (numerologies). Defined in relation to Point A. The network configures a scs-SpecificCarrier at least for each numerology (SCS) that is used e.g. in a BWP (see TS 38.211 [16], clause 5.3).

---

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpCellAdd</td>
<td>The field is mandatory present if this FrequencyInfoDL is for SpCell. Otherwise the field is optionally present, Need S.</td>
</tr>
</tbody>
</table>
FrequencyInfoDL-SIB

The IE FrequencyInfoDL-SIB provides basic parameters of a downlink carrier and transmission thereon.

FrequencyInfoDL-SIB information element

FrequencyInfoDL-SIB ::=             SEQUENCE {
  frequencyBandList                   MultiFrequencyBandListNR-SIB,
  offsetToPointA                      INTEGER (0..2199),
  scs-SpecificCarrierList             SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier
}

FrequencyInfoDL-SIB field descriptions

offsetToPointA
Represents the offset to Point A as defined in TS 38.211 [16], clause 4.4.4.2.

frequencyBandList
List of one or multiple frequency bands to which this carrier(s) belongs.

scs-SpecificCarrierList
A set of carriers for different subcarrier spacings (numerologies). Defined in relation to Point A (see TS 38.211 [16], clause 5.3). The network configures this for all SCSs that are used in DL BWPs in this serving cell.

FrequencyInfoUL

The IE FrequencyInfoUL provides basic parameters of an uplink carrier and transmission thereon.

FrequencyInfoUL information element

FrequencyInfoUL ::=                 SEQUENCE {
### FrequencyInfoUL field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>absoluteFrequencyPointA</strong></td>
<td>Absolute frequency of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A. Note that the lower edge of the actual carrier is not defined by this field but rather in the <code>scs-SpecificCarrierList</code> (see TS 38.211 [16], clause 4.4.4.2).</td>
</tr>
<tr>
<td><strong>additionalSpectrumEmission</strong></td>
<td>The additional spectrum emission requirements to be applied by the UE on this uplink. If the field is absent, the UE uses value 0 for the <code>additionalSpectrumEmission</code> (see TS 38.101-1 [15], table 6.2.3.1-1A, and TS 38.101-2 [39], table 6.2.3.1-2). Network configures the same value in additionalSpectrumEmission for all uplink carrier(s) of the same band with UL configured. The <code>additionalSpectrumEmission</code> is applicable for all uplink carriers of the same band with UL configured.</td>
</tr>
<tr>
<td><strong>frequencyBandList</strong></td>
<td>List containing only one frequency band to which this carrier(s) belongs. Multiple values are not supported.</td>
</tr>
<tr>
<td><strong>frequencyShift7p5khz</strong></td>
<td>Enable the NR UL transmission with a 7.5 kHz shift to the LTE raster. If the field is absent, the frequency shift is disabled.</td>
</tr>
<tr>
<td><strong>p-Max</strong></td>
<td>Maximum transmit power allowed in this serving cell. The maximum transmit power that the UE may use on this serving cell may be additionally limited by <code>p-NR-FR1</code> (configured for the cell group) and by <code>p-UE-FR1</code> (configured total for all serving cells operating on FR1). If absent, the UE applies the maximum power according to TS 38.101-1 [15]. Value in dBm. This field is ignored by IAB-MT, the IAB-MT applies output power and emissions requirements, as specified in TS 38.174 [63].</td>
</tr>
<tr>
<td><strong>scs-SpecificCarrierList</strong></td>
<td>A set of carriers for different subcarrier spacings (numerologies). Defined in relation to Point A. The network configures a <code>scs-SpecificCarrier</code> at least for each numerology (SCS) that is used e.g. in a BWP (see TS 38.211 [16], clause 5.3).</td>
</tr>
</tbody>
</table>

### Conditional Presence

<table>
<thead>
<tr>
<th>Condition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FDD-OrSUL</strong></td>
<td>The field is mandatory present if this <code>FrequencyInfoUL</code> is for the paired UL for a DL (defined in a <code>FrequencyInfoDL</code>) or if this <code>FrequencyInfoUL</code> is for a supplementary uplink (SUL). It is absent, Need R, otherwise (if this <code>FrequencyInfoUL</code> is for an unpaired UL (TDD)).</td>
</tr>
<tr>
<td><strong>FDD-TDD-OrSUL-Optional</strong></td>
<td>The field is optionally present. Need R, if this <code>FrequencyInfoUL</code> is for the paired UL for a DL (defined in a <code>FrequencyInfoDL</code>), or if this <code>FrequencyInfoUL</code> is for an unpaired UL (TDD) in certain bands (as defined in clause 5.4.2.1 of TS 38.101-1 and in clause 5.4.2.1 of TS 38.104 [12]), or if this <code>FrequencyInfoUL</code> is for a supplementary uplink (SUL). It is absent, Need R, otherwise.</td>
</tr>
</tbody>
</table>

---

**FrequencyInfoUL-SIB**

The IE `FrequencyInfoUL-SIB` provides basic parameters of an uplink carrier and transmission thereon.

---

**FrequencyInfoUL-SIB information element**

```asn1
FrequencyInfoUL-SIB ::= SEQUENCE {
  frequencyBandList       MultiFrequencyBandListNR-SIB OPTIONAL,  -- Cond FDD-OrSUL
  absoluteFrequencyPointA ARFCN-ValueNR OPTIONAL,  -- Cond FDD-OrSUL
  scs-SpecificCarrierList  SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier,
}
```
FrequencyInfoUL-SIB field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>absoluteFrequencyPointA</td>
<td>Absolute frequency of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A. Note that the lower edge of the actual carrier is not defined by this field but rather in the scs-SpecificCarrierList (see TS 38.211 [16], clause 4.4.4.2).</td>
</tr>
<tr>
<td>frequencyBandList</td>
<td>Provides the frequency band indicator and a list of additionalPmax and additionalSpectrumEmission values as defined in TS 38.101-1 [15], table 6.2.3.1-1, and TS 38.101-2 [39], table 6.2.3.1-2. The UE shall apply the first listed band which it supports in the frequencyBandList field.</td>
</tr>
<tr>
<td>frequencyShift7p5khz</td>
<td>Enable the NR UL transmission with a 7.5 kHz shift to the LTE raster. If the field is absent, the frequency shift is disabled.</td>
</tr>
<tr>
<td>p-Max</td>
<td>Value in dBm applicable for the cell. If absent the UE applies the maximum power according to TS 38.101-1 [15] in case of an FR1 cell or TS 38.101-2 [39] in case of an FR2 cell. In this release of the specification, if p-Max is present on a carrier frequency in FR2, the UE shall ignore the field and applies the maximum power according to TS 38.101-2 [39]. This field is ignored by IAB-MT, the IAB-MT applies output power and emissions requirements, as specified in TS 38.174 [63].</td>
</tr>
<tr>
<td>scs-SpecificCarrierList</td>
<td>A set of carriers for different subcarrier spacings (numerologies). Defined in relation to Point A (see TS 38.211 [16], clause 5.3). The network configures this for all SCSs that are used in UL BWPs configured in this serving cell.</td>
</tr>
</tbody>
</table>

Conditional Presence

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDD-OrSUL</td>
<td>The field is mandatory present if this FrequencyInfoUL-SIB is for the paired UL for a DL (defined in a FrequencyInfoDL-SIB) or if this FrequencyInfoUL-SIB is for a supplementary uplink (SUL). It is absent otherwise (if this FrequencyInfoUL-SIB is for an unpaired UL (TDD)).</td>
</tr>
<tr>
<td>FDD-TDD-OrSUL-Optional</td>
<td>The field is optionally present. Need R, if this FrequencyInfoUL-SIB is for the paired UL for a DL (defined in a FrequencyInfoDL-SIB), or if this FrequencyInfoUL-SIB is for an unpaired UL (TDD) in certain bands (as defined in clause 5.4.2.1 of TS 38.101-1 and in clause 5.4.2.1 of TS 38.104 [12]), or if this FrequencyInfoUL-SIB is for a supplementary uplink (SUL). It is absent otherwise.</td>
</tr>
</tbody>
</table>

---

**HighSpeedConfig**

The IE HighSpeedConfig is used to configure parameters for high speed scenarios.

**HighSpeedConfig** information element

```plaintext
-- ASN1START
-- TAG-HIGHSPEEDCONFIG-START
HighSpeedConfig-r16 ::= SEQUENCE {
```
HighSpeedMeasFlag-r16
If the field is present, the UE shall apply the enhanced RRM requirements to support high speed up to 500 km/h as specified in TS 38.133 [14].

HighSpeedDemodFlag-r16
If the field is present, the UE shall apply the enhanced demodulation processing for HST-SFN joint transmission scheme with velocity up to 500 km/h as specified in TS 38.101-4 [59].

Hysteresis

The IE *Hysteresis* is a parameter used within the entry and leave condition of an event triggered reporting condition. The actual value is field value * 0.5 dB.

**Hysteresis information element**

InvalidSymbolPattern

The IE *InvalidSymbolPattern* is used to configure one invalid symbol pattern for PUSCH transmission repetition type B applicable for both DCI format 0_1 and 0_2, see TS 38.214 [19], clause 6.1.

**InvalidSymbolPattern information element**
InvalidSymbolPattern field descriptions

periodicityAndPattern
A time domain repetition pattern at which the pattern. This slot pattern repeats itself continuously. When the field is not configured, the UE uses the value n1 (see TS 38.214 [19], clause 6.1).

symbols
A symbol level bitmap in time domain (see TS 38.214[19], clause 6.1).

---

I-RNTI-Value
The IE I-RNTI-Value is used to identify the suspended UE context of a UE in RRC_INACTIVE.

---

I-RNTI-Value information element

---

-- ASN1START
-- TAG-I-RNTI-VALUE-START

I-RNTI-Value ::= BIT STRING (SIZE(40))

-- TAG-I-RNTI-VALUE-STOP
-- ASN1STOP

---

LBT-FailureRecoveryConfig
The IE LBT-FailureRecoveryConfig-r16 is used to configure the parameters used for detection of consistent uplink LBT failures for operation with shared spectrum channel access, as specified in TS 38.321 [3].

---

LBT-FailureRecoveryConfig information element

---

-- ASN1START
-- TAG-LBT-FAILURERECOVERYCONFIG-START

LBT-FailureRecoveryConfig-r16 ::= SEQUENCE {
  lbt-FailureInstanceMaxCount-r16 ENUMERATED {n4, n8, n16, n32, n64, n128},

**LBT-FailureRecoveryConfig** field descriptions

**lbt-FailureDetectionTimer**
Timer for consistent uplink LBT failure detection (see TS 38.321 [3]). Value `ms10` corresponds to 10 ms, value `ms20` corresponds to 20 ms, and so on.

**lbt-FailureInstanceMaxCount**
This field determines after how many consistent uplink LBT failure events the UE triggers uplink LBT failure recovery (see TS 38.321 [3]). Value `n4` corresponds to 4, value `n8` corresponds to 8, and so on.

---

**LocationInfo**

The IE **LocationInfo** is used to transfer available detailed location information, Bluetooth, WLAN and sensor available measurement results at the UE.

**LocationInfo** information element

```asn1
LocationInfo-r16 ::= SEQUENCE {
  commonLocationInfo-r16  CommonLocationInfo-r16  OPTIONAL,
  bt-LocationInfo-r16      LogMeasResultListBT-r16            OPTIONAL,
  wlan-LocationInfo-r16   LogMeasResultListWLAN-r16         OPTIONAL,
  sensor-LocationInfo-r16  Sensor-LocationInfo-r16          OPTIONAL,
  ...}
```

---

**LocationMeasurementInfo**

The IE **LocationMeasurementInfo** defines the information sent by the UE to the network to assist with the configuration of measurement gaps for location related measurements.

**LocationMeasurementInfo** information element

```asn1
LocationMeasurementInfo ::= CHOICE {
  eutra-RSTD                  EUTRA-RSTD-InfoList,
  ...}
```
...,
eutra-FineTimingDetection NULL,
nr-PRS-Measurement-r16 NR-PRS-MeasurementInfoList-r16
}

EUTRA-RSTD-InfoList ::= SEQUENCE (SIZE (1..maxInterRAT-RSTD-Freq)) OF EUTRA-RSTD-Info

EUTRA-RSTD-Info ::= SEQUENCE {
carrierFreq ARFCN-ValueEUTRA,
measPRS-Offset INTEGER (0..39), ...
}

NR-PRS-MeasurementInfoList-r16 ::= SEQUENCE (SIZE (1..maxFreqLayers)) OF NR-PRS-MeasurementInfo-r16

NR-PRS-MeasurementInfo-r16 ::= SEQUENCE {
dl-PRS-PointA-r16 ARFCN-ValueNR,
  nr-MeasPRS-RepetitionAndOffset-r16 CHOICE {
    ms20-r16 INTEGER (0..19),
    ms40-r16 INTEGER (0..39),
    ms80-r16 INTEGER (0..79),
    ms160-r16 INTEGER (0..159), ...
  },
nr-MeasPRS-length-r16 ENUMERATED {ms1dot5, ms3, ms3dot5, ms4, ms5dot5, ms6, ms10, ms20}, ...
}

-- TAG-LOCATIONMEASUREMENTINFO-STOP
-- ASN1STOP
LocationMeasurementInfo field descriptions

carrierFreq
The EARFCN value of the carrier received from upper layers for which the UE needs to perform the inter-RAT RSTD measurements.

measPRS-Offset
Indicates the requested gap offset for performing RSTD measurements towards E-UTRA. It is the smallest subframe offset from the beginning of subframe 0 of SFN=0 of the serving cell of the requested gap for measuring PRS positioning occasions in the carrier frequency carrierFreq for which the UE needs to perform the inter-RAT RSTD measurements. The PRS positioning occasion information is received from upper layers. The value of measPRS-Offset is obtained by mapping the starting subframe of the PRS positioning occasion in the measured cell onto the corresponding subframe in the serving cell and is calculated as the serving cell's number of subframes from SFN=0 mod 40.

The UE shall take into account any additional time required by the UE to start PRS measurements on the other carrier when it does this mapping for determining the measPRS-Offset.

NOTE: Figure 6.2.2-1 in TS 36.331[10] illustrates the measPRS-Offset field.

dl-PRS-PointA
The ARFCN value of the carrier received from upper layers for which the UE needs to perform the NR DL-PRS measurements.

nr-MeasPRS-RepetitionAndOffset
Indicates the gap periodicity in ms and offset in number of subframes of the requested measurement gap for performing NR DL-PRS measurements.

nr-MeasPRS-length
Indicates measurement gap length in ms of the requested measurement gap for performing NR DL-PRS measurements. The measurement gap length is according to in Table 9.1.2-1 in TS 38.133 [14].

---

LogicalChannelConfig

The IE LogicalChannelConfig is used to configure the logical channel parameters.

LogicalChannelConfig information element

-- ASN1START
-- TAG--LOGICALCHANNELCONFIG--START

LogicalChannelConfig ::= SEQUENCE {
  ul-SpecificParameters               SEQUENCE {
    priority                            INTEGER (1..16),
    prioritisedBitRate                  ENUMERATED {kBps0, kBps8, kBps16, kBps32, kBps64, kBps128, kBps256, kBps512,
                                                   kBps1024, kBps2048, kBps4096, kBps8192, kBps16384, kBps32768, kBps65536, infinity),
    bucketSizeDuration                  ENUMERATED {ms5, ms10, ms20, ms50, ms100, ms200, ms400, ms800, ms1600},
    allowedServingCells                 SEQUENCE (SIZE (1..maxNrofServingCells-1)) OF ServCellIndex
  OPTIONAL,   -- Cond PDCP-CADuplication
  allowedSCS-List                     SEQUENCE (SIZE (1..maxSCSs)) OF SubcarrierSpacing
  OPTIONAL,   -- Need R
  maxPUSCH-Duration                   ENUMERATED {ms0p02, ms0p04, ms0p0625, ms0p125, ms0p25, ms0p5, spare2, spare1}
  OPTIONAL,   -- Need R
  configuredGrantType1Allowed         ENUMERATED {true}
  OPTIONAL,   -- Need R
  logicalChannelGroup                 INTEGER (0..maxLCG-ID)
  OPTIONAL,   -- Need R
  schedulingRequestID                 SchedulingRequestId
  OPTIONAL,   -- Need R
  logicalChannelISR-Mask              BOOLEAN,
  OPTIONAL,   -- Need R
  logicalChannelISR-DelayTimerApplied BOOLEAN,
  ...
  bitRateQueryProhibitTimer           ENUMERATED {s0, s0dot4, s0dot8, s1dot6, s3, s6, s12, s30}
  OPTIONAL,   -- Need R
  ...
}
allowedCG-List-r16
  SEQUENCE (SIZE (0..maxNrofConfiguredGrantConfigMAC-r16-1)) OF ConfiguredGrantConfigIndexMAC-r16
  OPTIONAL, -- Need S
allowedPHY-PriorityIndex-r16
  ENUMERATED {p0, p1}
  OPTIONAL, -- Need S
...,
[[
  channelAccessPriority-r16
  INTEGER (1..4)
  OPTIONAL, -- Need R
  bitRateMultiplier-r16
  ENUMERATED {x40, x70, x100, x200}
  OPTIONAL, -- Need R
]}

-- TAG-LOGICALCHANNELCONFIG-STOP
-- ASN1STOP
### LogicalChannelConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>allowedCG-List</strong></td>
<td>This restriction applies only when the UL grant is a configured grant. If present, UL MAC SDUs from this logical channel can only be mapped to the indicated configured grant configuration. If the size of the sequence is zero, UL MAC SDUs from this logical channel cannot be mapped to any configured grant configurations. If the field is not present, UL MAC SDUs from this logical channel can be mapped to any configured grant configurations. If the field configuredGrantType1Allowed is present, only those configured grant type 1 configuration indicated in this sequence are allowed for use by this logical channel; otherwise, this sequence shall not include any configured grant type 1 configuration. Corresponds to &quot;allowedCG-List&quot; as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>allowedPHY-PriorityIndex</strong></td>
<td>This restriction applies only when the UL grant is a dynamic grant. If the field is present and the dynamic grant has a PHY-priority index, UL MAC SDUs from this logical channel can only be mapped to the dynamic grants indicating PHY-priority index equal to the values configured by this field. If the field is present and the dynamic grant does not have a PHY-priority index, UL MAC SDUs from this logical channel can only be mapped to this dynamic grant if the value of the field is ( p_0 ). See TS 38.213 [13], clause 9. If the field is not present, UL MAC SDUs from this logical channel can be mapped to any dynamic grants. Corresponds to &quot;allowedPHY-PriorityIndex&quot; as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>allowedSCS-List</strong></td>
<td>If present, UL MAC SDUs from this logical channel can only be mapped to the indicated numerology. Otherwise, UL MAC SDUs from this logical channel can be mapped to any configured numerology. Only the values 15/30/60 kHz (for FR1) and 60/120 kHz (for FR2) are applicable. Corresponds to 'allowedSCS-List' as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>allowedServingCells</strong></td>
<td>If present, UL MAC SDUs from this logical channel can only be mapped to the serving cells indicated in this list. Otherwise, UL MAC SDUs from this logical channel can be mapped to any configured serving cell of this cell group. Corresponds to 'allowedServingCells' in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>bitRateMultiplier</strong></td>
<td>Bit rate multiplier for recommended bit rate MAC CE as specified in TS 38.321 [3]. Value ( x40 ) indicates bit rate multiplier 40, value ( x70 ) indicates bit rate multiplier 70 and so on.</td>
</tr>
<tr>
<td><strong>bitRateQueryProhibitTimer</strong></td>
<td>The timer is used for bit rate recommendation query in TS 38.321 [3]. Value ( s0 ) means 0 s, ( s0dot4 ) means 0.4 s and so on.</td>
</tr>
<tr>
<td><strong>bucketSizeDuration</strong></td>
<td>Value in ms. ( ms5 ) corresponds to 5 ms, value ( ms10 ) corresponds to 10 ms, and so on.</td>
</tr>
<tr>
<td><strong>channelAccessPriority</strong></td>
<td>Indicates the Channel Access Priority Class (CAPC), as specified in TS 38.300 [2], to be used on uplink transmissions for operation with shared spectrum channel access. The network configures this field only for SRB2 and DRBs.</td>
</tr>
<tr>
<td><strong>configuredGrantType1Allowed</strong></td>
<td>If present, or if the capability lcp-Restriction as specified in TS 38.306 [26] is not supported. UL MAC SDUs from this logical channel can be transmitted on a configured grant type 1. Otherwise, UL MAC SDUs from this logical channel cannot be transmitted on a configured grant type 1. Corresponds to 'configuredGrantType1Allowed' in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>logicalChannelGroup</strong></td>
<td>ID of the logical channel group, as specified in TS 38.321 [3], which the logical channel belongs to.</td>
</tr>
<tr>
<td><strong>logicalChannelSR-Mask</strong></td>
<td>Controls SR triggering when a configured uplink grant of ( type1 ) or ( type2 ) is configured. ( true ) indicates that SR masking is configured for this logical channel as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>logicalChannelSR-DelayTimerApplied</strong></td>
<td>Indicates whether to apply the delay timer for SR transmission for this logical channel. Set to ( false ) if <strong>logicalChannelSR-DelayTimer</strong> is not included in <strong>BSR-Config</strong>.</td>
</tr>
<tr>
<td><strong>maxPUSCH-Duration</strong></td>
<td>If present, UL MAC SDUs from this logical channel can only be transmitted using uplink grants that result in a PUSCH duration shorter than or equal to the duration indicated by this field. Otherwise, UL MAC SDUs from this logical channel can be transmitted using an uplink grant resulting in any PUSCH duration. Corresponds to &quot;maxPUSCH-Duration&quot; in TS 38.321 [3]. The PUSCH duration is calculated based on the same length of all symbols, and the shortest length applies if the symbol lengths are different.</td>
</tr>
<tr>
<td><strong>priority</strong></td>
<td>Logical channel priority, as specified in TS 38.321 [3].</td>
</tr>
</tbody>
</table>
prioritisedBitRate
Value in kiloBytes/s. Value kBps0 corresponds to 0 kiloBytes/s, value kBps8 corresponds to 8 kiloBytes/s, value kBps16 corresponds to 16 kiloBytes/s, and so on. For SRBs, the value can only be set to infinity.

schedulingRequestId
If present, it indicates the scheduling request configuration applicable for this logical channel, as specified in TS 38.321 [3].

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDCP-CADuplication</td>
<td>The field is mandatory present if the DRB/SRB associated with this logical channel is configured with PDCP CA duplication in UL in the cell group in which this IE is included (i.e. the PDCP entity is associated with multiple RLC entities belonging to this cell group). Otherwise the field is optionally present, need R.</td>
</tr>
<tr>
<td>UL</td>
<td>The field is mandatory present for a logical channel with uplink if it serves DRB. It is optionally present, Need R, for a logical channel with uplink if it serves an SRB. Otherwise it is absent.</td>
</tr>
</tbody>
</table>

LogicalChannelIdentity
The IE LogicalChannelIdentity is used to identify one logical channel (LogicalChannelConfig) and the corresponding RLC bearer (RLC-BearerConfig).

LogicalChannelIdentity information element

MAC-CellGroupConfig
The IE MAC-CellGroupConfig is used to configure MAC parameters for a cell group, including DRX.

MAC-CellGroupConfig information element
MAC-CellGroupConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>usePreBSR</td>
<td>If set to true, the MAC entity of the IAB-MT may use the Pre-emptive BSR, see TS 38.321 [3].</td>
</tr>
<tr>
<td>csi-Mask</td>
<td>If set to true, the UE limits CSI reports to the on-duration period of the DRX cycle, see TS 38.321 [3].</td>
</tr>
<tr>
<td>dataInactivityTimer</td>
<td>Releases the RRC connection upon data inactivity as specified in clause 5.3.8.5 and in TS 38.321 [3]. Value s1 corresponds to 1 second, value s2 corresponds to 2 seconds, and so on.</td>
</tr>
<tr>
<td>drx-Config</td>
<td>Used to configure DRX as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td>drx-ConfigSecondaryGroup</td>
<td>Used to configure DRX related parameters for the second DRX group as specified in TS 38.321 [3]. The network does not configure secondary DRX group with DCP simultaneously nor secondary DRX group with a dormant BWP simultaneously.</td>
</tr>
<tr>
<td>lch-BasedPrioritization</td>
<td>If this field is present, the corresponding MAC entity of the UE is configured with prioritization between overlapping grants and between scheduling request and overlapping grants based on LCH priority, see TS 38.321 [3].</td>
</tr>
<tr>
<td>schedulingRequestID-BFR-SCell</td>
<td>Indicates the scheduling request configuration applicable for BFR on SCell, as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td>schedulingRequestID-LBT-SCell</td>
<td>Indicates the scheduling request configuration applicable for consistent uplink LBT recovery on SCell, as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td>skipUplinkTxDynamic</td>
<td>If set to true, the UE skips UL transmissions as described in TS 38.321 [3].</td>
</tr>
<tr>
<td>tag-Config</td>
<td>The field is used to configure parameters for a time-alignment group. The field is not present if any DAPS bearer is configured.</td>
</tr>
</tbody>
</table>

### Conditional Presence

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCG-Only</td>
<td>This field is optionally present, Need M, for the MAC-CellGroupConfig of the MCG. It is absent otherwise.</td>
</tr>
</tbody>
</table>
The IE `MeasConfig` specifies measurements to be performed by the UE, and covers intra-frequency, inter-frequency and inter-RAT mobility as well as configuration of measurement gaps.

**MeasConfig information element**

```asn1
MeasConfig ::= SEQUENCE {
  measObjectToRemoveList          MeasObjectToRemoveList OPTIONAL, -- Need N
  measObjectToAddModList          MeasObjectToAddModList OPTIONAL, -- Need N
  reportConfigToRemoveList        ReportConfigToRemoveList OPTIONAL, -- Need N
  reportConfigToAddModList        ReportConfigToAddModList OPTIONAL, -- Need N
  measIdToRemoveList              MeasIdToRemoveList OPTIONAL, -- Need N
  measIdToAddModList              MeasIdToAddModList OPTIONAL, -- Need N
  s-MeasureConfig                 CHOICE {
    ssb-RSRP                        RSRP-Range,
    csi-RSRP                        RSRP-Range
  } OPTIONAL, -- Need M
  quantityConfig                  QuantityConfig OPTIONAL, -- Need M
  measGapConfig                   MeasGapConfig OPTIONAL, -- Need M
  measGapSharingConfig            MeasGapSharingConfig OPTIONAL, -- Need M
  ...,
  [[
    interFrequencyConfig-NoGap-r16 ENUMERATED {true} OPTIONAL -- Need R
  ]]
}
```

MeasObjectToRemoveList ::= SEQUENCE (SIZE (1..maxNrofObjectId)) OF MeasObjectId
MeasIdToRemoveList ::= SEQUENCE (SIZE (1..maxNrofMeasId)) OF MeasId
ReportConfigToRemoveList ::= SEQUENCE (SIZE (1..maxReportConfigId)) OF ReportConfigId

---

**ASN1START**

**TAG-MEASCONFIG-START**

---

**ASN1STOP**

**TAG-MEASCONFIG-STOP**

---

ETSI
**MeasConfig field descriptions**

*interFrequencyConfig-NoGap-r16*
If the field is set to true, UE is configured to perform SSB based inter-frequency measurement without measurement gaps when the inter-frequency SSB is completely contained in the active DL BWP of the UE, as specified in TS 38.133 [14], clause 9.3. Otherwise, the SSB based inter-frequency measurement is performed within measurement gaps.

*measGapConfig*
Used to setup and release measurement gaps in NR.

*measIdToAddModList*
List of measurement identities to add and/or modify.

*measIdToRemoVeList*
List of measurement identities to remove.

*measObjectIdToAddModList*
List of measurement objects to add and/or modify.

*measObjectIdToRemoveList*
List of measurement objects to remove.

*reportConfigToAddModList*
List of measurement reporting configurations to add and/or modify.

*reportConfigToRemoveList*
List of measurement reporting configurations to remove.

*s-MeasureConfig*
Threshold for NR SpCell RSRP measurement controlling when the UE is required to perform measurements on non-serving cells. Choice of ssb-RSRP corresponds to cell RSRP based on SS/PBCH block and choice of csi-RSRP corresponds to cell RSRP of CSI-RS.

*measGapSharingConfig*
Specifies the measurement gap sharing scheme and controls setup/release of measurement gap sharing.

---

**MeasGapConfig**

The IE *MeasGapConfig* specifies the measurement gap configuration and controls setup/release of measurement gaps.

**MeasGapConfig information element**

```asn1
MeasGapConfig ::= SEQUENCE {
  gapFR2  SetupRelease { GapConfig } OPTIONAL, -- Need M
  ..., 
  [ gapFR1  SetupRelease { GapConfig } OPTIONAL, -- Need M
    gapUE  SetupRelease { GapConfig } OPTIONAL, -- Need M
  ]
}

GapConfig ::= SEQUENCE {
  gapOffset INTEGER (0..159),
  mgl       ENUMERATED {ms1dot5, ms3, ms3dot5, ms4, ms5dot5, ms6},
}"
```
MeasGapConfig field descriptions

gapFR1
Indicates measurement gap configuration that applies to FR1 only. In (NG)EN-DC, gapFR1 cannot be set up by NR RRC (i.e. only LTE RRC can configure FR1 measurement gap). In NE-DC, gapFR1 can only be set up by NR RRC (i.e. LTE RRC cannot configure FR1 gap). In NR-DC, gapFR1 can only be set up in the measConfig associated with MCG. gapFR1 can not be configured together with gapUE. The applicability of the FR1 measurement gap is according to Table 9.1.2-2 and Table 9.1.2-3 in TS 38.133 [14].

gapFR2
Indicates measurement gap configuration applies to FR2 only. In (NG)EN-DC or NE-DC, gapFR2 can only be set up by NR RRC (i.e. LTE RRC cannot configure FR2 gap). In NR-DC, gapFR2 can only be set up in the measConfig associated with MCG. gapFR2 cannot be configured together with gapUE. The applicability of the FR2 measurement gap is according to Table 9.1.2-2 and Table 9.1.2-3 in TS 38.133 [14].

gapUE
Indicates measurement gap configuration that applies to all frequencies (FR1 and FR2). In (NG)EN-DC, gapUE cannot be set up by NR RRC (i.e. only LTE RRC can configure per UE measurement gap). In NE-DC, gapUE can only be set up by NR RRC (i.e. LTE RRC cannot configure per UE gap). In NR-DC, gapUE can only be set up in the measConfig associated with MCG. If gapUE is configured, then neither gapFR1 nor gapFR2 can be configured. The applicability of the per UE measurement gap is according to Table 9.1.2-2 and Table 9.1.2-3 in TS 38.133 [14].

gapOffset
Value gapOffset is the gap offset of the gap pattern with MGRP indicated in the field mgrp. The value range is from 0 to mgrp-1.

mgl
Value mgl is the measurement gap length in ms of the measurement gap. The measurement gap length is according to in Table 9.1.2-1 in TS 38.133 [14]. Value ms1dot5 corresponds to 1.5 ms, ms3 corresponds to 3 ms and so on. If mgl-r16 is present, UE shall ignore the mgl (without suffix).

mgrp
Value mgrp is measurement gap repetition period in (ms) of the measurement gap. The measurement gap repetition period is according to Table 9.1.2-1 in TS 38.133 [14].

mgta
Value mgta is the measurement gap timing advance in ms. The applicability of the measurement gap timing advance is according to clause 9.1.2 of TS 38.133 [14]. Value ms0 corresponds to 0 ms, ms0dot25 corresponds to 0.25 ms and ms0dot5 corresponds to 0.5 ms. For FR2, the network only configures 0 ms and 0.25 ms.

refFR2ServCellAsyncCA
Indicates the FR2 serving cell identifier whose SFN and subframe is used for FR2 gap calculation for this gap pattern with asynchronous CA involving FR2 carrier(s).

refServCellIndicator
Indicates the serving cell whose SFN and subframe are used for gap calculation for this gap pattern. Value pCell corresponds to the PCell, pSCell corresponds to the PSCell, and mcg-FR2 corresponds to a serving cell on FR2 frequency in MCG.
<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AsyncCA</td>
<td>This field is mandatory present when configuring FR2 gap pattern to UE in: - (NG)EN-DC or NR SA with asynchronous CA involving FR2 carrier(s); - NE-DC or NR-DC with asynchronous CA involving FR2 carrier(s), if the field refServCellIndicator is set to mcg-FR2. In case the gap pattern to UE in NE-DC and NR-DC is already configured and the serving cell used for the gap calculation corresponds to a serving cell on FR2 frequency in MCG, then the field is optionally present, need M. Otherwise, it is absent, Need R.</td>
</tr>
<tr>
<td>NEDCorNRDC</td>
<td>This field is mandatory present when configuring gap pattern to UE in NE-DC or NR-DC. In case the gap pattern to UE in NE-DC and NR-DC is already configured, then the field is absent, need M. Otherwise, it is absent.</td>
</tr>
<tr>
<td>PRS</td>
<td>This field is optionally present, Need R, when configuring gap pattern to UE for measurements of DL-PRS configured via LPP (TS 37.355 [49]). Otherwise, it is absent.</td>
</tr>
</tbody>
</table>

---

**MeasGapSharingConfig**

The IE *MeasGapSharingConfig* specifies the measurement gap sharing scheme and controls setup/ release of measurement gap sharing.

**MeasGapSharingConfig information element**

```asn1
MeasGapSharingConfig ::= SEQUENCE {
    gapSharingFR2                SetupRelease { MeasGapSharingScheme } OPTIONAL, -- Need M
    ...,
    [[
        gapSharingFR1                SetupRelease { MeasGapSharingScheme } OPTIONAL, -- Need M
        gapSharingUE                 SetupRelease { MeasGapSharingScheme } OPTIONAL, -- Need M
    ]]
"
MeasGapSharingScheme := ENUMERATED {scheme00, scheme01, scheme10, scheme11}
```

---

-- ASN1START
-- TAG-MEASGAPSHARINGCONFIG-START

---

-- ASN1STOP
-- TAG-MEASGAPSHARINGCONFIG-STOP

---

-- ASN1STOP

---
**MeasGapSharingConfig field descriptions**

- **gapSharingFR1**
  Indicates the measurement gap sharing scheme that applies to the gap set for FR1 only. In (NG)EN-DC, `gapSharingFR1` cannot be set up by NR RRC (i.e. only LTE RRC can configure FR1 gap sharing). In NE-DC, `gapSharingFR1` can only be set up by NR RRC (i.e. LTE RRC cannot configure FR1 gap sharing). In NR-DC, `gapSharingFR1` can only be set up in the `measConfig` associated with MCG. `gapSharingFR1` cannot be configured together with `gapSharingUE`. For the applicability of the different gap sharing schemes, see TS 38.133 [14]. Value `scheme00` corresponds to scheme "00", value `scheme01` corresponds to scheme "01", and so on.

- **gapSharingFR2**
  Indicates the measurement gap sharing scheme that applies to the gap set for FR2 only. In (NG)EN-DC or NE-DC, `gapSharingFR2` can only be set up by NR RRC (i.e. LTE RRC cannot configure FR2 gap sharing). In NR-DC, `gapSharingFR2` can only be set up by MCG in the `measConfig` associated with MCG. `gapSharingFR2` cannot be configured together with `gapSharingUE`. For applicability of the different gap sharing schemes, see TS 38.133 [14]. Value `scheme00` corresponds to scheme "00", value `scheme01` corresponds to scheme "01", and so on.

- **gapSharingUE**
  Indicates the measurement gap sharing scheme that applies to the gap set per UE. In (NG)EN-DC, `gapSharingUE` cannot be set up by NR RRC (i.e. only LTE RRC can configure per UE gap sharing). In NE-DC, `gapSharingUE` can only be set up by NR RRC (i.e. LTE RRC cannot configure per UE gap sharing). In NR-DC, `gapSharingUE` can only be set up in the `measConfig` associated with MCG. If `gapSharingUE` is configured, then neither `gapSharingFR1` nor `gapSharingFR2` can be configured. For the applicability of the different gap sharing schemes, see TS 38.133 [14]. Value `scheme00` corresponds to scheme "00", value `scheme01` corresponds to scheme "01", and so on.

---

**MeasId**

The IE `MeasId` is used to identify a measurement configuration, i.e., linking of a measurement object and a reporting configuration.

**MeasId information element**

```
   MeasId ::= INTEGER {1..maxNrofMeasId}
```

---

**MeasIdleConfig**

The IE `MeasIdleConfig` is used to convey information to UE about measurements requested to be done while in RRC_IDLE or RRC_INACTIVE.

**MeasIdleConfig information element**

```
   MeasIdleConfigSIB-r16 ::= SEQUENCE {
      measIdleCarrierListNR-r16  SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierNR-r16  OPTIONAL,  -- Need S
      measIdleCarrierListEUTRA-r16 SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierEUTRA-r16  OPTIONAL,  -- Need S
      ...}
```
MeasIdleConfigDedicated-r16 ::= SEQUENCE {
  measIdleCarrierListNR-r16   SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierNR-r16 OPTIONAL, -- Need N
  measIdleCarrierListEUTRA-r16 SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierEUTRA-r16 OPTIONAL, -- Need N
  measIdleDuration-r16 ENUMERATED{sec10, sec30, sec60, sec120, sec180, sec240, sec300, spare},
  validityAreaList-r16       ValidityAreaList-r16 OPTIONAL, -- Need N
...
}

ValidityAreaList-r16 ::= SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF ValidityArea-r16

ValidityArea-r16 ::= SEQUENCE {
  carrierFreq-r16           ARFCN-ValueNR,
  validityCellList-r16      ValidityCellList OPTIONAL -- Need N
}

ValidityCellList ::= SEQUENCE (SIZE (1..maxCellMeasIdle-r16)) OF PCI-Range

MeasIdleCarrierNR-r16 ::= SEQUENCE {
  carrierFreq-r16           ARFCN-ValueNR,
  ssbSubcarrierSpacing-r16  SubcarrierSpacing,
  frequencyBandList         MultiFrequencyBandListNR OPTIONAL, -- Need R
  measCellListNR-r16        CellListNR-r16 OPTIONAL, -- Need R
  reportQuantities-r16      ENUMERATED (rsrp, rsrq, both),
  qualityThreshold-r16      SEQUENCE {
    idleRSRP-Threshold-NR-r16 RSRP-Range OPTIONAL, -- Need R
    idleRSRQ-Threshold-NR-r16 RSRQ-Range OPTIONAL, -- Need R
  } OPTIONAL, -- Need R
  ssb-MeasConfig-r16        SEQUENCE {
    nrofSS-BlocksToAverage-r16 INTEGER (2..maxNrofSS-BlocksToAverage) OPTIONAL, -- Need S
    absThreshSS-BlocksConsolidation-r16 ThresholdNR OPTIONAL, -- Need S
    ssb-ToMeasure-r16         SSB-ToMeasure OPTIONAL, -- Need S
    deriveSSB-IndexFromCell-r16 BOOLEAN OPTIONAL, -- Need S
    ss-RSSI-Measurement-r16   SS-RSSI-Measurement OPTIONAL -- Need S
  } OPTIONAL, -- Need S
  beamMeasConfigIdle-r16    BeamMeasConfigIdle-NR-r16 OPTIONAL, -- Need R
...
}

MeasIdleCarrierEUTRA-r16 ::= SEQUENCE {
  carrierFreqEUTRA-r16       ARFCN-ValueEUTRA,
  allowedMeasBandwidth-r16   EUTRA-AllowedMeasBandwidth,
  measCellListEUTRA-r16      CellListEUTRA-r16 OPTIONAL, -- Need R
  reportQuantitiesEUTRA-r16  ENUMERATED {rsrp, rsrq, both},
  qualityThresholdEUTRA-r16  SEQUENCE {
    idleRSRP-Threshold-EUTRA-r16 RSRP-RangeEUTRA OPTIONAL, -- Need R
    idleRSRQ-Threshold-EUTRA-r16 RSRQ-RangeEUTRA-r16 OPTIONAL, -- Need R
  } OPTIONAL, -- Need R
  ...
}

CellListNR-r16 ::= SEQUENCE (SIZE (1..maxCellMeasIdle-r16)) OF PCI-Range
CellListEUTRA-r16 ::= SEQUENCE { SIZE (1..maxCellMeasIdle-r16)} OF EUTRA-PhysCellIdRange

BeamMeasConfigIdle-NR-r16 ::= SEQUENCE {
  reportQuantityRS-Indexes-r16 ENUMERATED (rsrp, rsrq, both),
  maxNrofRS-IndexesToReport-r16 INTEGER (1.. maxNrofIndexesToReport),
  includeBeamMeasurements-r16 BOOLEAN
}

RSRQ-RangeEUTRA-r16 ::= INTEGER (-30..46)

-- TAG-MEASIDLECONFIG-STOP
-- ASN1STOP
### MeasIdleConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>absThreshSS-BlocksConsolidation</strong></td>
<td>Threshold for consolidation of L1 measurements per RS index.</td>
</tr>
<tr>
<td><strong>beamMeasConfigIdle</strong></td>
<td>Indicates the beam level measurement configuration.</td>
</tr>
<tr>
<td><strong>carrierFreq</strong></td>
<td>Indicates the NR carrier frequency to be used for measurements during RRC_IDLE or RRC_INACTIVE.</td>
</tr>
<tr>
<td><strong>carrierFreqEUTRA</strong></td>
<td>Indicates the E-UTRA carrier frequency to be used for measurements during RRC_IDLE or RRC_INACTIVE.</td>
</tr>
<tr>
<td><strong>deriveSSB-IndexFromCell</strong></td>
<td>This field indicates whether the UE may use the timing of any detected cell on that frequency to derive the SSB index of all neighbour cells on that frequency. If this field is set to true, the UE assumes SFN and frame boundary alignment across cells on the neighbor frequency as specified in TS 38.133 [14].</td>
</tr>
<tr>
<td><strong>frequencyBandList</strong></td>
<td>Indicates the list of frequency bands for which the NR idle/inactive measurement parameters apply. The UE shall select the first listed band which it supports in the frequencyBandList field to represent the NR neighbour carrier frequency.</td>
</tr>
<tr>
<td><strong>includeBeamMeasurements</strong></td>
<td>Indicates whether or not the UE shall include beam measurements in the NR idle/inactive measurement results.</td>
</tr>
<tr>
<td><strong>maxNrofRS-IndexesToReport</strong></td>
<td>Max number of beam indices to include in the idle/inactive measurement result.</td>
</tr>
<tr>
<td><strong>measCellListEUTRA</strong></td>
<td>Indicates the list of E-UTRA cells which the UE is requested to measure and report for idle/inactive measurements.</td>
</tr>
<tr>
<td><strong>measCellListNR</strong></td>
<td>Indicates the list of NR cells which the UE is requested to measure and report for idle/inactive measurements.</td>
</tr>
<tr>
<td><strong>measIdleCarrierListEUTRA</strong></td>
<td>Indicates the E-UTRA carriers to be measured during RRC_IDLE or RRC_INACTIVE.</td>
</tr>
<tr>
<td><strong>measIdleCarrierListNR</strong></td>
<td>Indicates the NR carriers to be measured during RRC_IDLE or RRC_INACTIVE.</td>
</tr>
<tr>
<td><strong>measIdleDuration</strong></td>
<td>Indicates the duration for performing idle/inactive measurements while in RRC_IDLE or RRC_INACTIVE. Value sec10 correspond to 10 seconds, value sec30 to 30 seconds and so on.</td>
</tr>
<tr>
<td><strong>nrofSS-BlocksToAverage</strong></td>
<td>Number of SS blocks to average for cell measurement derivation.</td>
</tr>
<tr>
<td><strong>qualityThreshold</strong></td>
<td>Indicates the quality thresholds for reporting the measured cells for idle/inactive NR measurements.</td>
</tr>
<tr>
<td><strong>qualityThresholdEUTRA</strong></td>
<td>Indicates the quality thresholds for reporting the measured cells for idle/inactive E-UTRA measurements.</td>
</tr>
<tr>
<td><strong>reportQuantities</strong></td>
<td>Indicates which measurement quantities UE is requested to report in the idle/inactive measurement report.</td>
</tr>
<tr>
<td><strong>reportQuantitiesEUTRA</strong></td>
<td>Indicates which E-UTRA measurement quantities the UE is requested to report in the idle/inactive measurement report.</td>
</tr>
<tr>
<td><strong>reportQuantityRS-Indexes</strong></td>
<td>Indicates which measurement information per beam index the UE shall include in the NR idle/inactive measurement results.</td>
</tr>
<tr>
<td><strong>smtc</strong></td>
<td>Indicates the measurement timing configuration for inter-frequency measurement. If this field is absent in VarMeasIdleConfig, the UE assumes that SSB periodicity is 5 ms in this frequency.</td>
</tr>
</tbody>
</table>
**ssbSubcarrierSpacing**
Indicates subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.

**ssb-ToMeasure**
The set of SS blocks to be measured within the SMTC measurement duration (see TS 38.215 [9]). When the field is absent in VarMeasIdleConfig, the UE measures on all SS-blocks.

**ss-RSSI-Measurement**
Indicates the SSB-based RSSI measurement configuration. If the field is absent in VarMeasIdleConfig, the UE behaviour is defined in TS 38.215 [89], clause 5.1.3.

**validityAreaList**
Indicates the list of frequencies and optionally, for each frequency, a list of cells within which the UE is required to perform measurements while in RRC_IDLE and RRC_INACTIVE.

---

**MeasIdToAddModList**
The IE MeasIdToAddModList concerns a list of measurement identities to add or modify, with for each entry the measId, the associated measObjectId and the associated reportConfigId.

**MeasIdToAddModList information element**

```asn1
MeasIdToAddModList ::= SEQUENCE { SIZE (1..maxNrofMeasId)} OF MeasIdToAddMod

MeasIdToAddMod ::= SEQUENCE {
  measId                              MeasId,
  measObjectId                        MeasObjectId,
  reportConfigId                      ReportConfigId
}
```

---

**MeasObjectCLI**
The IE MeasObjectCLI specifies information applicable for SRS-RSRP measurements and/or CLI-RSSI measurements.

**MeasObjectCLI information element**

```asn1
MeasObjectCLI-r16 ::= SEQUENCE {
  cli-ResourceConfig-r16              CLI-ResourceConfig-r16,
  ...
}
```
CLI-ResourceConfig-r16 ::= SEQUENCE {
  srs-ResourceConfig-r16  SetupRelease { SRS-ResourceListConfigCLI-r16 }  OPTIONAL, -- Need M
  rssi-ResourceConfig-r16  SetupRelease { RSSI-ResourceListConfigCLI-r16 }  OPTIONAL    -- Need M
}

SRS-ResourceListConfigCLI-r16 ::= SEQUENCE (SIZE (1.. maxNrofCLI-SRS-Resources-r16)) OF SRS-ResourceConfigCLI-r16

RSSI-ResourceListConfigCLI-r16 ::= SEQUENCE (SIZE (1.. maxNrofCLI-RSSI-Resources-r16)) OF RSSI-ResourceConfigCLI-r16

SRS-ResourceConfigCLI-r16 ::= SEQUENCE {
  srs-Resource-r16                    SRS-Resource,
  srs-SCS-r16                         SubcarrierSpacing,
  refServCellIndex-r16                ServCellIndex OPTIONAL, -- Need S
  refBWP-r16                          BWP-Id,
... }

RSSI-ResourceConfigCLI-r16 ::= SEQUENCE {
  rssi-ResourceId-r16                 RSSI-ResourceId-r16,
  rssi-SCS-r16                        SubcarrierSpacing,
  startPRB-r16                        INTEGER (0..2169),
  nrofPRBs-r16                        INTEGER (4..maxNrofPhysicalResourceBlocksPlus1),
  startPosition-r16                   INTEGER (0..13),
  nrofSymbols-r16                     INTEGER (1..14),
  rssi-PeriodicityAndOffset-r16       RSSI-PeriodicityAndOffset-r16,
  refServCellIndex-r16                ServCellIndex OPTIONAL, -- Need S
  ... }

RSSI-ResourceId-r16 ::=             INTEGER (0.. maxNrofCLI-RSSI-Resources-r16-1)

RSSI-PeriodicityAndOffset-r16 ::=   CHOICE {
  s110                                INTEGER(0..9),
  s120                                INTEGER(0..19),
  s140                                INTEGER(0..39),
  s180                                INTEGER(0..79),
  s1160                               INTEGER(0..159),
  s1320                               INTEGER(0..319),
  s1640                               INTEGER(0..639),
  ... }

-- TAG-MEASOBJECTCLI-STOP
-- ASN1STOP

### CLI-ResourceConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>srs-ResourceConfig</td>
<td>SRS resources to be used for CLI measurements.</td>
</tr>
<tr>
<td>rssi-ResourceConfig</td>
<td>CLI-RSSI resources to be used for CLI measurements.</td>
</tr>
</tbody>
</table>
### MeasObjectCLI field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cli-ResourceConfig</td>
<td>SRS and/or CLI-RSSI resource configuration for CLI measurement.</td>
</tr>
</tbody>
</table>

### SRS-ResourceConfigCLI field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>refBWP</td>
<td>DL BWP id that is used to derive the reference point of the SRS resource (see TS 38.211[16], clause 6.4.1.4.3)</td>
</tr>
<tr>
<td>refServCellIndex</td>
<td>The index of the reference serving cell that the refBWP belongs to. If this field is absent, the reference serving cell is PCell.</td>
</tr>
<tr>
<td>srs-SCS</td>
<td>Subcarrier spacing for SRS. Only the values 15, 30 kHz or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable.</td>
</tr>
</tbody>
</table>

### RSSI-ResourceConfigCLI field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>nrofPRBs</td>
<td>Allowed size of the measurement BW. Only multiples of 4 are allowed. The smallest configurable number is the minimum of 4 and the width of the active DL BWP. If the configured value is larger than the width of the active DL BWP, the UE shall assume that the actual CLI-RSSI resource bandwidth is within the active DL BWP.</td>
</tr>
<tr>
<td>nrofSymbols</td>
<td>Within a slot that is configured for CLI-RSSI measurement (see slotConfiguration), the UE measures the RSSI from startPosition to startPosition + nrofSymbols - 1. The configured CLI-RSSI resource does not exceed the slot boundary of the reference SCS. If the SCS of configured DL BWP(s) is larger than the reference SCS, network configures startPosition and nrofSymbols such that the configured CLI-RSSI resource not to exceed the slot boundary corresponding to the configured BWP SCS. If the reference SCS is larger than SCS of configured DL BWP(s), network ensures startPosition and nrofSymbols are integer multiple of reference SCS divided by configured BWP SCS.</td>
</tr>
<tr>
<td>refServCellIndex</td>
<td>The index of the reference serving cell. Frequency reference point of the RSSI resource is subcarrier 0 of CRB0 of the reference serving cell. If this field is absent, the reference serving cell is PCell.</td>
</tr>
<tr>
<td>rssi-PeriodicityAndOffset</td>
<td>Periodicity and slot offset for this CLI-RSSI resource. All values are in “number of slots”. Value sl1 corresponds to a periodicity of 1 slot, value sl2 corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots.</td>
</tr>
<tr>
<td>rssi-scs</td>
<td>Reference subcarrier spacing for CLI-RSSI measurement. Only the values 15, 30 kHz or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. UE performs CLI-RSSI measurement with the SCS of the active bandwidth part within the configured CLI-RSSI resource in the active BWP regardless of the reference SCS of the measurement resource.</td>
</tr>
<tr>
<td>startPosition</td>
<td>OFDM symbol location of the CLI-RSSI resource within a slot.</td>
</tr>
<tr>
<td>startPRB</td>
<td>Starting PRB index of the measurement bandwidth. For the case where the reference subcarrier spacing is smaller than subcarrier spacing of active DL BWP(s), network configures startPRB and nrofPRBs are as a multiple of active BW SCS divided by reference SCS.</td>
</tr>
</tbody>
</table>

### MeasObjectEUTRA

The IE MeasObjectEUTRA specifies information applicable for E-UTRA cells.
MeasObjectEUTRA information element

```asn
MeasObjectEUTRA ::= SEQUENCE {
  carrierFreq        ARFCN-ValueEUTRA,  
  allowedMeasBandwidth EUTRA-AllowedMeasBandwidth,  
  cellsToRemoveListEUTRAN EUTRA-CellIndexList OPTIONAL, -- Need N  
  cellsToAddModListEUTRAN SEQUENCE (SIZE (1..maxCellMeasEUTRA)) OF EUTRA-Cell OPTIONAL, -- Need N  
  blackCellsToRemoveListEUTRAN EUTRA-CellIndexList OPTIONAL, -- Need N  
  blackCellsToAddModListEUTRAN SEQUENCE (SIZE (1..maxCellMeasEUTRA)) OF EUTRA-BlackCell OPTIONAL, -- Need N  
  eutra-PresenceAntennaPort1 EUTRA-PresenceAntennaPort1,  
  eutra-Q-OffsetRange                         EUTRA-Q-OffsetRange OPTIONAL, -- Need R  
  widebandRSRQ-Meas BOOLEAN, ... 
}
```

EUTRA-CellIndexList ::= SEQUENCE (SIZE (1..maxCellMeasEUTRA)) OF EUTRA-CellIndex

EUTRA-CellIndex ::= INTEGER (1..maxCellMeasEUTRA)

EUTRA-Cell ::= SEQUENCE {
  cellIndexEUTRA EUTRA-CellIndex,  
  physCellId     EUTRA-PhysCellId,  
  cellIndividualOffset EUTRA-Q-OffsetRange
}

EUTRA-BlackCell ::= SEQUENCE {
  cellIndexEUTRA EUTRA-CellIndex,  
  physCellIdRange EUTRA-PhysCellIdRange
}

EUTRAN-BlackCell field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cellIndexEUTRA</td>
<td>Entry index in the cell list.</td>
</tr>
<tr>
<td>physicalCellIdRange</td>
<td>Physical cell identity or a range of physical cell identities.</td>
</tr>
</tbody>
</table>

```
**EUTRAN-Cell** field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>physicalCellId</strong></td>
<td>Physical cell identity of a cell in the cell list.</td>
</tr>
<tr>
<td><strong>cellIndividualOffset</strong></td>
<td>Cell individual offset applicable to a specific cell. Value ( dB-24 ) corresponds to -24 dB, ( dB-22 ) corresponds to -22 dB and so on.</td>
</tr>
</tbody>
</table>

**MeasObjectEUTRA** field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>allowedMeasBandwidth</strong></td>
<td>The maximum allowed measurement bandwidth on a carrier frequency as defined by the parameter Transmission Bandwidth Configuration &quot;Nreff&quot; TS 36.104 [33].</td>
</tr>
<tr>
<td><strong>blackCellsToAddModListEUTRAN</strong></td>
<td>List of cells to add/ modify in the black list of cells.</td>
</tr>
<tr>
<td><strong>blackCellsToRemoveListEUTRAN</strong></td>
<td>List of cells to remove from the black list of cells.</td>
</tr>
<tr>
<td><strong>carrierFreq</strong></td>
<td>Identifies E-UTRA carrier frequency for which this configuration is valid. Network does not configure more than one <strong>MeasObjectEUTRA</strong> for the same physical frequency, regardless of the E-ARFCN used to indicate this.</td>
</tr>
<tr>
<td><strong>cellsToAddModListEUTRAN</strong></td>
<td>List of cells to add/ modify in the cell list.</td>
</tr>
<tr>
<td><strong>cellsToRemoveListEUTRAN</strong></td>
<td>List of cells to remove from the cell list.</td>
</tr>
<tr>
<td><strong>eutra-PresenceAntennaPort1</strong></td>
<td>When set to true, the UE may assume that at least two cell-specific antenna ports are used in all neighbouring cells.</td>
</tr>
<tr>
<td><strong>eutra-Q-OffsetRange</strong></td>
<td>Used to indicate a cell, or frequency specific offset to be applied when evaluating triggering conditions for measurement reporting. The value is in dB. Value ( dB-24 ) corresponds to -24 dB, ( dB-22 ) corresponds to -22 dB and so on.</td>
</tr>
<tr>
<td><strong>widebandRSRQ-Meas</strong></td>
<td>If set to true, the UE shall, when performing RSRQ measurements, use a wider bandwidth in accordance with TS 36.133 [40]. The network may set the field to true if the measurement bandwidth indicated by <strong>allowedMeasBandwidth</strong> is 50 resource blocks or larger; otherwise the network sets this field to false.</td>
</tr>
</tbody>
</table>

---

**MeasObjectld**

The IE **MeasObjectld** used to identify a measurement object configuration.

**MeasObjectld** information element

```plaintext
-- ASN1START
-- TAG-MEASOBJECTID-START

MeasObjectld ::= INTEGER {1..maxNrofObjectId}

-- TAG-MEASOBJECTID-STOP
-- ASN1STOP
```
The IE *MeasObjectNR* specifies information applicable for SS/PBCH block(s) intra/inter-frequency measurements and/or CSI-RS intra/inter-frequency measurements.

**MeasObjectNR information element**

```asn1
MeasObjectNR ::= SEQUENCE {
  ssbFrequency                        ARFCN-ValueNR                                                   OPTIONAL,   -- Cond SSBorAssociatedSSB
  ssbSubcarrierSpacing                SubcarrierSpacing                                               OPTIONAL,   -- Cond SSBorAssociatedSSB
  smtc1                               SSB-MTC                                                         OPTIONAL,   -- Cond SSBorAssociatedSSB
  smtc2                               SSB-MTC2                                                        OPTIONAL,   -- Cond SSBorAssociatedSSB
  refFreqCSI-RS                       ARFCN-ValueNR                                                   OPTIONAL,   -- Cond CSI-RS
  referenceSignalConfig               ReferenceSignalConfig,     absThreshSS-BlocksConsolidation     ThresholdNR                                                     OPTIONAL,   -- Cond CSI-RS
  absThreshCSI-RS-Consolidation       ThresholdNR                                                     OPTIONAL,   -- Cond CSI-RS
  nrofSS-BlocksToAverage              INTEGER (2..maxNrofSS-BlocksToAverage)                          OPTIONAL,   -- Cond CSI-RS
  nrofCSI-RS-ResourcesToAverage       INTEGER (2..maxNrofCSI-RS-ResourcesToAverage)                   OPTIONAL,   -- Cond CSI-RS
  quantityConfigIndex                 INTEGER (1..maxNrofQuantityConfig),
  offsetMO                             Q-OffsetRangeList,                                              OPTIONAL,   -- Cond CSI-RS
  blackCellsToRemoveList              PCI-List                                                        OPTIONAL,   -- Cond CSI-RS
  blackCellsToAddModList              PCI-List                                                        OPTIONAL,   -- Cond CSI-RS
  whiteCellsToRemoveList              PCI-List                                                        OPTIONAL,   -- Cond CSI-RS
  whiteCellsToAddModList              PCI-List                                                        OPTIONAL,   -- Cond CSI-RS
  freqBandIndicatorNR                 FreqBandIndicatorNR                                             OPTIONAL,   -- Cond CSI-RS
  measCycleSCell                      ENUMERATED {sf160, sf256, sf320, sf512, sf640, sf1024, sf1280}  OPTIONAL    -- Cond CSI-RS
  smtc3list-r16                      SSB-MTC3List-r16                                                  OPTIONAL,   -- Cond CSI-RS
  rmtc-Config-r16                     SetupRelease {RMTC-Config-r16}                                  OPTIONAL,   -- Cond CSI-RS
  t312-r16                            SetupRelease { T312-r16 }                                       OPTIONAL    -- Cond CSI-RS
}

SSB-MTC3List-r16 ::= SEQUENCE { Size(1..4) OF SSB-MTC3-r16

T312-r16 ::= ENUMERATED { ms0, ms50, ms100, ms200, ms300, ms400, ms500, ms1000}  OPTIONAL    -- Cond CSI-RS

ReferenceSignalConfig::= SEQUENCE { ssb-ConfigMobility SSB-ConfigMobility OPTIONAL,   -- Cond CSI-RS
  csi-rs-ResourceConfigMobility SetupRelease {CSI-RS-ResourceConfigMobility} OPTIONAL,   -- Cond CSI-RS
}

SSB-ConfigMobility::= SEQUENCE { ssb-ToMeasure SetupRelease {SSB-ToMeasure} OPTIONAL,   -- Cond CSI-RS
  deriveSSB-IndexFromCell BOOLEAN,     ss-RSSI-Measurement                         SS-RSSI-Measurement OPTIONAL,   -- Cond CSI-RS
...  

}```
Q-OffsetRangeList ::= SEQUENCE {
  rsrpOffsetSSB  Q-OffsetRange   DEFAULT dB0,
  rsrqOffsetSSB  Q-OffsetRange   DEFAULT dB0,
  sinrOffsetSSB  Q-OffsetRange   DEFAULT dB0,
  rsrpOffsetCSI-RS Q-OffsetRange DEFAULT dB0,
  rsrqOffsetCSI-RS Q-OffsetRange DEFAULT dB0,
  sinrOffsetCSI-RS Q-OffsetRange DEFAULT dB0
}

ThresholdNR ::= SEQUENCE {
  thresholdRSRP  RSRP-Range OPTIONAL, -- Need R
  thresholdRSRQ  RSRQ-Range OPTIONAL, -- Need R
  thresholdSINR  SINR-Range OPTIONAL, -- Need R
}

CellsToAddModList ::= SEQUENCE {SIZE (1..maxNrofCellMeas)} OF CellsToAddMod

CellsToAddMod ::= SEQUENCE {
  physCellMod  PhysCellId,
  cellIndividualOffset Q-OffsetRangeList
}

RMTC-Config-r16 ::= SEQUENCE {
  rmtc-Periodicity-r16 ENUMERATED {ms40, ms80, ms160, ms320, ms640},
  rmtc-SubframeOffset-r16 INTEGER(0..639) OPTIONAL, -- Need M
  measDurationSymbols-r16 ENUMERATED {sym1, sym14or12, sym28or24, sym42or36, sym70or60},
  rmtc-Frequency-r16 ARFCN-ValueNR,
  ref-SCS-CP-r16 ENUMERATED {kHz15, kHz30, kHz60-NCP, kHz60-ECP},
  ...
}

SSB-PositionQCL-CellsToAddModList-r16 ::= SEQUENCE {SIZE (1..maxNrofCellMeas)} OF SSB-PositionQCL-CellsToAddMod-r16

SSB-PositionQCL-CellsToAddMod-r16 ::= SEQUENCE {
  physCellId-r16  PhysCellId,
  ssb-PositionQCL-r16 SSB-PositionQCL-Relation-r16
}

-- TAG-MEASOBJECTNR-STOP
-- ASN1STOP
<table>
<thead>
<tr>
<th><strong>CellsToAddMod field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cellIndividualOffset</strong></td>
</tr>
<tr>
<td>Cell individual offsets applicable to a specific cell.</td>
</tr>
<tr>
<td><strong>physCellId</strong></td>
</tr>
<tr>
<td>Physical cell identity of a cell in the cell list.</td>
</tr>
<tr>
<td>Field Description</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>absThreshCSI-RS-Consolidation</td>
</tr>
<tr>
<td>absThreshSS-BlocksConsolidation</td>
</tr>
<tr>
<td>blackCellsToAddModList</td>
</tr>
<tr>
<td>blackCellsToRemoveList</td>
</tr>
<tr>
<td>cellsToAddModList</td>
</tr>
<tr>
<td>cellsToRemoveList</td>
</tr>
<tr>
<td>freqBandIndicatorNR</td>
</tr>
<tr>
<td>measCycleSCell</td>
</tr>
<tr>
<td>nrofCSInrofCSI-RS-ResourcesToAverage</td>
</tr>
<tr>
<td>nrofSS-BlocksToAverage</td>
</tr>
<tr>
<td>offsetMO</td>
</tr>
<tr>
<td>quantityConfigIndex</td>
</tr>
<tr>
<td>referenceSignalConfig</td>
</tr>
<tr>
<td>refFreqCSI-RS</td>
</tr>
<tr>
<td>smtc1</td>
</tr>
<tr>
<td>smtc2</td>
</tr>
<tr>
<td>smtc3list</td>
</tr>
</tbody>
</table>
**ssbFrequency**
Indicates the frequency of the SS associated to this `MeasObjectNR`. For operation with shared spectrum channel access, this field is a k*30 kHz shift from the sync raster where k = 0,1,2, and so on if the `reportType` within the corresponding `ReportConfigNR` is set to reportCGI (see TS 38.211 [16], clause 7.4.3.1). Frequencies are considered to be on the sync raster if they are also identifiable with a GSCN value (see TS 38.101-1 [15]).

**ssb-PositionQCL-Common**
Indicates the QCL relationship between SS/PBCH blocks for all measured cells as specified in TS 38.213 [13], clause 4.1.

**ssbSubcarrierSpacing**
Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.

**t312**
The value of timer T312. Value ms0 represents 0 ms, ms50 represents 50 ms and so on.

**whiteCellsToAddModList**
List of cells to add/modify in the white list of cells. It applies only to SSB resources.

**whiteCellsToRemoveList**
List of cells to remove from the white list of cells.

<table>
<thead>
<tr>
<th><strong>RMTC-Config field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>measDurationSymbols</strong></td>
</tr>
<tr>
<td>Number of consecutive symbols for which the Physical Layer reports samples of RSSI (see TS 38.215 [9], clause 5.1.21). Value <code>sym1</code> corresponds to one symbol, <code>sym14or12</code> corresponds to 14 symbols of the reference numerology for NCP and 12 symbols for ECP, and so on.</td>
</tr>
<tr>
<td><strong>ref-SCS-CP</strong></td>
</tr>
<tr>
<td>Indicates a reference subcarrier spacing and cyclic prefix to be used for RSSI measurements (see TS 38.215 [9]). Value kHz15 corresponds to 15 kHz, kHz30 corresponds to 30 kHz, value kHz60-NCP corresponds to 60 kHz using normal cyclic prefix (NCP), and kHz60-ECP corresponds to 60 kHz using extended cyclic prefix (ECP).</td>
</tr>
<tr>
<td><strong>rmtc-Frequency</strong></td>
</tr>
<tr>
<td>Indicates the center frequency of the measured bandwidth (see TS 38.215 [9], clause 5.1.21).</td>
</tr>
<tr>
<td><strong>rmtc-Periodicity</strong></td>
</tr>
<tr>
<td>Indicates the RSSI measurement timing configuration (RMTC) periodicity (see TS 38.215 [9], clause 5.1.21).</td>
</tr>
<tr>
<td><strong>rmtc-SubframeOffset</strong></td>
</tr>
<tr>
<td>Indicates the RSSI measurement timing configuration (RMTC) subframe offset for this frequency (see TS 38.215 [9], clause 5.1.21). For inter-frequency measurements, this field is optional present and if it is not configured, the UE chooses a random value as <code>rmtc-SubframeOffset</code> for <code>measDurationSymbols</code> which shall be selected to be between 0 and the configured <code>rmtc-Periodicity</code> with equal probability.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ReferenceSignalConfig field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>csi-rs-ResourceConfigMobility</strong></td>
</tr>
<tr>
<td>CSI-RS resources to be used for CSI-RS based RRM measurements.</td>
</tr>
<tr>
<td><strong>ssb-ConfigMobility</strong></td>
</tr>
<tr>
<td>SSB configuration for mobility (nominal SSBs, timing configuration).</td>
</tr>
</tbody>
</table>
SSB-ConfigMobility field descriptions

**deriveSSB-IndexFromCell**
If this field is set to true, UE assumes SFN and frame boundary alignment across cells on the same frequency carrier as specified in TS 38.133 [14]. Hence, if the UE is configured with a serving cell for which (absoluteFrequencySSB, subcarrierSpacing) in ServingCellConfigCommon is equal to (ssbFrequency, ssbSubcarrierSpacing) in this MeasObjectNR, this field indicates whether the UE can utilize the timing of this serving cell to derive the index of SS block transmitted by neighbour cell. Otherwise, this field indicates whether the UE may use the timing of any detected cell on that target frequency to derive the SSB index of all neighbour cells on that frequency.

**ssb-ToMeasure**
The set of SS blocks to be measured within the SMTC measurement duration. The first/leftmost bit corresponds to SS/PBCH block index 0, the second bit corresponds to SS/PBCH block index 1, and so on. Value 0 in the bitmap indicates that the corresponding SS/PBCH block is not to be measured while value 1 indicates that the corresponding SS/PBCH block is to be measured (see TS 38.215 [9]). When the field is not configured the UE measures on all SS blocks. Regardless of the value of this field, SS/PBCH blocks outside of the applicable smtc are not to be measured. See TS 38.215 [9] clause 5.1.1.

SSB-PositionQCL-CellsToAddMod field descriptions

**physCellId**
Physical cell identity of a cell in the cell list.

**ssb-PositionQCL**
Indicates the QCL relation between SS/PBCH blocks for a specific cell as specified in TS 38.213 [13], clause 4.1. If provided, the cell specific value overwrites the value signalled by ssb-PositionQCL-Common.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSI-RS</td>
<td>This field is mandatory present if csi-rs-ResourceConfigMobility is configured, otherwise, it is absent.</td>
</tr>
<tr>
<td>SSBorAssociatedSSB</td>
<td>This field is mandatory present if ssb-ConfigMobility is configured or associatedSSB is configured in at least one cell. Otherwise, it is absent, Need R.</td>
</tr>
<tr>
<td>IntraFreqConnected</td>
<td>This field is optionally present, Need R if the UE is configured with a serving cell for which (absoluteFrequencySSB, subcarrierSpacing) in ServingCellConfigCommon is equal to (ssbFrequency, ssbSubcarrierSpacing) in this MeasObjectNR, otherwise, it is absent.</td>
</tr>
<tr>
<td>SharedSpectrum</td>
<td>This field is mandatory present if this MeasObject is for a frequency which operates with shared spectrum channel access. Otherwise, it is absent, Need R.</td>
</tr>
</tbody>
</table>

---

**MeasObjectNR-SL**
The IE MeasObjectNR-SL concerns a measurement object including a list of transmission resource pool(s) for which CBR measurement is performed for NR sidelink communication.

**MeasObjectNR-SL information element**

```asn1
MeasObjectNR-SL-r16 ::= SEQUENCE {
    tx-PoolMeasToRemoveList-r16  Tx-PoolMeasList-r16  OPTIONAL,  -- Need N
    tx-PoolMeasToAddModList-r16  Tx-PoolMeasList-r16  OPTIONAL  -- Need N
}
```

---
---

**MeasObjectToAddModList**

The IE **MeasObjectToAddModList** concerns a list of measurement objects to add or modify.

**MeasObjectToAddModList information element**

```asn1
MeasObjectToAddModList ::= SEQUENCE (SIZE (1..maxNrofObjectId)) OF MeasObjectToAddMod

MeasObjectToAddMod ::= SEQUENCE {
   _measObjectId_ MeasObjectId,
   _measObject_ CHOICE {
        _measObjectNR_ MeasObjectNR,
        _measObjectUTRA_ MeasObjectUTRA,
        _measObjectEUTRA_ MeasObjectEUTRA,
        _measObjectUTRANR-SL-r16_ MeasObjectUTRANR-SL-r16,
        _measObjectCLI-r16_ MeasObjectCLI-r16
    }
}
```

---

**MeasObjectUTRA-FDD**

The IE **MeasObjectUTRA-FDD** specifies information applicable for inter-RAT UTRA-FDD neighbouring cells.

**MeasObjectUTRA-FDD information element**

```asn1
MeasObjectUTRA-FDD-r16 ::= SEQUENCE {
    carrierFreq-r16     ARFCN-ValueUTRA-FDD-r16,     utra-FDD-Q-OffsetRange-r16                  UTRA-FDD-Q-OffsetRange-r16                 OPTIONAL, -- Need R
    cellsToRemoveList-r16 UTRA-FDD-CellIndexList-r16 OPTIONAL, -- Need N
    cellsToAddModList-r16 CellsToAddModListUTRA-FDD-r16 OPTIONAL, -- Need N
    ... }
```
MeasObjectUTRA-FDD field descriptions

- **carrierFreq**
  Identifies UTRA-FDD carrier frequency for which this configuration is valid. NR does not configure more than one measurement object for the same physical frequency regardless of the ARFCN used to indicate this.

- **cellIndexUTRA-FDD**
  Entry index in the neighbouring cell list.

- **cellsToAddModList**
  List of UTRA-FDD cells to add/modify in the neighbouring cell list.

- **cellsToRemoveList**
  List of cells to remove from the neighbouring cell list.

- **utraFDD-Q-OffsetRange**
  Used to indicate a frequency specific offset to be applied when evaluating triggering conditions for measurement reporting. The value is in dB.

---

**MeasResultCellListSFTD-NR**

The IE *MeasResultCellListSFTD-NR* consists of SFN and radio frame boundary difference between the PCell and an NR cell as specified in TS 38.215 [9] and TS 38.133 [14].

**MeasResultCellListSFTD-NR information element**

---

---

---

---
sfn-OffsetResult
Indicates the SFN difference between the PCell and the NR cell as an integer value according to TS 38.215 [9].

frameBoundaryOffsetResult
Indicates the frame boundary difference between the PCell and the NR cell as an integer value according to TS 38.215 [9].

MeasResultCellListSFTD-EUTRA
The IE MeasResultCellListSFTD-EUTRA consists of SFN and radio frame boundary difference between the PCell and an E-UTRA PSCell.

MeasResultCellListSFTD-EUTRA information element

eutra-PhysCellId
Identifies the physical cell identity of the E-UTRA cell for which the reporting is being performed.
sfn-OffsetResult
Indicates the SFN difference between the PCell and the E-UTRA cell as an integer value according to TS 38.215 [9].
frameBoundaryOffsetResult
Indicates the frame boundary difference between the PCell and the E-UTRA cell as an integer value according to TS 38.215 [9].
-- TAG-MEASRESULTS-START

MeasResults ::= SEQUENCE {
  measId MeasId,
  measResultServMOList MeasResultServMOList,
  measResultNeighCells CHOICE {
    measResultListNR MeasResultListNR,
    ...,
    measResultListEUTRA MeasResultListEUTRA,
    measResultListUTRA-FDD-r16 MeasResultListUTRA-FDD-r16
  }
}

MeasResultServMOList ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF MeasResultServMO

MeasResultServMO ::= SEQUENCE {
  servCellId ServCellIndex,
  measResultServingCell MeasResultNR,
  measResultBestNeighCell MeasResultNR
}

MeasResultListNR ::= SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultNR

MeasResultNR ::= SEQUENCE {
  physCellId PhysCellId
}

MeasResultListEUTRA ::= SEQUENCE {
  cellResults SEQUENCE{
    resultsSSB-Cell MeasQuantityResults
  },
  rsIndexResults SEQUENCE{
    resultsSSB-Indexes ResultsPerSSB-IndexList
  }
}

MeasResultListUTRA-FDD-r16

MeasResultListUTRA-FDD-r16

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

MeasResultListEUTRA

Mea...
ETSI TS 138 331 V16.3.1 (2021-01)

MeasResultListEUTRA ::= SEQUENCE {SIZE (1..maxCellReport)} OF MeasResultEUTRA

MeasResultEUTRA ::= SEQUENCE {
eutra-PhysCellId                PhysCellId,
measResult                       MeasQuantityResultsEUTRA,
cgi-Info                         CGI-InfoEUTRA OPTIONAL,
...}

MultiBandInfoListEUTRA ::= SEQUENCE {SIZE (1..maxMultiBands)} OF FreqBandIndicatorEUTRA

MeasQuantityResults ::= SEQUENCE {
  rsrp                             RSRP-Range OPTIONAL,
  rsrq                             RSRQ-Range OPTIONAL,
  sinr                             SINR-Range OPTIONAL}

MeasQuantityResultsEUTRA ::= SEQUENCE {
  rsrp                             RSRP-RangeEUTRA OPTIONAL,
  rsrq                             RSRQ-RangeEUTRA OPTIONAL,
  sinr                             SINR-RangeEUTRA OPTIONAL}

ResultsPerSSB-IndexList ::= SEQUENCE {SIZE (1..maxNrofIndexesToReport2)} OF ResultsPerSSB-Index

ResultsPerSSB-Index ::= SEQUENCE {
  ssb-Index                       SSB-Index,
  ssb-Results                     MeasQuantityResults OPTIONAL}

ResultsPerCSI-RS-IndexList ::= SEQUENCE {SIZE (1..maxNrofIndexesToReport2)} OF ResultsPerCSI-RS-Index

ResultsPerCSI-RS-Index ::= SEQUENCE {
  csi-RS-Index                    CSI-RS-Index,
  csi-RS-Results                  MeasQuantityResults OPTIONAL}

MeasResultServFreqListEUTRA-SCG ::= SEQUENCE {SIZE (1..maxNrofServingCellsEUTRA)} OF MeasResult2EUTRA

MeasResultServFreqListNR-SCG ::= SEQUENCE {SIZE (1..maxNrofServingCells)} OF MeasResult2NR

MeasResultListUTRA-FDD-r16 ::= SEQUENCE {SIZE (1..maxCellReport)} OF MeasResultUTRA-FDD-r16

MeasResultUTRA-FDD-r16 ::= SEQUENCE {
  physCellId-r16                  PhysCellIdUTRA-FDD-r16,
  measResult-r16                  MeasResult-r16
  utra-FDD-RSCP-r16               INTEGER (-5..91) OPTIONAL,
  cgi-Info                        CGI-InfoNR OPTIONAL}
MeasResultEUTRA field descriptions

**eutra-PhysCellId**
Identifies the physical cell identity of the E-UTRA cell for which the reporting is being performed. The UE reports a value in the range 0..503, other values are reserved.
### MeasResultNR field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>averageDelay</td>
<td>Indicates average delay for the packets during the reporting period, as specified in TS 38.314 [53]. Value 0 corresponds to 0 millisecond, value 1 corresponds to 0.1 millisecond, value 2 corresponds to 0.2 millisecond, and so on.</td>
</tr>
<tr>
<td>cellResults</td>
<td>Cell level measurement results.</td>
</tr>
<tr>
<td>drb-id</td>
<td>Indicates DRB value for which uplink PDCP delay ratio or value is provided, according to TS 38.314 [53].</td>
</tr>
<tr>
<td>locationInfo</td>
<td>Positioning related information and measurements.</td>
</tr>
<tr>
<td>physCellId</td>
<td>The physical cell identity of the NR cell for which the reporting is being performed.</td>
</tr>
<tr>
<td>resultsSSB-Cell</td>
<td>Cell level measurement results based on SS/PBCH related measurements.</td>
</tr>
<tr>
<td>resultsSSB-Indexes</td>
<td>Beam level measurement results based on SS/PBCH related measurements.</td>
</tr>
<tr>
<td>resultsCSI-RS-Cell</td>
<td>Cell level measurement results based on CSI-RS related measurements.</td>
</tr>
<tr>
<td>resultsCSI-RS-Indexes</td>
<td>Beam level measurement results based on CSI-RS related measurements.</td>
</tr>
<tr>
<td>rsIndexResults</td>
<td>Beam level measurement results.</td>
</tr>
</tbody>
</table>

### MeasResultUTRA-FDD field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>physCellId</td>
<td>The physical cell identity of the UTRA-FDD cell for which the reporting is being performed.</td>
</tr>
<tr>
<td>utra-FDD-EcNo</td>
<td>According to CPICH_Ec/No in TS 25.133 [46] for FDD.</td>
</tr>
<tr>
<td>utra-FDD-RSCP</td>
<td>According to CPICH_RSCP in TS 25.133 [46] for FDD.</td>
</tr>
</tbody>
</table>
**MeasResults field descriptions**

**measId**  
Identifies the measurement identity for which the reporting is being performed.

**measQuantityResults**  
The value sinr is not included when it is used for LogMeasReport-r16.

**measResultCellListSFTD-NR**  
SFTD measurement results between the PCell and the NR neighbour cell(s) in NR standalone.

**measResultCLI**  
CLI measurement results.

**measResultEUTRA**  
Measured results of an E-UTRA cell.

**measResultForRSSI**  
Includes measured RSSI result in dBm (see TS 38.215 [9]) and channelOccupancy which is the percentage of samples when the RSSI was above the configured channelOccupancyThreshold for the associated reportConfig.

**measResultListEUTRA**  
List of measured results for the maximum number of reported best cells for an E-UTRA measurement identity.

**measResultListNR**  
List of measured results for the maximum number of reported best cells for an NR measurement identity.

**measResultListUTRA-FDD**  
List of measured results for the maximum number of reported best cells for a UTRA-FDD measurement identity.

**measResultNR**  
Measured results of an NR cell.

**measResultServFreqListEUTRA-SCG**  
Measured results of the E-UTRA SCG serving frequencies: the measurement result of PSCell and each SCell, if any, and of the best neighbouring cell on each E-UTRA SCG serving frequency.

**measResultServFreqListNR-SCG**  
Measured results of the NR SCG serving frequencies: the measurement result of PSCell and each SCell, if any, and of the best neighbouring cell on each NR SCG serving frequency.

**measResultServingMOList**  
Measured results of measured cells with reference signals indicated in the serving cell measurement objects including measurement results of SpCell, configured SCell(s) and best neighbouring cell within measured cells with reference signals indicated in on each serving cell measurement object. If the sending of the MeasurementReport message is triggered by a measurement configured by an NR RRCReconfiguration message that was received embedded within an E-UTRA RRCConnectionReconfiguration message (i.e. CBR measurements), this field is not applicable and its contents is ignored by the network.

**measResultSFTD-EUTRA**  
SFTD measurement results between the PCell and the E-UTRA PScell in NE-DC.

**measResultSFTD-NR**  
SFTD measurement results between the PCell and the NR PScell in NR-DC.

**measResultsSL**  
CBR measurements results for NR sidelink communication.

**measResultUTRA-FDD**  
Measured result of a UTRA-FDD cell.

---

**MeasResult2EUTRA**  
The IE MeasResult2EUTRA contains measurements on E-UTRA frequencies.
MeasResult2EUTRA information element

```asn1
MeasResult2EUTRA ::= SEQUENCE {
  carrierFreq                         ARFCN-ValueEUTRA,     
  measResultServingCell               MeasResultEUTRA                 OPTIONAL, 
  measResultBestNeighCell             MeasResultEUTRA                 OPTIONAL, 
  ... 
}
```

MeasResult2NR

The IE `MeasResult2NR` contains measurements on NR frequencies.

```asn1
MeasResult2NR ::= SEQUENCE {
  ssbFrequency                        ARFCN-ValueNR                           OPTIONAL, 
  refFreqCSI-RS                       ARFCN-ValueNR                           OPTIONAL, 
  measResultServingCell               MeasResultNR                            OPTIONAL, 
  measResultNeighCellListNR           MeasResultListNR                        OPTIONAL, 
  ... 
}
```

MeasResultIdleEUTRA

The IE `MeasResultIdleEUTRA` covers the E-UTRA measurement results performed in RRC_IDLE and RRC_INACTIVE.

```asn1
MeasResultIdleEUTRA ::= SEQUENCE {
  measResultsPerCarrierListIdleEUTRA   SEQUENCE (SIZE (1.. maxFreqIdle)) OF MeasResultsPerCarrierIdleEUTRA, 
  ... 
}
```
MeasResultsPerCarrierIdleEUTRA-r16 ::= SEQUENCE {
  carrierFreqEUTRA-r16                        ARFCN-ValueEUTRA,
  measResultsPerCellListIdleEUTRA-r16         SEQUENCE (SIZE (1..maxCellMeasIdle-r16)) OF MeasResultsPerCellIdleEUTRA-r16,
  ...                                    
}

MeasResultsPerCellIdleEUTRA-r16 ::= SEQUENCE {
  eutra-PhysCellId-r16                        EUTRA-PhysCellId,
  measIdleResultEUTRA-r16                    SEQUENCE {
    rsrp-ResultEUTRA-r16           RSRP-RangeEUTRA OPTIONAL,
    rsrq-ResultEUTRA-r16           RSRQ-RangeEUTRA-r16 OPTIONAL
  },
  ...                                    
}

-- TAG-MEASRESULTIDLEEUTRA-STOP
-- ASN1STOP

MeasResultIdleEUTRA field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>carrierFreqEUTRA</td>
<td>Indicates the E-UTRA carrier frequency.</td>
</tr>
<tr>
<td>eutra-PhysCellId</td>
<td>Indicates the physical cell identity of an E-UTRA cell.</td>
</tr>
<tr>
<td>measIdleResultEUTRA</td>
<td>Idle/inactive measurement results for an E-UTRA cell.</td>
</tr>
<tr>
<td>measResultsPerCarrierListIdleEUTRA</td>
<td>List of idle/inactive measured results for the maximum number of reported E-UTRA carriers.</td>
</tr>
<tr>
<td>measResultsPerCellListIdleEUTRA</td>
<td>List of idle/inactive measured results for the maximum number of reported best cells for a given E-UTRA carrier.</td>
</tr>
</tbody>
</table>

---

MeasResultIdleNR

The IE MeasResultIdleNR covers the NR measurement results performed in RRC_IDLE and RRC_INACTIVE.

MeasResultIdleNR information element

MeasResultIdleNR-r16 ::= SEQUENCE {
  measResultServingCell-r16                   RSRP-Range OPTIONAL,
  rsrq-Result-r16                            RSRQ-Range OPTIONAL,
  resultsSSB-Indexes-r16                     ResultsPerSSB-IndexList-r16 OPTIONAL
},
  measResultsPerCarrierListIdleNR-r16        SEQUENCE (SIZE (1.. maxFreqIdle-r16)) OF MeasResultsPerCarrierIdleNR-r16 OPTIONAL,
MeasResultsPerCarrierIdleNR-r16 ::= SEQUENCE {
  carrierFreq-r16       ARFCN-ValueNR,
  measResultsPerCellListIdleNR-r16  SEQUENCE (SIZE (1..maxCellMeasIdle-r16)) OF MeasResultsPerCellIdleNR-r16,
  ...
}

MeasResultsPerCellIdleNR-r16 ::= SEQUENCE {
  physCellId-r16                PhysCellId,
  measIdleResultNR-r16          SEQUENCE {
    rsrp-Result-r16               RSRP-Range OPTIONAL,
    rsrq-Result-r16               RSRQ-Range OPTIONAL,
    resultsSSB-Indexes-r16        ResultsPerSSB-IndexList-r16
  },
  ...
}

ResultsPerSSB-IndexList-r16 ::= SEQUENCE (SIZE (1.. maxNrofIndexesToReport)) OF ResultsPerSSB-IndexIdle-r16

ResultsPerSSB-IndexIdle-r16 ::= SEQUENCE {
  ssb-Index-r16                 SSB-Index,
  ssb-Results-r16               SEQUENCE {
    ssb-RSRP-Result-r16          RSRP-Range OPTIONAL,
    ssb-RSRQ-Result-r16          RSRQ-Range OPTIONAL
  }
}

-- TAG-MEASRESULTIDLENR-STOP
-- ASN1STOP

---

**MeasResultIdleNR field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>carrierFreq</td>
<td>Indicates the NR carrier frequency.</td>
</tr>
<tr>
<td>measIdleResultNR</td>
<td>Idle/inactive measurement results for an NR cell (optionally including beam level measurements).</td>
</tr>
<tr>
<td>measResultServingCell</td>
<td>Measured results of the serving cell (i.e., PCell) from idle/inactive measurements.</td>
</tr>
<tr>
<td>measResultsPerCellListIdleNR</td>
<td>List of idle/inactive measured results for the maximum number of reported best cells for a given NR carrier.</td>
</tr>
<tr>
<td>resultsSSB-Indexes</td>
<td>Beam level measurement results (indexes and optionally, beam measurements).</td>
</tr>
</tbody>
</table>

---

**MeasResultSCG-Failure**

The IE `MeasResultSCG-Failure` is used to provide information regarding failures detected by the UE in (NG)EN-DC and NR-DC.
MeasResultSCG-Failure information element

```asn1
MeasResultSCG-Failure ::= SEQUENCE {
  measResultPerMOList                  MeasResultList2NR,
  ...,
  [locationInfo-r16                  LocationInfo-r16 OPTIONAL]
}
MeasResultList2NR ::= SEQUENCE { SIZE (1..maxFreq) } OF MeasResult2NR
```

MeasResultsSL

The IE *MeasResultsSL* covers measured results for NR sidelink communication.

MeasResultsSL information element

```asn1
MeasResultsSL-r16 ::= SEQUENCE {
  measResultsListSL-r16               CHOICE {
    measResultNR-SL-r16               MeasResultNR-SL-r16,
    ...,
  },
  ...,
}
MeasResultNR-SL-r16 ::= SEQUENCE {
  measResultListCBR-NR-r16            SEQUENCE { SIZE (1..maxNrofSL-PoolToMeasureNR-r16) } OF MeasResultCBR-NR-r16,
  ...,
}
MeasResultCBR-NR-r16 ::= SEQUENCE {
  sl-poolReportIdentity-r16           SL-ResourcePoolID-r16,
  sl-CBR-ResultsNR-r16               SL-CBR-r16,
  ...,
}
```

---

3GPP TS 38.331 version 16.3.1 Release 16
467

-- ASN1START
-- TAG-MEASRESULTSCG-FAILURE-START
MeasResultSCG-Failure ::= SEQUENCE {
  measResultPerMOList                  MeasResultList2NR,
  ...,
  [locationInfo-r16                  LocationInfo-r16 OPTIONAL]
}
MeasResultList2NR ::= SEQUENCE { SIZE (1..maxFreq) } OF MeasResult2NR

-- TAG-MEASRESULTSCG-FAILURE-STOP
-- ASN1STOP

-- MeasResultsSL

The IE *MeasResultsSL* covers measured results for NR sidelink communication.

-- ASN1START
-- TAG-MEASRESULTSSL-START
MeasResultsSL-r16 ::= SEQUENCE {
  measResultsListSL-r16               CHOICE {
    measResultNR-SL-r16               MeasResultNR-SL-r16,
    ...,
  },
  ...,
}
MeasResultNR-SL-r16 ::= SEQUENCE {
  measResultListCBR-NR-r16            SEQUENCE { SIZE (1..maxNrofSL-PoolToMeasureNR-r16) } OF MeasResultCBR-NR-r16,
  ...,
}
MeasResultCBR-NR-r16 ::= SEQUENCE {
  sl-poolReportIdentity-r16           SL-ResourcePoolID-r16,
  sl-CBR-ResultsNR-r16               SL-CBR-r16,
  ...,
}

-- TAG-MEASRESULTSSL-STOP
-- ASN1STOP
MeasResultsSL field descriptions

measResultNR-SL
Include the measured results for NR sidelink communication.

MeasResultNR-SL field descriptions

measResultListCBR-NR
CBR measurement results for NR sidelink communication.

sl-poolReportIdentity
The identity of the transmission resource pool which is corresponding to the sl-ResourcePoolID configured in a resource pool for NR sidelink communication.

MeasTriggerQuantityEUTRA
The IE MeasTriggerQuantityEUTRA is used to configure the trigger quantity and reporting range for E-UTRA measurements. The RSRP, RSRQ and SINR ranges correspond to RSRP-Range, RSRQ-Range and RS-SINR-Range in TS 36.331 [10], respectively.

MeasTriggerQuantityEUTRA information element

-- ASN1START
-- TAG-MEASTRIGGERQUANTITYEUTRA-START

MeasTriggerQuantityEUTRA ::= CHOICE {
  rsrp       RSRP-RangeEUTRA,
  rsrq       RSRQ-RangeEUTRA,
  sinr       SINR-RangeEUTRA
}

RSRP-RangeEUTRA ::= INTEGER (0..97)
RSRQ-RangeEUTRA ::= INTEGER (0..34)
SINR-RangeEUTRA ::= INTEGER (0..127)

-- TAG-MEASTRIGGERQUANTITYEUTRA-STOP
-- ASN1STOP

MobilityStateParameters
The IE MobilityStateParameters contains parameters to determine UE mobility state.

MobilityStateParameters information element

-- ASN1START
-- TAG-MOBILITYSTATEPARAMETERS-START

MobilityStateParameters ::= SEQUENCE{

MobilityStateParameters field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-CellChangeHigh</td>
<td>The number of cell changes to enter high mobility state. Corresponds to $N_{CR_H}$ in TS 38.304 [20].</td>
</tr>
<tr>
<td>n-CellChangeMedium</td>
<td>The number of cell changes to enter medium mobility state. Corresponds to $N_{CR_M}$ in TS 38.304 [20].</td>
</tr>
<tr>
<td>t-Evaluation</td>
<td>The duration for evaluating criteria to enter mobility states. Corresponds to $T_{CR_{max}}$ in TS 38.304 [20]. Value in seconds, $s_{30}$ corresponds to 30 s and so on.</td>
</tr>
<tr>
<td>t-HystNormal</td>
<td>The additional duration for evaluating criteria to enter normal mobility state. Corresponds to $T_{CR_{max_{hyst}}}$ in TS 38.304 [20]. Value in seconds, value $s_{30}$ corresponds to 30 seconds and so on.</td>
</tr>
</tbody>
</table>

MsgA-ConfigCommon

The IE MsgA-ConfigCommon is used to configure the PRACH and PUSCH resource for transmission of MsgA in 2-step random access type procedure.

MsgA-ConfigCommon field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>msgA-PUSCH-Config</td>
<td>Configuration of cell-specific MsgA PUSCH parameters which the UE uses for contention-based MsgA PUSCH transmission of this BWP. If the field is not configured for the selected UL BWP, the UE shall use the MsgA PUSCH configuration of initial UL BWP.</td>
</tr>
<tr>
<td>rach-ConfigCommonTwoStepRA</td>
<td>Configuration of cell-specific random access parameters which the UE uses for contention based and contention free 2-step random access type procedure as well as for 2-step RA type contention based beam failure recovery in this BWP.</td>
</tr>
</tbody>
</table>
### Conditional Presence

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>InitialBWPConfig</td>
<td>The field is mandatory present when <code>MsgA-ConfigCommon</code> is configured for the initial uplink BWP, or when <code>MsgA-ConfigCommon</code> is configured for a non-initial uplink BWP and <code>MsgA-ConfigCommon</code> is not configured for the initial uplink BWP, otherwise the field is optionally present, Need S.</td>
</tr>
</tbody>
</table>

---

**MsgA-PUSCH-Config**

The IE `MsgA-PUSCH-Config` is used to specify the PUSCH allocation for MsgA in 2-step random access type procedure.

**MsgA-PUSCH-Config** information element

```asn1
-- ASN1START
-- TAG--MSGA-PUSCH-CONFIG-START

MsgA-PUSCH-Config-r16 ::= SEQUENCE {
    msgA-TransformPrecoder-r16                    ENUMERATED {enabled, disabled}                                 OPTIONAL, -- Need R
    msgA-DataScramblingIndex-r16                   INTEGER (0..1023)                                             OPTIONAL, -- Need S
    msgA-DeltaPreamble-r16                         INTEGER (-1..6)                                               OPTIONAL  -- Need R
    msgA-PUSCH-Resource-r16 ::=                    SEQUENCE {
        msgA-MCS-r16                                   INTEGER (0..15),
        nrofSlotsMsgA-PUSCH-r16                        INTEGER (1..4),
        nrofMsgA-PO-PerSlot-r16                        ENUMERATED {one, two, three, six},
        msgA-PUSCH-TimeDomainOffset-r16                INTEGER (1..32),
        msgA-PUSCH-TimeDomainAllocation-r16            INTEGER (1..maxNrofUL-Allocations)                            OPTIONAL, -- Need S
        startSymbolAndLengthMsgA-PO-r16                INTEGER (0..127)                                              OPTIONAL, -- Need S
        mappingTypeMsgA-PUSCH-r16                      ENUMERATED {typeA, typeB}                                     OPTIONAL, -- Need S
        guardPeriodMsgA-PUSCH-r16                     INTEGER (0..3)                                                OPTIONAL, -- Need R
        guardBandMsgA-PUSCH-r16                       INTEGER (0..1),
        frequencyStartMsgA-PUSCH-r16                  INTEGER (0..maxNrofPhysicalResourceBlocks-1),
        nrofPRBs-PerMsgA-PO-r16                        INTEGER (1..32),
        nrofMsgA-PO-FDM-r16                            ENUMERATED {pos0, pos1, pos3}                                 OPTIONAL, -- Need S
        msgA-DMRS-Config-r16                           MsgA-DMRS-Config-r16,
        nrofDMRS-Sequences-r16                         INTEGER (1..2),
        msgA-Alpha-r16                                 ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1} OPTIONAL, -- Need S
        interlaceIndexFirstPO-MsgA-PUSCH-r16          INTEGER (1..10)                                               OPTIONAL, -- Need R
        nrofInterlacesPerMsgA-PO-r16                  INTEGER (1..10)                                               OPTIONAL, -- Need R
        ...
    }
    MsgA-DMRS-Config-r16 ::=                       SEQUENCE {
        msgA-DMRS-AdditionalPosition-r16              ENUMERATED {pos0, pos1, pos3}                             OPTIONAL, -- Need S
        msgA-MaxLength-r16                            ENUMERATED {len2}                                            OPTIONAL, -- Need S
        msgA-PUSCH-DMRS-CDM-Group-r16                 INTEGER (0..1)                                              OPTIONAL, -- Need S
    }
}
```
### MsgA-PUSCH-Config field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>msgA-DataScramblingIndex</strong></td>
<td>Identifier used to initiate data scrambling (c_{init}) for msgA PUSCH. If the field is absent the UE applies the value Physical cell ID (physCellID).</td>
</tr>
<tr>
<td><strong>msgA-DeltaPreamble</strong></td>
<td>Power offset of msgA PUSCH relative to the preamble received target power. Actual value = field value * 2 [dB] (see TS 38.213 [13], clause 7.1).</td>
</tr>
<tr>
<td><strong>msgA-PUSCH-ResourceGroupA</strong></td>
<td>MsgA PUSCH resources that the UE shall use when performing MsgA transmission using preambles group A. If field is not configured for the selected UL BWP, the UE shall use the MsgA PUSCH configuration for group A of initial UL BWP.</td>
</tr>
<tr>
<td><strong>msgA-PUSCH-ResourceGroupB</strong></td>
<td>MsgA PUSCH resources that the UE shall use when performing MsgA transmission using preambles group B.</td>
</tr>
<tr>
<td><strong>msgA-TransformPrecoder</strong></td>
<td>Enables or disables the transform precoder for MsgA transmission (see clause 6.1.3 of TS 38.214 [19]).</td>
</tr>
</tbody>
</table>
**MsgA-PUSCH-Resource field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>guardBandMsgA-PUSCH</td>
<td>PRB-level guard band between FDMed PUSCH occasions (see TS 38.213 [13], clause 8.1A). If interlaced PUSCH is configured, value 0 is applied.</td>
</tr>
<tr>
<td>guardPeriodMsgA-PUSCH</td>
<td>Guard period between PUSCH occasions in the unit of symbols (see TS 38.213 [13], clause 8.1A).</td>
</tr>
<tr>
<td>frequencyStartMsgA-PUSCH</td>
<td>Offset of lowest PUSCH occasion in frequency domain with respect to PRB 0 (see TS 38.213 [13], clause 8.1A).</td>
</tr>
<tr>
<td>interfaceIndexFirstPO-MsgA-PUSCH</td>
<td>Interlace index of the first PUSCH occasion in frequency domain if interlaced PUSCH is configured. For 30kHz SCS only the integers 1, 2, 3, 4, 5 are applicable (see TS 38.213 [13], clause 8.1A).</td>
</tr>
<tr>
<td>mappingTypeMsgA-PUSCH</td>
<td>PUSCH mapping type A or B. If the field is absent, the UE shall use the parameter msgA-PUSCH-TimeDomainAllocation (see TS 38.213 [13], clause 8.1A).</td>
</tr>
<tr>
<td>msgA-Alpha</td>
<td>Dedicated alpha value for MsgA PUSCH. If value is absent, the UE shall use the value of msg3-Alpha if configured, else UE applies value 1 (see TS 38.213 [13], clause 7.1.1).</td>
</tr>
<tr>
<td>msgA-DMRS-Config</td>
<td>DMRS configuration for msgA PUSCH (see TS 38.213 [13], clause 8.1A and TS 38.214 [19] clause 6.2.2).</td>
</tr>
<tr>
<td>msgA-HoppingBits</td>
<td>Value of hopping bits to indicate which frequency offset to be used for second hop. See Table 8.3-1 in 38.213 [13]. This field is mandatory present when the field msgA-IntraSlotFrequencyHopping is configured. Otherwise, the field is absent.</td>
</tr>
<tr>
<td>msgA-IntraSlotFrequencyHopping</td>
<td>Intra-slot frequency hopping per PUSCH occasion (see TS 38.213 [13], clause 8.1A).</td>
</tr>
<tr>
<td>msgA-MCS</td>
<td>Indicates the MCS index for msgA PUSCH from the Table 6.1.4.1-1 for DFT-s-OFDM and Table 5.1.3.1-1 for CP-OFDM in 38.214 [19].</td>
</tr>
<tr>
<td>msgA-PUSCH-TimeDomainAllocation</td>
<td>Indicates a combination of start symbol and length and PUSCH mapping type from the TDRA table (PUSCH-TimeDomainResourceAllocationList if provided in PUSCH-ConfigCommon, or else the default Table 6.1.2.1.1-2 in 38.214 [19] is used if pusch-TimeDomainAllocationList is not provided in PUSCH-ConfigCommon). The parameter K2 in the table is not used for msgA PUSCH. The network configures one of msgA-PUSCH-TimeDomainAllocation and startSymbolAndLengthMsgA-PO, but not both. If the field is absent, the UE shall use the value of startSymbolAndLengthMsgA-PO.</td>
</tr>
<tr>
<td>msgA-PUSCH-TimeDomainOffset</td>
<td>A single time offset with respect to the start of each PRACH slot (with at least one valid RO), counted as the number of slots (based on the numerology of active UL BWP). See 38.213 [13], clause 8.1A.</td>
</tr>
<tr>
<td>nrofDMRS-Sequences</td>
<td>Number of DMRS sequences for MsgA PUSCH for CP-OFDM. In case of single PUSCH configuration or if the DMRS symbols of multiple configurations are not overlapped, if the DMRS resources configured in one PUSCH occasion is no larger than 8 (for len2) or 4 (for len1), then only DMRS port is configured.</td>
</tr>
<tr>
<td>nrofInterlacesPerMsgA-PO</td>
<td>Number of consecutive interlaces per PUSCH occasion if interlaced PUSCH is configured. For 30kHz SCS only the integers 1, 2, 3, 4, 5 are applicable (see TS 38.213 [13], clause 8.1A).</td>
</tr>
<tr>
<td>nrofMsgA-PO-FDM</td>
<td>The number of msgA PUSCH occasions FDMed in one time instance (see TS 38.213 [13], clause 8.1A).</td>
</tr>
<tr>
<td>nrofMsgA-PO-PerSlot</td>
<td>Number of time domain PUSCH occasions in each slot. PUSCH occasions including guard period are contiguous in time domain within a slot (see TS 38.213 [13], clause 8.1A).</td>
</tr>
<tr>
<td>nrofPRBs-PerMsgA-PO</td>
<td>Number of PRBs per PUSCH occasion (see TS 38.213 [13], clause 8.1A).</td>
</tr>
</tbody>
</table>
nrofSlotsMsgA-PUSCH
Number of slots (in active UL BWP numerology) containing one or multiple PUSCH occasions, each slot has the same time domain resource allocation (see TS 38.213 [13], clause 8.1A).

startSymbolAndLengthMsgA-PO
An index giving valid combinations of start symbol, length and mapping type as start and length indicator (SLIV) for the first msgA PUSCH occasion, for RRC_CONNECTED UEs in non-initial BWP as described in TS 38.214 [19] clause 6.1.2. The network configures the field so that the allocation does not cross the slot boundary. The number of occupied symbols excludes the guard period. If the field is absent, the UE shall use the value in msgA-PUSCH-TimeDomainAllocation (see TS 38.213 [13], clause 8.1A). The network configures one of msgA-PUSCH-TimeDomainAllocation and startSymbolAndLengthMsgA-PO, but not both. If the field is absent, the UE shall use the value of msgA-PUSCH-TimeDomainAllocation.

MsgA-DMRS-Config field descriptions

msgA-DMRS-AdditionalPosition
Indicates the position for additional DM-RS. If the field is absent, the UE applies value pos2.

msgA-MaxLength
indicates single-symbol or double-symbol DMRS. If the field is absent, the UE applies value len1.

msgA-PUSCH-DMRS-CDM-group
1-bit indication of indices of CDM group(s). If the field is absent, then both CDM groups are used.

msgA-PUSCH-NrofPort
0 indicates 1 port per CDM group, 1 indicates 2 ports per CDM group. If the field is absent then 4 ports per CDM group are used (see TS 38.213 [13], clause 8.1A).

msgA-ScramblingID0
UL DMRS scrambling initialization for CP-OFDM. If the field is absent the UE applies the value Physical cell ID (physCellID).

msgA-ScramblingID1
UL DMRS scrambling initialization for CP-OFDM. If the field is absent the UE applies the value Physical cell ID (physCellID).

Conditional Presence

| GroupBConfigured | The field is mandatory present if groupB-ConfiguredTwoStepRA is configured in RACH-ConfigCommonTwoStepRA, otherwise the field is absent. |
| InitialBWPConfig | The field is mandatory present when MsgA-ConfigCommon is configured for the initial uplink BWP, or when MsgA-ConfigCommon is configured for a non-initial uplink BWP and MsgA-ConfigCommon is not configured for the initial uplink BWP, otherwise the field is optionally present, Need S. |

MultiFrequencyBandListNR

The IE MultiFrequencyBandListNR is used to configure a list of one or multiple NR frequency bands.

MultiFrequencyBandListNR information element

```
-- ASN1START
-- TAG--MULTIFREQUENCYBANDLISTNR--START
MultiFrequencyBandListNR ::= SEQUENCE (SIZE (1..maxNrofMultiBands)) OF FreqBandIndicatorNR
-- TAG--MULTIFREQUENCYBANDLISTNR--STOP
-- ASN1STOP
```
— **MultiFrequencyBandListNR-SIB**

The IE MultiFrequencyBandListNR-SIB indicates the list of frequency bands, for which cell (re-)selection parameters are common, and a list of additionalPmax and additionalSpectrumEmission.

**MultiFrequencyBandListNR-SIB** information element

```asn1
MultiFrequencyBandListNR-SIB ::=            SEQUENCE (SIZE (1.. maxNrofMultiBands)) OF NR-MultiBandInfo

NR-MultiBandInfo ::=                        SEQUENCE {
  freqBandIndicatorNR                         FreqBandIndicatorNR         OPTIONAL,   -- Cond OptULNotSIB2
  nr-NS-PmaxList                              NR-NS-PmaxList              OPTIONAL    -- Need S
}
```

**NR-MultiBandInfo field descriptions**

<table>
<thead>
<tr>
<th>Field Descriptions</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>freqBandIndicatorNR</code></td>
<td>Provides an NR frequency band number as defined in TS 38.101-1[15] and TS 38.101-2[39], table 5.2-1.</td>
</tr>
<tr>
<td><code>nr-NS-PmaxList</code></td>
<td>Provides a list of additionalPmax and additionalSpectrumEmission values. If the field is absent the UE uses value 0 for the additionalSpectrumEmission (see TS 38.101-1[15] table 6.2.3.1-1A, and TS 38.101-2 [39], table 6.2.3.1-2). This field is ignored by IAB-MT, the IAB-MT applies output power and emissions requirements, as specified in TS 38.174[63].</td>
</tr>
</tbody>
</table>

**Conditional Presence**

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>OptULNotSIB2</td>
<td>The field is absent for SIB2 and is mandatory present in SIB4 and frequencyInfoDL-SIB. Otherwise, if the field is absent in frequencyInfoUL-SIB in UplinkConfigCommonSIB, the UE will use the frequency band indicated in frequencyInfoUL-SIB in DownlinkConfigCommonSIB.</td>
</tr>
</tbody>
</table>

— **NeedForGapsConfigNR**

The IE NeedForGapsConfigNR contains configuration related to the reporting of measurement gap requirement information.

**NeedForGapsConfigNR** information element

```asn1
NeedForGapsConfigNR-r16 ::=                          SEQUENCE {
```

**ETSI**
NeedForGapsConfigNR field descriptions

### requestedTargetBandFilterNR
Indicates the target NR bands that the UE is requested to report the gap requirement information.

#### NeedForGapsInfoNR
The IE `NeedForGapsInfoNR` indicates whether measurement gap is required for the UE to perform SSB based measurements on an NR target band while NR-DC or NE-DC is not configured.

### NeedForGapsInfoNR information element

```asn1
NeedForGapsInfoNR-r16 ::= SEQUENCE {
    intraFreq-needForGap-r16       NeedForGapsIntraFreqlist-r16,
    interFreq-needForGap-r16      NeedForGapsBandlistNR-r16
}

NeedForGapsIntraFreqlist-r16 ::= SEQUENCE (SIZE (1.. maxNrofServingCells)) OF NeedForGapsIntraFreq-r16

NeedForGapsBandlistNR-r16 ::= SEQUENCE (SIZE (1..maxBands)) OF NeedForGapsNR-r16

NeedForGapsIntraFreq-r16  ::=                 SEQUENCE {
    servCellId-r16                               ServCellIndex,
    gapIndicationIntra-r16                       ENUMERATED {gap, no-gap}
}

NeedForGapsNR-r16  ::=                        SEQUENCE {
    bandNR-r16                                   FreqBandIndicatorNR,
    gapIndication-r16                            ENUMERATED {gap, no-gap}
}
```
### NeedForGapsInfoNR field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>intraFreq-needForGap</td>
<td>Indicates the measurement gap requirement information for NR intra-frequency measurement.</td>
</tr>
<tr>
<td>interFreq-needForGap</td>
<td>Indicates the measurement gap requirement information for NR inter-frequency measurement.</td>
</tr>
</tbody>
</table>

### NeedForGapsIntraFreq field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>servCellId</td>
<td>Indicates the serving cell which contains the target SSB (associated with the initial DL BWP) to be measured.</td>
</tr>
<tr>
<td>gapIndicationIntra</td>
<td>Indicates whether measurement gap is required for the UE to perform intra-frequency SSB based measurements on the concerned serving cell. Value <strong>gap</strong> indicates that a measurement gap is needed if any of the UE configured BWPs do not contain the frequency domain resources of the SSB associated to the initial DL BWP. Value <strong>no-gap</strong> indicates a measurement gap is not needed to measure the SSB associated to the initial DL BWP for all configured BWPs, no matter the SSB is within the configured BWP or not.</td>
</tr>
</tbody>
</table>

### NeedForGapsNR field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bandNR</td>
<td>Indicates the NR target band to be measured.</td>
</tr>
<tr>
<td>gapIndication</td>
<td>Indicates whether measurement gap is required for the UE to perform SSB based measurements on the concerned NR target band while NR-DC or NE-DC is not configured. The UE determines this information based on the resultant configuration of the <strong>RRCReconfiguration</strong> or <strong>RRCResume</strong> message that triggers this response. Value <strong>gap</strong> indicates that a measurement gap is needed, value <strong>no-gap</strong> indicates a measurement gap is not needed.</td>
</tr>
</tbody>
</table>

---

### NextHopChainingCount

The **NextHopChainingCount** is used to update the $K_{\text{Nb}}$ key and corresponds to parameter NCC: See TS 33.501 [11].

**NextHopChainingCount information element**

```asn1
NextHopChainingCount ::= INTEGER (0..7)
```

---

### NG-5G-S-TMSI

The **NG-5G-S-TMSI** contains a 5G S-Temporary Mobile Subscription Identifier (5G-S-TMSI), a temporary UE identity provided by the 5GC which uniquely identifies the UE within the tracking area, see TS 23.003 [21].
NG-5G-S-TMSI information element

-- ASN1START
-- TAG-NG-5G-S-TMSI-START

NG-5G-S-TMSI ::= BIT STRING (SIZE (48))

-- TAG-NG-5G-S-TMSI-STOP
-- ASN1STOP

-- NPN-Identity

The IE NPN-Identity includes either a list of CAG-IDs or a list of NIDs per PLMN Identity. Further information regarding how to set the IE is specified in TS 23.003 [21].

NPN-Identity information element

-- ASN1START
-- TAG-NPN-IDENTITY-START

NPN-Identity-r16 ::= CHOICE {
  pni-npn-r16                      SEQUENCE {
    plmn-Identity-r16                PLMN-Identity,
    cag-IdentityList-r16             SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16
  },
  snpn-r16                         SEQUENCE {
    plmn-Identity-r16                PLMN-Identity,
    nid-List-r16                     SEQUENCE (SIZE (1..maxNPN-r16)) OF NID-r16
  }
}

CAG-IdentityInfo-r16 ::= SEQUENCE {
  cag-Identity-r16                 BIT STRING (SIZE (32)),
  manualCAGselectionAllowed-r16    ENUMERATED {true} OPTIONAL -- Need R
}

NID-r16 ::= BIT STRING (SIZE (44))

-- TAG-NPN-IDENTITY-STOP
-- ASN1STOP
**NPN-Identity field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cag-Identity</strong></td>
<td>A CAG-ID as specified in TS 23.003 [21]. The PLMN ID and a CAG ID in the <strong>NPN-Identity</strong> identifies a PNI-NPN.</td>
</tr>
<tr>
<td><strong>cag-IdentityList</strong></td>
<td>The <strong>cag-IdentityList</strong> contains one or more CAG IDs. All CAG IDs associated to the same PLMN ID are listed in the same <strong>cag-IdentityList</strong> entry.</td>
</tr>
<tr>
<td><strong>manualCAGselectionAllowed</strong></td>
<td>The <strong>manualCAGselectionAllowed</strong> indicates that the CAG ID can be selected manually even if it is outside the UE's allowed CAG list.</td>
</tr>
<tr>
<td><strong>NID</strong></td>
<td>A NID as specified in TS 23.003 [21]. The PLMN ID and a NID in the <strong>NPN-Identity</strong> identifies a SNPN.</td>
</tr>
<tr>
<td><strong>nid-List</strong></td>
<td>The <strong>nid-List</strong> contains one or more <strong>NID</strong>.</td>
</tr>
</tbody>
</table>

---

**NPN-IdentityInfoList**

The IE **NPN-IdentityInfoList** includes a list of NPN identity information.

---

**NPN-IdentityInfoList** information element

```asn1
NPN-IdentityInfoList-r16 ::= SEQUENCE (SIZE (1..maxNPN-r16)) OF NPN-IdentityInfo-r16

NPN-IdentityInfo-r16 ::= SEQUENCE {
  npn-IdentityList-r16             SEQUENCE (SIZE (1..maxNPN-r16)) OF NPN-Identity-r16,
  trackingAreaCode-r16             TrackingAreaCode,
  ranac-r16                        RAN-AreaCode                                                OPTIONAL, -- Need R
  cellIdentity-r16                 CellIdentity,
  cellReservedForOperatorUse-r16   ENUMERATED {reserved, notReserved},
  iab-Support-r16                  ENUMERATED {true}                                           OPTIONAL, -- Need S
  ...}
```

---

**ASN1STOP**
**NPN-IdentityInfoList field descriptions**

**iab-Support**
This field combines both the support of IAB and the cell status for IAB. If the field is present, the cell supports IAB and the cell is also considered as a candidate for cell (re)selection for IAB-nodes; if the field is absent, the cell does not support IAB and/or the cell is barred for IAB-node.

**NPN-IdentityInfo**
The NPN-IdentityInfo contains one or more NPN identities and additional information associated with those NPNs. Only the same type of NPNs (either SNPNs or PNI-NPNs) can be listed in a NPN-IdentityInfo element.

**npn-IdentityList**
The npn-IdentityList contains one or more NPN Identity elements.

**trackingAreaCode**
Indicates the Tracking Area Code to which the cell indicated by cellIdentity field belongs.

**ranac**
Indicates the RAN Area Code to which the cell indicated by cellIdentity field belongs.

**cellReservedForOperatorUse**
Indicates whether the cell is reserved for operator use (for the NPN(s) identified in the npn-IdentityList) as defined in TS 38.304 [20]. This field is ignored by NPN capable IAB-MT.

---

**NR-NS-PmaxList**

The IE NR-NS-PmaxList is used to configure a list of additionalPmax and additionalSpectrumEmission, as defined in TS 38.101-1 [15], table 6.2.3.1-1A, and TS 38.101-2 [39], table 6.2.3.1-2, for a given frequency band.

**NR-NS-PmaxList information element**

```asn1
NR-NS-PmaxList ::= SEQUENCE {SIZE (1..maxNR-NS-Pmax)) OF NR-NS-PmaxValue

NR-NS-PmaxValue ::= SEQUENCE {
  additionalPmax  P-Max  OPTIONAL,  -- Need N
  additionalSpectrumEmission  AdditionalSpectrumEmission
}
```

---

**NZP-CSI-RS-Resource**

The IE NZP-CSI-RS-Resource is used to configure Non-Zero-Power (NZP) CSI-RS transmitted in the cell where the IE is included, which the UE may be configured to measure on (see TS 38.214 [19], clause 5.2.2.3.1). A change of configuration between periodic, semi-persistent or aperiodic for an NZP-CSI-RS-Resource is not supported without a release and add.
**NZP-CSI-RS-Resource** information element

```asn1
NZP-CSI-RS-Resource ::= SEQUENCE {
    nzp-CSI-RS-ResourceId             NZP-CSI-RS-ResourceId,
    resourceMapping                   CSI-RS-ResourceMapping,
    powerControlOffset                INTEGER (-8..15), -- Need R
    powerControlOffsetSS              ENUMERATED{db-3, db0, db3, db6} OPTIONAL, -- Cond PeriodicOrSemiPersistent
    scramblingID                      ScramblingId,     periodicityAndOffset                CSI-ResourcePeriodicityAndOffset                OPTIONAL, -- Cond PeriodicOrSemiPersistent
    qcl-InfoPeriodicCSI-RS            TCI-StateId,     ...
}
```

**NZP-CSI-RS-Resource field descriptions**

- **periodicityAndOffset**: Periodicity and slot offset $s/l$ corresponds to a periodicity of 1 slot, $s/2$ to a periodicity of two slots, and so on. The corresponding offset is also given in number of slots (see TS 38.214 [19], clause 5.2.2.3.1). Network always configures the UE with a value for this field for periodic and semi-persistent NZP-CSI-RS-Resource (as indicated in CSI-ResourceConfig).

- **powerControlOffset**: Power offset of PDSCH RE to NZP CSI-RS RE. Value in dB (see TS 38.214 [19], clauses 5.2.2.3.1 and 4.1).

- **powerControlOffsetSS**: Power offset of NZP CSI-RS RE to SSS RE. Value in dB (see TS 38.214 [19], clause 5.2.2.3.1).

- **qcl-InfoPeriodicCSI-RS**: For a target periodic CSI-RS, contains a reference to one TCI-State in TCI-States for providing the QCL source and QCL type. For periodic CSI-RS, the source can be SSB or another periodic-CSI-RS. Refers to the TCI-State which has this value for tci-StateId and is defined in tci-StatesToAddModList in the PDSCH-Config included in the BWP-Downlink corresponding to the serving cell and to the DL BWP to which the resource belongs to (see TS 38.214 [19], clause 5.2.2.3.1).

- **resourceMapping**: OFDM symbol location(s) in a slot and subcarrier occupancy in a PRB of the CSI-RS resource.

- **scramblingID**: Scrambling ID (see TS 38.214 [19], clause 5.2.2.3.1).

### Conditional Presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Periodic</strong></td>
<td>The field is optionally present, Need M, for periodic NZP-CSI-RS-Resources (as indicated in CSI-ResourceConfig). The field is absent otherwise.</td>
</tr>
<tr>
<td><strong>PeriodicOrSemiPersistent</strong></td>
<td>The field is optionally present, Need M, for periodic and semi-persistent NZP-CSI-RS-Resources (as indicated in CSI-ResourceConfig). The field is absent otherwise.</td>
</tr>
</tbody>
</table>
— **NZP-CSI-RS-ResourceId**

The IE *NZP-CSI-RS-ResourceId* is used to identify one NZP-CSI-RS-Resource.

*NZP-CSI-RS-ResourceId* information element

```asn1
NZP-CSI-RS-ResourceId ::= INTEGER (0..maxNrofNZP-CSI-RS-Resources-1)
```

— **NZP-CSI-RS-ResourceSet**

The IE *NZP-CSI-RS-ResourceSet* is a set of Non-Zero-Power (NZP) CSI-RS resources (their IDs) and set-specific parameters.

*NZP-CSI-RS-ResourceSet* information element

```asn1
NZP-CSI-RS-ResourceSet ::= SEQUENCE {
    nzp-CSI-ResourceSetId       NZP-CSI-RS-ResourceId,       OPTIONAL, -- Need S
    nzp-CSI-RS-Resources        SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId,       OPTIONAL, -- Need S
    repetition                 ENUMERATED { on, off }                   OPTIONAL, -- Need S
    aperiodicTriggeringOffset  INTEGER (0..31)                         OPTIONAL   -- Need S
    trs-Info                   ENUMERATED {true}                         OPTIONAL, -- Need R
    ...,                        
    [ aperiodicTriggeringOffset-r16 INTEGER (0..31) ]                  OPTIONAL   -- Need S
}
```


### NZP-CSI-RS-ResourceSet field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>aperiodicTriggeringOffset</code></td>
<td>Offset X between the slot containing the DCI that triggers a set of aperiodic NZP CSI-RS resources and the slot in which the CSI-RS resource set is transmitted. For <code>aperiodicTriggeringOffset</code>, the value 0 corresponds to 0 slots, value 1 corresponds to 1 slot, value 2 corresponds to 2 slots, value 3 corresponds to 3 slots, value 4 corresponds to 4 slots, value 5 corresponds to 16 slots, value 6 corresponds to 24 slots. For <code>aperiodicTriggeringOffset-r16</code>, the value indicates the number of slots. The network configures only one of the fields. When neither field is included, the UE applies the value 0.</td>
</tr>
<tr>
<td><code>nzp-CSI-RS-Resources</code></td>
<td>NZP-CSI-RS-Resources associated with this NZP-CSI-RS resource set (see TS 38.214 [19], clause 5.2). For CSI, there are at most 8 NZP CSI RS resources per resource set.</td>
</tr>
<tr>
<td><code>repetition</code></td>
<td>Indicates whether repetition is on/off. If the field is set to off or if the field is absent, the UE may not assume that the NZP-CSI-RS resources within the resource set are transmitted with the same downlink spatial domain transmission filter (see TS 38.214 [19], clauses 5.2.2.3.1 and 5.1.6.1.2). It can only be configured for CSI-RS resource sets which are associated with <code>CSI-ReportConfig</code> with report of L1 RSRP or &quot;no report&quot;.</td>
</tr>
<tr>
<td><code>trs-Info</code></td>
<td>Indicates that the antenna port for all NZP-CSI-RS resources in the CSI-RS resource set is same. If the field is absent or released the UE applies the value <code>false</code> (see TS 38.214 [19], clause 5.2.2.3.1).</td>
</tr>
</tbody>
</table>

#### NZP-CSI-RS-ResourceId

The IE `NZP-CSI-RS-ResourceId` is used to identify one `NZP-CSI-RS-ResourceSet`.

#### NZP-CSI-RS-ResourceId information element

```
-- ASN1START
-- TAG-NZP-CSI-RS-RESOURCESETID-START
NZP-CSI-RS-ResourceId ::= INTEGER (0..maxNrofNZP-CSI-RS-ResourceSets-1)
-- TAG-NZP-CSI-RS-RESOURCESETID-STOP
-- ASN1STOP
```

#### P-Max

The IE `P-Max` is used to limit the UE's uplink transmission power on a carrier frequency, in TS 38.101-1 [15] and is used to calculate the parameter `Pcompensation` defined in TS 38.304 [20].

#### P-Max information element

```
-- ASN1START
-- TAG-P-MAX-START
P-Max ::= INTEGER (-30..33)
-- TAG-P-MAX-STOP
-- ASN1STOP
```
PCI-List

The IE **PCI-List** concerns a list of physical cell identities, which may be used for different purposes.

**PCI-List information element**

```asn1
-- ASN1START
-- TAG-PCI-LIST-START
PCI-List ::=                        SEQUENCE (SIZE (1..maxNrofCellMeas)) OF PhysCellId
-- TAG-PCI-LIST-STOP
-- ASN1STOP
```

PCI-Range

The IE **PCI-Range** is used to encode either a single or a range of physical cell identities. The range is encoded by using a *start* value and by indicating the number of consecutive physical cell identities (including *start*) in the range. For fields comprising multiple occurrences of *PCI-Range*, the Network may configure overlapping ranges of physical cell identities.

**PCI-Range information element**

```asn1
-- ASN1START
-- TAG-PCI-RANGE-START
PCI-Range ::=                       SEQUENCE {     start                               PhysCellId,
                                           range                               ENUMERATED {n4, n8, n12, n16, n24, n32, n48, n64, n84, n96, n128, n168, n252, n504, n1008, spare1}                  OPTIONAL    -- Need S
}                                      -- TAG-PCI-RANGE-STOP
-- ASN1STOP
```

**PCI-Range field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>range</td>
<td>Indicates the number of physical cell identities in the range (including <em>start</em>). Value <em>n4</em> corresponds with 4, value <em>n8</em> corresponds with 8 and so on. The UE shall apply value 1 in case the field is absent, in which case only the physical cell identity value indicated by <em>start</em> applies.</td>
</tr>
<tr>
<td>start</td>
<td>Indicates the lowest physical cell identity in the range.</td>
</tr>
</tbody>
</table>

PCI-RangeElement

The IE **PCI-RangeElement** is used to define a PCI-Range as part of a list (e.g. AddMod list).
**PCI-RangeElement** information element

```asn1
PCI-RangeElement ::= SEQUENCE {
  pci-RangeIndex  PCI-RangeIndex,
  pci-Range      PCI-Range
}
```

**PCI-RangeElement field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pci-Range</td>
<td>Physical cell identity or a range of physical cell identities.</td>
</tr>
<tr>
<td>pci-RangeIndexList</td>
<td>A list of indexes of physical cell id ranges, which may be used for different purposes.</td>
</tr>
</tbody>
</table>

---

**PCI-RangeIndex**

The IE PCI-RangeIndex identifies a physical cell id range, which may be used for different purposes.

```asn1
PCI-RangeIndex ::= INTEGER (1..maxNrofPCI-Ranges)
```

---

**PCI-RangeIndexList**

The IE **PCI-RangeIndexList** concerns a list of indexes of physical cell id ranges, which may be used for different purposes.

```asn1
PCI-RangeIndexList ::= SEQUENCE (SIZE (1..maxNrofPCI-Ranges)) OF PCI-RangeIndex
```
The IE **PDCCH-Config** is used to configure UE specific PDCCH parameters such as control resource sets (CORESET), search spaces and additional parameters for acquiring the PDCCH. If this IE is used for the scheduled cell in case of cross carrier scheduling, the fields other than `searchSpacesToAddModList` and `searchSpacesToReleaseList` are absent. If the IE is used for a dormant BWP, the fields other than `controlResourceSetToAddModList` and `controlResourceSetToReleaseList` are absent.

**PDCCH-Config** information element

```asn1
PDCCH-Config ::= SEQUENCE {
  controlResourceSetToAddModList      SEQUENCE(SIZE (1..3)) OF ControlResourceSet OPTIONAL, -- Need N
  controlResourceSetToReleaseList     SEQUENCE(SIZE (1..3)) OF ControlResourceSetId OPTIONAL, -- Need N
  searchSpacesToAddModList           SEQUENCE(SIZE (1..10)) OF SearchSpace OPTIONAL, -- Need N
  searchSpacesToReleaseList          SEQUENCE(SIZE (1..10)) OF SearchSpaceId OPTIONAL, -- Need N
  downlinkPreemption                 SetupRelease { DownlinkPreemption } OPTIONAL, -- Need M
  tpc-PUSCH                         SetupRelease { PUSCH-TPC-CommandConfig } OPTIONAL, -- Need M
  tpc-PUCCH                         SetupRelease { PUCCH-TPC-CommandConfig } OPTIONAL, -- Need M
  tpc-SRS                           SetupRelease { SRS-TPC-CommandConfig} OPTIONAL, -- Need M
  ...,     
  controlResourceSetToAddModList2-r16 SEQUENCE (SIZE (1..2)) OF ControlResourceSet OPTIONAL, -- Need N
  controlResourceSetToReleaseList-r16 SEQUENCE (SIZE (1..5)) OF ControlResourceSetId-r16 OPTIONAL, -- Need N
  searchSpacesToAddModListExt-r16    SEQUENCE(SIZE (1..10)) OF SearchSpaceExt-r16 OPTIONAL, -- Need N
  uplinkCancellation-r16             SetupRelease { UplinkCancellation-r16 } OPTIONAL, -- Need M
  monitoringCapabilityConfig-r16     ENUMERATED { r15monitoringcapability,r16monitoringcapability } OPTIONAL, -- Need M
  searchSpaceSwitchConfig-r16        SearchSpaceSwitchConfig-r16 OPTIONAL -- Need R
}
```

```asn1
SearchSpaceSwitchConfig-r16 ::= SEQUENCE {
  cellGroupsForSwitchList-r16        SEQUENCE(SIZE (1..4)) OF CellGroupForSwitch-r16 OPTIONAL, -- Need R
  searchSpaceSwitchDelay-r16         INTEGER (10..52) OPTIONAL -- Need R
}
```

```asn1
CellGroupForSwitch-r16 ::= SEQUENCE(SIZE (1..16)) OF ServCellIndex
```
The IE PDCCH-ConfigCommon is used to configure cell specific PDCCH parameters provided in SIB as well as in dedicated signalling.

**PDCCH-ConfigCommon information element**
PDCCH-ConfigCommon ::= SEQUENCE {
  controlResourceSetZero ControlResourceSetZero OPTIONAL, -- Cond InitialBWP-Only
  commonControlResourceSet ControlResourceSet OPTIONAL, -- Need R
  searchSpaceZero SearchSpaceZero OPTIONAL, -- Cond InitialBWP-Only
  commonSearchSpaceList SEQUENCE (SIZE(1..4)) OF SearchSpace OPTIONAL, -- Need R
  searchSpaceSIB1 SearchSpaceId OPTIONAL, -- Need S
  searchSpaceOtherSystemInformation SearchSpaceId OPTIONAL, -- Need S
  pagingSearchSpace SearchSpaceId OPTIONAL, -- Need S
  ra-SearchSpace SearchSpaceId OPTIONAL, -- Need S
  ...,
  [ ]
  firstPDCCH-MonitoringOccasionOfPO CHOICE {
    sCS15KHZzoneT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..139),
    sCS30KHZzoneT-SCS15KHZhalfT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..279),
    sCS60KHZzoneT-SCS30KHZhalfT-SCS15KHZquarterT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..559),
    sCS120KHZzoneT-SCS60KHZhalfT-SCS30KHZquarterT-SCS15KHZzoneEighthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..1119),
    sCS120KHZhalfT-SCS60KHZquarterT-SCS30KHZhalfT-SCS15KHZzoneEighthT-SCS15KHZzoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..2239),
    sCS120KHZquarterT-SCS60KHZzoneEighthT-SCS30KHZzoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..4479),
    sCS120KHZzoneEighthT-SCS60KHZzoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..8959),
    sCS120KHZzoneSixteenthT OPTIONAL -- Cond OtherBWP
  }
  [ ]
  commonSearchSpaceListExt-r16 SEQUENCE (SIZE(1..4)) OF SearchSpaceExt-r16 OPTIONAL -- Need R
} -- TAG-PDCCH-CONFIGCOMMON-STOP
-- ASN1STOP
**PDCCH-ConfigCommon** field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>commonControlResourceSet</td>
<td>An additional common control resource set which may be configured and used for any common or UE-specific search space. If the network configures this field, it uses a ControlResourceSetId other than 0 for this ControlResourceSet. The network configures the commonControlResourceSet in SIB1 so that it is contained in the bandwidth of CORESET#0.</td>
</tr>
<tr>
<td>commonSearchSpaceList, commonSearchSpaceListExt</td>
<td>A list of additional common search spaces. If the network configures this field, it uses the SearchSpaceIds other than 0. If the field is included, it replaces any previous list, i.e. all the entries of the list are replaced and each of the SearchSpace entries is considered to be newly created and the conditions and Need codes for setup of the entry apply. If the network includes commonSearchSpaceListExt, it includes the same number of entries, and listed in the same order, as in commonSearchSpaceList.</td>
</tr>
<tr>
<td>controlResourceSetZero</td>
<td>Parameters of the common CORESET#0 which can be used in any common or UE-specific search spaces. The values are interpreted like the corresponding bits in MIB pdcch-ConfigSIB1. Even though this field is only configured in the initial BWP (BWP#0) controlResourceSetZero can be used in search spaces configured in other DL BWP(s) than the initial DL BWP if the conditions defined in TS 38.213 [13], clause 10 are satisfied.</td>
</tr>
<tr>
<td>firstPDCCH-MonitoringOccasionOFPO</td>
<td>Indicates the first PDCCH monitoring occasion of each PO of the PF on this BWP, see TS 38.304 [20].</td>
</tr>
<tr>
<td>pagingSearchSpace</td>
<td>ID of the Search space for paging (see TS 38.213 [13], clause 10.1). If the field is absent, the UE does not receive paging in this BWP (see TS 38.213 [13], clause 10).</td>
</tr>
<tr>
<td>ra-SearchSpace</td>
<td>ID of the Search space for random access procedure (see TS 38.213 [13], clause 10.1). If the field is absent, the UE does not receive RAR in this BWP. This field is mandatory present in the DL BWP(s) if the conditions described in TS 38.321 [3], subclause 5.15 are met.</td>
</tr>
<tr>
<td>searchSpaceOtherSystemInformation</td>
<td>ID of the Search space for other system information, i.e., SIB2 and beyond (see TS 38.213 [13], clause 10.1) If the field is absent, the UE does not receive other system information in this BWP.</td>
</tr>
<tr>
<td>searchSpaceSIB1</td>
<td>ID of the search space for SIB1 message. In the initial DL BWP of the UE's PCell, the network sets this field to 0. If the field is absent, the UE does not receive SIB1 in this BWP. (see TS 38.213 [13], clause 10)</td>
</tr>
<tr>
<td>searchSpaceZero</td>
<td>Parameters of the common SearchSpace#0. The values are interpreted like the corresponding bits in MIB pdcch-ConfigSIB1. Even though this field is only configured in the initial BWP (BWP#0), searchSpaceZero can be used in search spaces configured in other DL BWP(s) than the initial DL BWP if the conditions described in TS 38.213 [13], clause 10, are satisfied.</td>
</tr>
</tbody>
</table>

### Conditional Presence

<table>
<thead>
<tr>
<th>BWP Type</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>InitialBWP-Only</td>
<td>If SIB1 is broadcast the field is mandatory present in the PDCCH-ConfigCommon of the initial BWP (BWP#0) in ServingCellConfigCommon; it is absent in other BWPs and when sent in system information. If SIB1 is not broadcast and there is an SSB associated to the cell, the field is optionally present, Need M, in the PDCCH-ConfigCommon of the initial BWP (BWP#0) in ServingCellConfigCommon (still with the same setting for all UEs). In other cases, the field is absent.</td>
</tr>
<tr>
<td>OtherBWP</td>
<td>This field is optionally present, Need R, if this BWP is not the initial DL BWP and pagingSearchSpace is configured in this BWP. Otherwise this field is absent.</td>
</tr>
</tbody>
</table>

---

**PDCCH-ConfigSIB1**

The IE PDCCH-ConfigSIB1 is used to configure CORESET#0 and search space#0.
PDCCH-ConfigSIB1 information element

--- ASN1START
--- TAG-PDCCH-CONFIGSIB1-START
PDCCH-ConfigSIB1 ::= SEQUENCE {
  controlResourceSetZero ControlResourceSetZero,
  searchSpaceZero SearchSpaceZero
}
--- TAG-PDCCH-CONFIGSIB1-STOP
--- ASN1STOP

PDCCH-ConfigSIB1 field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>controlResourceSetZero</td>
<td>Determines a common ControlResourceSet (CORESET) with ID #0, see TS 38.213</td>
</tr>
<tr>
<td>searchSpaceZero</td>
<td>Determines a common search space with ID #0, see TS 38.213</td>
</tr>
</tbody>
</table>

--- PDCCH-ServingCellConfig

The IE *PDCCH-ServingCellConfig* is used to configure UE specific PDCCH parameters applicable across all bandwidth parts of a serving cell.

PDCCH-ServingCellConfig information element

--- ASN1START
--- TAG-PDCCH-SERVINGCELLCONFIG-START
PDCCH-ServingCellConfig ::= SEQUENCE {
  slotFormatIndicator SetRelease { SlotFormatIndicator } OPTIONAL, -- Need M
  ...[
    availabilityIndicator-r16 SetRelease {AvailabilityIndicator-r16} OPTIONAL, -- Need M
    searchSpaceSwitchTimer-r16 INTEGER (1..80) OPTIONAL, -- Need R
  ]
}
--- TAG-PDCCH-SERVINGCELLCONFIG-STOP
--- ASN1STOP
**PDCCH-ServingCellConfig** field descriptions

<table>
<thead>
<tr>
<th>availabilityIndicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use to configure monitoring a PDCCH for Availability Indicators (AI).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>searchSpaceSwitchTimer</th>
</tr>
</thead>
<tbody>
<tr>
<td>The value of the timer in slots for monitoring PDCCH in the active DL BWP of the serving cell before moving to the default search space group (see TS 38.213 [13], clause 10.4). For 15 kHz SCS, (1..20) are valid. For 30 kHz SCS, (1..40) are valid. For 60kHz SCS, (1..80) are valid. The network configures the same value for all serving cells in the same CellGroupForSwitch.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>slotFormatIndicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration of Slot-Format-Indicators to be monitored in the correspondingly configured PDCCHs of this serving cell.</td>
</tr>
</tbody>
</table>

---

**PDCP-Config**

The IE *PDCP-Config* is used to set the configurable PDCP parameters for signalling and data radio bearers.

**PDCP-Config information element**

```asn1
PDCP-Config ::= SEQUENCE {
  drb                     SEQUENCE {
    discardTimer            ENUMERATED {ms10, ms20, ms30, ms40, ms50, ms60, ms75, ms100, ms150, ms200,
                                   ms250, ms300, ms500, ms750, ms1500, infinity} OPTIONAL, -- Cond Setup
    pdcp-SN-SizeUL          ENUMERATED {len12bits, len18bits} OPTIONAL, -- Cond Setup2
    pdcp-SN-SizeDL          ENUMERATED {len12bits, len18bits} OPTIONAL, -- Cond Setup2
    headerCompression       CHOICE {
      notUsed                 NULL,
      rohc                    SEQUENCE {
        maxCID                  INTEGER (1..16383) DEFAULT 15,
        profiles               SEQUENCE {
          profile0x0001          BOOLEAN,  
          profile0x0002          BOOLEAN,  
          profile0x0003          BOOLEAN,  
          profile0x0004          BOOLEAN,  
          profile0x0006          BOOLEAN,  
          profile0x0101          BOOLEAN,  
          profile0x0102          BOOLEAN,  
          profile0x0103          BOOLEAN,  
          profile0x0104          BOOLEAN
        },
        drb-ContinueROHC        ENUMERATED { true } OPTIONAL -- Need N
      },
      uplinkOnlyROHC          SEQUENCE {
        maxCID                  INTEGER (1..16383) DEFAULT 15,
        profiles               SEQUENCE {
          profile0x0006          BOOLEAN
        },
        drb-ContinueROHC        ENUMERATED { true } OPTIONAL -- Need N
      }
    }
  }
```

---

ETSi
...,
}
}
integrityProtection ENUMERATED { enabled }
statusReportRequired ENUMERATED { true }
outOfOrderDelivery ENUMERATED { true }
}
moreThanOneRLC SEQUENCE {
primaryPath SEQUENCE {
cellGroup CellGroupId
logicalChannel LogicalChannelIdentity
},
ul-DataSplitThreshold UL-DataSplitThreshold
pdcp-Duplication BOOLEAN
}

t-Reordering ENUMERATED {
ms0, ms1, ms2, ms4, ms5, ms8, ms10, ms15, ms20, ms30, ms40,
ms50, ms60, ms80, ms100, ms120, ms140, ms160, ms180, ms200, ms220,
ms240, ms260, ms280, ms300, ms500, ms750, ms1000, ms1250,
ms1500, ms1750, ms2000, ms2250, ms2500, ms2750,
ms3000, spare28, spare27, spare26, spare25, spare24,
spare23, spare22, spare21, spare20, spare19, spare18, spare17, spare16, spare15, spare14,
spare13, spare12, spare11, spare10, spare09,
spare08, spare07, spare06, spare05, spare04, spare03,
spare02, spare01 }
}

cipheringDisabled ENUMERATED {true}
}
}

discardTimerExt-r16 SetupRelease { DiscardTimerExt-r16 }
}
}
moreThanTwoRLC-DRB-r16 SEQUENCE {
splitSecondaryPath-r16 LogicalChannelIdentity
duplicationState-r16 SEQUENCE (SIZE (3)) OF BOOLEAN
}
ethernetHeaderCompression-r16 SetupRelease { EthernetHeaderCompression-r16 }
})

EthernetHeaderCompression-r16 ::= SEQUENCE {
ehc-Common-r16 SEQUENCE {
ehc-CID-Length-r16 ENUMERATED { bits7, bits15 },
},
ehc-Downlink-r16 SEQUENCE {
    drb-ContinueEHC-DL-r16 ENUMERATED { true }
},
ehc-Uplink-r16 SEQUENCE {
    maxCID-EHC-UL-r16 INTEGER (1..32767),
    drb-ContinueEHC-UL-r16 ENUMERATED { true }
},

t-Reordering ENUMERATED {
ms0, ms1, ms2, ms4, ms5, ms8, ms10, ms15, ms20, ms30, ms40,
ms50, ms60, ms80, ms100, ms120, ms140, ms160, ms180, ms200, ms220,
ms240, ms260, ms280, ms300, ms500, ms750, ms1000, ms1250,
ms1500, ms1750, ms2000, ms2250, ms2500, ms2750,
ms3000, spare28, spare27, spare26, spare25, spare24,
spare23, spare22, spare21, spare20, spare19, spare18, spare17, spare16, spare15, spare14,
spare13, spare12, spare11, spare10, spare09,
spare08, spare07, spare06, spare05, spare04, spare03,
spare02, spare01 }
}
UL-DataSplitThreshold ::= ENumerated {
  b0, b100, b200, b400, b800, b1600, b3200, b6400, b12800, b25600, b51200, b102400, b204800,
  b409600, b819200, b1638400, b3276800, b6553600, b13107200, b26214400, b52428800, b104857600,
  b209715200, b419430400, b838860800, b1677721600, b3355443200, b6710886400, b13421772800,
  infinity, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1}

DiscardTimerExt-r16 ::= ENumerated (ms0dot5, ms1, ms2, ms4, ms6, ms8, spare2, spare1)

-- TAG-PDCP-CONFIG-STOP
-- ASN1STOP
### PDCP-Config field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ciphersingDisabled</strong></td>
<td>If included, ciphering is disabled for this DRB regardless of which ciphering algorithm is configured for the SRB/DRBs. The field may only be included if the UE is connected to 5GC. Otherwise the field is absent. The network configures all DRBs with the same PDU-session ID with same value for this field. The value for this field cannot be changed after the DRB is set up.</td>
</tr>
<tr>
<td><strong>discardTimer</strong></td>
<td>Value in ms of discardTimer specified in TS 38.323 [5]. Value ms10 corresponds to 10 ms, value ms20 corresponds to 20 ms and so on. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearer.</td>
</tr>
<tr>
<td><strong>discardTimerExt</strong></td>
<td>Value in ms of discardTimer specified in TS 38.323 [5]. Value ms01 corresponds to 0.5 ms, value ms1 corresponds to 1 ms and so on. If this field is present, the field discardTimer is ignored and discardTimerExt is used instead.</td>
</tr>
<tr>
<td><strong>drb-ContinueROHC</strong></td>
<td>Indicates whether the PDCP entity continues or resets the ROHC header compression protocol during PDCP re-establishment, as specified in TS 38.323 [5]. This field is configured only in case of resuming an RRC connection or reconfiguration with sync, where the PDCP termination point is not changed and the fullConfig is not indicated. The network does not include the field if the bearer is configured as DAPS bearer.</td>
</tr>
<tr>
<td><strong>duplicationState</strong></td>
<td>This field indicates the uplink PDCP duplication state for the associated RLC entities at the time of receiving this IE. If set to true, the PDCP duplication state is activated for the associated RLC entity. The index for the indication is determined by ascending order of logical channel ID of all RLC entities other than the primary RLC entity indicated by primaryPath in the order of MCG and SCG, as in clause 6.1.3.32 of TS 38.321 [3]. If the number of associated RLC entities other than the primary RLC entity is two, UE ignores the value in the largest index of this field. If the field is absent, the PDCP duplication states are deactivated for all associated RLC entities.</td>
</tr>
<tr>
<td><strong>ethernetHeaderCompression</strong></td>
<td>This field configures Ethernet Header Compression. This field can only be configured for a bi-directional DRB. The network reconfigures ethernetHeaderCompression only upon reconfiguration involving PDCP re-establishment and with neither drb-ContinueEHC-DL nor drb-ContinueEHC-UL configured.</td>
</tr>
<tr>
<td><strong>headerCompression</strong></td>
<td>If rohc is configured, the UE shall apply the configured ROHC profile(s) in both uplink and downlink. If uplinkOnlyROHC is configured, the UE shall apply the configured ROHC profile(s) in uplink (there is no header compression in downlink). ROHC can be configured for any bearer type. ROHC and EHC can be both configured simultaneously for a DRB. The network reconfigures headerCompression only upon reconfiguration involving PDCP re-establishment, and without any drb-ContinueROHC. Network configures headerCompression to notUsed when outOfOrderDelivery is configured.</td>
</tr>
<tr>
<td><strong>integrityProtection</strong></td>
<td>Indicates whether or not integrity protection is configured for this radio bearer. The network configures all DRBs with the same PDU-session ID with same value for this field. The value for this field cannot be changed after the DRB is set up.</td>
</tr>
<tr>
<td><strong>maxCID</strong></td>
<td>Indicates the value of the MAX_CID parameter as specified in TS 38.323 [5]. The total value of MAX_CIDs across all bearers for the UE should be less than or equal to the value of maxNumberROHC-ContextSessions parameter as indicated by the UE.</td>
</tr>
<tr>
<td><strong>moreThanOneRLC</strong></td>
<td>This field configures UL data transmission when more than one RLC entity is associated with the PDCP entity. This field is not present if the bearer is configured as DAPS bearer.</td>
</tr>
<tr>
<td><strong>moreThanTwoRLC-DRB</strong></td>
<td>This field configures UL data transmission when more than two RLC entities are associated with the PDCP entity for DRBs.</td>
</tr>
<tr>
<td><strong>outOfOrderDelivery</strong></td>
<td>Indicates whether or not outOfOrderDelivery specified in TS 38.323 [5] is configured. This field should be either always present or always absent, after the radio bearer is established.</td>
</tr>
</tbody>
</table>
### PDCP-Config field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pdcp-Duplication</strong></td>
<td>Indicates whether or not uplink duplication status at the time of receiving this IE is configured and activated as specified in TS 38.323 [5]. The presence of this field indicates that duplication is configured. PDCP duplication is not configured for CA packet duplication of LTE RLC bearer. The value of this field, when the field is present, indicates the state of the duplication at the time of receiving this IE. If set to true, duplication is activated. The value of this field is always true, when configured for a SRB. For PDCP entity with more than two associated RLC entities for UL transmission, this field is always present. If the field moreThanTwoRLC-DRB is present, the value of this field is ignored and the state of the duplication is indicated by duplicationState. For PDCP entity with more than two associated RLC entities, only NR RLC bearer is supported.</td>
</tr>
<tr>
<td><strong>pdcp-SN-SizeDL</strong></td>
<td>PDCP sequence number size for downlink, 12 or 18 bits, as specified in TS 38.323 [5]. For SRBs only the value len12bits is applicable. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearer.</td>
</tr>
<tr>
<td><strong>pdcp-SN-SizeUL</strong></td>
<td>PDCP sequence number size for uplink, 12 or 18 bits, as specified in TS 38.323 [5]. For SRBs only the value len12bits is applicable. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearer.</td>
</tr>
<tr>
<td><strong>primaryPath</strong></td>
<td>Indicates the cell group ID and LCID of the primary RLC entity as specified in TS 38.323 [5], clause 5.2.1 for UL data transmission when more than one RLC entity is associated with the PDCP entity. In this version of the specification, only cell group ID corresponding to MCG is supported for SRBs. The NW indicates cellGroup for split bearers using logical channels in different cell groups. The NW always indicates logicalChannel if CA based PDCP duplication is configured in the cell group indicated by cellGroup of this field.</td>
</tr>
<tr>
<td><strong>splitSecondaryPath</strong></td>
<td>Indicates the LCID of the split secondary RLC entity as specified in TS 38.323 [5] for fallback to split bearer operation when UL data transmission with more than two RLC entities is associated with the PDCP entity. This RLC entity belongs to a cell group that is different from the cell group indicated by cellGroup in the field primaryPath.</td>
</tr>
<tr>
<td><strong>statusReportRequired</strong></td>
<td>For AM DRBs and DAPS UM DRBs, indicates whether the DRB is configured to send a PDCP status report in the uplink, as specified in TS 38.323 [5]. For DAPS AM DRBs, it also indicates whether the DRB is configured to send a second PDCP status report in the uplink, as specified in TS 38.323 [5].</td>
</tr>
<tr>
<td><strong>t-Reordering</strong></td>
<td>Value in ms of t-Reordering specified in TS 38.323 [5]. Value ms0 corresponds to 0 ms, value ms20 corresponds to 20 ms, value ms40 corresponds to 40 ms, and so on. When the field is absent the UE applies the value infinity. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearer.</td>
</tr>
<tr>
<td><strong>ul-DataSplitThreshold</strong></td>
<td>Parameter specified in TS 38.323 [5]. Value b0 corresponds to 0 bytes, value b100 corresponds to 100 bytes, value b200 corresponds to 200 bytes, and so on. The network sets this field to infinity for UEs not supporting splitDRB-withUL-Both-MCG-SCG. If the field is absent when the split bearer is configured for the radio bearer first time, then the default value infinity is applied.</td>
</tr>
</tbody>
</table>
## EthernetHeaderCompression field descriptions

**drb-ContinueEHC-DL**
Indicates whether the PDCP entity continues or resets the downlink EHC header compression protocol during PDCP re-establishment, as specified in TS 38.323 [5]. The field is configured only in case of resuming an RRC connection or reconfiguration with sync, where the PDCP termination point is not changed and the `fullConfig` is not indicated.

**drb-ContinueEHC-UL**
Indicates whether the PDCP entity continues or resets the uplink EHC header compression protocol during PDCP re-establishment, as specified in TS 38.323 [5]. The field is configured only in case of resuming an RRC connection or reconfiguration with sync, where the PDCP termination point is not changed and the `fullConfig` is not indicated.

**ehc-CID-Length**
Indicates the length of the CID field for EHC packet. The value `bits7` indicates the length is 7 bits, and the value `bits15` indicates the length is 15 bits. Once the field `ethernetHeaderCompression-r16` is configured for a DRB, the value of the field `ehc-CID-Length` for this DRB is not reconfigured to a different value.

**ehc-Common**
Indicates the configurations that apply for both downlink and uplink.

**ehc-Downlink**
Indicates the configurations that apply for only downlink. If the field is configured, then Ethernet header compression is configured for downlink. Otherwise, it is not configured for downlink.

**ehc-Uplink**
Indicates the configurations that apply for only uplink. If the field is configured, then Ethernet header compression is configured for uplink. Otherwise, it is not configured for uplink.

**maxCID-EHC-UL**
Indicates the value of the MAX_CID_EHC_UL parameter as specified in TS 38.323 [5]. The total value of MAX_CID_EHC_UL across all bearers for the UE should be less than or equal to the value of `maxNumberEHC-Contexts` parameter as indicated by the UE.
### Conditional presence

| DRB | This field is mandatory present when the corresponding DRB is being set up, absent for SRBs. Otherwise this field is optionally present, need M. |
| DRB2 | This field is optionally present in case of DRB, need M. Otherwise, it is absent for SRBs. |
| MoreThanOneRLC | This field is mandatory present upon RRC reconfiguration with setup of a PDCP entity for a radio bearer with more than one associated logical channel and upon RRC reconfiguration with the association of additional logical channels to the PDCP entity. The field is also mandatory present in case the field MoreThanTwoRLC-DRB is included in PDCP-Config. Upon RRC reconfiguration when a PDCP entity is associated with multiple logical channels, this field is optionally present need M. Otherwise, this field is absent. Need R. |
| MoreThanTwoRLC-DRB | For SRBs, this field is absent. For DRBs, this field is mandatory present upon RRC reconfiguration with setup of a PDCP entity for a radio bearer with more than two associated logical channels and upon RRC reconfiguration with the association of one or more additional logical channel(s) to the PDCP entity so that the PDCP entity has more than two associated logical channels. Upon RRC reconfiguration when a PDCP entity is associated with more than two logical channels, this field is optionally present, Need M. Otherwise, the field is absent, Need R. |
| Rlc-AM-UM | For RLC UM (if the UE supports DAPS handover) or RLC AM, the field is optionally present, need R. Otherwise, the field is absent. |
| Setup | The field is mandatory present in case of radio bearer setup. Otherwise the field is optionally present, need M. |
| SplitBearer | The field is absent for SRBs. Otherwise, the field is optional present, need M, in case of radio bearer with more than one associated RLC mapped to different cell groups. |
| SplitBearer2 | The field is mandatory present, in case of a split bearer. Otherwise the field is absent. |
| ConnectedTo5GC | The field is optionally present, need R, if the UE is connected to 5GC. Otherwise the field is absent. |
| ConnectedTo5GC1 | The field is optionally present, need R, if the UE is connected to NR/5GC. Otherwise the field is absent. |
| Setup2 | This field is mandatory present in case for radio bearer setup for RLC-AM and RLC-UM. Otherwise, this field is absent, Need M. |

---

**PDSCH-Config**

The *PDSCH-Config* IE is used to configure the UE specific PDSCH parameters.

**PDSCH-Config** information element

```asn1
PDSCH-Config ::= SEQUENCE {
    dataScramblingIdentityPDSCH               INTEGER (0..1023) OPTIONAL, -- Need S
    dmrs-DownlinkForPDSCH-MappingTypeA       SetupRelease { DMRS-DownlinkConfig } OPTIONAL, -- Need M
    dmrs-DownlinkForPDSCH-MappingTypeB       SetupRelease { DMRS-DownlinkConfig } OPTIONAL, -- Need M
    tci-StatesToAddModList                   SEQUENCE (SIZE(1..maxNrofTCI-States)) OF TCI-State OPTIONAL, -- Need N
    tci-StatesToReleaseList                  SEQUENCE (SIZE(1..maxNrofTCI-States)) OF TCI-StateId OPTIONAL, -- Need N
    vrb-ToPRB-Interleaver                    ENUMERATED {n2, n4} OPTIONAL, -- Need S
    resourceAllocation                       ENUMERATED {resourceAllocationType0, resourceAllocationType1, dynamicSwitch}, OPTIONAL, -- Need S
    pdsch-TimeDomainAllocationList           SetupRelease { PDSCH-TimeDomainResourceAllocationList } OPTIONAL, -- Need N
    pdsch-AggregationFactor                  ENUMERATED { n2, n4, n8 } OPTIONAL, -- Need S
    rateMatchPatternToAddModList             SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPattern OPTIONAL, -- Need N
    rateMatchPatternToReleaseList            SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPatternId OPTIONAL, -- Need N
    rateMatchPatternGroup1                   RateMatchPatternGroup OPTIONAL, -- Need R
}
```

---

**Explanation**

ETSI
rateMatchPatternGroup2  RateMatchPatternGroup  OPTIONAL, -- Need R

rbg-Size  ENUMERATED {config1, config2},
mcs-Table  ENUMERATED {qam256, qam64LowSE}
maxNrofCodeWordsScheduledByDCI  ENUMERATED {n1, n2}

prb-BundlingType  CHOICE {
  staticBundling  SEQUENCE {
    bundleSize  ENUMERATED {n4, wideband }
  },
  dynamicBundling  SEQUENCE {
    bundleSizeSet1  ENUMERATED {n4, wideband, n2-wideband, n4-wideband }
    bundleSizeSet2  ENUMERATED {n4, wideband }
  }
},

zp-CSI-RS-ResourceToAddModList  SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-Resources)) OF ZP-CSI-RS-Resource
zp-CSI-RS-ResourceToReleaseList  SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-Resources)) OF ZP-CSI-RS-ResourceId

aperiodic-ZP-CSI-RS-ResourceSetsToAddModList  SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceSet
aperiodic-ZP-CSI-RS-ResourceSetsToReleaseList  SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceId

sp-ZP-CSI-RS-ResourceSetsToAddModList  SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceSet
sp-ZP-CSI-RS-ResourceSetsToReleaseList  SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceId

p-ZP-CSI-RS-ResourceSet  SetupRelease { ZP-CSI-RS-ResourceSet }
minMIMO-Layers-r16  SetupRelease { MaxMIMO-LayersDL-r16 }
minimumSchedulingOffsetK0-r16  SetupRelease { MinSchedulingOffsetK0-Values-r16 }

dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2-r16  SetupRelease { DMRS-DownlinkConfig }
dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2-r16  SetupRelease { DMRS-DownlinkConfig }
dmrs-SequenceInitializationDCI-1-2-r16  ENUMERATED {enabled}
harq-ProcessNumberSizeDCI-1-2-r16  INTEGER (0..4)
mcs-TableDCI-1-2-r16  ENUMERATED {qam256, qam64LowSE}
numberOfBitsForRV-DCI-1-2-r16  INTEGER (0..2)
pdsch-TimeDomainAllocationListDCI-1-2-r16  SetupRelease { PDSCH-TimeDomainResourceAllocationList-r16 }

prb-BundlingTypeDCI-1-2-r16  CHOICE {
  staticBundling-r16  SEQUENCE {
    bundleSize-r16  ENUMERATED {n4, wideband }
  },
  dynamicBundling-r16  SEQUENCE {
    bundleSizeSet1-r16  ENUMERATED {n4, wideband, n2-wideband, n4-wideband }
  }
}
bundleSizeSet2-r16 ENUMERATED { n4, wideband } OPTIONAL -- Need S

priorityIndicatorDCI-1-2-r16 ENUMERATED {enabled} OPTIONAL, -- Need R
rateMatchPatternGroupDCI-1-2-r16 RateMatchPatternGroup OPTIONAL, -- Need R
rateMatchPatternGroup2DCI-1-2-r16 RateMatchPatternGroup OPTIONAL, -- Need R
resourceAllocationType1GranularityDCI-1-2-r16 ENUMERATED {n2, n4, n8, n16} OPTIONAL, -- Need R
vrb-ToPRB-InterleaverDCI-1-2-r16 ENUMERATED {n2, n4} OPTIONAL, -- Need S
referenceOfSLIVDCI-1-2-r16 ENUMERATED {enabled} OPTIONAL, -- Need S
resourceAllocationDCI-1-2-r16 ENUMERATED {resourceAllocationType0, resourceAllocationType1, dynamicSwitch} OPTIONAL, -- Need S

-- End of the parameters for DCI format 1_2 introduced in V16.1.0

priorityIndicatorDCI-1-1-r16 ENUMERATED {enabled} OPTIONAL, -- Need S
dataScramblingIdentityPDSCH2-r16 INTEGER (0..1023) OPTIONAL, -- Need R
pdsch-TimeDomainAllocationList-r16 SetupRelease { PDSCH-TimeDomainResourceAllocationList-r16 } OPTIONAL, -- Need M
repetitionSchemeConfig-r16 SetupRelease { RepetitionSchemeConfig-r16} OPTIONAL -- Need M
repetitionSchemeConfig-v1630 SetupRelease { RepetitionSchemeConfig-v1630} OPTIONAL -- Need M

RateMatchPatternGroup ::= SEQUENCE (SIZE (1..maxNrofRateMatchPatternsPerGroup)) OF CHOICE {
  cellLevel RateMatchPatternId,
  bwpLevel RateMatchPatternId
}

MinSchedulingOffsetK0-Values-r16 ::= SEQUENCE (SIZE (1..maxNrOfMinSchedulingOffsetValues-r16)) OF INTEGER (0..maxK0-SchedulingOffset-r16)

MaxMIMO-LayersDL-r16 ::= INTEGER (1..8)

-- TAG-PDSCH-CONFIG-STOP
-- ASN1STOP
### PDSCH-Config field descriptions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>antennaPortsFieldPresenceDCI-1-2</strong></td>
<td>Configure the presence of &quot;Antenna ports&quot; field in DCI format 1_2. When the field is configured, then the &quot;Antenna ports&quot; field is present in DCI format 1_2. Otherwise, the field size is set to 0 for DCI format 1_2 (see TS 38.212 [17], clause 7.3.1.1.3). If neither dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2 nor dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 is configured, this field is absent.</td>
</tr>
<tr>
<td><strong>aperiodic-ZP-CSI-RS-ResourceSetsToAddModList, aperiodic-ZP-CSI-RS-ResourceSetsToAddModListDCI-1-2</strong></td>
<td>AddMod/Release lists for configuring aperiodically triggered zero-power CSI-RS resource sets. Each set contains a ZP-CSI-RS-ResourceSetId and the IDs of one or more ZP-CSI-RS-Resources (the actual resources are defined in the zp-CSI-RS-ResourceSetToAddMod). The network configures the UE with at most 3 aperiodic ZP-CSI-RS-ResourceSets and it uses only the ZP-CSI-RS-ResourceSetId 1 to 3. The network triggers a set by indicating its ZP-CSI-RS-ResourceSetId in the DCI payload. The DCI codepoint '01' triggers the resource set with ZP-CSI-RS-ResourceSetId 1, the DCI codepoint '10' triggers the resource set with ZP-CSI-RS-ResourceSetId 2, and the DCI codepoint '11' triggers the resource set with ZP-CSI-RS-ResourceSetId 3 (see TS 38.214 [19], clause 5.1.4.2). The field aperiodic-ZP-CSI-RS-ResourceSetsToAddModListDCI-1-2 applies to DCI format 1_1 and the field aperiodic-ZP-CSI-RS-ResourceSetsToAddModListDCI-1-2 applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.4.2 and TS 38.212 [17], clause 7.3.1).</td>
</tr>
<tr>
<td><strong>dataScramblingIdentityPDSCH, dataScramblingIdentityPDSCH2</strong></td>
<td>Identifier(s) used to initialize data scrambling (c_init) for PDSCH as specified in TS 38.211 [16], clause 7.3.1.1. The dataScramblingIdentityPDSCH2 is configured if coresetPoolIndex is configured with 1 for at least one CORESET in the same BWP.</td>
</tr>
<tr>
<td><strong>dmrs-DownlinkForPDSCH-MappingTypeA, dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2</strong></td>
<td>DMRS configuration for PDSCH transmissions using PDSCH mapping type A (chosen dynamically via PDSCH-TimeDomainResourceAllocation). Only the fields dmrs-Type, dmrs-AdditionalPosition and maxLength may be set differently for mapping type A and B. The field dmrs-DownlinkForPDSCH-MappingTypeA applies to DCI format 1_1 and the field dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2 applies to DCI format 1_2 (see TS 38.212 [17], clause 7.3.1).</td>
</tr>
<tr>
<td><strong>dmrs-DownlinkForPDSCH-MappingTypeB, dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2</strong></td>
<td>DMRS configuration for PDSCH transmissions using PDSCH mapping type B (chosen dynamically via PDSCH-TimeDomainResourceAllocation). Only the fields dmrs-Type, dmrs-AdditionalPosition and maxLength may be set differently for mapping type A and B. The field dmrs-DownlinkForPDSCH-MappingTypeB applies to DCI format 1_1 and the field dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 applies to DCI format 1_2 (see TS 38.212 [17], clause 7.3.1).</td>
</tr>
<tr>
<td><strong>dmrs-SequenceInitializationDCI-1_2</strong></td>
<td>Configure whether the field &quot;DMRS Sequence Initialization&quot; is present or not in DCI format 1_2. If the field is absent, then the UE applies the value of 0 bit for the field &quot;DMRS Sequence Initialization&quot; in DCI format 1_2. If the field is present, then the UE applies the value of 1 bit as in DCI format 1_2 (see TS 38.212 [17], clause 7.3.1).</td>
</tr>
<tr>
<td><strong>harq-ProcessNumberSizeDCI-1-2</strong></td>
<td>Configure the number of bits for the field &quot;HARQ process number&quot; in DCI format 1_2 (see TS 38.212 [17], clause 7.3.1).</td>
</tr>
<tr>
<td><strong>maxMIMO-Layers</strong></td>
<td>Indicates the maximum number of MIMO layers to be used for PDSCH in this DL BWP. If not configured, the UE uses the maxMIMO-Layers configuration in IE PDSCH-ServingCellConfig of the serving cell to which this BWP belongs, when the UE operates in this BWP. The value of maxMIMO-Layers for a DL BWP shall be smaller than or equal to the value of maxMIMO-Layers configured in IE PDSCH-ServingCellConfig of the serving cell to which this BWP belongs.</td>
</tr>
<tr>
<td><strong>maxNrofCodeWordsScheduledByDCI</strong></td>
<td>Maximum number of code words that a single DCI may schedule. This changes the number of MCS/RV/NDI bits in the DCI message from 1 to 2.</td>
</tr>
<tr>
<td><strong>mcs-Table, mcs-TableDCI-1-2</strong></td>
<td>Indicates which MCS table the UE shall use for PDSCH. (see TS 38.214 [19], clause 5.1.3.1). If the field is absent the UE applies the value 64QAM. The field mcs-Table applies to DCI format 1_0 and DCI format 1_1, and the field mcs-TableDCI-1-2 applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.3.1).</td>
</tr>
<tr>
<td><strong>minimumSchedulingOffsetK0</strong></td>
<td>List of minimum K0 values. Minimum K0 parameter denotes minimum applicable value(s) for the TDRA table for PDSCH and for A-CSI RS triggering Offset(s) (see TS 38.214 [19], clause 5.3.1).</td>
</tr>
<tr>
<td><strong>numberOfBitsForRV-DCI-1-2</strong></td>
<td>Configures the number of bits for &quot;Redundancy version&quot; in the DCI format 1_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.214 [19], clause 5.1.2.1).</td>
</tr>
<tr>
<td><strong>pdsch-AggregationFactor</strong></td>
<td>Number of repetitions for data (see TS 38.214 [19], clause 5.1.2.1). When the field is absent the UE applies the value 1.</td>
</tr>
</tbody>
</table>
The field `pdsch-TimeDomainAllocationList` (with or without suffix) applies to DCI format 1_0 and DCI format 1_1 (see table 5.1.2.1.1-1 in TS 38.214 [19]), and if the field `pdsch-TimeDomainAllocationListDCI-1-2` is not configured, to DCI format 1_2. If the field `pdsch-TimeDomainAllocationListDCI-1-2` is configured, it applies to DCI format 1_2 (see table 5.1.2.1.1-1A in TS 38.214 [19]). The network does not configure the `pdsch-TimeDomainAllocationList-r16` simultaneously with the `pdsch-TimeDomainAllocationList` (without suffix) in the same `PDSCH-Config`.

- **prb-BundlingType, prb-BundlingTypeDCI-1-2**
  Indicates the PRB bundle type and bundle size(s) (see TS 38.214 [19], clause 5.1.2.3). If dynamic is chosen, the actual `bundleSizeSet1` or `bundleSizeSet2` to use is indicated via DCI. Constraints on `bundleSizeSet` setting depending on `vrToPRB-Interleaver` and `rbg-Size` settings are described in TS 38.214 [19], clause 5.1.2.3. If a `bundleSizeSet` value is absent, the UE applies the value n2. The field `prb-BundlingType` applies to DCI format 1_1, and the field `prb-BundlingTypeDCI-1-2` applies to DCI format 1_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.214 [19], clause 5.1.2.3).

- **priorityIndicatorDCI-1-1, priorityIndicatorDCI-1-2**
  Configure the presence of “priority indicator” in DCI format 1_1/1_2. When the field is absent in the IE, then 0 bit for “priority indicator” in DCI format 1_1/1_2. The field `priorityIndicatorDCI-1-1` applies to DCI format 1_1 and the field `priorityIndicatorDCI-1-2` applies to DCI format 1_2, respectively (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13] clause 9).

- **p-ZP-CSI-RS-ResourceSet**
  A set of periodically occurring ZP-CSI-RS-Resources (the actual resources are defined in the `zp-CSI-RS-ResourceToAddModList`). The network uses the ZP-CSI-RS-ResourceSetId=0 for this set.

- **rateMatchPatternGroup1, rateMatchPatternGroup1DCI-1-2**
  The IDs of a first group of RateMatchPatterns defined in `PDSCH-Config->rateMatchPatternToAddModList` (BWP level) or in `ServingCellConfig->rateMatchPatternToAddModList` (cell level). These patterns can be activated dynamically by DCI (see TS 38.214 [19], clause 5.1.4.1). The field `rateMatchPatternGroup1` applies to DCI format 1_1, and the field `rateMatchPatternGroup1DCI-1-2` applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.4.1).

- **rateMatchPatternGroup2, rateMatchPatternGroup2DCI-1-2**
  The IDs of a second group of RateMatchPatterns defined in `PDSCH-Config->rateMatchPatternToAddModList` (BWP level) or in `ServingCellConfig->rateMatchPatternToAddModList` (cell level). These patterns can be activated dynamically by DCI (see TS 38.214 [19], clause 5.1.4.1). The field `rateMatchPatternGroup2` applies to DCI format 1_1, and the field `rateMatchPatternGroup2DCI-1-2` applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.4.1).

- **rbg-Size**
  Selection between config 1 and config 2 for RBG size for PDSCH. The UE ignores this field if `resourceAllocation` is set to `resourceAllocationType1GranularityDCI-1-2`.

- **repetitionSchemeConfig**
  Configure the UE with repetition schemes. The network does not configure `repetitionSchemeConfig-r16` and `repetitionSchemeConfig-v1630` simultaneously to `setup` in the same `PDSCH-Config`.

- **resourceAllocation, resourceAllocationDCI-1-2**
  Configuration of resource allocation type 0 and resource allocation type 1 for non-fallback DCI (see TS 38.214 [19], clause 5.1.2.2). The field `resourceAllocation` applies to DCI format 1_1, and the field `resourceAllocationDCI-1-2` applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.2.2).

- **resourceAllocationType1GranularityDCI-1-2**
  Configure the scheduling granularity applicable for both the starting point and length indication for resource allocation type 1 in DCI format 1_2. If this field is absent, the granularity is 1 PRB (see TS 38.214 [19], clause 5.1.2.2).
AddMod/Release lists for configuring semi-persistent zero-power CSI-RS resource sets. Each set contains a ZP-CSI-RS-ResourceSetId and the IDs of one or more ZP-CSI-RS-Resources (the actual resources are defined in the zp-CSI-RS-ResourceToAddModList) (see TS 38.214 [19], clause 5.1.4.2).

A list of Transmission Configuration Indicator (TCI) states indicating a transmission configuration which includes QCL-relationships between the DL RSs in one RS set and the PDSCH DMRS ports (see TS 38.214 [19], clause 5.1.5).

Interleaving unit configurable between 2 and 4 PRBs (see TS 38.211 [16], clause 7.3.1.6). When the field is absent, the UE performs non-interleaved VRB-to-PRB mapping. The field vrb-ToPRB-Interleaver applies to DCI format 1_1, and the field vrb-ToPRB-InterleaverDCI-1-2 applies to DCI format 1_2 (see TS 38.211 [16], clause 7.3.1.6).

A list of Zero-Power (ZP) CSI-RS resources used for PDSCH rate-matching. Each resource in this list may be referred to from only one type of resource set, i.e., aperiodic, semi-persistent or periodic (see TS 38.214 [19]).

### PDSCH-ConfigCommon

The IE **PDSCH-ConfigCommon** is used to configure cell specific PDSCH parameters.

**PDSCH-ConfigCommon** information element

```asn1
PDSCH-ConfigCommon ::= SEQUENCE {
    pdsch-TimeDomainAllocationList                  PDSCH-TimeDomainResourceAllocationList          OPTIONAL, -- Need R
    ... }
```

**PDSCH-ConfigCommon** field descriptions

**pdsch-TimeDomainAllocationList**

List of time-domain configurations for timing of DL assignment to DL data (see table 5.1.2.1.1-1 in TS 38.214 [19]).

### PDSCH-ServingCellConfig

The IE **PDSCH-ServingCellConfig** is used to configure UE specific PDSCH parameters that are common across the UE’s BWPs of one serving cell.

**PDSCH-ServingCellConfig** information element

```asn1
PDSCH-ServingCellConfig ::= SEQUENCE {
```
3GPP TS 38.331 version 16.3.1 Release 16

ETSI TS 138 331 V16.3.1 (2021-01)

502

<table>
<thead>
<tr>
<th>Field Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>codeBlockGroupFlushIndicator</td>
</tr>
<tr>
<td>Indicates whether CBGFI for CBG based (re)transmission in DL is enabled (true). (see TS 38.212 [17], clause 7.3.1.2.2).</td>
</tr>
<tr>
<td>maxCodeBlockGroupsPerTransportBlock</td>
</tr>
<tr>
<td>Maximum number of code-block-groups (CBGs) per TB. In case of multiple CW, the maximum CBG is 4 (see TS 38.213 [13], clause 9.1.1).</td>
</tr>
</tbody>
</table>
### PDSCH-ServingCellConfig field descriptions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>codeBlockGroupTransmission</strong></td>
<td>Enables and configures code-block-group (CBG) based transmission (see TS 38.213 [13], clause 9.1.1). Network does not configure for a UE both spatial bundling of HARQ ACKs and codeBlockGroupTransmission within the same cell group.</td>
</tr>
<tr>
<td><strong>maxMIMO-Layers</strong></td>
<td>Indicates the maximum number of MIMO layers to be used for PDSCH in all BWPs of this serving cell. (see TS 38.212 [17], clause 5.4.2.1).</td>
</tr>
<tr>
<td><strong>nrofHARQ-ProcessesForPDSCH</strong></td>
<td>The number of HARQ processes to be used on the PDSCH of a serving cell. Value n2 corresponds to 2 HARQ processes, value n4 to 4 HARQ processes, and so on. If the field is absent, the UE uses 8 HARQ processes (see TS 38.214 [19], clause 5.1).</td>
</tr>
<tr>
<td><strong>pdsch-CodeBlockGroupTransmissionList</strong></td>
<td>A list of configurations for up to two simultaneously constructed HARQ-ACK codebooks (see TS 38.213 [13], clause 9.3).</td>
</tr>
<tr>
<td><strong>processingType2Enabled</strong></td>
<td>Enables configuration of advanced processing time capability 2 for PDSCH (see 38.214 [19], clause 5.3).</td>
</tr>
<tr>
<td><strong>pucch-Cell</strong></td>
<td>The ID of the serving cell (of the same cell group) to use for PUCCH. If the field is absent, the UE sends the HARQ feedback on the PUCCH of the SpCell of this cell group, or on this serving cell if it is a PUCCH SCell.</td>
</tr>
<tr>
<td><strong>xOverhead</strong></td>
<td>Accounts for overhead from CSI-RS, CORESET, etc. If the field is absent, the UE applies value xOh0 (see TS 38.214 [19], clause 5.1.3.2).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCellAddOnly</strong></td>
<td>It is optionally present. Need S, for (non-PUCCH) SCells when adding a new SCell. The field is absent, Need M, when reconfiguring SCells. The field is also absent for the SpCells as well as for a PUCCH SCell.</td>
</tr>
</tbody>
</table>

### PDSCH-TimeDomainResourceAllocationList

The IE **PDSCH-TimeDomainResourceAllocation** is used to configure a time domain relation between PDCCH and PDSCH. The **PDSCH-TimeDomainResourceAllocationList** contains one or more of such **PDSCH-TimeDomainResourceAllocation**. The network indicates in the DL assignment which of the configured time domain allocations the UE shall apply for that DL assignment. The UE determines the bit width of the DCI field based on the number of entries in the **PDSCH-TimeDomainResourceAllocationList**. Value 0 in the DCI field refers to the first element in this list, value 1 in the DCI field refers to the second element in this list, and so on.

**PDSCH-TimeDomainResourceAllocationList** information element

```asn1
PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation

PDSCH-TimeDomainResourceAllocation ::= SEQUENCE {
  k0                                      INTEGER(0..32)                                                  OPTIONAL, -- Need S
  mappingType                             ENUMERATED {typeA, typeB},
  startSymbolAndLength                    INTEGER (0..127)
}

PDSCH-TimeDomainResourceAllocationList-r16 ::= SEQUENCE (SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation-r16
```
PDSCH-TimeDomainResourceAllocation-r16 ::= SEQUENCE {
  k0-r16                                      INTEGER (0..32)                                             OPTIONAL,   -- Need S
  mappingType-r16                             ENUMERATED {typeA, typeB},                                      
  startSymbolAndLength-r16                   INTEGER (0..127),                                                
  repetitionNumber-r16                       ENUMERATED {n2, n3, n4, n5, n6, n7, n8, n16}                OPTIONAL,   -- Cond Formats1-0and1-1
  ...                                        
}

-- TAG-PDSCH-TIMEDOMAINRESOURCEALLOCATIONLIST-STOP

PDSCH-TimeDomainResourceAllocation field descriptions

<table>
<thead>
<tr>
<th>k0</th>
<th>Slot offset between DCI and its scheduled PDSCH (see TS 38.214 [19], clause 5.1.2.1) When the field is absent the UE applies the value 0.</th>
</tr>
</thead>
<tbody>
<tr>
<td>mappingType</td>
<td>PDSCH mapping type. (see TS 38.214 [19], clause 5.3).</td>
</tr>
<tr>
<td>repetitionNumber</td>
<td>Indicates the number of PDSCH transmission occasions for slot-based repetition scheme in IE RepetitionSchemeConfig. The parameter is used as specified in 38.214 [19].</td>
</tr>
<tr>
<td>startSymbolAndLength</td>
<td>An index giving valid combinations of start symbol and length (jointly encoded) as start and length indicator (SLIV). The network configures the field so that the allocation does not cross the slot boundary (see TS 38.214 [19], clause 5.1.2.1).</td>
</tr>
</tbody>
</table>

---

PHR-Config

The IE PHR-Config is used to configure parameters for power headroom reporting.

**PHR-Config information element**

---

PHR-Config ::= SEQUENCE {
  phr-PeriodicTimer               ENUMERATED {sf10, sf20, sf50, sf100, sf200, sf500, sf1000, infinity},
  phr-ProhibitTimer                ENUMERATED {sf0, sf10, sf20, sf50, sf100, sf200, sf500, sf1000},
  phr-Tx-PowerFactorChange         ENUMERATED {dB1, dB3, dB6, infinity},
  multiplePHR                     BOOLEAN,
  dummy                           BOOLEAN,
  phr-Type2OtherCell              BOOLEAN,
  phr-ModeOtherCG                 ENUMERATED {real, virtual},
  ...
}

---

**Conditional Presence**

<table>
<thead>
<tr>
<th>Formats1-0and1-1</th>
<th>In pdsch-TimeDomainResourceAllocationList-r16, this field is optionally present. Need R.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In pdsch-TimeDomainAllocationListDCI-1-2, this field is absent.</td>
</tr>
</tbody>
</table>

---

PHR-Config
**PHR-Config field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dummy</td>
<td>This field is not used in this version of the specification and the UE ignores the received value.</td>
</tr>
<tr>
<td>mpe-ProhibitTimer</td>
<td>Value in number of subframes for MPE reporting, as specified in TS 38.321 [3]. Value sf10 corresponds to 10 subframes, and so on.</td>
</tr>
<tr>
<td>mpe-Reporting-FR2</td>
<td>Indicates whether the UE shall report MPE P-MPR in the PHR MAC control element, as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td>mpe-Threshold</td>
<td>Value of the P-MPR threshold in dB for reporting MPE P-MPR when FR2 is configured, as specified in TS 38.321 [3]. The same value applies for each serving cell (although the associated functionality is performed independently for each cell).</td>
</tr>
<tr>
<td>multiplePHR</td>
<td>Indicates if power headroom shall be reported using the Single Entry PHR MAC control element or Multiple Entry PHR MAC control element defined in TS 38.321 [3]. True means to use Multiple Entry PHR MAC control element and False means to use the Single Entry PHR MAC control element defined in TS 38.321 [3]. The network configures this field to true for MR-DC and UL CA for NR, and to false in all other cases.</td>
</tr>
<tr>
<td>phr-ModeOtherCG</td>
<td>Indicates the mode (i.e. real or virtual) used for the PHR of the activated cells that are part of the other Cell Group (i.e. MCG or SCG), when DC is configured. If the UE is configured with only one cell group (no DC), it ignores the field.</td>
</tr>
<tr>
<td>phr-PeriodicTimer</td>
<td>Value in number of subframes for PHR reporting as specified in TS 38.321 [3]. Value sf10 corresponds to 10 subframes, value sf20 corresponds to 20 subframes, and so on.</td>
</tr>
<tr>
<td>phr-ProhibitTimer</td>
<td>Value in number of subframes for PHR reporting as specified in TS 38.321 [3]. Value sf0 corresponds to 0 subframe, value sf10 corresponds to 10 subframes, value sf20 corresponds to 20 subframes, and so on.</td>
</tr>
<tr>
<td>phr-Tx-PowerFactorChange</td>
<td>Value in dB for PHR reporting as specified in TS 38.321 [3]. Value dB1 corresponds to 1 dB, dB3 corresponds to 3 dB and so on. The same value applies for each serving cell (although the associated functionality is performed independently for each cell).</td>
</tr>
<tr>
<td>phr-Type2OtherCell</td>
<td>If set to true, the UE shall report a PHR type 2 for the SpCell of the other MAC entity. See TS 38.321 [3], clause 5.4.6. Network sets this field to false if the UE is not configured with an E-UTRA MAC entity.</td>
</tr>
</tbody>
</table>

---

**PhysCellId**

The `PhysCellId` identifies the physical cell identity (PCI).
**PhysCellId** information element

```asn1
PhysCellId ::= INTEGER {0..1007}
```

---

**PhysicalCellGroupConfig**

The IE **PhysicalCellGroupConfig** is used to configure cell-group specific L1 parameters.

```asn1
PhysicalCellGroupConfig ::= SEQUENCE {
  harq-ACK-SpatialBundlingPUCCH ENUMERATED {true} OPTIONAL, -- Need S
  harq-ACK-SpatialBundlingPUSCH ENUMERATED {true} OPTIONAL, -- Need S
  p-NR-FR1 P-Max OPTIONAL, -- Need R
  pdsch-HARQ-ACK-Codebook ENUMERATED {semiStatic, dynamic}, OPTIONAL, -- Need R
  tpc-SRS-RNTI RNTI-Value OPTIONAL, -- Need R
  tpc-PUSCH-RNTI RNTI-Value OPTIONAL, -- Need R
  sp-CSI-RNTI RNTI-Value OPTIONAL, -- Need R
  cs-RNTI SetupRelease { RNTI-Value } OPTIONAL, -- Need M
  ..., 
  mcs-C-RNTI RNTI-Value OPTIONAL, -- Need R
  p-UE-FR1 P-Max OPTIONAL -- Cond MCG-Only
  xScale ENUMERATED {dB0, dB6, spare2, spare1} OPTIONAL -- Cond SCG-Only
  pdcch-BlindDetection SetupRelease { PDCCH-BlindDetection } OPTIONAL -- Need M
  ..., 
  dcp-Config-r16 SetupRelease { DCP-Config-r16 } OPTIONAL, -- Need M
  harq-ACK-SpatialBundlingPUCCH-secondaryPUCCHgroup-r16 ENUMERATED {enabled, disabled} OPTIONAL, -- Cond twoPUCCHgroup
  harq-ACK-SpatialBundlingPUSCH-secondaryPUCCHgroup-r16 ENUMERATED {enabled, disabled} OPTIONAL, -- Cond twoPUCCHgroup
  pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16 ENUMERATED {semiStatic, dynamic} OPTIONAL, -- Cond twoPUCCHgroup
  p-NR-FR2-r16 P-Max OPTIONAL, -- Need R
  p-UE-FR2-r16 P-Max OPTIONAL, -- Cond MCG-Only
  nrdc-PCmode-FR1-r16 ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic} OPTIONAL, -- Cond MCG-Only
  nrdc-PCmode-FR2-r16 ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic} OPTIONAL, -- Cond MCG-Only
  pdsch-HARQ-ACK-Codebook-r16 ENUMERATED {enhancedDynamic} OPTIONAL, -- Need R
  nfi-TotalDAI-Included-r16 ENUMERATED {true} OPTIONAL, -- Need R
}"
```
ul-TotalDAI Included r16 ENUMERATED (true) OPTIONAL, -- Need R

pdcch-HARQ-ACK-OneShotFeedback r16 ENUMERATED (true) OPTIONAL, -- Need R

pdcch-HARQ-ACK-OneShotFeedbackNDI r16 ENUMERATED (true) OPTIONAL, -- Need R

pdcch-HARQ-ACK-OneShotFeedbackCBG r16 ENUMERATED (true) OPTIONAL, -- Need R

downlinkAssignmentIndexDCI 0-2 r16 ENUMERATED ( enabled ) OPTIONAL, -- Need S

downlinkAssignmentIndexDCI 1-2 r16 ENUMERATED ( n1, n2, n4 ) OPTIONAL, -- Need S

pdcch-HARQ-ACK-CodebookList r16 SetupRelease (PDCCH-HARQ-ACK-CodebookList r16) OPTIONAL, -- Need M

ackBackFeedbackMode r16 ENUMERATED ( joint, separate ) OPTIONAL, -- Need R

pdcch-BlindDetectionCA CombIndicator r16 SetupRelease ( PDCCH-BlindDetectionCA-CombIndicator r16 ) OPTIONAL, -- Need M

pdcch-BlindDetection2 r16 SetupRelease ( PDCCH-BlindDetection2 r16 ) OPTIONAL, -- Need M

pdcch-BlindDetection3 r16 SetupRelease ( PDCCH-BlindDetection3 r16 ) OPTIONAL, -- Need M

bdFactorR r16 ENUMERATED ( n1 ) OPTIONAL -- Need R

PDCCH-BlindDetection ::= INTEGER (1..15)

DCP-Config r16 ::= SEQUENCE {
    ps-RNTI r16 RNTI-Value,
    ps-Offset r16 INTEGER (1..120),
    sizeDCI 2-6 r16 INTEGER (1..maxDCI 2-6 Size r16),
    ps-PositionDCI 2-6 r16 INTEGER (0..maxDCI 2-6 Size 1 r16),
    ps-WakeUp r16 ENUMERATED (true) OPTIONAL, -- Need S
    ps-TransmitPeriodicL1-RSRP r16 ENUMERATED (true) OPTIONAL, -- Need S
    ps-TransmitOtherPeriodicCSI r16 ENUMERATED (true) OPTIONAL -- Need S
}

PDCCH-HARQ-ACK-CodebookList r16 ::= SEQUENCE (SIZE (1..2)) OF ENUMERATED {semiStatic, dynamic}

PDCCH-BlindDetectionCA-CombIndicator r16 ::= SEQUENCE {
    pdcch-BlindDetectionCA1 r16 INTEGER (1..15),
    pdcch-BlindDetectionCA2 r16 INTEGER (1..15)
}

PDCCH-BlindDetection2 r16 ::= INTEGER (1..15)

PDCCH-BlindDetection3 r16 ::= INTEGER (1..15)

-- TAG PHYSICALCELLGROUPCONFIG STOP
-- ASN1STOP
### PhysicalCellGroupConfig field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ackNackFeedbackMode</strong></td>
<td>Indicates which among the joint and separate ACK/NACK feedback modes to use within a slot as specified in TS 38.214 [19] (clause 9).</td>
</tr>
<tr>
<td><strong>bdFactorR</strong></td>
<td>Parameter for determining and distributing the maximum numbers of BD/CCE for mPDCCCH based mPDSCH transmission as specified in TS 38.213 [13] Clause 10.1.</td>
</tr>
<tr>
<td><strong>cs-RNTI</strong></td>
<td>RNTI value for downlink SPS (see SPS-Config) and uplink configured grant (see ConfiguredGrantConfig).</td>
</tr>
<tr>
<td><strong>downlinkAssignmentIndexDCI-0-2</strong></td>
<td>Indicates that “Downlink assignment index” is present or absent in DCI format 0_2. If the field “downlinkAssignmentIndexDCI-0-2” is absent, then 0 bit for “Downlink assignment index” in DCI format 0_2 is defined as the same as that in DCI format 0_1 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.1).</td>
</tr>
<tr>
<td><strong>downlinkAssignmentIndexDCI-1-2</strong></td>
<td>Configures the number of bits for “Downlink assignment index” in DCI format 1_2. If the field is absent, then 0 bit for “Downlink assignment index” in DCI format 1_2. Note that 1 bit and 2 bits are applied if only one serving cell is configured in the DL and the higher layer parameter pdsch-HARQ-ACK-Codebook=dynamic. 4 bits is applied if more than one serving cell are configured in the DL and the higher layer parameter pdsch-HARQ-ACK-Codebook is set to dynamic (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.1).</td>
</tr>
<tr>
<td><strong>harq-ACK-SpatialBundlingPUCCH</strong></td>
<td>Enables spatial bundling of HARQ ACKs. It is configured per cell group (i.e. for all the cells within the cell group) for PUCCH reporting of HARQ-ACK. It is only applicable when more than 4 layers are possible to schedule. When the field is absent, the spatial bundling of PUCCH HARQ ACKs for the primary PUCCH group is disabled (see TS 38.213 [13], clause 9.1.2.1). If the field harq-ACK-SpatialBundlingPUCCH-secondaryPUCCHgroup is present, harq-ACK-SpatialBundlingPUCCH is only applied to primary PUCCH group. Network does not configure for a UE both spatial bundling of HARQ ACKs and codeBlockGroupTransmission within the same cell group.</td>
</tr>
<tr>
<td><strong>harq-ACK-SpatialBundlingPUCCH-secondaryPUCCHgroup</strong></td>
<td>Indicates whether spatial bundling of PUCCH HARQ ACKs for the secondary PUCCH group is enabled or disabled. The field is only applicable when more than 4 layers are possible to schedule (see TS 38.213 [13], clause 9.1.2.1). When the field is absent, the use of spatial bundling of PUCCH HARQ ACKs for the secondary PUCCH group is indicated by harq-ACK-SpatialBundlingPUCCH. See TS 38.213 [13], clause 9.1.2.1. Network does not configure for a UE both spatial bundling of HARQ ACKs and codeBlockGroupTransmission within the same cell group.</td>
</tr>
<tr>
<td><strong>harq-ACK-SpatialBundlingPUSCH</strong></td>
<td>Enables spatial bundling of HARQ ACKs. It is configured per cell group (i.e. for all the cells within the cell group) for PUSCH reporting of HARQ-ACK. It is only applicable when more than 4 layers are possible to schedule. When the field is absent, the spatial bundling of PUSCH HARQ ACKs for the primary PUSCH group is disabled (see TS 38.213 [13], clauses 9.1.2.2 and 9.1.3.2). If the field harq-ACK-SpatialBundlingPUSCH-secondaryPUSCHgroup is present, harq-ACK-SpatialBundlingPUSCH is only applied to primary PUSCH group. Network does not configure for a UE both spatial bundling of HARQ ACKs and codeBlockGroupTransmission within the same cell group.</td>
</tr>
<tr>
<td><strong>harq-ACK-SpatialBundlingPUSCH-secondaryPUSCHgroup</strong></td>
<td>Indicates whether spatial bundling of PUSCH HARQ ACKs for the secondary PUSCH group is enabled or disabled. The field is only applicable when more than 4 layers are possible to schedule (see TS 38.213 [13], clauses 9.1.2.2 and 9.1.3.2). When the field is absent, the use of spatial bundling of PUSCH HARQ ACKs for the secondary PUSCH group is indicated by harq-ACK-SpatialBundlingPUSCH. See TS 38.213 [13], clauses 9.1.2.2 and 9.1.3.2. Network does not configure for a UE both spatial bundling of HARQ ACKs and codeBlockGroupTransmission within the same cell group.</td>
</tr>
<tr>
<td><strong>mcs-C-RNTI</strong></td>
<td>RNTI to indicate use of qam64LowSE for grant-based transmissions. When the mcs-C-RNTI is configured, RNTI scrambling of DCI CRC is used to choose the corresponding MCS table.</td>
</tr>
<tr>
<td><strong>nfi-TotalDAI-Included</strong></td>
<td>Indicates whether the NFI and total DAI fields of the non-scheduled PDSCH group is included in the non-fallback DL grant DCI (see TS 38.212 [17], clause 7.3.1). The network configures this only when enhanced dynamic codebook is configured (pdsch-HARQ-ACK-Codebook is set to enhancedDynamic).</td>
</tr>
<tr>
<td><strong>nrdc-PCmode-FR1</strong></td>
<td>Indicates the uplink power sharing mode that the UE uses in NR-DC in frequency range 1 (FR1) (see TS 38.213 [13], clause 7.6).</td>
</tr>
</tbody>
</table>
nrDC-PCmode-FR2
Indicates the uplink power sharing mode that the UE uses in NR-DC in frequency range 2 (FR2) (see TS 38.213 [13], clause 7.6).

pdcch-BlindDetection, pdcch-BlindDetection2, pdcch-BlindDetection3
Indicates the reference number of cells for PDCCH blind detection for the CG. Network configures the field for each CG when the UE is in NR DC and sets the value in accordance with the constraints specified in TS 38.213 [13]. The network configures pdcch-BlindDetection only if the UE is in NR-DC. The network configures pdcch-BlindDetection2 only if the UE is in NR-DC with at least one downlink cell using Rel-16 PDCCH monitoring capability. The network configures pdcch-BlindDetection3 only if the UE is in NR-DC with at least one downlink cell using Rel-15 PDCCH monitoring capability.

pdcch-BlindDetectionCA-Comblndicator
Configure one combination of pdcch-BlindDetectionCA1 (for R15) and pdcch-BlindDetectionCA2 (for R16) for UE to use for scaling PDCCCH monitoring capability if the number of serving cells configured to a UE is larger than the reported capability, and if UE reports more than one combination of pdcch-BlindDetectionCA1 and pdcch-BlindDetectionCA2 as UE capability. The combination of pdcch-BlindDetectionCA1 and pdcch-BlindDetectionCA2 configured by pdcch-BlindDetectionCAComblndicator is from the more than one combination of pdcch-BlindDetectionCA1 and pdcch-BlindDetectionCA2 reported by UE (see TS 38.213 [13], clause 10).

p-NR-FR1
The maximum total transmit power to be used by the UE in this NR cell group across all serving cells in frequency range 1 (FR1). The maximum transmit power that the UE may use may be additionally limited by $p_{\text{Max}}$ (configured in FrequencyInfoUL) and by $p_{\text{UE-FR1}}$ (configured total for all serving cells operating on FR1).

p-NR-FR2
The maximum total transmit power to be used by the UE in this NR cell group across all serving cells in frequency range 2 (FR2). The maximum transmit power that the UE may use may be additionally limited by $p_{\text{Max}}$ (configured in FrequencyInfoUL) and by $p_{\text{UE-FR2}}$ (configured total for all serving cells operating on FR2). This field is only used in NR-DC.

ps-RNTI
RNTI value for scrambling CRC of DCI format 2-6 used for power saving (see TS 38.213 [13], clause 10.1).

ps-Offset
The start of the search-time of DCI format 2-6 with CRC scrambled by PS-RNTI relative to the start of the $\text{drx-onDurationTimer}$ of Long DRX (see TS 38.213 [13], clause 10.3). Value in multiples of 0.125 ms (milliseconds). 1 corresponds to 0.125 ms, 2 corresponds to 0.25 ms, 3 corresponds to 0.375 ms and so on.

ps-WakeUp
Indicates the UE to wake-up if DCI format 2-6 is not detected outside active time (see TS 38.213 [13], clause 10.3). If the field is absent, the UE does not wake-up if DCI format 2-6 is not detected outside active time.

ps-PositionDCI-2-6
Starting position of UE wakeup and SCell dormancy indication in DCI format 2-6 (see TS 38.213 [13], clause 10.3).

ps-TransmitPeriodicL1-RSRP
Indicates the UE to transmit periodic L1-RSRP report(s) when the $\text{drx-onDurationTimer}$ does not start (see TS 38.321 [3], clause 5.7). If the field is absent, the UE does not transmit periodic L1-RSRP report(s) when the $\text{drx-onDurationTimer}$ does not start.

ps-TransmitOtherPeriodicCSI
Indicates the UE to transmit periodic CSI report(s) other than L1-RSRP reports when the $\text{drx-onDurationTimer}$ does not start (see TS 38.321 [3], clause 5.7). If the field is absent, the UE does not transmit periodic CSI report(s) other than L1-RSRP reports when the $\text{drx-onDurationTimer}$ does not start.

p-UE-FR1
The maximum total transmit power to be used by the UE across all serving cells in frequency range 1 (FR1) across all cell groups. The maximum transmit power that the UE may use may be additionally limited by $p_{\text{Max}}$ (configured in FrequencyInfoUL) and by $p_{\text{UE-FR1}}$ (configured for the cell group).

p-UE-FR2
The maximum total transmit power to be used by the UE across all serving cells in frequency range 2 (FR2) across all cell groups. The maximum transmit power that the UE may use may be additionally limited by $p_{\text{Max}}$ (configured in FrequencyInfoUL) and by $p_{\text{UE-FR2}}$ (configured for the cell group).

pdsch-HARQ-ACK-Codebook
The PDSCH HARQ-ACK codebook is either semi-static or dynamic. This is applicable to both CA and none CA operation (see TS 38.213 [13], clauses 9.1.2 and 9.1.3). If pdsch-HARQ-ACK-Codebook is signalled, UE shall ignore the pdsch-HARQ-ACK-Codebook (without suffix). If the field pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup is present, pdsch-HARQ-ACK-Codebook is applied to primary PUCCH group. Otherwise, this field is applied to the cell group (i.e. for all the cells within the cell group).
### pdsch-HARQ-ACK-CodebookList
A list of configuration for at least two simultaneously constructed HARQ-ACK codebooks. Each configuration in the list is defined in the same way as `pdsch-HARQ-ACK-Codebook` (see TS 38.212 [17], clause 7.3.1.2.2 and TS 38.213 [13], clauses 7.2.1, 9.1.2, 9.1.3 and 9.2.1). If this field is present, the field `pdsch-HARQ-ACK-Codebook` is ignored for the case at least two HARQ-ACK codebooks are simultaneously constructed.

### pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup
The PDSCH HARQ-ACK codebook is either semi-static or dynamic. This is applicable to both CA and none CA operation (see TS 38.213 [13], clauses 9.1.2 and 9.1.3). It is configured for secondary PUCCH group.

### pdsch-HARQ-ACK-OneShotFeedback
When configured, the DCI format 1_1 can request the UE to report A/N for all HARQ processes and all CCs configured in the PUCCH group (see TS 38.212 [17], clause 7.3.1). If this field is present, the field `pdsch-HARQ-ACK-Codebook` is ignored for the case at least two HARQ-ACK codebooks are simultaneously constructed.

### pdsch-HARQ-ACK-OneShotFeedbackCBG
When configured, the DCI format 1_1 can request the UE to include CBG level A/N for each CC with CBG level transmission configured. When not configured, the UE will report TB level A/N even if CBG level transmission is configured for a CC. The network configures this only when `pdsch-HARQ-ACK-OneShotFeedback` is configured.

### pdsch-HARQ-ACK-OneShotFeedbackNDI
When configured, the DCI format 1_1 can request the UE to include NDI for each A/N reported. The network configures this only when `pdsch-HARQ-ACK-OneShotFeedback` is configured.

### sizeDCI-2-6
Size of DCI format 2-6 (see TS 38.213 [13], clause 11.5).

### sp-CSI-RNTI
RNTI for Semi-Persistent CSI reporting on PUSCH (see `CSI-ReportConfig`) (see TS 38.214 [19], clause 5.2.1.5.2). Network always configures the UE with a value for this field when at least one `CSI-ReportConfig` with `reportConfigType` set to `semiPersistentOnPUSCH` is configured.

### tpc-PUCCH-RNTI
RNTI used for PUCCH TPC commands on DCI (see TS 38.213 [13], clause 10.1).

### tpc-PUSCH-RNTI
RNTI used for PUSCH TPC commands on DCI (see TS 38.213 [13], clause 10.1).

### tpc-SRS-RNTI
RNTI used for SRS TPC commands on DCI (see TS 38.213 [13], clause 10.1).

### ul-TotalDAI-Included
Indicates whether the total DAI fields of the additional PDSCH group is included in the non-fallback UL grant DCI (see TS 38.212 [17], clause 7.3.1). The network configures this only when enhanced dynamic codebook is configured (`pdsch-HARQ-ACK-Codebook` is set to `enhancedDynamic`).

### xScale
The UE is allowed to drop NR only if the power scaling applied to NR results in a difference between scaled and unscaled NR UL of more than `xScale` dB (see TS 38.213 [13]). If the value is not configured for dynamic power sharing, the UE assumes default value of 6 dB.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCG-Only</td>
<td>This field is optionally present, Need R, in the <code>PhysicalCellGroupConfig</code> of the MCG. It is absent otherwise.</td>
</tr>
<tr>
<td>SCG-Only</td>
<td>This field is optionally present, Need S, in the <code>PhysicalCellGroupConfig</code> of the SCG in (NG)EN-DC as defined in TS 38.213 [13]. It is absent otherwise.</td>
</tr>
<tr>
<td>twoPUCCHgroup</td>
<td>This field is optionally present, Need R, if secondary PUCCH group is configured. It is absent otherwise.</td>
</tr>
</tbody>
</table>

### PLMN-Identity
The IE `PLMN-Identity` identifies a Public Land Mobile Network. Further information regarding how to set the IE is specified in TS 23.003 [21].
**PLMN-Identity information element**

```asn1
PLMN-Identity ::= SEQUENCE {
  mcc                              MCC OPTIONAL, -- Cond MCC
  mnc                              MNC
}

MCC ::= SEQUENCE (SIZE (3)) OF MCC-MNC-Digit

MNC ::= SEQUENCE (SIZE (2..3)) OF MCC-MNC-Digit

MCC-MNC-Digit ::= INTEGER (0..9)
```

**PLMN-Identity field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>mcc</strong></td>
<td>The first element contains the first MCC digit, the second element the second MCC digit and so on. If the field is absent, it takes the same value as the <strong>mcc</strong> of the immediately preceding IE PLMN-Identity. See TS 23.003 [21].</td>
</tr>
<tr>
<td><strong>mnc</strong></td>
<td>The first element contains the first MNC digit, the second element the second MNC digit and so on. See TS 23.003 [21].</td>
</tr>
</tbody>
</table>

**Conditional Presence**

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MCC</strong></td>
<td>This field is mandatory present when PLMN-Identity is not used in a list or if it is the first entry of PLMN-Identity in a list. Otherwise it is optionally present. Need S.</td>
</tr>
</tbody>
</table>

---

**PLMN-IdentityInfoList**

The IE **PLMN-IdentityInfoList** includes a list of PLMN identity information.

**PLMN-IdentityInfoList information element**

```asn1
PLMN-IdentityInfoList ::= SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo

PLMN-IdentityInfo ::= SEQUENCE {
  plm-IdentityList                        SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity,
  trackingAreaCode                       TrackingAreaCode OPTIONAL, -- Need R
  ranac                                  RAN-AreaCode OPTIONAL, -- Need R
  cellIdentity                           CellIdentity,
  cellReservedForOperatorUse             ENUMERATED {reserved, notReserved},
}
```
**PLMN-IdentityInfo field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>cellReservedForOperatorUse</code></td>
<td>Indicates whether the cell is reserved for operator use (per PLMN), as defined in TS 38.304 [20]. This field is ignored by IAB-MT.</td>
</tr>
<tr>
<td><code>iab-Support</code></td>
<td>This field combines both the support of IAB and the cell status for IAB. If the field is present, the cell supports IAB and the cell is also considered as a candidate for cell (re)selection for IAB-node; if the field is absent, the cell does not support IAB and/or the cell is barred for IAB-node.</td>
</tr>
<tr>
<td><code>trackingAreaCode</code></td>
<td>Indicates Tracking Area Code to which the cell indicated by <code>cellIdentity</code> field belongs. The absence of the field indicates that the cell only supports PSCell/SCell functionality (per PLMN).</td>
</tr>
</tbody>
</table>

---

**PLMN-IdentityList2**

Includes a list of PLMN identities.

**PLMN-IdentityList2 information element**

---

**PRB-Id**

The IE `PRB-Id` identifies a Physical Resource Block (PRB) position within a carrier.

**PRB-Id information element**

---
PTRS-DownlinkConfig

The IE PTRS-DownlinkConfig is used to configure downlink phase tracking reference signals (PTRS) (see TS 38.214 [19] clause 5.1.6.3)

**PTRS-DownlinkConfig information element**

---

**PTRS-DownlinkConfig field descriptions**

**epre-Ratio**
EPRE ratio between PTRS and PDSCH. Value 0 corresponds to the codepoint "00" in table 4.1-2. Value 1 corresponds to codepoint "01", and so on. If the field is not provided, the UE applies value 0 (see TS 38.214 [19], clause 4.1).

**frequencyDensity**
Presence and frequency density of DL PT-RS as a function of Scheduled BW. If the field is absent, the UE uses $K_{PT-RS} = 2$ (see TS 38.214 [19], clause 5.1.6.3, table 5.1.6.3-2).

**maxNrofPorts**
The maximum number of DL PTRS ports specified in TS 38.214 [19] (clause 5.1.6.3). 2 PT-RS ports can only be configured for a DL BWP that is configured, as specified in TS 38.214 [19] clause 5.1, with a mode where a single PDSCH has association between the DM-RS ports and the TCI states as defined in TS 38.214 [19] clause 5.1.6.2.

**resourceElementOffset**
Indicates the subcarrier offset for DL PTRS. If the field is absent, the UE applies the value offset00 (see TS 38.214 [19], clause 6.4.1.2.2.1).

**timeDensity**
Presence and time density of DL PT-RS as a function of MCS. The value 29 is only applicable for MCS Table 5.1.3.1-1 (TS 38.214 [19]). If the field is absent, the UE uses $L_{PT-RS} = 1$ (see TS 38.214 [19], clause 5.1.6.3, table 5.1.6.3-1).

---

PTRS-UplinkConfig

The IE PTRS-UplinkConfig is used to configure uplink Phase-Tracking-Reference-Signals (PTRS).
PTRS-UplinkConfig information element

```asn1
PTRS-UplinkConfig ::= SEQUENCE {
    transformPrecoderDisabled  SEQUENCE {
        frequencyDensity  SEQUENCE (SIZE (2)) OF INTEGER (1..276) OPTIONAL, -- Need S
        timeDensity      SEQUENCE (SIZE (3)) OF INTEGER (0..29) OPTIONAL, -- Need S
        maxNrofPorts     ENUMERATED {n1, n2},
        resourceElementOffset  ENUMERATED {offset01, offset10, offset11 } OPTIONAL, -- Need S
        ptrs-Power       ENUMERATED {p00, p01, p10, p11} OPTIONAL, -- Need R
    },
    transformPrecoderEnabled  SEQUENCE {
        sampleDensity  SEQUENCE (SIZE (5)) OF INTEGER (1..276),
        timeDensityTransformPrecoding  ENUMERATED {d2} OPTIONAL -- Need R
    },
    ...
}
```

**PTRS-UplinkConfig field descriptions**

- **frequencyDensity**
  Presence and frequency density of UL PT-RS for CP-OFDM waveform as a function of scheduled BW. If the field is absent, the UE uses K_PT-RS = 2 (see TS 38.214 [19], clause 6.1).

- **maxNrofPorts**
  The maximum number of UL PTRS ports for CP-OFDM (see TS 38.214 [19], clause 6.2.3.1).

- **ptrs-Power**
  UL PTRS power boosting factor per PTRS port (see TS 38.214 [19], clause 6.1, table 6.2.3.1.3).

- **resourceElementOffset**
  Indicates the subcarrier offset for UL PTRS for CP-OFDM. If the field is absent, the UE applies the value offset00 (see TS 38.211 [16], clause 6.4.1.2.2).

- **sampleDensity**
  Sample density of PT-RS for DFT-s-OFDM, pre-DFT, indicating a set of thresholds T={NRBn, n=0,1,2,3,4}, that indicates dependency between presence of PT-RS and scheduled BW and the values of X and K the UE should use depending on the scheduled BW, see TS 38.214 [19], clause 6.1, table 6.2.3.2-1.

- **timeDensity**
  Presence and time density of UL PT-RS for CP-OFDM waveform as a function of MCS. If the field is absent, the UE uses L_PT-RS = 1 (see TS 38.214 [19], clause 6.1).

- **timeDensityTransformPrecoding**
  Time density (OFDM symbol level) of PT-RS for DFT-s-OFDM. If the field is absent, the UE applies value d1 (see TS 38.214 [19], clause 6.1).

- **transformPrecoderDisabled**
  Configuration of UL PTRS without transform precoder (with CP-OFDM).

- **transformPrecoderEnabled**
  Configuration of UL PTRS with transform precoder (DFT-S-OFDM).
The IE PUCCH-Config is used to configure UE specific PUCCH parameters (per BWP).

**PUCCH-Config information element**

```asn1
PUCCH-Config ::= SEQUENCE {
  resourceSetToAddModList                 SEQUENCE (SIZE (1..maxNrofPUCCH-ResourceSets)) OF PUCCH-ResourceSet OPTIONAL, -- Need N
  resourceSetToReleaseList                SEQUENCE (SIZE (1..maxNrofPUCCH-ResourceSets)) OF PUCCH-ResourceSetId OPTIONAL, -- Need N
  resourceToAddModList                    SEQUENCE (SIZE (1..maxNrofPUCCH-Resources)) OF PUCCH-Resource OPTIONAL, -- Need N
  resourceToReleaseList                   SEQUENCE (SIZE (1..maxNrofPUCCH-Resources)) OF PUCCH-ResourceId       OPTIONAL, -- Need N
  format1                                 SetupRelease { PUCCH-FormatConfig }                                   OPTIONAL, -- Need M
  format2                                 SetupRelease { PUCCH-FormatConfig }                                   OPTIONAL, -- Need M
  format3                                 SetupRelease { PUCCH-FormatConfig }                                   OPTIONAL, -- Need M
  format4                                 SetupRelease { PUCCH-FormatConfig }                                   OPTIONAL, -- Need M
  schedulingRequestResourceToAddModList   SEQUENCE (SIZE (1..maxNrofSR-Resources)) OF SchedulingRequestResourceConfig OPTIONAL, -- Need N
  schedulingRequestResourceToReleaseList  SEQUENCE (SIZE (1..maxNrofSR-Resources)) OF SchedulingRequestResourceId OPTIONAL, -- Need N
  multi-CSI-PUCCH-ResourceList            SEQUENCE (SIZE (1..2)) OF PUCCH-ResourceId                            OPTIONAL, -- Need M
  dl-DataToUL-ACK                         SEQUENCE (SIZE (1..8)) OF INTEGER (0..15)                             OPTIONAL, -- Need M
  spatialRelationInfoToAddModList         SEQUENCE (SIZE (1..maxNrofSpatialRelationInfos)) OF PUCCH-SpatialRelationInfo     OPTIONAL, -- Need N
  spatialRelationInfoToReleaseList        SEQUENCE (SIZE (1..maxNrofSpatialRelationInfos)) OF PUCCH-SpatialRelationInfoId    OPTIONAL, -- Need N
  pucch-PowerControl                      PUCCH-PowerControl                                                    OPTIONAL, -- Need M
  \[
  resourceToAddModListExt-r16             SEQUENCE (SIZE (1..maxNrofPUCCH-Resources)) OF PUCCH-ResourceExt-r16  OPTIONAL, -- Need N
  dl-DataToUL-ACK-r16                     SetupRelease { DL-DataToUL-ACK-r16 }                                  OPTIONAL, -- Need M
  ul-AccessConfigListDCI-1-1-r16          SetupRelease { UL-AccessConfigListDCI-1-1-r16 }                       OPTIONAL, -- Need M
  subslotLengthForPUCCH-r16               CHOICE { normalCP-r16                        ENUMERATED {n2,n7},
                                         extendedCP-r16                      ENUMERATED {n2,n6} }
  dl-DataToUL-ACK-DCI-1-2-r16             SetupRelease { DL-DataToUL-ACK-DCI-1-2-r16 }                            OPTIONAL, -- Need M
  numberOfBitsForPUCCH-ResourceIndicatorDCI-1-2-r16  INTEGER (0..3)                                             OPTIONAL, -- Need R
  dmers-UplinkTransformPrecodingPUCCH-r16  ENUMERATED {enabled}                                                  OPTIONAL, -- Cond PI2-BPSK
  spatialRelationInfoToAddModList2-r16    SEQUENCE (SIZE (1..maxNrofSpatialRelationInfosDiff-r16)) OF PUCCH-SpatialRelationInfoId    OPTIONAL, -- Need N
  spatialRelationInfoToReleaseList2-r16   SEQUENCE (SIZE (1..maxNrofSpatialRelationInfosDiff-r16)) OF PUCCH-SpatialRelationInfoId    OPTIONAL, -- Need N
  spatialRelationInfoToAddModListExt-r16  SEQUENCE (SIZE (1..maxNrofPUCCH-ResourceGroups-r16)) OF PUCCH-ResourceGroup-r16   OPTIONAL, -- Need N
  spatialRelationInfoToReleaseList-r16    SEQUENCE (SIZE (1..maxNrofPUCCH-ResourceGroups-r16)) OF PUCCH-ResourceGroupId-r16 ... OPTIONAL, -- Need N
  \[
}
```

---
sp-PUCCH-AN-List-r16  SetupRelease { SPS-PUCCH-AN-List-r16 } OPTIONAL, -- Need M
schedulingRequestResourceToAddModList-v1610  SEQUENCE (SIZE (1..maxNrofSR-Resources)) OF SchedulingRequestResourceConfig-v1610 OPTIONAL -- Need N
}
}
PUCCH-FormatConfig ::= SEQUENCE {
  interslotFrequencyHopping ENUMERATED {enabled} OPTIONAL, -- Need R
  additionalDMRS ENUMERATED {true} OPTIONAL, -- Need R
  maxCodeRate PUCCH-MaxCodeRate OPTIONAL, -- Need R
  nrofSlots ENUMERATED {n2,n4,n8} OPTIONAL, -- Need S
  pi2BPSK ENUMERATED {enabled} OPTIONAL, -- Need R
  simultaneousHARQ-ACK-CSI ENUMERATED {true} OPTIONAL -- Need R
}
PUCCH-MaxCodeRate ::= ENUMERATED {zeroDot08, zeroDot15, zeroDot25, zeroDot35, zeroDot45, zeroDot60, zeroDot80}
-- A set with one or more PUCCH resources
PUCCH-ResourceSet ::= SEQUENCE {
  pucch-ResourceSetId PUCCH-ResourceSetId,
  resourceIdList SEQUENCE (SIZE (1..maxNrofPUCCH-ResourcesPerSet)) OF PUCCH-ResourceId,
  maxPayloadSize INTEGER (4..256) OPTIONAL -- Need R
}
PUCCH-ResourceId ::= INTEGER (0..maxNrofPUCCH-ResourceSets-1)
PUCCH-Format ::= SEQUENCE {
  pucch-ResourceId PUCCH-ResourceId,
  startingPRB PRB-Id,
  intraSlotFrequencyHopping ENUMERATED { enabled } OPTIONAL, -- Need R
  secondHopPRB PRB-Id OPTIONAL, -- Need A
  format CHOICE {
    format0 PUCCH-format0,
    format1 PUCCH-format1,
    format2 PUCCH-format2,
    format3 PUCCH-format3,
    format4 PUCCH-format4
  }
}
PUCCH-ResourceExt-r16 ::= SEQUENCE {
  interlaceAllocation-r16 SEQUENCE {
    rb-SetIndex INTEGER (0..4),
    interlace0 CHOICE {
      scs15 INTEGER (0..9),
      scs30 INTEGER (0..4)
    }
  }
  formatExt-v1610 CHOICE {
    interlace1-v1610 INTEGER (0..9),
   occ-v1610 SEQUENCE {
      occ-Length-v1610 ENUMERATED {n2,n4} OPTIONAL, -- Need M
      occ-Index-v1610 ENUMERATED {n0,n1,n2,n3} OPTIONAL -- Need M
    }
  }
}
PUCCH-ResourceId ::= INTEGER (0..maxNrofPUCCH-Resources-1)

PUCCH-format0 ::= SEQUENCE {
    initialCyclicShift INTEGER (0..11),
    nrofSymbols INTEGER (1..2),
    startingSymbolIndex INTEGER (0..13)
}

PUCCH-format1 ::= SEQUENCE {
    initialCyclicShift INTEGER (0..11),
    nrofSymbols INTEGER (4..14),
    startingSymbolIndex INTEGER (0..10),
    timeDomainOCC INTEGER (0..6)
}

PUCCH-format2 ::= SEQUENCE {
    nrofPRBs INTEGER (1..16),
    nrofSymbols INTEGER (1..2),
    startingSymbolIndex INTEGER (0..13)
}

PUCCH-format3 ::= SEQUENCE {
    nrofPRBs INTEGER (1..16),
    nrofSymbols INTEGER (4..14),
    startingSymbolIndex INTEGER (0..10)
}

PUCCH-format4 ::= SEQUENCE {
    nrofSymbols INTEGER (4..14),
    occ-Index ENUMERATED (n0,n1,n2,n3),
    startingSymbolIndex INTEGER (0..10)
}

PUCCH-ResourceGroup-r16 ::= SEQUENCE {
    pucch-ResourceGroupId-r16 PUCCH-ResourceGroupId-r16,
    resourcePerGroupList-r16 SEQUENCE (SIZE (1..maxNrofPUCCH-ResourcesPerGroup-r16)) OF PUCCH-ResourceId
}

PUCCH-ResourceGroupId-r16 ::= INTEGER (0..maxNrofPUCCH-ResourceGroups-1-r16)

DL-DataToUL-ACK-r16 ::= SEQUENCE (SIZE (1..8)) OF INTEGER (-1..15)

UL-AccessConfigListDCI-1-1-r16 ::= SEQUENCE (SIZE (1..16)) OF INTEGER (0..15)
## PUCCH-Config field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>dl-DataToUL-ACK, dl-DataToUL-ACK-DCI-1-2</strong></td>
<td>List of timing for given PDSCH to the DL ACK (see TS 38.213 [13], clause 9.1.2). The field <code>dl-DataToUL-ACK</code> applies to DCI format 1_1 and the field <code>dl-DataToUL-ACK-DCI-1-2</code> applies to DCI format 1_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.2.3). If <code>dl-DataToUL-ACK-r16</code> is signalled, UE shall ignore the <code>dl-DataToUL-ACK</code> (without suffix). The value -1 corresponds to &quot;non-numerical value&quot; for the case where the A/N feedback timing is not explicitly included at the time of scheduling PDSCH.</td>
</tr>
<tr>
<td><strong>dmrs-UplinkTransformPrecodingPUCCH</strong></td>
<td>This field is used for PUCCH formats 3 and 4 according to TS 38.211, Clause 6.4.1.3.3.1.</td>
</tr>
<tr>
<td><strong>format1</strong></td>
<td>Parameters that are common for all PUCCH resources of format 1.</td>
</tr>
<tr>
<td><strong>format2</strong></td>
<td>Parameters that are common for all PUCCH resources of format 2.</td>
</tr>
<tr>
<td><strong>format3</strong></td>
<td>Parameters that are common for all PUCCH resources of format 3.</td>
</tr>
<tr>
<td><strong>format4</strong></td>
<td>Parameters that are common for all PUCCH resources of format 4</td>
</tr>
<tr>
<td><strong>numberOfBitsForPUCCH-ResourceIndicatorDCI-1-2</strong></td>
<td>Configuration of the number of bits for &quot;PUCCH resource indicator&quot; in DCI format 1_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.2.3).</td>
</tr>
<tr>
<td><strong>resourceGroupToAddModList, resourceGroupToReleaseList</strong></td>
<td>Lists for adding and releasing groups of PUCCH resources that can be updated simultaneously for spatial relations with a MAC CE</td>
</tr>
<tr>
<td><strong>resourceSetToAddModList, resourceSetToReleaseList</strong></td>
<td>Lists for adding and releasing PUCCH resource sets (see TS 38.213 [13], clause 9.2).</td>
</tr>
<tr>
<td><strong>resourceToAddModList, resourceToAddModListExt, resourceToReleaseList</strong></td>
<td>Lists for adding and releasing PUCCH resources applicable for the UL BWP and serving cell in which the PUCCH-Config is defined. The resources defined herein are referred to from other parts of the configuration to determine which resource the UE shall use for which report. If the network includes of resourceToAddModListExt, it includes the same number of entries, and listed in the same order, as in resourceToAddModList.</td>
</tr>
<tr>
<td><strong>spatialRelationInfoToAddModList, spatialRelationInfoToAddModList2, spatialRelationInfoToAddModListExt</strong></td>
<td>Configuration of the spatial relation between a reference RS and PUCCH. Reference RS can be SSB/CSI-RS/SRS. If the list has more than one element, MAC-CE selects a single element (see TS 38.321 [3], clause 5.18.8 and TS 38.213 [13], clause 9.2.2). The UE shall consider entries in spatialRelationInfoToAddModList and in spatialRelationInfoToAddModList2 as a single list, i.e. an entry created using spatialRelationInfoToAddModList can be modified using spatialRelationInfoToAddModList2 (or deleted using spatialRelationInfoToReleaseList2) and vice-versa. If the network includes spatialRelationInfoToAddModListExt, it includes the same number of entries, and listed in the same order, as in the concatenation of spatialRelationInfoToAddModList and of spatialRelationInfoToAddModList2.</td>
</tr>
<tr>
<td><strong>sps-PUCCH-AN</strong></td>
<td>Indicates a list of PUCCH resources for DL SPS HARQ ACK. The field <code>maxPayloadSize</code> is absent for the first and the last SPS-PUCCH-AN in the list. If configured, this overrides n1PUCCH-AN in SPS-config.</td>
</tr>
<tr>
<td><strong>subslotLengthForPUCCH</strong></td>
<td>Indicate the sub-slot length for sub-slot based PUCCH feedback in number of symbols (see TS 38.213 [13], clause 9). Value <code>n2</code> corresponds to 2 symbols, value <code>n6</code> corresponding to 6 symbols, value <code>n7</code> corresponds to 7 symbols. For normal CP, the value is either <code>n2</code> or <code>n7</code>. For extended CP, the value is either <code>n2</code> or <code>n6</code>.</td>
</tr>
<tr>
<td><strong>ul-AccessConfigListDCI-1-1</strong></td>
<td>List of the combinations of cyclic prefix extension and UL channel access type (See TS 38.212 [17], Clause 7.3.1).</td>
</tr>
</tbody>
</table>
### PUCCH-format3 field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>nrofPRBs</td>
<td>The supported values are 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, and 16. The UE shall ignore this field when formatExt is configured.</td>
</tr>
</tbody>
</table>

### PUCCH-FormatConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>additionalDMRS</td>
<td>If the field is present, the UE enables 2 DMRS symbols per hop of a PUCCH Format 3 or 4 if both hops are more than X symbols when FH is enabled (X=4). And it enables 4 DMRS symbols for a PUCCH Format 3 or 4 with more than 2X+1 symbols when FH is disabled (X=4). The field is not applicable for format 1 and 2. See TS 38.213 [13], clause 9.2.2.</td>
</tr>
<tr>
<td>interslotFrequencyHopping</td>
<td>If the field is present, the UE enables inter-slot frequency hopping when PUCCH Format 1, 3 or 4 is repeated over multiple slots. For long PUCCH over multiple slots, the intra and inter slot frequency hopping cannot be enabled at the same time for a UE. The field is not applicable for format 2. See TS 38.213 [13], clause 9.2.6.</td>
</tr>
<tr>
<td>maxCodeRate</td>
<td>Max coding rate to determine how to feedback UCI on PUCCH for format 2, 3 or 4. The field is not applicable for format 1. See TS 38.213 [13], clause 9.2.5.</td>
</tr>
<tr>
<td>nrofSlots</td>
<td>Number of slots with the same PUCCH F1, F3 or F4. When the field is absent the UE applies the value n1. The field is not applicable for format 2. See TS 38.213 [13], clause 9.2.6.</td>
</tr>
<tr>
<td>pi2BPSK</td>
<td>If the field is present, the UE uses pi/2 BPSK for UCI symbols instead of QPSK for PUCCH. The field is not applicable for format 1 and 2. See TS 38.213 [13], clause 9.2.5.</td>
</tr>
<tr>
<td>rb-SetIndex</td>
<td>Indicates the RB set where PUCCH resource is allocated.</td>
</tr>
<tr>
<td>simultaneousHARQ-ACK-CSI</td>
<td>If the field is present, the UE uses simultaneous transmission of CSI and HARQ-ACK feedback with or without SR with PUCCH Format 2, 3 or 4. See TS 38.213 [13], clause 9.2.5. When the field is absent the UE applies the value off. The field is not applicable for format 1.</td>
</tr>
</tbody>
</table>
**PUCCH-Resource, PUCCH-ResourceExt field descriptions**

**Format, formatExt**
Selection of the PUCCH format (format 0 – 4) and format-specific parameters, see TS 38.213 [13], clause 9.2. format0 and format1 are only allowed for a resource in a first PUCCH resource set. format2, format3 and format4 are only allowed for a resource in non-first PUCCH resource set. The network can only configure formatExt when format is set to format2 or format3.

**interlace0**
This is the only interlace of interlaced PUCCH Format 0 and 1 and the first interlace for interlaced PUCCH Format 2 and 3.

**interlace1**
A second interlace, in addition to interlace 0, as specified in TS 38.213 [13], clause 9.2.1. For 15kHz SCS, values {0..9} are applicable; for 30Khz SCS, values {0..4} are applicable. For 15kHz SCS, the values of interlace1 shall satisfy interlace1=mod(interlace0+X,10) where X=1, -1, or 5.

**intraSlotFrequencyHopping**
Enabling intra-slot frequency hopping, applicable for all types of PUCCH formats. For long PUCCH over multiple slots, the intra and inter slot frequency hopping cannot be enabled at the same time for a UE. See TS 38.213 [13], clause 9.2.1.

**occ-Index**
Indicates the orthogonal cover code index (see TS 38.213 [13], clause 9.2.1). This field is Applicable when useInterlacePUCCH-Dedicated-r16 is configured.

**occ-Length**
Indicates the orthogonal cover code length (see TS 38.213 [13], clause 9.2.1). Applicable when useInterlacePUCCH-Dedicated-r16 is configured.

**pucch-ResourceId**
Identifier of the PUCCH resource.

**secondHopPRB**
Index of first PRB after frequency hopping of PUCCH. This value is applicable for intra-slot frequency hopping (see TS 38.213 [13], clause 9.2.1) or inter-slot frequency hopping (see TS 38.213 [13], clause 9.2.6).

**PUCCH-ResourceSet field descriptions**

**maxPayloadSize**
Maximum number of UCI information bits that the UE may transmit using this PUCCH resource set (see TS 38.213 [13], clause 9.2.1). In a PUCCH occurrence, the UE chooses the first of its PUCCH-ResourceSet which supports the number of bits that the UE wants to transmit. The field is absent in the first set (Set0) and in the last configured set since the UE derives the maximum number of UCI information bits as specified in TS 38.213 [13], clause 9.2.1. This field can take integer values that are multiples of 4.

**resourceList**
PUCCH resources of format0 and format1 are only allowed in the first PUCCH resource set, i.e., in a PUCCH-ResourceSet with pucch-ResourceSetId = 0. This set may contain between 1 and 32 resources. PUCCH resources of format2, format3 and format4 are only allowed in a PUCCH-ResourceSet with pucch-ResourceSetId > 0. If present, these sets contain between 1 and 8 resources each. The UE chooses a PUCCH-Resource from this list as specified in TS 38.213 [13], clause 9.2.3. Note that this list contains only a list of resource IDs. The actual resources are configured in PUCCH-Config.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI2-BPSK</td>
<td>The field is optionally present, Need R, if format3 and/or format4 are configured and pi2BPSK is configured in each of them. It is absent, Need R otherwise.</td>
</tr>
</tbody>
</table>

**PUCCH-ConfigCommon**
The IE PUCCH-ConfigCommon is used to configure the cell specific PUCCH parameters.
**PUCCH-ConfigCommon** information element

```asn1
PUCCH-ConfigCommon ::= SEQUENCE {
    pucch-ResourceCommon               INTEGER (0..15) OPTIONAL, -- Cond InitialBWP-Only
    pucch-GroupHopping                  ENUMERATED { neither, enable, disable },
    hoppingId                           INTEGER (0..1023) OPTIONAL, -- Need R
    p0-nominal                          INTEGER (-202..24) OPTIONAL, -- Need R
    ...
}
```

**PUCCH-ConfigCommon** field descriptions

- **hoppingId**
  Cell-specific scrambling ID for group hopping and sequence hopping if enabled, see TS 38.211 [16], clause 6.3.2.2.

- **p0-nominal**
  Power control parameter P0 for PUCCH transmissions. Value in dBm. Only even values (step size 2) allowed (see TS 38.213 [13], clause 7.2).

- **pucch-GroupHopping**
  Configuration of group- and sequence hopping for all the PUCCH formats 0, 1, 3 and 4. Value `neither` implies neither group or sequence hopping is enabled. Value `enable` enables group hopping and disables sequence hopping. Value `disable` disables group hopping and enables sequence hopping (see TS 38.211 [16], clause 6.3.2.2).

- **pucch-ResourceCommon**
  An entry into a 16-row table where each row configures a set of cell-specific PUCCH resources/parameters. The UE uses those PUCCH resources until it is provided with a dedicated **PUCCH-Config** (e.g. during initial access) on the initial uplink BWP. Once the network provides a dedicated **PUCCH-Config** for that bandwidth part the UE applies that one instead of the one provided in this field (see TS 38.213 [13], clause 9.2).

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>InitialBWP-Only</td>
<td>The field is mandatory present in the <strong>PUCCH-ConfigCommon</strong> of the initial BWP (BWP#0) in SIB1. It is absent in other BWPs.</td>
</tr>
</tbody>
</table>

---

**PUCCH-ConfigurationList**

The IE **PUCCH-ConfigurationList** is used to configure UE specific PUCCH parameters (per BWP) for two simultaneously constructed HARQ-ACK codebooks. See TS 38.213 [13], clause 9.1.

**PUCCH-ConfigurationList** information element

```asn1
PUCCH-ConfigurationList ::=  SEQUENCE (SIZE (1..2)) OF PUCCH-Config
```

---

**PUCCH-ConfigCommon**
The IE **PUCCH-PathlossReferenceRS-Id** is an ID for a reference signal (RS) configured as PUCCH pathloss reference (see TS 38.213 [13], clause 7.2).

**PUCCH-PathlossReferenceRS-Id information element**

```asn1
PUCCH-PathlossReferenceRS-Id ::=            INTEGER (0..maxNrofPUCCH-PathlossReferenceRSs-1)
PUCCH-PathlossReferenceRS-Id-v1610 ::=      INTEGER (maxNrofPUCCH-PathlossReferenceRSs..maxNrofPUCCH-PathlossReferenceRSs-1-r16)
```

The IE **PUCCH-PowerControl** is used to configure UE-specific parameters for the power control of PUCCH.

**PUCCH-PowerControl information element**

```asn1
PUCCH-PowerControl ::=              SEQUENCE {
  deltaF-PUCCH-f0                     INTEGER (-16..15)                                                       OPTIONAL, -- Need R
  deltaF-PUCCH-f1                     INTEGER (-16..15)                                                       OPTIONAL, -- Need R
  deltaF-PUCCH-f2                     INTEGER (-16..15)                                                       OPTIONAL, -- Need R
  deltaF-PUCCH-f3                     INTEGER (-16..15)                                                       OPTIONAL, -- Need R
  deltaF-PUCCH-f4                     INTEGER (-16..15)                                                       OPTIONAL, -- Need R
  p0-Set                              SEQUENCE (SIZE (1..maxNrofPUCCH-P0-PerSet)) OF P0-PUCCH                 OPTIONAL, -- Need M
  pathlossReferenceRSs                SEQUENCE (SIZE (1..maxNrofPUCCH-PathlossReferenceRSs)) OF PUCCH-PathlossReferenceRS          OPTIONAL, -- Need M
  twoPUCCH-PC-AdjustmentStates        ENUMERATED {twoStates}                                                  OPTIONAL, -- Need S
  ...,
  [[
    pathlossReferenceRSs-v1610        SetupRelease { PathlossReferenceRSs-v1610 }                                      OPTIONAL -- Need M
  ]]
}

P0-PUCCH ::=                            SEQUENCE {
  p0-PUCCH-Id                             P0-PUCCH-Id,
  p0-PUCCH-Value                          INTEGER (-16..15)
}

P0-PUCCH-Id ::=                         INTEGER (1..8)
```
P0-PUCCH field descriptions

**p0-PUCCH-Value**
P0 value for PUCCH with 1dB step size.
**PUCCH-PowerControl** field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>deltaF-PUCCH-f0</td>
<td>deltaF for PUCCH format 0 with 1dB step size (see TS 38.213 [13], clause 7.2).</td>
</tr>
<tr>
<td>deltaF-PUCCH-f1</td>
<td>deltaF for PUCCH format 1 with 1dB step size (see TS 38.213 [13], clause 7.2).</td>
</tr>
<tr>
<td>deltaF-PUCCH-f2</td>
<td>deltaF for PUCCH format 2 with 1dB step size (see TS 38.213 [13], clause 7.2).</td>
</tr>
<tr>
<td>deltaF-PUCCH-f3</td>
<td>deltaF for PUCCH format 3 with 1dB step size (see TS 38.213 [13], clause 7.2).</td>
</tr>
<tr>
<td>deltaF-PUCCH-f4</td>
<td>deltaF for PUCCH format 4 with 1dB step size (see TS 38.213 [13], clause 7.2).</td>
</tr>
<tr>
<td>p0-Set</td>
<td>A set with dedicated P0 values for PUCCH, i.e., {P01, P02, ...} (see TS 38.213 [13], clause 7.2).</td>
</tr>
<tr>
<td>pathlossReferenceRSs</td>
<td>A set of Reference Signals (e.g., a CSI-RS config or a SS block) to be used for PUCCH pathloss estimation. Up to <code>maxNrofPUCCH-PathlossReference-RSs</code> may be configured. If the field is not configured, the UE uses the SSB as reference signal (see TS 38.213 [13], clause 7.2). The set includes References Signals indicated in pathlossReferenceRSs (without suffix) and in pathlossReferenceRSs-v1610.</td>
</tr>
<tr>
<td>twoPUCCH-PC-AdjustmentStates</td>
<td>Number of PUCCH power control adjustment states maintained by the UE (i.e., gi). If the field is present (n2) the UE maintains two power control states (i.e., g(i,0) and g(i,1)). If the field is absent, it maintains one power control state (i.e., g(i,0)) (see TS 38.213 [13], clause 7.2).</td>
</tr>
</tbody>
</table>

---

**PUCCH-SpatialRelationInfo**

The IE **PUCCH-SpatialRelationInfo** is used to configure the spatial setting for PUCCH transmission and the parameters for PUCCH power control, see TS 38.213, [13], clause 9.2.2.

**PUCCH-SpatialRelationInfo** information element

```asn1
-- ASN1START
-- TAG-PUCCH-SPATIALRELATIONINFO-START

PUCCH-SpatialRelationInfo ::=           SEQUENCE {
  pucch-SpatialRelationInfoId         PUCCH-SpatialRelationInfoId,  
  servingCellId                           ServCellIndex                                                    OPTIONAL,   -- Need S
  referenceSignal                         CHOICE {         ssb-Index                               SSB-Index,         
                                      csi-RS-Index                            NZP-CSI-RS-ResourceId,     
                                      srs                                     PUCCH-SRS          
                              ),
  pucch-PathlossReferenceRS-Id            PUCCH-PathlossReferenceRS-Id,  
  p0-PUCCH-Id                             P0-PUCCH-Id,  
  closedLoopIndex                         ENUMERATED { i0, i1 }     
} 

PUCCH-SpatialRelationInfoExt-r16 ::=       SEQUENCE {  
  pucch-SpatialRelationInfoId-v1610         PUCCH-SpatialRelationInfoId-v1610    OPTIONAL, -- Cond SetupOnly  
  pucch-PathlossReferenceRS-Id-v1610        PUCCH-PathlossReferenceRS-Id-v1610    OPTIONAL, -- Need R
}
```

---

3GPP TS 38.331 version 16.3.1 Release 16 524  ETSI TS 138 331 V16.3.1 (2021-01)
PUCCH-SpatialRelationInfo field descriptions

<table>
<thead>
<tr>
<th>Field Descriptions</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>pucch-PathLossReferenceRS-Id</td>
<td>When pucch-PathLossReferenceRS-Id-v1610 is configured, the UE shall ignore pucch-PathLossReferenceRS-Id (without suffix).</td>
</tr>
<tr>
<td>pucch-SpatialRelationInfoId</td>
<td>When pucch-SpatialRelationInfoId-v1610 is configured, the UE shall ignore pucch-SpatialRelationInfoId (without suffix).</td>
</tr>
<tr>
<td>servingCellId</td>
<td>If the field is absent, the UE applies the ServCellId of the serving cell in which this PUCCH-SpatialRelationInfo is configured.</td>
</tr>
</tbody>
</table>

Conditional Presence

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SetupOnly</td>
<td>This field is mandatory present upon creation of a PUCCH-SpatialRelationInfo. It is absent. Need M otherwise.</td>
</tr>
</tbody>
</table>

-- PUCCH-SpatialRelationInfo-Id

The IE PUCCH-SpatialRelationInfo-Id is used to indentify a PUCCH-SpatialRelationInfo

PUCCH-SpatialRelationInfo-Id information element

-- ASN1START
-- TAG-PUCCH-SPATIALRELATIONINFO-START

PUCCH-SpatialRelationInfoId ::= INTEGER (1..maxNrofSpatialRelationInfos)
PUCCH-SpatialRelationInfoId-r16 ::= INTEGER (1..maxNrofSpatialRelationInfos-r16)
PUCCH-SpatialRelationInfoId-v1610 ::= INTEGER (maxNrofSpatialRelationInfos-plus-1..maxNrofSpatialRelationInfos-r16)

-- TAG-PUCCH-SPATIALRELATIONINFO-STOP
-- ASN1STOP

-- PUCCH-TPC-CommandConfig

The IE PUCCH-TPC-CommandConfig is used to configure the UE for extracting TPC commands for PUCCH from a group-TPC messages on DCI.
**PUCCH-TPC-CommandConfig** information element

```
-- ASN1START
-- TAG-PUCCH-TPC-COMMANDCONFIG-START
PUCCH-TPC-CommandConfig ::= SEQUENCE {
   tpc-IndexPCell                          INTEGER (1..15)                         OPTIONAL,   -- Cond PDCCH-OfSpcell
   tpc-IndexPUCCH-SCell                    INTEGER (1..15)                         OPTIONAL,   -- Cond PDCCH-ofSpCellOrPUCCH-SCell
   ...
}
-- TAG-PUCCH-TPC-COMMANDCONFIG-STOP
-- ASN1STOP
```

**PUCCH-TPC-CommandConfig** field descriptions

**tpc-IndexPCell**
An index determining the position of the first bit of TPC command (applicable to the SpCell) inside the DCI format 2-2 payload.

**tpc-IndexPUCCH-SCell**
An index determining the position of the first bit of TPC command (applicable to the PUCCH SCell) inside the DCI format 2-2 payload.

---

**PUSCH-Config**

The IE **PUSCH-Config** is used to configure the UE specific PUSCH parameters applicable to a particular BWP.

**PUSCH-Config** information element

```
-- ASN1START
-- TAG-PUSCH-CONFIG-START
PUSCH-Config ::= SEQUENCE {
   dataScramblingIdentityPUSCH             INTEGER (0..1023)                                                   OPTIONAL,   -- Need S
   txConfig                                ENUMERATED {codebook, nonCodebook}                                  OPTIONAL,   -- Need S
   dmrs-UplinkForPUSCH-MappingTypeA        SetupRelease { DMRS-UplinkConfig }                                  OPTIONAL,   -- Need M
   dmrs-UplinkForPUSCH-MappingTypeB        SetupRelease { DMRS-UplinkConfig }                                  OPTIONAL,   -- Need M
   pusch-PowerControl                      PUSCH-PowerControl                                                  OPTIONAL,   -- Need M
   frequencyHopping                        ENUMERATED {intraSlot, interSlot}                                   OPTIONAL,   -- Need S
   frequencyHoppingOffsetLists             SEQUENCE (SIZE (1..4)) OF INTEGER (1.. maxNrofPhysicalResourceBlocks-1) OPTIONAL,   -- Need M
}
```

---
resourceAllocation                      ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch},
pusch-TimeDomainAllocationList         SetupRelease { PUSCH-TimeDomainResourceAllocationList }              OPTIONAL, -- Need M
pusch-AggregationFactor               ENUMERATED { n2, n4, n8 }                                                OPTIONAL, -- Need S
mcs-Table                             ENUMERATED {qam256, qam64LowSE}                                        OPTIONAL, -- Need S
mcs-TableTransformPrecoder            ENUMERATED {qam256, qam64LowSE}                                        OPTIONAL, -- Need S
transformPrecoder                     ENUMERATED {enabled, disabled}                                            OPTIONAL, -- Need S
codebookSubset                         ENUMERATED {fullyAndPartialAndNonCoherent, partialAndNonCoherent,nonCoherent} 
maxRank                                INTEGER (1..4)                                                OPTIONAL, -- Cond codebookBased
rbg-Size                               ENUMERATED { config2}                                                OPTIONAL, -- Cond codebookBased
uci-OnPUSCH                            SetupRelease { UCI-OnPUSCH}                                    OPTIONAL, -- Need M
tp-pi2BPSK                             ENUMERATED {enabled}                                          OPTIONAL, -- Need S

minimumSchedulingOffsetK2-r16         SetupRelease { MinSchedulingOffsetK2-Values-r16 }             OPTIONAL, -- Need M
ul-AccessConfigListDCI-0-1-r16         SetupRelease { UL-AccessConfigListDCI-0-1-r16 }               OPTIONAL, -- Need M
harq-ProcessNumberSizeDCI-0-2-r16     INTEGER (0..4)                                                OPTIONAL, -- Need R
dmrs-SequenceInitializationDCI-0-2-r16 ENUMERATED {enabled}                                            OPTIONAL, -- Need S
numberOfBitsForRV-DCI-0-2-r16          INTEGER (0..2)                                                OPTIONAL, -- Need R
antennaPortsFieldPresenceDCI-0-2-r16  ENUMERATED {enabled}                                            OPTIONAL, -- Need S
dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2-r16 SetupRelease { DMRS-UplinkConfig }            OPTIONAL, -- Need M
dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2-r16 SetupRelease { DMRS-UplinkConfig }            OPTIONAL, -- Need M
frequencyHoppingDCI-0-2-r16            CHOICE {
pusch-RepTypeA                          ENUMERATED {intraSlot, interSlot),
pusch-RepTypeB                          ENUMERATED {interRepetition, interSlot)

} frequencyHoppingOffsetsDCI-0-2-r16 SetupRelease { FrequencyHoppingOffsetsDCI-0-2-r16 }          OPTIONAL, -- Need M
codebookSubsetDCI-0-2-r16              ENUMERATED {fullyAndPartialAndNonCoherent, partialAndNonCoherent,nonCoherent} 

invalidSymbolPatternIndicatorDCI-0-2-r16 ENUMERATED {enabled}                                            OPTIONAL, -- Cond codebookBased
maxRankDCI-0-2-r16                      INTEGER (1..4)                                                OPTIONAL, -- Cond codebookBased
mcs-TableDCI-0-2-r16                   ENUMERATED {qam256, qam64LowSE}                                        OPTIONAL, -- Need S
mcs-TableTransformPrecoderDCI-0-2-r16  ENUMERATED {qam256, qam64LowSE}                                        OPTIONAL, -- Need S
priorityIndicatorDCI-0-2-r16           ENUMERATED {enabled}                                            OPTIONAL, -- Need S
pusch-RepTypeIndicatorDCI-0-2-r16      ENUMERATED { pusch-RepTypeA, pusch-RepTypeB}                        OPTIONAL, -- Need R
resourceAllocationTypeDCI-0-2-r16      ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch} 
resourceAllocationType1GranularityDCI-0-2-r16 ENUMERATED { n2,n4,n8,n16 }                                      OPTIONAL, -- Need S
uci-OnPUSCH-ListDCI-0-2-r16            SetupRelease { UCI-OnPUSCH-ListDCI-0-2-r16 }             OPTIONAL, -- Need M
pusch-TimeDomainAllocationListDCI-0-2-r16 SetupRelease { PUSCH-TimeDomainResourceAllocationList-r16 }         OPTIONAL, -- Need M

-- Start of the parameters for DCI format 0_2 introduced in V16.1.0

pusch-TimeDomainAllocationListDCI-0-1-r16 SetupRelease { PUSCH-TimeDomainResourceAllocationList-r16 }         OPTIONAL, -- Need M
pusch-RepTypeIndicatorDCI-0-1-r16       ENUMERATED { pusch-RepTypeA, pusch-RepTypeB}                        OPTIONAL, -- Need R
priorityIndicatorDCI-0-1-r16           ENUMERATED { enabled}                                            OPTIONAL, -- Need S
frequencyHoppingDCI-0-1-r16            ENUMERATED {interRepetition, interSlot}                   OPTIONAL, -- Cond RepTypeB
uci-OnPUSCH-ListDCI-0-1-r16            SetupRelease { UCI-OnPUSCH-ListDCI-0-1-r16 }             OPTIONAL, -- Need M

-- Start of the parameters for DCI format 0_1 introduced in V16.1.0

pusch-PowerControl-v1610               SetupRelease { PUSCH-PowerControl-v1610}                       OPTIONAL, -- Need M
invalidSymbolPattern-r16               InvalidSymbolPattern-r16                                    OPTIONAL, -- Need S
ul-FullPowerTransmission-r16 ENUMERATED {fullpower, fullpowerModel1, fullpowerModel2} OPTIONAL, -- Need R
pusch-TimeDomainAllocationListForMultiPUSCH-r16 SetupRelease { PUSCH-TimeDomainResourceAllocationList-r16 } OPTIONAL, -- Need M
numberOfInvalidSymbolsForDL-UL-Switching-r16 INTEGER (1..4) OPTIONAL -- Cond RepTypeB2
}

UCI-OnPUSCH ::= SEQUENCE {
betaOffsets                             CHOICE {
dynamic                             SEQUENCE (SIZE (4)) OF BetaOffsets,

semiStatic                          BetaOffsets }
scaling                                 ENUMERATED { f0p5, f0p65, f0p8, f1 } }

MinSchedulingOffsetK2-Values-r16 ::= SEQUENCE {SIZE (1..maxNrOfMinSchedulingOffsetValues-r16)} OF INTEGER {0..maxK2-SchedulingOffset-r16}

UCI-OnPUSCH-DCI-0-2-r16 ::= SEQUENCE {
betaOffsetsDCI-0-2-r16                  CHOICE {
dynamicDCI-0-2-r16                      CHOICE {
oneBit-r16                              SEQUENCE (SIZE (2)) OF BetaOffsets,
twoBits-r16                             SEQUENCE (SIZE (4)) OF BetaOffsets


semiStaticDCI-0-2-r16                  BetaOffsets }
scalingDCI-0-2-r16                 ENUMERATED { f0p5, f0p65, f0p8, f1 } }

FrequencyHoppingOffsetListsDCI-0-2-r16 ::= SEQUENCE {SIZE (1..4)} OF INTEGER {1..maxNrofPhysicalResourceBlocks-1}

UCI-OnPUSCH-ListDCI-0-2-r16 ::= SEQUENCE {SIZE (1..2)} OF UCI-OnPUSCH-DCI-0-2-r16

UL-AccessConfigListDCI-0-1-r16 ::= SEQUENCE {SIZE (1..64)} OF INTEGER {0..63}

-- TAG-PUSCH-CONFIG-STOP
-- ASN1STOP
## PUSCH-Config field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>antennaPortsFieldPresenceDCI-0-2</code></td>
<td>Configure the presence of &quot;Antenna ports&quot; field in DCI format 0_2. When the field is configured, then the &quot;Antenna ports&quot; field is present in DCI format 0_2. Otherwise, the field size is set to 0 for DCI format 0_2 (see TS 38.212 [17], clause 7.3.1.1.3). If neither <code>dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2</code> nor <code>dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2</code> is configured, this field is absent.</td>
</tr>
<tr>
<td><code>codebookSubset, codebookSubsetDCI-0-2</code></td>
<td>Subset of PMIs addressed by TPMI, where PMIs are those supported by UEs with maximum coherence capabilities (see TS 38.214 [19], clause 6.1.1.1). The field <code>codebookSubset</code> applies to DCI format 0_1 and the field <code>codebookSubsetDCI-0-2</code> applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.1.1).</td>
</tr>
<tr>
<td><code>dataScramblingIdentityPUSCH</code></td>
<td>Identifier used to initialize data scrambling (<code>c_init</code>) for PUSCH. If the field is absent, the UE applies the physical cell ID. (see TS 38.211 [16], clause 6.3.1.1).</td>
</tr>
<tr>
<td><code>dmrs-SequencelnitializationDCI-0-2</code></td>
<td>Configure whether the field &quot;DMRS Sequence Initialization&quot; is present or not in DCI format 0_2. If the field is absent, then 0 bit for the field &quot;DMRS Sequence Initialization&quot; in DCI format 0_2. If the field is present, then the number of bits is determined in the same way as DCI format 0_1. (see TS 38.212 [17], clause 7.3.1).</td>
</tr>
<tr>
<td><code>dmrs-UplinkForPUSCH-MappingTypeA, dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2</code></td>
<td>DMRS configuration for PUSCH transmissions using PUSCH mapping type A (chosen dynamically via <code>PUSCH-TimeDomainResourceAllocation</code>). Only the fields <code>dmrs-Type</code>, <code>dmrs-AdditionalPosition</code> and <code>maxLength</code> may be set differently for mapping type A and B. The field <code>dmrs-UplinkForPUSCH-MappingTypeA</code> applies to DCI format 0_1 and the field <code>dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2</code> applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1).</td>
</tr>
<tr>
<td><code>dmrs-UplinkForPUSCH-MappingTypeB, dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2</code></td>
<td>DMRS configuration for PUSCH transmissions using PUSCH mapping type B (chosen dynamically via <code>PUSCH-TimeDomainResourceAllocation</code>). Only the fields <code>dmrs-Type</code>, <code>dmrs-AdditionalPosition</code> and <code>maxLength</code> may be set differently for mapping type A and B. The field <code>dmrs-UplinkForPUSCH-MappingTypeB</code> applies to DCI format 0_1 and the field <code>dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2</code> applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1).</td>
</tr>
<tr>
<td><code>frequencyHopping</code></td>
<td>The value <code>intraSlot</code> enables 'Intra-slot frequency hopping' and the value <code>interSlot</code> enables 'Inter-slot frequency hopping'. If the field is absent, frequency hopping is not configured for 'pusch-RepTypeA' (see TS 38.214 [19], clause 6.3). The field <code>frequencyHopping</code> applies to DCI format 0_0 and 0_1 for 'pusch-RepTypeA'.</td>
</tr>
<tr>
<td><code>frequencyHoppingDCI-0-1</code></td>
<td>Indicates the frequency hopping scheme for DCI format 0_1 when <code>pusch-RepTypeIndicatorDCI-0-1</code> is set to 'pusch-RepTypeB'. The value <code>interRepetition</code> enables 'Inter-repetition frequency hopping', and the value <code>intraSlot</code> enables 'Inter-slot frequency hopping'. If the field is absent, frequency hopping is not configured for DCI format 0_1 (see TS 38.214 [19], clause 6.1).</td>
</tr>
<tr>
<td><code>frequencyHoppingDCI-0-2</code></td>
<td>Indicates the frequency hopping scheme for DCI format 0_2. The value <code>intraSlot</code> enables 'Intra-slot frequency hopping', and the value <code>interSlot</code> enables 'Inter-slot frequency hopping', and the value <code>interRepetition</code> enables 'Inter-repetition frequency hopping'. If the field is absent, frequency hopping is not configured for DCI format 0_2 (see TS 38.214 [19], clause 6.3).</td>
</tr>
<tr>
<td><code>frequencyHoppingOffsetLists, frequencyHoppingOffsetListsDCI-0-2</code></td>
<td>Set of frequency hopping offsets used when frequency hopping is enabled for granted transmission (not msg3) and type 2 configured grant activation (see TS 38.214 [19], clause 6.3). The field <code>frequencyHoppingOffsetLists</code> applies to DCI format 0_0 and DCI format 0_1 and the field <code>frequencyHoppingOffsetListsDCI-0-2</code> applies to DCI format 0_2 (see TS 38.214 [19], clause 6.3).</td>
</tr>
<tr>
<td><code>harq-ProcessNumberSizeDCI-0-2</code></td>
<td>Configure the number of bits for the field &quot;HARQ process number&quot; in DCI format 0_2 (see TS 38.212 [17], clause 7.3.1).</td>
</tr>
<tr>
<td><code>invalidSymbolPattern</code></td>
<td>Indicates one pattern for invalid symbols for PUSCH transmission repetition type B applicable to both DCI format 0_1 and 0_2. If <code>InvalidSymbolPattern</code> is not configured, semi-static flexible symbols are used for PUSCH. Segmentation occurs only around semi-static DL symbols (see TS 38.214 [19] clause 6.1).</td>
</tr>
<tr>
<td><code>invalidSymbolPatternIndicatorDCI-0-1, invalidSymbolPatternIndicatorDCI-0-2</code></td>
<td>Indicates the presence of an additional bit in the DCI format 0_1/0_2. If <code>invalidSymbolPattern</code> is absent, then both <code>invalidSymbolPatternIndicatorDCI-0-1</code> and <code>invalidSymbolPatternIndicatorDCI-0-2</code> are absent. The field <code>invalidSymbolPatternIndicatorDCI-0-1</code> applies to the DCI format 0_1 and the field <code>invalidSymbolPatternIndicatorDCI-0-2</code> applies to DCI format 0_2 (see TS 38.214 [19] clause 6.1).</td>
</tr>
</tbody>
</table>
maxRank, maxRankDCI-0-2
Subset of PMIs addressed by TRIs from 1 to ULmaxRank (see TS 38.214 [19], clause 6.1.1.1). The field maxRank applies to DCI format 0_1 and the field maxRankDCI-0-2 applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.1.1).

mcs-Table, mcs-TableFormat0-2
Indicates which MCS table the UE shall use for PUSCH without transform precoder (see TS 38.214 [19], clause 6.1.4.1). The field mcs-Table applies to DCI format 0_0 and DCI format 0_1 and the field mcs-TableDCI-0-2 applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.4.1).

mcs-TableTransformPrecoder, mcs-TableTransformPrecoderDCI-0-2
Indicates which MCS table the UE shall use for PUSCH with transform precoding (see TS 38.214 [19], clause 6.1.4.1). The field mcs-TableTransformPrecoder applies to DCI format 0_0 and DCI format 0_1 and the field mcs-TableTransformPrecoderDCI-0-2 applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.4.1).

minimumSchedulingOffsetK2
List of minimum K2 values. Minimum K2 parameter denotes minimum applicable value(s) for the Time domain resource assignment table for PUSCH (see TS 38.214 [19], clause 6.1.2.1).

numberOfBitsRV-DCI-0-2
Configures the number of bits for “Redundancy version” in the DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.214 [19], clause 6.1.2.1).

numberOfInvalidSymbolsForDL-UL-Switching
Indicates the number of symbols after the last semi-static DL symbol that are invalid symbols for PUSCH repetition Type B. If it is absent, no symbol is explicitly defined for DL- to-UL switching (see TS 38.214 [19], clause 6.1).

priorityIndicatorDCI-0-1, priorityIndicatorDCI-0-2
Configures the presence of “priority indicator” in DCI format 0_1/0_2. When the field is absent in the IE, then the UE shall apply 0 bit for “Priority indicator” in DCI format 0_1/0_2. The field priorityIndicatorDCI-0-1 applies to DCI format 0_1 and the field priorityIndicatorDCI-0-2 applies to DCI format 0_2 (see TS 38.212 [17] clause 7.3.1 and TS 38.213 [13] clause 9).

pusch-AggregationFactor
Number of repetitions for data (see TS 38.214 [19], clause 6.1.2.1). If the field is absent the UE applies the value 1.

pusch-RepTypeIndicatorDCI-0-1, pusch-RepTypeIndicatorDCI-0-2
Indicates whether UE follows the behavior for “PUSCH repetition type A” or the behavior for “PUSCH repetition type B” for the PUSCH scheduled by DCI format 0_1/0_2 and for Type 2 CG associated with the activating DCI format 0_1/0_2. The value pusch-RepTypeA enables the ‘PUSCH repetition type A’ and the value pusch-RepTypeB enables the ‘PUSCH repetition type B’. The field pusch-RepTypeIndicatorDCI-0-1 applies to DCI format 0_1 and the field pusch-RepTypeIndicatorDCI-0-2 applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.2).

pusch-TimeDomainAllocationList
List of time domain allocations for timing of UL assignment to UL data (see TS 38.214 [19], table 6.1.2.1.1-1). The field pusch-TimeDomainAllocationList applies to DCI formats 0_0 or DCI format 0_1 when the field pusch-TimeDomainAllocationListDCI-0-1 is not configured (see TS 38.214 [19], table 6.1.2.1.1-1 and table 6.1.2.1.1-1A). The network does not configure the pusch-TimeDomainAllocationList (without suffix) simultaneously with the pusch-TimeDomainAllocationListDCI-0-2-r16 or pusch-TimeDomainAllocationListDCI-0-1-r16 or pusch-TimeDomainAllocationListForMultiPUSCH-r16.

pusch-TimeDomainAllocationListDCI-0-1
Configuration of the time domain resource allocation (TDRA) table for DCI format 0_1 (see TS 38.214 [19], clause 6.1, table 6.1.2.1.1-1A).

pusch-TimeDomainAllocationListDCI-0-2
Configuration of the time domain resource allocation (TDRA) table for DCI format 0_2 (see TS 38.214 [19], clause 6.1.2, table 6.1.2.1.1-1B).

pusch-TimeDomainAllocationListForMultiPUSCH
Configuration of the time domain resource allocation (TDRA) table for multiple PUSCH (see TS 38.214 [19], clause 6.1.2). The network configures at most 16 rows in this TDRA table in PUSCH-TimeDomainResourceAllocationList-r16 configured by this field.

rbg-Size
Selection between configuration 1 and configuration 2 for RBG size for PUSCH. The UE does not apply this field if resourceAllocation is set to resourceAllocationType1. Otherwise, the UE applies the value config1 when the field is absent (see TS 38.214 [19], clause 6.1.2.2.1).

resourceAllocation, resourceAllocationDCI-0-2
Configuration of resource allocation type 0 and resource allocation type 1 for non-fallback DCI (see TS 38.214 [19], clause 6.1.2). The field resourceAllocation applies to DCI format 0_1 and the field resourceAllocationDCI-0-2 applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.2).
<table>
<thead>
<tr>
<th><strong>resourceAllocationType1GranularityDCI-0-2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Configures the scheduling granularity applicable for both the starting point and length indication for resource allocation type 1 in DCI format 0_2. If this field is absent, the granularity is 1 PRB (see TS 38.214 [19], clause 6.1.2.2.2).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>tp-pi2BPSK</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Enables pi/2-BPSK modulation with transform precoding if the field is present and disables it otherwise.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>transformPrecoder</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The UE specific selection of transformer precoder for PUSCH (see TS 38.214 [19], clause 6.1.3). When the field is absent the UE applies the value of the field msg3-transformPrecoder.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>txConfig</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Whether UE uses codebook based or non-codebook based transmission (see TS 38.214 [19], clause 6.1.1). If the field is absent, the UE transmits PUSCH on one antenna port, see TS 38.214 [19], clause 6.1.1.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>uci-OnPUSCH-ListDCI-0-1, uci-OnPUSCH-ListDCI-0-2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration for up to 2 HARQ-ACK codebooks specific to DCI format 0_1/0_2. The field uci-OnPUSCH-ListDCI-0-1 applies to DCI format 0_1 and the field uci-OnPUSCH-ListDCI-0-2 applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13] clause 9.3).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ul-AccessConfigListDCI-0-1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>List of the combinations of cyclic prefix extension, channel access priority class (CAPC), and UL channel access type (see TS 38.212 [17], Table 7.3.1.1.2-35).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ul-FullPowerTransmission</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Configures the UE with UL full power transmission mode as specified in TS 38.213.</td>
</tr>
</tbody>
</table>

### UCI-OnPUSCH field descriptions

<table>
<thead>
<tr>
<th><strong>betaOffsets</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection between and configuration of dynamic and semi-static beta-offset for DCI formats other than DCI format 0_2. If the field is not configured, the UE applies the value 'semiStatic' (see TS 38.213 [13], clause 9.3).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>scaling</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicates a scaling factor to limit the number of resource elements assigned to UCI on PUSCH for DCI formats other than DCI format 0_2. Value f0p5 corresponds to 0.5, value f0p65 corresponds to 0.65, and so on. The value configured herein is applicable for PUSCH with configured grant (see TS 38.212 [17], clause 6.3).</td>
</tr>
</tbody>
</table>

### UCI-OnPUSCH-DCI-0-2 field descriptions

<table>
<thead>
<tr>
<th><strong>betaOffsetsDCI-0-2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration of beta-offset for DCI format 0_2. If semiStaticDCI-0-2 is chosen, the UE shall apply the value of 0 bit for the field of beta offset indicator in DCI format 0_2. If dynamicDCI-0-2 is chosen, the UE shall apply the value of 1 bit or 2 bits for the field of beta offset indicator in DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13] clause 9.3).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>dynamicDCI-0-2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicates the UE applies the value 'dynamic' for DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.3).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>semiStaticDCI-0-2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicates the UE applies the value 'semiStatic' for DCI format 0_2. (see TS 38.212 [17], clause 7.3.1 and see TS 38.213 [13], clause 9.3).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>scalingDCI-0-2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicates a scaling factor to limit the number of resource elements assigned to UCI on PUSCH for DCI format 0_2. Value f0p5 corresponds to 0.5, value f0p65 corresponds to 0.65, and so on (see TS 38.212 [17], clause 6.3).</td>
</tr>
</tbody>
</table>
Conditional Presence | Explanation
--- | ---
**codebookBased** | The field is mandatory present if txConfig is set to codebook and absent otherwise.
**RepTypeB** | The field is optionally present, Need S, if pusch-RepTypeIndicatorDCI-0-1 is set to pusch-RepTypeB. It is absent otherwise.
**RepTypeB2** | The field is optionally present, Need S, if pusch-RepTypeIndicatorDCI-0-1 or pusch-RepTypeIndicatorDCI-0-2 is set to pusch-RepTypeB. It is absent otherwise.

---

**PUSCH-ConfigCommon**

The IE **PUSCH-ConfigCommon** is used to configure the cell specific PUSCH parameters.

**PUSCH-ConfigCommon** information element

```asn1
PUSCH-ConfigCommon ::= SEQUENCE {
  groupHoppingEnabledTransformPrecoding     ENUMERATED {enabled} OPTIONAL, -- Need R
  pusch-TimeDomainAllocationList           PUSCH-TimeDomainResourceAllocationList OPTIONAL, -- Need R
  msg3-DeltaPreamble                       INTEGER {-1..6} OPTIONAL, -- Need R
  p0-NominalWithGrant                      INTEGER {-202..24} OPTIONAL, -- Need R
  ...
}
```

**PUSCH-ConfigCommon** field descriptions

**groupHoppingEnabledTransformPrecoding**
For DMRS transmission with transform precoder, the NW may configure group hopping by this cell-specific parameter, see TS 38.211 [16], clause 6.4.1.1.1.2.

**msg3-DeltaPreamble**
Power offset between msg3 and RACH preamble transmission. Actual value = field value * 2 [dB] (see TS 38.213 [13], clause 7.1)

**p0-NominalWithGrant**
P0 value for PUSCH with grant (except msg3). Value in dBm. Only even values (step size 2) allowed (see TS 38.213 [13], clause 7.1) This field is cell specific

**pusch-TimeDomainAllocationList**
List of time domain allocations for timing of UL assignment to UL data (see TS 38.214 [19], table 6.1.2.1.1-1).

---

**PUSCH-PowerControl**

The IE **PUSCH-PowerControl** is used to configure UE specific power control parameter for PUSCH.

**PUSCH-PowerControl** information element

```asn1
PUSCH-PowerControl ::= ...
```

---
PUSCH-PowerControl ::= SEQUENCE {
    tpc-Accumulation            ENUMERATED { disabled } OPTIONAL, -- Need S
    msg3-Alpha                  Alpha OPTIONAL, -- Need S
    p0-NominalWithoutGrant      INTEGER (-202..24) OPTIONAL, -- Need M
    p0-AlphaSets                SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF P0-PUSCH-AlphaSet OPTIONAL, -- Need M
    pathlossReferenceRSToAddModList SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSs)) OF PUSCH-PathlossReferenceRS OPTIONAL, -- Need N
    pathlossReferenceRSToReleaseList SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSs)) OF PUSCH-PathlossReferenceRS-Id OPTIONAL, -- Need N
    twoPUSCH-PC-AdjustmentStates ENUMERATED { twoStates } OPTIONAL, -- Need S
    deltaMCS                     ENUMERATED { enabled } OPTIONAL, -- Need S
    sri-PUSCH-MappingToAddModList SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF SRI-PUSCH-PowerControl OPTIONAL, -- Need N
    sri-PUSCH-MappingToReleaseList SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF SRI-PUSCH-PowerControlId OPTIONAL  -- Need N
}

P0-PUSCH-AlphaSet ::= SEQUENCE {
    p0-PUSCH-AlphasetId         P0-PUSCH-AlphasetId, OPTIONAL, -- Need S
    p0                       INTEGER (-16..15) OPTIONAL, -- Need S
    alpha                     Alpha OPTIONAL  -- Need S
}

P0-PUSCH-AlphasetId ::= INTEGER (0..maxNrofP0-PUSCH-Alphasets-1)

PUSCH-PathlossReferenceRS ::= SEQUENCE {
    pusch-PathlossReferenceRs-Id  PUSCH-PathlossReferenceRS-Id, OPTIONAL, -- Need S
    referenceSignal              CHOICE {
        ssb-Index                  SSB-Index, OPTIONAL, -- Need S
        csi-RS-Index               NZP-CSI-RS-ResourceIndex OPTIONAL, -- Need S
    }
}

PUSCH-PathlossReferenceRS-r16 ::= SEQUENCE {
    pusch-PathlossReferenceRs-Id-r16    PUSCH-PathlossReferenceRS-Id-v1610, OPTIONAL, -- Need S
    referenceSignal-r16                CHOICE {
        ssb-Index-r16              SSB-Index, OPTIONAL, -- Need S
        csi-RS-Index-r16           NZP-CSI-RS-ResourceIndex OPTIONAL, -- Need S
    }
}

PUSCH-PathlossReferenceRS-Id ::= INTEGER (0..maxNrofPUSCH-PathlossReferenceRSs-1)

PUSCH-PathlossReferenceRS-Id-v1610 ::= INTEGER (maxNrofPUSCH-PathlossReferenceRSs..maxNrofPUSCH-PathlossReferenceRSs-1-r16)

SRI-PUSCH-PowerControl ::= SEQUENCE {
    sri-PUSCH-PowerControlId                SRI-PUSCH-PowerControlId, OPTIONAL, -- Need S
    sri-PUSCH-PathlossReferenceRs-Id        PUSCH-PathlossReferenceRS-Id, OPTIONAL, -- Need S
    sri-P0-PUSCH-AlphasetId                P0-PUSCH-AlphasetId, OPTIONAL, -- Need S
    sri-PUSCH-ClosedLoopIndex              ENUMERATED { 0, 1 } OPTIONAL, -- Need S
}

SRI-PUSCH-PowerControlId ::= INTEGER (0..maxNrofSRI-PUSCH-Mappings-1)
PUSCH-PowerControl-v1610 ::= SEQUENCE {
  pathlossReferenceRSToAddModList2-r16  SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSsDiff-r16)) OF PUSCH-PathlossReferenceRS-r16
    OPTIONAL, -- Need N
  pathlossReferenceRSToReleaseList2-r16 SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSsDiff-r16)) OF PUSCH-PathlossReferenceRS-r16
    OPTIONAL, -- Need N
  p0-PUSCH-SetList-r16  SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF P0-PUSCH-Set-r16
    OPTIONAL, -- Need N
  olpc-ParameterSet               SEQUENCE {
    olpc-ParameterSetDCI-0-1-r16     INTEGER (1..2)
      OPTIONAL, -- Need R
    olpc-ParameterSetDCI-0-2-r16     INTEGER (1..2)
      OPTIONAL, -- Need R
  }                                                 OPTIONAL, -- Need M
  ...                                          }
}

P0-PUSCH-Set-r16 ::= SEQUENCE {
  p0-PUSCH-SetId-r16                  P0-PUSCH-SetId-r16,
  p0-List-r16                         SEQUENCE (SIZE (1..maxNrofP0-PUSCH-Set-r16)) OF P0-PUSCH-r16
    OPTIONAL, -- Need R
  ...                                          }
}

P0-PUSCH-SetId-r16 ::= INTEGER (0..maxNrofSRI-PUSCH-Mappings-1)

P0-PUSCH-r16 ::= INTEGER (-16..15)

-- TAG-PUSCH-POWERCONTROL-STOP
-- ASN1STOP

### P0-PUSCH-AlphaSet field descriptions

**alpha**

alpha value for PUSCH with grant (except msg3) (see TS 38.213 [13], clause 7.1). When the field is absent the UE applies the value 1.

**p0**

P0 value for PUSCH with grant (except msg3) in steps of 1dB (see TS 38.213 [13], clause 7.1). When the field is absent the UE applies the value 0.

### P0-PUSCH-Set field descriptions

**p0-List**

Configuration of (p0-PUSCH, p0-PUSCH) sets for PUSCH. If SRI is present in the DCI, then one p0-PUSCH can be configured in P0-PUSCH-Set. If SRI is not present in the DCI, and both olpc-ParameterSetDCI-0-1 and olpc-ParameterSetDCI-0-2 are configured to be 1 bit, then one p0-PUSCH can be configured in P0-PUSCH-Set. If SRI is not present in the DCI, and if any of olpc-ParameterSetDCI-0-1 and olpc-ParameterSetDCI-0-2 is configured to be 2 bits, then two p0-PUSCH values can be configured in P0-PUSCH-Set (see TS 38.213 [13] clause 7 and TS 38.212 [17] clause 7.3.1).

**p0-PUSCH-SetId**

**PUSCH-PowerControl field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>deltaMCS</td>
<td>Indicates whether to apply delta MCS. When the field is absent, the UE applies $K_s = 0$ in delta_TFC formula for PUSCH (see TS 38.213 [13], clause 7.1).</td>
</tr>
<tr>
<td>msg3-Alpha</td>
<td>Dedicated alpha value for msg3 PUSCH (see TS 38.213 [13], clause 7.1). When the field is absent the UE applies the value 1.</td>
</tr>
<tr>
<td>olpc-ParameterSetDCI-0-1, olpc-ParameterSetDCI-0-2</td>
<td>Configures the number of bits for Open-loop power control parameter set indication for DCI format 0_1/0_2 in case SRI is not configured in the DCI. 2 bits is applicable only if SRI is not present in the DCI format 0_1. The field olpc-ParameterSetDCI-0-1 applies to DCI format 0_1 and the field olpc-ParameterSetDCI-0-2 applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 11).</td>
</tr>
<tr>
<td>p0-AlphaSets</td>
<td>configuration {p0-pusch, alpha} sets for PUSCH (except msg3), i.e., { {p0, alpha, index1}, {p0, alpha, index2},...} (see TS 38.213 [13], clause 7.1). When no set is configured, the UE uses the P0-nominal for msg3 PUSCH, P0-UE is set to 0 and alpha is set according to msg3-Alpha configured for msg3 PUSCH.</td>
</tr>
<tr>
<td>p0-NominalWithoutGrant</td>
<td>P0 value for UL grant-free/SPS based PUSCH. Value in dBm. Only even values (step size 2) allowed (see TS 38.213 [13], clause 7.1).</td>
</tr>
<tr>
<td>p0-PUSCH-SetList</td>
<td>Configure one additional P0-PUSCH-Set per SRI. If present, the one bit or 2 bits in the DCI is used to dynamically indicate among the P0 value from the existing P0-PUSCH-AlphaSet and the P0 value(s) from the P0-PUSCH-Set (See TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 17).</td>
</tr>
<tr>
<td>pathlossReferenceRSToAddModList, pathlossReferenceRSToAddModList2</td>
<td>A set of Reference Signals (e.g. a CSI-RS config or a SS block) to be used for PUSCH path loss estimation. The set consists of Reference Signals configured using pathlossReferenceRSToAddModList and Reference Signals configured using pathlossReferenceRSToAddModList2. Up to maxNrofPUSCH-PathlossReferenceRSSs may be configured (see TS 38.213 [13], clause 7.1).</td>
</tr>
<tr>
<td>sri-PUSCH-MappingToAddModList</td>
<td>A list of SRI-PUSCH-PowerControl elements among which one is selected by the SRI field in DCI (see TS 38.213 [13], clause 7.1).</td>
</tr>
<tr>
<td>tpc-Accumulation</td>
<td>If enabled, UE applies TPC commands via accumulation. If not enabled, UE applies the TPC command without accumulation. If the field is absent, TPC accumulation is enabled (see TS 38.213 [13], clause 7.1).</td>
</tr>
<tr>
<td>twoPUSCH-PC-AdjustmentStates</td>
<td>Number of PUSCH power control adjustment states maintained by the UE (i.e., $f_c(i)$). If the field is present (n2) the UE maintains two power control states (i.e., $f_c(i,0)$ and $f_c(i,1)$). If the field is absent, it maintains one power control state (i.e., $f_c(i,0)$) (see TS 38.213 [13], clause 7.1).</td>
</tr>
</tbody>
</table>

**SRI-PUSCH-PowerControl field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sri-P0-PUSCH-AlphaSetId</td>
<td>The ID of a P0-PUSCH-AlphaSet as configured in p0-AlphaSets in PUSCH-PowerControl.</td>
</tr>
<tr>
<td>sri-PUSCH-ClosedLoopIndex</td>
<td>The index of the closed power control loop associated with this SRI-PUSCH-PowerControl.</td>
</tr>
<tr>
<td>sri-PUSCH-PathlossReferenceRS-Id</td>
<td>The ID of PUSCH-PathlossReferenceRS as configured in the pathlossReferenceRSToAddModList in PUSCH-PowerControl.</td>
</tr>
<tr>
<td>sri-PUSCH-PowerControlId</td>
<td>The ID of this SRI-PUSCH-PowerControl configuration. It is used as the codepoint (payload) in the SRI DCI field.</td>
</tr>
</tbody>
</table>

**– PUSCH-ServingCellConfig**

The IE PUSCH-ServingCellConfig is used to configure UE specific PUSCH parameters that are common across the UE's BWPs of one serving cell.
**PUSCH-ServingCellConfig** information element

-- ASN1START
-- TAG-PUSCH-SERVINGCELLCONFIG-START

PUSCH-ServingCellConfig ::= SEQUENCE {
  codeBlockGroupTransmission SetupRelease { PUSCH-CodeBlockGroupTransmission } OPTIONAL, -- Need M
  rateMatching ENUMERATED {limitedBufferRM} OPTIONAL, -- Need S
  xOverhead ENUMERATED {xoh6, xoh12, xoh18} OPTIONAL, -- Need S
...
[[
  maxMIMO-Layers INTEGER (1..4) OPTIONAL, -- Need M
  processingType2Enabled BOOLEAN OPTIONAL -- Need M
]
][[
  maxMIMO-LayersDCI-0-2-r16 SetupRelease { MaxMIMO-LayersDCI-0-2-r16} OPTIONAL -- Need M
]]
}

PUSCH-CodeBlockGroupTransmission ::= SEQUENCE {
  maxCodeBlockGroupsPerTransportBlock ENUMERATED {n2, n4, n6, n8},
  ...
}

MaxMIMO-LayersDCI-0-2-r16 ::= INTEGER (1..4)

-- TAG-PUSCH-SERVINGCELLCONFIG-STOP
-- ASN1STOP

---

**PUSCH-CodeBlockGroupTransmission** field descriptions

*maxCodeBlockGroupsPerTransportBlock*

Maximum number of code-block-groups (CBGs) per TB (see TS 38.213 [13], clause 9.1).
**PUSCH-ServingCellConfig field descriptions**

**codeBlockGroupTransmission**
Enables and configures code-block-group (CBG) based transmission (see TS 38.214 [19], clause 5.1.5).

**maxMIMO-Layers**
Indicates the maximum MIMO layer to be used for PUSCH in all BWPs of the normal UL of this serving cell (see TS 38.212 [17], clause 5.4.2.1). If present, the network sets maxRank to the same value. For SUL, the maximum number of MIMO layers is always 1, and network does not configure this field. The field maxMIMO-Layers refers to DCI format 0_1.

**processingType2Enabled**
Enables configuration of advanced processing time capability 2 for PUSCH (see 38.214 [19], clause 6.4).

**rateMatching**
Enables LBRM (Limited buffer rate-matching). When the field is absent the UE applies FBRM (Full buffer rate-matching LBRM) (see TS 38.212 [17], clause 5.4.2). xOverhead
If the field is absent, the UE applies the value 'xoh0' (see TS 38.214 [19], clause 5.1.3.2).

**maxMIMO-LayersDCI-0-2**
Indicates the maximum MIMO layer to be used for PUSCH for DCI format 0_2 in all BWPs of the normal UL of this serving cell (see TS 38.212 [17], clause 5.4.2.1). If present, the network sets maxRankDCI-0-2 to the same value. For SUL, the maximum number of MIMO layers is always 1, and network does not configure this field.

---

**PUSCH-TimeDomainResourceAllocationList**

The IE PUSCH-TimeDomainResourceAllocation is used to configure a time domain relation between PDCCH and PUSCH. PUSCH-TimeDomainResourceAllocationList contains one or more of such PUSCH-TimeDomainResourceAllocations. The network indicates in the UL grant which of the configured time domain allocations the UE shall apply for that UL grant. The UE determines the bit width of the DCI field based on the number of entries in the PUSCH-TimeDomainResourceAllocationList. Value 0 in the DCI field refers to the first element in this list, value 1 in the DCI field refers to the second element in this list, and so on.

**PUSCH-TimeDomainResourceAllocation information element**

```asn1
-- ASN1START
-- TAG--PUSCH-TIMEDOMAINRESOURCEALLOCATIONLIST--START

PUSCH-TimeDomainResourceAllocationList ::= SEQUENCE { size(1..maxNrofUL-Allocations) } OF PUSCH-TimeDomainResourceAllocation

PUSCH-TimeDomainResourceAllocation ::= SEQUENCE { k2 INTEGER(0..32), OPTIONAL, -- Need S mappingType ENUMERATED {typeA, typeB}, startSymbolAndLength INTEGER(0..127) }

PUSCH-TimeDomainResourceAllocationList-r16 ::= SEQUENCE { size(1..maxNrofUL-Allocations-r16) } OF PUSCH-TimeDomainResourceAllocation-r16

PUSCH-TimeDomainResourceAllocation-r16 ::= SEQUENCE { k2-r16 INTEGER(0..32), OPTIONAL, -- Need S puschAllocationList-r16 size(1..maxNrofMultiplePUSCHs-r16) } OF PUSCH-Allocation-r16

PUSCH-Allocation-r16 ::= SEQUENCE { mappingType-r16 ENUMERATED {typeA, typeB}, OPTIONAL, -- Cond NotFormat01-02-Or-TypeA
```

---

ETSI
PUSCH-TimeDomainResourceAllocationList field descriptions

k2
Corresponds to L1 parameter 'K2' (see TS 38.214 [19], clause 6.1.2.1) When the field is absent the UE applies the value 1 when PUSCH SCS is 15/30 kHz; the value 2 when PUSCH SCS is 60 kHz, and the value 3 when PUSCH SCS is 120KHz.

length
Indicates the length allocated for PUSCH for DCI format 0_1/0_2 (see TS 38.214 [19], clause 6.1.2.1).

mappingType
Mapping type (see TS 38.214 [19], clause 6.1.2.1).

numberOfRepetitions
Number of repetitions for DCI format 0_1/0_2 (see TS 38.214 [19], clause 6.1.2.1).

puschAllocationList
One or multiple PUSCH continuous in time domain which share a common k2 (see TS 38.214 [19], clause 6.1.2.1). This list only has one element in pusch-TimeDomainAllocationListDCI-0-1-r16 and in pusch-TimeDomainAllocationListDCI-0-2-r16.

startSymbol
Indicates the index of start symbol for PUSCH for DCI format 0_1/0_2 (see TS 38.214 [19], clause 6.1.2.1).

startSymbolAndLength
An index giving valid combinations of start symbol and length (jointly encoded) as start and length indicator (SLIV). The network configures the field so that the allocation does not cross the slot boundary. (see TS 38.214 [19], clause 6.1.2.1).

---

**Conditional Presence**

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format01-02</td>
<td>In pusch-TimeDomainAllocationListForMultiPUSCH-r16, the field is absent. In pusch-TimeDomainAllocationListDCI-0-1 and in pusch-TimeDomainAllocationListDCI-0-2, the field is mandatory present.</td>
</tr>
<tr>
<td>NotFormat01-02-Or-TypeA</td>
<td>In pusch-TimeDomainAllocationListForMultiPUSCH-r16, the field is mandatory present. In pusch-TimeDomainAllocationListDCI-0-1, the field is optionally present if pusch-RepTypeIndicatorDCI-0-1 is set to pusch-RepTypeA, Need R. It is absent otherwise, Need R. In pusch-TimeDomainAllocationListDCI-0-2, the field is optionally present if pusch-RepTypeIndicatorDCI-0-2 is set to pusch-RepTypeA, Need R. It is absent otherwise, Need R.</td>
</tr>
<tr>
<td>RepTypeB</td>
<td>In pusch-TimeDomainAllocationListForMultiPUSCH-r16, the field is absent. In pusch-TimeDomainAllocationListDCI-0-1, the field is optionally present if pusch-RepTypeIndicatorDCI-0-1 is set to pusch-RepTypeB, Need R. It is absent otherwise, Need R. In pusch-TimeDomainAllocationListDCI-0-2, the field is optionally present if pusch-RepTypeIndicatorDCI-0-2 is set to pusch-RepTypeB, Need R. It is absent otherwise, Need R.</td>
</tr>
</tbody>
</table>
The IE `PUSCH-TPC-CommandConfig` is used to configure the UE for extracting TPC commands for PUSCH from a group-TPC messages on DCI.

**PUSCH-TPC-CommandConfig information element**

```asn1
PUSCH-TPC-CommandConfig ::= SEQUENCE {
  tpc-Index                           INTEGER (1..15)  OPTIONAL,   -- Cond SUL
  tpc-IndexSUL                        INTEGER (1..15)  OPTIONAL,   -- Cond SUL-Only
  targetCell                          ServCellIndex   OPTIONAL,   -- Need S
  ...
}
```

**PUSCH-TPC-CommandConfig field descriptions**

- **targetCell**
  The serving cell to which the acquired power control commands are applicable. If the value is absent, the UE applies the TPC commands to the serving cell on which the command has been received.

- **tpc-Index**
  An index determining the position of the first bit of TPC command inside the DCI format 2-2 payload.

- **tpc-IndexSUL**
  An index determining the position of the first bit of TPC command inside the DCI format 2-2 payload.

**Conditional Presence**

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUL-Only</td>
<td>The field is optionally present. Need R, if <code>supplementaryUplink</code> is configured within <code>ServingCellConfig</code>. It is absent otherwise.</td>
</tr>
<tr>
<td>SUL</td>
<td>The field is optionally present. Need R, if <code>supplementaryUplink</code> is configured within <code>ServingCellConfig</code>. It is mandatory present otherwise.</td>
</tr>
</tbody>
</table>

**Q-OffsetRange**

The IE `Q-OffsetRange` is used to indicate a cell, beam or measurement object specific offset to be applied when evaluating candidates for cell re-selection or when evaluating triggering conditions for measurement reporting. The value is in dB. Value `dB-24` corresponds to -24 dB, `dB-22` corresponds to -22 dB and so on.

**Q-OffsetRange information element**

```asn1
Q-OffsetRange ::=      ENUMERATED {
  dB-24, dB-22, dB-20, dB-18, dB-16, dB-14,
}
```
The IE $Q$-$QualMin$ is used to indicate for cell selection/re-selection the required minimum received RSRQ level in the (NR) cell. Corresponds to parameter $Q_{\text{qualmin}}$ in TS 38.304 [20]. Actual value $Q_{\text{qualmin}} = \text{field value} \ [\text{dB}]$.

$Q$-$QualMin$ information element

```
Q-QualMin ::= INTEGER {-43..-12}
```

The IE $Q$-$RxLevMin$ is used to indicate for cell selection/re-selection the required minimum received RSRP level in the (NR) cell. Corresponds to parameter $Q_{\text{rxlevmin}}$ in TS 38.304 [20]. Actual value $Q_{\text{rxlevmin}} = \text{field value} \times 2 \ [\text{dBm}]$.

$Q$-$RxLevMin$ information element

```
Q-RxLevMin ::= INTEGER {-70..-22}
```

The IE $QuantityConfig$ specifies the measurement quantities and layer 3 filtering coefficients for NR and inter-RAT measurements.

$QuantityConfig$
QuantityConfig information element

```asn1
QuantityConfig ::= SEQUENCE {
  quantityConfigNR-List  SEQUENCE (SIZE (1..maxNrofQuantityConfig)) OF QuantityConfigNR  OPTIONAL, -- Need M
  ...,  
  [[
    quantityConfigEUTRA  FilterConfig
  ]],
  [[
    quantityConfigUTRA-FDD-r16  QuantityConfigUTRA-FDD-r16
    quantityConfigCLI-r16  FilterConfigCLI-r16
  ]]
}

QuantityConfigNR ::= SEQUENCE {
  quantityConfigCell  QuantityConfigRS,
  quantityConfigRS-Index  QuantityConfigRS  OPTIONAL  -- Need M
}

QuantityConfigRS ::= SEQUENCE {
  ssb-FilterConfig  FilterConfig,
  csi-RS-FilterConfig  FilterConfig
}

FilterConfig ::= SEQUENCE {
  filterCoefficientRSRP  FilterCoefficient  DEFAULT fc4,
  filterCoefficientRSRQ  FilterCoefficient  DEFAULT fc4,
  filterCoefficientRS-SINR  FilterCoefficient  DEFAULT fc4
}

FilterConfigCLI-r16 ::= SEQUENCE {
  filterCoefficientSRS-RSRP-r16  FilterCoefficient  DEFAULT fc4,
  filterCoefficientCLI-RSSI-r16  FilterCoefficient  DEFAULT fc4
}

QuantityConfigUTRA-FDD-r16 ::= SEQUENCE {
  filterCoefficientRSCP-r16  FilterCoefficient  DEFAULT fc4,
  filterCoefficientEcNO-r16  FilterCoefficient  DEFAULT fc4
}
```
QuantityConfigNR field descriptions

quantityConfigCell
Specifies L3 filter configurations for cell measurement results for the configurable RS Types (e.g. SS/PBCH block and CSI-RS) and the configurable measurement quantities (e.g. RSRP, RSRQ and SINR).

quantityConfigRS-Index
Specifies L3 filter configurations for measurement results per RS index for the configurable RS Types (e.g. SS/PBCH block and CSI-RS) and the configurable measurement quantities (e.g. RSRP, RSRQ and SINR).

QuantityConfigRS field descriptions

csi-RS-FilterConfig
CSI-RS based L3 filter configurations:
Specifies L3 filter configurations for CSI-RSRP, CSI-RSRQ and CSI-SINR measurement results from the L1 filter(s), as defined in TS 38.215 [9].

ssb-FilterConfig
SS Block based L3 filter configurations:
Specifies L3 filter configurations for SS-RSRP, SS-RSRQ and SS-SINR measurement results from the L1 filter(s), as defined in TS 38.215 [9].

QuantityConfigUTRA-FDD field descriptions

filterCoefficientRSCP
Specifies L3 filter coefficient for FDD UTRAN CPICH_RSCP measurement results from L1 filter.

filterCoefficientEcN0
Specifies L3 filter coefficient for FDD UTRAN CPICH_EcN0 measurement results from L1 filter.

— RACH-ConfigCommon

The IE RACH-ConfigCommon is used to specify the cell specific random-access parameters.

RACH-ConfigCommon information element

-- ASN1START
-- TAG-RACH-CONFIGCOMMON-START

RACH-ConfigCommon ::= SEQUENCE {
  rach-ConfigGeneric RACH-ConfigGeneric,
  totalNumberOfRA-Preambles INTEGER (1..63) OPTIONAL, -- Need S
  ssb-perRACH-OccasionAndCB-PreamblesPerSSB CHOICE {
    oneEighth ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
    oneFourth ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
    oneHalf ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
    one ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
    two ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
    four INTEGER (1..16),
    eight INTEGER (1..8),
    sixteen INTEGER (1..4) OPTIONAL, -- Need M
  }
} OPTIONAL, -- Need S

-- ASN1END

groupBconfigured
  ra-Msg3SizeGroupA
    ENUMERATED { b56, b144, b288, b256, b282, b480, b640, b800, b1000, b72, spare6, spare5, spare4, spare3, spare2, spare1 },
    ENUMERATED { minusinfinity, dB0, dB5, dB8, dB10, dB12, dB15, dB18 },
    INTEGER (1..64)
OPTIONAL, -- Need R
ra-ContentionResolutionTimer
  ENUMERATED { sf8, sf16, sf24, sf32, sf40, sf48, sf56, sf64 },
  OPTIONAL, -- Need R
rsrp-ThresholdSSB-SUL
  RSRP-Range
  OPTIONAL, -- Cond SUL
prach-RootSequenceIndex
  CHOICE { l839, l139 }
msg1-SubcarrierSpacing
  SubcarrierSpacing
  OPTIONAL, -- Cond L139
restrictedSetConfig
  ENUMERATED { unrestrictedSet, restrictedSetTypeA, restrictedSetTypeB },
  ENUMERATED { enabled },
  OPTIONAL, -- Need R
  ...
ra-PrioritizationForAccessIdentity-r16
  SEQUENCE { RA-Prioritization, BIT STRING (SIZE (2)) }
OPTIONAL, -- Cond InitialBWP-Only
prach-RootSequenceIndex-r16
  CHOICE { l571, l1151 }
OPTIONAL, -- Need R
}
**RACH-ConfigCommon field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>messagePowerOffsetGroupB</strong></td>
<td>Threshold for preamble selection. Value is in dB. Value <em>minus infinity</em> corresponds to –infinity. Value dB0 corresponds to 0 dB, dB5 corresponds to 5 dB and so on. (see TS 38.321 [3], clause 5.1.2)</td>
</tr>
<tr>
<td><strong>msg1-SubcarrierSpacing</strong></td>
<td>Subcarrier spacing of PRACH (see TS 38.211 [16], clause 5.3.2). Only the values 15 or 30 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. If absent, the UE applies the SCS as derived from the prach-ConfigurationIndex in RACH-ConfigGeneric (see tables Table 6.3.3.1-1 and Table 6.3.3.2-2, TS 38.211 [16]). The value also applies to contention free random access (RACH-ConfigDedicated), to SI-request and to contention-based beam failure recovery (CB-BFR). But it does not apply for contention free beam failure recovery (CF-BFR) (see BeamFailureRecoveryConfig).</td>
</tr>
<tr>
<td><strong>msg3-transformPrecoder</strong></td>
<td>Enables the transform precoder for Msg3 transmission according to clause 6.1.3 of TS 38.214 [19]. If the field is absent, the UE disables the transformer precoder (see TS 38.213 [13], clause 8.3).</td>
</tr>
<tr>
<td><strong>numberOfRA-PreamblesGroupA</strong></td>
<td>The number of CB preambles per SSB in group A. This determines implicitly the number of CB preambles per SSB available in group B. (see TS 38.321 [3], clause 5.1.1). The setting should be consistent with the setting of ssb-perRACH-OccasionAndCB-PreamblesPerSSB.</td>
</tr>
<tr>
<td><strong>prach-RootSequenceIndex</strong></td>
<td>PRACH root sequence index (see TS 38.211 [16], clause 6.3.3.1). The value range depends on whether (L=839) or (L=139) or (L=571) or (L=1151). The length of the root sequence corresponding with the index indicated in this IE should be consistent with the one indicated in prach-ConfigurationIndex in the RACH-ConfigDedicated (if configured). If prach-RootSequence/index-r16 is signalled, UE shall ignore the prach-RootSequenceIndex (without suffix).</td>
</tr>
<tr>
<td><strong>ra-ContentionResolutionTimer</strong></td>
<td>The initial value for the contention resolution timer (see TS 38.321 [3], clause 5.1.5). Value sf8 corresponds to 8 subframes, value sf16 corresponds to 16 subframes, and so on.</td>
</tr>
<tr>
<td><strong>ra-Msg3SizeGroupA</strong></td>
<td>Transport Blocks size threshold in bits below which the UE shall use a contention-based RA preamble of group A. (see TS 38.321 [3], clause 5.1.2).</td>
</tr>
<tr>
<td><strong>ra-Prioritization</strong></td>
<td>Parameters which apply for prioritized random access procedure on any UL BWP of SpCell for specific Access Identities (see TS 38.321 [3], clause 5.1.1a).</td>
</tr>
<tr>
<td><strong>ra-PrioritizationForAI</strong></td>
<td>Indicates whether the field ra-Prioritization-r16 applies for Access Identities. The first/leftmost bit corresponds to Access Identity 1, the next bit corresponds to Access Identity 2. Value 1 indicates that the field ra-Prioritization-r16 applies otherwise the field does not apply (see TS 23.501 [32]).</td>
</tr>
<tr>
<td><strong>rach-ConfigGeneric</strong></td>
<td>RACH parameters for both regular random access and beam failure recovery.</td>
</tr>
<tr>
<td><strong>restrictedSetConfig</strong></td>
<td>Configuration of an unrestricted set or one of two types of restricted sets, see TS 38.211 [16], clause 6.3.3.1.</td>
</tr>
<tr>
<td><strong>rsrp-ThresholdSSB</strong></td>
<td>UE may select the SS block and corresponding PRACH resource for path-loss estimation and (re)transmission based on SS blocks that satisfy the threshold (see TS 38.213 [13]).</td>
</tr>
<tr>
<td><strong>rsrp-ThresholdSSB-SUL</strong></td>
<td>The UE selects SUL carrier to perform random access based on this threshold (see TS 38.321 [3], clause 5.1.1). The value applies to all the BWPs.</td>
</tr>
<tr>
<td><strong>ssb-perRACH-OccasionAndCB-PreamblesPerSSB</strong></td>
<td>The meaning of this field is twofold: the CHOICE conveys the information about the number of SSBs per RACH occasion. Value oneEighth corresponds to one SSB associated with 8 RACH occasions, value oneFourth corresponds to one SSB associated with 4 RACH occasions, and so on. The ENUMERATED part indicates the number of Contention Based preambles per SSB. Value n4 corresponds to 4 Contention Based preambles per SSB, value n8 corresponds to 8 Contention Based preambles per SSB, and so on. The total number of CB preambles in a RACH occasion is given by CB-preambles-per-SSB * max(1, SSB-per-rach-occasion). See TS 38.213 [13].</td>
</tr>
<tr>
<td><strong>totalNumberOfRA-Preambles</strong></td>
<td>Total number of preambles used for contention based and contention free 4-step or 2-step random access in the RACH resources defined in RACH-ConfigCommon, excluding preambles used for other purposes (e.g. for SI request). If the field is absent, all 64 preambles are available for RA. The setting should be consistent with the setting of ssb-perRACH-OccasionAndCB-PreamblesPerSSB, i.e. it should be a multiple of the number of SSBs per RACH occasion.</td>
</tr>
<tr>
<td>Conditional Presence</td>
<td>Explanation</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>L139</td>
<td>The field is mandatory present if <code>prach-RootSequenceIndex</code> ( \leq 139 ), otherwise the field is absent, Need S.</td>
</tr>
<tr>
<td>SUL</td>
<td>The field is mandatory present in <code>initialUplinkBWP</code> if <code>supplementaryUplink</code> is configured in <code>ServingCellConfigCommonSIB</code> or if <code>supplementaryUplinkConfig</code> is configured in <code>ServingCellConfigCommon</code>; otherwise, the field is absent.</td>
</tr>
<tr>
<td>InitialBWP-Only</td>
<td>This field is optionally present, Need R, if this BWP is the initial BWP of SpCell. Otherwise the field is absent.</td>
</tr>
</tbody>
</table>

---

**RACH-ConfigCommonTwoStepRA**

The IE `RACH-ConfigCommonTwoStepRA` is used to specify cell specific 2-step random-access type parameters.

---

**RACH-ConfigCommonTwoStepRA information element**

```asn1
-- ASN1START
-- TAG-RACH-CONFIGCOMMONTWOSTEPRA-START

RACH-ConfigCommonTwoStepRA-r16 ::= SEQUENCE {
  rach-ConfigGenericTwoStepRA-r16,  -- OPTIONAL, -- Need S
  msgA-TotalNumberOfRA-Preambles-r16   INTEGER (1..63) OPTIONAL, -- Cond 2StepOnly
  msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB-r16
    oneEighth    ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
    oneFourth    ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
    oneHalf      ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
    one          ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
    two          ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32},
    four         ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32},
    eight        ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32},
    sixteen      ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32},
  msgA-CB-PreamblesPerSSB-PerSharedRO-r16   INTEGER (1..60) OPTIONAL, -- Cond SharedRO
  msgA-SSB-SharedRO-MaskIndex-r16           INTEGER (1..15) OPTIONAL, -- Need S
  groupB-ConfiguredTwoStepRA-r16           GroupB-ConfiguredTwoStepRA-r16 OPTIONAL, -- Need S
  msga-PRACH-RootSequenceIndex-r16         CHOICE {
    l839       INTEGER (0..837),
    l139       INTEGER (0..137),
    l571       INTEGER (0..569),
    l1151      INTEGER (0..1149)
  } OPTIONAL, -- Cond 2StepOnly
  msga-TransMax-r16                        ENUMERATED {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200} OPTIONAL, -- Cond 2Step4Step
  msga-RSRP-Threshold-r16                  RSRP-Range OPTIONAL, -- Cond 2StepOnly
  msga-RSRP-ThresholdSSB-r16               RSRP-Range OPTIONAL, -- Cond SharedRO
  msga-SubcarrierSpacing-r16               SubcarrierSpacing OPTIONAL, -- Cond 2StepOnly
  msga-RestrictedSetConfig-r16             ENUMERATED {unrestrictedSet, restrictedSetTypeA, restrictedSetTypeB} OPTIONAL, -- Cond 2StepOnly
  ra-PrioritizationForAccessIdentityTwoStep-r16
    ra-Prioritization-r16   RA-Prioritization,  BIT STRING (SIZE (2))
} OPTIONAL, -- Cond 2StepOnly
```

---

3GPP TS 38.331 version 16.3.1 Release 16
GroupB-ConfiguredTwoStepRA-r16 ::=  
   ra-MsgA-SizeGroupA
   messagePowerOffsetGroupB
   numberOfRA-PreamblesGroupA

-- TAG-RACH-CONFIGCOMMONTWOSTEPRA-STOP
-- ASN1STOP
**RACH-ConfigCommonTwoStepRA field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>groupB-ConfiguredTwoStepRA</td>
<td>Preamble grouping for 2-step random access type. If the field is absent then there is only one preamble group configured and only one msgA PUSCH configuration.</td>
</tr>
<tr>
<td>msgA-CB-PreamblesPerSSB-PerSharedRO</td>
<td>Number of contention-based preambles used for 2-step RA type from the non-CBRA 4-step type preambles associated with each SSB for RO shared with 4-step type RA. The number of preambles for 2-step RA type shall not exceed the number of preambles per SSB minus the number of contention-based preambles per SSB for 4-step type RA. The possible value range for this parameter needs to be aligned with value range for the configured SSBS per RACH occasion in SSB-perRACH-OccasionAndCB-PreamblesPerSSB in RACH-ConfigCommon. The field is only applicable for the case of shared ROs with 4-step type random access.</td>
</tr>
<tr>
<td>msgA-PRACH-RootSequenceIndex</td>
<td>PRACH root sequence index. If the field is not configured, the UE applies the value in field prach-RootSequenceIndex in RACH-ConfigCommon in the configured BWP. When both 2-step and 4-step type random access is configured, this field is only configured for the case of separate ROs between 2-step and 4-step type random access.</td>
</tr>
<tr>
<td>msgA-RestrictedSetConfig</td>
<td>Configuration of an unrestricted set or one of two types of restricted sets for 2-step random access type preamble. If the field is not configured, the UE applies the value in field restrictedSetConfig in RACH-ConfigCommon in the configured BWP. When both 2-step and 4-step type random access is configured, this field is only configured for the case of separate ROs between 2-step and 4-step type random access.</td>
</tr>
<tr>
<td>msgA-RSRP-Threshold</td>
<td>The UE selects 2-step random access type to perform random access based on this threshold (see TS 38.321 [3], clause 5.1.1). This field is only present if both 2-step and 4-step RA type are configured for the BWP.</td>
</tr>
<tr>
<td>msgA-SSB-perRACH-OccasionAndCB-PreamblesPerSSB</td>
<td>The meaning of this field is twofold: the CHOICE conveys the information about the number of SSBS per RACH occasion. Value oneEight corresponds to one SSB associated with 8 RACH occasions, value oneFourth corresponds to one SSB associated with 4 RACH occasions, and so on. The ENUMERATED part indicates the number of Contention Based preambles per SSB. Value n4 corresponds to 4 Contention Based preambles per SSB, value n8 corresponds to 8 Contention Based preambles per SSB, and so on. The total number of CB preambles in a RACH occasion is given by CB-preambles-per-SSB * max(1, SSB-per-rach-occasion). If the field is not configured and both 2-step and 4-step are configured for the BWP, the UE applies the value in the field sbb-perRACH-OccasionAndCB-PreamblesPerSSB in RACH-ConfigCommon. The field is not present when RACH occasions are shared between 2-step and 4-step type random access in the BWP.</td>
</tr>
<tr>
<td>msgA-SSB-SharedRO-MaskIndex</td>
<td>Indicates the subset of 4-step type ROs shared with 2-step random access type for each SSB. This field is configured when there is more than one RO per SSB. If the field is absent, and 4-step and 2-step has shared ROs, then all ROs are shared.</td>
</tr>
<tr>
<td>msgA-SubcarrierSpacing</td>
<td>Subcarrier spacing of PRACH (see TS 38.211 [16], clause 5.3.2). Only the values 15 or 30 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. The field is only present in case of 2-step only BWP, otherwise the UE applies the SCS as derived from the msg1-SubcarrierSpacing in RACH-ConfigCommon. The value also applies to contention free 2-step random access type (RACH-ConfigDedicated).</td>
</tr>
<tr>
<td>msgA-TotalNumberOfRA-Preambles</td>
<td>Indicates the total number of preambles used for contention-based and contention-free 2-step random access type when ROs for 2-step are not shared with 4-step. If the field is absent, and 2-step and 4-step does not have shared ROs, all 64 preambles are available for 2-step random access type.</td>
</tr>
<tr>
<td>msgA-TransMax</td>
<td>Max number of MsgA preamble transmissions performed before switching to 4-step random access (see TS 38.321 [3], clauses 5.1.1). This field is only applicable when 2-step and 4-step RA type are configured and switching to 4-step type RA is supported. If the field is absent, switching from 2-step RA type to 4-step RA type is not allowed.</td>
</tr>
<tr>
<td>ra-ContentionResolutionTimer</td>
<td>The initial value for the contention resolution timer for fallback RAR in case no 4-step random access type is configured (see TS 38.321 [3], clause 5.1.5). Value sf8 corresponds to 8 subframes, value sf16 corresponds to 16 subframes, and so on. If both 2-step and 4-step random access type resources are configured on the BWP, then this field is absent.</td>
</tr>
<tr>
<td>ra-Prioritization</td>
<td>Parameters which apply for prioritized random access procedure on any UL BWP of SpCell for specific Access Identities (see TS 38.321 [3], clause 5.1.1a).</td>
</tr>
</tbody>
</table>
ra-PrioritizationForAI
Indicates whether the field ra-Prioritization-r16 applies for Access Identities. The first/leftmost bit corresponds to Access Identity 1, the next bit corresponds to Access Identity 2. Value 1 for an Access Identity indicates that the field ra-Prioritization-r16 applies, otherwise the field does not apply.

rach-ConfigGenericTwoStepRA
2-step random access type parameters for both regular random access and beam failure recovery.

### GroupB-ConfiguredTwoStepRA field descriptions

- **messagePowerOffsetGroupB**
  Threshold for preamble selection. Value is in dB. Value \( -\infty \) corresponds to \(-\infty\). Value \( dB0 \) corresponds to 0 dB, \( dB5 \) corresponds to 5 dB and so on. (see TS 38.321 [3], clause 5.1.1).

- **numberOfRA-PreamblesGroupA**
The number of CB preambles per SSB in group A for idle/inactive or connected mode. The setting of the number of preambles for each group should be consistent with \( ssb-perRACH-OccasionAndCB-PreamblesPerSSB-TwoStepRA \) or \( msgA-CB-PreamblesPerSSB-PerSharedRO \) if configured.

- **ra-MsgA-SizeGroupA**
  Transport block size threshold in bits below which the UE shall use a contention-based RA preamble of group A. (see TS 38.321 [3], clause 5.1.1).

### Conditional Presence

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2StepOnlyL139</td>
<td>The field is mandatory present if ( prach-RootSequenceIndex ) ( L=139 ) and no 4-step random access type is configured, otherwise the field is absent. Need S.</td>
</tr>
<tr>
<td>2StepOnly</td>
<td>The field is mandatory present if there are no 4-step random access configurations configured in the BWP, i.e only 2-step random access type configured in the BWP, otherwise the field is Need S.</td>
</tr>
<tr>
<td>SharedRO</td>
<td>The field is mandatory present if the 2-step random access type occasions are shared with 4-step random access type, otherwise the field is not present.</td>
</tr>
<tr>
<td>2Step4Step</td>
<td>The field is mandatory present if both 2-step random access type and 4-step random access type are configured in the BWP, otherwise the field is not present.</td>
</tr>
<tr>
<td>InitialBWP-Only</td>
<td>This field is optionally present, Need R, if this BWP is the initial BWP of SpCell. Otherwise the field is absent.</td>
</tr>
</tbody>
</table>

---

RACH-ConfigDedicated

The IE RACH-ConfigDedicated is used to specify the dedicated random access parameters.

RACH-ConfigDedicated information element

---

RACH-ConfigDedicated ::= SEQUENCE {
  cfra CFRA OPTIONAL, -- Need S
  ra-Prioritization RA-Prioritization OPTIONAL, -- Need N
  ...
  [ ra-PrioritizationTwoStep-r16 RA-Prioritization OPTIONAL, -- Need N
    cfra-TwoStep-r16 CFRA-TwoStep-r16 OPTIONAL -- Need S
  ]
}
CFRA ::= \text{SEQUENCE} ( \\
\text{occasions} \text{SEQUENCE} ( \\
rach-ConfigGeneric \text{RACH-ConfigGeneric}, \\
ssb-perRACH-Occasion \text{ENUMERATED \{oneEight, oneFourth, oneHalf, one, two, four, eight, sixteen\}} \\
\text{OPTIONAL, -- Cond Mandatory} \\
\text{OPTIONAL, -- Need S} \\
\text{resources} \text{CHOICE} ( \\
\text{ssb} \text{SEQUENCE} ( \\
\text{ssb-ResourceList} \text{SEQUENCE \{(SIZE(1..maxRA-SSB-Resources)) OF CFRA-SSB-Resource,} \\
\text{ra-ssb-OccasionMaskIndex} \text{INTEGER \{0..15\}} \\
\text{OPTIONAL, -- Cond Occasions} \\
\text{csirs} \text{SEQUENCE} ( \\
\text{csirs-ResourceList} \text{SEQUENCE \{(SIZE(1..maxRA-CSIRS-Resources)) OF CFRA-CSIRS-Resource,} \\
rmsp-ThresholdCSI-RS \text{RSRP-Range} \\
\text{OPTIONAL, -- Cond Occasions} \\
\text{totalNumberOfRA-Preambles INTEGER \{1..63\}} \\
\text{OPTIONAL, -- Cond Occasions} \\
) \\
) \\
CFRA-TwoStep-r16 ::= \text{SEQUENCE} ( \\
\text{occasionsTwoStepRA-r16} \text{SEQUENCE} ( \\
rach-ConfigGenericTwoStepRA-r16 \text{RACH-ConfigGenericTwoStepRA-r16,} \\
\text{ssb-PerRACH-OccasionTwoStepRA-r16} \text{ENUMERATED \{oneEight, oneFourth, oneHalf, one,} \\
two, four, eight, sixteen\} \\
\text{OPTIONAL, -- Need S} \\
\text{msgA-CFRA-PUSCH-r16} \text{MsgA-PUSCH-Resource-r16,} \\
\text{msgA-TransMax-r16} \text{ENUMERATED \{n1, n2, n4, n6, n8, n10, n20, n50, n100, n200\}} \\
\text{OPTIONAL, -- Need S} \\
\text{resourcesTwoStep-r16} \text{SEQUENCE} ( \\
\text{ssb-ResourceList} \text{SEQUENCE \{(SIZE(1..maxRA-SSB-Resources)) OF CFRA-SSB-Resource,} \\
\text{ra-ssb-OccasionMaskIndex} \text{INTEGER \{0..15\}} \\
\text{OPTIONAL, -- Need S} \\
) \\
CFRA-SSB-Resource ::= \text{SEQUENCE} ( \\
\text{ssb} \text{SSB-Index,} \\
rp-PreambleIndex \text{INTEGER \{0..63\}} \\
\text{OPTIONAL, -- Cond 2StepCFRA} \\
) \\
CFRA-CSIRS-Resource ::= \text{SEQUENCE} ( \\
\text{csi-RS} \text{CSI-RS-Index,} \\
rp-OccasionList \text{SEQUENCE \{(SIZE(1..maxRA-OccasionsPerCSIRS)) OF INTEGER \{0..maxRA-Occasions-1\},} \\
rp-PreambleIndex \text{INTEGER \{0..63\},} \\
)
### CFRA-CSIRS-Resource field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>csi-RS</td>
<td>The ID of a CSI-RS resource defined in the measurement object associated with this serving cell.</td>
</tr>
<tr>
<td>ra-OccasionList</td>
<td>RA occasions that the UE shall use when performing CF-RA upon selecting the candidate beam identified by this CSI-RS. The network ensures that the RA occasion indexes provided herein are also configured by prach-ConfigurationIndex and msg1-FDM. Each RACH occasion is sequentially numbered, first, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions; second, in increasing order of time resource indexes for time multiplexed PRACH occasions within a PRACH slot and third, in increasing order of indexes for PRACH slots.</td>
</tr>
<tr>
<td>ra-PreambleIndex</td>
<td>The RA preamble index to use in the RA occasions associated with this CSI-RS.</td>
</tr>
</tbody>
</table>

### CFRA field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>occasions</td>
<td>RA occasions for contention free random access. If the field is absent, the UE uses the RA occasions configured in RACH-ConfigCommon in the first active UL BWP.</td>
</tr>
<tr>
<td>ra-ssb-OccasionMaskIndex</td>
<td>Explicitly signalled PRACH Mask Index for RA Resource selection in TS 38.321 [3]. The mask is valid for all SSB resources signalled in ssb-ResourceList.</td>
</tr>
<tr>
<td>rach-ConfigGeneric</td>
<td>Configuration of contention free random access occasions for CFRA. The UE shall ignore preambleReceivedTargetPower, preambleTransMax, powerRampingStep, ra-ResponseWindow signaled within this field and use the corresponding values provided in RACH-ConfigCommon.</td>
</tr>
<tr>
<td>ssb-perRACH-Occasion</td>
<td>Number of SSBs per RACH occasion.</td>
</tr>
<tr>
<td>totalNumberOfRA-Preambles</td>
<td>Total number of preambles used for contention free random access in the RACH resources defined in CFRA, excluding preambles used for other purposes (e.g. for SI request). If the field is absent but the field occasions is present, the UE may assume all the 64 preambles are for RA. The setting should be consistent with the setting of ssb-perRACH-Occasion. If present, i.e. it should be a multiple of the number of SSBs per RACH occasion.</td>
</tr>
<tr>
<td>CFRA-Resource Index</td>
<td>msgA-PUSCH-Resource-Index</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Identifies the index of the PUSCH resource used for MSGA CFRA. The PUSCH resource index indicates a valid PUSCH occasion (as specified in TS 38.213 [13], subclause 8.1A) and the associated DMRS resources corresponding to a PRACH slot. The PUSCH resource indexes are sequentially numbered and are mapped to valid PUSCH occasions corresponding to a PRACH slot which are ordered, first, in increasing order of frequency resource indexes for frequency multiplexed PUSCH occasions; second, in increasing order of DMRS resource indexes within a PUSCH occasion, where a DMRS resource index ( DMRS_{\mu} ) is determined first in an ascending order of a DMRS port index and then in an ascending order of a DMRS sequence index, third in increasing order of time resource indexes for time multiplexed PUSCH occasions within a PUSCH slot and fourth, in increasing order of indexes for PUSCH slots. For the case of contention free 2-step random access type, if this field is absent, the UE shall use the value 0.</td>
<td></td>
</tr>
<tr>
<td>ra-PreambleIndex</td>
<td>The preamble index that the UE shall use when performing CF-RA upon selecting the candidate beams identified by this SSB.</td>
</tr>
<tr>
<td>ssb</td>
<td>The ID of an SSB transmitted by this serving cell.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CFRA-TwoStep</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>msgA-CFRA-PUSCH</td>
<td>PUSCH resource configuration(s) for msgA CFRA.</td>
</tr>
<tr>
<td>msgA-TransMax</td>
<td>Max number of MsgA preamble transmissions performed before switching to 4-step type random access (see TS 38.321 [3], clauses 5.1.1). This field is only applicable when 2-step and 4-step RA type are configured and switching to 4-step type RA is supported. If the field is absent in RACH-ConfigDedicated, switching from 2-step RA type to 4-step RA type is not allowed.</td>
</tr>
<tr>
<td>occasionsTwoStepRA</td>
<td>RA occasions for contention free random access. If the field is absent, the UE uses the RA occasions configured in RACH-ConfigCommonTwoStepRA in the first active UL BWP.</td>
</tr>
<tr>
<td>ra-SSB-OccasionMaskIndex</td>
<td>Explicitly signalled PRACH Mask Index for RA Resource selection in TS 38.321 [3]. The mask is valid for all SSB resources signalled in ssb-ResourceList.</td>
</tr>
<tr>
<td>rach-ConfigGenericTwoStepRA</td>
<td>Configuration of contention free random access occasions for CFRA 2-step random access type.</td>
</tr>
<tr>
<td>ssb-PerRACH-OccasionTwoStep</td>
<td>Number of SSBs per RACH occasion for 2-step random access type.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RACH-ConfigDedicated</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>cfra</td>
<td>Parameters for contention free random access to a given target cell. If this field and cfra-TwoStep are absent, the UE performs contention based random access.</td>
</tr>
<tr>
<td>cfra-TwoStep</td>
<td>Parameters for contention free 2-step random access type to a given target cell. Network ensures that cfra and cfra-TwoStep are not configured at the same time. If this field and cfra are absent, the UE performs contention based random access. This field may only be present if msgA-ConfigCommon is configured on the BWP.</td>
</tr>
<tr>
<td>ra-prioritization</td>
<td>Parameters which apply for prioritized random access procedure to a given target cell (see TS 38.321 [3], clause 5.1.1).</td>
</tr>
<tr>
<td>ra-PrioritizationTwoStep</td>
<td>Parameters which apply for prioritized 2-step random access type procedure to a given target cell (see TS 38.321 [3], clause 5.1.1).</td>
</tr>
<tr>
<td>Conditional Presence</td>
<td>Explanation</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Mandatory</strong></td>
<td>The field is mandatory present.</td>
</tr>
<tr>
<td><strong>Occasions</strong></td>
<td>The field is optionally present, Need S, if the field occasions is present, otherwise it is absent.</td>
</tr>
<tr>
<td><strong>2StepCFRA</strong></td>
<td>The field is optionally present for the case of 2-step RA type contention free random access, Need S, otherwise it is absent.</td>
</tr>
</tbody>
</table>

---

**RACH-ConfigGeneric**

The IE **RACH-ConfigGeneric** is used to specify the random-access parameters both for regular random access as well as for beam failure recovery.

**RACH-ConfigGeneric information element**

```asn1
RACH-ConfigGeneric ::= SEQUENCE {
  prach-ConfigurationIndex            INTEGER (0..255),
  msg1-FDM                            ENUMERATED {one, two, four, eight},
  msg1-FrequencyStart                 INTEGER (0..maxNrofPhysicalResourceBlocks-1),
  zeroCorrelationZoneConfig           INTEGER(0..15),
  preambleReceivedTargetPower         INTEGER (-202..-60),
  preambleTransMax                    ENUMERATED {n3, n4, n5, n6, n7, n8, n10, n20, n50, n100, n200},
  powerRampingStep                    ENUMERATED {dB0, dB2, dB4, dB6},
  ra-ResponseWindow                   ENUMERATED {sl1, sl2, sl4, sl8, sl10, sl20, sl40, sl80},
  ...,
  [ prach-ConfigurationPeriodScaling-IAB-r16    ENUMERATED {scf1,scf2,scf4,scf8,scf16,scf32,scf64} OPTIONAL, -- Need R
    prach-ConfigurationFrameOffset-IAB-r16     INTEGER (0..63) OPTIONAL, -- Need R
    prach-ConfigurationSOffset-IAB-r16         INTEGER (0..39) OPTIONAL, -- Need R
    ra-ResponseWindow-v1610                   ENUMERATED { s160, s1160} OPTIONAL, -- Need R
    prach-ConfigurationIndex-v1610            INTEGER (256..262) OPTIONAL -- Need R ]
}
```

---

-- ASN1START
-- TAG-RACH-CONFIGGENERIC-START

RACH-ConfigGeneric ::= SEQUENCE {
  prach-ConfigurationIndex            INTEGER (0..255),
  msg1-FDM                            ENUMERATED {one, two, four, eight},
  msg1-FrequencyStart                 INTEGER (0..maxNrofPhysicalResourceBlocks-1),
  zeroCorrelationZoneConfig           INTEGER(0..15),
  preambleReceivedTargetPower         INTEGER (-202..-60),
  preambleTransMax                    ENUMERATED {n3, n4, n5, n6, n7, n8, n10, n20, n50, n100, n200},
  powerRampingStep                    ENUMERATED {dB0, dB2, dB4, dB6},
  ra-ResponseWindow                   ENUMERATED {sl1, sl2, sl4, sl8, sl10, sl20, sl40, sl80},
  ...,
  [ prach-ConfigurationPeriodScaling-IAB-r16    ENUMERATED {scf1,scf2,scf4,scf8,scf16,scf32,scf64} OPTIONAL, -- Need R
    prach-ConfigurationFrameOffset-IAB-r16     INTEGER (0..63) OPTIONAL, -- Need R
    prach-ConfigurationSOffset-IAB-r16         INTEGER (0..39) OPTIONAL, -- Need R
    ra-ResponseWindow-v1610                   ENUMERATED { s160, s1160} OPTIONAL, -- Need R
    prach-ConfigurationIndex-v1610            INTEGER (256..262) OPTIONAL -- Need R ]
}

-- TAG-RACH-CONFIGGENERIC-STOP
-- ASN1STOP
### RACH-ConfigGeneric field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>msg1-FDM</td>
<td>The number of PRACH transmission occasions FDMed in one time instance. (see TS 38.211 [16], clause 6.3.3.2).</td>
</tr>
<tr>
<td>msg1-FrequencyStart</td>
<td>Offset of lowest PRACH transmission occasion in frequency domain with respective to PRB 0. The value is configured so that the corresponding RACH resource is entirely within the bandwidth of the UL BWP. (see TS 38.211 [16], clause 6.3.3.2).</td>
</tr>
<tr>
<td>powerRampingStep</td>
<td>Power ramping steps for PRACH (see TS 38.321 [3], 5.1.3).</td>
</tr>
<tr>
<td>prach-ConfigurationFrameOffset-IAB</td>
<td>Frame offset for ROs defined in the baseline configuration indicated by prach-ConfigurationIndex and is used only by the IAB-MT. (see TS 38.211 [16], clause 6.3.3.2).</td>
</tr>
<tr>
<td>prach-ConfigurationIndex</td>
<td>PRACH configuration index. For prach-ConfigurationIndex configured under beamFailureRecovery-Config, the prach-ConfigurationIndex can only correspond to the short preamble format, (see TS 38.211 [16], clause 6.3.3.2). If the field prach-ConfigurationIndex-v1610 is present, the UE shall ignore the value provided in prach-ConfigurationIndex (without suffix).</td>
</tr>
<tr>
<td>prach-ConfigurationPeriodScaling-IAB</td>
<td>Scaling factor to extend the periodicity of the baseline configuration indicated by prach-ConfigurationIndex and is used only by the IAB-MT. Value scf1 corresponds to scaling factor of 1 and so on. (see TS 38.211 [16], clause 6.3.3.2).</td>
</tr>
<tr>
<td>prach-ConfigurationSOffset-IAB</td>
<td>Subframe/Slot offset for ROs defined in the baseline configuration indicated by prach-ConfigurationIndex and is used only by the IAB-MT. (see TS 38.211 [16], clause 6.3.3.2).</td>
</tr>
<tr>
<td>preambleReceivedTargetPower</td>
<td>The target power level at the network receiver side (see TS 38.213 [13], clause 7.4, TS 38.321 [3], clauses 5.1.2, 5.1.3). Only multiples of 2 dBm may be chosen (e.g., -202, -200, -198, ...).</td>
</tr>
<tr>
<td>preambleTransMax</td>
<td>Max number of RA preamble transmission performed before declaring a failure (see TS 38.321 [3], clauses 5.1.4, 5.1.5).</td>
</tr>
<tr>
<td>ra-ResponseWindow</td>
<td>Msg2 (RAR) window length in number of slots. The network configures a value lower than or equal to 10 ms when Msg2 is transmitted in licensed spectrum and a value lower than or equal to 40 ms when Msg2 is transmitted with shared spectrum channel access (see TS 38.321 [3], clause 5.1.4). UE ignores the field if included in SCellConfig. If ra-ResponseWindow-v1610 is signalled, UE shall ignore the ra-ResponseWindow (without suffix).</td>
</tr>
<tr>
<td>zeroCorrelationZoneConfig</td>
<td>N-CS configuration, see Table 6.3.3.1-5 in TS 38.211 [16].</td>
</tr>
</tbody>
</table>

---

**RACH-ConfigGenericTwoStepRA**

The IE **RACH-ConfigGenericTwoStepRA** is used to specify the 2-step random access type parameters.

### RACH-ConfigGenericTwoStepRA information element

```asn1
RACH-ConfigGenericTwoStepRA-r16 ::= SEQUENCE {
    msgA-PRACH-ConfigurationIndex-r16               INTEGER (0..262) OPTIONAL, -- Cond 2StepOnly
    msgA-RO-FDM-r16                                ENUMERATED {one, two, four, eight} OPTIONAL, -- Cond 2StepOnly
    msgA-RO-FrequencyStart-r16                     INTEGER (0..maxNrofPhysicalResourceBlocks-1) OPTIONAL, -- Cond 2StepOnly
    msgA-ZeroCorrelationZoneConfig-r16             INTEGER (0..15) OPTIONAL, -- Cond 2StepOnly
    msgA-PreamblePowerRampingStep-r16              ENUMERATED {dB0, dB2, dB4, dB6} OPTIONAL, -- Cond 2StepOnlyNoCFRA
}
```

ETSI
msgA-PreambleReceivedTargetPower-r16 INTEGER {-202..-60}, OPTIONAL, -- Cond 2StepOnlyNoCFRA
msgB-ResponseWindow-r16 ENUMERATED {sl1, sl2, sl4, sl8, sl10, sl20, sl40, sl80, sl160, sl320}, OPTIONAL, -- Cond NoCFRA
preambleTransMax-r16 ENUMERATED {n3, n4, n5, n6, n7, n8, n10, n20, n50, n100, n200}, OPTIONAL, -- Cond 2StepOnlyNoCFRA

--TAG-RACH-CONFIGGENERICTWOSTEPRA-STOP
--ASN1STOP

<table>
<thead>
<tr>
<th>RACH-ConfigGenericTwoStepRA field descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>msgA-PreamblePowerRampingStep</strong></td>
</tr>
<tr>
<td>Power ramping steps for msgA PRACH. If the field is absent, UE shall use the value of powerRampingStep in RACH-ConfigGeneric in the configured BWP (see TS 38.321 [3], 5.1.3). This field may only be present if no 4-step type RA is configured in the BWP or in the case of separate ROs with 4-step type RA. The field is absent if RACH-ConfigGenericTwoStepRA is included in CFRA-TwoStep in RACH-ConfigDedicated and then the UE uses the value of msgA-PreamblePowerRampingStep in RACH-ConfigGenericTwoStepRA configured for CBRA.</td>
</tr>
</tbody>
</table>

| **msgA-PreambleReceivedTargetPower** |
| The target power level at the network receiver side (see TS 38.213 [13], clause 7.1.1 and TS 38.321 [3], clause 5.1.1). Only multiples of 2 dBm may be chosen (e.g. -202, -200, -198, …). If the field is absent, UE shall use the value of preambleReceivedTargetPower in RACH-ConfigGeneric in the configured BWP. This field may only be present if no 4-step type RA is configured in the BWP. The field is absent if RACH-ConfigGenericTwoStepRA is included in CFRA-TwoStep in RACH-ConfigDedicated and then the UE uses the value of msgA-PreambleReceivedTargetPower in RACH-ConfigGenericTwoStepRA configured for CBRA. |

| **msgA-PRACH-ConfigurationIndex** |
| Cell-specific PRACH configuration index for 2-step RA type. If the field is absent the UE shall use the value of corresponding 4-step random access parameter in the configured BWP. If the value is in the range of 256 to 262, the field prach-ConfigurationIndex-v1610 should be considered configured (see TS 38.211 [16], clause 6.3.3.2). This field may only be present if no 4-step type RA is configured in the BWP or in the case of separate ROs with 4-step type RA. |

| **msgA-RO-FDM** |
| The number of msgA PRACH transmission occasions Frequency-Division Multiplexed in one time instance. If the field is absent, UE shall use value of msg1-FDM in RACH-ConfigGeneric in the configured BWP (see TS 38.211 [16], clause 6.3.3.2). This field may only be present if no 4-step type RA is configured in the BWP or in the case of separate ROs with 4-step type RA. |

| **msgA-RO-FrequencyStart** |
| Offset of lowest PRACH transmissions occasion in frequency domain with respect to PRB 0. If the field is absent, UE shall use value of msg1-FrequencyStart in RACH-ConfigGeneric in the configured BWP (see TS 38.211 [16], clauses 5.3.2 and 6.3.3.2). This field may only be present if no 4-step type RA is configured in the BWP or in the case of separate ROs with 4-step type RA. |

| **msgA-ZeroCorrelationZoneConfig** |
| N-CS configuration for msgA preamble, see Table 6.3.3.1-5 in TS 38.211 [16]. If the field is absent, UE shall use value zeroCorrelationZoneConfig in RACH-ConfigGeneric in the configured BWP. This field may only be present if no 4-step type RA is configured in the BWP or in the case of separate ROs with 4-step type RA. |

| **msgB-ResponseWindow** |
| MsgB monitoring window length in number of slots. The network configures a value lower than or equal to 40ms (see TS 38.321 [3], clause 5.1.1). If the field is absent, the UE uses the value of msgB-ResponseWindow in RACH-ConfigGenericTwoStepRA configured for CBRA. |

| **preambleTransMax** |
| Max number of RA preamble transmission performed before declaring a failure (see TS 38.321 [3], clauses 5.1.4, 5.1.5). If the field is absent, UE shall use the value of preambleTransMax in RACH-ConfigGeneric in the configured BWP. The field is absent if RACH-ConfigGenericTwoStepRA is included in CFRA-TwoStep in RACH-ConfigDedicated and then the UE uses the value of preambleTransMax in RACH-ConfigGenericTwoStepRA configured for CBRA. |
Conditional Presence | Explanation
--- | ---
2StepOnly | The field is mandatory present if there are no 4-step random access configurations configured in the BWP, i.e. only 2-step random access type configured in the BWP, otherwise the field is Need S.
2StepOnlyNoCFRA | The field is mandatory present if RACH-ConfigGenericTwoStepRA is included in the RACH-ConfigCommonTwoStepRA and there are no 4-step random access configurations configured in the BWP (i.e. only 2-step random access type configured in the BWP), otherwise (i.e. 4-step random access configuration also exists in the BWP) the field is optional, Need S. When RACH-ConfigGenericTwoStepRA is included in the RACH-ConfigDedicated, this field is absent.
NoCFRA | The field is mandatory present if RACH-ConfigGenericTwoStepRA is not included in CFRA-TwoStep in RACH-ConfigDedicated, otherwise the field is absent, Need S.

--- RA-Prioritization

The IE RA-Prioritization is used to configure prioritized random access.

**RA-Prioritization** information element

```asn1
RA-Prioritization ::= SEQUENCE {
  powerRampingStepHighPriority ENUMERATED {dB0, dB2, dB4, dB6},
  scalingFactorBI            ENUMERATED {zero, dot25, dot5, dot75} OPTIONAL, -- Need R
  ...
}
```

**RA-Prioritization field descriptions**

- **powerRampingStepHighPriority**
  Power ramping step applied for prioritized random access procedure.

- **scalingFactorBI**
  Scaling factor for the backoff indicator (BI) for the prioritized random access procedure. (see TS 38.321 [3], clause 5.1.4). Value zero corresponds to 0, value dot25 corresponds to 0.25 and so on.

--- RadioBearerConfig

The IE RadioBearerConfig is used to add, modify and release signalling and/or data radio bearers. Specifically, this IE carries the parameters for PDCP and, if applicable, SDAP entities for the radio bearers.

**RadioBearerConfig** information element

```asn1
-- ASN1START
-- TAG--RADIOBEARERCONFIG--START
```
RadioBearerConfig ::= SEQUENCE {
  srb-ToAddModList                        SRB-ToAddModList                                        OPTIONAL,   -- Cond HO-Conn
  srb3-ToRelease                          ENUMERATED{true}                                        OPTIONAL,   -- Need N
  drb-ToAddModList                        DRB-ToAddModList                                        OPTIONAL,   -- Cond HO-toNR
  drb-ToReleaseList                       DRB-ToReleaseList                                       OPTIONAL,   -- Need N
  securityConfig                          SecurityConfig                                          OPTIONAL,   -- Need M
  ...
}

SRB-ToAddModList ::= SEQUENCE (SIZE (1..2)) OF SRB-ToAddMod
SRB-ToAddMod ::= SEQUENCE {
  srb-Identity                            SRB-Identity,     reestablishPDCP                         ENUMERATED{true}                                        OPTIONAL,   -- Need N
  discardOnPDCP                           ENUMERATED{true}                                        OPTIONAL,   -- Need N
  pdcp-Config                             PDCP-Config                                             OPTIONAL,   -- Cond PDCP
  ...
}

DRB-ToAddModList ::= SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod
DRB-ToAddMod ::= SEQUENCE {
  cnAssociation                           CHOICE {
    eps-BearerIdentity                      INTEGER (0..15),         sdap-Config                             SDAP-Config
  }                                                                                               OPTIONAL,   -- Cond DRBSetup
  drb-Identity                            DRB-Identity,     reestablishPDCP                         ENUMERATED{true}                                        OPTIONAL,   -- Need N
  recoverPDCP                             ENUMERATED{true}                                        OPTIONAL,   -- Need N
  pdcp-Config                             PDCP-Config                                             OPTIONAL,   -- Cond PDCP
  ...
  ...,
  [ [ daps-Config-r16                         ENUMERATED{true}                                        OPTIONAL    -- Cond DAPS
    ]]
}

DRB-ToReleaseList ::= SEQUENCE (SIZE (1..maxDRB)) OF DRB-Identity

SecurityConfig ::= SEQUENCE {
  securityAlgorithmConfig                 SecurityAlgorithmConfig                                 OPTIONAL,   -- Cond RBTermChange1
  keyToUse                                ENUMERATED{master, secondary}                           OPTIONAL,   -- Cond RBTermChange     ...
}

-- TAG-RADIOBEARERCONFIG-STOP
-- ASN1STOP
<table>
<thead>
<tr>
<th><strong>DRB-ToAddMod field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cnAssociation</strong></td>
</tr>
<tr>
<td>Indicates if the bearer is associated with the \textit{eps-bearerIdentity} (when connected to EPC) or \textit{sdap-Config} (when connected to 5GC).</td>
</tr>
<tr>
<td><strong>daps-Config</strong></td>
</tr>
<tr>
<td>Indicates that the bearer is configured as DAPS bearer.</td>
</tr>
<tr>
<td><strong>drb-Identity</strong></td>
</tr>
<tr>
<td>In case of DC, the DRB identity is unique within the scope of the UE, i.e. an MCG DRB cannot use the same value as a split DRB. For a split DRB the same identity is used for the MCG and SCG parts of the configuration.</td>
</tr>
<tr>
<td><strong>eps-BearerIdentity</strong></td>
</tr>
<tr>
<td>The EPS bearer ID determines the EPS bearer.</td>
</tr>
<tr>
<td><strong>reestablishPDCP</strong></td>
</tr>
<tr>
<td>Indicates that PDCP should be re-established. Network sets this to \textit{true} whenever the security key used for this radio bearer changes. Key change could for example be due to termination point change for the bearer, reconfiguration with sync, resuming an RRC connection, or the first reconfiguration after reestablishment. It is also applicable for LTE procedures when NR PDCP is configured. Network doesn't include this field for DRB if the bearer is configured as DAPS bearer.</td>
</tr>
<tr>
<td><strong>recoverPDCP</strong></td>
</tr>
<tr>
<td>Indicates that PDCP should perform recovery according to TS 38.323 [5]. Network doesn't include this field if the bearer is configured as DAPS bearer.</td>
</tr>
<tr>
<td><strong>sdap-Config</strong></td>
</tr>
<tr>
<td>The SDAP configuration determines how to map QoS flows to DRBs when NR or E-UTRA connects to the 5GC and presence/absence of UL/DL SDAP headers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>RadioBearerConfig field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>securityConfig</strong></td>
</tr>
<tr>
<td>Indicates the security algorithm and key to use for the signalling and data radio bearers configured with the list in this IE \textit{RadioBearerConfig}. When the field is not included after AS security has been activated, the UE shall continue to use the currently configured \textit{keyToUse} and security algorithm for the radio bearers reconfigured with the lists in this IE \textit{RadioBearerConfig}. The field is not included when configuring SRB1 before AS security is activated.</td>
</tr>
<tr>
<td><strong>srb3-ToRelease</strong></td>
</tr>
<tr>
<td>Release SRB3. SRB3 release can only be done over SRB1 and only at SCG release and reconfiguration with sync.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SecurityConfig field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>keyToUse</strong></td>
</tr>
<tr>
<td>Indicates if the bearers configured with the list in this IE \textit{RadioBearerConfig} are using the master key or the secondary key for deriving ciphering and/or integrity protection keys. For MR-DC, network should not configure SRB1 and SRB2 with secondary key and SRB3 with the master key. When the field is not included, the UE shall continue to use the currently configured \textit{keyToUse} for the radio bearers reconfigured with the lists in this IE \textit{RadioBearerConfig}.</td>
</tr>
<tr>
<td><strong>securityAlgorithmConfig</strong></td>
</tr>
<tr>
<td>Indicates the security algorithm for the signalling and data radio bearers configured with the list in this IE \textit{RadioBearerConfig}. When the field is not included, the UE shall continue to use the currently configured security algorithm for the radio bearers reconfigured with the lists in this IE \textit{RadioBearerConfig}.</td>
</tr>
</tbody>
</table>
SRB-ToAddMod field descriptions

**discardOnPDCP**
Indicates that PDCP should discard stored SDU and PDU according to TS 38.323 [5].

**reestablishPDCP**
Indicates that PDCP should be re-established. Network sets this to true whenever the security key used for this radio bearer changes. Key change could for example be due to reconfiguration with sync, for SRB2 when resuming an RRC connection, or at the first reconfiguration after RRC connection reestablishment in NR. For LTE SRBs using NR PDCP, it could be for handover, RRC connection reestablishment or resume. Network doesn’t include this field if any DAPS bearer is configured.

**srb-Identity**
Value 1 is applicable for SRB1 only. Value 2 is applicable for SRB2 only. Value 3 is applicable for SRB3 only.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RBTermChange</strong></td>
<td>The field is mandatory present in case of set up of signalling and data radio bearer and change of termination point for the radio bearer between MN and SN. It is optionally present otherwise, Need S.</td>
</tr>
</tbody>
</table>
| **RBTermChange1**    | The field is mandatory present in case of:  
- set up of signalling and data radio bearer,  
- change of termination point for the radio bearer between MN and SN,  
- handover from E-UTRA/EPC or E-UTRA/5GC to NR,  
- handover from NR or E-UTRA/EPC to E-UTRA/5GC if the UE supports NGEN-DC.  
It is optionally present otherwise, Need S. |
| **PDCP**             | The field is mandatory present if the corresponding DRB is being setup or corresponding DRB is reconfigured with NR PDCP or corresponding SRB associated with two RLC entities is being setup or if the number of RLC bearsers associated with the DRB or SRB is changed. The field is optionally present. Need S, if the corresponding SRB associated with one RLC entity is being setup or corresponding SRB is reconfigured with NR PDCP; otherwise the field is optionally present, need M. |
| **DRBSetup**         | The field is mandatory present if the corresponding DRB is being setup; otherwise the field is optionally present, need M. |
| **HO-Conn**          | The field is mandatory present  
- in case of inter-system handover from E-UTRA/EPC to E-UTRA/5GC or NR,  
- or when the fullConfig is included in the RRCReconfiguration message and NE-DC/NR-DC is not configured,  
- or in case of RRCSetup.  
Otherwise the field is optionally present, need N.  
Upon RRCSetup, only SRB1 can be present. |
| **HO-toNR**          | The field is mandatory present  
- in case of inter-system handover from E-UTRA/EPC to E-UTRA/5GC or NR,  
- or when the fullConfig is included in the RRCReconfiguration message and NE-DC/NR-DC is not configured.  
In case of RRCSetup, the field is absent; otherwise the field is optionally present, need N. |
| **DAPS**             | The field is optionally present, need N, in case masterCellGroup includes ReconfigurationWithSync, SCell(s) and SCG are not configured, multi-DCI/single-DCI based multi-TRP are not configured in any DL BWP and ethernetHeaderCompression is not configured for the DRB. Otherwise the field is absent. |

---

**RadioLinkMonitoringConfig**

The IE RadioLinkMonitoringConfig is used to configure radio link monitoring for detection of beam- and/or cell radio link failure. See also TS 38.321 [3], clause 5.1.1.
RadioLinkMonitoringConfig information element

```
RadioLinkMonitoringConfig ::= SEQUENCE {
  failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF RadioLinkMonitoringRS OPTIONAL, -- Need N
  failureDetectionResourcesToReleaseList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF RadioLinkMonitoringRS-Id OPTIONAL, -- Need N
  beamFailureInstanceMaxCount ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10} OPTIONAL, -- Need R
  beamFailureDetectionTimer ENUMERATED {pbfd1, pbfd2, pbfd3, pbfd4, pbfd5, pbfd6, pbfd8, pbfd10} OPTIONAL, -- Need R
  ... }

RadioLinkMonitoringRS ::= SEQUENCE {
  radioLinkMonitoringRS-Id             RadioLinkMonitoringRS-Id,
  purpose                              ENUMERATED {beamFailure, rlf, both},
  detectionResource                    CHOICE {
    ssb-Index                           SSB-Index,
    csi-RS-Index                        NZP-CSI-RS-ResourceId
  },
  ... }
```

RadioLinkMonitoringConfig field descriptions

- **beamFailureDetectionTimer**
  Timer for beam failure detection (see TS 38.321 [3], clause 5.17). See also the BeamFailureRecoveryConfig IE. Value in number of "Qout,LR reporting periods of Beam Failure Detection" Reference Signal (see TS 38.213 [13], clause 6). Value pbfd1 corresponds to 1 Qout,LR reporting period of Beam Failure Detection Reference Signal, value pbfd2 corresponds to 2 Qout,LR reporting periods of Beam Failure Detection Reference Signal and so on.

- **beamFailureInstanceMaxCount**
  This field determines after how many beam failure events the UE triggers beam failure recovery (see TS 38.321 [3], clause 5.17). Value n1 corresponds to 1 beam failure instance, value n2 corresponds to 2 beam failure instances and so on.

- **failureDetectionResourcesToAddModList**
  A list of reference signals for detecting beam failure and/or cell level radio link failure (RLF). The limits of the reference signals that the network can configure are specified in TS 38.213 [13], table 5-1. The network configures at most two detectionResources per BWP for the purpose beamFailure or both. If no RSs are provided for the purpose of beam failure detection, the UE performs beam monitoring based on the activated TCI-State for PDCCH as described in TS 38.213 [13], clause 6. If no RSs are provided in this list for the purpose of RLF detection, the UE performs Cell-RLM based on the activated TCI-State of PDCCH as described in TS 38.213 [13], clause 5. The network ensures that the UE has a suitable set of reference signals for performing cell-RLM.
RadioLinkMonitoringRS field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>detectionResource</td>
<td>A reference signal that the UE shall use for radio link monitoring or beam failure detection (depending on the indicated purpose). Only periodic 1-port CSI-RS can be configured on SCell for beam failure detection purpose.</td>
</tr>
<tr>
<td>purpose</td>
<td>Determines whether the UE shall monitor the associated reference signal for the purpose of cell- and/or beam failure detection. For SCell, network only configures the value to beamFailure.</td>
</tr>
</tbody>
</table>

- **RadioLinkMonitoringRS-Id**

The IE *RadioLinkMonitoringRS-Id* is used to identify one *RadioLinkMonitoringRS*.

**RadioLinkMonitoringRS-Id information element**

```
RadioLinkMonitoringRS-Id ::= INTEGER (0..maxNrofFailureDetectionResources-1)
```

- **RAN-AreaCode**

The IE *RAN-AreaCode* is used to identify a RAN area within the scope of a tracking area.

**RAN-AreaCode information element**

```
RAN-AreaCode ::= INTEGER (0..255)
```

- **RateMatchPattern**

The IE *RateMatchPattern* is used to configure one rate matching pattern for PDSCH, see TS 38.214 [19], clause 5.1.4.1.

**RateMatchPattern information element**

```
```
RateMatchPattern ::= SEQUENCE {
  rateMatchPatternId                  RateMatchPatternId,
  patternType                         CHOICE {
    bitmaps                             SEQUENCE {
      resourceBlocks                      BIT STRING (SIZE (275)),
      symbolsInResourceBlock             CHOICE {
        oneSlot                             BIT STRING (SIZE (14)),
        twoSlots                            BIT STRING (SIZE (28))
      },
      periodicityAndPattern              CHOICE {
        n2                                  BIT STRING (SIZE (2)),
        n4                                  BIT STRING (SIZE (4)),
        n5                                  BIT STRING (SIZE (5)),
        n8                                  BIT STRING (SIZE (8)),
        n10                                 BIT STRING (SIZE (10)),
        n20                                 BIT STRING (SIZE (20)),
        n40                                 BIT STRING (SIZE (40))
      }
    },
    controlResourceSet                  ControlResourceSetId     OPTIONAL,   -- Cond CellLevel
  },
  subcarrierSpacing                   SubcarrierSpacing OPTIONAL,   -- Cond CellLevel
  dummy                               ENUMERATED { dynamic, semiStatic },...,
  }[[
    controlResourceSet-r16              ControlResourceSetId-r16 OPTIONAL    -- Cond CellLevel
  ]]}}

-- TAG-RATEMATCHPATTERN-STOP
-- ASN1STOP
<table>
<thead>
<tr>
<th><strong>RateMatchPatternId</strong> information element</th>
</tr>
</thead>
<tbody>
<tr>
<td>** RateMatchPattern field descriptions **</td>
</tr>
</tbody>
</table>

| **bitmaps** | Indicates rate matching pattern by a pair of bitmaps `resourceBlocks` and `symbolsInResourceBlock` to define the rate match pattern within one or two slots, and a third bitmap `periodicityAndPattern` to define the repetition pattern with which the pattern defined by the above bitmap pair occurs. |
| **controlResourceSet** | This ControlResourceSet is used as a PDSCH rate matching pattern, i.e., PDSCH reception rate matches around it. In frequency domain, the resource is determined by the frequency domain resource of the CORESET with the corresponding CORESET ID. Time domain resource is determined by the parameters of the associated search space of the CORESET. If the field `controlResourceSetId-r16` is present, UE shall ignore the `controlResourceSetId` (without suffix). |
| **periodicityAndPattern** | A time domain repetition pattern at which the pattern defined by `symbolsInResourceBlock` and `resourceBlocks` recurs. This slot pattern repeats itself continuously. Absence of this field indicates the value `n1`, i.e., the `symbolsInResourceBlock` recurs every 14 symbols (see TS 38.214 [19], clause 5.1.4.1). |
| **resourceBlocks** | A resource block level bitmap in the frequency domain. A bit in the bitmap set to 1 indicates that the UE shall apply rate matching in the corresponding resource block in accordance with the `symbolsInResourceBlock` bitmap. If used as cell-level rate matching pattern, the bitmap identifies "common resource blocks (CRB)". If used as BWP-level rate matching pattern, the bitmap identifies "physical resource blocks" inside the BWP. The first/ leftmost bit corresponds to resource block 0, and so on (see TS 38.214 [19], clause 5.1.4.1). |
| **subcarrierSpacing** | The SubcarrierSpacing for this resource pattern. If the field is absent, the UE applies the SCS of the associated BWP. The value `kHz15` corresponds to $\mu=0$, the value `kHz30` corresponds to $\mu=1$, and so on. Only the values 15 kHz, 30 kHz or 60 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable (see TS 38.214 [19], clause 5.1.4.1). |
| **symbolsInResourceBlock** | A symbol level bitmap in time domain. It indicates with a bit set to true that the UE shall rate match around the corresponding symbol. This pattern recurs (in time domain) with the configured periodicityAndPattern (see TS 38.214 [19], clause 5.1.4.1). For `oneSlot`, if ECP is configured, the first 12 bits represent the symbols within the slot and the last two bits within the bitstring are ignored by the UE; Otherwise, the 14 bits represent the symbols within the slot. For `twoSlots`, if ECP is configured, the first 12 bits represent the symbols within the first slot and the next 12 bits represent the symbols in the second slot and the last four bits within the bit string are ignored by the UE; Otherwise, the first 14 bits represent the symbols within the first slot and the next 14 bits represent the symbols in the second slot. For the bits representing symbols in a slot, the most significant bit of the bit string represents the first symbol in the slot and the second most significant bit represents the second symbol in the slot and so on. |

<table>
<thead>
<tr>
<th><strong>Conditional Presence</strong></th>
<th><strong>Explanation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>CellLevel</td>
<td>The field is mandatory present if the <code>RateMatchPattern</code> is defined on cell level. The field is absent when the <code>RateMatchPattern</code> is defined on BWP level. If the <code>RateMatchPattern</code> is defined on BWP level, the UE applies the SCS of the BWP.</td>
</tr>
</tbody>
</table>

---

The IE `RateMatchPatternId` identifies one RateMatchMattern (see TS 38.214 [19], clause 5.1.4.2).
RateMatchPatternId ::= INTEGER (0..maxNrofRateMatchPatterns-1)
-- TAG-RATEMATCHPATTERNID-STOP
-- ASN1STOP

-- RateMatchPatternLTE-CRS

The IE RateMatchPatternLTE-CRS is used to configure a pattern to rate match around LTE CRS. See TS 38.214 [19], clause 5.1.4.2.

RateMatchPatternLTE-CRS information element

-- ASN1START
-- TAG-RATEMATCHPATTERNLTE-CRS-START
RateMatchPatternLTE-CRS ::= SEQUENCE {
carrierFreqDL                  INTEGER (0..16383),
carrierBandwidthDL             ENUMERATED {n6, n15, n25, n50, n75, n100, spare2, spare1},
mbsfn-SubframeConfigList       EUTRA-MBSFN-SubframeConfigList OPTIONAL, -- Need M
nrofCRS-Ports                  ENUMERATED {n1, n2, n4},  v-Shift              ENUMERATED {n0, n1, n2, n3, n4, n5}
}
LTE-CRS-PatternList-r16 ::= SEQUENCE (SIZE (1..maxLTE-CRS-Patterns-r16)) OF RateMatchPatternLTE-CRS
-- TAG-RATEMATCHPATTERNLTE-CRS-STOP
-- ASN1STOP

RateMatchPatternLTE-CRS field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>carrierBandwidthDL</td>
<td>BW of the LTE carrier in number of PRBs (see TS 38.214 [19], clause 5.1.4.2).</td>
</tr>
<tr>
<td>carrierFreqDL</td>
<td>Center of the LTE carrier (see TS 38.214 [19], clause 5.1.4.2).</td>
</tr>
<tr>
<td>mbsfn-SubframeConfigList</td>
<td>LTE MBSFN subframe configuration (see TS 38.214 [19], clause 5.1.4.2).</td>
</tr>
<tr>
<td>nrofCRS-Ports</td>
<td>Number of LTE CRS antenna port to rate-match around (see TS 38.214 [19], clause 5.1.4.2).</td>
</tr>
<tr>
<td>v-Shift</td>
<td>Shifting value v-shift in LTE to rate match around LTE CRS (see TS 38.214 [19], clause 5.1.4.2).</td>
</tr>
</tbody>
</table>

-- ReferenceTimeInfo

The IE ReferenceTimeInfo contains timing information for 5G internal system clock used for, e.g., time stamping, see TS 23.501 [32], clause 5.27.1.2.
ReferenceTimeInfo information element

```asn1
ReferenceTimeInfo-r16 ::= SEQUENCE {
  time-r16                            ReferenceTime-r16,     uncertainty-r16                     INTEGER (0..32767)          OPTIONAL,   -- Need S
  timeInfoType-r16                    ENUMERATED {localClock}     OPTIONAL,   -- Need S
  referenceSFN-r16                    INTEGER (0..1023)           OPTIONAL    -- Cond RefTime
}
```

ReferenceTime-r16 ::=           SEQUENCE {
  refDays-r16                         INTEGER (0..72999),
  refSeconds-r16                      INTEGER (0..86399),
  refMilliSeconds-r16                 INTEGER (0..999),
  refTenNanoSeconds-r16               INTEGER (0..99999)
}

ReferenceTimeInfo field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>referenceSFN</td>
<td>This field indicates the reference SFN corresponding to the reference time information. If referenceTimeInfo field is received in DLInformationTransfer message, this field indicates the SFN of PCell.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>time</td>
<td>This field indicates time reference with 10ns granularity. The indicated time is referenced at the network, i.e., without compensating for RF propagation delay. The indicated time in 10ns unit from the origin is ( \text{refDays} \times 86400 \times 1000 \times 100000 + \text{refSeconds} \times 1000 \times 100000 + \text{refMilliSeconds} \times 100000 + \text{refTenNanoSeconds} ). The refDays field specifies the sequential number of days (with day count starting at 0) from the origin of the time field. If the referenceTimeInfo field is received in DLInformationTransfer message, the time field indicates the time at the ending boundary of the system frame indicated by referenceSFN. The UE considers this frame (indicated by referenceSFN) to be the frame which is nearest to the frame where the message is received (which can be either in the past or in the future). If the referenceTimeInfo field is received in SIB9, the time field indicates the time at the SFN boundary or immediately after the ending boundary of the SI-window in which SIB9 is transmitted. If referenceTimeInfo field is received in SIB9, this field is excluded when determining changes in system information, i.e. changes of time should neither result in system information change notifications nor in a modification of valueTag in SIB1.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>timeInfoType</td>
<td>If timeInfoType is not included, the time indicates the GPS time and the origin of the time field is 00:00:00 on Gregorian calendar date 6 January, 1980 (start of GPS time). If timeInfoType is set to localClock, the origin of the time is unspecified.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>uncertainty</td>
<td>This field indicates the uncertainty of the reference time information provided by the time field. The uncertainty is 25ns multiplied by this field. If this field is absent, the uncertainty is unspecified.</td>
</tr>
<tr>
<td>Conditional Presence</td>
<td>Explanation</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>RefTime</td>
<td>The field is mandatory present if referenceTimeInfo is included in DLInformationTransfer message; otherwise the field is absent.</td>
</tr>
</tbody>
</table>

— **RejectWaitTime**

The IE *RejectWaitTime* is used to provide the value in seconds for timer T302.

*RejectWaitTime* information element

```asn1
RejectWaitTime ::= INTEGER (1..16)
```

— **RepetitionSchemeConfig**

The IE *RepetitionSchemeConfig* is used to configure the UE with repetition schemes as specified in TS 38.214 [19] clause 5.1.

*RepetitionSchemeConfig* information element

```asn1
RepetitionSchemeConfig-r16 ::= CHOICE {
  fdm-TDM-r16                        SetupRelease { FDM-TDM-r16 },
  slotBased-r16                      SetupRelease { SlotBased-r16 }
}
RepetitionSchemeConfig-v1630 ::= SEQUENCE {     slotBased-v1630                    SetupRelease { SlotBased-v1630 } }
FDM-TDM-r16 ::= SEQUENCE {
  repetitionScheme-r16               ENUMERATED {fdmSchemeA, fdmSchemeB,tdmSchemeA },
  startingSymbolOffsetK-r16          INTEGER (0..7)                                    OPTIONAL  -- Need R
}
SlotBased-r16 ::= SEQUENCE {
  tciMapping-r16                    ENUMERATED {cyclicMapping, sequentialMapping},
  sequenceOffsetForRV-r16           INTEGER (1..3)
}
SlotBased-v1630 ::= SEQUENCE {
```
RepetitionSchemeConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>fdm-TDM</td>
<td>Configures UE with a repetition scheme among fdmSchemeA, fdmSchemeB and tdmSchemeA as specified in clause 5.1 of TS 38.214 [19].</td>
</tr>
<tr>
<td>sequenceOffsetForRV</td>
<td>For slot-based repetition scheme, selected RV sequence is applied to transmission occasions associated to the first TCI state. The RV sequence associated to the second TCI state is determined by a RV offset from that selected RV sequence.</td>
</tr>
<tr>
<td>slotBased</td>
<td>Configures UE with slot-based repetition scheme. Network always configures this field when the parameter repetitionNumber is present in IE PDSCH-TimeDomainResourceAllocationList.</td>
</tr>
<tr>
<td>startingSymbolOffsetK</td>
<td>The starting symbol of the second transmission occasion has K symbol offset relative to the last symbol of the first transmission occasion. When UE is configured with tdmSchemeA, the parameter startingSymbolOffsetK is present, otherwise absent.</td>
</tr>
<tr>
<td>tciMapping</td>
<td>Enables TCI state mapping method to PDSCH transmission occasions.</td>
</tr>
</tbody>
</table>

ReportConfigId

The IE ReportConfigId is used to identify a measurement reporting configuration.

ReportConfigId information element

```
-- ASN1START
-- TAG-REPORTCONFIGID-START
ReportConfigId ::= INTEGER (1..maxReportConfigId)
-- TAG-REPORTCONFIGID-STOP
-- ASN1STOP
```

ReportConfigInterRAT

The IE ReportConfigInterRAT specifies criteria for triggering of an inter-RAT measurement reporting event. The inter-RAT measurement reporting events for E-UTRA and UTRA-FDD are labelled BN with N equal to 1, 2 and so on.

Event B1: Neighbour becomes better than absolute threshold;

Event B2: PCell becomes worse than absolute threshold1 AND Neighbour becomes better than another absolute threshold2;
ReportConfigInterRAT information element

-- ASN1START
-- TAG-REPORTCONFIGINTERRAT-START

ReportConfigInterRAT ::= SEQUENCE {
  reportType
    CHOICE {
    periodical                  PeriodicalReportConfigInterRAT,
    eventTriggered              EventTriggerConfigInterRAT,
    reportCGI                   ReportCGI-EUTRA,
    ...
    reportSFTD                  ReportSFTD-EUTRA
  }
}

ReportCGI-EUTRA ::= SEQUENCE {
  cellForWhichToReportCGI     EUTRA-PhysCellId,
  ...
  [ useAutonomousGaps-r16     ENUMERATED {setup} OPTIONAL -- Need R ]
}

ReportSFTD-EUTRA ::= SEQUENCE {
  reportSFTD-Meas             BOOLEAN,
  reportRSRP                  BOOLEAN,
  ...
}

EventTriggerConfigInterRAT ::= SEQUENCE {
  eventId
    CHOICE {
    eventB1
      b1-ThresholdEUTRA
      reportOnLeave
      hysteresis
      timeToTrigger
      ...
    ),
    eventB2
      b2-Threshold1
      b2-Threshold2EUTRA
      reportOnLeave
      hysteresis
      timeToTrigger
      ...
    ),
    ...
    [ [ eventB1-UTRA-FDD-r16
      b1-ThresholdUTRA-FDD-r16
      reportOnLeave-r16
      hysteresis-r16
      timeToTrigger-r16
      ...
      ] ]
}

-- ASN1END
SEQUENCE { MeasTriggerQuantity, MeasTriggerQuantityUTRA-FDD-r16, BOOLEAN, Hysteresis, TimeToTrigger, ...
  ...]
  ]]
rsType                              NR-RS-Type,
reportInterval                      ReportInterval,
reportAmount                        ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
maxReportCells                      INTEGER (1..maxCellReport), ...
  [[
  reportQuantityUTRA-FDD-r16          MeasReportQuantityUTRA-FDD-r16         OPTIONAL   -- Need R
  ]]

PeriodicalReportConfigInterRAT ::=              SEQUENCE { ReportInterval, ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity}, MeasReportQuantity, INTEGER (1..maxCellReport), ...
  ]]
  [
  reportQuantityUTRA-FDD-r16          MeasReportQuantityUTRA-FDD-r16         OPTIONAL   -- Need R
  ]]

MeasTriggerQuantityUTRA-FDD-r16 ::=          CHOICE{utra-FDD-RSCP-r16, INTEGER (-5..91),utra-FDD-EcN0-r16, INTEGER (0..49)}

MeasReportQuantityUTRA-FDD-r16 ::=        SEQUENCE { cpich-RSCP, BOOLEAN, cpich-EcN0, BOOLEAN }
**ReportConfigInterRAT field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>reportType</td>
<td>Type of the configured measurement report. In EN-DC, network does not configure report of type ReportCGI-EUTRA.</td>
</tr>
</tbody>
</table>

**ReportCGI-EUTRA field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>useAutonomousGaps</td>
<td>Indicates whether or not the UE is allowed to use autonomous gaps in acquiring system information from the E-UTRAN neighbour cell. When the field is included, the UE applies the corresponding value for T321.</td>
</tr>
</tbody>
</table>

**EventTriggerConfigInterRAT field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>b2-Threshold1</td>
<td>NR threshold to be used in inter RAT measurement report triggering condition for event B2.</td>
</tr>
<tr>
<td>bN-ThresholdEUTRA</td>
<td>E-UTRA threshold value associated with the selected trigger quantity (RSRP, RSRQ, SINR) to be used in inter RAT measurement report triggering condition for event number bN. In the same eventB2, the network configures the same CHOICE name (rsrp, rsrq or sinr) for the MeasTriggerQuantity of the b2-Threshold1 and for the MeasTriggerQuantityEUTRA of the b2-Threshold2EUTRA.</td>
</tr>
<tr>
<td>eventId</td>
<td>Choice of inter RAT event triggered reporting criteria.</td>
</tr>
<tr>
<td>maxReportCells</td>
<td>Max number of non-serving cells to include in the measurement report.</td>
</tr>
<tr>
<td>reportAmount</td>
<td>Number of measurement reports applicable for eventTriggered as well as for periodical report types</td>
</tr>
<tr>
<td>reportOnLeave</td>
<td>Indicates whether or not the UE shall initiate the measurement reporting procedure when the leaving condition is met for a cell in cellsTriggeredList, as specified in 5.5.4.1.</td>
</tr>
<tr>
<td>reportQuantity, reportQuantityUTRA-FDD</td>
<td>The cell measurement quantities to be included in the measurement report. If the field eventB1-UTRA-FDD or eventB2-UTRA-FDD is present, the UE shall ignore the value(s) provided in reportQuantity.</td>
</tr>
<tr>
<td>timeToTrigger</td>
<td>Time during which specific criteria for the event needs to be met in order to trigger a measurement report.</td>
</tr>
<tr>
<td>bN-ThresholdUTRA-FDD</td>
<td>UTRA-FDD threshold value associated with the selected trigger quantity (RSCP, EcN0) to be used in inter RAT measurement report triggering condition for event number bN. utra-FDD-RSCP corresponds to CPICH_RSCP in TS 25.133 [46] for FDD. utra-FDD-EcN0 corresponds to CPICH_EcNo in TS 25.133 [46] for FDD. For utra-FDD-RSCP: The actual value is field value – 115 dBm. For utra-FDD-EcN0: The actual value is (field value – 49)/2 dB.</td>
</tr>
</tbody>
</table>
Periodical/ReportConfigInterRAT field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxReportCells</td>
<td>Max number of non-serving cells to include in the measurement report.</td>
</tr>
<tr>
<td>reportAmount</td>
<td>Number of measurement reports applicable for eventTriggered as well as for periodical report types</td>
</tr>
<tr>
<td>reportQuantity, reportQuantityUTRA-FDD</td>
<td>The cell measurement quantities to be included in the measurement report. If the field reportQuantityUTRA-FDD is present, the UE shall ignore the value(s) provided in reportQuantity.</td>
</tr>
</tbody>
</table>

ReportConfigNR

The IE ReportConfigNR specifies criteria for triggering of an NR measurement reporting event or of a CHO or CPC event. For events labelled AN with N equal to 1, 2 and so on, measurement reporting events and CHO or CPC events are based on cell measurement results, which can either be derived based on SS/PBCH block or CSI-RS.

- Event A1: Serving becomes better than absolute threshold;
- Event A2: Serving becomes worse than absolute threshold;
- Event A3: Neighbour becomes amount of offset better than PCell/PSCell;
- Event A4: Neighbour becomes better than absolute threshold;
- Event A5: PCell/PSCell becomes worse than absolute threshold1 AND Neighbour/SCell becomes better than another absolute threshold2;
- Event A6: Neighbour becomes amount of offset better than SCell;
- CondEvent A3: Conditional reconfiguration candidate becomes amount of offset better than PCell/PSCell;
- CondEvent A5: PCell/PSCell becomes worse than absolute threshold1 AND Conditional reconfiguration candidate becomes better than another absolute threshold2;

For event I1, measurement reporting event is based on CLI measurement results, which can either be derived based on SRS-RSRP or CLI-RSSI.

- Event I1: Interference becomes higher than absolute threshold.

ReportConfigNR information element

```asn1
ReportConfigNR ::= SEQUENCE {
  reportType                          CHOICE {
    periodical                          PeriodicalReportConfig,
    eventTriggered                      EventTriggerConfig,
    ...,                                  
    reportCGI                           ReportCGI,
    reportSFTD-NR                       ReportSFTD-NR,
    condTriggerConfig-r16               CondTriggerConfig-r16,
  }
}
```
3GPP TS 38.331 version 16.3.1 Release 16

cli-Periodical-r16, CLI-PeriodicalReportConfig-r16
cli-EventTriggered-r16, CLI-EventTriggerConfig-r16

ReportCGI ::= SEQUENCE {
  cellForWhichToReportCGI PhysCellId,
  ...
  useAutonomousGaps-r16 ENUMERATED {setup} OPTIONAL -- Need R
}

ReportSFTD-NR ::= SEQUENCE {
  reportSFTD-Meas BOOLEAN,
  reportRSRP BOOLEAN,
  ...
  reportSFTD-NeighMeas ENUMERATED {true} OPTIONAL, -- Need R
drx-SFTD-NeighMeas ENUMERATED {true} OPTIONAL, -- Need R
cellsForWhichToReportSFTD SEQUENCE (SIZE (1..maxCellSFTD)) OF PhysCellId OPTIONAL -- Need R
}

CondTriggerConfig-r16 ::= SEQUENCE {
  condEventId
  condEventA3
    a3-Offset MeasTriggerQuantityOffset,
    hysteresis Hysteresis,
    timeToTrigger TimeToTrigger
  ),
  condEventA5
    a5-Threshold1 MeasTriggerQuantity,
    a5-Threshold2 MeasTriggerQuantity,
    hysteresis Hysteresis,
    timeToTrigger TimeToTrigger
  ),
  ...
  rsType-r16 NR-RS-Type,
}

EventTriggerConfig::= SEQUENCE {
  eventId
  eventA1
    a1-Threshold MeasTriggerQuantity,
    reportOnLeave BOOLEAN,
    hysteresis Hysteresis,
    timeToTrigger TimeToTrigger
  ),
  eventA2
    a2-Threshold MeasTriggerQuantity,
...}
},
rsType
reportInterval
reportAmount
reportQuantityCell
maxReportCells
reportQuantityRS-Indexes
maxNrofRS-IndexesToReport
includeBeamMeasurements
reportAddNeighMeas
[[
measRSSI-ReportConfig-r16
useT312-r16
includeCommonLocationInfo-r16
includeBT-Meas-r16
includeWLAN-Meas-r16
includeSensor-Meas-r16
]]}
PeriodicalReportConfig ::= SEQUENCE {
  rsType                                      NR-RS-Type,
  reportInterval                              ReportInterval,
  reportAmount                                ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
  reportQuantityCell                          MeasReportQuantity,
  maxReportCells                              INTEGER (1..maxCellReport),
  reportQuantityRS-Indexes                    MeasReportQuantity OPTIONAL, -- Need R
  maxNrofRS-IndexesToReport                   INTEGER (1..maxNrofIndexesToReport) OPTIONAL, -- Need R
  includeBeamMeasurements                     BOOLEAN,
  useWhiteCellList                            BOOLEAN,
  ...,
  measRSSI-ReportConfig-r16                   MeasRSSI-ReportConfig-r16 OPTIONAL, -- Need R
  includeCommonLocationInfo-r16               ENUMERATED {true} OPTIONAL, -- Need R
  includeBT-Meas-r16                          SetupRelease (BT-NameList-r16) OPTIONAL, -- Need M
  includeWLAN-Meas-r16                        SetupRelease (WLAN-NameList-r16) OPTIONAL, -- Need M
  includeSensor-Meas-r16                      SetupRelease (Sensor-NameList-r16) OPTIONAL, -- Need M
  ul-DelayValueConfig-r16                     SetupRelease ( UL-DelayValueConfig-r16 ) OPTIONAL, -- Need M
  reportAddNeighMeas-r16                      ENUMERATED {setup} OPTIONAL
}

NR-RS-Type ::= ENUMERATED {ssb, csi-rs}

MeasTriggerQuantity ::= CHOICE {
  rsrp                                        RSRP-Range,
  rsrq                                        RSRQ-Range,
  sinr                                        SINR-Range
}

MeasTriggerQuantityOffset ::= CHOICE {
  rsrp                                        INTEGER (-30..30),
  rsrq                                        INTEGER (-30..30),
  sinr                                        INTEGER (-30..30)
}

MeasReportQuantity ::= SEQUENCE {
  rsrp                                        BOOLEAN,
  rsrq                                        BOOLEAN,
  sinr                                        BOOLEAN
}

MeasRSSI-ReportConfig-r16 ::= SEQUENCE {
  channelOccupancyThreshold-r16               RSSI-Range-r16 OPTIONAL -- Need R
}

CLI-EventTriggerConfig-r16 ::= SEQUENCE {
  eventId-r16                                 CHOICE {
    eventI1-r16                                 SEQUENCE {
      i1-Threshold-r16                            MeasTriggerQuantityCLI-r16,
      reportOnLeave-r16                           BOOLEAN,
      hysteresis-r16                              Hysteresis,
    }
  }
}
timeToTrigger-r16                           TimeToTrigger
    ... },
    reportInterval-r16                           ReportInterval,
    reportAmount-r16                             ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
    maxReportCLI-r16                             INTEGER {1..maxCLI-Report-r16},
    ... }

CLI-PeriodicalReportConfig-r16 ::=          SEQUENCE {
    reportInterval-r16                           ReportInterval,
    reportAmount-r16                             ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
    reportQuantityCLI-r16                        MeasReportQuantityCLI-r16,
    maxReportCLI-r16                             INTEGER {1..maxCLI-Report-r16},
    ... }

MeasTriggerQuantityCLI-r16 ::=              CHOICE {
    srs-RSRP-r16                                SRS-RSRP-Range-r16,
    cli-RSSI-r16                                CLI-RSSI-Range-r16
  }

MeasReportQuantityCLI-r16 ::=               ENUMERATED {srs-rsrp, cli-rssi}

CondTriggerConfig field descriptions

- **a3-Offset**
  Offset value(s) to be used in NR conditional reconfiguration triggering condition for cond event a3. The actual value is field value * 0.5 dB.

- **a5-Threshold1/ a5-Threshold2**
  Threshold value associated to the selected trigger quantity (e.g. RSRP, RSRQ, SINR) per RS Type (e.g. SS/PBCH block, CSI-RS) to be used in NR conditional reconfiguration triggering condition for cond event a5. In the same condEventA5, the network configures the same quantity for the MeasTriggerQuantity of the a5-Threshold1 and for the MeasTriggerQuantity of the a5-Threshold2.

- **condEventId**
  Choice of NR conditional reconfiguration event triggered criteria.

- **timeToTrigger**
  Time during which specific criteria for the event needs to be met in order to execute the conditional reconfiguration evaluation.

ReportConfigNR field descriptions

- **reportType**
  Type of the configured measurement report. In EN-DC, network does not configure report of type reportCGI using SRB3. The condTriggerConfig is used for CHO or CPC configuration.
### ReportCGI field descriptions

**useAutonomousGaps**
Indicates whether or not the UE is allowed to use autonomous gaps in acquiring system information from the NR neighbour cell. When the field is included, the UE applies the corresponding value for T321.

### EventTriggerConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a3-Offset/a6-Offset</strong></td>
<td>Offset value(s) to be used in NR measurement report triggering condition for event a3/a6. The actual value is field value * 0.5 dB.</td>
</tr>
<tr>
<td><strong>aN-Threshold</strong></td>
<td>Threshold value associated to the selected trigger quantity (e.g. RSRP, RSRQ, SINR) per RS Type (e.g. SS/PBCH block, CSI-RS) to be used in NR measurement report triggering condition for event number aN. If multiple thresholds are defined for event number aN, the thresholds are differentiated by M. The network configures aN-Threshold1 only for events A1, A2, A4, A5 and a5-Threshold2 only for event A5. In the same event A5, the network configures the same quantity for the MeasTriggerQuantity of the a5-Threshold1 and for the MeasTriggerQuantity of the a5-Threshold2.</td>
</tr>
<tr>
<td><strong>channelOccupancyThreshold</strong></td>
<td>RSSI threshold which is used for channel occupancy evaluation.</td>
</tr>
<tr>
<td><strong>eventId</strong></td>
<td>Choice of NR event triggered reporting criteria.</td>
</tr>
<tr>
<td><strong>maxNrofRS-IndexesToReport</strong></td>
<td>Max number of RS indexes to include in the measurement report for A1-A6 events.</td>
</tr>
<tr>
<td><strong>maxReportCells</strong></td>
<td>Max number of non-serving cells to include in the measurement report.</td>
</tr>
<tr>
<td><strong>reportAddNeighMeas</strong></td>
<td>Indicates that the UE shall include the best neighbour cells per serving frequency.</td>
</tr>
<tr>
<td><strong>reportAmount</strong></td>
<td>Number of measurement reports applicable for eventTriggered as well as for periodical report types.</td>
</tr>
<tr>
<td><strong>reportOnLeave</strong></td>
<td>Indicates whether or not the UE shall initiate the measurement reporting procedure when the leaving condition is met for a cell in cellsTriggeredList, as specified in 5.5.4.1.</td>
</tr>
<tr>
<td><strong>reportQuantityCell</strong></td>
<td>The cell measurement quantities to be included in the measurement report.</td>
</tr>
<tr>
<td><strong>reportQuantityRS-Indexes</strong></td>
<td>Indicates which measurement information per RS index the UE shall include in the measurement report.</td>
</tr>
<tr>
<td><strong>timeToTrigger</strong></td>
<td>Time during which specific criteria for the event needs to be met in order to trigger a measurement report.</td>
</tr>
<tr>
<td><strong>ul-DelayValueConfig</strong></td>
<td>If the field is present, the UE shall perform the actual PDCP queueing delay measurement per DRB as specified in TS 38.314 [53] and the UE shall ignore the fields reportQuantityCell and maxReportCells. The applicable values for the corresponding reportInterval are (one of the) (ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240, ms20480, ms40960, min1,min6, min12, min30). The reportInterval indicates the periodicity for performing and reporting of UL PDCP Delay per DRB measurement as specified in TS 38.314 [53].</td>
</tr>
<tr>
<td><strong>useT312</strong></td>
<td>If value TRUE is configured, the UE shall use the timer T312 with the value t312 as specified in the corresponding measObjectNR. If value FALSE is configured, the timer T312 is considered as disabled. Network configures value TRUE only if reportType is set to eventTriggered.</td>
</tr>
<tr>
<td><strong>useWhiteCellList</strong></td>
<td>Indicates whether only the cells included in the white-list of the associated measObject are applicable as specified in 5.5.4.1.</td>
</tr>
</tbody>
</table>
### CLI-EventTriggerConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>i1-Threshold</strong></td>
<td>Threshold value associated to the selected trigger quantity (e.g. SRS-RSRP, CLI-RSSI) to be used in CLI measurement report triggering condition for event i1.</td>
</tr>
<tr>
<td><strong>eventId</strong></td>
<td>Choice of CLI event triggered reporting criteria.</td>
</tr>
<tr>
<td><strong>maxReportCLI</strong></td>
<td>Max number of CLI measurement resource to include in the measurement report.</td>
</tr>
<tr>
<td><strong>reportAmount</strong></td>
<td>Number of measurement reports.</td>
</tr>
<tr>
<td><strong>reportOnLeave</strong></td>
<td>Indicates whether or not the UE shall initiate the measurement reporting procedure when the leaving condition is met for a CLI measurement resource in srsTriggeredList or rssiTriggeredList, as specified in 5.5.4.1.</td>
</tr>
<tr>
<td><strong>timeToTrigger</strong></td>
<td>Time during which specific criteria for the event needs to be met in order to trigger a measurement report.</td>
</tr>
</tbody>
</table>

### CLI-PeriodicalReportConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>maxReportCLI</strong></td>
<td>Max number of CLI measurement resource to include in the measurement report.</td>
</tr>
<tr>
<td><strong>reportAmount</strong></td>
<td>Number of measurement reports.</td>
</tr>
<tr>
<td><strong>reportQuantityCLI</strong></td>
<td>The CLI measurement quantities to be included in the measurement report.</td>
</tr>
</tbody>
</table>

### PeriodicalReportConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>maxNrofRS-IndexesToReport</strong></td>
<td>Max number of RS indexes to include in the measurement report.</td>
</tr>
<tr>
<td><strong>maxReportCells</strong></td>
<td>Max number of non-serving cells to include in the measurement report.</td>
</tr>
<tr>
<td><strong>reportAddNeighMeas</strong></td>
<td>Indicates that the UE shall include the best neighbour cells per serving frequency.</td>
</tr>
<tr>
<td><strong>reportAmount</strong></td>
<td>Number of measurement reports applicable for eventTriggered as well as for periodical report types</td>
</tr>
<tr>
<td><strong>reportQuantityCell</strong></td>
<td>The cell measurement quantities to be included in the measurement report.</td>
</tr>
<tr>
<td><strong>reportQuantityRS-Indexes</strong></td>
<td>Indicates which measurement information per RS index the UE shall include in the measurement report.</td>
</tr>
<tr>
<td><strong>ul-DelayValueConfig</strong></td>
<td>If the field is present, the UE shall perform the actual UL PDCP Packet Average Delay measurement per DRB as specified in TS 38.314 [53] and the UE shall ignore the fields reportQuantityCell and maxReportCells. The applicable values for the corresponding reportInterval are (one of the) [ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240, ms20480, ms40960, min1, min6, min12, min30]. The reportInterval indicates the periodicity for performing and reporting of UL PDCP Packet Average Delay per DRB measurement as specified in TS 38.314 [53].</td>
</tr>
<tr>
<td><strong>useWhiteCellList</strong></td>
<td>Indicates whether only the cells included in the white-list of the associated measObject are applicable as specified in 5.5.4.1.</td>
</tr>
</tbody>
</table>
ReportSFTD-NR field descriptions

<table>
<thead>
<tr>
<th>ReportSFTD-NR field descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cellForWhichToReportSFTD</strong></td>
</tr>
<tr>
<td>Indicates the target NR neighbour cells for SFTD measurement between PCell and NR neighbour cells.</td>
</tr>
<tr>
<td><strong>drx-SFTD-NeighMeas</strong></td>
</tr>
<tr>
<td>Indicates that the UE shall use available idle periods (i.e., DRX off periods) for the SFTD measurement in NR standalone. The network only includes drx-SFTD-NeighMeas field when reportSFTD-NeighMeas is set to true.</td>
</tr>
<tr>
<td><strong>reportSFTD-Meas</strong></td>
</tr>
<tr>
<td>Indicates whether UE is required to perform SFTD measurement between PCell and NR PSCell in NR-DC.</td>
</tr>
<tr>
<td><strong>reportSFTD-NeighMeas</strong></td>
</tr>
<tr>
<td>Indicates whether UE is required to perform SFTD measurement between PCell and NR neighbour cells in NR standalone. The network does not include this field if reportSFTD-Meas is set to true.</td>
</tr>
<tr>
<td><strong>reportRSRP</strong></td>
</tr>
<tr>
<td>Indicates whether UE is required to include RSRP result of NR PSCell or NR neighbour cells in SFTD measurement result, derived based on SSB. If it is set to true, the network should ensure that ssb-ConfigMobility is included in the measurement object for NR PSCell or NR neighbour cells.</td>
</tr>
</tbody>
</table>

other field descriptions

<table>
<thead>
<tr>
<th>other field descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>MeasTriggerQuantity</td>
</tr>
<tr>
<td>SINR is applicable only for CONNECTED mode events.</td>
</tr>
</tbody>
</table>

---

**ReportConfigNR-SL**

The IE ReportConfigNR-SL specifies criteria for triggering of a CBR measurement reporting event for NR sidelink communication. Measurement reporting events are based on CBR measurement results on the corresponding transmission resource pools. These events are labelled CN with N equal to 1 and 2.

Event C1: CBR of NR sidelink communication becomes better than absolute threshold;

Event C2: CBR of NR sidelink communication becomes worse than absolute threshold;

---

**ReportConfigNR-SL information element**

---

```asn1
-- ASN.1
-- TAG=REPORTCONFIGNR-SL-START
ReportConfigNR-SL-r16 ::= SEQUENCE {
  reportType-r16 CHOICE {
    periodical-r16 PeriodicalReportConfigNR-SL-r16
    eventTriggered-r16 EventTriggerConfigNR-SL-r16
  }
}
```

```asn1
EventTriggerConfigNR-SL-r16 ::= SEQUENCE {
  eventId-r16 CHOICE {
    eventC1 SEQUENCE {
      c1-Threshold-r16 SL-CBR-r16
      hysteresis-r16 Hysteresis
      timeToTrigger-r16 TimeToTrigger
    }
  }
}
```
ReportConfigNR-SL field descriptions

**reportType**
Type of the configured CBR measurement report for NR sidelink communication.

EventTriggerConfig field descriptions

**cN-Threshold**
Threshold used for events C1 and C2 specified in subclauses 5.5.4.11 and 5.5.4.12, respectively.

**eventId**
Choice of NR event triggered reporting criteria.

**reportAmount**
Number of measurement reports applicable for *eventTriggered* as well as for *periodical* report types.

**reportQuantity**
The sidelink measurement quantities to be included in the measurement report. In this release, this is set as the CBR measurement result.

**timeToTrigger**
Time during which specific criteria for the event needs to be met in order to trigger a measurement report.

**SL-CBR**
Value 0 corresponds to 0, value 1 to 0.01, value 2 to 0.02, and so on.
**ReportConfigToAddModList**

The IE `ReportConfigToAddModList` concerns a list of reporting configurations to add or modify.

**ReportConfigToAddModList information element**

---

```asn1
ReportConfigToAddModList ::= SEQUENCE (SIZE (1..maxReportConfigId)) OF ReportConfigToAddMod
```

---

**ReportInterval**

The IE `ReportInterval` indicates the interval between periodical reports. The `ReportInterval` is applicable if the UE performs periodical reporting (i.e. when `reportAmount` exceeds 1), for `triggerType event` as well as for `triggerType periodical`. Value `ms120` corresponds to 120 ms, value `ms240` corresponds to 240 ms and so on, while value `min1` corresponds to 1 min, `min6` corresponds to 6 min and so on.

**ReportInterval information element**

---

```asn1
ReportInterval ::= ENUMERATED {ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240, ms20480, ms40960, min1, min6, min12, min30 }
```

---
---

**ReselectionThreshold**

The IE *ReselectionThreshold* is used to indicate an Rx level threshold for cell reselection. Actual value of threshold = field value * 2 [dB].

**ReselectionThreshold information element**

```asn1
ReselectionThreshold ::= INTEGER (0..31)
```

---

**ReselectionThresholdQ**

The IE *ReselectionThresholdQ* is used to indicate a quality level threshold for cell reselection. Actual value of threshold = field value [dB].

**ReselectionThresholdQ information element**

```asn1
ReselectionThresholdQ ::= INTEGER (0..31)
```

---

**ResumeCause**

The IE *ResumeCause* is used to indicate the resume cause in *RRCResumeRequest* and *RRCResumeRequest1*.

**ResumeCause information element**

```asn1
ResumeCause ::= ENUMERATED {emergency, highPriorityAccess, mt-Access, mo-Signalling, mo-Data, mo-VoiceCall, mo-VideoCall, mo-SMS, rna-Update, mps-PriorityAccess, mcs-PriorityAccess, spare1, spare2, spare3, spare4, spare5 }
```
-- RLC-BearerConfig

The IE RLC-BearerConfig is used to configure an RLC entity, a corresponding logical channel in MAC and the linking to a PDCP entity (served radio bearer).

**RLC-BearerConfig information element**

```asn1
-- ASN1START
-- TAG-RLC-BEARERCONFIG-START

RLC-BearerConfig ::= SEQUENCE {
  logicalChannelIdentity                      LogicalChannelIdentity,
  servedRadioBearer                           CHOICE {
    srb-Identity                                SRB-Identity,
    drb-Identity                                DRB-Identity,
  } OPTIONAL,   -- Cond LCH-SetupOnly
  reestablishRLC                              ENUMERATED {true} OPTIONAL,   -- Need N
  rlc-Config                                  RLC-Config                                          OPTIONAL,   -- Cond LCH-Setup
  mac-LogicalChannelConfig                    LogicalChannelConfig                                OPTIONAL,   -- Cond LCH-Setup
  ...
  [rcl-Config-v1610                            RLC-Config-v1610                                    OPTIONAL    -- Need R
    ]}

-- TAG-RLC-BEARERCONFIG-STOP
-- ASN1STOP
```

**RLC-BearerConfig field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>logicalChannelIdentity</td>
<td>ID used commonly for the MAC logical channel and for the RLC bearer.</td>
</tr>
<tr>
<td>reestablishRLC</td>
<td>Indicates that RLC should be re-established. Network sets this to true at least whenever the security key used for the radio bearer associated with this RLC entity changes. For SRB2 and DRBs, it is also set to true during the resumption of the RRC connection or the first reconfiguration after reestablishment.</td>
</tr>
<tr>
<td>rlc-Config</td>
<td>Determines the RLC mode (UM, AM) and provides corresponding parameters. RLC mode reconfiguration can only be performed by DRB release/addition or full configuration. The network may configure rlc-Config-v1610 only when rlc-Config (without suffix) is set to am.</td>
</tr>
<tr>
<td>servedRadioBearer</td>
<td>Associates the RLC Bearer with an SRB or a DRB. The UE shall deliver DL RLC SDUs received via the RLC entity of this RLC bearer to the PDCP entity of the servedRadioBearer. Furthermore, the UE shall advertise and deliver uplink PDCP PDUs of the uplink PDCP entity of the servedRadioBearer to the uplink RLC entity of this RLC bearer unless the uplink scheduling restrictions (moreThanOneRLC in PDCP-Config and the restrictions in LogicalChannelConfig) forbid it to do so.</td>
</tr>
</tbody>
</table>
### Conditional Presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCH-Setup</td>
<td>This field is mandatory present upon creation of a new logical channel for a DRB. This field is optionally present, Need S, upon creation of a new logical channel for an SRB. It is optionally present, Need M, otherwise.</td>
</tr>
<tr>
<td>LCH-SetupOnly</td>
<td>This field is mandatory present upon creation of a new logical channel. It is absent, Need M otherwise.</td>
</tr>
</tbody>
</table>

---

### RLC-Config

The IE `RLC-Config` is used to specify the RLC configuration of SRBs and DRBs.

**RLC-Config information element**

```asn1
RLC-Config ::= CHOICE {
  am                  SEQUENCE {
    ul-AM-RLC          UL-AM-RLC,
    dl-AM-RLC          DL-AM-RLC
  },
  um-Bi-Directional   SEQUENCE {
    ul-UM-RLC          UL-UM-RLC,
    dl-UM-RLC          DL-UM-RLC
  },
  um-Uni-Directional-UL SEQUENCE {
    ul-UM-RLC          UL-UM-RLC
  },
  um-Uni-Directional-DL  SEQUENCE {
    dl-UM-RLC          DL-UM-RLC
  },
  ...                    
}

UL-AM-RLC ::= SEQUENCE {
  sn-FieldLength       SN-FieldLengthAM OPTIONAL, -- Cond Reestab
  t-PollRetransmit     T-PollRetransmit,
  pollPDU              PollPDU,
  pollByte             PollByte,
  maxRetxThreshold     ENUMERATED { t1, t2, t3, t4, t6, t8, t16, t32 }
}

DL-AM-RLC ::= SEQUENCE {
  sn-FieldLength       SN-FieldLengthAM OPTIONAL, -- Cond Reestab
  t-Reassembly         T-Reassembly,
  t-StatusProhibit     T-StatusProhibit
}

UL-UM-RLC ::= SEQUENCE {
  sn-FieldLength       SN-FieldLengthUM OPTIONAL -- Cond Reestab
}
```
3GPP TS 38.331 version 16.3.1 Release 16

DL-UM-RLC ::= SEQUENCE {
  sn-FieldLength OPTIONAL, -- Cond Reestab
  t-Reassembly } T-PollRetransmit ::= ENUMERATED {
  ms5, ms10, ms15, ms20, ms25, ms30, ms35,
  ms40, ms45, ms50, ms55, ms60, ms65, ms70,
  ms75, ms80, ms85, ms90, ms95, ms100, ms105,
  ms110, ms115, ms120, ms125, ms130, ms135,
  ms140, ms145, ms150, ms155, ms160, ms165,
  ms170, ms175, ms180, ms185, ms190, ms195,
  ms200, ms205, ms210, ms215, ms220, ms225,
  ms230, ms235, ms240, ms245, ms250, ms300,
  ms350, ms400, ms450, ms500, ms800, ms1000,
  ms2000, ms4000, ms1-v1610, ms2-v1610, ms3-v1610,
  ms4-v1610, spare1} PollPDU ::= ENUMERATED {
  p4, p8, p16, p32, p64, p128, p256, p512, p1024, p2048, p4096, p6144, p8192, p12288, p24576, p28672, p32768, p40960, p49152, p57344, p65536, infinity, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1} PollByte ::= ENUMERATED {
  kB1, kB2, kB5, kB8, kB10, kB15, kB25, kB50, kB75,
  kB100, kB125, kB250, kB375, kB500, kB750, kB1000,
  kB1250, kB1500, kB2000, kB3000, kB4000, kB4500,
  kB5000, kB5500, kB6000, kB6500, kB7000, kB7500,
  mB8, mB9, mB10, mB11, mB12, mB13, mB14, mB15,
  mB16, mB17, mB18, mB20, mB25, mB30, mB40, infinity, spare20, spare19, spare18, spare17, spare16, spare15, spare14, spare13, spare12, spare11, spare10, spare9, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1} T-Reassembly ::= ENUMERATED {
  ms0, ms5, ms10, ms15, ms20, ms25, ms30, ms35,
  ms40, ms45, ms50, ms55, ms60, ms65, ms70,
  ms75, ms80, ms85, ms90, ms95, ms100, ms110,
  ms120, ms130, ms140, ms150, ms160, ms170,
  ms180, ms190, ms200, spare1} T-StatusProhibit ::= ENUMERATED {
  ms0, ms5, ms10, ms15, ms20, ms25, ms30, ms35,
  ms40, ms45, ms50, ms55, ms60, ms65, ms70,
  ms75, ms80, ms85, ms90, ms95, ms100, ms105,
  ms110, ms115, ms120, ms125, ms130, ms135,
  ms140, ms145, ms150, ms155, ms160, ms165,
  ms170, ms175, ms180, ms185, ms190, ms195,
  ms200, ms205, ms210, ms215, ms220, ms225,
  ms230, ms235, ms240, ms245, ms250, ms300,
  ms350, ms400, ms450, ms500, ms800, ms1000,
  ms1200, ms1600, ms2000, ms2400, spare2, spare1}
ETSI-Config field descriptions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxRetxThreshold</td>
<td>Parameter for RLC AM in TS 38.322 [4]. Value ( t_1 ) corresponds to 1 retransmission, value ( t_2 ) corresponds to 2 retransmissions and so on.</td>
</tr>
<tr>
<td>pollByte</td>
<td>Parameter for RLC AM in TS 38.322 [4]. Value ( kB_{25} ) corresponds to 25 kBytes, value ( kB_{50} ) corresponds to 50 kBytes and so on. ( infinity ) corresponds to an infinite amount of kBytes.</td>
</tr>
<tr>
<td>pollPDU</td>
<td>Parameter for RLC AM in TS 38.322 [4]. Value ( p_4 ) corresponds to 4 PDUs, value ( p_8 ) corresponds to 8 PDUs and so on. ( infinity ) corresponds to an infinite number of PDUs.</td>
</tr>
<tr>
<td>sn-FieldLength</td>
<td>Indicates the RLC SN field size, see TS 38.322 [4], in bits. Value ( size_{6} ) means 6 bits, value ( size_{12} ) means 12 bits, value ( size_{18} ) means 18 bits. The value of ( sn-FieldLength ) for a DRB shall be changed only using reconfiguration with sync. The network configures only value ( size_{12} ) in ( sn-FieldLengthAM ) for SRB.</td>
</tr>
<tr>
<td>t-PollRetransmit</td>
<td>Timer for RLC AM in TS 38.322 [4], in milliseconds. Value ( ms_{5} ) means 5 ms, value ( ms_{10} ) means 10 ms and so on.</td>
</tr>
<tr>
<td>t-Reassembly</td>
<td>Timer for reassembly in TS 38.322 [4], in milliseconds. Value ( ms_{0} ) means 0 ms, value ( ms_{5} ) means 5 ms and so on.</td>
</tr>
<tr>
<td>t-StatusProhibit</td>
<td>Timer for status reporting in TS 38.322 [4], in milliseconds. Value ( ms_{0} ) means 0 ms, value ( ms_{5} ) means 5 ms and so on. If ( t-StatusProhibit-v1610 ) is present, the UE shall ignore ( t-StatusProhibit ) (without suffix).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reestab</td>
<td>The field is mandatory present at bearer setup. It is optionally present, need M, at RLC re-establishment. Otherwise it is absent. Need M.</td>
</tr>
</tbody>
</table>
**RLF-TimersAndConstants information element**

```
-- ASN1START
-- TAG-RLF-TIMERSANDCONSTANTS-START
RLF-TimersAndConstants ::= SEQUENCE {
  t310                                ENUMERATED {ms0, ms50, ms100, ms200, ms500, ms1000, ms2000, ms4000, ms6000},
  n310                                ENUMERATED {n1, n2, n3, n4, n6, n8, n10, n20},
  n311                                ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10},
  ...,
  [[
    t311                                ENUMERATED {ms1000, ms3000, ms5000, ms10000, ms15000, ms20000, ms30000}
  ]]}
-- TAG-RLF-TIMERSANDCONSTANTS-STOP
-- ASN1STOP
```

**RLF-TimersAndConstants field descriptions**

| n3xy | Constants are described in clause 7.3. Value n1 corresponds to 1, value n2 corresponds to 2 and so on. |
| t3xy | Timers are described in clause 7.1. Value ms0 corresponds to 0 ms, value ms50 corresponds to 50 ms and so on. |

**RNTI-Value**

The IE **RNTI-Value** represents a Radio Network Temporary Identity.

```
-- ASN1START
-- TAG-RNTI-VALUE-START
RNTI-Value ::= INTEGER (0..65535)
-- TAG-RNTI-VALUE-STOP
-- ASN1STOP
```

**RSRP-Range**

The IE **RSRP-Range** specifies the value range used in RSRP measurements and thresholds. For measurements, integer value for RSRP measurements is according to Table 10.1.6.1-1 in TS 38.133 [14]. For thresholds, the actual value is (IE value – 156) dBm, except for the IE value 127, in which case the actual value is infinity.
RSRP-Range information element

-- ASN1START
-- TAG-RSRP-RANGE-START

RSRP-Range ::= INTEGER(0..127)

-- TAG-RSRP-RANGE-STOP
-- ASN1STOP

-- RSRQ-Range

The IE RSRQ-Range specifies the value range used in RSRQ measurements and thresholds. For measurements, integer value for RSRQ measurements is according to Table 10.1.11.1-1 in TS 38.133 [14]. For thresholds, the actual value is (IE value – 87) / 2 dB.

RSRQ-Range information element

-- ASN1START
-- TAG-RSRQ-RANGE-START

RSRQ-Range ::= INTEGER(0..127)

-- TAG-RSRQ-RANGE-STOP
-- ASN1STOP

-- RSSI-Range

The IE RSSI-Range specifies the value range used in RSSI measurements and thresholds for NR operation with shared spectrum channel access. The integer value for RSSI measurements is derived from the mapping table as defined in in TS 38.133 [14].

RSSI-Range information element

-- ASN1START
-- TAG-RSSI-RANGE-START

RSSI-Range-r16 ::= INTEGER(0..76)

-- TAG-RSSI-RANGE-STOP
-- ASN1STOP

-- SCellIndex

The IE SCellIndex concerns a short identity, used to identify an SCell or PCell. The value range is shared across the Cell Groups.


---

**SCellIndex information element**

```
SCellIndex ::= INTEGER {1..31}
```

---

**SchedulingRequestConfig**

The IE `SchedulingRequestConfig` is used to configure the parameters, for the dedicated scheduling request (SR) resources.

---

**SchedulingRequestConfig information element**

```
SchedulingRequestConfig ::= SEQUENCE {
  schedulingRequestToAddModList SEQUENCE (SIZE (1..maxNrofSR-ConfigPerCellGroup)) OF SchedulingRequestToAddMod OPTIONAL, -- Need N
  schedulingRequestToReleaseList SEQUENCE (SIZE (1..maxNrofSR-ConfigPerCellGroup)) OF SchedulingRequestId OPTIONAL  -- Need N
}

SchedulingRequestToAddMod ::= SEQUENCE {
  schedulingRequestId SchedulingRequestId,
  sr-ProhibitTimer ENUMERATED {ms1, ms2, ms4, ms8, ms16, ms32, ms64, ms128} OPTIONAL, -- Need S
  sr-TransMax ENUMERATED { n4, n8, n16, n32, n64, spare3, spare2, spare1}
}
```

---

**SchedulingRequestConfig field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>schedulingRequestToAddModList</td>
<td>List of Scheduling Request configurations to add or modify.</td>
</tr>
<tr>
<td>schedulingRequestToReleaseList</td>
<td>List of Scheduling Request configurations to release.</td>
</tr>
</tbody>
</table>
### SchedulingRequestToAddMod field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>schedulingRequestId</strong></td>
<td>Used to modify a SR configuration and to indicate, in LogicalChannelConfig, the SR configuration to which a logical channel is mapped and to indicate, in SchedulingRequestResourceConfig, the SR configuration for which a scheduling request resource is used.</td>
</tr>
<tr>
<td><strong>sr-ProhibitTimer</strong></td>
<td>Timer for SR transmission on PUCCH in TS 38.321 [3]. Value is in ms. Value ms1 corresponds to 1ms, value ms2 corresponds to 2ms, and so on. When the field is absent, the UE applies the value 0.</td>
</tr>
<tr>
<td><strong>sr-TransMax</strong></td>
<td>Maximum number of SR transmissions as described in TS 38.321 [3]. Value n4 corresponds to 4, value n8 corresponds to 8, and so on.</td>
</tr>
</tbody>
</table>

### SchedulingRequestId

The IE **SchedulingRequestId** is used to identify a Scheduling Request instance in the MAC layer.

**SchedulingRequestId information element**

```asn1
SchedulingRequestId ::= INTEGER (0..7)
```

### SchedulingRequestResourceConfig

The IE **SchedulingRequestResourceConfig** determines physical layer resources on PUCCH where the UE may send the dedicated scheduling request (D-SR) (see TS 38.213 [13], clause 9.2.4).

**SchedulingRequestResourceConfig information element**

```asn1
SchedulingRequestResourceConfig ::= SEQUENCE {
  schedulingRequestResourceId             SchedulingRequestResourceId,
  schedulingRequestID                     SchedulingRequestId,
  periodicityAndOffset                    CHOICE {
    sym2                                    NULL,
    sym6or7                                 NULL,
    sl1                                     NULL, -- Recurs in every slot
    sl2                                     INTEGER (0..1),
    sl4                                     INTEGER (0..3),
    sl5                                     INTEGER (0..4),
    sl8                                     INTEGER (0..7),
    sl10                                    INTEGER (0..9),
  }
}
```
periodicityAndOffset
SR periodicity and offset in number of symbols or slots (see TS 38.213 [13], clause 9.2.4) The following periodicities may be configured depending on the chosen subcarrier spacing:
SCS = 15 kHz: 2sym, 7sym, 1sl, 2sl, 4sl, 8sl, 16sl, 20sl, 40sl, 80sl
SCS = 30 kHz: 2sym, 7sym, 1sl, 2sl, 4sl, 8sl, 10sl, 16sl, 20sl, 40sl, 80sl, 160sl
SCS = 60 kHz: 2sym, 7sym/6sym, 1sl, 2sl, 4sl, 8sl, 16sl, 20sl, 40sl, 80sl, 160sl, 320sl
SCS = 120 kHz: 2sym, 7sym, 1sl, 2sl, 4sl, 8sl, 16sl, 40sl, 80sl, 160sl, 320sl, 640sl
sym6or7 corresponds to 6 symbols if extended cyclic prefix and a SCS of 60 kHz are configured, otherwise it corresponds to 7 symbols. For periodicities 2sym, 7sym and sl1 the UE assumes an offset of 0 slots.

phy-PriorityIndex
Indicates whether this scheduling request resource is high or low priority in PHY prioritization/multiplexing handling (see TS 38.213 [13], clause 9.2.4). Value p0 indicates low priority and value p1 indicates high priority.

resource
ID of the PUCCH resource in which the UE shall send the scheduling request. The actual PUCCH-Resource is configured in PUCCH-Config of the same UL BWP and serving cell as this SchedulingRequestResourceConfig. The network configures a PUCCH-Resource of PUCCH-format0 or PUCCH-format1 (other formats not supported) (see TS 38.213 [13], clause 9.2.4)
schedulingRequestID
The ID of the SchedulingRequestConfig that uses this scheduling request resource.

-- SchedulingRequestResourceId

The IE SchedulingRequestResourceId is used to identify scheduling request resources on PUCCH.

SchedulingRequestResourceId information element

---

ETSI
ScramblingId

The IE *ScramblingId* is used for scrambling channels and reference signals.

**ScramblingId information element**

```asn1
ScramblingId ::= INTEGER (0..1023)
```

-- ASN1STOP

SCS-SpecificCarrier

The IE *SCS-SpecificCarrier* provides parameters determining the location and width of the actual carrier or the carrier bandwidth. It is defined specifically for a numerology (subcarrier spacing (SCS)) and in relation (frequency offset) to Point A.

**SCS-SpecificCarrier information element**

```asn1
SCS-SpecificCarrier ::= SEQUENCE {
    offsetToCarrier       INTEGER (0..2199),
    subcarrierSpacing     SubcarrierSpacing,
    carrierBandwidth      INTEGER (1..maxNrofPhysicalResourceBlocks),
    ...
    txDirectCurrentLocation INTEGER (0..4095) OPTIONAL -- Need S
}
```

-- ASN1STOP
### SCS-SpecificCarrier field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>carrierBandwidth</td>
<td>Width of this carrier in number of PRBs (using the subcarrierSpacing defined for this carrier) (see TS 38.211 [16], clause 4.4.2).</td>
</tr>
<tr>
<td>offsetToCarrier</td>
<td>Offset in frequency domain between Point A (lowest subcarrier of common RB 0) and the lowest usable subcarrier on this carrier in number of PRBs (using the subcarrierSpacing defined for this carrier). The maximum value corresponds to 275*8-1. See TS 38.211 [16], clause 4.4.2.</td>
</tr>
<tr>
<td>txDirectCurrentLocation</td>
<td>Indicates the downlink Tx Direct Current location for the carrier. A value in the range 0..3299 indicates the subcarrier index within the carrier. The values in the value range 3301..4095 are reserved and ignored by the UE. If this field is absent for downlink within ServingCellConfigCommon and ServingCellConfigCommonSIB, the UE assumes the default value of 3300 (i.e. &quot;Outside the carrier&quot;). (see TS 38.211 [16], clause 4.4.2). Network does not configure this field via ServingCellConfig or for uplink carriers.</td>
</tr>
<tr>
<td>subcarrierSpacing</td>
<td>Subcarrier spacing of this carrier. It is used to convert the offsetToCarrier into an actual frequency. Only the values 15 kHz, 30 kHz or 60 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable.</td>
</tr>
</tbody>
</table>

---

### SDAP-Config

The IE SDAP-Config is used to set the configurable SDAP parameters for a data radio bearer. All configured instances of SDAP-Config with the same value of pdu-Session correspond to the same SDAP entity as specified in TS 37.324 [24].

#### SDAP-Config information element

```asn1
SDAP-Config ::= SEQUENCE {
  pdu-Session                        PDU-SessionID,
  sdap-HeaderDL                      ENUMERATED {present, absent},
  sdap-HeaderUL                      ENUMERATED {present, absent},
  defaultDRB                         BOOLEAN,
  mappedQoS-FlowsToAdd               SEQUENCE (SIZE (1..maxNrofQFIs)) OF QFI OPTIONAL, -- Need N
  mappedQoS-FlowsToRelease           SEQUENCE (SIZE (1..maxNrofQFIs)) OF QFI OPTIONAL, -- Need N
  ...
}
QFI ::= INTEGER (0..maxQFI)
PDU-SessionID ::= INTEGER (0..255)
```

---

ETSi
**SDAP-Config field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>defaultDRB</td>
<td>Indicates whether or not this is the default DRB for this PDU session. Among all configured instances of SDAP-Config with the same value of pdu-Session, this field shall be set to true in at most one instance of SDAP-Config and to false in all other instances.</td>
</tr>
<tr>
<td>mappedQoS-FlowsToAdd</td>
<td>Indicates the list of QFIs of UL QoS flows of the PDU session to be additionally mapped to this DRB. A QFI value can be included at most once in all configured instances of SDAP-Config with the same value of pdu-Session. For QoS flow remapping, the QFI value of the remapped QoS flow is only included in mappedQoS-FlowsToAdd in sdap-Config corresponding to the new DRB and not included in mappedQoS-FlowsToRelease in sdap-Config corresponding to the old DRB.</td>
</tr>
<tr>
<td>mappedQoS-FlowsToRelease</td>
<td>Indicates the list of QFIs of QoS flows of the PDU session to be released from existing QoS flow to DRB mapping of this DRB.</td>
</tr>
<tr>
<td>pdu-Session</td>
<td>Identity of the PDU session whose QoS flows are mapped to the DRB.</td>
</tr>
<tr>
<td>sdap-HeaderUL</td>
<td>Indicates whether or not a SDAP header is present for UL data on this DRB. The field cannot be changed after a DRB is established. The network sets this field to present if the field defaultDRB is set to true.</td>
</tr>
<tr>
<td>sdap-HeaderDL</td>
<td>Indicates whether or not a SDAP header is present for DL data on this DRB. The field cannot be changed after a DRB is established.</td>
</tr>
</tbody>
</table>

---

**SearchSpace**

The IE SearchSpace defines how/where to search for PDCCH candidates. Each search space is associated with one ControlResourceSet. For a scheduled cell in the case of cross carrier scheduling, except for nrofCandidates, all the optional fields are absent (regardless of their presence conditions).

**SearchSpace information element**

```asn1
SearchSpace ::= SEQUENCE {
  searchSpaceId                           SearchSpaceId,  
  controlResourceSetId                    ControlResourceSetId                                        OPTIONAL, -- Cond SetupOnly
  monitoringSlotPeriodicityAndOffset      CHOICE {         sl1                                     NULL,   
                                            s12                                    INTEGER {0..1},
                                            s14                                    INTEGER {0..3},
                                            s15                                    INTEGER {0..4},
                                            s18                                    INTEGER {0..7},
                                            s110                                   INTEGER {0..9},
                                            s116                                   INTEGER {0..15},
                                            s120                                   INTEGER {0..19},
                                            s140                                   INTEGER {0..39},
                                            s180                                   INTEGER {0..79},
                                            s1160                                  INTEGER {0..159},
                                            s1320                                  INTEGER {0..319},
                                            s1640                                  INTEGER {0..639},
                                            s11280                                 INTEGER {0..1279},
                                            s12560                                 INTEGER {0..2559}) 
  OPTIONAL, -- Cond Setup
```

---

ETS1
duration INTEGER (2..2559) OPTIONAL, -- Need R
monitoringSymbolsWithinSlot BIT STRING (SIZE (14)) OPTIONAL, -- Cond Setup

nrofCandidates:
  aggregationLevel1 ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},
  aggregationLevel2 ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},
  aggregationLevel4 ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},
  aggregationLevel8 ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},
  aggregationLevel16 ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8}

searchSpaceType:
  common:
    dci-Format0-0-AndFormat1-0
    ...
    dci-Format2-0
      nrofCandidates-SFI
        aggregationLevel1 ENUMERATED {n1, n2}
        aggregationLevel2 ENUMERATED {n1, n2}
        aggregationLevel4 ENUMERATED {n1, n2}
        aggregationLevel8 ENUMERATED {n1, n2}
      ...
    ...
    dci-Format2-1
    ...
    dci-Format2-2
    ...
    dci-Format2-3
      dummy1
      dummy2
      ...
  ...

  ue-Specific:
    dci-Formats ENUMERATED {formats0-0-And-1-0, formats0-1-And-1-1},
    ...
    dci-Formats-MT-r16 ENUMERATED {formats2-5}
    dci-FormatsSI-r16 ENUMERATED {formats0-0-And-1-0, formats0-1-And-1-1, formats3-0, formats3-1, formats3-0-And-3-1}
    dci-FormatsExt-r16 ENUMERATED {formats0-2-And-1-2, formats0-1-And-1-1And-0-2-And-1-2}

SearchSpaceExt-r16 ::=
  controlResourceSetId-r16 ControlResourceSetId-r16
  searchSpaceType-r16
  common-r16

  SEQUENCE {  

SEQUENCE {
  nrofCandidates-CI-r16
    SEQUENCE {
      aggregationLevel1-r16
        ENUMERATED \{n1, n2\} OPTIONAL, -- Need R
      aggregationLevel2-r16
        ENUMERATED \{n1, n2\} OPTIONAL, -- Need R
      aggregationLevel4-r16
        ENUMERATED \{n1, n2\} OPTIONAL, -- Need R
      aggregationLevel8-r16
        ENUMERATED \{n1, n2\} OPTIONAL, -- Need R
      aggregationLevel16-r16
        ENUMERATED \{n1, n2\} OPTIONAL, -- Need R
    }, ...
  ...
} dci-Format2-5-r16
  nrofCandidates-IAB-r16
    SEQUENCE {
      aggregationLevel1-r16
        ENUMERATED \{n1, n2\} OPTIONAL, -- Need R
      aggregationLevel2-r16
        ENUMERATED \{n1, n2\} OPTIONAL, -- Need R
      aggregationLevel4-r16
        ENUMERATED \{n1, n2\} OPTIONAL, -- Need R
      aggregationLevel8-r16
        ENUMERATED \{n1, n2\} OPTIONAL, -- Need R
      aggregationLevel16-r16
        ENUMERATED \{n1, n2\} OPTIONAL, -- Need R
    }, ...
  ...
} dci-Format2-6-r16
  ...
} ...
}

searchSpaceGroupIdList-r16
  SEQUENCE (SIZE (1..2)) OF INTEGER \{0..1\} OPTIONAL, -- Cond Setup3
freqMonitorLocations-r16
  BIT STRING (SIZE (5)) OPTIONAL, -- Need R

-- TAG-SEARCHSPACE-STOP
-- ASN1STOP
### SearchSpace field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>common</strong></td>
<td>Configures this search space as common search space (CSS) and DCI formats to monitor.</td>
</tr>
<tr>
<td><strong>controlResourceSetId</strong></td>
<td>The CORESET applicable for this SearchSpace. Value 0 identifies the common CORESET#0 configured in MIB and in ServingCellConfigCommon. Values 1..maxNrofControlResourceSets-1 identify CORESETs configured in System Information or by dedicated signalling. The CORESETs with non-zero controlResourceSetId are configured in the same BWP as this SearchSpace. If the field controlResourceSetId-r16 is present, UE shall ignore the controlResourceSetId (without suffix).</td>
</tr>
<tr>
<td><strong>dummy1, dummy2</strong></td>
<td>This field is not used in the specification. If received it shall be ignored by the UE.</td>
</tr>
<tr>
<td><strong>dci-Format0-0-AndFormat1-0</strong></td>
<td>If configured, the UE monitors the DCI formats 0_0 and 1_0 according to TS 38.213 [13], clause 10.1.</td>
</tr>
<tr>
<td><strong>dci-Format2-0</strong></td>
<td>If configured, the UE monitors the DCI format 2_0 according to TS 38.213 [13], clause 10.1.</td>
</tr>
<tr>
<td><strong>dci-Format2-1</strong></td>
<td>If configured, the UE monitors the DCI format 2_1 according to TS 38.213 [13], clause 10.1.</td>
</tr>
<tr>
<td><strong>dci-Format2-2</strong></td>
<td>If configured, the UE monitors the DCI format 2_2 according to TS 38.213 [13], clause 10.1.</td>
</tr>
<tr>
<td><strong>dci-Format2-3</strong></td>
<td>If configured, the UE monitors the DCI format 2_3 according to TS 38.213 [13], clause 10.1.</td>
</tr>
<tr>
<td><strong>dci-Format2-4</strong></td>
<td>If configured, the UE monitors the DCI format 2_4 according to TS 38.213 [13], clause 11.2A.</td>
</tr>
<tr>
<td><strong>dci-Format2-5</strong></td>
<td>If configured, IAB-MT monitors the DCI format 2_5 according to TS 38.213 [13], clause 14.</td>
</tr>
<tr>
<td><strong>dci-Format2-6</strong></td>
<td>If configured, the UE monitors the DCI format 2_6 according to TS 38.213 [13], clause 10.1. DCI format 2_6 can only be configured on the SpCell.</td>
</tr>
<tr>
<td><strong>dci-Formats</strong></td>
<td>Indicates whether the UE monitors in this USS for DCI formats 0-0 and 1-0 or for formats 0-1 and 1-1.</td>
</tr>
<tr>
<td><strong>dci-FormatsExt</strong></td>
<td>If this field is present, the field dci-Formats is ignored and dci-FormatsExt is used instead to indicate whether the UE monitors in this USS for DCI format 0_2 and 1_2 or formats 0_1 and 1_1 and 0_2 and 1_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 10.1).</td>
</tr>
<tr>
<td><strong>dci-Formats-MT</strong></td>
<td>Indicates whether the IAB-MT monitors the DCI formats 2-5 according to TS 38.213 [13], clause 14.</td>
</tr>
<tr>
<td><strong>dci-FormatsSL</strong></td>
<td>Indicates whether the UE monitors in this USS for DCI formats 0-0 and 1-0 or for formats 0-1 and 1-1 or for format 3-0 of dynamic grant or for format 3-1 or for formats 3-0 of dynamic grant and 3-1.</td>
</tr>
<tr>
<td><strong>duration</strong></td>
<td>Number of consecutive slots that a SearchSpace lasts in every occasion, i.e., upon every period as given in the periodicityAndOffset. If the field is absent, the UE applies the value 1 slot, except for DCI format 2_0. The UE ignores this field for DCI format 2_0. The maximum valid duration is periodicity-1 (periodicity as given in the monitoringSlotPeriodicityAndOffset). For IAB-MT, duration indicates number of consecutive slots that a SearchSpace lasts in every occasion, i.e., upon every period as given in the periodicityAndOffset. If the field is absent, the IAB-MT applies the value 1 slot, except for DCI format 2_0 and DCI format 2_5. The IAB-MT ignores this field for DCI format 2_0 and DCI format 2_5. The maximum valid duration is periodicity-1 (periodicity as given in the monitoringSlotPeriodicityAndOffset).</td>
</tr>
<tr>
<td><strong>freqMonitorLocations</strong></td>
<td>Defines an association of the search space to multiple monitoring locations in the frequency domain and indicates whether the pattern configured in the associated CORESET is replicated to a specific RB set, see TS 38.213, clause 10.1. Each bit in the bitmap corresponds to one RB set, and the rightmost (least significant) bit corresponds to RB set 0 in the BWP. A bit set to 1 indicates that a frequency domain resource allocation replicated from the pattern configured in the associated CORESET is mapped to the RB set.</td>
</tr>
</tbody>
</table>
### 3GPP TS 38.331 version 16.3.1 Release 16

**monitoringSlotPeriodicityAndOffset**

SLOTS for PDCCH monitoring configured as periodicity and offset. If the UE is configured to monitor DCI format 2_1, only the values ‘sl1’, ‘sl2’ or ‘sl4’ are applicable. If the UE is configured to monitor DCI format 2_0, only the values ‘sl1’, ‘sl2’, ‘sl4’, ‘sl5’, ‘sl8’, ‘sl10’, ‘sl16’, and ‘sl20’ are applicable (see TS 38.213 [13], clause 10). If the UE is configured to monitor DCI format 2_4, only the values ‘sl1’, ‘sl2’, ‘sl4’, ‘sl5’, ‘sl8’ and ‘sl10’ are applicable.

For IAB-MT, if the IAB-MT is configured to monitor DCI format 2_1, only the values ‘sl1’, ‘sl2’ or ‘sl4’ are applicable. If the IAB-MT is configured to monitor DCI format 2_0 or DCI format 2_5, only the values ‘sl1’, ‘sl2’, ‘sl4’, ‘sl5’, ‘sl8’, ‘sl10’, ‘sl16’, and ‘sl20’ are applicable (see TS 38.213, clause 10).

**monitoringSymbolsWithinSlot**

The first symbol(s) for PDCCH monitoring in the slots configured for PDCCH monitoring (see monitoringSlotPeriodicityAndOffset and duration). The most significant (left) bit represents the first OFDM symbol in a slot, and the second most significant (left) bit represents the second OFDM symbol in a slot and so on. The bit(s) set to one identify the first OFDM symbol(s) of the control resource set within a slot. If the cyclic prefix of the BWP is set to extended CP, the last two bits within the bit string shall be ignored by the UE or IAB-MT.

For DCI format 2_0, the first one symbol applies if the duration of CORESET (in the IE ControlResourceSet identified by controlResourceSetId) indicates 3 symbols, the first two symbols apply if the duration of CORESET identified by controlResourceSetId indicates 2 symbols, and the first three symbols apply if the duration of CORESET identified by controlResourceSetId indicates 1 symbol.

See TS 38.213 [13], clause 10.

For IAB-MT: For DCI format 2_0 or DCI format 2_5, the first one symbol applies if the duration of CORESET (in the IE ControlResourceSet identified by controlResourceSetId) indicates 3 symbols, the first two symbols apply if the duration of CORESET identified by controlResourceSetId indicates 2 symbols, and the first three symbols apply if the duration of CORESET identified by controlResourceSetId indicates 1 symbol.

See TS 38.213 [13], clause 10.

**nrofCandidates-CI**

The number of PDCCH candidates specifically for format 2-4 for the configured aggregation level. If an aggregation level is absent, the UE does not search for any candidates with that aggregation level. The network configures only one aggregationLevel and the corresponding number of candidates (see TS 38.213 [13], clause 10.1).

**nrofCandidates-SFI**

The number of PDCCH candidates specifically for format 2-0 for the configured aggregation level. If an aggregation level is absent, the UE does not search for any candidates with that aggregation level. The network configures only one aggregationLevel and the corresponding number of candidates (see TS 38.213 [13], clause 11.1.1). For a search space configured with freqMonitorLocations-r16, only value ‘n1’ is valid.

**nrofCandidates**

Number of PDCCH candidates per aggregation level. The number of candidates and aggregation levels configured here applies to all formats unless a particular value is specified or a format-specific value is provided (see inside searchSpaceType). If configured in the SearchSpace of a cross carrier scheduled cell, this field determines the number of candidates and aggregation levels to be used on the linked scheduling cell (see TS 38.213 [13], clause 10).

**searchSpaceGroupIdList**

List of search space group IDs which the search space is associated with. The network configures at most 2 search space groups per BWP where the group ID is either 0 or 1.

**searchSpaceId**

Identity of the search space. SearchSpaceId = 0 identifies the searchSpaceZero configured via PBCH (MIB) or ServingCellConfigCommon and may hence not be used in the SearchSpace IE. The searchSpaceId is unique among the BWPs of a Serving Cell. In case of cross carrier scheduling, scheduling spaces with the same searchSpaceId in scheduled cell and scheduling cell are linked to each other. The UE applies the search space for the scheduled cell only if the DL BWPs in which the linked search spaces are configured in scheduling cell and scheduled cell are both active.

For an IAB-MT, the search space defines how/where to search for PDCCH candidates for an IAB-MT. Each search space is associated with one ControlResearchSet. For a scheduled cell in the case of cross carrier scheduling, except for nrofCandidates, all the optional fields are absent.

**searchSpaceType**

Indicates whether this is a common search space (present) or a UE specific search space as well as DCI formats to monitor for.

**ue-Specific**

Configures this search space as UE specific search space (USS). The UE monitors the DCI format with CRC scrambled by C-RNTI, CS-RNTI (if configured), and SP-CSI-RNTI (if configured)
<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setup</td>
<td>This field is mandatory present upon creation of a new SearchSpace. It is optionally present, Need M, otherwise.</td>
</tr>
<tr>
<td>Setup2</td>
<td>This field is mandatory present when a new SearchSpace is set up, if the same SearchSpace ID is not included in searchSpacesToAddModListExt-r16 of the parent IE with the field searchSpaceType-r16 included. Otherwise it is optionally present, Need M.</td>
</tr>
<tr>
<td>Setup3</td>
<td>This field is mandatory present when a new SearchSpace is set up, if the same SearchSpace ID is not included in searchSpacesToAddModListExt (without suffix) of the parent IE with the field searchSpaceType (without suffix) included. Otherwise it is optionally present, Need M.</td>
</tr>
<tr>
<td>SetupOnly</td>
<td>This field is mandatory present upon creation of a new SearchSpace. It is absent, Need M, otherwise.</td>
</tr>
<tr>
<td>SetupOnly2</td>
<td>In PDCCH-Config, the field is optionally present upon creation of a new SearchSpace and absent, Need M upon reconfiguration of an existing SearchSpace. In PDCCH-ConfigCommon, the field is absent.</td>
</tr>
</tbody>
</table>

### SearchSpaceId

The IE `SearchSpaceId` is used to identify Search Spaces. The ID space is used across the BWPs of a Serving Cell. The search space with the `SearchSpaceId` = 0 identifies the search space configured via PBCH (MIB) and in `ServingCellConfigCommon (searchSpaceZero)`. The number of Search Spaces per BWP is limited to 10 including the common and UE specific Search Spaces.

**SearchSpaceId information element**

```asn1
SearchSpaceId ::= INTEGER {0..maxNrofSearchSpaces-1}
```

### SearchSpaceZero

The IE `SearchSpaceZero` is used to configure SearchSpace#0 of the initial BWP (see TS 38.213 [13], clause 13).

**SearchSpaceZero information element**

```asn1
SearchSpaceZero ::= INTEGER {0..15}
```
The IE SecurityAlgorithmConfig is used to configure AS integrity protection algorithm and AS ciphering algorithm for SRBs and DRBs.

**SecurityAlgorithmConfig** information element

```asn1
SecurityAlgorithmConfig ::= SEQUENCE {
  cipheringAlgorithm                  CipheringAlgorithm,
  integrityProtAlgorithm              IntegrityProtAlgorithm OPTIONAL,  -- Need R
  ...
}
```

**cipheringAlgorithm**
Indicates the ciphering algorithm to be used for SRBs and DRBs, as specified in TS 33.501 [11]. The algorithms nea0-nea3 are identical to the LTE algorithms eea0-3. The algorithms configured for all bearers using master key shall be the same, and the algorithms configured for all bearers using secondary key, if any, shall be the same. If UE is connected to E-UTRA/EPC, this field indicates the ciphering algorithm to be used for RBs configured with NR PDCP, as specified in TS 33.501 [11].

**integrityProtAlgorithm**
Indicates the integrity protection algorithm to be used for SRBs and DRBs, as specified in TS 33.501 [11]. The algorithms nia0-nia3 are identical to the E-UTRA algorithms eia0-3. The algorithms configured for all bearers using master key shall be the same and the algorithms configured for all bearers using secondary key, if any, shall be the same. The network does not configure nia0 except for unauthenticated emergency sessions for unauthenticated UEs in LSM (limited service mode). If UE is connected to E-UTRA/EPC, this field indicates the integrity protection algorithm to be used for SRBs configured with NR PDCP, as specified in TS 33.501 [11]. The network does not configure nia0 for SRB3.

---

**SemiStaticChannelAccessConfig**

The IE SemiStaticChannelAccessConfig is used to configure channel access parameters when the network is operating in semi-static channel access mode (see clause 4.3 TS 37.213 [48].

**SemiStaticChannelAccessConfig** information element

```asn1
SemiStaticChannelAccessConfig ::= ...
```

---
SemiStaticChannelAccessConfig field descriptions

**period**
Indicates the periodicity of the semi-static channel access mode (see TS 37.213 [48], clause 4.3). Value ms1 corresponds to 1 ms, value ms2 corresponds to 2 ms, value ms2dot5 corresponds to 2.5 ms, and so on.

---

Sensor-LocationInfo

The IE **Sensor-LocationInfo** is used by the UE to provide sensor information.

**Sensor-LocationInfo** information element

Sensor-LocationInfo field descriptions

**sensor-MeasurementInformation**
This field provides barometric pressure measurements as **Sensor-MeasurementInformation** defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.

**sensor-MotionInformation**
This field provides motion sensor measurements as **Sensor-MotionInformation** defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.

---

ServCellIndex

The IE **ServCellIndex** concerns a short identity, used to identify a serving cell (i.e. the PCell, the PSCell or an SCell). Value 0 applies for the PCell, while the **SCellIndex** that has previously been assigned applies for SCells.
ServCellIndex information element

ServCellIndex ::= INTEGER {0..maxNrofServingCells-1}

ServingCellConfig

The IE ServingCellConfig is used to configure (add or modify) the UE with a serving cell, which may be the SpCell or an SCell of an MCG or SCG. The parameters herein are mostly UE specific but partly also cell specific (e.g. in additionally configured bandwidth parts). Reconfiguration between a PUCCH and PUCCHless SCell is only supported using an SCell release and add.

ServingCellConfig information element

ServingCellConfig ::= SEQUENCE {
  tdd-UL-DL-ConfigurationDedicated  TDD-UL-DL-ConfigDedicated OPTIONAL, -- Cond TDD
  initialDownlinkBWP  BWP-DownlinkDedicated OPTIONAL, -- Need M
  downlinkBWP-ToReleaseList  SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Id OPTIONAL, -- Need N
  downlinkBWP-ToAddModList  SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Downlink OPTIONAL, -- Need N
  firstActiveDownlinkBWP-Id  BWP-Id OPTIONAL, -- Cond SyncAndCellAdd
  bwp-InactivityTimer ENUMERATED {ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30,
    ms40, ms50, ms60, ms80, ms100, ms200, ms300, ms500,
    ms750, ms1280, ms1920, ms2560, spare10, spare9, spare8,
    spare7, spare6, spare5, spare4, spare3, spare2, spare1 } OPTIONAL, -- Need R
  defaultDownlinkBWP-Id  BWP-Id OPTIONAL, -- Need S
  uplinkConfig  UplinkConfig OPTIONAL, -- Need M
  supplementaryUplink  UplinkConfig OPTIONAL, -- Need M
  pdcch-ServingCellConfig  SetupRelease { PDCCH-ServingCellConfig } OPTIONAL, -- Need M
  pdsch-ServingCellConfig  SetupRelease { PDSCH-ServingCellConfig } OPTIONAL, -- Need M
  csi-MeasConfig  SetupRelease { CSI-MeasConfig } OPTIONAL, -- Need M
  sCellDeactivationTimer ENUMERATED {ms20, ms40, ms80, ms160, ms200, ms240,
    ms320, ms400, ms480, ms520, ms640, ms720,
    ms840, ms1280, spare2, spare1} OPTIONAL, -- Cond ServingCellWithoutPUCCH
  crossCarrierSchedulingConfig  CrossCarrierSchedulingConfig OPTIONAL, -- Need M
tag-Id                              TAG-Id,
dummy1                              ENUMERATED {enabled} OPTIONAL, -- Need R
  pathlossReferenceLinking ENUMERATED {spCell, sCell} OPTIONAL, -- Cond SCellOnly
  servingCellMO  MeasObjectId OPTIONAL, -- Cond MeasObject...
  [197  lte-CRS-ToMatchAround  SetupRelease { RateMatchPatternLTE-CRS } OPTIONAL, -- Need M
  rateMatchPatternToAddModList  SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPattern OPTIONAL, -- Need N
  rateMatchPatternToReleaseList  SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPatternId OPTIONAL, -- Need N
...

ETSI
downlinkChannelBW-PerSCS-List ::= SEQUENCE {
  (1..maxSCSs) OF SCS-SpecificCarrier
} OPTIONAL -- Need S

supplementaryUplinkRelease-r16 ::= ENUMERATED {true} OPTIONAL -- Need N

tdd-UL-DL-ConfigurationDedicated-IAB-MT-r16 TDD-UL-DL-ConfigDedicated-IAB-MT-r16 OPTIONAL -- Cond TDD_IAB

dormantBWP-Config-r16 SetupRelease { DSBWP-BWP-Config-r16 } OPTIONAL -- Need M

car-SlotOffset-r16 ::= CHOICE {
  refSCS15kHz INTEGER (-2..2),
  refSCS30KHz INTEGER (-5..5),
  refSCS60KHz INTEGER (-10..10),
  refSCS120KHz INTEGER (-20..20)
} OPTIONAL -- Cond AsyncCA

dummy2 SetupRelease { DummyJ } OPTIONAL -- Need M

intraCellGuardBandsDL-List-r16 ::= SEQUENCE {
  (1..maxSCSs) OF IntraCellGuardBandsPerSCS-r16
} OPTIONAL -- Need S

intraCellGuardBandsUL-List-r16 ::= SEQUENCE {
  (1..maxSCSs) OF IntraCellGuardBandsPerSCS-r16
} OPTIONAL -- Need S

csi-RS-ValidationWithDCI-r16 ::= ENUMERATED {enabled} OPTIONAL -- Need R

csi-RS-PatternList1-r16 SetupRelease { LTE-CRS-PatternList-r16 } OPTIONAL -- Need M

csi-RS-PatternList2-r16 SetupRelease { LTE-CRS-PatternList-r16 } OPTIONAL -- Need M

crs-RateMatch-PerCORESETPoolIndex-r16 ::= ENUMERATED {enabled} OPTIONAL -- Need R

crb-RateMatch-PerCORESETPoolIndex-r16 ::= ENUMERATED {enabled} OPTIONAL -- Need R

towDefaultTCI-MFL-bwPoolIndex-r16 ::= ENUMERATED {enabled} OPTIONAL -- Need R

towDefaultTCI-States-r16 ::= ENUMERATED {true} OPTIONAL -- Need R

directionalCollisionHandling-r16 ::= ENUMERATED {enabled} OPTIONAL -- Need R

channelAccessConfig-r16 SetupRelease { ChannelAccessConfig-r16 } OPTIONAL -- Need M

UplinkConfig ::= SEQUENCE {
  initialUplinkBWP BWP-UplinkDedicated OPTIONAL -- Need M

  uplinkBWP-ToReleaseList SEQUENCE {
    (1..maxNrofBWPs) OF BWP-Id
  } OPTIONAL -- Need M

  uplinkBWP-ToAddModList SEQUENCE {
    (1..maxNrofBWPs) OF BWP-Uplink
  } OPTIONAL -- Need M

  firstActiveUplinkBWP-Id BWP-Id OPTIONAL -- Cond SyncAndCellAdd

  pusch-ServingCellConfig SetupRelease { PUSCH-ServingCellConfig } OPTIONAL -- Need M

  carrierSwitching SetupRelease { SRS-CarrierSwitching } OPTIONAL -- Need M

  ..., 

  powerBoostPi2BPSK BOOLEAN OPTIONAL -- Need N

  uplinkChannelBW-PerSCS-List SEQUENCE {
    (1..maxSCSs) OF SCS-SpecificCarrier
  } OPTIONAL -- Need S

  enablePL-RS-UpdateForPUSCH-SRS-r16 ENUMERATED {enabled} OPTIONAL -- Need R

  enableDefaultBeamPL-ForPUSCH0-0-r16 ENUMERATED {enabled} OPTIONAL -- Need R

  enableDefaultBeamPL-ForPUSCH-r16 ENUMERATED {enabled} OPTIONAL -- Need R

  enableDefaultBeamPL-ForSRS-r16 ENUMERATED {enabled} OPTIONAL -- Need R

  uplinkTxSwitching-r16 SetupRelease { UplinkTxSwitching-r16 } OPTIONAL -- Need M

  mpr-PowerBoost-FR2-r16 ENUMERATED {true} OPTIONAL -- Need R

}
maxEnergyDetectionThreshold-r16    INTEGER(-85..-52),
ergyDetectionThresholdOffset-r16    INTEGER(-20..-13),
ul-toDL-COT-SharingED-Threshold-r16 INTEGER (-85..-52)          OPTIONAL, -- Need R
absenceOfAnyOtherTechnology-r16    ENUMERATED {true}            OPTIONAL -- Need R

ChannelAccessConfig-r16 ::=        SEQUENCE {
   energyDetectionConfig-r16           CHOICE {
      maxEnergyDetectionThreshold-r16    INTEGER (-85..-52),
ergyDetectionThresholdOffset-r16    INTEGER (-13..20)
   }                                                                                                           OPTIONAL, -- Need R
   ul-toDL-COT-SharingED-Threshold-r16 INTEGER (-85..-52)                                              OPTIONAL, -- Need R
   absenceOfAnyOtherTechnology-r16    ENUMERATED {true}                                               OPTIONAL -- Need R
}

IntraCellGuardBandsPerSCS-r16 ::=      SEQUENCE {
   guardBandSCS-r16                       SubcarrierSpacing,
   intraCellGuardBands-r16                SEQUENCE (SIZE (1..4)) OF GuardBand-r16
}

GuardBand-r16 ::=                      SEQUENCE {
   startCRB-r16                          INTEGER (0..274),
   nrofCRBs-r16                          INTEGER (0..15)
}

DormancyGroupID-r16 ::=         INTEGER (0..4)

DormantBWP-Config-r16::=               SEQUENCE {
   dormantBWP-Id-r16                      BWP-Id                                                           OPTIONAL, -- Need M
   withinActiveTimeConfig-r16             SetupRelease { WithinActiveTimeConfig-r16 }                      OPTIONAL, -- Need M
   outsideActiveTimeConfig-r16           SetupRelease { OutsideActiveTimeConfig-r16 }                     OPTIONAL    -- Need M
}

WithinActiveTimeConfig-r16 ::=         SEQUENCE {
   firstWithinActiveTimeBWP-Id-r16        BWP-Id                                                           OPTIONAL, -- Need M
dormancyGroupWithinActiveTime-r16       DormancyGroupID-r16                                              OPTIONAL -- Need R
}

OutsideActiveTimeConfig-r16 ::=        SEQUENCE {
   firstOutsideActiveTimeBWP-Id-r16       BWP-Id                                                           OPTIONAL, -- Need M
dormancyGroupOutsideActiveTime-r16      DormancyGroupID-r16                                              OPTIONAL -- Need R
}

UplinkTxSwitching-r16 ::=              SEQUENCE {
   uplinkTxSwitchingPeriodLocation-r16    BOOLEAN,
   uplinkTxSwitchingCarrier-r16           ENUMERATED {carrier1, carrier2}
}

-- TAG-SERVINGCELLCONFIG-STOP
-- ASN1STOP
<table>
<thead>
<tr>
<th><strong>ChannelAccessConfig field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>absenceOfAnyOtherTechnology</strong></td>
</tr>
<tr>
<td>Presence of this field indicates absence on a long term basis (e.g. by level of regulation) of any other technology sharing the carrier; absence of this field indicates the potential presence of any other technology sharing the carrier, as specified in TS 37.213 [48] clauses 4.2.1 and 4.2.3.</td>
</tr>
<tr>
<td><strong>energyDetectionConfig</strong></td>
</tr>
<tr>
<td>Indicates whether to use the maxEnergyDetectionThreshold or the energyDetectionThresholdOffset (see TS 37.213 [48], clause 4.2.3).</td>
</tr>
<tr>
<td><strong>energyDetectionThresholdOffset</strong></td>
</tr>
<tr>
<td>Indicates the offset to the default maximum energy detection threshold value. Unit in dB. Value -13 corresponds to -13dB, value -12 corresponds to -12dB, and so on (i.e. in steps of 1dB) as specified in TS 37.213 [48], clause 4.2.3.</td>
</tr>
<tr>
<td><strong>maxEnergyDetectionThreshold</strong></td>
</tr>
<tr>
<td>Indicates the absolute maximum energy detection threshold value. Unit in dBm. Value -85 corresponds to -85 dBm, value -84 corresponds to -84 dBm, and so on (i.e. in steps of 1dBm) as specified in TS 37.213 [48], clause 4.2.3.</td>
</tr>
<tr>
<td><strong>ul-toDL-COT-SharingED-Threshold</strong></td>
</tr>
<tr>
<td>Maximum energy detection threshold that the UE should use to share channel occupancy with gNB for DL transmission as specified in TS 37.213 [48], clause 4.1.3 for downlink channel access and clause 4.2.3 for uplink channel access.</td>
</tr>
</tbody>
</table>
### ServingCellConfig field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bwp-InactivityTimer</strong></td>
<td>The duration in ms after which the UE falls back to the default Bandwidth Part (see TS 38.321[3], clause 5.15). When the network releases the timer configuration, the UE stops the timer without switching to the default BWP.</td>
</tr>
<tr>
<td><strong>ca-SlotOffset</strong></td>
<td>Slot offset between the primary cell (PCell/PSCell) and the SCell in unaligned frame boundary with slot alignment and partial SFN alignment inter-band CA. Based on this field, the UE determines the time offset of the SCell as specified in clause 4.5 of TS 38.211 [16]. The granularity of this field is determined by the reference SCS for the slot offset (i.e. the maximum of PCell/PSCell lowest SCS among all the configured SCSSs in DL/UL SCS-SpecificCarrierList in ServingCellConfigCommon or ServingCellConfigCommonSIB and this serving cell's lowest SCS among all the configured SCSSs in DL/UL SCS-SpecificCarrierList in ServingCellConfigCommon or ServingCellConfigCommonSIB). The Network configures at most single non-zero offset duration in ms (independent on SCS) among CCs in the unaligned CA configuration. If the field is absent, the UE applies the value of 0. The slot offset value can only be changed with SCell release and add.</td>
</tr>
<tr>
<td><strong>cbg-TxDiffTBsProcessingType1, cbg-TxDiffTBsProcessingType2</strong></td>
<td>Indicates whether processing types 1 and 2 based CBG based operation is enabled according to Rel-16 UE capabilities.</td>
</tr>
<tr>
<td><strong>channelAccessConfig</strong></td>
<td>List of parameters used for access procedures of operation with shared spectrum channel access (see TS 37.213[48]).</td>
</tr>
<tr>
<td><strong>crossCarrierSchedulingConfig</strong></td>
<td>Indicates whether this serving cell is cross-carrier scheduled by another serving cell or whether it cross-carrier schedules another serving cell.</td>
</tr>
<tr>
<td><strong>crs-RateMatch-PerCORESETPoolIndex</strong></td>
<td>Indicates how UE performs rate matching when both lte-CRS-PatternList1-r16 and lte-CRS-PatternList2-r16 are configured as specified in TS 38.314, clause 5.1.4.2.</td>
</tr>
<tr>
<td><strong>csi-RS-ValidationWithDCI</strong></td>
<td>Indicates how the UE performs periodic and semi-persistent CSI-RS reception in a slot. The presence of this field indicates that the UE uses DCI detection to validate whether to receive CSI-RS (see TS 38.213[13], clause 11.1).</td>
</tr>
<tr>
<td><strong>defaultDownlinkBWP-Id</strong></td>
<td>The initial bandwidth part is referred to by BWP-Id = 0. ID of the downlink bandwidth part to be used upon expiry of the BWP inactivity timer. This field is UE specific. When the field is absent the UE uses the initial BWP as default BWP. (see TS 38.213[13], clause 12 and TS 38.321[3], clause 5.15).</td>
</tr>
<tr>
<td><strong>directionalCollisionHandling</strong></td>
<td>Indicates that this serving cell is using directional collision handling between a reference and other cell(s) for half-duplex operation in TDD CA with same SCS as specified in TS 38.213[13], clause 11.1. The half-duplex operation only applies within the same frequency range and cell group. The network only configures this field for TDD serving cells that are using the same SCS.</td>
</tr>
<tr>
<td><strong>dormantBWP-Config</strong></td>
<td>The dormant BWP configuration for an SCell. This field can be configured only for a (non-PUCCH) SCell.</td>
</tr>
<tr>
<td><strong>downlinkBWP-ToAddModList</strong></td>
<td>List of additional downlink bandwidth parts to be added or modified. (see TS 38.213[13], clause 12).</td>
</tr>
<tr>
<td><strong>downlinkBWP-ToReleaseList</strong></td>
<td>List of additional downlink bandwidth parts to be released. (see TS 38.213[13], clause 12).</td>
</tr>
<tr>
<td><strong>downlinkChannelBW-PerSCS-List</strong></td>
<td>A set of UE specific channel bandwidth and location configurations for different subcarrier spacings (numerologies). Defined in relation to Point A. The UE uses the configuration provided in this field only for the purpose of channel bandwidth and location determination. If absent, UE uses the configuration indicated in scs-SpecificCarrierList in DownlinkConfigCommon / DownlinkConfigCommonSIB. Network only configures channel bandwidth that corresponds to the channel bandwidth values defined in TS 38.101-1 [15] and TS 38.101-2 [39].</td>
</tr>
<tr>
<td><strong>dummy1, dummy 2</strong></td>
<td>This field is not used in the specification. If received it shall be ignored by the UE.</td>
</tr>
<tr>
<td><strong>enableBeamSwitchTiming</strong></td>
<td>Indicates the aperiodic CSI-RS triggering with beam switching triggering behaviour as defined in clause 5.2.1.5.1 of TS 38.214[19].</td>
</tr>
</tbody>
</table>
### enableDefaultTCI-StatePerCoresetPoolIndex
Presence of this field indicates the UE shall follow the release 16 behavior of default TCI state per CORESETPoolIndex when the UE is configured by higher layer parameter
PDCH-Config that contains two different values of CORESETPoolIndex in ControlResourceSet is enabled.

### enableTwoDefaultTCI-States
Presence of this field indicates the UE shall follow the release 16 behavior of two default TCI states for PDSCH when at least one TCI codepoint is mapped to two TCI states is enabled.

### firstActiveDownlinkBWP-Id
If configured for an SpCell, this field contains the ID of the DL BWP to be activated upon performing the RRC (re-)configuration. If the field is absent, the RRC (re-)configuration does not impose a BWP switch.
If configured for an SCell, this field contains the ID of the downlink bandwidth part to be used upon activation of an SCell. The initial bandwidth part is referred to by BWP-Id = 0.
Upon PCell change and PCell addition/change, the network sets the firstActiveDownlinkBWP-Id and firstActiveUplinkBWP-Id to the same value.

### initialDownlinkBWP
The dedicated (UE-specific) configuration for the initial downlink bandwidth-part (i.e. DL BWP#0). If any of the optional IEs are configured within this IE, the UE considers the BWP#0 to be an RRC configured BWP (from UE capability viewpoint). Otherwise, the UE does not consider the BWP#0 as an RRC configured BWP (from UE capability viewpoint). Network always configures the UE with a value for this field if no other BWPs are configured. NOTE1

### intraCellGuardBandsDL-List, intraCellGuardBandsUL-List
List of intra-cell guard bands in a serving cell for operation with shared spectrum channel access. If not configured, the guard bands are defined according to 38.101-1 [15], see TS 38.214 [19], clause 7. For operation in licensed spectrum, this field is absent, and no UE action is required.

### lte-CRS-PatternList1
A list of LTE CRS patterns around which the UE shall do rate matching for PDSCH. The LTE CRS patterns in this list shall be non-overlapping in frequency. The network does not configure this field and lte-CRS-ToMatchAround simultaneously.

### lte-CRS-PatternList2
A list of LTE CRS patterns around which the UE shall do rate matching for PDSCH scheduled with a DCI detected on a CORESET with CORESETPoolIndex configured with 1. This list is configured only if CORESETPoolIndex configured with 1. The first LTE CRS pattern in this list shall be fully overlapping in frequency with the first LTE CRS pattern in lte-CRS-PatternList1, The second LTE CRS pattern in this list shall be fully overlapping in frequency with the second LTE CRS pattern in lte-CRS-PatternList1, and so on. Network configures this field only if the field lte-CRS-ToMatchAround is not configured and there is at least one ControlResourceSet in one DL BWP of this serving cell with coresetPoolIndex set to 1.

### lte-CRS-ToMatchAround
Parameters to determine an LTE CRS pattern that the UE shall rate match around.

### pathlossReferenceLinking
Indicates whether UE shall apply as pathloss reference either the downlink of SpCell (PCell for MCG or PSCell for SCG) or of SCell that corresponds with this uplink (see TS 38.213 [13], clause 7).

### pdsch-ServingCellConfig
PDSCH related parameters that are not BW-specific.

### rateMatchPatternToAddModList
Resources patterns which the UE should rate match PDSCH around. The UE rate matches around the union of all resources indicated in the rate match patterns. Rate match patterns defined here on cell level apply only to PDSCH of the same numerology. See TS 38.214 [19], clause 5.1.2.2.3.

### sCellDeactivationTimer
SCell deactivation timer in TS 38.321 [3]. If the field is absent, the UE applies the value infinity.

### servingCellMO
measObjectId of the MeasObjectNR in MeasConfig which is associated to the serving cell. For this MeasObjectNR, the following relationship applies between this MeasObjectNR and frequencyInfoDL in ServingCellConfigCommon of the serving cell: if ssbFrequency is configured, its value is the same as the absoluteFrequencySSB and if csi-rs-ResourceConfigMobility is configured, the value of its subcarrierSpacing is present in one entry of the csi-SpecificCarrierList. csi-RS-CellListMobility includes an entry corresponding to the serving cell (with cellId equal to physCellId in ServingCellConfigCommon) and the frequency range indicated by the csi-rs-MeasurementBW of the entry in csi-RS-CellListMobility is included in the frequency range indicated by in the entry of the csi-SpecificCarrierList.
<table>
<thead>
<tr>
<th><strong>supplementaryUplink</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Network may configure this field only when supplementaryUplinkConfig is configured in ServingCellConfigCommon or supplementaryUplink is configured in ServingCellConfigCommonSIB.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>supplementaryUplinkRelease</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>If this field is included, the UE shall release the uplink configuration configured by supplementaryUplink. The network only includes either supplementaryUplinkRelease or supplementaryUplink at a time.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>tag-Id</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing Advance Group ID, as specified in TS 38.321 [3], which this cell belongs to.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>tdd-UL-DL-ConfigurationDedicated-iab-mt</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource configuration per IAB-MT D/U/F overrides all symbols (with a limitation that effectively only flexible symbols can be overwritten in Rel-16) per slot over the number of slots as provided by TDD-UL-DL ConfigurationCommon.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>uplinkConfig</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Network may configure this field only when uplinkConfigCommon is configured in ServingCellConfigCommon or ServingCellConfigCommonSIB. Addition or release of this field can only be done upon SCell addition or release (respectively).</td>
</tr>
</tbody>
</table>
### UplinkConfig field descriptions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>carrierSwitching</strong></td>
<td>Includes parameters for configuration of carrier based SRS switching (see TS 38.214 [19], clause 6.2.1.3.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>enableDefaultBeamPL-ForPUSCH0-0</strong>, <strong>enableDefaultBeamPL-ForPUCCH</strong>, <strong>enableDefaultBeamPL-ForSRS</strong></td>
<td>When the parameter is present, UE derives the spatial relation and the corresponding pathloss reference Rs as specified in 38.213, clauses 7.1.1, 7.2.1, 7.3.1 and 9.2.2. The network only configures these parameters for FR2.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>enablePL-RS-UpdateForPUSCH-SRS</strong></td>
<td>When this parameter is present, the Rel-16 feature of MAC CE based pathloss RS updates for PUSCH/SRS is enabled. Network only configures this parameter when the UE is configured with sri-PUSCH-PowerControl. If this field is not configured, network configures at most 4 pathloss RS resources for PUSCH/PUCCH/SRS transmissions per BWP, not including pathloss RS resources for SRS transmissions for positioning. (See TS 38.213 [13], clause 7).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>firstActiveUplinkBWP-Id</strong></td>
<td>If configured for an SpCell, this field contains the ID of the UL BWP to be activated upon performing the RRC (re-)configuration. If the field is absent, the RRC (re-)configuration does not impose a BWP switch. If configured for an SCell, this field contains the ID of the uplink bandwidth part to be used upon MAC-activation of an SCell. The initial bandwidth part is referred to by BandwidthPartId = 0.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>initialUplinkBWP</strong></td>
<td>The dedicated (UE-specific) configuration for the initial uplink bandwidth-part (i.e. UL BWP#0). If any of the optional IEs are configured within this IE as part of the IE UplinkConfig, the UE considers the BWP#0 to be an RRC configured BWP (from UE capability viewpoint). Otherwise, the UE does not consider the BWP#0 as an RRC configured BWP (from UE capability viewpoint). Network always configures the UE with a value for this field if no other BWPs are configured. NOTE1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>mpr-PowerBoost-FR2</strong></td>
<td>Indicates whether UE is allowed to boost uplink transmission power by suspending in-band emission (IBE) requirements as specified in TS 38.101-2 [39]. Network only configures this field for FR2 serving cells.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>powerBoostP2BPSK</strong></td>
<td>If this field is set to true, the UE determines the maximum output power for PUCCH/PUSCH transmissions that use pi/2 BPSK modulation according to TS 38.101-1 [15], clause 6.2.4.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pusch-ServingCellConfig</strong></td>
<td>PUSCH related parameters that are not BWP-specific.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>uplinkBWP-ToAddModList</strong></td>
<td>The additional bandwidth parts for uplink to be added or modified. In case of TDD uplink- and downlink BWP with the same bandwidthPartId are considered as a BWP pair and must have the same center frequency.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>uplinkBWP-ToReleaseList</strong></td>
<td>The additional bandwidth parts for uplink to be released.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>uplinkChannelBW-PerSCS-List</strong></td>
<td>A set of UE specific channel bandwidth and location configurations for different subcarrier spacings (numerologies). Defined in relation to Point A. The UE uses the configuration provided in this field only for the purpose of channel bandwidth and location determination. If absent, UE uses the configuration indicated in scs-SpecificCarrierList in UplinkConfigCommon / UplinkConfigCommonSIB. Network only configures channel bandwidth that corresponds to the channel bandwidth values defined in TS 38.101-1 [15] and TS 38.101-2 [39].</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>uplinkTxSwitchingPeriodLocation</strong></td>
<td>Indicates whether the location of UL Tx switching period is configured in this uplink carrier in case of inter-band UL CA, SUL, or (NG)EN-DC, as specified in TS 38.101-1 [15] and TS 38.101-3 [34]. In case of inter-band UL CA or SUL, network configures this field to TRUE for one of the uplink carriers involved in dynamic UL TX switching and configures this field in the other carrier to FALSE. In case of (NG)EN-DC, network always configures this field to TRUE for NR carrier (i.e. with (NG)EN-DC, the UL switching period always occurs on the NR carrier).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>uplinkTxSwitchingCarrier</strong></td>
<td>Indicates that the configured carrier is carrier1 or carrier2 for dynamic uplink Tx switching, as defined in TS 38.101-1 [15] and TS 38.101-3 [34]. In case of inter-band UL CA or SUL, network configures one of the two uplink carriers involved in dynamic UL TX switching as carrier1 and the other as carrier2. In case of (NG)EN-DC, network always configures the NR carrier as carrier 2.</td>
</tr>
</tbody>
</table>
**DormantBWP-Config field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>dormancyGroupWithinActiveTime</strong></td>
<td>This field contains the ID of an SCell group for Dormancy within active time, to which this SCell belongs. The use of the Dormancy within active time SCell groups is specified in TS 38.213 [13].</td>
</tr>
<tr>
<td><strong>dormancyGroupOutsideActiveTime</strong></td>
<td>This field contains the ID of an SCell group for Dormancy outside active time, to which this SCell belongs. The use of the Dormancy outside active time SCell groups is specified in TS 38.213 [13].</td>
</tr>
<tr>
<td><strong>dormantBWP-Id</strong></td>
<td>This field contains the ID of the downlink bandwidth part to be used as dormant BWP. If this field is configured, its value is different from defaultDownlinkBWP-Id, and at least one of the withinActiveTimeConfig and outsideActiveTimeConfig should be configured.</td>
</tr>
<tr>
<td><strong>firstOutsideActiveTimeBWP-Id</strong></td>
<td>This field contains the ID of the downlink bandwidth part to be activated when receiving a DCI indication for SCell dormancy outside active time.</td>
</tr>
<tr>
<td><strong>firstWithinActiveTimeBWP-Id</strong></td>
<td>This field contains the ID of the downlink bandwidth part to be activated when receiving a DCI indication for SCell dormancy within active time.</td>
</tr>
<tr>
<td><strong>outsideActiveTimeConfig</strong></td>
<td>This field contains the configuration to be used for SCell dormancy outside active time, as specified in TS 38.213 [13]. The field can only be configured when the cell group the SCell belongs to is configured with dcp-Config.</td>
</tr>
<tr>
<td><strong>withinActiveTimeConfig</strong></td>
<td>This field contains the configuration to be used for SCell dormancy within active time, as specified in TS 38.213 [13].</td>
</tr>
</tbody>
</table>

**GuardBand field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>startCRB</strong></td>
<td>Indicates the starting RB of the guard band.</td>
</tr>
<tr>
<td><strong>nrofCRB</strong></td>
<td>Indicates the length of the guard band in RBs. When set to 0, zero-size guard band is used.</td>
</tr>
</tbody>
</table>

**NOTE 1:** If the dedicated part of initial UL/DL BWP configuration is absent, the initial BWP can be used but with some limitations. For example, changing to another BWP requires RRCReconfiguration since DCI format 1_0 doesn't support DCI-based switching.
Conditional Presence | Explanation
--- | ---
AsyncCA | This field is mandatory present for SCells whose slot offset between the SpCell is not 0. Otherwise it is absent, Need S.
MeasObject | This field is mandatory present for the SpCell if the UE has a measConfig, and it is optionally present, Need M, for SCells.
SCellOnly | This field is optionally present, Need R, for SCells. It is absent otherwise.
ServingCellWithoutPUCCH | This field is optionally present, Need S, for SCells except PUCCH SCells. It is absent otherwise.
SyncAndCellAdd | This field is mandatory present for a SpCell upon PCell change and PSCell addition/change and upon RRCSetup/RRCResume.
The field is mandatory present for an SCell upon addition.
For SpCell, the field is optionally present, Need N, upon reconfiguration without reconfigurationWithSync, and upon reconfiguration with reconfigurationWithSync to the same SpCell.
In all other cases the field is absent.
TDD | This field is optionally present, Need R, for TDD cells. It is absent otherwise.
TDD IAB | For IAB-MT, this field is optionally present. Need R, for TDD cells. It is absent otherwise.

---

**ServingCellConfigCommon**

The IE `ServingCellConfigCommon` is used to configure cell specific parameters of a UE's serving cell. The IE contains parameters which a UE would typically acquire from SSB, MIB or SIBs when accessing the cell from IDLE. With this IE, the network provides this information in dedicated signalling when configuring a UE with a SCells or with an additional cell group (SCG). It also provides it for SpCells (MCG and SCG) upon reconfiguration with sync.

**ServingCellConfigCommon** information element

---

```asn1
ServingCellConfigCommon ::= SEQUENCE {
  physCellId                          PhysCellId                                                          OPTIONAL,   -- Cond HOAndServCellAdd,
  downlinkConfigCommon                DownlinkConfigCommon                                                OPTIONAL,   -- Cond HOAndServCellAdd
  uplinkConfigCommon                  UplinkConfigCommon                                                  OPTIONAL,   -- Need M
  supplementaryUplinkConfig           UplinkConfigCommon                                                  OPTIONAL,   -- Need S
  n-TimingAdvanceOffset               ENUMERATED { n0, n25600, n39936 }                                   OPTIONAL,   -- Need S
  ssb-PositionsInBurst                CHOICE {         shortBitmap                         BIT STRING (SIZE (4)),
                                                      mediumBitmap                        BIT STRING (SIZE (8)),
                                                      longBitmap                          BIT STRING (SIZE (64)) }                                       OPTIONAL, -- Cond AbsFreqSSB
  ssb-periodicityServingCell          ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, spare2, spare1 }   OPTIONAL,   -- Cond HOAndServCellAdd
  dms-TypeA-Position                  ENUMERATED { pos2, pos3},
  lte-CRS-ToMatchAround               SetupRelease { RateMatchPatternLTE-CRS }                            OPTIONAL,   -- Need M
  rateMatchPatternToAddModList        SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPattern   OPTIONAL,   -- Need N
  rateMatchPatternToReleaseList       SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPatternId OPTIONAL,   -- Need N
  ssbSubcarrierSpacing                SubcarrierSpacing                                                   OPTIONAL,   -- Cond HOAndServCellWithSSB
  tdd-UL-DL-ConfigurationCommon       TDD-UL-DL-ConfigCommon                                              OPTIONAL,   -- Cond TDD
  ss-PBCH-BlockPower                  INTEGER (-60..50),
  ...,
  [channelAccessMode-r16 dynamic]    CHOICE {                     ...
  ...}
```

---

ETSIP
semiStatic
}  
  discoveryBurstWindowLength-r16
  ssb-PositionQCL-r16
  highSpeedConfig-r16
}]]

-- TAG-SERVINGCELLCONFIGCOMMON-STOP
-- ASN1STOP
### ServingCellConfigCommon field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>channelAccessMode</strong></td>
<td>If present, this field indicates which channel access procedures to apply for operation with shared spectrum channel access as defined in TS 37.213 [48]. If the field is configured as &quot;semiStatic&quot;, the UE shall apply the channel access procedures for semi-static channel occupancy as described in subclause 4.3 in TS 37.213. If the field is configured as &quot;dynamic&quot;, the UE shall apply the channel access procedures in TS 37.213, with the exception of subclause 4.3 of TS 37.213.</td>
</tr>
<tr>
<td><strong>dmrs-TypeA-Position</strong></td>
<td>Position of (first) DM-RS for downlink (see TS 38.211 [16], clause 7.4.1.1.1) and uplink (TS 38.211 [16], clause 6.4.1.1.3).</td>
</tr>
<tr>
<td><strong>downlinkConfigCommon</strong></td>
<td>The common downlink configuration of the serving cell, including the frequency information configuration and the initial downlink BWP common configuration. The parameters provided herein should match the parameters configured by MIB and SIB1 (if provided) of the serving cell, with the exception of controlResourceSetZero and searchSpaceZero which can be configured in ServingCellConfigCommon even if MIB indicates that they are absent.</td>
</tr>
<tr>
<td><strong>discoveryBurstWindowLength</strong></td>
<td>Indicates the window length of the discovery burst in ms (see TS 37.213 [48]).</td>
</tr>
<tr>
<td><strong>longBitmap</strong></td>
<td>Bitmap when maximum number of SS/PBCH blocks per half frame equals to 64 as defined in TS 38.213 [13], clause 4.1.</td>
</tr>
<tr>
<td><strong>lte-CRS-ToMatchAround</strong></td>
<td>Parameters to determine an LTE CRS pattern that the UE shall rate match around.</td>
</tr>
<tr>
<td><strong>mediumBitmap</strong></td>
<td>Bitmap when maximum number of SS/PBCH blocks per half frame equals to 8 as defined in TS 38.213 [13], clause 4.1.</td>
</tr>
<tr>
<td><strong>n-TimingAdvanceOffset</strong></td>
<td>The N_TA-Offset to be applied for all uplink transmissions on this serving cell. If the field is absent, the UE applies the value defined for the duplex mode and frequency range of this serving cell. See TS 38.133 [14], table 7.1.2-2.</td>
</tr>
<tr>
<td><strong>rateMatchPatternToAddModList</strong></td>
<td>Resources patterns which the UE should rate match PDSCH around. The UE rate matches around the union of all resources indicated in the rate match patterns. Rate match patterns defined here on cell level apply only to PDSCH of the same numerology (see TS 38.214 [19], clause 5.1.4.1).</td>
</tr>
<tr>
<td><strong>shortBitmap</strong></td>
<td>Bitmap when maximum number of SS/PBCH blocks per half frame equals to 4 as defined in TS 38.213 [13], clause 4.1.</td>
</tr>
<tr>
<td><strong>ss-PBCH-BlockPower</strong></td>
<td>Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission, see TS 38.213 [13], clause 7.</td>
</tr>
<tr>
<td><strong>ssb-periodicityServingCell</strong></td>
<td>The SSB periodicity in ms for the rate matching purpose. If the field is absent, the UE applies the value ms5. (see TS 38.213 [13], clause 4.1)</td>
</tr>
<tr>
<td><strong>ssb-PositionQCL</strong></td>
<td>Indicates the QCL relation between SSB positions for this serving cell as specified in TS 38.213 [13], clause 4.1.</td>
</tr>
<tr>
<td><strong>ssb-PositionsInBurst</strong></td>
<td>For operation in licensed spectrum, indicates the time domain positions of the transmitted SS-blocks in a half frame with SS/PBCH blocks as defined in TS 38.213 [13], clause 4.1. The first/lastmost bit corresponds to SS/PBCH block index 0, the second bit corresponds to SS/PBCH block index 1, and so on. Value 0 in the bitmap indicates that the corresponding SS/PBCH block is not transmitted while value 1 indicates that the corresponding SS/PBCH block is transmitted. The network configures the same pattern in this field as in the corresponding field in ServingCellConfigCommonSIB. For operation with shared spectrum channel access, only mediumBitmap is used and the UE assumes that one or more SS/PBCH blocks indicated by ssb-PositionsInBurst may be transmitted within the discovery burst transmission window and have candidate SS/PBCH block indexes corresponding to SS/PBCH block indexes provided by ssb-PositionsInBurst (see TS 38.213 [13], clause 4.1). If the k-th bit of ssb-PositionsInBurst is set to 1, the UE assumes that one or more SS/PBCH blocks within the discovery burst transmission window with candidate SS/PBCH block indexes corresponding to SS/PBCH block index equal to k – 1 may be transmitted; if the k-th bit is set to 0, the UE assumes that the corresponding SS/PBCH block(s) are not transmitted. If ssb-PositionQCL is configured, the k-th bit is set to 0, where k &gt; ssb-PositionQCL and the number of actually transmitted SS/PBCH blocks is not larger than the number of 1's in the bitmap. The network configures the same pattern in this field as in the corresponding field in ServingCellConfigCommonSIB.</td>
</tr>
<tr>
<td><strong>ssbSubcarrierSpacing</strong></td>
<td>Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.</td>
</tr>
</tbody>
</table>
supplementaryUplinkConfig
The network configures this field only if uplinkConfigCommon is configured. If this field is absent, the UE shall release the supplementaryUplinkConfig and the supplementaryUplink configured in ServingCellConfig of this serving cell, if configured.

**tdd-UL-DL-ConfigurationCommon**
A cell-specific TDD UL/DL configuration, see TS 38.213 [13], clause 11.1.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AbsFreqSSB</td>
<td>The field is absent when absoluteFrequencySSB in frequencyInfoDL is absent, otherwise the field is mandatory present.</td>
</tr>
<tr>
<td>HOAndServCellAdd</td>
<td>This field is mandatory present upon SpCell change and upon serving cell (PSCell/SCell) addition. Otherwise, the field is absent.</td>
</tr>
<tr>
<td>HOAndServCellWithSSB</td>
<td>This field is mandatory present upon SpCell change and upon serving cell (SCell with SSB or PSCell) addition. Otherwise, the field is absent.</td>
</tr>
<tr>
<td>SharedSpectrum</td>
<td>This field is mandatory present if this cell operates with shared spectrum channel access. Otherwise, it is absent. Need R.</td>
</tr>
<tr>
<td>TDD</td>
<td>The field is optionally present, Need R, for TDD cells; otherwise it is absent.</td>
</tr>
</tbody>
</table>

---

**ServingCellConfigCommonSIB**
The IE **ServingCellConfigCommonSIB** is used to configure cell specific parameters of a UE's serving cell in SIB1.

**ServingCellConfigCommonSIB** information element

```asn1
ServingCellConfigCommonSIB ::= SEQUENCE {
  downlinkConfigCommon                    DownlinkConfigCommonSIB,  
  uplinkConfigCommon                      UplinkConfigCommonSIB,  
  supplementaryUplink                      UplinkConfigCommonSIB,  
  n-TimingAdvanceOffset                   ENUMERATED { n0, n25600, n39936 },  
  ssb-PositionsInBurst                    SEQUENCE {  
    inOneGroup                             BIT STRING (SIZE (8)),  
    groupPresence                          BIT STRING (SIZE (8)) OPTIONAL -- Cond FR2-Only  
  },  
  ssb-PeriodicityServingCell              ENUMERATED {ms5, ms10, ms20, ms40, ms80, ms160},  
  tdd-UL-DL-ConfigurationCommon           TDD-UL-DL-ConfigurationCommon,  
  ss-PBCH-BlockPower                     INTEGER (-60..50),  
  ...,  
  [channelAccessMode-r16  
    dynamic                               CHOICE {  
      NULL,  
      semiStatic                            SemiStaticChannelAccessConfig-r16  
    }],  
  discoveryBurstWindowLength-r16          ENUMERATED {ms0dot5, ms1, ms2, ms3, ms4, ms5},  
  highSpeedConfig-r16                    HighSpeedConfig-r16  
}
```

---

**ETS**
channelAccessMode
If present, this field indicates which channel access procedures to apply for operation with shared spectrum channel access as defined in TS 37.213 [48]. If the field is configured as "semiStatic", the UE shall apply the channel access procedures for semi-static channel occupancy as described in subclause 4.3 in TS 37.213. If the field is configured as "dynamic", the UE shall apply the channel access procedures in TS 37.213, with the exception of subclause 4.3 of TS 37.213.

discoveryBurstWindowLength
Indicates the window length of the discovery burst in ms (see TS 37.213 [48]).

groupPresence
This field is present when maximum number of SS/PBCH blocks per half frame equals to 64 as defined in TS 38.213 [13], clause 4.1. The first/leftmost bit corresponds to the SS/PBCH index 0-7, the second bit corresponds to SS/PBCH block 8-15, and so on. Value 0 in the bitmap indicates that the SSBs according to inOneGroup are absent. Value 1 indicates that the SS/PBCH blocks are transmitted in accordance with inOneGroup.

inOneGroup
When maximum number of SS/PBCH blocks per half frame equals to 4 as defined in TS 38.213 [13], clause 4.1, only the 4 leftmost bits are valid; the UE ignores the 4 rightmost bits. When maximum number of SS/PBCH blocks per half frame equals to 8 as defined in TS 38.213 [13], clause 4.1, all 8 bits are valid. The first/leftmost bit corresponds to SS/PBCH block index 0, the second bit corresponds to SS/PBCH block index 1, and so on. When maximum number of SS/PBCH blocks per half frame equals to 64 as defined in TS 38.213 [13], clause 4.1, all 8 bit are valid; The first/leftmost bit corresponds to the first SS/PBCH block index in the group (i.e., to SSB index 0, 8, and so on); the second bit corresponds to the second SS/PBCH block index in the group (i.e., to SSB index 1, 9, and so on), and so on. Value 0 in the bitmap indicates that the corresponding SS/PBCH block is not transmitted while value 1 indicates that the corresponding SS/PBCH block is transmitted.

n-TimingAdvanceOffset
The N_TA-Offset to be applied for random access on this serving cell. If the field is absent, the UE applies the value defined for the duplex mode and frequency range of this serving cell. See TS 38.133 [14], table 7.1.2-2.

ssb-PositionsInBurst
Time domain positions of the transmitted SS-blocks in an SS-burst as defined in TS 38.213 [13], clause 4.1. For operation with shared spectrum channel access, only mediumBitmap is used. The UE assumes that a bit at position $k > N_{SSB}^0$ is 0, where $N_{SSB}^0$ is obtained from MIB as specified in TS 38.213 [13], clause 4.1. For operation with shared spectrum channel access, only inOneGroup is used and the UE interprets this field same as mediumBitmap in ServingCellConfigCommon.

ss-PBCH-BlockPower
Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission, see TS 38.213 [13], clause 7.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR2-Only</td>
<td>This field is mandatory present for an FR2 carrier frequency. It is absent otherwise and UE releases any configured value.</td>
</tr>
<tr>
<td>SharedSpectrum</td>
<td>This field is mandatory present if this cell operates with shared spectrum channel access. Otherwise, it is absent, Need R.</td>
</tr>
<tr>
<td>TDD</td>
<td>The field is optionally present, Need R, for TDD cells; otherwise it is absent.</td>
</tr>
</tbody>
</table>

--- ShortI-RNTI-Value

The IE ShortI-RNTI-Value is used to identify the suspended UE context of a UE in RRC_INACTIVE using fewer bits compared to I-RNTI-Value.

ShortI-RNTI-Value information element

---
-- TAG-SHORTI-RNTI-VALUE-START
ShortI-RNTI-Value ::= BIT STRING (SIZE(24))
-- TAG-SHORTI-RNTI-VALUE-STOP
-- ASN1STOP

-- ShortMAC-I

The IE ShortMAC-I is used to identify and verify the UE at RRC connection re-establishment. The 16 least significant bits of the MAC-I calculated using the AS security configuration of the source PCell, as specified in 5.3.7.4.

    ShortMAC-I information element

-- ASN1START
-- TAG-SHORTMAC-I-START
ShortMAC-I ::= BIT STRING (SIZE (16))
-- TAG-SHORTMAC-I-STOP
-- ASN1STOP

-- SINR-Range

The IE SINR-Range specifies the value range used in SINR measurements and thresholds. For measurements, integer value for SINR measurements is according to Table 10.1.16.1-1 in TS 38.133 [14]. For thresholds, the actual value is (IE value – 46) / 2 dB.

    SINR-Range information element

-- ASN1START
-- TAG-SINR-RANGE-START
SINR-Range ::= INTEGER(0..127)
-- TAG-SINR-RANGE-STOP
-- ASN1STOP

-- SI-RequestConfig

The IE SI-RequestConfig contains configuration for Msg1 based SI request.

    SI-RequestConfig information element

-- ASN1START
--- TAG-SI-REQUESTCONFIG-START

SI-RequestConfig ::= SEQUENCE {
  rach-OccasionsSI
    SEQUENCE {
      rach-ConfigSI
        RACH-ConfigGeneric,
      ssb-perRACH-Occasion
        ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen} OPTIONAL, -- Need R
    } OPTIONAL, -- Need R
  si-RequestPeriod
    ENUMERATED {one, two, four, six, eight, ten, twelve, sixteen} OPTIONAL, -- Need R
  si-RequestResources
    SEQUENCE (SIZE (1..maxSI-Message)) OF SI-RequestResources
}

SI-RequestResources ::= SEQUENCE {
  ra-PreambleStartIndex
    INTEGER (0..63),
  ra-AssociationPeriodIndex
    INTEGER (0..15) OPTIONAL, -- Need R
  ra-ssb-OccasionMaskIndex
    INTEGER (0..15) OPTIONAL -- Need R
}

--- ASN1STOP
--- TAG-SI-REQUESTCONFIG-STOP

**SI-RequestConfig field descriptions**

* rach-OccasionsSI
  Configuration of dedicated RACH Occasions for SI. If the field is absent, the UE uses the corresponding parameters configured in rach-ConfigCommon of the initial uplink BWP.

* si-RequestPeriod
  Periodicity of the SI-Request configuration in number of association periods.

* si-RequestResources
  If there is only one entry in the list, the configuration is used for all SI messages for which si-BroadcastStatus is set to notBroadcasting. Otherwise the 1st entry in the list corresponds to the first SI message in schedulingInfoList for which si-BroadcastStatus is set to notBroadcasting, 2nd entry in the list corresponds to the second SI message in schedulingInfoList for which si-BroadcastStatus is set to notBroadcasting and so on. Change of si-RequestResources should not result in system information change notification.

---

**SI-SchedulingInfo**

The IE SI-SchedulingInfo contains information needed for acquisition of SI messages.

--- ASN1START
--- TAG-SI-SCHEDULINGINFO-START

SI-SchedulingInfo ::= SEQUENCE {
  schedulingInfoList
    SEQUENCE (SIZE (1..maxSI-Message)) OF SchedulingInfo,
  si-WindowLength
    ENUMERATED {s5, s10, s20, s40, s80, s160, s320, s640, s1280},
  si-RequestConfig
    SI-RequestConfig OPTIONAL, -- Cond MSG-1
  si-RequestConfigSUL
    SI-RequestConfig OPTIONAL, -- Cond SUL-MSG-1
  systemInformationAreaID
    BIT STRING (SIZE (24)) OPTIONAL, -- Need R
  ...
}

--- ASN1STOP
--- TAG-SI-SCHEDULINGINFO-STOP

**SI-SchedulingInfo information element**
SchedulingInfo ::= SEQUENCE {
  si-BroadcastStatus ENUMERATED {broadcasting, notBroadcasting},
  si-Periodicity ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},
  sib-MappingInfo SIB-Mapping
}

SIB-Mapping ::= SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo

SIB-TypeInfo ::= SEQUENCE {
  type ENUMERATED {sibType2, sibType3, sibType4, sibType5, sibType6, sibType7, sibType8, sibType9, sibType10-v1610, sibType11-v1610, sibType12-v1610, sibType13-v1610, sibType14-v1610, spare3, spare2, spare1,... },
  valueTag INTEGER (0..31) OPTIONAL, -- Cond SIB-TYPE
  areaScope ENUMERATED {true} OPTIONAL -- Need S
}

-- TAG-SI-SCHEDULINGINFO-STOP
-- ASN1STOP

**SchedulingInfo field descriptions**

<table>
<thead>
<tr>
<th><strong>areaScope</strong></th>
<th>Indicates that a SIB is area specific. If the field is absent, the SIB is cell specific.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>si-BroadcastStatus</strong></td>
<td>Indicates if the SI message is being broadcasted or not. Change of si-BroadcastStatus should not result in system information change notifications in Short Message transmitted with P-RNTI over DCI (see clause 6.5). The value of the indication is valid until the end of the BCCH modification period when set to broadcasting.</td>
</tr>
<tr>
<td><strong>si-Periodicity</strong></td>
<td>Periodicity of the SI-message in radio frames. Value rf8 corresponds to 8 radio frames, value rf16 corresponds to 16 radio frames, and so on.</td>
</tr>
</tbody>
</table>

**SI-RequestResources field descriptions**

| **ra-AssociationPeriodIndex** | Index of the association period in the si-RequestPeriod in which the UE can send the SI request for SI message(s) corresponding to this SI-RequestResources, using the preambles indicated by ra-PreambleStartIndex and rach occasions indicated by ra-ssb-OccasionMaskIndex. |
| **ra-PreambleStartIndex** | If N SSBS are associated with a RACH occasion, where N >= 1, for the i-th SSB (i=0, ..., N-1) the preamble with preamble index = ra-PreambleStartIndex + i is used for SI request; For N < 1, the preamble with preamble index = ra-PreambleStartIndex is used for SI request. |
### SI-SchedulingInfo field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>si-RequestConfig</strong></td>
<td>Configuration of Msg1 resources that the UE uses for requesting SI-messages for which <em>si-BroadcastStatus</em> is set to <em>notBroadcasting</em>.</td>
</tr>
<tr>
<td><strong>si-RequestConfigSUL</strong></td>
<td>Configuration of Msg1 resources that the UE uses for requesting SI-messages for which <em>si-BroadcastStatus</em> is set to <em>notBroadcasting</em>.</td>
</tr>
<tr>
<td><strong>si-WindowLength</strong></td>
<td>The length of the SI scheduling window. Value s5 corresponds to 5 slots, value s10 corresponds to 10 slots and so on. The network always configures <em>si-WindowLength</em> to be shorter than or equal to the <em>si-Periodicity</em>.</td>
</tr>
<tr>
<td><strong>systemInformationAreaID</strong></td>
<td>Indicates the system information area that the cell belongs to, if any. Any SIB with <em>areaScope</em> within the SI is considered to belong to this <em>systemInformationAreaID</em>. The <em>systemInformationAreaID</em> is unique within a PLMN.</td>
</tr>
</tbody>
</table>

### Conditional presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSG-1</td>
<td>The field is optionally present, Need R, if <em>si-BroadcastStatus</em> is set to <em>notBroadcasting</em> for any SI-message included in <em>SchedulingInfo</em>. It is absent otherwise.</td>
</tr>
<tr>
<td>SIB-TYPE</td>
<td>The field is mandatory present if the SIB type is different from <em>SIB6</em>, <em>SIB7</em> or <em>SIB8</em>. For <em>SIB6</em>, <em>SIB7</em> and <em>SIB8</em> it is absent.</td>
</tr>
<tr>
<td>SUL-MSG-1</td>
<td>The field is optionally present, Need R, if <em>supplementaryUplink</em> is configured in <em>ServingCellConfigCommonSIB</em> and if <em>si-BroadcastStatus</em> is set to <em>notBroadcasting</em> for any SI-message included in <em>SchedulingInfo</em>. It is absent otherwise.</td>
</tr>
</tbody>
</table>

---

### SK-Counter

The IE **SK-Counter** is a counter used upon initial configuration of SN security for NR-DC and NE-DC, as well as upon refresh of S-KgNB or S-KeNB based on the current or newly derived K_{gNB} during RRC Resume or RRC Reconfiguration, as defined in TS 33.501 [11].

```
-- ASN1START
-- TAG-SK_COUNTER-START

SK-Counter ::= INTEGER (0..65535)

-- TAG-SK_COUNTER-STOP
-- ASN1STOP
```

---

### SlotFormatCombinationsPerCell

The IE **SlotFormatCombinationsPerCell** is used to configure the SlotFormatCombinations applicable for one serving cell (see TS 38.213 [13], clause 11.1.1).

```
-- ASN1START
-- TAG-SLOTFORMATCOMBINATIONSPERCELL-START

SlotFormatCombinationsPerCell ::= SEQUENCE {
  servingCellId       ServCellIndex,
  subcarrierSpacing   SubcarrierSpacing,

-- TAG-SLOTFORMATCOMBINATIONSPERCELL-STOP
-- ASN1STOP
```
SlotFormatCombination field descriptions

**slotFormatCombinationId**
This ID is used in the DCI payload to dynamically select this SlotFormatCombination (see TS 38.213 [13], clause 11.1.1).

**slotFormats**
Slot formats that occur in consecutive slots in time domain order as listed here (see TS 38.213 [13], clause 11.1.1 and TS 38.213 [13], clause 14 for IAB-MT).
### SlotFormatCombinationsPerCell field descriptions

**enableConfiguredUL**
If configured, the UE is allowed to transmit uplink signals (SRS, PUCCH, CG-PUSCH) in the set of symbols of the slot when the UE does not detect a DCI format 2_0 providing a slot format for the set of symbols (see TS 38.213 [13], 11.1.1).

**positionInDCI**
The (starting) position (bit) of the slotFormatCombinationId (SFI-Index) for this serving cell (servingCellId) within the DCI payload (see TS 38.213 [13], clause 11.1.1).

**servingCellId**
The ID of the serving cell for which the slotFormatCombinations are applicable.

**slotFormatCombinations**
A list with SlotFormatCombinations. Each SlotFormatCombination comprises of one or more SlotFormats (see TS 38.211 [16], clause 4.3.2). The total number of slotFormats in the slotFormatCombinations list does not exceed 512.

**subcarrierSpacing2**
Reference subcarrier spacing for a Slot Format Combination on an FDD or SUL cell (see TS 38.213 [13], clause 11.1.1). For FDD, subcarrierSpacing (SFI-scs) is the reference SCS for DL BWP and subcarrierSpacing2 (SFI-scs2) is the reference SCS for UL BWP. For SUL, subcarrierSpacing (SFI-scs) is the reference SCS for non-SUL carrier and subcarrierSpacing2 (SFI-scs2) is the reference SCS for SUL carrier. The network configures a value that is smaller than or equal to any SCS of configured BWPs of the serving cell that the command applies to. And the network configures a value that is smaller than or equal to the SCS of the serving cell which the UE monitors for SFI indications.

**subcarrierSpacing**
Reference subcarrier spacing for this Slot Format Combination. The network configures a value that is smaller than or equal to any SCS of configured BWPs of the serving cell that the command applies to. And the network configures a value that is smaller than or equal to the SCS of the serving cell which the UE monitors for SFI indications (see TS 38.213 [13], clause 11.1.1).

---

**SlotFormatIndicator**

The IE SlotFormatIndicator is used to configure monitoring a Group-Common-PDCCH for Slot-Format-Indicators (SFI).

**SlotFormatIndicator information element**

```asn1
SlotFormatIndicator ::= SEQUENCE {
  sfi-RNTI                    RNTI-Value,     
  dci-PayloadSize             INTEGER (1..maxSFI-DCI-PayloadSize),
  slotFormatCombinationsPerCell     SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF SlotFormatCombinationsPerCell OPTIONAL, -- Need N
                             slotFormatCombToAddModList SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF SlotFormatCombinationsPerCell OPTIONAL, -- Need N
                             slotFormatCombToReleaseList SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF SlotFormatCombinationsPerCell OPTIONAL, -- Need N
...,
  availableRB-SetsToAddModList-r16  SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF AvailableRB-SetsPerCell-r16 OPTIONAL, -- Need N
  availableRB-SetsToRelease-r16    SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF AvailableRB-SetsPerCell-r16 OPTIONAL, -- Need N
  switchTriggerToAddModList-r16    SEQUENCE (SIZE(1..4)) OF SearchSpaceSwitchTrigger-r16 OPTIONAL, -- Need N
  switchTriggerToReleaseList-r16   SEQUENCE (SIZE(1..4)) OF SearchSpaceSwitchTrigger-r16 OPTIONAL, -- Need N
  co-DurationsPerCellToAddModList-r16 SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF CO-DurationsPerCell-r16 OPTIONAL, -- Need N
  co-DurationsPerCellToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF CO-DurationsPerCell-r16 OPTIONAL, -- Need N
}
```

**CO-DurationsPerCell-r16**

```asn1
CO-DurationsPerCell-r16 ::= SEQUENCE {
...}
```
availableRB-SetsToAddModList
A list of AvailableRB-SetsPerCell objects (see TS 38.213 [13], clause 11.1.1).

co-DurationsPerCellToAddModList
A list of CO-DurationPerCell objects. If not configured, the UE uses the slot format indicator (SFI), if available, to determine the channel occupancy duration (see TS 38.213 [13], clause 11.1.1).

dci-PayloadSize
Total length of the DCI payload scrambled with SFI-RNTI (see TS 38.213 [13], clause 11.1.1).

sfi-RNTI
RNTI used for SFI on the given cell (see TS 38.213 [13], clause 11.1.1).

slotFormatCombToAddModList
A list of SlotFormatCombinations for the UE's serving cells (see TS 38.213 [13], clause 11.1.1).

switchTriggerToAddModList
A list of SearchSpaceSwitchTrigger objects. Each SearchSpaceSwitchTrigger object provides position in DCI of the bit field indicating search space switching flag for a serving cell or, if cellGroupsForSwitchList-r16 is configured, group of serving cells (see TS 38.213 [13], clause 10.4).

AvailableRB-SetsPerCell field descriptions

positionInDCI
The (starting) position of the bits within DCI payload indicating the availability of the RB sets of a serving cell (see TS 38.213 [13], clause 11.1.1).

servingCellId
The ID of the serving cell for which the configuration is applicable.
### CO-DurationsPerCell field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>co-DurationList</td>
<td>A list of Channel Occupancy duration in symbols.</td>
</tr>
<tr>
<td>positionInDCI</td>
<td>Position in DCI of the bit field indicating Channel Occupancy duration for UE's serving cells (see TS 38.213 [13], clause 11.1.1).</td>
</tr>
<tr>
<td>servingCellId</td>
<td>The ID of the serving cell for which the configuration is applicable.</td>
</tr>
<tr>
<td>subcarrierSpacing</td>
<td>Reference subcarrier spacing for the list of Channel Occupancy durations (see TS 38.213 [13], clause 11.1.1).</td>
</tr>
</tbody>
</table>

### SearchSpaceSwitchTrigger field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>positionInDCI</td>
<td>The position of the bit within DCI payload containing a search space switching flag (see TS 38.213 [13], clause 11.1.1).</td>
</tr>
<tr>
<td>servingCellId</td>
<td>The ID of the serving cell for which the configuration is applicable or the group of serving cells as indicated by CellGroupsForSwitch-r16 containing this servingCellId.</td>
</tr>
</tbody>
</table>

### S-NSSAI

The IE S-NSSAI (Single Network Slice Selection Assistance Information) identifies a Network Slice end to end and comprises a slice/service type and a slice differentiator, see TS 23.003 [21].

#### S-NSSAI information element

```asn1
S-NSSAI ::= CHOICE{
  sst            BIT STRING (SIZE (8)),
  sst-SD         BIT STRING (SIZE (32))
}
```

### S-NSSAI field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sst</td>
<td>Indicates the S-NSSAI consisting of Slice/Service Type, see TS 23.003 [21].</td>
</tr>
<tr>
<td>sst-SD</td>
<td>Indicates the S-NSSAI consisting of Slice/Service Type and Slice Differentiator, see TS 23.003 [21].</td>
</tr>
</tbody>
</table>
— **SpeedStateScaleFactors**

The IE *SpeedStateScaleFactors* concerns factors, to be applied when the UE is in medium or high speed state, used for scaling a mobility control related parameter.

**SpeedStateScaleFactors information element**

```asgn
SpeedStateScaleFactors ::= SEQUENCE {
  sf-Medium                           ENUMERATED {oDot25, oDot5, oDot75, lDot0},
  sf-High                             ENUMERATED {oDot25, oDot5, oDot75, lDot0}
}
```

**SpeedStateScaleFactors field descriptions**

- **sf-High**
  The concerned mobility control related parameter is multiplied with this factor if the UE is in High Mobility state as defined in TS 38.304 [20]. Value oDot25 corresponds to 0.25, value oDot5 corresponds to 0.5, oDot75 corresponds to 0.75 and so on.

- **sf-Medium**
  The concerned mobility control related parameter is multiplied with this factor if the UE is in Medium Mobility state as defined in TS 38.304 [20]. Value oDot25 corresponds to 0.25, value oDot5 corresponds to 0.5, value oDot75 corresponds to 0.75, and so on.

— **SPS-Config**

The IE *SPS-Config* is used to configure downlink semi-persistent transmission. Multiple Downlink SPS configurations may be configured in one BWP of a serving cell.

**SPS-Config information element**

```asgn
SPS-Config ::= SEQUENCE {
  periodicity                     ENUMERATED {ms10, ms20, ms32, ms40, ms64, ms80, ms128, ms160, ms320, ms640, spare6, spare5, spare4, spare3, spare2, spare1},
  nrofHARQ-Processes              INTEGER (1..8),
  n1PUCCH-AN                      PUCCH-ResourceId OPTIONAL, -- Need M
  mcs-Table                       ENUMERATED {qam64LowSE} OPTIONAL, -- Need S
  ...,
  sps-ConfigIndex-r16             SPS-ConfigIndex-r16 OPTIONAL, -- Cond SPS-List
  harq-ProcID-Offset-r16          INTEGER (0..15) OPTIONAL, -- Need R
  periodicityExt-r16              INTEGER (1..5120) OPTIONAL, -- Need R
  harq-CodebookID-r16             INTEGER (1..2) OPTIONAL, -- Need R
  pdsch-AggregationFactor-r16     ENUMERATED {n1, n2, n4, n8 } OPTIONAL -- Need S
}
```
**SPS-Config field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>harq-CodebookID</strong></td>
<td>Indicates the HARQ-ACK codebook index for the corresponding HARQ-ACK codebook for SPS PDSCH and ACK for SPS PDSCH release.</td>
</tr>
<tr>
<td><strong>harq-Procid-Offset</strong></td>
<td>Indicates the offset used in deriving the HARQ process IDs, see TS 38.321 [3], clause 5.3.1.</td>
</tr>
<tr>
<td><strong>mcs-Table</strong></td>
<td>Indicates the MCS table the UE shall use for DL SPS (see TS 38.214 [19], clause 5.1.3.1). If present, the UE shall use the MCS table of low-SE 64QAM table indicated in Table 5.1.3.1-3 of TS 38.214 [19]. If this field is absent and field mcs-table in PDSCH-Config is set to 'qam256' and the activating DCI is of format 1_1, the UE applies the 256QAM table indicated in Table 5.1.3.1-2 of TS 38.214 [19]. Otherwise, the UE applies the non-low-SE 64QAM table indicated in Table 5.1.3.1-1 of TS 38.214 [19].</td>
</tr>
<tr>
<td><strong>n1PUCCH-AN</strong></td>
<td>HARQ resource for PUCCH for DL SPS. The network configures the resource either as format0 or format1. The actual PUCCH-Resource is configured in PUCCH-Config and referred to by its ID. See TS 38.213 [13], clause 9.2.3.</td>
</tr>
<tr>
<td><strong>nrofHARQ-Processes</strong></td>
<td>Number of configured HARQ processes for SPS DL (see TS 38.321 [3], clause 5.8.1).</td>
</tr>
<tr>
<td><strong>pdsch-AggregationFactor</strong></td>
<td>Number of repetitions for SPS PDSCH (see TS 38.214 [19], clause 5.1.2.1). When the field is absent, the UE applies PDSCH aggregation factor of PDSCH-Config.</td>
</tr>
<tr>
<td><strong>periodicity</strong></td>
<td>Periodicity for DL SPS (see TS 38.214 [19] and TS 38.321 [3], clause 5.8.1).</td>
</tr>
<tr>
<td><strong>periodicityExt</strong></td>
<td>This field is used to calculate the periodicity for DL SPS (see TS 38.214 [19] and see TS 38.321 [3], clause 5.8.1). If this field is present, the field periodicity is ignored. The following periodicities are supported depending on the configured subcarrier spacing [ms]: 15 kHz: periodicityExt, where periodicityExt has a value between 1 and 640. 30 kHz: 0.5 x periodicityExt, where periodicityExt has a value between 1 and 1280. 60 kHz with normal CP: 0.25 x periodicityExt, where periodicityExt has a value between 1 and 2560. 60 kHz with ECP: 0.25 x periodicityExt, where periodicityExt has a value between 1 and 2560. 120 kHz: 0.125 x periodicityExt, where periodicityExt has a value between 1 and 5120.</td>
</tr>
<tr>
<td><strong>spc-ConfigIndex</strong></td>
<td>Indicates the index of one of multiple SPS configurations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPS-List</strong></td>
<td>The field is mandatory present when included in sps-ConfigToAddModList-r16, otherwise the field is absent.</td>
</tr>
</tbody>
</table>

---

**SPS-ConfigIndex**

The IE **SPS-ConfigIndex** is used to indicate the index of one of multiple DL SPS configurations in one BWP.
**SPS-ConfigIndex** information element

```asn1
SPS-ConfigIndex-r16 ::= INTEGER (0.. maxNrofSPS-Config-r16-1)
```

---

**SPS-PUCCH-AN**

The IE **SPS-PUCCH-AN** is used to indicate a PUCCH resource for HARQ ACK and configure the corresponding maximum payload size for the PUCCH resource.

**SPS-PUCCH-AN** information element

```asn1
SPS-PUCCH-AN-r16 ::= SEQUENCE {
  sps-PUCCH-AN-ResourceID-r16  PUCCH-ResourceId,
  maxPayloadSize-r16              INTEGER (4..256) OPTIONAL -- Need R
}
```

---

**SPS-PUCCH-AN field descriptions**

<table>
<thead>
<tr>
<th>maxPayloadSize</th>
<th>Indicates the maximum payload size for the corresponding PUCCH resource ID.</th>
</tr>
</thead>
<tbody>
<tr>
<td>sps-PUCCH-AN-ResourceId</td>
<td>Indicates the PUCCH resource ID</td>
</tr>
</tbody>
</table>

---

**SPS-PUCCH-AN-List**

The IE **SPS-PUCCH-AN-List** is used to configure the list of PUCCH resources per HARQ ACK codebook

**SPS-PUCCH-AN-List** information element

```asn1
SPS-PUCCH-AN-List-r16 ::= SEQUENCE (SIZE(1..4)) OF SPS-PUCCH-AN-r16
```

---
SRB-Identity

The IE SRB-Identity is used to identify a Signalling Radio Bearer (SRB) used by a UE.

**SRB-Identity information element**

```
SRB-Identity ::= INTEGER (1..3)
```

SRS-CarrierSwitching

The IE SRS-CarrierSwitching is used to configure for SRS carrier switching when PUSCH is not configured and independent SRS power control from that of PUSCH.

**SRS-CarrierSwitching information element**

```
SRS-CarrierSwitching ::= SEQUENCE {
    srs-SwitchFromServCellIndex INTEGER (0..31) OPTIONAL, -- Need M
    srs-SwitchFromCarrier ENUMERATED {sUL, nUL},
    srs-TPC-PDCCH-Group CHOICE {
        typeA SEQUENCE (SIZE (1..32)) OF SRS-TPC-PDCCH-Config,
        typeB SRS-TPC-PDCCH-Config
    }
    monitoringCells SEQUENCE (SIZE (1..maxNrofServingCells)) OF ServCellIndex OPTIONAL, -- Need M
    ... }

SRS-TPC-PDCCH-Config ::= SEQUENCE {
    srs-CC-SetIndexlist SEQUENCE (SIZE(1..4)) OF SRS-CC-SetIndex OPTIONAL -- Need M
}

SRS-CC-SetIndex ::= SEQUENCE {
    cc-SetIndex INTEGER (0..3) OPTIONAL, -- Need M
    cc-IndexInOneCC-Set INTEGER (0..7) OPTIONAL -- Need M
}
```
### SRS-CC-SetIndex field descriptions
*cc-IndexInOneCC-Set*
Indicates the CC index in one CC set for Type A (see TS 38.212 [17], TS 38.213 [13], clause 7.3.1, 11.4). The network always includes this field when the srs-TPC-PDCCH-Group is set to typeA.

*cc-SetIndex*
Indicates the CC set index for Type A associated (see TS 38.212 [17], TS 38.213 [13], clause 7.3.1, 11.4). The network always includes this field when the srs-TPC-PDCCH-Group is set to typeA. The network does not configure this field to 3 in this release of specification.

### SRS-CarrierSwitching field descriptions
*monitoringCells*
A set of serving cells for monitoring PDCCH conveying SRS DCI format with CRC scrambled by TPC-SRS-RNTI (see TS 38.212 [17], TS 38.213 [13], clause 7.3.1, 11.3).

*srs-SwitchFromServCellIndex*
Indicates the serving cell whose UL transmission may be interrupted during SRS transmission on a PUSCH-less SCell. During SRS transmission on a PUSCH-less SCell, the UE may temporarily suspend the UL transmission on a serving cell with PUSCH in the same CG to allow the PUSCH-less SCell to transmit SRS. (see TS 38.214 [19], clause 6.2.1.3).

*srs-TPC-PDCCH-Group*
Network configures the UE with either typeA-SRS-TPC-PDCCH-Group or typeB-SRS-TPC-PDCCH-Group, if any.

*typeA*
Type A trigger configuration for SRS transmission on a PUSCH-less SCell (see TS 38.213 [13], clause 11.4). In this release, the network configures at most one entry (the first entry) of typeA, and the first entry corresponds to the serving cell in which the SRS-CarrierSwitching field is configured. SRS carrier switching to SUL carrier is not supported in this version of the specification.

*typeB*
Type B trigger configuration for SRS transmission on a PUSCH-less SCell (see TS 38.213 [13], clause 11.4).

### SRS-TPC-PDCCH-Config field descriptions
*srs-CC-SetIndexlist*
A list of pairs of [cc-SetIndex; cc-IndexInOneCC-Set] (see TS 38.212 [17], TS 38.213 [13], clause 7.3.1, 11.4). The network does not configure this field for typeB.

---

---

### SRS-Config

The IE SRS-Config is used to configure sounding reference signal transmissions. The configuration defines a list of SRS-Resources and a list of SRS-ResourceSets. Each resource set defines a set of SRS-Resources. The network triggers the transmission of the set of SRS-Resources using a configured aperiodicSRS-ResourceTrigger (L1 DCI).

#### SRS-Config information element

```
-- ASN.1START
-- TAG-SRS-CONFIG-START

SRS-Config ::= SEQUENCE {
  srs-ResourceSetToReleaseList  SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceId OPTIONAL, -- Need N
  srs-ResourceSetToAddModList   SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceId OPTIONAL, -- Need N
  srs-ResourceToReleaseList     SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SRS-ResourceId OPTIONAL, -- Need N
}

-- ASN.1END
```
srs-ResourceToAddModList SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SRS-Resource OPTIONAL, -- Need N
tpc-Accumulation ENUMERATED {disabled} OPTIONAL, -- Need S
...,
[ srs-RequestDCI-1-2-r16 INTEGER (1..2) OPTIONAL, -- Need S
  srs-RequestDCI-0-2-r16 INTEGER (1..2) OPTIONAL, -- Need S
  srs-ResourceSetToAddModListDCI-0-2-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSet OPTIONAL, -- Need N
  srs-ResourceSetToReleaseListDCI-0-2-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSetId OPTIONAL, -- Need N
  srs-PosResourceSetToAddModList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSetId-r16 OPTIONAL, -- Need N
  srs-PosResourceSetToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSetId-r16 OPTIONAL, -- Need N
  srs-RequestDCI-1-2-r16 INTEGER (1..2)
]
]
SRS-ResourceSet ::= SEQUENCE {
  srs-ResourceSetId SRS-ResourceSetId,
  srs-ResourceIdList SEQUENCE (SIZE(1..maxNrofSRS-ResourcesPerSet)) OF SRS-ResourceId OPTIONAL, -- Cond Setup
  resourceType CHOICE {
    aperiodic SEQUENCE {
      aperiodicSRS-ResourceTrigger INTEGER (1..maxNrofSRS-TriggerStates-1),
      csi-RS NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook
      slotOffset INTEGER (1..32) OPTIONAL, -- Need S
      ...
    },
    semi-persistent SEQUENCE {
      associatedCSI-RS NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook
      ...
    },
    periodic SEQUENCE {
      associatedCSI-RS NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook
      ...
    }
  },
  usage ENUMERATED {beamManagement, codebook, nonCodebook, antennaSwitching},
  alpha Alpha OPTIONAL, -- Need S
  p0 INTEGER (-202..24) OPTIONAL, -- Cond Setup
  pathlossReferenceRS PathlossReferenceRS-Config OPTIONAL, -- Need M
  srs-PowerControl AdjustmentStates ENUMERATED {sameAsFci2, separateClosedLoop} OPTIONAL, -- Need S
  ...
  [ pathlossReferenceRSLIST-r16 SetupRelease { PathlossReferenceRSLIST-r16 } OPTIONAL -- Need M
  ]
}
PathlossReferenceRS-Config ::= CHOICE {
  ssb-Index SSB-Index,
  csi-RS-Index NZP-CSI-RS-ResourceId
}
PathlossReferenceRSList-r16 := SEQUENCE (SIZE (1..maxNrofSRS-PathlossReferenceRS-r16)) OF PathlossReferenceRS-r16

PathlossReferenceRS-r16 := SEQUENCE {
  srs-PathlossReferenceRS-Id-r16
  pathlossReferenceRS-r16
}

SRS-PathlossReferenceRS-Id-r16 := INTEGER (0..maxNrofSRS-PathlossReferenceRS-1-r16)

SRS-PosResourceSet-r16 := SEQUENCE {
  srs-PosResourceSetId-r16
  srs-PosResourceIdList-r16 OPTIONAL, -- Cond Setup
  resourceType-r16
  aperiodic-r16
    aperiodicSRS-ResourceTriggerList-r16 SEQUENCE (SIZE(1..maxNrofSRS-TriggerStates-1)) OF INTEGER (1..maxNrofSRS-TriggerStates-1) OPTIONAL, -- Need M
  semi-persistent-r16
    semi-persistentSRS-ResourceTriggerList-r16 SEQUENCE (SIZE(1..maxNrofSRS-TriggerStates-1)) OF INTEGER (1..maxNrofSRS-TriggerStates-1) OPTIONAL, -- Need M
  periodic-r16
    periodicSRS-ResourceTriggerList-r16 SEQUENCE (SIZE(1..maxNrofSRS-TriggerStates-1)) OF INTEGER (1..maxNrofSRS-TriggerStates-1) OPTIONAL, -- Need M
}

alpha-r16
p0-r16
pathlossReferenceRS-Pos-r16
  sbb-IndexServing-r16 SSB-Index
  sbb-Ncell-r16 SSB-InfoNcell-r16
  dl-PRS-r16 DL-PRS-Info-r16
}

SRS-ResourceSetId ::= INTEGER (0..maxNrofSRS-ResourceSets-1)

SRS-PosResourceSetId-r16 ::= INTEGER (0..maxNrofSRS-PosResourceSets-1-r16)

SRS-Resource ::= SEQUENCE {
  srs-ResourceId
  nrofSRS-Ports ENUMERATED {port1, ports2, ports4},
  ptrs-PortIndex ENUMERATED {n0, n1 } OPTIONAL, -- Need R
  transmissionComb n2
    combOffset-n2
    cyclicShift-n2
  ,
  n4
    combOffset-n4
    cyclicShift-n4
}

ETS
sequenceMapping ::= SEQUENCE {
  startPosition ::= INTEGER (0..5),
  nrofSymbols ::= ENUMERATED {n1, n2, n4},
  repetitionFactor ::= ENUMERATED {n1, n2, n4}
}

freqDomainPosition ::= INTEGER (0..67),
freqDomainShift ::= INTEGER (0..268),
freqHopping ::= SEQUENCE {
  c-SRS ::= INTEGER (0..63),
  b-SRS ::= INTEGER (0..3),
  b-hop ::= INTEGER (0..3)
}

groupOrSequenceHopping ::= ENUMERATED {neither, groupHopping, sequenceHopping},
resourceType ::= CHOICE {
  aperiodic ::= SEQUENCE {
    ...}
  semi-persistent ::= SEQUENCE {
    periodicityAndOffset-sp ::= SRS-PeriodicityAndOffset,
    ...}
  periodic ::= SEQUENCE {
    periodicityAndOffset-p ::= SRS-PeriodicityAndOffset,
    ...}
}

sequenceId ::= INTEGER (0..1023),
spatialRelationInfo ::= SRS-SpatialRelationInfo

SRS-PosResource ::= SEQUENCE {
  srs-PosResourceId ::= SRS-PosResourceId,
  transmissionComb ::= CHOICE {
    n2 ::= SEQUENCE {
      combOffset-n2 ::= INTEGER (0..1),
      cyclicShift-n2 ::= INTEGER (0..7)
    },
    n4 ::= SEQUENCE {
      combOffset-n4 ::= INTEGER (0..3),
      cyclicShift-n4 ::= INTEGER (0..11)
    },
    n8 ::= SEQUENCE {
      combOffset-n8 ::= INTEGER (0..7),
      cyclicShift-n8 ::= INTEGER (0..5)
    }
  }
}

SRS-PosResourceId ::= INTEGER (0..1023)
sequence Mapping-r16
startPosition-r16
nrofSymbols-r16
},
freqDomainShift-r16
freqHopping-r16
c-SRS-r16
...}
groupOrSequenceHopping-r16
resourceType-r16
  aperiodic-r16
    slotOffset-r16
    ...}
  },
  semi-persistent-r16
    periodicityAndOffset-sp-r16
    ...}
  },
  periodic-r16
    periodicityAndOffset-p-r16
    ...}
  },
sequenceId-r16
spatialRelationInfoPos-r16
SRS-SpatialRelationInfo ::= SEQUENCE {
  servingCellId
  referenceSignal
    ssb-Index
    csi-RS-Index
    srs
    resourceId
    uplinkBWP
}  
SRS-SpatialRelationInfoPos-r16 ::= CHOICE {
  servingRS-r16
    servingCellId
    referenceSignal-r16
      ssb-IndexServing-r16
      csi-RS-IndexServing-r16
      srs
      resourceIdServing-r16
      uplinkBWP
      BWP-Id
}
SSB-Configuration-r16 ::= SEQUENCE {
  sbb-Freq-r16                        ARFCN-ValueNR,
  halfFrameIndex-r16                  ENUMERATED {zero, one},
  sbb-SubcarrierSpacing-r16          SubcarrierSpacing,
  sbb-Periodicity-r16                ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, spare2, spare1 } OPTIONAL, -- Need S
  sfn0-Offset-r16                    SEQUENCE {
    sfn-Offset-r16                    INTEGER (0..1023),
    integerSubframeOffset-r16        INTEGER (0..9) OPTIONAL -- Need R
  },
  sfn-SSB-Offset-r16                 INTEGER (0..15),
  ss-PBCH-BlockPower-r16             INTEGER (-60..50) OPTIONAL -- Cond Pathloss
}

SSB-InfoNcell-r16 ::= SEQUENCE {
  physicalCellId-r16                 PhysCellId,
  sbb-IndexNcell-r16                 SSB-Index
}

DL-PRS-Info-r16 ::= SEQUENCE {
  dl-PRS-ID-r16                      INTEGER (0..255),
  dl-PRS-ResourceSetId-r16           INTEGER (0..7),
  dl-PRS-ResourceId-r16             INTEGER (0..63) OPTIONAL -- Need S
}

SRS-ResourceId ::=                      INTEGER (0..maxNrofSRS-Resources-1)
SRS-PosResourceId-r16 ::=               INTEGER (0..maxNrofSRS-PosResources-1-r16)

SRS-PeriodicityAndOffset ::=            CHOICE {
  sl11                              NULL,
  sl12                              INTEGER(0..1),
  sl14                              INTEGER(0..3),
  sl15                              INTEGER(0..4),
  sl18                              INTEGER(0..7),
  sl110                             INTEGER(0..9),
  sl116                             INTEGER(0..15),
  sl120                             INTEGER(0..19),
  sl132                             INTEGER(0..31),
  sl140                             INTEGER(0..39),
  sl164                             INTEGER(0..63),
  sl180                             INTEGER(0..79),
  sl1160                            INTEGER(0..159),
  sl1320                            INTEGER(0..319),
  sl1640                            INTEGER(0..639),
  sl11280                           INTEGER(0..1279),
SRS-PeriodicityAndOffset-r16 ::=  
  CHOICE {
    sl1                     NULL,
    sl2                     INTEGER(0..1),
    sl4                     INTEGER(0..3),
    sl5                     INTEGER(0..4),
    sl8                     INTEGER(0..7),
    sl10                    INTEGER(0..9),
    sl11                    INTEGER(0..10),
    sl12                    INTEGER(0..12),
    sl14                    INTEGER(0..14),
    sl15                    INTEGER(0..15),
    sl16                    INTEGER(0..16),
    sl18                    INTEGER(0..18),
    sl20                    INTEGER(0..20),
    sl32                    INTEGER(0..32),
    sl40                    INTEGER(0..40),
    sl5120                  INTEGER(0..5120),
    sl640                   INTEGER(0..640),
    sl1280                  INTEGER(0..1280),
    sl2560                  INTEGER(0..2560),
    sl5120                  INTEGER(0..5120),
    sl10240                 INTEGER(0..10240),
    sl40960                 INTEGER(0..40960),
    sl81920                 INTEGER(0..81920),
    ...                     ...
  }

SRS-Config field descriptions

tpc-Accumulation
If the field is absent, UE applies TPC commands via accumulation. If disabled, UE applies the TPC command without accumulation (this applies to SRS when a separate 
closed loop is configured for SRS) (see TS 38.213 [13], clause 7.3).
### SRS-Resource field descriptions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cyclicShift-n2</td>
<td>Cyclic shift configuration (see TS 38.214 [19], clause 6.2.1).</td>
</tr>
<tr>
<td>cyclicShift-n4</td>
<td>Cyclic shift configuration (see TS 38.214 [19], clause 6.2.1).</td>
</tr>
<tr>
<td>freqHopping</td>
<td>Includes parameters capturing SRS frequency hopping (see TS 38.214 [19], clause 6.2.1). For CLI SRS-RSRP measurement, the network always configures this field such that ( b-hop &gt; b-SRS ).</td>
</tr>
<tr>
<td>groupOrSequenceHopping</td>
<td>Parameter(s) for configuring group or sequence hopping (see TS 38.211 [16], clause 6.4.1.4.2). For CLI SRS-RSRP measurement, the network always configures this parameter to 'neither'.</td>
</tr>
<tr>
<td>nrofSRS-Ports</td>
<td>Number of ports. For CLI SRS-RSRP measurement, the network always configures this parameter to 'port1'.</td>
</tr>
<tr>
<td>periodicityAndOffset-p</td>
<td>Periodicity and slot offset for this SRS resource. All values are in &quot;number of slots&quot;. Value ( sl1 ) corresponds to a periodicity of 1 slot, value ( sl2 ) corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots. For periodicity ( sl1 ) the offset is 0 slots (see TS 38.214 [19], clause 6.2.1). For CLI SRS-RSRP measurement, ( sl1280 ) and ( sl2560 ) cannot be configured.</td>
</tr>
<tr>
<td>periodicityAndOffset-sp</td>
<td>Periodicity and slot offset for this SRS resource. All values are in &quot;number of slots&quot;. Value ( sl1 ) corresponds to a periodicity of 1 slot, value ( sl2 ) corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots. For periodicity ( sl1 ) the offset is 0 slots (see TS 38.214 [19], clause 6.2.1).</td>
</tr>
<tr>
<td>ptrs-PortIndex</td>
<td>The PTRS port index for this SRS resource for non-codebook based UL MIMO. This is only applicable when the corresponding PTRS-UplinkConfig is set to CP-OFDM. The ptrs-PortIndex configured here must be smaller than the ( \text{maxNrofPorts} ) configured in the PTRS-UplinkConfig (see TS 38.214 [19], clause 6.2.3.1). This parameter is not applicable to CLI SRS-RSRP measurement.</td>
</tr>
<tr>
<td>resourceMapping</td>
<td>OFDM symbol location of the SRS resource within a slot including ( \text{nrofSymbols} ) (number of OFDM symbols), ( \text{startPosition} ) (value 0 refers to the last symbol, value 1 refers to the second last symbol, and so on) and ( \text{repetitionFactor} ) (see TS 38.214 [19], clause 6.2.1 and TS 38.211 [16], clause 6.4.1.4). The configured SRS resource does not exceed the slot boundary. If resourceMapping-r16 is signalled, UE shall ignore the resourceMapping (without suffix). For CLI SRS-RSRP measurement, the network always configures ( \text{nrofSymbols} ) and ( \text{repetitionFactor} ) to '1'.</td>
</tr>
<tr>
<td>resourceType</td>
<td>Periodicity and offset for semi-persistent and periodic SRS resource (see TS 38.214 [19], clause 6.2.1). For CLI SRS-RSRP measurement, only 'periodic' is applicable for resourceType.</td>
</tr>
<tr>
<td>sequenceId</td>
<td>Sequence ID used to initialize pseudo random group and sequence hopping (see TS 38.214 [19], clause 6.2.1).</td>
</tr>
<tr>
<td>servingCellId</td>
<td>The serving Cell ID of the source SSB, CSI-RS, or SRS for the spatial relation of the target SRS resource. If this field is absent the SSB, the CSI-RS, or the SRS is from the same serving cell where the SRS is configured.</td>
</tr>
<tr>
<td>spatialRelationInfo</td>
<td>Configuration of the spatial relation between a reference RS and the target SRS. Reference RS can be SSB/CSI-RS/SRS (see TS 38.214 [19], clause 6.2.1). This parameter is not applicable to CLI SRS-RSRP measurement.</td>
</tr>
<tr>
<td>spatialRelationInfoPos</td>
<td>Configuration of the spatial relation between a reference RS and the target SRS. Reference RS can be SSB/CSI-RS/SRS/DL-PRS (see TS 38.214 [19], clause 6.2.1).</td>
</tr>
<tr>
<td>srs-RequestDCI-0-2</td>
<td>Indicates the number of bits for &quot;SRS request&quot; in DCI format 0_2. When the field is absent, then the value of 0 bit for &quot;SRS request&quot; in DCI format 0_2 is applied. If the parameter srs-RequestDCI-0-2 is configured to value 1, 1 bit is used to indicate one of the first two rows of Table 7.3.1.1.2-24 in TS 38.212 [17] for triggered aperiodic SRS resource set. If the value 2 is configured, 2 bits are used to indicate one of the rows of Table 7.3.1.1.2-24 in TS 38.212 [17]. When UE is configured with supplementaryUplink, an extra bit (the first bit of the SRS request field) is used for the non-SUL/SUL indication.</td>
</tr>
<tr>
<td><strong>srs-RequestDCI-1-2</strong></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td></td>
</tr>
<tr>
<td>Indicate the number of bits for &quot;SRS request&quot; in DCI format 1_2. When the field is absent, then the value of 0 bit for &quot;SRS request&quot; in DCI format 1_2 is applied. When the UE is configured with <code>supplementaryUplink</code>, an extra bit (the first bit of the SRS request field) is used for the non-SUL/SUL indication (see TS 38.214 [19], clause 6.1.1.2).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>srs-ResourceSetToAddModListDCI-0-2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>List of SRS resource set to be added or modified for DCI format 0_2 (see TS 38.212 [17], clause 7.3.1).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>srs-ResourceSetToReleaseListDCI-0-2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>List of SRS resource set to be released for DCI format 0_2 (see TS 38.212 [17], clause 7.3.1).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>transmissionComb</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Comb value (2 or 4 or 8) and comb offset (0..combValue-1) (see TS 38.214 [19], clause 6.2.1).</td>
</tr>
<tr>
<td><strong>SRS-ResourceSet field descriptions</strong></td>
</tr>
<tr>
<td>---------------------------------------</td>
</tr>
<tr>
<td><strong>alpha</strong></td>
</tr>
<tr>
<td>alpha value for SRS power control (see TS 38.213 [13], clause 7.3). When the field is absent the UE applies the value 1.</td>
</tr>
<tr>
<td><strong>aperiodicSRS-ResourceTriggerList</strong></td>
</tr>
<tr>
<td>An additional list of DCI &quot;code points&quot; upon which the UE shall transmit SRS according to this SRS resource set configuration (see TS 38.214 [19], clause 6.1). When the field is not included during a reconfiguration of SRS-ResourceSet of resourceType set to aperiodic, UE maintains this value based on the Need M; that is, this list is not considered as an extension of aperiodicSRS-ResourceTrigger for purpose of applying the general rule for extended list in clause 6.1.3.</td>
</tr>
<tr>
<td><strong>associatedCSI-RS</strong></td>
</tr>
<tr>
<td>ID of CSI-RS resource associated with this SRS resource set in non-codebook based operation (see TS 38.214 [19], clause 6.1.1.2).</td>
</tr>
<tr>
<td><strong>csi-RS</strong></td>
</tr>
<tr>
<td>ID of CSI-RS resource associated with this SRS resource set. (see TS 38.214 [19], clause 6.1.1.2).</td>
</tr>
<tr>
<td><strong>csi-RS-IndexServingcell</strong></td>
</tr>
<tr>
<td>Indicates CSI-RS index belonging to a serving cell</td>
</tr>
<tr>
<td><strong>p0</strong></td>
</tr>
<tr>
<td>P0 value for SRS power control. The value is in dBm. Only even values (step size 2) are allowed (see TS 38.213 [13], clause 7.3).</td>
</tr>
<tr>
<td><strong>pathlossReferenceRS</strong></td>
</tr>
<tr>
<td>A reference signal (e.g. a CSI-RS config or a SS block) to be used for SRS path loss estimation (see TS 38.213 [13], clause 7.3).</td>
</tr>
<tr>
<td><strong>pathlossReferenceRS-Pos</strong></td>
</tr>
<tr>
<td>A reference signal (e.g. a SS block or a DL-PRS config) to be used for SRS path loss estimation (see TS 38.213 [13], clause 7.3).</td>
</tr>
<tr>
<td><strong>pathlossReferenceRSL</strong></td>
</tr>
<tr>
<td>Multiple candidate pathloss reference RS(s) for SRS power control, where one candidate RS can be mapped to SRS Resource Set via MAC CE (clause 6.1.3.27 in TS 38.321 [3]). The network can only configure this field if pathlossReferenceRS is not configured in the same SRS-ResourceSet.</td>
</tr>
<tr>
<td><strong>resourceSelection</strong></td>
</tr>
<tr>
<td>Indicates whether the configured SRS spatial relation resource is a SRS-Resource or SRS-PosResource.</td>
</tr>
<tr>
<td><strong>resourceType</strong></td>
</tr>
<tr>
<td>Time domain behavior of SRS resource configuration, see TS 38.214 [19], clause 6.2.1. The network configures SRS resources in the same resource set with the same time domain behavior on periodic, aperiodic and semi-persistent SRS.</td>
</tr>
<tr>
<td><strong>slotOffset</strong></td>
</tr>
<tr>
<td>An offset in number of slots between the triggering DCI and the actual transmission of this SRS-ResourceSet. If the field is absent the UE applies no offset (value 0).</td>
</tr>
<tr>
<td><strong>srs-PowerControlAdjustmentStates</strong></td>
</tr>
<tr>
<td>Indicates whether srs.c(i) = fc(i,1) or srs.c(i) = fc(i,2) (if twoPUSCH-PC-AdjustmentStates are configured) or separate close loop is configured for SRS. This parameter is applicable only for UEs on which UE also transmits PUSCH. If absent or release, the UE applies the value sameAs-Fci1 (see TS 38.213 [13], clause 7.3).</td>
</tr>
<tr>
<td><strong>srs-ResourceIdList</strong></td>
</tr>
<tr>
<td>The IDs of the SRS-Resources used in this SRS-ResourceSet. If this SRS-ResourceSet is configured with usage set to codebook, the srs-ResourceIdList contains at most 2 entries. If this SRS-ResourceSet is configured with usage set to nonCodebook, the srs-ResourceIdList contains at most 4 entries.</td>
</tr>
<tr>
<td><strong>srs-ResourceSetId</strong></td>
</tr>
<tr>
<td>The ID of this resource set. It is unique in the context of the BWP in which the parent SRS-Config is defined.</td>
</tr>
<tr>
<td><strong>ssb-IndexServingcell</strong></td>
</tr>
<tr>
<td>Indicates SSB index belonging to a serving cell</td>
</tr>
<tr>
<td><strong>ssb-NCell</strong></td>
</tr>
<tr>
<td>This field indicates a SSB configuration from neighboring cell</td>
</tr>
<tr>
<td><strong>usage</strong></td>
</tr>
<tr>
<td>Indicates if the SRS resource set is used for beam management, codebook based or non-codebook based transmission or antenna switching. See TS 38.214 [19], clause 6.2.1. Reconfiguration between codebook based and non-codebook based transmission is not supported.</td>
</tr>
</tbody>
</table>
### SSB-InfoNCell field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>physicalCellId</td>
<td>This field specifies the physical cell ID of the neighbour cell for which SSB configuration is provided.</td>
</tr>
<tr>
<td>ssb-IndexNcell</td>
<td>This field specifies the index of the SSB for a neighbour cell. See TS 38.213 [13]. If this field is absent, the UE determines the ssb-IndexNcell of the physicalCellId based on its SSB measurement from the cell.</td>
</tr>
<tr>
<td>ssb-Configuration</td>
<td>This field specifies the full configuration of the SSB. If this field is absent, the UE obtains the configuration for the SSB from nr-SSB-Config received as part of DL-PRS assistance data in LPP, see TS 37.355 [49], by looking up the corresponding SSB configuration using the field physicalCellId.</td>
</tr>
</tbody>
</table>

### DL-PRS-Info field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dl-PRS-ID</td>
<td>This field specifies the UE specific TRP ID (see TS 37.355 [49]) for which PRS configuration is provided.</td>
</tr>
<tr>
<td>dl-PRS-ResourceSetId</td>
<td>This field specifies the PRS-ResourceSet ID of a PRS resourceSet.</td>
</tr>
<tr>
<td>dl-PRS-ResourceId</td>
<td>This field specifies the PRS-Resource ID of a PRS resource. If this field is absent, the UE determines the dl-PRS-ResourceId based on its PRS measurement from the TRP and DL-PRS Resource Set.</td>
</tr>
</tbody>
</table>

### SSB-Configuration field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>halfFrameIndex</td>
<td>Indicates whether SSB is in the first half or the second half of the frame. Value zero indicates the first half and value 1 indicates the second half.</td>
</tr>
<tr>
<td>integerSubframeOffset</td>
<td>Indicates the subframe boundary offset of the cell in which SSB is transmitted.</td>
</tr>
<tr>
<td>sfn0-Offset</td>
<td>Indicates the time offset of the SFN0 slot 0 for the cell with respect to SFN0 slot 0 of serving cell.</td>
</tr>
<tr>
<td>sfn-Offset</td>
<td>Specifies the SFN offset between the cell in which SSB is transmitted and serving cell. The offset corresponds to the number of full radio frames counted from the beginning of a radio frame #0 of serving cell to the beginning of the closest subsequent radio frame #0 of the cell in which SSB is transmitted.</td>
</tr>
<tr>
<td>sfn-SSB-Offset</td>
<td>Indicates the SFN offset of the transmitted SSB relative to the start of the SSB period. Value 0 indicates that the SSB is transmitted in the first system frame, value 1 indicates that SSB is transmitted in the second system frame and so on. The network configures this field according to the field ssb-Periodicity such that the indicated system frame does not exceed the configured SSB periodicity.</td>
</tr>
<tr>
<td>sfb-Freq</td>
<td>Indicates the frequency of the SSB.</td>
</tr>
<tr>
<td>sfb-PBCH-BlockPower</td>
<td>Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission, see TS 38.213 [13], clause 7.</td>
</tr>
<tr>
<td>sfb-Periodicity</td>
<td>Indicates the periodicity of the SSB. If the field is absent, the UE applies the value ms5. (see TS 38.213 [13], clause 4.1)</td>
</tr>
<tr>
<td>sfbSubcarrierSpacing</td>
<td>Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.</td>
</tr>
<tr>
<td>Conditional Presence</td>
<td>Explanation</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Setup</strong></td>
<td>This field is mandatory present upon configuration of <code>SRS-ResourceSet</code> or <code>SRS-Resource</code> and optionally present, Need M, otherwise.</td>
</tr>
<tr>
<td><strong>NonCodebook</strong></td>
<td>This field is optionally present, Need M, in case of non-codebook based transmission, otherwise the field is absent.</td>
</tr>
<tr>
<td><strong>Pathloss</strong></td>
<td>The field is mandatory present if the IE <code>SSB-InfoNcell</code> is included in <code>pathlossReferenceRS-Pos</code>; otherwise it is optionally present, Need R</td>
</tr>
</tbody>
</table>

---

**SRS-RSRP-Range**

The IE *SRS-RSRP-Range* specifies the value range used in SRS-RSRP measurements and thresholds. The integer value for SRS-RSRP measurements is according to Table [FFS] in TS 38.133 [14]. For thresholds, the actual value is (IE value –140) dBm, except for the IE value 98, in which case the actual value is infinity.

*SRS-RSRP-Range* information element

```asn1
SRS-RSRP-Range-r16 ::= INTEGER(0..98)
```

---

**SRS-TPC-CommandConfig**

The IE *SRS-TPC-CommandConfig* is used to configure the UE for extracting TPC commands for SRS from a group-TPC messages on DCI

*SRS-TPC-CommandConfig* information element

```asn1
SRS-TPC-CommandConfig ::= SEQUENCE {
    startingBitOfFormat2-3 INTEGER (1..31) OPTIONAL, -- Need R
    fieldTypeFormat2-3 INTEGER (0..1) OPTIONAL, -- Need R
    ...,
    {[ startingBitOfFormat2-3SUL INTEGER (1..31) OPTIONAL -- Need R ]}
}
```
### SRS-TPC-CommandConfig field descriptions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>fieldTypeFormat2-3</td>
<td>The type of a field within the group DCI with SRS request fields (optional), which indicates how many bits in the field are for SRS request (0 or 2). Note that for Type A, there is a common SRS request field for all SCells in the set, but each SCell has its own TPC command bits. See TS 38.212 [17] clause 7.3.1 and , TS 38.213 [13], clause 11.3.</td>
</tr>
<tr>
<td>startingBitOfFormat2-3</td>
<td>The starting bit position of a block within the group DCI with SRS request fields (optional) and TPC commands. The value 1 of the field corresponds to the first/left most bit of format2-3. The value 2 of the field corresponds to the second bit format2-3, and so on (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 11.3).</td>
</tr>
<tr>
<td>startingBitOfFormat2-3SUL</td>
<td>The starting bit position of a block within the group DCI with SRS request fields (optional) and TPC commands for SUL carrier (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 11.3).</td>
</tr>
</tbody>
</table>

---

### SSB-Index

The IE *SSB-Index* identifies an SS-Block within an SS-Burst. See TS 38.213 [13], clause 4.1.

**SSB-Index information element**

```
SSB-Index ::= INTEGER (0..maxNrofSSBs-1)
```

---

### SSB-MTC

The IE *SSB-MTC* is used to configure measurement timing configurations, i.e., timing occasions at which the UE measures SSBs.

**SSB-MTC information element**

```
SSB-MTC ::= SEQUENCE {
    periodicityAndOffset       CHOICE {
        sf5                          INTEGER (0..4),
        sf10                         INTEGER (0..9),
        sf20                         INTEGER (0..19),
        sf40                         INTEGER (0..39),
        sf80                         INTEGER (0..79),
        sf160                        INTEGER (0..159)
    },
    duration                   ENUMERATED { sf1, sf2, sf3, sf4, sf5 }
}
```
SSB-MTC2 ::= SEQUENCE {
    pci-List               SEQUENCE (SIZE (1..maxNrofPCIsPerSMTC)) OF PhysCellId OPTIONAL, -- Need M
    periodicity            ENUMERATED {sf5, sf10, sf20, sf40, sf80, spare3, spare2, spare1} }

SSB-MTC2-LP-r16 ::= SEQUENCE {
    pci-List               SEQUENCE (SIZE (1..maxNrofPCIsPerSMTC)) OF PhysCellId OPTIONAL, -- Need R
    periodicity            ENUMERATED {sf10, sf20, sf40, sf80, sf160, spare3, spare2, spare1} }

SSB-MTC3-r16 ::= SEQUENCE {
    periodicityAndOffset-r16            CHOICE {
        sf5-r16                                     INTEGER (0..4),
        sf10-r16                                    INTEGER (0..9),
        sf20-r16                                    INTEGER (0..19),
        sf40-r16                                    INTEGER (0..39),
        sf80-r16                                    INTEGER (0..79),
        sf160-r16                                   INTEGER (0..159),
        sf320-r16                                   INTEGER (0..319),
        sf640-r16                                   INTEGER (0..639),
        sf1280-r16                                  INTEGER (0..1279),
    },
    duration-r16                        ENUMERATED {sf1, sf2, sf3, sf4, sf5},
    pci-List-r16                       SEQUENCE (SIZE (1..maxNrofPCIsPerSMTC)) OF PhysCellId OPTIONAL, -- Need M
    ssb-ToMeasure-r16                  SetupRelease { SSB-ToMeasure } OPTIONAL   -- Need M
}

-- TAG-SSB-MTC-STOP
-- ASN1STOP

**SSB-MTC field descriptions**

**duration**

Duration of the measurement window in which to receive SS/PBCH blocks. It is given in number of subframes (see TS 38.213 [13], clause 4.1).

**periodicityAndOffset**

Periodicity and offset of the measurement window in which to receive SS/PBCH blocks, see 5.5.2.10. Periodicity and offset are given in number of subframes.

**SSB-MTC2 field descriptions**

**pci-List**

PCIs that are known to follow this SMT.
### SSB-MTC3 field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>duration</strong></td>
<td>Duration of the measurement window in which to receive SS/PBCH blocks. It is given in number of subframes (see TS 38.213 [13], clause 4.1).</td>
</tr>
<tr>
<td><strong>pci-List</strong></td>
<td>PCs that are known to follow this SMTC, used for IAB-node discovery.</td>
</tr>
<tr>
<td><strong>periodicityAndOffset</strong></td>
<td>Periodicity and offset of the measurement window in which to receive SS/PBCH blocks, see 5.5.2.10. Periodicity and offset are given in number of subframes.</td>
</tr>
<tr>
<td><strong>ssb-ToMeasure</strong></td>
<td>The set of SS blocks to be measured within the SMTC measurement duration. The first/leftmost bit corresponds to SS block index 0, the second bit corresponds to SS block index 1, and so on. Value 0 in the bitmap indicates that the corresponding SS block is not to be measured while value 1 indicates that the corresponding SS block is to be measured (see TS 38.215 [9]). When the field is not configured the IAB-MT measures on all SS blocks. Regardless of the value of this field, SS blocks outside of the applicable smtc are not to be measured. See TS 38.215 [9] clause 5.1.1.</td>
</tr>
</tbody>
</table>

---

**SSB-PositionQCL-Relation**

The IE **SSB-PositionQCL-Relation** is used to indicate the QCL relationship between SSB positions on the frequency indicated by *ssbFrequency* (see TS 38.213 [13], clause 4.1) for operation with shared spectrum channel access. Value n1 corresponds to 1, value n2 corresponds to 2 and so on.

#### SSB-PositionQCL-Relation information element

```asn1
SSB-PositionQCL-Relation-r16 ::=  ENUMERATED {n1,n2,n4,n8}
```

---

**SSB-ToMeasure**

The IE **SSB-ToMeasure** is used to configure a pattern of SSBs.

#### SSB-ToMeasure information element

```asn1
SSB-ToMeasure ::=                   CHOICE {
  shortBitmap                         BIT STRING (SIZE (4)),
  mediumBitmap                        BIT STRING (SIZE (8)),
  longBitmap                          BIT STRING (SIZE (64))
}
```

---
SSB-ToMeasure field descriptions

| longBitmap | Bimap when maximum number of SS/PBCH blocks per half frame equals to 64 as defined in TS 38.213 [13], clause 4.1. |
| mediumBitmap | Bimap when maximum number of SS/PBCH blocks per half frame equals to 8 as defined in TS 38.213 [13], clause 4.1. For operation with shared spectrum channel access, if the k-th bit is set to 1, the UE assumes that one or more SS/PBCH blocks within the discovery burst transmission window with candidate SS/PBCH block indexes corresponding to SS/PBCH block index equal to k – 1 may be transmitted; if the k-th bit is set to 0, the UE assumes that the corresponding SS/PBCH block(s) are not transmitted. If ssb-PositionQCL is configured, the k-th bit is set to 0, where k > ssb-PositionQCL and the number of actually transmitted SS/PBCH blocks is not larger than the number of 1's in the bitmap. |
| shortBitmap | Bimap when maximum number of SS/PBCH blocks per half frame equals to 4 as defined in TS 38.213 [13], clause 4.1. |

SS-RSSI-Measurement

The IE SS-RSSI-Measurement is used to configure RSSI measurements based on synchronization reference signals.

SS-RSSI-Measurement information element

```asn1
SS-RSSI-Measurement ::= SEQUENCE {
  measurementSlots          BIT STRING (SIZE (1..80)),
  endSymbol                 INTEGER(0..3)
}
```

SS-RSSI-Measurement field descriptions

| endSymbol | Within a slot that is configured for RSSI measurements (see measurementSlots) the UE measures the RSSI from symbol 0 to symbol endSymbol. This field identifies the entry in Table 5.1.3-1 in TS 38.215 [9], which determines the actual end symbol. |
| measurementSlots | Indicates the slots in which the UE can perform RSSI measurements. The length of the BIT STRING is equal to the number of slots in the configured SMTC window (determined by the duration and by the subcarrierSpacing). The first (left-most / most significant) bit in the bitmap corresponds to the first slot in the SMTC window, the second bit in the bitmap corresponds to the second slot in the SMTC window, and so on. The UE measures in slots for which the corresponding bit in the bitmap is set to 1. In case this field is configured for a SCell with ca-SlotOffset-r16, the bits in the bitmap corresponds to the slots that are fully contained in the SMTC window. |
SubcarrierSpacing

The IE SubcarrierSpacing determines the subcarrier spacing. Restrictions applicable for certain frequencies, channels or signals are clarified in the fields that use this IE.

SubcarrierSpacing information element

 TAG-Config

The IE TAG-Config is used to configure parameters for a time-alignment group.

TAG-Config information element

 TAG field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>tag-Id</td>
<td>Indicates the TAG of the SpCell or an SCell, see TS 38.321 [3]. Uniquely identifies the TAG within the scope of a Cell Group (i.e. MCG or SCG).</td>
</tr>
<tr>
<td>timeAlignmentTimer</td>
<td>Value in ms of the timeAlignmentTimer for TAG with ID tag-Id, as specified in TS 38.321 [3].</td>
</tr>
</tbody>
</table>
TCI-State

The IE TCI-State associates one or two DL reference signals with a corresponding quasi-colocation (QCL) type.

TCI-State information element

--- ASN1START
--- TAG-TCI-STATE-START

TCI-State ::= SEQUENCE {
  tci-StateId                         TCI-StateId,
  qcl-Type1                           QCL-Info,
  qcl-Type2                           QCL-Info OPTIONAL, -- Need R
  ... }

QCL-Info ::= SEQUENCE {
  cell                                ServCellIndex OPTIONAL, -- Need R
  bwp-Id                              BWP-Id OPTIONAL, -- Cond CSI-RS-Indicated
  referenceSignal                     CHOICE {
    csi-rs                              NZP-CSI-RS-ResourceId,
    ssb                                 SSB-Index },
  qcl-Type                            ENUMERATED {typeA, typeB, typeC, typeD},
  ... }
--- TAG-TCI-STATE-STOP
--- ASN1STOP

QCL-Info field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bwp-Id</td>
<td>The DL BWP which the RS is located in.</td>
</tr>
<tr>
<td>cell</td>
<td>The UE’s serving cell in which the referenceSignal is configured. If the field is absent, it applies to the serving cell in which the TCI-State is configured. The RS can be located on a serving cell other than the serving cell in which the TCI-State is configured only if the qcl-Type is configured as typeC or typeD. See TS 38.214 [19] clause 5.1.5.</td>
</tr>
<tr>
<td>referenceSignal</td>
<td>Reference signal with which quasi-collocation information is provided as specified in TS 38.214 [19] subclause 5.1.5.</td>
</tr>
<tr>
<td>qcl-Type</td>
<td>QCL type as specified in TS 38.214 [19] subclause 5.1.5.</td>
</tr>
</tbody>
</table>

Conditional Presence

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSI-RS-Indicated</td>
<td>This field is mandatory present if csi-rs is included, absent otherwise</td>
</tr>
</tbody>
</table>

---
The IE *TCI-StateId* is used to identify one *TCI-State* configuration.

**TCI-StateId** information element

```asn1
TCI-StateId ::=          INTEGER (0..maxNrofTCI-States-1)
```

The IE *TDD-UL-DL-ConfigCommon* determines the cell specific Uplink/Downlink TDD configuration.

**TDD-UL-DL-ConfigCommon** information element

```asn1
TDD-UL-DL-ConfigCommon ::=          SEQUENCE {
    referenceSubcarrierSpacing          SubcarrierSpacing,
    pattern1                            TDD-UL-DL-Pattern,
    nrofDownlinkSlots                   INTEGER (0..maxNrofSlots),
    nrofUplinkSlots                     INTEGER (0..maxNrofSlots),
    ...,
    dl-UL-TransmissionPeriodicity-v1530 ENUMERATED {ms0p5, ms0p625, ms1, ms1p25, ms2, ms2p5, ms5, ms10},
    nrofDownlinkSymbols                 INTEGER (0..maxNrofSymbols-1),
    nrofUplinkSymbols                   INTEGER (0..maxNrofSymbols-1),
    ...,
}
```

```asn1
TDD-UL-DL-Pattern ::=               SEQUENCE {     dl-UL-TransmissionPeriodicity       ENUMERATED {ms0p5, ms0p625, ms1, ms1p25, ms2, ms2p5, ms5, ms10},
    nrofDownlinkSlots          INTEGER (0..maxNrofSlots),
    nrofUplinkSymbols          INTEGER (0..maxNrofSymbols-1),
    nrofUplinkSymbols          INTEGER (0..maxNrofSymbols-1),
    ...,
    dl-UL-TransmissionPeriodicity-v1530 Enumeration {ms3, ms4} OPTIONAL -- Need R
}
```
**TDD-UL-DL-ConfigCommon field descriptions**

**referenceSubcarrierSpacing**
Reference SCS used to determine the time domain boundaries in the UL-DL pattern which must be common across all subcarrier specific carriers, i.e., independent of the actual subcarrier spacing using for data transmission. Only the values 15, 30 or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. The network configures a not larger than any SCS of configured BWPs for the serving cell. The network or SL-PreconfigGeneral configures a not larger than the SCS of (pre-)configured SL BWP. See TS 38.213 [13], clause 11.1.

---

**TDD-UL-DL-Pattern field descriptions**

**dl-UL-TransmissionPeriodicity**
Periodicity of the DL-UL pattern, see TS 38.213 [13], clause 11.1. If the `dl-UL-TransmissionPeriodicity-v1530` is signalled, UE shall ignore the `dl-UL-TransmissionPeriodicity` (without suffix).

**nrofDownlinkSlots**
Number of consecutive full DL slots at the beginning of each DL-UL pattern, see TS 38.213 [13], clause 11.1. In this release, the maximum value for this field is 80.

**nrofDownlinkSymbols**
Number of consecutive DL symbols in the beginning of the slot following the last full DL slot (as derived from `nrofDownlinkSlots`). The value 0 indicates that there is no partial-downlink slot. (see TS 38.213 [13], clause 11.1).

**nrofUplinkSlots**
Number of consecutive full UL slots at the end of each DL-UL pattern, see TS 38.213 [13], clause 11.1. In this release, the maximum value for this field is 80.

**nrofUplinkSymbols**
Number of consecutive UL symbols in the end of the slot preceding the first full UL slot (as derived from `nrofUplinkSlots`). The value 0 indicates that there is no partial-uplink slot. (see TS 38.213 [13], clause 11.1).

---

**TDD-UL-DL-ConfigDedicated**

The IE `TDD-UL-DL-ConfigDedicated` determines the UE-specific Uplink/Downlink TDD configuration.

---

**TDD-UL-DL-ConfigDedicated information element**

```asciidoc
TDD-UL-DL-ConfigDedicated ::= SEQUENCE {
  slotSpecificConfigurationsToAddModList  SEQUENCE (SIZE (1..maxNrofSlots)) OF TDD-UL-DL-SlotConfig OPTIONAL, -- Need N
  slotSpecificConfigurationsToReleaseList  SEQUENCE (SIZE (1..maxNrofSlots)) OF TDD-UL-DL-SlotIndex OPTIONAL, -- Need N
  ...
}
```

```asciidoc
TDD-UL-DL-ConfigDedicated-IAB-MT-r16 ::= SEQUENCE {
  slotSpecificConfigurationsToAddModList-IAB-MT-r16  SEQUENCE (SIZE (1..maxNrofSlots)) OF TDD-UL-DL-SlotConfig-IAB-MT-r16 OPTIONAL, -- Need N
  slotSpecificConfigurationsToReleaseList-IAB-MT-r16  SEQUENCE (SIZE (1..maxNrofSlots)) OF TDD-UL-DL-SlotIndex-IAB-MT-r16 OPTIONAL, -- Need N
  ...
}
```

```asciidoc
TDD-UL-DL-SlotConfig ::= SEQUENCE {
  ...
}
```
TDD-UL-DL-SlotIndex ::= INTEGER (0..maxNrofSlots-1)

-- TAG-TDD-UL-DL-CONFIGDEDICATED-STOP
-- ASN1STOP

TDD-UL-DL-ConfigDedicated field descriptions

**slotSpecificConfigurationsToAddModList**
The `slotSpecificConfigurationsToAddModList` allows overriding UL/DL allocations provided in tdd-UL-DL-configurationCommon, see TS 38.213 [13], clause 11.1.

TDD-UL-DL-ConfigDedicated-IAB-MT field descriptions

**slotSpecificConfigurationsToAddModList-IAB-MT**
The `slotSpecificConfigurationsToAddModList-IAB-MT` allows overriding UL/DL allocations provided in tdd-UL-DL-configurationCommon with a limitation that effectively only flexible symbols can be overwritten in Rel-16.

**slotSpecificConfigurationsToReleaseList-IAB-MT**
The `slotSpecificConfigurationsToReleaseList-IAB-MT` allows release of a set of slot configuration previously add with `slotSpecificConfigurationsToAddModList-IAB-MT`.
### TDD-UL-DL-SlotConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>nrofDownlinkSymbols</td>
<td>Number of consecutive DL symbols in the beginning of the slot identified by <em>slotIndex</em>. If the field is absent the UE assumes there are no leading DL symbols. (see TS 38.213 [13], clause 11.1).</td>
</tr>
<tr>
<td>nrofUplinkSymbols</td>
<td>Number of consecutive UL symbols in the end of the slot identified by <em>slotIndex</em>. If the field is absent the UE assumes there are no trailing UL symbols. (see TS 38.213 [13], clause 11.1).</td>
</tr>
<tr>
<td>slotIndex</td>
<td>Identifies a slot within a slot configuration period given in <em>tdd-UL-DL-configurationCommon</em>, see TS 38.213 [13], clause 11.1.</td>
</tr>
<tr>
<td>symbols</td>
<td>The direction (downlink or uplink) for the symbols in this slot. Value <em>allDownlink</em> indicates that all symbols in this slot are used for downlink; value <em>allUplink</em> indicates that all symbols in this slot are used for uplink; value <em>explicit</em> indicates explicitly how many symbols in the beginning and end of this slot are allocated to downlink and uplink, respectively.</td>
</tr>
</tbody>
</table>

### TDD-UL-DL-SlotConfig-IAB-MT field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>symbols-IAB-MT</td>
<td>The <em>symbols-IAB-MT</em> is used to configure an IAB-MT with the SlotConfig applicable for one serving cell. Value <em>allDownlink</em> indicates that all symbols in this slot are used for downlink; value <em>allUplink</em> indicates that all symbols in this slot are used for uplink; value <em>explicit</em> indicates explicitly how many symbols in the beginning and end of this slot are allocated to downlink and uplink, respectively; value <em>explicit-IAB-MT</em> indicates explicitly how many symbols in the beginning and end of this slot are allocated to uplink and downlink, respectively.</td>
</tr>
</tbody>
</table>

---

### TrackingAreaCode

The IE *TrackingAreaCode* is used to identify a tracking area within the scope of a PLMN, see TS 24.501 [23].

**TrackingAreaCode information element**

```asn1
TrackingAreaCode ::= BIT STRING (SIZE (24))
```

---

### T-Reselection

The IE *T-Reselection* concerns the cell reselection timer TreselectionRAT for NR and E-UTRA Value in seconds. For value 0, behaviour as specified in 7.1.2 applies.

**T-Reselection information element**

```asn1
T-Reselection ::= < asn1 type >
```

---

ETSI
--- INTEGER {0..7}  
--- ASN1STOP

--- TimeToTrigger

The IE TimeToTrigger specifies the value range used for time to trigger parameter, which concerns the time during which specific criteria for the event needs to be met in order to trigger a measurement report. Value ms0 corresponds to 0 ms and behaviour as specified in 7.1.2 applies, value ms40 corresponds to 40 ms, and so on.

**TimeToTrigger information element**

--- ASN1START
--- TAG-TIMETOTRIGGER-START

TimeToTrigger ::= ENUMERATED {  
  ms0, ms40, ms64, ms80, ms100, ms160, ms256,  
  ms320, ms480, ms512, ms640, ms1024, ms1280, ms2560,  
  ms5120}  
--- TAG-TIMETOTRIGGER-STOP
--- ASN1STOP

--- UAC-BarringInfoSetIndex

The IE UAC-BarringInfoSetIndex provides the index of the entry in uac-BarringInfoSetList. Value 1 corresponds to the first entry in uac-BarringInfoSetList, value 2 corresponds to the second entry in this list and so on. An index value referring to an entry not included in uac-BarringInfoSetList indicates no barring.

**UAC-BarringInfoSetIndex information element**

--- ASN1START
--- TAG-UAC-BARRINGINFOSETINDEX-START

UAC-BarringInfoSetIndex ::= INTEGER {1..maxBarringInfoSet}  
--- TAG-UAC-BARRINGINFOSETINDEX-STOP
--- ASN1STOP

--- UAC-BarringInfoSetList

The IE UAC-BarringInfoSetList provides a list of access control parameter sets. An access category can be configured with access parameters according to one of the sets.

**UAC-BarringInfoSetList information element**

--- ASN1START

--- ASN1STOP

--- ETSI
**UAC-BarringInfoSetList**

List of access control parameter sets. Each access category can be configured with access parameters corresponding to a particular set by `uac-barringInfoSetIndex`.

Association of an access category with an index that has no corresponding entry in the `UAC-BarringInfoSetList` is valid configuration and indicates no barring.

**uac-BarringForAccessIdentity**
Indicates whether access attempt is allowed for each Access Identity. The leftmost bit, bit 0 in the bit string corresponds to Access Identity 1, bit 1 in the bit string corresponds to Access Identity 2, bit 2 in the bit string corresponds to Access Identity 3, and so on. Value 0 means that access attempt is allowed for the corresponding access identity.

**uac-BarringFactor**
Represents the probability that access attempt would be allowed during access barring check.

**uac-BarringTime**
The minimum time in seconds before a new access attempt is to be performed after an access attempt was barred at access barring check for the same access category.

---

**UAC-BarringPerCatList**
The IE `UAC-BarringPerCatList` provides access control parameters for a list of access categories.

---

**UAC-BarringPerCatList**

The IE `UAC-BarringPerCatList` information element

---
The Access Category according to TS 22.261 [25].

--  UAC-BarringPerPLMN-List

The IE UAC-BarringPerPLMN-List provides access category specific access control parameters, which are configured per PLMN.

**UAC-BarringPerPLMN-List field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>accessCategory</td>
<td>The Access Category according to TS 22.261 [25].</td>
</tr>
</tbody>
</table>

**UAC-BarringPerPLMN-List information element**

```asn1
UAC-BarringPerPLMN-List ::= SEQUENCE (SIZE (1.. maxPLMN)) OF UAC-BarringPerPLMN
```

```asn1
UAC-BarringPerPLMN ::= SEQUENCE {
  plmn-IdentityIndex                  INTEGER (1.. maxPLMN),
  uac-ACBarringListType               CHOICE{
    uac-ImplicitACBarringList           SEQUENCE (SIZE(maxAccessCat-1)) OF UAC-BarringInfoSetIndex,
    uac-ExplicitACBarringList           UAC-BarringPerCatList
  } OPTIONAL -- Need S
  uac-ExplicitACBarringList           UAC-BarringPerCatList
}
```

**UAC-BarringPerPLMN-List field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>uac-ACBarringListType</td>
<td>Access control parameters for each access category valid only for a specific PLMN or SNPN. UE behaviour upon absence of this field is specified in clause 5.3.14.2.</td>
</tr>
<tr>
<td>plmn-IdentityIndex</td>
<td>Index of the PLMN or SNPN across the plmn-IdentityList and npn-IdentityInfoList fields included in SIB1.</td>
</tr>
</tbody>
</table>

--  UE-TimersAndConstants

The IE UE-TimersAndConstants contains timers and constants used by the UE in RRC_CONNECTED, RRC_INACTIVE and RRC_IDLE.

**UE-TimersAndConstants information element**

```asn1
UE-TimersAndConstants ::= SEQUENCE {
  t300                                ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000},
  t301                                ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000},
  t310                                ENUMERATED {ms0, ms50, ms100, ms200, ms500, ms1000, ms2000},
}
```
n310 ENUMERATED {n1, n2, n3, n4, n6, n8, n10, n20},
n311 ENUMERATED {ms1000, ms3000, ms5000, ms10000, ms15000, ms20000, ms30000},
n311 ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10},
t319 ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000},
...

-- TAG-UE-TIMERSANDCONSTANTS-STOP
-- ASN1STOP

—

UL-DelayValueConfig

The IE UL-DelayValueConfig IE specifies the configuration of the UL PDCP Packet Delay value per DRB measurement specified in TS 38.314 [53].

UL-DelayValueConfig information element

-- ASN1START
-- TAG-ULDELAYVALUECONFIG-START
UL-DelayValueConfig-r16 ::= SEQUENCE {
  delay-DRBlist SEQUENCE (SIZE(1..maxDRB)) OF DRB-Identity
}

-- TAG-ULDELAYVALUECONFIG-STOP
-- ASN1STOP

UL-DelayValueConfig field descriptions

Delay-DRBlist
Indicates the DRB IDs used by UE to provide results of UL PDCP Packet Delay value per DRB measurement as specified in TS 38.314 [53].

—

UplinkCancellation

The IE UplinkCancellation is used to configure the UE to monitor PDCCH for the CI-RNTI.

UplinkCancellation information element

-- ASN1START
-- TAG-UPLINKCANCELLATION-START
UplinkCancellation-r16 ::= SEQUENCE {
  ci-RNTI-r16 RNTI-Value,
  dci-PayloadSizeForCI-r16 INTEGER (0..maxCI-DCI-PayloadSize-r16),
  ci-ConfigurationPerServingCell-r16 SEQUENCE (SIZE (1..maxNrofServingCells)) OF CI-ConfigurationPerServingCell-r16,
  ...
}
CI-ConfigurationPerServingCell-r16 ::= SEQUENCE {
  servingCellId                        ServCellIndex,
  positionInDCI-r16                   INTEGER (0..maxCI-DCI-PayloadSize-r16-1),
  positionInDCI-ForSUL-r16            INTEGER (0..maxCI-DCI-PayloadSize-r16-1) OPTIONAL, -- Cond SUL-Only
  ci-PayloadSize-r16                  ENUMERATED {n1, n2, n4, n5, n7, n8, n10, n14, n16, n20, n28, n32, n35, n42, n56, n112},
  timeFrequencyRegion-r16             SEQUENCE {
    timeDurationForCI-r16              ENUMERATED {n2, n4, n7, n14} OPTIONAL, -- Cond
    SymbolPeriodicity                 ENUMERATED {n1, n2, n4, n7, n14, n28},
    timeGranularityForCI-r16          ENUMERATED {n1, n2, n4, n7, n14, n28},
    frequencyRegionForCI-r16          INTEGER (0..37949),
    deltaOffset-r16                   INTEGER (0..2),
    ...
  },
  uplinkCancellationPriority-v1610    ENUMERATED {enabled} OPTIONAL -- Need S
}

-- TAG-UPLINKCANCELLATION-STOP
-- ASN1STOP

**UplinkCancellation field descriptions**

<table>
<thead>
<tr>
<th><strong>ci-ConfigurationPerServingCell</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicates (per serving cell) the position of the <strong>ci-PayloadSize</strong> bit CI values inside the DCI payload (see TS 38.213 [13], clause 11.2A).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ci-RNTI</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>RNTI used for indication cancellation in UL (see TS 38.212 [17] clause 7.3.1 and TS 38.213 [13], clause 11.2A).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>dci-PayloadSizeForCI</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length of the DCI payload scrambled with CI-RNTI (see TS 38.213 [13], clause 11.2A).</td>
</tr>
</tbody>
</table>
### Ci-ConfigurationPerServingCell field descriptions

**ci-PayloadSize**  
Configures the field size for each UL cancelation indicator of this serving cell (servingCellId) (see TS 38.213 [13], clause 11.2A).

**deltaOffset**  
Configures the additional offset from the end of a PDCCH reception where the UE detects the DCI format 2_4 and the first symbol of the T_"CI" symbols, in the unit of OFDM symbols (see TS 38.213 [13], clause 11.2A).

**frequencyRegionForCI**  
Configures the reference frequency region where a detected UL CI is applicable (see TS 38.213 [13], clause 11.2A). It is defined in the same way as locationAndBandwidth.

**positionInDCI**  
Starting position (in number of bit) of the ci-PayloadSize bit CI value applicable for this serving cell (servingCellId) within the DCI payload (see TS 38.213 [13], clause 11.2A).

**positionInDCI-ForSUL**  
Starting position (in number of bit) of the ci-PayloadSize bit CI value applicable for SUL of this serving cell (servingCellId) within the DCI payload (see TS 38.213 [13], clause 11.2A).

**timeDurationForCI**  
Configures the duration of the reference time region in symbols where a detected UL CI is applicable of this serving cell (servingCellId) (see TS 38.213 [13], clause 11.2A). If the field is absent, i.e., the configured UL CI monitoring periodicity indicated by monitoringSlotPeriodicityAndOffset for DCI format 2_4 is larger than 1 slot or 1 slot with only one monitoring occasion, the UE applies the value of the configured UL CI monitoring periodicity.

**timeFrequencyRegion**  
Configures the reference time and frequency region where a detected UL CI is applicable of this serving cell (servingCellId) (see TS 38.213 [13], clause 11.2A).

**timeGranularityForCI**  
Configures the number of partitions within the time region of this serving cell (servingCellId) (see TS 38.213 [13], clause 11.2A).

**uplinkCancellationPriority**  
Configures uplink cancellation behavior if both UL CI and intra-UE priority indicator are configured for a given UE. If the field is present, then UL CI is only applicable to the UL transmissions indicated/configured as low priority level. If the field is absent, UL CI is applicable to UL transmission irrespective of its priority level (see TS 38.213 [13], clause 11.2A).

---

### Conditional Presence

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUL-Only</td>
<td>The field is optionally present, Need R, if supplementaryUplink is configured in ServingCellConfig. It is absent otherwise.</td>
</tr>
<tr>
<td>SymbolPeriodicity</td>
<td>This field is mandatory present if the configured UL CI monitoring periodicity indicated by monitoringSlotPeriodicityAndOffset for DCI format 2_4 is 1 slot with more than one monitoring occasion, otherwise absent.</td>
</tr>
</tbody>
</table>

---

### UplinkConfigCommon

The IE UplinkConfigCommon provides common uplink parameters of a cell.

**UplinkConfigCommon information element**

```
-- ASN1START
-- TAG=UPLINKCONFIGCOMMON-START
UplinkConfigCommon ::= SEQUENCE {
  frequencyInfoUL FrequencyInfoUL OPTIONAL, -- Cond InterFreqHOAndServCellAdd
  initialUplinkBWP BWP-UplinkCommon OPTIONAL, -- Cond ServCellAdd
dummy TimeAlignmentTimer
}
```

---

ETSIT38331 version 16.3.1 Release 16 653 ETSI TS 138 331 V16.3.1 (2021-01)
UplinkConfigCommon field descriptions

<table>
<thead>
<tr>
<th>frequencyInfoUL</th>
<th>Absolute uplink frequency configuration and subcarrier specific virtual carriers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>initialUplinkBWP</td>
<td>The initial uplink BWP configuration for a serving cell (see TS 38.213 [13], clause 12).</td>
</tr>
</tbody>
</table>

Conditional Presence | Explanation
--- | ---
InterFreqHOAndServCellAdd | This field is mandatory present for inter-frequency handover and upon serving cell (PCell/SCell) addition. Otherwise, the field is optionally present, Need M.
ServCellAdd | This field is mandatory present upon serving cell addition (for PCell and SCell) and upon handover from E-UTRA to NR. It is optionally present, Need M otherwise.

UplinkConfigCommonSIB

The IE UplinkConfigCommonSIB provides common uplink parameters of a cell.

UplinkConfigCommonSIB information element

UplinkConfigCommonSIB ::= SEQUENCE {
  frequencyInfoUL FrequencyInfoUL-SIB,
  initialUplinkBWP BWP-UplinkCommon,
  timeAlignmentTimerCommon TimeAlignmentTimer
}

UplinkConfigCommonSIB field descriptions

<table>
<thead>
<tr>
<th>frequencyInfoUL</th>
<th>Absolute uplink frequency configuration and subcarrier specific virtual carriers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>InitialUplinkBWP</td>
<td>The initial uplink BWP configuration for a PCell (see TS 38.213 [13], clause 12).</td>
</tr>
</tbody>
</table>
— **UplinkTxDirectCurrentList**

The IE *UplinkTxDirectCurrentList* indicates the Tx Direct Current locations per serving cell for each configured UL BWP in the serving cell, based on the BWP numerology and the associated carrier bandwidth.

**UplinkTxDirectCurrentList information element**

```asn1
UplinkTxDirectCurrentList ::=           SEQUENCE (SIZE (1..maxNrofServingCells)) OF UplinkTxDirectCurrentCell

UplinkTxDirectCurrentCell ::=           SEQUENCE {
  servCellIndex                           ServCellIndex,
  uplinkDirectCurrentBWP                  SEQUENCE (SIZE (1..maxNrofBWPs)) OF UplinkTxDirectCurrentBWP,
  ...,
  uplinkDirectCurrentBWP-SUL              SEQUENCE (SIZE (1..maxNrofBWPs)) OF UplinkTxDirectCurrentBWP               OPTIONAL
}

UplinkTxDirectCurrentBWP ::=            SEQUENCE {
  bwp-Id                                  BWP-Id,
  shift7dot5kHz                           BOOLEAN,
  txDirectCurrentLocation                 INTEGER (0..3301)
}
```

---

**UplinkTxDirectCurrentBWP field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bwp-Id</strong></td>
<td>The BWP-Id of the corresponding uplink BWP.</td>
</tr>
<tr>
<td><strong>shift7dot5kHz</strong></td>
<td>Indicates whether there is 7.5 kHz shift or not. 7.5 kHz shift is applied if the field is set to <em>true</em>. Otherwise 7.5 kHz shift is not applied.</td>
</tr>
<tr>
<td><strong>txDirectCurrentLocation</strong></td>
<td>The uplink Tx Direct Current location for the carrier. Only values in the value range of this field between 0 and 3299, which indicate the subcarrier index within the carrier corresponding to the numerology of the corresponding uplink BWP and value 3300, which indicates “Outside the carrier” and value 3301, which indicates “Undetermined position within the carrier” are used in this version of the specification.</td>
</tr>
</tbody>
</table>
### UplinkTxDirectCurrentCell field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>servCellIndex</td>
<td>The serving cell ID of the serving cell corresponding to the \textit{uplinkDirectCurrentBWP}.</td>
</tr>
<tr>
<td>uplinkDirectCurrentBWP</td>
<td>The Tx Direct Current locations for all the uplink BWPs configured at the corresponding serving cell.</td>
</tr>
<tr>
<td>uplinkDirectCurrentBWP-SUL</td>
<td>The Tx Direct Current locations for all the supplementary uplink BWPs configured at the corresponding serving cell.</td>
</tr>
</tbody>
</table>

---

### ZP-CSI-RS-Resource

The IE \textit{ZP-CSI-RS-Resource} is used to configure a Zero-Power (ZP) CSI-RS resource (see TS 38.214 [19], clause 5.1.4.2). Reconfiguration of a \textit{ZP-CSI-RS-Resource} between periodic or semi-persistent and aperiodic is not supported.

#### ZP-CSI-RS-Resource information element

```
-- ASN1START
-- TAG-ZP-CSI-RS-RESOURCE-START

ZP-CSI-RS-Resource ::= SEQUENCE {
    zp-CSI-RS-ResourceId  ZP-CSI-RS-ResourceId,
    resourceMapping       CSI-RS-ResourceMapping,
    periodicityAndOffset  CSI-ResourcePeriodicityAndOffset OPTIONAL, --Cond PeriodicOrSemiPersistent
    ... }

ZP-CSI-RS-ResourceId ::= INTEGER (0..maxNrofZP-CSI-RS-Resources-1)

-- TAG-ZP-CSI-RS-RESOURCE-STOP
-- ASN1STOP
```

#### ZP-CSI-RS-Resource field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>periodicityAndOffset</td>
<td>Periodicity and slot offset for periodic/semi-persistent ZP-CSI-RS (see TS 38.214 [19], clause 5.1.4.2). Network always configures the UE with a value for this field for periodic and semi-persistent ZP-CSI-RS resource (as indicated in PDSCH-Config).</td>
</tr>
<tr>
<td>resourceMapping</td>
<td>OFDM symbol and subcarrier occupancy of the ZP-CSI-RS resource within a slot.</td>
</tr>
<tr>
<td>zp-CSI-RS-ResourceId</td>
<td>ZP CSI-RS resource configuration ID (see TS 38.214 [19], clause 5.1.4.2).</td>
</tr>
</tbody>
</table>

#### Conditional Presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PeriodicOrSemiPersistent</td>
<td>The field is optionally present, Need M, for periodic and semi-persistent ZP-CSI-RS-Resources (as indicated in PDSCH-Config). The field is absent otherwise.</td>
</tr>
</tbody>
</table>
The IE ZP-CSI-RS-ResourceSet refers to a set of ZP-CSI-RS-Resources using their ZP-CSI-RS-ResourceIds.

ZP-CSI-RS-ResourceSet information element

```asn1
ZP-CSI-RS-ResourceSet ::= SEQUENCE {
  zp-CSI-RS-ResourceSetId  ZP-CSI-RS-ResourceSetId,
  zp-CSI-RS-ResourceIdList  SEQUENCE (SIZE(1..maxNrofZP-CSI-RS-ResourcesPerSet)) OF ZP-CSI-RS-ResourceId,
  ...
}
```

ZP-CSI-RS-ResourceIdList
The list of ZP-CSI-RS-ResourceId identifying the ZP-CSI-RS-Resource elements belonging to this set.

ZP-CSI-RS-ResourceId
The IE ZP-CSI-RS-ResourceId identifies a ZP-CSI-RS-ResourceSet.

ZP-CSI-RS-ResourceId information element

```asn1
ZP-CSI-RS-ResourceIdId ::= INTEGER (0..maxNrofZP-CSI-RS-ResourceSets-1)
```

6.3.3 UE capability information elements

AccessStratumRelease
The IE AccessStratumRelease indicates the release supported by the UE.
AccessStratumRelease information element

-- ASN1START
-- TAG-ACCESSSTRATUMRELEASE-START
AccessStratumRelease ::= ENumerated {
    rel15, rel16, spare6, spare5, spare4, spare3, spare2, spare1, ...}
-- TAG-ACCESSSTRATUMRELEASE-STOP
-- ASN1STOP

BandCombinationList

The IE BandCombinationList contains a list of NR CA, NR non-CA and/or MR-DC band combinations (also including DL only or UL only band).

BandCombinationList information element

-- ASN1START
-- TAG-BANDCOMBINATIONLIST-START
BandCombinationList ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination
BandCombinationList-v1540 ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination-v1540
BandCombinationList-v1550 ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination-v1550
BandCombinationList-v1560 ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination-v1560
BandCombinationList-v1570 ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination-v1570
BandCombinationList-v1580 ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination-v1580
BandCombinationList-v1590 ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination-v1590
BandCombinationList-v1610 ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination-v1610
BandCombinationList-v1630 ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination-v1630
BandCombinationList-UplinkTxSwitch-r16 ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination-UplinkTxSwitch-r16
BandCombinationList-UplinkTxSwitch-v1630 ::= SEQUENCE {SIZE (1..maxBandComb)} OF BandCombination-UplinkTxSwitch-v1630

BandCombination ::= SEQUENCE {
    bandList SEQUENCE {SIZE (1..maxSimultaneousBands)} OF BandParameters,
    featureSetCombination FeatureSetCombinationId OPTIONAL,
    ca-ParametersEUTRA CA-ParametersEUTRA OPTIONAL,
    ca-ParametersNR CA-ParametersNR OPTIONAL,
    mrdc-Parameters MRDC-Parameters OPTIONAL,
    supportedBandwidthCombinationSet BIT STRING {SIZE (1..32)} OPTIONAL,
    powerClass-v1530 ENUMERATED {pc2} OPTIONAL
}
BandCombination-v1540 ::= SEQUENCE {
  bandList-v1540  SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParameters-v1540,
  ca-ParametersNR-v1540  CA-ParametersNR-v1540  OPTIONAL
}

BandCombination-v1550 ::= SEQUENCE {
  ca-ParametersNR-v1550  CA-ParametersNR-v1550
}

BandCombination-v1560 ::= SEQUENCE {
  ne-DC-BC  ENUMERATED {supported}  OPTIONAL,
  ca-ParametersNRDC  CA-ParametersNRDC  OPTIONAL,
  ca-ParametersEUTRA-v1560  CA-ParametersEUTRA-v1560  OPTIONAL,
  ca-ParametersNR-v1560  CA-ParametersNR-v1560  OPTIONAL
}

BandCombination-v1570 ::= SEQUENCE {
  ca-ParametersEUTRA-v1570  CA-ParametersEUTRA-v1570
}

BandCombination-v1580 ::= SEQUENCE {
  mrdc-Parameters-v1580  MRDC-Parameters-v1580
}

BandCombination-v1590 ::= SEQUENCE {
  supportedBandwidthCombinationSetIntraENDC  BIT STRING (SIZE (1..32))  OPTIONAL,
  mrdc-Parameters-v1590  MRDC-Parameters-v1590
}

BandCombination-v1610 ::= SEQUENCE {
  bandList-v1610  SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParameters-v1610  OPTIONAL,
  ca-ParametersNR-v1610  CA-ParametersNR-v1610  OPTIONAL,
  ca-ParametersNRDC-v1610  CA-ParametersNRDC-v1610  OPTIONAL,
  powerClass-v1610  ENUMERATED {pc1dot5}  OPTIONAL,
  powerClassNRPart-r16  ENUMERATED {pc1, pc2, pc3, pc5}  OPTIONAL,
  featureSetCombinationDAPS-r16  FeatureSetCombinationId  OPTIONAL,
  mrdc-Parameters-v1620  MRDC-Parameters-v1620  OPTIONAL
}

BandCombination-v1630 ::= SEQUENCE {
  ca-ParametersNR-v1630  CA-ParametersNR-v1630  OPTIONAL,
  ca-ParametersNRDC-v1630  CA-ParametersNRDC-v1630  OPTIONAL,
  mrdc-Parameters-v1630  MRDC-Parameters-v1630  OPTIONAL,
  supportedTxBandCombListPerBC-Sidelink-r16  BIT STRING (SIZE (1..maxBandComb))  OPTIONAL,
  supportedRxBandCombListPerBC-Sidelink-r16  BIT STRING (SIZE (1..maxBandComb))  OPTIONAL,
  scalingFactorTx-Sidelink-r16  SEQUENCE (SIZE (1..maxBandComb)) OF ScalingFactorSidelink-r16  OPTIONAL,
  scalingFactorRx-Sidelink-r16  SEQUENCE (SIZE (1..maxBandComb)) OF ScalingFactorSidelink-r16  OPTIONAL
}

BandCombination-UplinkTxSwitch-r16 ::= SEQUENCE {
  bandCombination-r16  BandCombination,
  bandCombination-v1540  BandCombination-v1540  OPTIONAL,
  bandCombination-v1560  BandCombination-v1560  OPTIONAL,
  bandCombination-v1570  BandCombination-v1570  OPTIONAL
}
ETSI TS 138 331 V16.3.1 (2021-01)

3GPP TS 38.331 version 16.3.1 Release 16

BandCombination-v1580
BandCombination-v1590
BandCombination-v1610

supportedBandPairListNR-r16
SEQUENCE
(SIZE (1..maxULTxSwitchingBandPairs)) OF ULTxSwitchingBandPair-r16,

uplinkTxSwitching-OptionSupport-r16
ENUMERATED {switchedUL, dualUL, both}
OPTIONAL,

uplinkTxSwitching-PowerBoosting-r16
ENUMERATED {supported}
OPTIONAL,
...

BandCombination-UplinkTxSwitch-v1630
SEQUENCE

bandCombination-v1630
BandCombination-v1630
OPTIONAL

ULTxSwitchingBandPair-r16
SEQUENCE

bandIndexUL1-r16
INTEGER (1..maxSimultaneousBands),

bandIndexUL2-r16
INTEGER (1..maxSimultaneousBands),

uplinkTxSwitchingPeriod-r16
ENUMERATED {n35us, n140us, n210us},

uplinkTxSwitching-DL-Interuption-r16
BIT STRING (SIZE (1..maxSimultaneousBands))
OPTIONAL

BandParameters
CHOICE

eutra
SEQUENCE

bandEUTRA
FreqBandIndicatorEUTRA,

ca-BandwidthClassDL-EUTRA
CA-BandwidthClassEUTRA
OPTIONAL,

ca-BandwidthClassUL-EUTRA
CA-BandwidthClassEUTRA
OPTIONAL,

nr
SEQUENCE

bandNR
FreqBandIndicatorNR,

ca-BandwidthClassDL-NR
CA-BandwidthClassNR
OPTIONAL,

ca-BandwidthClassUL-NR
CA-BandwidthClassNR
OPTIONAL

BandParameters-v1540
SEQUENCE

srs-CarrierSwitch
CHOICE

nr
SEQUENCE

srs-SwitchingTimesListNR
SEQUENCE (SIZE (1..maxSimultaneousBands)) OF SRS-SwitchingTimeNR

,(eutra
srs-SwitchingTimesListEUTRA
SEQUENCE (SIZE (1..maxSimultaneousBands)) OF SRS-SwitchingTimeEUTRA

)

OPTIONAL,

srs-TxSwitch
SEQUENCE

supportedSRS-TxPortSwitch
ENUMERATED {t1r2, t1r4, t2r4, t1r4-t2r4, t1r1, t2r2, t4r4, notSupported},
txSwitchImpactToRx
INTEGER (1..32)
OPTIONAL,
txSwitchWithAnotherBand
INTEGER (1..32)
OPTIONAL

)

OPTIONAL

BandParameters-v1610
SEQUENCE

srs-TxSwitch-v1610
SEQUENCE

supportedSRS-TxPortSwitch-v1610
ENUMERATED {t1r1-t1r2, t1r1-t1r2-t1r4, t1r1-t1r2-t2r2-t2r4, t1r1-t1r2-t2r2-t1r4-t2r4, t1r1-t2r2, t1r1-t2r2-t4r4}

)

OPTIONAL
BandCombination field descriptions

BandCombinationList-v1540, BandCombinationList-v1550, BandCombinationList-v1560, BandCombinationList-v1570, BandCombinationList-v1580, BandCombinationList-v1590, BandCombinationList-r16

The UE shall include the same number of entries, and listed in the same order, as in BandCombinationList (without suffix). If the field is included in supportedBandCombinationListNEDC-Only-v1610, the UE shall include the same number of entries, and listed in the same order, as in BandCombinationList of supportedBandCombinationListNEDC-Only (without suffix) field.

If the field is included in supportedBandCombinationListNEDC-Only-v15a0, the UE shall include the same number of entries, and listed in the same order, as in BandCombinationList (without suffix) of supportedBandCombinationListNEDC-Only (without suffix) field.

ca-ParametersNRDC

If the field is included for a band combination in the NR capability container, the field indicates support of NR-DC. Otherwise, the field is absent.

featureSetCombinationDAPS

If this field is present for a band combination, it reports the feature set combination supported for the band combination when any DAPS bearer is configured.

ne-DC-BC

If the field is included for a band combination in the MR-DC capability container, the field indicates support of NE-DC. Otherwise, the field is absent.

srs-SwitchingTimesListNR

Indicates, for a particular pair of NR bands, the RF retuning time when switching between a NR carrier corresponding to this band entry and another (PUSCH-less) NR carrier corresponding to the band entry in the order indicated below:
- For the first NR band, the UE shall include the same number of entries for NR bands as in bandList, i.e. first entry corresponds to first NR band in bandList and so on,
- For the second NR band, the UE shall include one entry less, i.e. first entry corresponds to the second NR band in bandList and so on
- And so on

srs-SwitchingTimesListEUTRA

Indicates, for a particular pair of E-UTRA bands, the RF retuning time when switching between an E-UTRA carrier corresponding to this band entry and another (PUSCH-less) E-UTRA carrier corresponding to the band entry in the order indicated below:
- For the first E-UTRA band, the UE shall include the same number of entries for E-UTRA bands as in bandList, i.e. first entry corresponds to first E-UTRA band in bandList and so on,
- For the second E-UTRA band, the UE shall include one entry less, i.e. first entry corresponds to the second E-UTRA band in bandList and so on
- And so on

srs-TxSwitch

Indicates supported SRS antenna switch capability for the associated band. If the UE indicates support of SRS-SwitchingTimeNR, the UE is allowed to set this field for a band with associated FeatureSetUplinkId set to 0 for SRS carrier switching.

BandCombinationListSidetlinkEUTRA-NR

The IE BandCombinationListSidetlinkEUTRA-NR contains a list of V2X sidelink and NR sidelink band combinations.

BandCombinationListSidetlinkEUTRA-NR information element

-- ASN1START
ETSI TS 138 331 V16.3.1 (2021-01)

--- TAG-BANDCOMBINATIONLISTSIDELINKEUTRANR-START

BandCombinationListSidelinkEUTRA-NR-r16 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationParametersSidelinkEUTRA-NR-r16

BandCombinationListSidelinkEUTRA-NR-v1630 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationParametersSidelinkEUTRA-NR-v1630

BandCombinationParametersSidelinkEUTRA-NR-r16 ::= SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParametersSidelinkEUTRA-NR-r16

BandCombinationParametersSidelinkEUTRA-NR-v1630 ::= SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParametersSidelinkEUTRA-NR-v1630

BandParametersSidelinkEUTRA-NR-r16 ::= CHOICE {
  eutra                           SEQUENCE {
    bandParametersSidelinkEUTRA1-r16 OCTET STRING              OPTIONAL,
    bandParametersSidelinkEUTRA2-r16 OCTET STRING              OPTIONAL,
  },
  nr                              SEQUENCE {
    bandParametersSidelinkNR-r16 BandParametersSidelink-r16
  }
}

BandParametersSidelinkEUTRA-NR-v1630 ::= CHOICE {
  eutra                           NULL,
  nr                              SEQUENCE {
    tx-Sidelink-r16 ENUMERATED {supported} OPTIONAL,
    rx-Sidelink-r16 ENUMERATED {supported} OPTIONAL,
    sl-CrossCarrierScheduling-r16 ENUMERATED {supported} OPTIONAL,
  }
}

BandParametersSidelink-r16 ::= SEQUENCE {
  freqBandSidelink-r16 FreqBandIndicatorNR
}

--- TAG-BANDCOMBINATIONLISTSIDELINKEUTRANR-STOP

--- ASN1STOP---

**BandParametersSidelinkEUTRA-NR field descriptions**

- **bandParametersSidelinkEUTRA1, bandParametersSidelinkEUTRA2**
  This field includes the V2X-BandParameters-r14 and V2X-BandParameters-v1530 IE as specified in 36.331 [10]. It is used for reporting the per-band capability for V2X sidelink communication.

---

**CA-BandwidthClassEUTRA**

The IE **CA-BandwidthClassEUTRA** indicates the E-UTRA CA bandwidth class as defined in TS 36.101 [22], table 5.6A-1.

---

**CA-BandwidthClassEUTRA information element**
CA-BandwidthClassEUTRA ::= ENUMERATED {a, b, c, d, e, f, ...}

-- TAG-CA-BANDWIDTHCLASSEUTRA-STOP
-- ASN1STOP

-- CA-BandwidthClassNR

The IE CA-BandwidthClassNR indicates the NR CA bandwidth class as defined in TS 38.101-1 [15], table 5.3A.5-1 and TS 38.101-2 [39], table 5.3A.4-1.

CA-BandwidthClassNR ::= ENUMERATED {a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, ...}

-- TAG-CA-BANDWIDTHCLASSNR-STOP
-- ASN1STOP

-- CA-ParametersEUTRA

The IE CA-ParametersEUTRA contains the E-UTRA part of band combination parameters for a given MR-DC band combination.

NOTE: If additional E-UTRA band combination parameters are defined in TS 36.331 [10], which are supported for MR-DC, they will be defined here as well.

CA-ParametersEUTRA ::= SEQUENCE {
  multipleTimingAdvance                          ENUMERATED {supported} OPTIONAL,
  simultaneousRx-Tx                              ENUMERATED {supported} OPTIONAL,
  supportedNAICS-2CRS-AP                          BIT STRING (SIZE (1..8)) OPTIONAL,
  additionalRx-Tx-PerformanceReq                  ENUMERATED {supported} OPTIONAL,
  ue-CA-PowerClass-N                              ENUMERATED {class2} OPTIONAL,
  supportedBandwidthCombinationSetEUTRA-v1530     BIT STRING (SIZE (1..32)) OPTIONAL,
  ... }

CA-ParametersEUTRA-v1560 ::= SEQUENCE {
  fd-MIMO-TotalWeightedLayers                     INTEGER (2..128) OPTIONAL
}

CA-ParametersEUTRA-v1570 ::= SEQUENCE {
  dl-1024QAM-TotalWeightedLayers                  INTEGER (0..10) OPTIONAL
}
The IE `CA-ParametersNR` contains carrier aggregation and inter-frequency DAPS handover related capabilities that are defined per band combination.

**CA-ParametersNR information element**

```asn1
CA-ParametersNR ::= SEQUENCE {
  dummy                                         ENUMERATED {supported} OPTIONAL,
  parallelTxSRS-PUCCH-PUSCH                    ENUMERATED {supported} OPTIONAL,
  parallelTxPRACH-SRS-PUCCH-PUSCH              ENUMERATED {supported} OPTIONAL,
  simultaneousRxTxInterBandCA                 ENUMERATED {supported} OPTIONAL,
  simultaneousRxSUL                           ENUMERATED {supported} OPTIONAL,
  diffNumerologyAcrossPUCCH-Group             ENUMERATED {supported} OPTIONAL,
  supportedNumberTAG                          ENUMERATED {n2, n3, n4} OPTIONAL,
  ...                                          
}

CA-ParametersNR-v1540 ::= SEQUENCE {
  simultaneousSRS-AssocCSI1-RS-Al1CC           INTEGER (5..32) OPTIONAL,
  csi-RS-IM-ReceptionForFeedbackPerBandComb    SEQUENCE {
    maxNumberSimultaneousNZP-CSI-RS-ActBWP-Al1CC INTEGER (1..64) OPTIONAL,
    totalNumberPortsSimultaneousNZP-CSI-RS-ActBWP-Al1CC INTEGER (2..256) OPTIONAL
  },
  simultaneousCSI-ReportsAl1CC                 INTEGER (5..32) OPTIONAL,
  dualPA-Architecture                         ENUMERATED {supported} OPTIONAL
}

CA-ParametersNR-v1550 ::= SEQUENCE {
  dummy                                         ENUMERATED {supported} OPTIONAL
}

CA-ParametersNR-v1560 ::= SEQUENCE {
  diffNumerologyWithinPUCCH-GroupLargerSCS     ENUMERATED {supported} OPTIONAL
}

CA-ParametersNR-v1610 ::= SEQUENCE {
  -- R1 9-3: Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA
  parallelTxMsgA-SRS-PUCCH-PUSCH-r16           ENUMERATED {supported} OPTIONAL,
  -- R1 9-4: MsgA operation in a band combination including SUL
  msgA-SUL-r16                                 ENUMERATED {supported} OPTIONAL,
  -- R1 10-9c: Joint search space group switching across multiple cells
  jointSearchSpaceGroupSwitchingAcrossCells-r16 ENUMERATED {supported} OPTIONAL,
  ...                                          
}
```
-- R1 14-5: Half-duplex UE behaviour in TDD CA for same SCS
half-DuplexTDD-CA-SameSCS-r16 ENUMERATED {supported} OPTIONAL,
-- R1 18-4: SCell dormancy within active time
scellDormancyWithinActiveTime-r16 ENUMERATED {supported} OPTIONAL,
-- R1 18-4a: SCell dormancy outside active time
scellDormancyOutsideActiveTime-r16 ENUMERATED {supported} OPTIONAL,
-- R1 18-6: Cross-carrier A-CSI RS triggering with different SCS
crossCarrierA-CSI-trigDiffSCS-r16 ENUMERATED {higherA-CSI-SCS, lowerA-CSI-SCS, both} OPTIONAL,
-- R1 18-6a: Default QCL assumption for cross-carrier A-CSI-RS triggering
defaultQCL-CrossCarrierA-CSI-Trig-r16 ENUMERATED {diffOnly, both} OPTIONAL,
-- R1 18-7: CA with non-aligned frame boundaries for inter-band CA
interCA-NonAlignedFrame-r16 ENUMERATED {supported} OPTIONAL,
simul-SRS-Trans-BC-r16 ENUMERATED {n2} OPTIONAL,
interFreqDAPS-r16 SEQUENCE {
  interFreqAsyncDAPS-r16 ENUMERATED {supported} OPTIONAL,
  interFreqDiffSCS-DAPS-r16 ENUMERATED {supported} OPTIONAL,
  interFreqMultiUL-TransmissionDAPS-r16 ENUMERATED {supported} OPTIONAL,
  interFreqSemiStaticPowerSharingDAPS-Model1-r16 ENUMERATED {supported} OPTIONAL,
  interFreqSemiStaticPowerSharingDAPS-Model2-r16 ENUMERATED {supported} OPTIONAL,
  interFreqDynamicPowerSharingDAPS-r16 ENUMERATED {supported} OPTIONAL,
  interFreqUL-TransCancellationDAPS-r16 ENUMERATED {supported} OPTIONAL,
} OPTIONAL,
codebookParametersPerBC-r16 CodebookParameters-v1610 OPTIONAL,
-- R1 16-2a-10 Value of R for BD/CCE
blindDetectFactor-r16 INTEGER (1..2) OPTIONAL,
-- R1 11-2a: Capability on the number of CCs for monitoring a maximum number of BDs and non-overlapped CCEs per span when configured
-- with DL CA with Rel-16 PDCCH monitoring capability on all the serving cells
pdcch-MonitoringCA-r16 SEQUENCE {
  maxNumberOfMonitoringCC-r16 INTEGER (2..16),
supportedSpanArrangement-r16 ENUMERATED {alignedOnly, alignedAndNonAligned} OPTIONAL,
} OPTIONAL,
-- R1 11-2c: Number of carriers for CCE/BD scaling with DL CA with mix of Rel. 16 and Rel. 15 PDCCH monitoring capabilities on
-- different carriers
pdcch-BlindDetectionCA-Mixed-r16 SEQUENCE {
  pdcch-BlindDetectionCA1-r16 INTEGER (1..15),
  pdcch-BlindDetectionCA2-r16 INTEGER (1..15),
supportedSpanArrangement-r16 ENUMERATED {alignedOnly, alignedAndNonAligned} OPTIONAL,
} OPTIONAL,
-- R1 11-2d: Capability on the number of CCs for monitoring a maximum number of BDs and non-overlapped CCEs per span for MCG and for
-- SCG when configured for NR-DC operation with Rel-16 PDCCH monitoring capability on all the serving cells
pdcch-BlindDetectionMCG-UE-r16 INTEGER (1..14) OPTIONAL,
pdcch-BlindDetectionSCG-UE-r16 INTEGER (1..14) OPTIONAL,
-- R1 11-2e: Number of carriers for CCE/BD scaling for MCG and for SCG when configured for NR-DC operation with mix of Rel. 16 and
-- Rel. 15 PDCCH monitoring capabilities on different carriers
pdcch-BlindDetectionMCG-UE-Mixed-r16 SEQUENCE {
  pdcch-BlindDetectionMCG-UE1-r16 INTEGER (0..15),
pdcch-BlindDetectionMCG-UE2-r16 INTEGER (0..15),
} OPTIONAL,
pdcch-BlindDetectionSCG-UE-Mixed-r16 SEQUENCE {
  pdcch-BlindDetectionSCG-UE1-r16 INTEGER (0..15),
pdcch-BlindDetectionSCG-UE2-r16 INTEGER (0..15),
} OPTIONAL,
-- R1 18-5 cross-carrier scheduling with different SCS in DL CA
crossCarrierSchedulingDL-DiffSCS-r16 ENUMERATED {low-to-high, high-to-low, both} OPTIONAL,
CA-ParametersNR-v1630 ::= SEQUENCE {
  -- R1 22-5b: Simultaneous transmission of SRS for antenna switching and SRS for CB/NB /BM for inter-band UL CA
  -- R1 22-5d: Simultaneous transmission of SRS for antenna switching for inter-band UL CA
  simulTX-SRS-AntSwitchingInterBandUL-CA-r16       SimulSRS-ForAntennaSwitching-r16            OPTIONAL,
  -- R4 8-5: supported beam management type for inter-band CA
  beamManagementType-r16                           ENUMERATED {ibm, cbm}                       OPTIONAL,
  -- R4 7-3a: UL frequency separation class with aggregate BW and Gap BW
  intraBandFreqSeparationUL-AggBW-GapBW-r16        ENUMERATED {classI, classII, classIII}      OPTIONAL,
  -- RAN 89: Case B in case of inter-band CA with non-aligned frame boundaries
  interCA-NonAlignedFrame-B-r16                     ENUMERATED {supported}                      OPTIONAL
}

SimulSRS-ForAntennaSwitching-r16 ::= SEQUENCE {
  supportSRS-xTyR-xLessThanY-r16       ENUMERATED {supported}                     OPTIONAL,
  supportSRS-xTyR-xEqualToY-r16        ENUMERATED {supported}                     OPTIONAL,
  supportSRS-AntennaSwitching-r16      ENUMERATED {supported}                     OPTIONAL
}

-- TAG-CA-PARAMETERSNR-STOP
-- ASN1STOP

CA-ParametersNR field description

**codebookParametersPerBC**
For a given supported band combination, this field indicates the alternative list of **SupportedCSI-RS-Resource** supported for each codebook type, amongst the supported CSI-RS resources included in **codebookParametersPerBand** in **MIMO-ParametersPerBand**.

**– CA-ParametersNRDC**

The IE **CA-ParametersNRDC** contains dual connectivity related capabilities that are defined per band combination.

**CA-ParametersNRDC information element**
CA-ParametersNRDC field descriptions

---

**ca-ParametersNR-forDC** (with and without suffix)

If this field is present for a band combination, it reports the UE capabilities when NR-DC is configured with the band combination. If no version of this field (i.e., with and without suffix) is present for a band combination, the ca-ParametersNR field versions (with and without suffix) in BandCombination are applicable to the UE configured with NR-DC for the band combination.

**featureSetCombinationDC**

If this field is present for a band combination, it reports the feature set combination supported for the band combination when NR-DC is configured. If this field is absent for a band combination, the featureSetCombination in BandCombination (without suffix) is applicable to the UE configured with NR-DC for the band combination.

---

**CarrierAggregationVariant**

The IE CarrierAggregationVariant informs the network about supported "placement" of the SpCell in an NR cell group.

---

**CarrierAggregationVariant** information element

---

---

---
CodebookParameters

The IE CodebookParameters is used to convey codebook related parameters.

**CodebookParameters information element**

CodebookParameters ::= SEQUENCE {
  type1    SEQUENCE {
    singlePanel                             SEQUENCE {
      supportedCSI-RS-ResourceList         SEQUENCE (SIZE (1.. maxNrofCSI-RS-Resources)) OF SupportedCSI-RS-Resource,
      modes                                 ENUMERATED {mode1, model1andMode2},
      maxNumberCSI-RS-PerResourceSet       INTEGER (1..8)
    },
    multiPanel                            SEQUENCE {
      supportedCSI-RS-ResourceList         SEQUENCE (SIZE (1.. maxNrofCSI-RS-Resources)) OF SupportedCSI-RS-Resource,
      modes                                 ENUMERATED {mode1, mode2, both},
      nrofPanels                            ENUMERATED {n2, n4},
      maxNumberCSI-RS-PerResourceSet       INTEGER (1..8)
    } OPTIONAL
  },
  type2    SEQUENCE {
    supportedCSI-RS-ResourceList         SEQUENCE (SIZE (1.. maxNrofCSI-RS-Resources)) OF SupportedCSI-RS-Resource,
    parameterLx                          INTEGER (2..4),
    amplitudeScalingType                 ENUMERATED {wideband, widebandAndSubband},
    amplitudeSubsetRestriction           ENUMERATED {supported} OPTIONAL
  } OPTIONAL,
  type2-PortSelection                   SEQUENCE {
    supportedCSI-RS-ResourceList         SEQUENCE (SIZE (1.. maxNrofCSI-RS-Resources)) OF SupportedCSI-RS-Resource,
    parameterLx                          INTEGER (2..4),
    amplitudeScalingType                 ENUMERATED {wideband, widebandAndSubband}
  } OPTIONAL
}

CodebookParameters-v1610 ::= SEQUENCE {
  supportedCSI-RS-ResourceListAlt-r16  SEQUENCE {
    type1-SinglePanel-r16                SEQUENCE (SIZE (0..maxNrofCSI-RS-ResourcesAlt-1-r16)) OPTIONAL,
    type1-MultiPanel-r16                 SEQUENCE (SIZE (0..maxNrofCSI-RS-ResourcesAlt-1-r16)) OPTIONAL,
  } OPTIONAL,
  }
type2-r16 ::= SEQUENCE (SIZE (1..maxNrofCSI-RS-Resources)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16) OPTIONAL,

type2-PortSelection-r16 ::= SEQUENCE (SIZE (1..maxNrofCSI-RS-Resources)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16) OPTIONAL

CodebookParametersAddition-r16 ::= SEQUENCE {
  etype2-r16 OPTIONAL,
  type2-PortSelection-r16 OPTIONAL
}

CodebookComboParametersAddition-r16 ::= SEQUENCE {
  -- R1 16-3a Regular eType 2 R=1
  etype2R1-r16 ::= SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16) OPTIONAL,
  },
  -- R1 16-3a-1 Regular eType 2 R=2
  etype2R2-r16 ::= SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16) OPTIONAL,
  },
  -- R1 16-3a-2: Support of parameter combinations 7-8
  paramComb7-8-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 16-3a-3: Support of rank 3,4
  rank3-4-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 16-3a-4: CBSR with soft amplitude restriction
  amplitudeSubsetRestriction-r16 ENUMERATED {supported} OPTIONAL
}

etype2-PS-r16 ::= SEQUENCE {
  -- R1 16-3b Regular eType 2 R=1 PortSelection
  etype2R1-PortSelection-r16 ::= SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16) OPTIONAL,
  },
  -- R1 16-3b-1 Regular eType 2 R=2 PortSelection
  etype2R2-PortSelection-r16 ::= SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16) OPTIONAL,
  },
  -- R1 16-3b-2: Support of rank 3,4
  rank3-4-r16 ENUMERATED {supported} OPTIONAL
}

CodebookComboParametersAddition-r16 ::= SEQUENCE {
  -- R1 16-8 Mixed codebook types
  type1SP-Type2-null-r16 ::= SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16) OPTIONAL,
  }
  type1SP-Type2PS-null-r16 ::= SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16) OPTIONAL,
  }
  type1SP-eType2R1-null-r16 ::= SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16) OPTIONAL,
  }
}
CodebookParametersAdditionPerBC-r16 ::= SEQUENCE {
    -- R1 16-3a Regular eType 2 R=1
type1SP-eType2R2-null-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
    -- R1 16-3a-1 Regular eType 2 R=2
type1SP-eType2R1PS-null-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
    -- R1 16-3b Regular eType 2 R=1 PortSelection
type1SP-eType2R2PS-null-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
    -- R1 16-3b-1 Regular eType 2 R=2 PortSelection
type1SP-Type2-Type2PS-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
    -- R1 16-3c Mixed codebook types
type1MP-Type2-null-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
    -- R1 16-3c-1 Mixed codebook types
type1MP-Type2PS-null-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
    -- R1 16-3e Regular eType 2 R=1
type1MP-eType2R1-null-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
    -- R1 16-3e-1 Regular eType 2 R=2
type1MP-eType2R2-null-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
    -- R1 16-3f Mixed codebook types
type1MP-eType2R1PS-null-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
    -- R1 16-3f-1 Mixed codebook types
type1MP-eType2R2PS-null-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
    -- R1 16-3g Mixed codebook types
type1MP-Type2-Type2PS-r16  SEQUENCE {
        supportedCSI-RS-ResourceListAdd-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    }
}

CodebookComboParametersAdditionPerBC-r16 ::= SEQUENCE {
    -- R1 16-3a Regular eType 2 R=1
etype1SP-eType2R2-null-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-3a-1 Regular eType 2 R=2
etype1SP-eType2R1PS-null-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-3b Regular eType 2 R=1 PortSelection
etype1SP-eType2R2PS-null-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-3b-1 Regular eType 2 R=2 PortSelection
etype1SP-Type2-Type2PS-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-3c Mixed codebook types
type1MP-Type2-null-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-3c-1 Mixed codebook types
type1MP-Type2PS-null-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-3e Regular eType 2 R=1
type1MP-eType2R1-null-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-3e-1 Regular eType 2 R=2
type1MP-eType2R2-null-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-3f Mixed codebook types
type1MP-eType2R1PS-null-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-3f-1 Mixed codebook types
type1MP-eType2R2PS-null-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-3g Mixed codebook types
type1MP-Type2-Type2PS-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
    -- R1 16-8 Mixed codebook types
type1SP-Type2-null-r16  SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)  OPTIONAL,
supportedCSI-RS-ResourceListAlt
This field indicates the alternative list of SupportedCSI-RS-Resource supported for each codebook type. The supported CSI-RS resource is indicated by an integer value which pinpoints SupportedCSI-RS-Resource defined in CodebookVariantsList. The value 0 corresponds to the first entry of CodebookVariantsList. The value 1 corresponds to the second entry of CodebookVariantsList, and so on. For each codebook type, the field shall be included in both codebookParametersPerBC and codebookParametersPerBand.

---

FeatureSetCombination
The IE FeatureSetCombination is a two-dimensional matrix of FeatureSet entries.
Each FeatureSetsPerBand contains a list of feature sets applicable to the carrier(s) of one band entry of the associated band combination. Across the associated bands, the UE shall support the combination of FeatureSets at the same position in the FeatureSetsPerBand. All FeatureSetsPerBand in one FeatureSetCombination must have the same number of entries.

The number of FeatureSetsPerBand in the FeatureSetCombination must be equal to the number of band entries in an associated band combination. The first FeatureSetsPerBand applies to the first band entry of the band combination, and so on.

Each FeatureSet contains either a pair of NR or E-UTRA feature set IDs for UL and DL.

In case of NR, the actual feature sets for UL and DL are defined in the FeatureSets IE and referred to from here by their ID, i.e., their position in the featureSetsUplink / featureSetsDownlink list in the FeatureSet IE.

In case of E-UTRA, the feature sets referred to from this list are defined in TS 36.331 [10] and conveyed as part of the UE-EUTRA-Capability container.

The FeatureSetUplink and FeatureSetDownlink referred to from the FeatureSet comprise, among other information, a set of FeatureSetUplinkPerCC-Id:s and FeatureSetDownlinkPerCC-Id:s. The number of these per-CC IDs determines the number of carriers that the UE is able to aggregate contiguously in frequency domain in the corresponding band. The number of carriers supported by the UE is also restricted by the bandwidth class indicated in the associated BandCombination, if present.

In feature set combinations the UE shall exclude entries for fallback combinations with same capabilities, since the network may anyway assume that the UE supports those.

NOTE 1: The UE may advertise fallback band-combinations in which it supports additional functionality explicitly in two ways: Either by setting FeatureSet IDs to zero (inter-band and intra-band non-contiguous fallback) and by reducing the number of FeatureSet-PerCC Ids in a Feature Set (intra-band contiguous fallback). Or by separate BandCombination entries with associated FeatureSetCombinations.

NOTE 2: The UE may advertise a FeatureSetCombination containing only fallback band combinations. That means, in a FeatureSetCombination, each group of FeatureSets across the bands may contain at least one pair of FeatureSetUplinkId and FeatureSetDownlinkId which is set to 0/0.

NOTE 3: The Network configures serving cell(s) and BWP(s) configuration to comply with capabilities derived from the combination of FeatureSets at the same position in the FeatureSetsPerBand, regardless of activated/deactivated serving cell(s) and BWP(s).

--- ASN1START
--- TAG--FEATURESETCOMBINATION--START

FeatureSetCombination ::= SEQUENCE (SIZE (1..maxSimultaneousBands)) OF FeatureSetsPerBand
FeatureSetsPerBand ::= SEQUENCE (SIZE (1..maxFeatureSetsPerBand)) OF FeatureSet
FeatureSet ::= CHOICE {
  eutra
    downlinkSetEUTRA FeatureSetEUTRA-DownlinkId,
    uplinkSetEUTRA FeatureSetEUTRA-UplinkId
  ),
  nr
    downlinkSetNR FeatureSetNR-DownlinkId,
    uplinkSetNR FeatureSetNR-UplinkId
}
FeatureSetCombinationId

The IE FeatureSetCombinationId identifies a FeatureSetCombination. The FeatureSetCombinationId of a FeatureSetCombination is the position of the FeatureSetCombination in the featureSetCombinations list (in UE-NR-Capability or UE-MRDC-Capability). The FeatureSetCombinationId = 0 refers to the first entry in the featureSetCombinations list (in UE-NR-Capability or UE-MRDC-Capability).

NOTE: The FeatureSetCombinationId = 1024 is not used due to the maximum entry number of featureSetCombinations.

FeatureSetCombinationId information element

FeatureSetDownlink

The IE FeatureSetDownlink indicates a set of features that the UE supports on the carriers corresponding to one band entry in a band combination.

FeatureSetDownlink information element
FeatureSetDownlink-v1540 ::= SEQUENCE {
  oneFL-DMRS-TwoAdditionalDMRS-DL       ENUMERATED {supported}   OPTIONAL,
  twoFL-DMRS-TwoAdditionalDMRS-DL       ENUMERATED {supported}   OPTIONAL,
  oneFL-DMRS-ThreeAdditionalDMRS-DL     ENUMERATED {supported}   OPTIONAL,
  pdcch-MonitoringAnyOccasionsWithSpanGap SEQUENCE {          scs-15kHz       ENUMERATED {set1, set2, set3}            OPTIONAL,
    scs-30kHz       ENUMERATED {set1, set2, set3}            OPTIONAL,
    scs-60kHz       ENUMERATED {set1, set2, set3}            OPTIONAL,
    scs-120kHz      ENUMERATED {set1, set2, set3}            OPTIONAL,
  } OPTIONAL,
  pdsch-SeparationWithGap                ENUMERATED {supported}   OPTIONAL,
  pdsch-ProcessingType2                  SEQUENCE {
    scs-15kHz       ProcessingParameters                      OPTIONAL,
    scs-30kHz       ProcessingParameters                      OPTIONAL,
    scs-60kHz       ProcessingParameters                      OPTIONAL,
  } OPTIONAL,
  pdsch-ProcessingType2-Limited          SEQUENCE {
    differentTB-PerSlot-SCS-30kHz                        ENUMERATED {upto1, upto2, upto4, upto7} OPTIONAL,
  } OPTIONAL,
}

FeatureSetDownlink-v15a0 ::= SEQUENCE {
  supportedSRS-Resources                  SRS-Resources        OPTIONAL
}

FeatureSetDownlink-v1610 ::= SEQUENCE {
  cbgPDSCH-ProcessingType1-NumberOfTB-PerSlot-r16  SEQUENCE {
    scs-15kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
    scs-30kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
    scs-60kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
    scs-120kHz-r16      ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
  } OPTIONAL,
  cbgPDSCH-ProcessingType2-NumberOfTB-PerSlot-r16  SEQUENCE {
    scs-15kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
    scs-30kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
    scs-60kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
    scs-120kHz-r16      ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
  } OPTIONAL,
  cbgPDSCH-ProcessingType2-NumberOfTB-PerSlot-r16  SEQUENCE {
    scs-15kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
    scs-30kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
    scs-60kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
    scs-120kHz-r16      ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
  } OPTIONAL,
  cbgPDSCH-ProcessingType2-NumberOfTB-PerSlot-r16  SEQUENCE {
    scs-15kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
    scs-30kHz-r16       ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
3GPP TS 38.331 version 16.3.1 Release 16

ETSI TS 138 331 V16.3.1 (2021-01)

---

**ETSI**

---

**3GPP TS 38.331 version 16.3.1 Release 16**

**dummyA ::=**

**SEQUENCE**

- **maxNumberNZP-CSI-RS-PerCC**
  - **INTEGER** \(1 \ldots 32\)

- **maxNumberOfPortsAcrossNZP-CSI-RS-PerCC**

- **maxNumberCS-IM-PerCC**
  - **ENUMERATED** \(\{n1, n2, n4, n8, n16, n32\}\)

- **maxNumberOfSimultaneousCSI-RS-ActBWP-AllCC**
  - **ENUMERATED** \(\{n5, n6, n7, n8, n9, n10, n12, n14, n16, n18, n20, n22, n24, n26\}\)

---

**PDCCH-MonitoringOccasions-r16 ::=**

**SEQUENCE**

- **period7span3-r16**
  - **ENUMERATED** \(\{n1, n2, n4\}\)

- **period4span3-r16**
  - **ENUMERATED** \(\{n1, n2, n4\}\)

- **period2span2-r16**
  - **ENUMERATED** \(\{n1, n2\}\)

---

**PDCCH-Monitoring-r16 ::=**

**SEQUENCE**

- **pdsch-ProcessingType1-r16**
  - **SEQUENCE**
    - **scs-15kHz-r16**
      - **PDCCH-MonitoringOccasions-r16**
    - **scs-30kHz-r16**
      - **PDCCH-MonitoringOccasions-r16**

- **pdsch-ProcessingType2-r16**
  - **SEQUENCE**
    - **scs-15kHz-r16**
      - **PDCCH-MonitoringOccasions-r16**
    - **scs-30kHz-r16**
      - **PDCCH-MonitoringOccasions-r16**
n28, n30, n32, n34, n36, n38, n40, n42, n44, n46, n48, n50, n52, n54, n56, n58, n60, n62, n64},
}

DummyB ::=       SEQUENCE { maxNumberTxPortsPerResource ENUMERATED {p2, p4, p8, p12, p16, p24, p32}, maxNumberResources INTEGER (1..64), totalNumberTxPorts INTEGER (2..256), supportedCodebookMode ENUMERATED {mode1, mode1AndMode2}, maxNumberCSI-RS-PerResourceSet INTEGER (1..8) }

DummyC ::=        SEQUENCE { maxNumberTxPortsPerResource ENUMERATED {p8, p16, p32}, maxNumberResources INTEGER (1..64), totalNumberTxPorts INTEGER (2..256), supportedCodebookMode ENUMERATED {mode1, mode2, both}, supportedNumberPanels ENUMERATED {n2, n4}, maxNumberCSI-RS-PerResourceSet INTEGER (1..8) }

DummyD ::=                 SEQUENCE { maxNumberTxPortsPerResource ENUMERATED {p4, p8, p12, p16, p24, p32}, totalNumberTxPorts INTEGER (2..256), parameterLx INTEGER (2..4), amplitudeScalingType ENUMERATED {wideband, widebandAndSubband}, amplitudeSubsetRestriction ENUMERATED {supported} OPTIONAL, maxNumberCSI-RS-PerResourceSet INTEGER (1..8) }

DummyE ::=    SEQUENCE { maxNumberTxPortsPerResource ENUMERATED {p4, p8, p12, p16, p24, p32}, totalNumberTxPorts INTEGER (2..256), parameterLx INTEGER (2..4), amplitudeScalingType ENUMERATED {wideband, widebandAndSubband}, maxNumberCSI-RS-PerResourceSet INTEGER (1..8) }

-- TAG-FEATURESETDOWNLINK-STOP
-- ASN1STOP
**FeatureSetDownlink field descriptions**

**featureSetListPerDownlinkCC**
Indicates which features the UE supports on the individual DL carriers of the feature set (and hence of a band entry that refer to the feature set). The UE shall hence include at least as many FeatureSetDownlinkPerCC-Id in this list as the number of carriers it supports according to the ca-BandwidthClassDL, except if indicating additional functionality by reducing the number of FeatureSetDownlinkPerCC-Id in the feature set (see NOTE 1 in FeatureSetCombination IE description). The order of the elements in this list is not relevant, i.e., the network may configure any of the carriers in accordance with any of the FeatureSetDownlinkPerCC-Id in this list.

**supportedSRS-Resources**
Indicates supported SRS resources for SRS carrier switching to the band associated with this FeatureSetDownlink. The UE is only allowed to set this field for a band with associated FeatureSetUplinkId set to 0.

---

**FeatureSetDownlinkId**

The IE FeatureSetDownlinkId identifies a downlink feature set. The FeatureSetDownlinkId of a FeatureSetDownlink is the index position of the FeatureSetDownlink in the featureSetsDownlink list in the FeatureSets IE. The first element in that list is referred to by FeatureSetDownlinkId = 1. The FeatureSetDownlinkId=0 is not used by an actual FeatureSetDownlink but means that the UE does not support a carrier in this band of a band combination.

**FeatureSetDownlinkId information element**

```asn1
FeatureSetDownlinkId ::= INTEGER {0..maxDownlinkFeatureSets}
```

---

**FeatureSetDownlinkPerCC**

The IE FeatureSetDownlinkPerCC indicates a set of features that the UE supports on the corresponding carrier of one band entry of a band combination.

**FeatureSetDownlinkPerCC information element**

```asn1
FeatureSetDownlinkPerCC ::= SEQUENCE {
  supportedSubcarrierSpacingDL        SubcarrierSpacing,
  supportedBandwidthDL                SupportedBandwidth,
  channelBW-90mhz                     ENUMERATED {supported} OPTIONAL,
  maxNumberMIMO-LayersPDSCH           MIMO-LayersDL OPTIONAL,
  supportedModulationOrderDL          ModulationOrder OPTIONAL
}
```

**FeatureSetDownlinkPerCC-v1620**

```asn1
FeatureSetDownlinkPerCC-v1620 ::= SEQUENCE {
  R1-16-2a: Multi-DCI based multi-TRP
  multiDCI-MultiTRP-r16               MultiDCI-MultiTRP-r16 OPTIONAL,
```

---
FeatureSetDownlinkPerCC-Id

The IE FeatureSetDownlinkPerCC-Id identifies a set of features applicable to one carrier of a feature set. The FeatureSetDownlinkPerCC-Id of a FeatureSetDownlinkPerCC is the index position of the FeatureSetDownlinkPerCC in the featureSetsDownlinkPerCC. The first element in the list is referred to by FeatureSetDownlinkPerCC-Id = 1, and so on.

FeatureSetDownlinkPerCC-Id information element

FeatureSetEUTRA-DownlinkId

The IE FeatureSetEUTRA-DownlinkId identifies a downlink feature set in E-UTRA list (see TS 36.331 [10]. The first element in that list is referred to by FeatureSetEUTRA-DownlinkId = 1. The FeatureSetEUTRA-DownlinkId=0 is used when the UE does not support a carrier in this band of a band combination.

FeatureSetEUTRA-DownlinkId information element

ETSI
The IE `FeatureSetEUTRA-UplinkId` identifies an uplink feature set in E-UTRA list (see TS 36.331 [10]). The first element in that list is referred to by `FeatureSetEUTRA-UplinkId = 1`. The `FeatureSetEUTRA-UplinkId = 0` is used when the UE does not support a carrier in this band of a band combination.

```
FeatureSetEUTRA-UplinkId ::= INTEGER {0..maxEUTRA-UL-FeatureSets}
```

The `FeatureSets` is used to provide pools of downlink and uplink features sets. A `FeatureSetCombination` refers to the IDs of the feature set(s) that the UE supports in that `FeatureSetCombination`. The `BandCombination` entries in the `BandCombinationList` then indicate the ID of the `FeatureSetCombination` that the UE supports for that band combination.

The entries in the lists in this IE are identified by their index position. For example, the `FeatureSetUplinkPerCC-Id = 4` identifies the 4th element in the `featureSetsUplinkPerCC` list.

**NOTE:** When feature sets (per CC) IEs require extension in future versions of the specification, new versions of the `FeatureSetDownlink`, `FeatureSetUplink`, `FeatureSets`, `FeatureSetDownlinkPerCC` and/or `FeatureSetUplinkPerCC` will be created and instantiated in corresponding new lists in the `FeatureSets` IE. For example, if new capability bits are to be added to the `FeatureSetDownlink`, they will instead be defined in a new `FeatureSetDownlink-rxy` which will be instantiated in a new `featureSetDownlinkList-rxy` list. If a UE indicates in a `FeatureSetCombination` that it supports the `FeatureSetDownlink` with ID #5, it implies that it supports both the features in `FeatureSetDownlink #5` and `FeatureSetDownlink-rxy #5` (if present). The number of entries in the new list(s) shall be the same as in the original list(s).
FeatureSetUplink

The IE FeatureSetUplink is used to indicate the features that the UE supports on the carriers corresponding to one band entry in a band combination.

FeatureSetUplink information element

FeatureSetUplink ::= SEQUENCE {
  featureSetListPerUplinkCC            SEQUENCE (SIZE (1.. maxNrofServingCells)) OF FeatureSetUplinkPerCC-Id, OPTIONAL,
  scalingFactor                        ENUMERATED {f0p4, f0p75, f0p8} OPTIONAL,
  dummy3                                ENUMERATED {supported} OPTIONAL,
  intraBandFreqSeparationUL            ENUMERATED {supported} OPTIONAL,
  searchSpaceSharingCA-UL              ENUMERATED {supported} OPTIONAL,
  dummy1                                DummyI OPTIONAL,
  supportedSRS-Resources                SRS-Resources OPTIONAL,
  twoPUCCH-Group                        ENUMERATED {supported} OPTIONAL,
  dynamicSwitchSUL                      ENUMERATED {supported} OPTIONAL,
  simultaneousTxSUL-NonSUL             ENUMERATED {supported} OPTIONAL,
  pusch-ProcessingType1-DifferentTB-PerSlot    SEQUENCE {
    scs-15kHz                            ENUMERATED {upto2, upto4, upto7} OPTIONAL,
    scs-30kHz                            ENUMERATED {upto2, upto4, upto7} OPTIONAL,
    scs-60kHz                            ENUMERATED {upto2, upto4, upto7} OPTIONAL,
    scs-120kHz                           ENUMERATED {upto2, upto4, upto7} OPTIONAL,
  } OPTIONAL,
  dummy2                                DummyF OPTIONAL
}

FeatureSetUplink-v1540 ::= SEQUENCE {
  zeroSlotOffsetAperiodicSRS            ENUMERATED {supported} OPTIONAL,
  pa-PhaseDiscontinuityImpacts         ENUMERATED {supported} OPTIONAL,
  pusch-SeparationWithGap              ENUMERATED {supported} OPTIONAL,
  pusch-ProcessingType2                SEQUENCE {
    scs-15kHz                            ProcessingParameters OPTIONAL,
  }
}
FeatureSetUplink-v1610 ::= SEQUENCE {
  -- R1 11-5: PUSCH repetition Type B
  pusch-RepetitionTypeB-r16        SEQUENCE {
    maxNumberPUSCH-Tx-r16            ENUMERATED {n2, n3, n4, n7, n8, n12},
    hoppingScheme-r16                ENUMERATED {interSlotHopping, interRepetitionHopping, both}
  } OPTIONAL,
  -- R1 11-7: UL cancelation scheme for self-carrier
  ul-CancellationSelfCarrier-r16    ENUMERATED {supported} OPTIONAL,
  -- R1 11-7a: UL cancelation scheme for cross-carrier
  ul-CancellationCrossCarrier-r16   ENUMERATED {supported} OPTIONAL,
  -- R1 16-5c: The maximum number of SRS resources in one SRS resource set with usage set to 'codebook' for Mode 2
  ul-FullPwrMode2-MaxSRS-ResInSet-r16  ENUMERATED {n1, n2, n4},
  -- R1 22-4a/4b/4c/4d: CBG based transmission for UL with unicast PUSCH(s) per slot per CC with UE processing time Capability 1
  cbgPUSCH-ProcessingType1-DifferentTB-PerSlot-r16    SEQUENCE {
    scs-15kHz-r16        ENUMERATED {one-pusch, upto2, upto4, upto7},
    scs-30kHz-r16        ENUMERATED {one-pusch, upto2, upto4, upto7},
    scs-60kHz-r16        ENUMERATED {one-pusch, upto2, upto4, upto7},
    scs-120kHz-r16       ENUMERATED {one-pusch, upto2, upto4, upto7}
  } OPTIONAL,
  -- R1 22-3a/3b/3c/3d: CBG based transmission for UL with unicast PUSCH(s) per slot per CC with UE processing time Capability 2
  cbgPUSCH-ProcessingType2-DifferentTB-PerSlot-r16    SEQUENCE {
    scs-15kHz-r16        ENUMERATED {one-pusch, upto2, upto4, upto7},
    scs-30kHz-r16        ENUMERATED {one-pusch, upto2, upto4, upto7},
    scs-60kHz-r16        ENUMERATED {one-pusch, upto2, upto4, upto7},
    scs-120kHz-r16       ENUMERATED {one-pusch, upto2, upto4, upto7}
  } OPTIONAL,
  supportedSRS-PosResources-r16              SRS-AllPosResources-r16 OPTIONAL,
  intraFreqDAPS-UL-r16                  SEQUENCE {
    intraFreqMultiUL-TransmissionDAPS-r16 ENUMERATED {supported} OPTIONAL,
    intraFreqTwoTAGs-DAPS-r16             ENUMERATED {supported} OPTIONAL,
    intraFreqSemiStaticPowerSharingDAPS-Mode2-r16 ENUMERATED {supported} OPTIONAL,
    intraFreqDynamicPowerSharingDAPS-r16  ENUMERATED {short, long} OPTIONAL
  } OPTIONAL,
  intraBandFreqSeparationUL-v1620          FreqSeparationClassUL-v1620 OPTIONAL,
  -- R1 11-3: More than one PUCCH for HARQ-ACK transmission within a slot
  multiPUCCH-r16                       SEQUENCE {
    sub-SlotConfig-NCP-r16              ENUMERATED {set1, set2} OPTIONAL,
    sub-SlotConfig-ECP-r16              ENUMERATED {set1, set2} OPTIONAL
  } OPTIONAL,
  -- R1 11-3c: 2 PUCCH of format 0 or 2 for a single 7*2-symbol subslot based HARQ-ACK codebook
  twoPUCCH-Type1-r16                   ENUMERATED {supported} OPTIONAL,
  -- R1 11-3d: 2 PUCCH of format 0 or 2 for a single 2*7-symbol subslot based HARQ-ACK codebook
  twoPUCCH-Type2-r16                   ENUMERATED {supported} OPTIONAL,
  -- R1 11-3e: 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 or 4 in the same subslot for a single 2*7-symbol HARQ-ACK codebooks
}
twoPUCCH-Type3-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-3f: 2 PUCCH transmissions in the same subslot for a single 2*7-symbol HARQ-ACK codebooks which are not covered by 11-3d and
-- 11-3e

twoPUCCH-Type4-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-3g: SR/HARQ-ACK multiplexing once per subslot using a PUCCH (or HARQ-ACK piggybacked on a PUSCH) when SR/HARQ-ACK
-- are supposed to be sent with different starting symbols in a subslot

mux-SR-HARQ-ACK-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-4: Two HARQ-ACK codebooks with up to one sub-slot based HARQ-ACK codebook (i.e. slot-based + slot-based, or slot-based +
-- sub-slot based) simultaneously constructed for supporting HARQ-ACK codebooks with different priorities at a UE

twoHARQ-ACK-Codebook-type1-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-4a: Two sub-slot based HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different
-- priorities at a UE

twoHARQ-ACK-Codebook-type2-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-4c: 2 PUCCH of format 0 or 2 for two HARQ-ACK codebooks with one 7*2-symbol sub-slot based HARQ-ACK codebook

twoPUCCH-Type5-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-4d: 2 PUCCH of format 0 or 2 in consecutive symbols for two HARQ-ACK codebooks with one 2*7-symbol sub-slot based HARQ-ACK
-- codebook

twoPUCCH-Type6-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-4e: 2 PUCCH of format 0 or 2 for two subslot based HARQ-ACK codebooks

twoPUCCH-Type7-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-4f: 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 or 4 in the same subslot for HARQ-ACK codebooks with one 2*7-symbol
-- subslot based HARQ-ACK codebook

twoPUCCH-Type8-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-4g: 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 or 4 in the same subslot for two subslot based HARQ-ACK codebooks

twoPUCCH-Type9-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-4h: 2 PUCCH transmissions in the same subslot for two HARQ-ACK codebooks with one 2*7-symbol subslot which are not covered
-- by 11-4c and 11-4e

twoPUCCH-Type10-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 11-4i: 2 PUCCH transmissions in the same subslot for two subslot based HARQ-ACK codebooks which are not covered by 11-4d and
-- 11-4f

twoPUCCH-Type11-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 12-1: UL intra-UE multiplexing/prioritization of overlapping channel/signals with two priority levels in physical layer

ul-IntraUE-Mux-r16  SEQUENCE {
  pusch-PreparationLowPriority-r16  ENUMERATED {sym0, sym1, sym2},
  pusch-PreparationHighPriority-r16  ENUMERATED {sym0, sym1, sym2}
}

-- R1 16-5a: Supported UL full power transmission mode of fullpower
ul-FullPwrMode-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 18-5d: Processing up to X unicast DCI scheduling for UL per scheduled CC

crossCarrierSchedulingProcessing-DiffSCS-r16  SEQUENCE {
  scs-15kHz-120kHz-r16  ENUMERATED {n1,n2,n4}  OPTIONAL,
  scs-15kHz-60kHz-r16  ENUMERATED {n1,n2,n4}  OPTIONAL,
  scs-30kHz-120kHz-r16  ENUMERATED {n1,n2,n4}  OPTIONAL,
  scs-15kHz-30kHz-r16  ENUMERATED {n2}  OPTIONAL,
  scs-30kHz-60kHz-r16  ENUMERATED {n2}  OPTIONAL,
  scs-60kHz-120kHz-r16  ENUMERATED {n2}  OPTIONAL,
}
-- R1 16-5b: Supported UL full power transmission mode of fullpowerModel
ul-FullPwrModel-r16  ENUMERATED {supported}  OPTIONAL,
-- R1 16-5c-2: Ports configuration for Mode 2
ull-PwrMode2-SRSConfig-diffNumSRSPorts-r16  ENUMERATED {p1-2, p1-4, p1-2-4}  OPTIONAL,
-- R1 16-5c-3: TPMI group for Mode 2
ull-PwrMode2-TPMIGroup-r16  SEQUENCE {
  twoPorts-r16  BIT STRING(SIZE(2))  OPTIONAL,
fourPortsNonCoherent-r16 ENUMERATED {g0, g1, g2, g3} OPTIONAL,
fourPortsPartialCoherent-r16 ENUMERATED {g0, g1, g2, g3, g4, g5, g6} OPTIONAL

FeatureSetUplink-v1630 ::= SEQUENCE {
  -- R1 22-8: For SRS for CB PUSCH and antenna switching on FR1 with symbol level offset for aperiodic SRS transmission
  offsetSRS-CB-PUSCH-Ant-Switch-fr1-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 22-8a: PDCCH monitoring on any span of up to 3 consecutive OFDM symbols of a slot and constrained timeline for SRS for CB
  -- PUSCH and antenna switching on FR1
  offsetSRS-CB-PUSCH-PDCCH-MonitorSingleOcc-fr1-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 22-8b: For type 1 CSS with dedicated RRC configuration, type 3 CSS, and UE-SS, monitoring occasion can be any OFDM symbol(s)
  -- of a slot for Case 2 and constrained timeline for SRS for CB PUSCH and antenna switching on FR1
  offsetSRS-CB-PUSCH-PDCCH-MonitorAnyOccWithoutGap-fr1-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 22-8c: For type 1 CSS with dedicated RRC configuration, type 3 CSS, and UE-SS, monitoring occasion can be any OFDM symbol(s)
  -- of a slot for Case 2 with a DCI gap and constrained timeline for SRS for CB PUSCH and antenna switching on FR1
  offsetSRS-CB-PUSCH-PDCCH-MonitorAnyOccWithGap-fr1-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 22-8d: All PDCCH monitoring occasion can be any OFDM symbol(s) of a slot for Case 2 with a span gap and constrained timeline
  -- for SRS for CB PUSCH and antenna switching on FR1
  offsetSRS-CB-PUSCH-PDCCH-MonitorAnyOccWithSpanGap-fr1-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 22-9: Cancellation of PUCCH, PUSCH or PRACH with a DCI scheduling a PDSCH or CSI-RS or a DCI format 2_0 for SFI
  partialCancellationPUCCH-PUSCH-PRACH-TX-r16 ENUMERATED {supported} OPTIONAL
}

SRS-AllPosResources-r16 ::= SEQUENCE {
  srs-PosResources-r16 SRS-PosResources-r16,
  srs-PosResourceAP-r16 SRS-PosResourceAP-r16 OPTIONAL,
  srs-PosResourceSP-r16 SRS-PosResourceSP-r16 OPTIONAL
}

SRS-PosResources-r16 ::= SEQUENCE {
  maxNumberSRS-PosResourceSetPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n12, n16},
  maxNumberSRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n12, n16, n32, n64},
  maxNumberSRS-ResourcesPerBWP-PerSlot-r16 ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14},
  maxNumberPeriodicSRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},
  maxNumberPeriodicSRS-PosResourcesPerBWP-PerSlot-r16 ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}
}

SRS-PosResourceAP-r16 ::= SEQUENCE {
  maxNumberAP-SRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},
  maxNumberAP-SRS-PosResourcesPerBWP-PerSlot-r16 ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}
}

SRS-PosResourceSP-r16 ::= SEQUENCE {
  maxNumberSP-SRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},
  maxNumberSP-SRS-PosResourcesPerBWP-PerSlot-r16 ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}
}

SRS-Resources ::= SEQUENCE {
  maxNumberAperiodicSRS-PerBWP ENUMERATED {n1, n2, n4, n8, n16},
  maxNumberAperiodicSRS-PerBWP-PerSlot INTEGER (1..6),
  maxNumberPeriodicSRS-PerBWP ENUMERATED {n1, n2, n4, n8, n16},
  maxNumberPeriodicSRS-PerBWP-PerSlot INTEGER (1..6),
  maxNumberOfSemiPersistentSRS-PerBWP ENUMERATED {n1, n2, n4, n8, n16},

maxNumberSemiPersistentSRS-PerBWP-PerSlot INTEGER (1..6),
maxNumberSR3-Ports-PerResource ENUMERATED {n1, n2, n4}
}

DummyF ::= SEQUENCE {
  maxNumberPeriodicCSI-ReportPerBWP INTEGER (1..4),
  maxNumberOfPeriodicCSI-ReportPerBWP INTEGER (1..4),
  maxNumberOfAperiodicCSI-ReportPerBWP INTEGER (1..4),
  maxNumberSemiPersistentCSI-ReportPerBWP INTEGER (0..4),
  simultaneousCSI-ReportsAllCC INTEGER (5..32)
}

-- TAG-FEATURESETUPLINK-STOP
-- ASN1STOP

---

**FeatureSetUplink field descriptions**

---

**featureSetListPerUplinkCC**
Indicates which features the UE supports on the individual UL carriers of the feature set (and hence of a band entry that refers to the feature set). The UE shall hence include at least as many FeatureSetUplinkPerCC-Id in this list as the number of carriers it supports according to the ca-BandwidthClassUL, except if indicating additional functionality by reducing the number of FeatureSetUplinkPerCC-Id in the feature set (see NOTE 1 in FeatureSetCombination IE description). The order of the elements in this list is not relevant, i.e., the network may configure any of the carriers in accordance with any of the FeatureSetUplinkPerCC-Id in this list.

---

**FeatureSetUplinkld**
The IE FeatureSetUplinkld identifies an uplink feature set. The FeatureSetUplinkld of a FeatureSetUplink is the index position of the FeatureSetUplink in the featureSetsUplink list in the FeatureSets IE. The first element in the list is referred to by FeatureSetUplinkld = 1, and so on. The FeatureSetUplinkld =0 is not used by an actual FeatureSetUplink but means that the UE does not support a carrier in this band of a band combination.

---

**FeatureSetUplinkld** information element

---

**FeatureSetUplinkPerCC**
The IE FeatureSetUplinkPerCC indicates a set of features that the UE supports on the corresponding carrier of one band entry of a band combination.

---

**FeatureSetUplinkPerCC** information element
FeatureSetUplinkPerCC ::= SEQUENCE {
supportedSubcarrierSpacingUL SubcarrierSpacing,  
supportedBandwidthUL SupportedBandwidth,  
channelBW-90mhz ENUMERATED {supported} OPTIONAL,  
mimo-CB-PUSCH SEQUENCE {
  maxNumberMIMO-LayersCB-PUSCH MIMO-LayersUL OPTIONAL,  
  maxNumberSRS-ResourcePerSet INTEGER (1..2) OPTIONAL  
}  
mimo-CB-PUSCH SEQUENCE {
  maxNumberSRS-ResourcePerSet INTEGER (1..4),  
  maxNumberSimultaneousSRS-ResourceTx INTEGER (1..4)  
} OPTIONAL

FeatureSetUplinkPerCC-v1540 ::= SEQUENCE {
mimo-NonCB-PUSCH SEQUENCE {
  maxNumberSRS-ResourcePerSet INTEGER (1..4),  
  maxNumberSimultaneousSRS-ResourceTx INTEGER (1..4)  
} OPTIONAL

-- TAG-FEATURESETUPLINKPERCC-STOP
-- ASN1STOP

-- FeatureSetUplinkPerCC-Id

The IE FeatureSetUplinkPerCC-Id identifies a set of features applicable to one carrier of a feature set. The FeatureSetUplinkPerCC-Id of a FeatureSetUplinkPerCC is the index position of the FeatureSetUplinkPerCC in the featureSetsUplinkPerCC. The first element in the list is referred to by FeatureSetUplinkPerCC-Id = 1, and so on.

FeatureSetUplinkPerCC-Id information element

-- ASN1START
-- TAG-FEATURESETUPLINKPERCC-ID-START

FeatureSetUplinkPerCC-Id ::= INTEGER (1..maxPerCC-FeatureSets)

-- TAG-FEATURESETUPLINKPERCC-ID-STOP
-- ASN1STOP

-- FreqBandIndicatorEUTRA

-- ASN1START
-- TAG-FREQBANDINDICATOREUTRA-START

FreqBandIndicatorEUTRA ::= INTEGER (1..maxBandsEUTRA)

-- TAG-FREQBANDINDICATOREUTRA-STOP
-- ASN1STOP
---

**FreqBandList**

The IE *FreqBandList* is used by the network to request NR CA, NR non-CA and/or MR-DC band combinations for specific NR and/or E-UTRA frequency bands and/or up to a specific number of carriers and/or up to specific aggregated bandwidth. This is also used to request feature sets (for NR) and feature set combinations (for NR and MR-DC). For NR sidelink communication, this is used by the initiating UE to request sidelink UE radio access capabilities from the peer UE.

**FreqBandList information element**

```asn1
-- ASN1START
-- TAG-FREQBANDLIST-START
FreqBandList ::= SEQUENCE (SIZE (1..maxBandsMRDC)) OF FreqBandInformation
FreqBandInformation ::= CHOICE {
  bandInformationEUTRA  FreqBandInformationEUTRA,
  bandInformationNR     FreqBandInformationNR
}
FreqBandInformationEUTRA ::= SEQUENCE {
  bandEUTRA             FreqBandIndicatorEUTRA,
  ca-BandwidthClassDL-EUTRA  CA-BandwidthClassEUTRA OPTIONAL, -- Need N
  ca-BandwidthClassUL-EUTRA  CA-BandwidthClassEUTRA OPTIONAL    -- Need N
}
FreqBandInformationNR ::= SEQUENCE {
  bandNR                FreqBandIndicatorNR,
  maxBandwidthRequestedDL  AggregatedBandwidth OPTIONAL, -- Need N
  maxBandwidthRequestedUL  AggregatedBandwidth OPTIONAL, -- Need N
  maxCarriersRequestedDL   INTEGER (1..maxNrofServingCells) OPTIONAL, -- Need N
  maxCarriersRequestedUL   INTEGER (1..maxNrofServingCells) OPTIONAL    -- Need N
}
AggregatedBandwidth ::= ENUMERATED {mhz50, mhz100, mhz150, mhz200, mhz250, mhz300, mhz350, mhz400, mhz450, mhz500, mhz550, mhz600, mhz650, mhz700, mhz750, mhz800}
-- TAG-FREQBANDLIST-STOP
-- ASN1STOP
---

**FreqSeparationClass**

The IE *FreqSeparationClass* is used for an intra-band non-contiguous CA band combination to indicate frequency separation between lower edge of lowest CC and upper edge of highest CC in a frequency band.

**FreqSeparationClass information element**

```asn1
-- ASN1START
-- TAG-FREQSEPARATIONCLASS-START
FreqSeparationClass ::= ENUMERATED { mhz800, mhz1200, mhz1400, ...}
-- TAG-FREQSEPARATIONCLASS-STOP
-- ASN1STOP
```
FreqSeparationClassDL-v1620 ::= ENUMERATED {mhz1000, mhz1600, mhz1800, mhz2000, mhz2200, mhz2400}
FreqSeparationClassUL-v1620 ::= ENUMERATED {mhz1000}

FreqSeparationClassDL-Only

The IE *FreqSeparationClassDL-Only* is used to indicate the frequency separation between lower edge of lowest CC and upper edge of highest CC of DL only frequency spectrum in a frequency band.

**FreqSeparationClassDL-Only information element**

HighSpeedParameters

The IE *HighSpeedParameters* is used to convey capabilities related to high speed scenarios.

**HighSpeedParameters information element**

IMS-Parameters

The IE *IMS-Parameters* is used to convey capabilities related to IMS.
-- ASN1START
-- TAG-IMS-PARAMETERS-START
IMS-Parameters ::= SEQUENCE {
  ims-ParametersCommon  IMS-ParametersCommon OPTIONAL,
  ims-ParametersFRX-Diff IMS-ParametersFRX-Diff OPTIONAL,
...
}

IMS-ParametersCommon ::= SEQUENCE {
  voiceOverEUTRA-5GC ENUMERATED {supported} OPTIONAL,
  ...
}

IMS-ParametersFRX-Diff ::= SEQUENCE {
  voiceOverNR ENUMERATED {supported} OPTIONAL,
  ...
}

-- TAG-IMS-PARAMETERS-STOP
-- ASN1STOP

-- InterRAT-Parameters

The IE InterRAT-Parameters is used convey UE capabilities related to the other RATs.

-- ASN1START
-- TAG-INTERRAT-PARAMETERS-START
InterRAT-Parameters ::= SEQUENCE {
  eutra EUTRA-Parameters OPTIONAL,
  ...
}

EUTRA-Parameters ::= SEQUENCE {
  supportedBandListEUTRA SEQUENCE (SIZE (1..maxBandsEUTRA)) OF FreqBandIndicatorEUTRA,
  eutra-ParametersCommon EUTRA-ParametersCommon OPTIONAL,
}
The IE **MAC-Parameters** is used to convey capabilities related to MAC.

**MAC-Parameters** information element

```
-- ASN1START
-- TAG-MAC-PARAMETERS-START
MAC-Parameters ::= SEQUENCE {
    mac-ParametersCommon MAC-ParametersCommon OPTIONAL,
    ...
}
```

---

**MAC-Parameters**

The IE **MAC-Parameters** is used to convey capabilities related to MAC.

**MAC-Parameters** information element

```
-- ASN1START
-- TAG-MAC-PARAMETERS-START
MAC-Parameters ::= SEQUENCE {
    mac-ParametersCommon MAC-ParametersCommon OPTIONAL,
    ...
}
```
MAC-Parameters-v1610 ::= SEQUENCE {
  mac-ParametersFRX-Diff-r16  MAC-ParametersFRX-Diff-r16  OPTIONAL
}

MAC-ParametersFRX-Diff-r16 ::= SEQUENCE {
  directMCG-SCellActivation-r16  ENUMERATED {supported}  OPTIONAL,
  directMCG-SCellActivationResume-r16  ENUMERATED {supported}  OPTIONAL,
  directSCG-SCellActivation-r16  ENUMERATED {supported}  OPTIONAL,
  directSCG-SCellActivationResume-r16  ENUMERATED {supported}  OPTIONAL,
  -- R1 19-1: DRX Adaptation
  drx-Adaptation-r16  SEQUENCE {
    non-SharedSpectrumChAccess-r16  MINTimeGap-r16  OPTIONAL,
    sharedSpectrumChAccess-r16  MINTimeGap-r16  OPTIONAL
  }
}

MAC-ParametersFRX-Diff ::= SEQUENCE {
  skipUplinkTxDynamic  ENUMERATED {supported}  OPTIONAL,
  logicalChannelSR-DelayTimer  ENUMERATED {supported}  OPTIONAL,
  longDRX-Cycle  ENUMERATED {supported}  OPTIONAL,
  shortDRX-Cycle  ENUMERATED {supported}  OPTIONAL,
  multipleSR-Configurations  ENUMERATED {supported}  OPTIONAL,
  multipleConfiguredGrants  ENUMERATED {supported}  OPTIONAL,
  -- R4 8-1: MPE
  tdd-MPE-P-MPR-Reporting-r16  ENUMERATED {supported}  OPTIONAL,
  lcid-ExtensionIAB-r16  ENUMERATED {supported}  OPTIONAL
}

MAC-ParametersCommon ::= SEQUENCE {
  lcp-Restriction ENUMERATED {supported}  OPTIONAL,
  dummy ENUMERATED {supported}  OPTIONAL,
  lch-ToSCellRestriction ENUMERATED {supported}  OPTIONAL,
  ...,[
    recommendedBitRate ENUMERATED {supported}  OPTIONAL,
    recommendedBitRateQuery ENUMERATED {supported}  OPTIONAL
  ],[
    recommendedBitRateMultiplier-r16 ENUMERATED {supported}  OPTIONAL,
    preEmptiveBSR-r16 ENUMERATED {supported}  OPTIONAL,
    autonomousTransmission-r16 ENUMERATED {supported}  OPTIONAL,
    lch-PriorityBasedPrioritization-r16 ENUMERATED {supported}  OPTIONAL,
    lch-ToConfiguredGrantMapping-r16 ENUMERATED {supported}  OPTIONAL,
    lch-ToGrantPriorityRestriction-r16 ENUMERATED {supported}  OPTIONAL,
    singlePHR-P-r16 ENUMERATED {supported}  OPTIONAL,
    ul-LBT-FailureDetectionRecovery-r16 ENUMERATED {supported}  OPTIONAL,
    -- R4 9-1: MPE
    tdd-MPE-P-MPR-Reporting-r16 ENUMERATED {supported}  OPTIONAL,
    lcid-ExtensionIAB-r16 ENUMERATED {supported}  OPTIONAL,
  ]
}

MAC-ParametersXDD-Diff ::= SEQUENCE {
  skipUplinkTxDynamic ENUMERATED {supported}  OPTIONAL,
  logicalChannelSR-DelayTimer ENUMERATED {supported}  OPTIONAL,
  longDRX-Cycle ENUMERATED {supported}  OPTIONAL,
  shortDRX-Cycle ENUMERATED {supported}  OPTIONAL,
  multipleSR-Configurations ENUMERATED {supported}  OPTIONAL,
  multipleConfiguredGrants ENUMERATED {supported}  OPTIONAL,
  -- R4 9-1: MPE
  secondaryDRX-Group-r16 ENUMERATED {supported}  OPTIONAL
MinTimeGap-r16 ::= SEQUENCE {
    scs-15kHz-r16                           ENUMERATED {s11, s13}  OPTIONAL,
    scs-30kHz-r16                           ENUMERATED {s11, s16}  OPTIONAL,
    scs-60kHz-r16                           ENUMERATED {s11, s112} OPTIONAL,
    scs-120kHz-r16                          ENUMERATED {s12, s124} OPTIONAL
}

MeasAndMobParameters

The IE MeasAndMobParameters is used to convey UE capabilities related to measurements for radio resource management (RRM), radio link monitoring (RLM) and mobility (e.g. handover).

MeasAndMobParameters information element
NRDC, NEDC, NRDC, ENUMERATED {supported} OPTIONAL,
reportAddNeighMeasForPeriodic-r16 ENUMERATED {supported} OPTIONAL,
condHandoverParametersCommon-r16 ENUMERATED {supported} OPTIONAL,
condHandoverFDD-TDD-r16 ENUMERATED {supported} OPTIONAL,
condHandoverFR1-FR2-r16 ENUMERATED {supported} OPTIONAL,
.nr-NeedForGap-Reporting-r16 ENUMERATED {supported} OPTIONAL,
supportedGapPattern-NRonly-r16 BIT STRING (SIZE (10)) OPTIONAL,
supportedGapPattern-NRonly-NEDC-r16 ENUMERATED {supported} OPTIONAL,
maxNumberCLI-RSSI-r16 ENUMERATED {n8, n16, n32, n64} OPTIONAL,
maxNumberCLI-SRS-RSRP-r16 ENUMERATED {n4, n8, n16, n32} OPTIONAL,
maxNumberPerSlotCLI-SRS-RSRP-r16 ENUMERATED {n2, n4, n8} OPTIONAL,
mfi-IAB-r16 ENUMERATED {supported} OPTIONAL,
.nr-CGI-Reporting-NPN-r16 ENUMERATED {supported} OPTIONAL,
idleInactiveEUTRA-MeasReport-r16 ENUMERATED {supported} OPTIONAL,
idleInactive-ValidityArea-r16 ENUMERATED {supported} OPTIONAL,
eutra-AutonomousGaps-NEDC-r16 ENUMERATED {supported} OPTIONAL,
eutra-AutonomousGaps-NRDC-r16 ENUMERATED {supported} OPTIONAL,
pcellT312-r16 ENUMERATED {supported} OPTIONAL,
supportedGapPattern-r16 BIT STRING (SIZE (2)) OPTIONAL
}
}
MeasAndMobParametersXDD-Diff ::= SEQUENCE {
intraAndInterF-MeasAndReport ENUMERATED {supported} OPTIONAL,
eventA-MeasAndReport ENUMERATED {supported} OPTIONAL,
...,
[ [handoverInterF ENUMERATED {supported} OPTIONAL,
handoverLTE-EPC ENUMERATED {supported} OPTIONAL,
handoverLTE-SGC ENUMERATED {supported} OPTIONAL ]],
[ [sftd-MeasNR-Neigh ENUMERATED {supported} OPTIONAL,
sftd-MeasNR-Neigh-DRX ENUMERATED {supported} OPTIONAL ]],
[ [handoverUTRA-FDD-r16 ENUMERATED {supported} OPTIONAL ]]
}
MeasAndMobParametersFRX-Diff ::= SEQUENCE {
ss-SINR-Meas ENUMERATED {supported} OPTIONAL,
csi-RSRP-AndRSRQ-MeasWithSSB ENUMERATED {supported} OPTIONAL,
csi-RSRP-AndRSRQ-MeasWithoutSSB ENUMERATED {supported} OPTIONAL,
csi-SINR-Meas ENUMERATED {supported} OPTIONAL,
csi-RS-RLM ENUMERATED {supported} OPTIONAL,
...,
MeasAndMobParametersMRDC

The IE `MeasAndMobParametersMRDC` is used to convey capability parameters related to RRM measurements and RRC mobility.

`MeasAndMobParametersMRDC` information element
MIMO-Layers

The IE MIMO-Layers is used to convey the number of supported MIMO layers.

MIMO-Layers information element

```asn1
-- ASN1START
-- TAG-MIMO-LAYERS-START
MIMO-LayersDL ::= ENUMERATED {twoLayers, fourLayers, eightLayers}
MIMO-LayersUL ::= ENUMERATED {oneLayer, twoLayers, fourLayers}
-- TAG-MIMO-LAYERS-STOP
-- ASN1STOP
```
The IE `MIMO-ParametersPerBand` is used to convey MIMO related parameters specific for a certain band (not per feature set or band combination).

**MIMO-ParametersPerBand** information element

```
MIMO-ParametersPerBand ::= SEQUENCE {
  tci-StatePDSCH SEQUENCE {
    maxNumberConfiguredTCIstatesPerCC ENUMERATED {n4, n8, n16, n32, n64, n128} OPTIONAL,
    maxNumberActiveTCI-PerBWP ENUMERATED {n1, n2, n4, n8} OPTIONAL
  } OPTIONAL,
  additionalActiveTCI-StatePDCCH ENUMERATED {supported} OPTIONAL,
  pusch-TransCoherence ENUMERATED {nonCoherent, partialCoherent, fullCoherent} OPTIONAL,
  beamCorrespondenceWithoutUL-BeamSweeping ENUMERATED {supported} OPTIONAL,
  periodicBeamReport ENUMERATED {supported} OPTIONAL,
  aperiodicBeamReport ENUMERATED {supported} OPTIONAL,
  sp-BeamReportPUCCH ENUMERATED {supported} OPTIONAL,
  sp-BeamReportPUSCH ENUMERATED {supported} OPTIONAL,
  dummy1 DummyG OPTIONAL,
  maxNumberRxBeam INTEGER (2..8) OPTIONAL,
  maxNumberRxTxBeamSwitchDL SEQUENCE {
    scs-15kHz ENUMERATED {n4, n7, n14} OPTIONAL,
    scs-30kHz ENUMERATED {n4, n7, n14} OPTIONAL,
    scs-60kHz ENUMERATED {n4, n7, n14} OPTIONAL,
    scs-120kHz ENUMERATED {n4, n7, n14} OPTIONAL,
    scs-240kHz ENUMERATED {n4, n7, n14} OPTIONAL,
  } OPTIONAL,
  maxNumberNonGroupBeamReporting ENUMERATED {n1, n2, n4} OPTIONAL,
  groupBeamReporting ENUMERATED {supported} OPTIONAL,
  uplinkBeamManagement SEQUENCE {
    maxNumberSRS-ResourcePerSet-BM ENUMERATED {n2, n4, n8, n16},
    maxNumberSRS-ResourceSet INTEGER (1..8) OPTIONAL,
  } OPTIONAL,
  maxNumberCSI-RS-BFD INTEGER (1..64) OPTIONAL,
  maxNumberSSB-BFD INTEGER (1..64) OPTIONAL,
  maxNumberCSI-RS-SSB-CBD INTEGER (1..256) OPTIONAL,
  dummy2 ENUMERATED {supported} OPTIONAL,
  twoPortsPTRS-UL ENUMERATED {supported} OPTIONAL,
  dummy5 SRS-Resources OPTIONAL,
  dummy3 INTEGER (1..4) OPTIONAL,
  beamReportTiming SEQUENCE {
    scs-15kHz ENUMERATED {sym2, sym4, sym8} OPTIONAL,
    scs-30kHz ENUMERATED {sym4, sym8, sym14, sym28} OPTIONAL,
    scs-60kHz ENUMERATED {sym8, sym14, sym28} OPTIONAL,
    scs-120kHz ENUMERATED {sym14, sym28, sym56} OPTIONAL,
  } OPTIONAL,
  ptrs-DensityRecommendationSetDL SEQUENCE {
    scs-15kHz PTRS-DensityRecommendationDL OPTIONAL,
    scs-30kHz PTRS-DensityRecommendationDL OPTIONAL,
    scs-60kHz PTRS-DensityRecommendationDL OPTIONAL,
  } OPTIONAL,
}
```
ETSI TS 138 331 V16.3.1 (2021-01)

696

3GPP TS 38.331 version 16.3.1 Release 16

ETSI

```{.cpp}

```
multiDCI-multiTRP-Parameters-r16
  SEQUENCE {
    -- R1 16-2a-0: Overlapping PDSCHs in time and fully overlapping in frequency and time
    overlapPDSCHsFullyFreqTime-r16 INTEGER (1..2) OPTIONAL,
    -- R1 16-2a-1: Overlapping PDSCHs in time and partially overlapping in frequency and time
    overlapPDSCHsInTimePartiallyFreq-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-2a-2: Out of order operation for DL
    outOfOrderOperationDL-r16 SEQUENCE {
      supportPDCCH-ToPDSCH-r16 ENUMERATED {supported} OPTIONAL,
      supportPDSCH-ToHARQ-ACK-r16 ENUMERATED {supported} OPTIONAL
    } OPTIONAL,
    -- R1 16-2a-3: Out of order operation for UL
    outOfOrderOperationUL-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-2a-5: Separate CRS rate matching
    separateCRS-RateMatching-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-2a-6: Default QCL enhancement for multi-DCI based multi-TRP
    defaultQCL-PerCORESETPoolIndex-r16 ENUMERATED {supported} OPTIONAL
    -- R1 16-2a-7: Maximum number of activated TCI states
    maxNumberActivatedTCI-States-r16 SEQUENCE {
      maxNumberPerCORESET-Pool-r16 ENUMERATED {n1, n2, n4, n8},
      maxTotalNumberAcrossCORESET-Pool-r16 ENUMERATED {n2, n4, n8, n16}
    } OPTIONAL
  } OPTIONAL,

singleDCI-SDM-scheme-Parameters-r16
  SEQUENCE {
    -- R1 16-2b-1b: Single-DCI based SDM scheme – Support of new DMRS port entry
    supportNewDMRS-Port-r16 ENUMERATED {n0, n2, n3} OPTIONAL,
    -- R1 16-2b-1a: Support of s-port DL PTRS
    supportTwoPortDL-PTRS-r16 ENUMERATED {supported} OPTIONAL
  } OPTIONAL,

    -- R1 16-2b-2: Support of single-DCI based FDMSchemeA
    supportFDMSchemeA-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-2b-3a: Single-DCI based FDMSchemeB CW soft combining
    supportCodeWordSoftCombining-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-2b-4: Single-DCI based TDMSchemeA
    supportTDMSchemeA-r16 ENUMERATED {kb3, kb5, kb10, kb20, noRestriction} OPTIONAL,
    -- R1 16-2b-5: Single-DCI based inter-slot TDM
    supportInter-slotTDM-r16 SEQUENCE {
      supportRepNumPDSCH-TDMA-r16 ENUMERATED {n2, n3, n4, n5, n6, n7, n8, n16},
      maxTBS-Size-r16 ENUMERATED {kb3, kb5, kb10, kb20, noRestriction},
      maxNumberTCI-states-r16 INTEGER (1..2) OPTIONAL
    } OPTIONAL
  } OPTIONAL,

    -- R1 16-4: Low PAPR DMRS for PDSCH
    lowPAPR-DMRS-PDSCH-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-6a: Low PAPR DMRS for PUSCH without transform precoding
    lowPAPR-DMRS-PUSCHwithoutPrecoding-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-6b: Low PAPR DMRS for PUCCH
    lowPAPR-DMRS-PUCCH-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-6c: Low PAPR DMRS for PUSCH with transform precoding & \pi/2 BPSK
    lowPAPR-DMRS-PUSCHwithPrecoding-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-7: Extension of the maximum number of configured aperiodic CSI report settings
    csi-ReportFrameworkExt-r16 CSI-ReportFrameworkExt-r16 OPTIONAL,
    -- R1 16-3a, 16-3a-1, 16-3b, 16-3b-1, 16-8: Individual new codebook types
    codebookParametersAddition-r16 CodebookParametersAddition-r16 OPTIONAL,
    -- R1 16-8: Mixed codebook types
    codebookComboParametersAddition-r16 CodebookComboParametersAddition-r16 OPTIONAL
-- R4 8-2: SSB based beam correspondence
beamCorrespondenceSSB-based-r16 ENUMERATED {supported} OPTIONAL,
-- R4 8-3: CSI-RS based beam correspondence
beamCorrespondenceCSI-RS-based-r16 ENUMERATED {supported} OPTIONAL,
beamSwitchTiming-r16 SEQUENCE {
  scs-60kHz-r16 ENUMERATED {sym224, sym336} OPTIONAL,
  scs-120kHz-r16 ENUMERATED {sym224, sym336} OPTIONAL
}

-- R1 16-la-4: Semi-persistent L1-SINR report on PUCCH
semi-PersistentL1-SINR-Report-PUCCH-r16 SEQUENCE {
  supportReportFormat1-2OFDM-syms-r16 ENUMERATED {supported} OPTIONAL,
  supportReportFormat4-14OFDM-syms-r16 ENUMERATED {supported} OPTIONAL
}

-- R1 16-la-5: Semi-persistent L1-SINR report on PUSCH
semi-PersistentL1-SINR-Report-PUSCH-r16 ENUMERATED {supported} OPTIONAL

DummyG ::= SEQUENCE {
  maxNumberSSB-CSI-RS-ResourceOneTx ENUMERATED {n8, n16, n32, n64},
  maxNumberSSB-CSI-RS-ResourceTwoTx ENUMERATED {n0, n4, n8, n16, n32, n64},
  supportedCSI-RS-Density ENUMERATED {one, three, oneAndThree}
}

BeamManagementSSB-CSI-RS ::= SEQUENCE {
  maxNumberSSB-CSI-RS-ResourceOneTx ENUMERATED {n0, n8, n16, n32, n64},
  maxNumberCSI-RS-Resource ENUMERATED {n0, n4, n8, n16, n32, n64},
  maxNumberCSI-RS-ResourceTwoTx ENUMERATED {n0, n4, n8, n16, n32, n64},
  supportedCSI-RS-Density ENUMERATED {one, three, oneAndThree} OPTIONAL,
  maxNumberAperiodicCSI-RS-Resource ENUMERATED {n0, n1, n4, n8, n16, n32, n64}
}

DummyH ::= SEQUENCE {
  burstLength INTEGER (1..2),
  maxSimultaneousResourceSetsPerCC INTEGER (1..8),
  maxConfiguredResourceSetsPerCC INTEGER (1..64),
  maxConfiguredResourceSetsAllCC INTEGER (1..128)
}

CSI-RS-ForTracking ::= SEQUENCE {
  maxBurstLength INTEGER (1..2),
  maxSimultaneousResourceSetsPerCC INTEGER (1..8),
  maxConfiguredResourceSetsPerCC INTEGER (1..64),
  maxConfiguredResourceSetsAllCC INTEGER (1..256)
}

CSI-RS-IM-ReceptionForFeedback ::= SEQUENCE {
  maxConfigNumberNZP-CSI-RS-PerCC INTEGER (1..64),
  maxConfigNumberPortsAcrossNZP-CSI-RS-PerCC INTEGER (2..256),
  maxConfigNumberCSI-IM-PerCC ENUMERATED {n1, n2, n4, n8, n16, n32},
  maxNumberSimultaneousNZP-CSI-RS-PerCC INTEGER (1..64),
  totalNumberPortsSimultaneousNZP-CSI-RS-PerCC INTEGER (2..256)
}
CSI-RS-ProcFrameworkForSRS ::=  
   SEQUENCE {
      maxNumberPeriodicSRS-AssocCSI-RS-PerBWP INTEGER (1..4),
      maxNumberAperiodicSRS-AssocCSI-RS-PerBWP INTEGER (1..4),
      maxNumberSP-SRS-AssocCSI-RS-PerBWP INTEGER (0..4),
      simultaneousSRS-AssocCSI-RS-PerCC INTEGER (1..8)
   }

CSI-ReportFramework ::=  
   SEQUENCE {
      maxNumberPeriodicCSI-PerBWP-ForCSI-Report INTEGER (1..4),
      maxNumberAperiodicCSI-PerBWP-ForCSI-Report INTEGER (1..4),
      maxNumberSemiPersistentCSI-PerBWP-ForCSI-Report INTEGER (0..4),
      maxNumberPeriodicCSI-PerBWP-ForBeamReport INTEGER (1..4),
      maxNumberAperiodicCSI-PerBWP-ForBeamReport INTEGER (1..4),
      maxNumberAperiodicCSI-configurationStatePerCC ENUMERATED {n3, n7, n15, n31, n63, n128},
      maxNumberSemiPersistentCSI-PerBWP-ForBeamReport INTEGER (0..4),
      simultaneousCSI-ReportsPerCC INTEGER (1..8)
   }

CSI-ReportFrameworkExt-r16 ::=  
   SEQUENCE {
      maxNumberAperiodicCSI-PerBWP-ForCSI-ReportExt-r16 INTEGER (5..8)
   }

PTRS-DensityRecommendationDL ::=    
   SEQUENCE {
      frequencyDensity1 INTEGER (1..276),
      frequencyDensity2 INTEGER (1..276),
      timeDensity1 INTEGER (0..29),
      timeDensity2 INTEGER (0..29),
      timeDensity3 INTEGER (0..29)
   }

PTRS-DensityRecommendationUL ::=    
   SEQUENCE {
      frequencyDensity1 INTEGER (1..276),
      frequencyDensity2 INTEGER (1..276),
      timeDensity1 INTEGER (0..29),
      timeDensity2 INTEGER (0..29),
      timeDensity3 INTEGER (0..29),
      sampleDensity1 INTEGER (1..276),
      sampleDensity2 INTEGER (1..276),
      sampleDensity3 INTEGER (1..276),
      sampleDensity4 INTEGER (1..276),
      sampleDensity5 INTEGER (1..276)
   }

SpatialRelations ::=  
   SEQUENCE {
      maxNumberConfiguredSpatialRelations ENUMERATED {n4, n8, n16, n32, n64, n96},
      maxNumberActiveSpatialRelations ENUMERATED {n1, n2, n4, n8, n14},
      additionalActiveSpatialRelationPUCCH ENUMERATED {supported} OPTIONAL,
      maxNumberDL-RS-QCL-TypeD ENUMERATED {n1, n2, n4, n8, n14}
   }

DummyI ::=  
   SEQUENCE {
      supportedSRS-TxPortSwitch ENUMERATED {t1r2, t1r4, t2r4, t1r4-t2r4, tr-equal},
   }

ETSI-ParametersPerBand field description

**ModulationOrder**

The IE *ModulationOrder* is used to convey the maximum supported modulation order.

**ModulationOrder** information element

-- ASN1START
-- TAG-MODULATIONORDER-START

ModulationOrder ::= ENUMERATED {bpsk-halfpi, bpsk, qpsk, qam16, qam64, qam256}

-- TAG-MODULATIONORDER-STOP
-- ASN1STOP

**MRDC-Parameters**

The IE *MRDC-Parameters* contains the band combination parameters specific to MR-DC for a given MR-DC band combination.

**MRDC-Parameters** information element

-- ASN1START
-- TAG-MRDC-PARAMETERS-START

MRDC-Parameters ::= SEQUENCE {
    singleUL-Transmission ENUMERATED {supported} OPTIONAL,
    dynamicPowerSharingENDC ENUMERATED {supported} OPTIONAL,
    tdm-Pattern ENUMERATED {supported} OPTIONAL,
    ul-SharingEUTRA-NR ENUMERATED {tdm, fdm, both} OPTIONAL,
    ul-SwitchingTimeEUTRA-NR ENUMERATED {type1, type2} OPTIONAL,
    simultaneousRxTxInterBandENDC ENUMERATED {supported} OPTIONAL,
    asyncIntraBandENDC ENUMERATED {supported} OPTIONAL,
}
MRDC-Parameters-v1580 ::= SEQUENCE {
  dynamicPowerSharingNEDC ENUMERATED {supported} OPTIONAL}

MRDC-Parameters-v1590 ::= SEQUENCE {
  interBandContiguousMRDC ENUMERATED {supported} OPTIONAL}

MRDC-Parameters-v1620 ::= SEQUENCE {
  maxUplinkDutyCycle-interBandENDC-TDD-PC2-r16 SEQUENCE{
    eutra-TDD-Config0-r16 ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100} OPTIONAL,
    eutra-TDD-Config1-r16 ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100} OPTIONAL,
    eutra-TDD-Config2-r16 ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100} OPTIONAL,
    eutra-TDD-Config3-r16 ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100} OPTIONAL,
    eutra-TDD-Config4-r16 ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100} OPTIONAL,
    eutra-TDD-Config5-r16 ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100} OPTIONAL,
    eutra-TDD-Config6-r16 ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100} OPTIONAL
  },
  -- R1 18-2 Single UL TX operation for TDD PCell in EN-DC
tdm-restrictionTDD-endc-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 18-2a Single UL TX operation for FDD PCell in EN-DC
tdm-restrictionFDD-endc-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 18-2b Support of HARQ-offset for SUO case1 in EN-DC with LTE TDD PCell for type 1 UE
  singleUL-HARQ-offsetTDD-PCell-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 18-3 Dual Tx transmission for EN-DC with FDD PCell (TDM pattern for dual Tx UE)
tdm-restrictionDualTX-FDD-endc-r16 ENUMERATED {supported} OPTIONAL}

MRDC-Parameters-v1630 ::= SEQUENCE {
  -- R4 2-20 Maximum uplink duty cycle for FDD+TDD EN-DC power class 2
  maxUplinkDutyCycle-interBandENDC-FDD-TDD-PC2-r16 SEQUENCE{
    maxUplinkDutyCycle-FDD-TDD-EN-DC1-r16 ENUMERATED {n30, n40, n50, n60, n70, n80, n90, n100} OPTIONAL,
    maxUplinkDutyCycle-FDD-TDD-EN-DC2-r16 ENUMERATED {n30, n40, n50, n60, n70, n80, n90, n100} OPTIONAL
  },
  -- R4 2-19 FDD-FDD or TDD-TDD inter-band MR-DC with overlapping or partially overlapping DL spectrum
  interBandMRDC-WithOverlapDL-Bands--r16 ENUMERATED {supported} OPTIONAL
}

-- TAG-MRDC-PARAMETERS-STOP
-- ASN1STOP
NRDC-Parameters

The IE NRDC-Parameters contains parameters specific to NR-DC, i.e., which are not applicable to NR SA.

NRDC-Parameters information element

OLPC-SRS-Pos

The IE OLPC-SRS-Pos is used to convey OLPC SRS positioning related parameters specific for a certain band.

OLPC-SRS-Pos information element
PDPC-Parameters

The IE *PDPC-Parameters* is used to convey capabilities related to PDPC.

**PDPC-Parameters information element**

```asn1
PDPC-Parameters ::= SEQUENCE {
  supportedROHC-Profiles      SEQUENCE {
    profile0x0000               BOOLEAN,
    profile0x0001               BOOLEAN,
    profile0x0002               BOOLEAN,
    profile0x0003               BOOLEAN,
    profile0x0004               BOOLEAN,
    profile0x0006               BOOLEAN,
    profile0x0101               BOOLEAN,
    profile0x0102               BOOLEAN,
    profile0x0103               BOOLEAN,
    profile0x0104               BOOLEAN
  },
  maxNumberROHC-ContextSessions       ENUMERATED {cs2, cs4, cs8, cs12, cs16, cs24, cs32, cs48, cs64,  
                                          cs128, cs256, cs512, cs1024, cs16384, spare2, spare1},
  uplinkOnlyROHC-Profiles             ENUMERATED {supported}      OPTIONAL,
  continueROHC-Context                ENUMERATED {supported}      OPTIONAL,
  outOfOrderDelivery                  ENUMERATED {supported}      OPTIONAL,
  shortSN                             ENUMERATED {supported}      OPTIONAL,
  pdcp-DuplicationSRB                 ENUMERATED {supported}      OPTIONAL,
  pdcp-DuplicationMCG-OrSCG-DRB       ENUMERATED {supported}      OPTIONAL,
  ...,
  [drb-IAB-r16                         ENUMERATED {supported}      OPTIONAL},
  non-DRB-IAB-r16                     ENUMERATED {supported}      OPTIONAL,
  extendedDiscardTimer-r16            ENUMERATED {supported}      OPTIONAL,
  continueEHC-Context-r16             ENUMERATED {supported}      OPTIONAL,
  ehc-r16                            ENUMERATED {supported}      OPTIONAL,
  maxNumberEHC-Contexts-r16           ENUMERATED {cs2, cs4, cs8, cs16, cs32, cs64, cs128, cs256, cs512,  
                                          cs1024, cs2048, cs4096, cs8192, cs16384, cs32768, cs65536}    OPTIONAL,
  jointEHC-ROHC-Config-r16            ENUMERATED {supported}      OPTIONAL,
  pdcp-DuplicationMoreThanTwoRLC-r16  ENUMERATED {supported}      OPTIONAL
}
```

-- TAG-PDCP-PARAMETERS-STOP
The **IE PDCP-ParametersMRDC** is used to convey PDCP related capabilities for MR-DC.

**PDCP-ParametersMRDC information element**

```
-- ASN1START
-- TAG-PDCP-PARAMETERSMRDC-START
PDCP-ParametersMRDC ::=                 SEQUENCE {
  pdcp-DuplicationSplitSRB                ENUMERATED {supported}      OPTIONAL,
  pdcp-DuplicationSplitDRB                ENUMERATED {supported}      OPTIONAL
}
PDCP-ParametersMRDC-v1610 ::= SEQUENCE {
  scg-DRB-NR-IAB-r16                  ENUMERATED {supported}          OPTIONAL
}
-- TAG-PDCP-PARAMETERSMRDC-STOP
-- ASN1STOP
```

The **IE Phy-Parameters** is used to convey the physical layer capabilities.

**Phy-Parameters information element**

```
-- ASN1START
-- TAG-PHY-PARAMETERS-START
Phy-Parameters ::=                  SEQUENCE {
  phy-ParametersCommon                Phy-ParametersCommon                        OPTIONAL,
  phy-ParametersXDD-Diff              Phy-ParametersXDD-Diff                      OPTIONAL,
  phy-ParametersFRX-Diff              Phy-ParametersFRX-Diff                      OPTIONAL,
  phy-ParametersFR1                   Phy-ParametersFR1                           OPTIONAL,
  phy-ParametersFR2                   Phy-ParametersFR2                           OPTIONAL
}
Phy-ParametersCommon ::=            SEQUENCE {
  csi-RS-CFRA-ForHO                 ENUMERATED {supported}                      OPTIONAL,
  dynamicPRB-BundlingDL             ENUMERATED {supported}                      OPTIONAL,
  sp-CSI-ReportPUCCH               ENUMERATED {supported}                      OPTIONAL,
  sp-CSI-ReportPUSCH               ENUMERATED {supported}                      OPTIONAL,
  nzp-CSI-RS-IntefMgmt             ENUMERATED {supported}                      OPTIONAL,
  type2-SP-CSI-Feedback-LongPUCCH  ENUMERATED {supported}                      OPTIONAL,
  precoderGranularityCORESET       ENUMERATED {supported}                      OPTIONAL,
}
3GPP TS 38.331 version 16.3.1 Release 16

705

ETSI TS 138 331 V16.3.1 (2021-01)

dynamicHARQ-ACK-Codebook ENUMERATED {supported} OPTIONAL,
semiStaticHARQ-ACK-Codebook ENUMERATED {supported} OPTIONAL,
spatialBundlingHARQ-ACK ENUMERATED {supported} OPTIONAL,
dynamicBetaOffsetInd-HARQ-ACK-CSI ENUMERATED {supported} OPTIONAL,
pusch-Repetition-F1-3-4 ENUMERATED {supported} OPTIONAL,
ra-Type0-PUSCH ENUMERATED {supported} OPTIONAL,
dynamicSwitchRA-Type0-1-PDSCH ENUMERATED {supported} OPTIONAL,
dynamicSwitchRA-Type0-1-PUSCH ENUMERATED {supported} OPTIONAL,
pdsch-MappingTypeA ENUMERATED {supported} OPTIONAL,
pdsch-MappingTypeB ENUMERATED {supported} OPTIONAL,
interleavingVBR-ToPRB-PDSCH ENUMERATED {supported} OPTIONAL,
interSlotFreqHopping-PUSCH ENUMERATED {supported} OPTIONAL,
type1-PUSCH-RepetitionMultiSlots ENUMERATED {supported} OPTIONAL,
type2-PUSCH-RepetitionMultiSlots ENUMERATED {supported} OPTIONAL,
pusch-RepetitionMultiSlots ENUMERATED {supported} OPTIONAL,
pdsch-RepetitionMultiSlots ENUMERATED {supported} OPTIONAL,
downlinkSPS ENUMERATED {supported} OPTIONAL,
configuredUL-GrantType1 ENUMERATED {supported} OPTIONAL,
configuredUL-GrantType2 ENUMERATED {supported} OPTIONAL,
pre-EmptIndication-DL ENUMERATED {supported} OPTIONAL,
cbg-TransIndication-DL ENUMERATED {supported} OPTIONAL,
cbg-TransIndication-UL ENUMERATED {supported} OPTIONAL,
cbg-FlushIndication-DL ENUMERATED {supported} OPTIONAL,
dynamicHARQ-ACK-CodeBG-Retx-DL ENUMERATED {supported} OPTIONAL,
rateMatchingResrcSetSemi-Static ENUMERATED {supported} OPTIONAL,
rateMatchingResrcSetDynamic ENUMERATED {supported} OPTIONAL,
spCellPlacement CarrierAggregationVariant OPTIONAL,
-- R1 9-1: Basic channel structure and procedure of 2-step RACH
twoStepRACH-r16 ENUMERATED {supported} OPTIONAL,
-- R1 11-1: Monitoring DCI format 1_2 and DCI format 0_2
dci-Format1-2And0-2-r16 ENUMERATED {supported} OPTIONAL,
-- R1 11-1a: Monitoring both DCI format 0_1/1_1 and DCI format 0_2/1_2 in the same search space
monitoringDCI-SameSearchSpace-r16 ENUMERATED {supported} OPTIONAL,
-- R1 11-10: Type 2 configured grant release by DCI format 0_1
type2-CG-ReleaseDCI-0-1-r16 ENUMERATED {supported} OPTIONAL,
-- R1 11-11: Type 2 configured grant release by DCI format 0_2
type2-CG-ReleaseDCI-0-2-r16 ENUMERATED {supported} OPTIONAL,
-- R1 12-3: SPS release by DCI format 1_1
sps-ReleaseDCI-1-1-r16 ENUMERATED {supported} OPTIONAL,
-- R1 12-3a: SPS release by DCI format 1_2
sps-ReleaseDCI-1-2-r16 ENUMERATED {supported} OPTIONAL,

...,
**ETSI TS 38.331 Version 16.3.1**

---

**CSI trigger states containing non-active BWP**

csi-TriggerStateNon-ActiveBWP-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-5a: Support semi-static configuration/indication of UL-Flexible-DL slot formats for IAB-MT resources  
ul-flexibleDL-SlotFormatSemiStatic-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-5b: Support dynamic indication of UL-Flexible-DL slot formats for IAB-MT resources  
ul-flexibleDL-SlotFormatDynamics-IAB-r16 ENUMERATED {supported} OPTIONAL,  
dft-S-OFDM-WaveformUL-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-6: Support DCI Format 2_5 based indication of soft resource availability to an IAB node  
dci-25-AI-RNTI-Support-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-7: Support _T_delta reception.  
t-DeltaReceptionSupport-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 18-8 HARQ-ACK codebook type and spatial bundling per PUCCH group  
harqACK-Cb-SpatialBundlingPUCCH-Group-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 19-2: Cross Slot Scheduling  
crossSlotScheduling-r16 SEQUENCE {  
  non-SharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
  sharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
} OPTIONAL,  
maxNumberSRS-PosPathLossEstimateAllServingCells-r16 ENUMERATED {n1, n4, n8, n16} OPTIONAL,  
extendedCG-Periodicities-r16 ENUMERATED {supported} OPTIONAL,  
extendedSPS-Periodicities-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 11-6: PUSCH repetition Type A  
pusch-RepetitionTypeA-r16 SEQUENCE {  
  non-SharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
  sharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
} OPTIONAL,  
-- R1 11-4b: UL priority indication in DCI with mixed DCI formats  
dci-UL-PriorityIndicator-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 16-1e: Maximum number of configured pathloss reference RSs for PUSCH/PUCCH/SRS by RRC for MAC-CE based pathloss reference RS update  
maxNumberPathlossRS-Update-r16 ENUMERATED {n4, n8, n16, n32, n64} OPTIONAL,  
-- R1 14-8: CSI trigger states containing non-active BWP  
csi-TriggerStateNon-ActiveBWP-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-5a: Support semi-static configuration/indication of UL-Flexible-DL slot formats for IAB-MT resources  
ul-flexibleDL-SlotFormatSemiStatic-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-5b: Support dynamic indication of UL-Flexible-DL slot formats for IAB-MT resources  
ul-flexibleDL-SlotFormatDynamics-IAB-r16 ENUMERATED {supported} OPTIONAL,  
dft-S-OFDM-WaveformUL-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-6: Support DCI Format 2_5 based indication of soft resource availability to an IAB node  
dci-25-AI-RNTI-Support-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-7: Support _T_delta reception.  
t-DeltaReceptionSupport-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 18-8 HARQ-ACK codebook type and spatial bundling per PUCCH group  
harqACK-Cb-SpatialBundlingPUCCH-Group-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 19-2: Cross Slot Scheduling  
crossSlotScheduling-r16 SEQUENCE {  
  non-SharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
  sharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
} OPTIONAL,  
maxNumberSRS-PosPathLossEstimateAllServingCells-r16 ENUMERATED {n1, n4, n8, n16} OPTIONAL,  
extendedCG-Periodicities-r16 ENUMERATED {supported} OPTIONAL,  
extendedSPS-Periodicities-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 11-6: PUSCH repetition Type A  
pusch-RepetitionTypeA-r16 SEQUENCE {  
  non-SharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
  sharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
} OPTIONAL,  
-- R1 11-4b: UL priority indication in DCI with mixed DCI formats  
dci-UL-PriorityIndicator-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 16-1e: Maximum number of configured pathloss reference RSs for PUSCH/PUCCH/SRS by RRC for MAC-CE based pathloss reference RS update  
maxNumberPathlossRS-Update-r16 ENUMERATED {n4, n8, n16, n32, n64} OPTIONAL,  
-- R1 18-9: Usage of the PDSCH starting time for HARQ-ACK type 2 codebook  
type2-HARQ-ACK-Codebook-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 16-1g-1: Resources for beam management, pathloss measurement, BFD, RLM and new beam identification across frequency ranges  
maxTotalResourcesForAcrossFreqRanges-r16 SEQUENCE {  
  maxNumberResWithinSlotAcrossCC-AcrossFR-r16 ENUMERATED {n2, n4, n8, n12, n16, n32, n64, n128} OPTIONAL,  
  maxNumberResAcrossCC-AcrossFR-r16 ENUMERATED {n2, n4, n8, n12, n16, n32, n64, n128} OPTIONAL,  
} OPTIONAL,  
-- R1 11-4b: HARQ-ACK for multi-DCI based multi-TRP – separate  
harqACK-separateMultiDCI-MultiTRP-r16 SEQUENCE {  
  maxNumberOfLongPUCCHs-r16 ENUMERATED {longAndLong, longAndShort, shortAndShort} OPTIONAL,  
} OPTIONAL,  
-- R1 16-2a-4: HARQ-ACK for multi-DCI based multi-TRP – joint  
harqACK-MultiDCI-MultiTRP-r16 SEQUENCE {  
  maxNumberOfLongPUCCHs-r16 ENUMERATED {longAndLong, longAndShort, shortAndShort} OPTIONAL,  
} OPTIONAL,  
-- R1 14-8: CSI trigger states containing non-active BWP  
csi-TriggerStateNon-ActiveBWP-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-5a: Support semi-static configuration/indication of UL-Flexible-DL slot formats for IAB-MT resources  
ul-flexibleDL-SlotFormatSemiStatic-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-5b: Support dynamic indication of UL-Flexible-DL slot formats for IAB-MT resources  
ul-flexibleDL-SlotFormatDynamics-IAB-r16 ENUMERATED {supported} OPTIONAL,  
dft-S-OFDM-WaveformUL-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-6: Support DCI Format 2_5 based indication of soft resource availability to an IAB node  
dci-25-AI-RNTI-Support-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 20-7: Support _T_delta reception.  
t-DeltaReceptionSupport-IAB-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 18-8 HARQ-ACK codebook type and spatial bundling per PUCCH group  
harqACK-Cb-SpatialBundlingPUCCH-Group-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 19-2: Cross Slot Scheduling  
crossSlotScheduling-r16 SEQUENCE {  
  non-SharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
  sharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
} OPTIONAL,  
maxNumberSRS-PosPathLossEstimateAllServingCells-r16 ENUMERATED {n1, n4, n8, n16} OPTIONAL,  
extendedCG-Periodicities-r16 ENUMERATED {supported} OPTIONAL,  
extendedSPS-Periodicities-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 11-6: PUSCH repetition Type A  
pusch-RepetitionTypeA-r16 SEQUENCE {  
  non-SharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
  sharedSpectrumChAccess-r16 ENUMERATED {supported} OPTIONAL,  
} OPTIONAL,  
-- R1 11-4b: UL priority indication in DCI with mixed DCI formats  
dci-UL-PriorityIndicator-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 16-1e: Maximum number of configured pathloss reference RSs for PUSCH/PUCCH/SRS by RRC for MAC-CE based pathloss reference RS update  
maxNumberPathlossRS-Update-r16 ENUMERATED {n4, n8, n16, n32, n64} OPTIONAL,  
-- R1 18-9: Usage of the PDSCH starting time for HARQ-ACK type 2 codebook  
type2-HARQ-ACK-Codebook-r16 ENUMERATED {supported} OPTIONAL,  
-- R1 16-1g-1: Resources for beam management, pathloss measurement, BFD, RLM and new beam identification across frequency ranges  
maxTotalResourcesForAcrossFreqRanges-r16 SEQUENCE {  
  maxNumberResWithinSlotAcrossCC-AcrossFR-r16 ENUMERATED {n2, n4, n8, n12, n16, n32, n64, n128} OPTIONAL,  
  maxNumberResAcrossCC-AcrossFR-r16 ENUMERATED {n2, n4, n8, n12, n16, n32, n40, n48, n64, n72, n80, n96, n128, n256} OPTIONAL,  
} OPTIONAL,  
-- R1 16-2a-4: HARQ-ACK for multi-DCI based multi-TRP – separate  
harqACK-separateMultiDCI-MultiTRP-r16 SEQUENCE {  
  maxNumberOfLongPUCCHs-r16 ENUMERATED {longAndLong, longAndShort, shortAndShort} OPTIONAL,  
} OPTIONAL,  
-- R1 16-2a-4: HARQ-ACK for multi-DCI based multi-TRP – joint  

Phy-ParametersXDD-Diff ::= SEQUENCE {
    dynamicSFI                          ENUMERATED {supported}                      OPTIONAL,
    twoPUCCH-F0-2-ConsecSymbols         ENUMERATED {supported}                      OPTIONAL,
    twoDifferentTPC-Loop-PUSCH          ENUMERATED {supported}                      OPTIONAL,
    twoDifferentTPC-Loop-PUCCH          ENUMERATED {supported}                      OPTIONAL,
    ...,
    dl-SchedulingOffset-PDSCH-TypeA     ENUMERATED {supported}                      OPTIONAL,
    dl-SchedulingOffset-PDSCH-TypeB     ENUMERATED {supported}                      OPTIONAL,
    ul-SchedulingOffset                 ENUMERATED {supported}                      OPTIONAL
}

Phy-ParametersFRX-Diff ::= SEQUENCE {
    dynamicSFI                                  ENUMERATED {supported}                      OPTIONAL,
    dummy1                                      BIT STRING (SIZE (2))                       OPTIONAL,
    twoFL-DMRS                                  BIT STRING (SIZE (2))                       OPTIONAL,
    dummy2                                      BIT STRING (SIZE (2))                       OPTIONAL,
    dummy3                                      BIT STRING (SIZE (2))                       OPTIONAL,
    supportedDMRS-TypeDL                        ENUMERATED {type1, type1And2}               OPTIONAL,
    supportedDMRS-TypeUL                        ENUMERATED {type1, type1And2}               OPTIONAL,
    semiOpenLoopCSI                             ENUMERATED {supported}                      OPTIONAL,
    csi-ReportWithoutPMI                        ENUMERATED {supported}                      OPTIONAL,
    csi-ReportWithoutCQI                        ENUMERATED {supported}                      OPTIONAL,
    onePortsPTRS                                BIT STRING (SIZE (2))                       OPTIONAL,
    twoPUCCH-F0-2-ConsecSymbols                 ENUMERATED {supported}                      OPTIONAL,
    pucch-F2-WithFH                             ENUMERATED {supported}                      OPTIONAL,
    pucch-F3-WithFH                             ENUMERATED {supported}                      OPTIONAL,
    pucch-F4-WithFH                             ENUMERATED {supported}                      OPTIONAL,
    pucch-F0-2WithoutFH                         ENUMERATED {notSupported}                   OPTIONAL,
    pucch-F1-3-4WithoutFH                       ENUMERATED {notSupported}                   OPTIONAL,
    mux-SR-HARQ-ACK-CSI-PUCCH-MultiPerSlot      ENUMERATED {supported}                      OPTIONAL,
    uci-CodeBlockSegmentation                   ENUMERATED {supported}                      OPTIONAL,
    onePUCCH-LongAndShortFormat                ENUMERATED {supported}                      OPTIONAL,
    twoPUCCH-AnyOthersInSlot                   ENUMERATED {supported}                      OPTIONAL,
    intraSlotFreqHopping-PUSCH                 ENUMERATED {supported}                      OPTIONAL,
    pusch-LBRM                                  ENUMERATED {supported}                      OPTIONAL,
    pdcch-BlindDetectionCA                     INTEGER (4..16)                             OPTIONAL,
    tpc-PUSCH-RNTI                             ENUMERATED {supported}                      OPTIONAL,
tpc-PUCCH-RNTI ENUMERATED {supported} OPTIONAL,

tpc-SRS-RNTI ENUMERATED {supported} OPTIONAL,

absoluteTPC-Command ENUMERATED {supported} OPTIONAL,

twoDifferentTPC-Loop-PUSCH ENUMERATED {supported} OPTIONAL,

twoDifferentTPC-Loop-PUCCH ENUMERATED {supported} OPTIONAL,

pucch-HalfP1-BPSK ENUMERATED {supported} OPTIONAL,

almostContiguousCP-OFDM-UL ENUMERATED {supported} OPTIONAL,

sp-C SI-IM ENUMERATED {supported} OPTIONAL,

tdd-MultiDL-UL-SwitchPerSlot ENUMERATED {supported} OPTIONAL,

mul tipleCORESET ENUMERATED {supported} OPTIONAL,

...,

[[
    csi-RS-IM-ReceptionForFeedback CSI-RS-IM-ReceptionForFeedback OPTIONAL,
    csi-RS-ProcFrameworkForSRS CSI-RS-ProcFrameworkForSRS OPTIONAL,
    csi-ReportFramework CSI-ReportFramework OPTIONAL,

    mux-SR-HARQ-ACK-C SI-PUCCH-On c ePerSlot]
        sameSymbol ENUMERATED {supported} OPTIONAL,
        diffSymbol ENUMERATED {supported} OPTIONAL
    }

mux-SR-HARQ-ACK-PUCCH ENUMERATED {supported} OPTIONAL,

mux-MultipleGroupCtrlCH-Overlap ENUMERATED {supported} OPTIONAL,

dl-SchedulingOffset-PDSCH-TypeA ENUMERATED {supported} OPTIONAL,

dl-SchedulingOffset-PDSCH-TypeB ENUMERATED {supported} OPTIONAL,

ul-Schedulingoffset ENUMERATED {supported} OPTIONAL,

dl-64QAM-MCS-TableAlt ENUMERATED {supported} OPTIONAL,

ul-64QAM-MCS-TableAlt ENUMERATED {supported} OPTIONAL,

cqi-TableAlt ENUMERATED {supported} OPTIONAL,

oneFL-DMRS-TwoAdditionalDMRS-UL ENUMERATED {supported} OPTIONAL,

twoFL-DMRS-TwoAdditionalDMRS-UL ENUMERATED {supported} OPTIONAL,

mul tipleCORESET ENUMERATED {supported} OPTIONAL,

[[
    pdcch-BlindDetectionNRDC SEQUENCE {
        pdcch-BlindDetectionMCG-UE INTEGER (1..15),
        pdcch-BlindDetectionMCG-UE INTEGER (1..15)
    }

    mux-HARQ-ACK-PUSCH-DiffSymbol ENUMERATED {supported} OPTIONAL,

    }

    ]]

-- R1 11-1b: Type 1 HARQ-ACK codebook support for relative TDRA for DL

type1-HARQ-ACK-Codebook-r16 ENUMERATED {supported} OPTIONAL,

-- R1 11-8: Enhanced UL power control scheme

enhancedPowerControl-r16 ENUMERATED {supported} OPTIONAL,

-- R1 16-1b-1: TCI state activation across multiple CCs

simultaneousTCI-ActMultipleCC-r16 ENUMERATED {supported} OPTIONAL,

-- R1 16-1b-2: Spatial relation update across multiple CCs

simultaneousSpatialRelationMultipleCC-r16 ENUMERATED {supported} OPTIONAL,

cli-RSSI-FDM-DL-r16 ENUMERATED {supported} OPTIONAL,

cli-SRS-RSRP-FDM-DL-r16 ENUMERATED {supported} OPTIONAL,

-- R1 19-3: Maximum MIMO Layer Adaptation

maxLayersMIMO-Adaptation-r16 ENUMERATED {supported} OPTIONAL,

-- R1 12-5: Configuration of aggregation factor per SPS configuration

ETS I
aggregationFactorSPS-DL-r16 ENUMERATED {supported} OPTIONAL,
-- R1 16-1g: Resources for beam management, pathloss measurement, BFD, RLM and new beam identification
maxTotalResourcesForOneFreqRange-r16 SEQUENCE {
  maxNumberResWithinSlotAcrossCC-OneFR-r16 ENUMERATED {n2, n4, n8, n12, n16, n32, n64, n128} OPTIONAL,
  maxNumberResAcrossCC-OneFR-r16 ENUMERATED {n2, n4, n8, n12, n16, n32, n40, n48, n64, n72, n80, n96, n128, n256}
} OPTIONAL,
-- R1 16-7: Extension of the maximum number of configured aperiodic CSI report settings
csi-ReportFrameworkExt-r16 ENUMERATED {supported} OPTIONAL,
[
  twoTCI-Act-servingCellInCC-List-r16 ENUMERATED {supported} OPTIONAL
]
}

Phy-ParametersFR1 ::= SEQUENCE {
  pdcch-MonitoringSingleOccasion ENUMERATED {supported} OPTIONAL,
  scs-60kHz ENUMERATED {supported} OPTIONAL,
  pdsch-256QAM-FR1 ENUMERATED {supported} OPTIONAL,
  pdsch-RE-MappingFR1-PerSymbol ENUMERATED {n10, n20} OPTIONAL,
  ...
  pdsch-RE-MappingFR1-PerSlot ENUMERATED {n16, n32, n48, n64, n80, n96, n112, n128, n144, n160, n176, n192, n208, n224, n240, n256} OPTIONAL
}

Phy-ParametersFR2 ::= SEQUENCE {
  dummy ENUMERATED {supported} OPTIONAL,
  pdsch-RE-MappingFR2-PerSymbol ENUMERATED {n6, n20} OPTIONAL,
  ...
  pCell-FR2 ENUMERATED {supported} OPTIONAL,
  pdsch-RE-MappingFR2-PerSlot ENUMERATED {n16, n32, n48, n64, n80, n96, n112, n128, n144, n160, n176, n192, n208, n224, n240, n256} OPTIONAL
},
[
  -- R1 16-1c: Support of default spatial relation and pathloss reference RS for dedicated-PUCCH/SRS and PUSCH
  defaultSpatialRelationPathlossRS-r16 ENUMERATED {supported} OPTIONAL,
  -- R1 16-1d: Support of spatial relation update for AP-SRS via MAC CE
  spatialRelationUpdateAP-SRS-r16 ENUMERATED {supported} OPTIONAL,
  maxNumberSRS-PosSpatialRelationsAllServingCells-r16 ENUMERATED {n0, n1, n2, n4, n8, n16} OPTIONAL
]
}

-- TAG-PHY-PARAMETERS-STOP
-- ASN1STOP
Phy-ParametersFRX-Diff field description


These fields are optionally present in fr1-fr2-Add-UE-NR-Capabilities in UE-NR-Capability. They shall not be set in any other instance of the IE Phy-ParametersFRX-Diff. If the network configures the UE with serving cells on both FR1 and FR2 bands, these parameters, if present, limit the corresponding parameters in MIMO-ParametersPerBand.

Phy-ParametersMRDC

The IE Phy-ParametersMRDC is used to convey physical layer capabilities for MR-DC.

Phy-ParametersMRDC information element

-- ASN1START
-- TAG-PHY-PARAMETERSMRDC-START

Phy-ParametersMRDC ::= SEQUENCE {  naics-Capability-List               SEQUENCE (SIZE (1..maxNrofNAICS-Entries)) OF NAICS-Capability-Entry OPTIONAL,  ...,  [[  spCellPlacement                     CarrierAggregationVariant OPTIONAL  ]],  ]]

-- R1 18-3b: Semi-statically configured LTE UL transmissions in all UL subframes not limited to tdm-pattern in case of TOD PCell  tdd-PCellUL-TX-AllUL-Subframe-r16   ENUMERATED {supported} OPTIONAL,  -- R1 18-3a: Semi-statically configured LTE UL transmissions in all UL subframes not limited to tdm-pattern in case of FDD PCell  fdd-PCellUL-TX-AllUL-Subframe-r16   ENUMERATED {supported} OPTIONAL  ]]

NAICS-Capability-Entry ::= SEQUENCE {  numberOfNAICS-CapableCC             INTEGER (1..5),  numberOfAggregatedPRB               ENUMERATED {n50, n75, n100, n125, n150, n175, n200, n225, n250, n275, n300, n350, n400, n450, n500, spare},  ...  }

-- TAG-PHY-PARAMETERSMRDC-STOP
-- ASN1STOP

PHY-ParametersMRDC field descriptions

-- naics-Capability-List
Indicates that UE in MR-DC supports NAICS as defined in TS 36.331 [10].

PowSav-Parameters

The IE PowSav-Parameters is used to convey the capabilities supported by the UE for the power saving preferences.
PowSav-Parameters information element

```asn1
-- ASN1START
-- TAG-POWSAV-PARAMETERS-START
PowSav-Parameters-r16 ::= SEQUENCE {
  PowSav-ParametersCommon-r16   PowSav-ParametersCommon-r16                    OPTIONAL,
  PowSav-ParametersFRX-Diff-r16 PowSav-ParametersFRX-Diff-r16                  OPTIONAL,
  ...
}

PowSav-ParametersCommon-r16 ::= SEQUENCE {
  drx-Preference-r16           ENUMERATED {supported}                              OPTIONAL,
  maxCC-Preference-r16         ENUMERATED {supported}                              OPTIONAL,
  releasePreference-r16        ENUMERATED {supported}                              OPTIONAL,
  -- R1 19-4a: UE assistance information
  minSchedulingOffsetPreference-r16 ENUMERATED {supported}                          OPTIONAL,
  ...
}

PowSav-ParametersFRX-Diff-r16 ::= SEQUENCE {
  maxBW-Preference-r16         ENUMERATED {supported}                              OPTIONAL,
  maxMIMO-LayerPreference-r16  ENUMERATED {supported}                              OPTIONAL,
  ...
}

-- TAG-POWSAV-PARAMETERS-STOP
-- ASN1STOP
```

-- ProcessingParameters

The IE `ProcessingParameters` is used to indicate PDSCH/PUSCH processing capabilities supported by the UE.

ProcessingParameters information element

```asn1
-- ASN1START
-- TAG-PROCESSINGPARAMETERS-START
ProcessingParameters ::= SEQUENCE {
  fallback                        ENUMERATED {sc, cap1-only},
  differentTB-PerSlot              SEQUENCE {
    upto1                          NumberOfCarriers                     OPTIONAL,
    upto2                          NumberOfCarriers                     OPTIONAL,
    upto4                          NumberOfCarriers                     OPTIONAL,
    upto7                          NumberOfCarriers                     OPTIONAL,
  }                                                                 OPTIONAL
}

NumberOfCarriers ::= INTEGER {1..16}

-- TAG-PROCESSINGPARAMETERS-STOP
```

ETSI
**RAT-Type**

The IE **RAT-Type** is used to indicate the radio access technology (RAT), including NR, of the requested/transferred UE capabilities.

**RAT-Type information element**

```asn1
RAT-Type ::= ENUMERATED {nr, eutra-nr, eutra, utra-fdd-v1610, ...}
```

**RF-Parameters**

The IE **RF-Parameters** is used to convey RF-related capabilities for NR operation.

**RF-Parameters information element**

```asn1
RF-Parameters ::= SEQUENCE {
  supportedBandListNR SupportedBandList
  supportedBandCombinationList BandCombinationList
  appliedFreqBandListFilter FreqBandList
  ...,
  [[
    supportedBandCombinationList-v1540 BandCombinationList-v1540
    srs-SwitchingTimeRequested ENUMERATED {true}
  ]],
  [[
    supportedBandCombinationList-v1550 BandCombinationList-v1550
  ]],
  [[
    supportedBandCombinationList-v1560 BandCombinationList-v1560
  ]],
  [[
    supportedBandCombinationList-v1610 BandCombinationList-v1610
  ]],
  [[
    supportedBandCombinationListSidelinkEUTRA-NR-r16 BandCombinationListSidelinkEUTRA-NR-r16
    supportedBandCombinationList-UplinkTxSwitch-r16 BandCombinationList-UplinkTxSwitch-r16
  ]],
  [[
    supportedBandCombinationList-v1630 BandCombinationList-v1630
    supportedBandCombinationListSidelinkEUTRA-NR-v1630 BandCombinationListSidelinkEUTRA-NR-v1630
  ]]
}
```
supportedBandCombinationList-UplinkTxSwitch-v1630  BandCombinationList-UplinkTxSwitch-v1630  OPTIONAL
]]
}

BandNR ::= SEQUENCE {
  bandNR                          FreqBandIndicatorNR,
  modifiedMPR-Behaviour           BIT STRING (SIZE (8))  OPTIONAL,
  mimo-ParametersPerBand          MIMO-ParametersPerBand  OPTIONAL,
  extendedCP                      ENUMERATED {supported}  OPTIONAL,
  multipleTCI                     ENUMERATED {supported}  OPTIONAL,
  bwp-WithoutRestriction          ENUMERATED {supported}  OPTIONAL,
  bwp-SameNumerology              ENUMERATED {upto2, upto4}  OPTIONAL,
  bwp-DiffNumerology              ENUMERATED {upto4}  OPTIONAL,
  crossCarrierScheduling-SameSCS   ENUMERATED {supported}  OPTIONAL,
  pdsch-256QAM-FR2                 ENUMERATED {supported}  OPTIONAL,
  pusch-256QAM                     ENUMERATED {supported}  OPTIONAL,
  rateMatchingLTE-CRS              ENUMERATED {supported}  OPTIONAL,
  channelBWs-DL                    CHOICE {
    fr1                             SEQUENCE {
      scs-15kHz                      BIT STRING (SIZE (10))  OPTIONAL,
      scs-30kHz                      BIT STRING (SIZE (10))  OPTIONAL,
      scs-60kHz                      BIT STRING (SIZE (10))  OPTIONAL,
    },
    fr2                             SEQUENCE {
      scs-60kHz                      BIT STRING (SIZE (3))  OPTIONAL,
      scs-120kHz                     BIT STRING (SIZE (3))  OPTIONAL,
    }
  },
  channelBWs-UL                    CHOICE {
    fr1                             SEQUENCE {
      scs-15kHz                      BIT STRING (SIZE (10))  OPTIONAL,
      scs-30kHz                      BIT STRING (SIZE (10))  OPTIONAL,
      scs-60kHz                      BIT STRING (SIZE (10))  OPTIONAL,
    },
    fr2                             SEQUENCE {
      scs-60kHz                      BIT STRING (SIZE (3))  OPTIONAL,
      scs-120kHz                     BIT STRING (SIZE (3))  OPTIONAL,
    }
  },
  maxUplinkDutyCycle-PC2-FR1       ENUMERATED {n60, n70, n80, n90, n100}  OPTIONAL,
  pucch-SpatialRelInfoMAC-CE       ENUMERATED {supported}  OPTIONAL,
  powerBoothing-pi2BPSK           ENUMERATED {supported}  OPTIONAL,
  maxUplinkDutyCycle-FR2          ENUMERATED {n15, n20, n25, n30, n40, n50, n60, n70, n80, n90, n100}  OPTIONAL,
  channelBWs-DL-v1590              CHOICE {
    fr1                             SEQUENCE {
    }}
}
channelBWs-UL-v1590  

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>scs-15kHz</td>
<td>BIT STRING (SIZE (16)) OPTIONAL,</td>
</tr>
<tr>
<td>scs-30kHz</td>
<td>BIT STRING (SIZE (16)) OPTIONAL,</td>
</tr>
<tr>
<td>scs-60kHz</td>
<td>BIT STRING (SIZE (16)) OPTIONAL,</td>
</tr>
<tr>
<td>fr1</td>
<td>SEQUENCE {</td>
</tr>
<tr>
<td>scs-60kHz</td>
<td>BIT STRING (SIZE (8)) OPTIONAL,</td>
</tr>
<tr>
<td>scs-120kHz</td>
<td>BIT STRING (SIZE (8)) OPTIONAL</td>
</tr>
<tr>
<td>} OPTIONAL,</td>
<td></td>
</tr>
<tr>
<td>fr2</td>
<td>SEQUENCE {</td>
</tr>
<tr>
<td>scs-60kHz</td>
<td>BIT STRING (SIZE (8)) OPTIONAL,</td>
</tr>
<tr>
<td>scs-120kHz</td>
<td>BIT STRING (SIZE (8)) OPTIONAL</td>
</tr>
<tr>
<td>} OPTIONAL,</td>
<td></td>
</tr>
</tbody>
</table>

channelBW-DL-IAB-r16  

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>fr1-100mhz</td>
<td>SEQUENCE {</td>
</tr>
<tr>
<td>scs-15kHz</td>
<td>ENUMERATED (supported) OPTIONAL,</td>
</tr>
<tr>
<td>scs-30kHz</td>
<td>ENUMERATED (supported) OPTIONAL,</td>
</tr>
<tr>
<td>scs-60kHz</td>
<td>ENUMERATED (supported) OPTIONAL</td>
</tr>
<tr>
<td>}</td>
<td></td>
</tr>
<tr>
<td>fr2-200mhz</td>
<td>SEQUENCE {</td>
</tr>
<tr>
<td>scs-60kHz</td>
<td>ENUMERATED (supported) OPTIONAL,</td>
</tr>
<tr>
<td>scs-120kHz</td>
<td>ENUMERATED (supported) OPTIONAL</td>
</tr>
<tr>
<td>} OPTIONAL,</td>
<td></td>
</tr>
</tbody>
</table>
channelBW-UL-IAB-r16

fr1-100mhz
  scs-15kHz  ENUMERATED {supported}  OPTIONAL,
  scs-30kHz  ENUMERATED {supported}  OPTIONAL,
  scs-60kHz  ENUMERATED {supported}  OPTIONAL
},
fr2-200mhz
  scs-60kHz  ENUMERATED {supported}  OPTIONAL,
  scs-120kHz  ENUMERATED {supported}  OPTIONAL
}
}
rasterShift7dot5-IAB-r16  ENUMERATED {supported}  OPTIONAL,
ue-PowerClass-v1610  ENUMERATED {p1dot5}  OPTIONAL,
condHandover-r16  ENUMERATED {supported}  OPTIONAL,
condHandoverFailure-r16  ENUMERATED {supported}  OPTIONAL,
condHandoverTwoTriggerEvents-r16  ENUMERATED {supported}  OPTIONAL,
condPSCellChange-r16  ENUMERATED {supported}  OPTIONAL,
condPSCellChangeTwoTriggerEvents-r16  ENUMERATED {supported}  OPTIONAL,
mpr-PowerBoost-FR2-r16  ENUMERATED {supported}  OPTIONAL,

-- R1 11-9: Multiple active configured grant configurations for a BWP of a serving cell
activeConfiguredGrant-r16

maxNumberConfigsPerBWP-r16  ENUMERATED {n1, n2, n4, n8, n12},
maxNumberConfigsAllCC-r16  INTEGER (2..32)
}  OPTIONAL,

-- R1 11-9a: Joint release in a DCI for two or more configured grant Type 2 configurations for a given BWP of a serving cell
jointReleaseConfiguredGrantType2-r16  ENUMERATED {supported}  OPTIONAL,

-- R1 12-2: Multiple SPS configurations
sps-r16

maxNumberConfigsPerBWP-r16  INTEGER (1..8),
maxNumberConfigsAllCC-r16  INTEGER (2..32)
}  OPTIONAL,

-- R1 12-2a: Joint release in a DCI for two or more SPS configurations for a given BWP of a serving cell
jointReleaseSPS-r16  ENUMERATED {supported}  OPTIONAL,

-- R1 13-19: Simultaneous positioning SRS and MIMO SRS transmission within a band across multiple CCs
simulSRS-TransWithinBand-r16  ENUMERATED {n2},
trs-AdditionalBandwidth-r16  ENUMERATED {trs-AddBW-Set1, trs-AddBW-Set2}  OPTIONAL,
handoverIntraF-IAB-r16  ENUMERATED {supported}  OPTIONAL
},
]

-- R1 22-5a: Simultaneous transmission of SRS for antenna switching and SRS for CB/NCE /BM for intra-band UL CA
simulTX-SRS-AntSwitchingIntraBandUL-CA-r16  SimulSRS-ForAntennaSwitching-r16  OPTIONAL,

-- R1 10: NR-unlicensed
sharedSpectrumChAccessParamsPerBand-v1630  SharedSpectrumChAccessParamsPerBand-v1630  OPTIONAL
}
RF-Parameters field descriptions

**appliedFreqBandListFilter**
In this field the UE mirrors the `FreqBandList` that the NW provided in the capability enquiry, if any. The UE filtered the band combinations in the `supportedBandCombinationList` in accordance with this `appliedFreqBandListFilter`. The UE does not include this field if the UE capability is requested by E-UTRAN and the network request includes the field `eutra-nr-only` [10].

**supportedBandCombinationList**
A list of band combinations that the UE supports for NR (and NR-DC, if requested). The `FeatureSetCombinationId`'s in this list refer to the `FeatureSetCombination` entries in the `featureSetCombinations` list in the `UE-NR-Capability` IE. The UE does not include this field if the UE capability is requested by E-UTRAN and the network request includes the field `eutra-nr-only` [10].

**supportedBandCombinationListSidelinkEUTRA-NR**
A list of band combinations that the UE supports for NR sidelink communication only, for joint NR sidelink communication and V2X sidelink communication, or for V2X sidelink communication only. The UE does not include this field if the UE capability is requested by E-UTRAN (see TS 36.331[10]) and the network request includes the field `eutra-nr-only`.

**supportedBandCombinationList-UplinkTxSwitch**
A list of band combinations that the UE supports dynamic uplink Tx switching for NR UL CA and SUL. The `FeatureSetCombinationId`'s in this list refer to the `FeatureSetCombination` entries in the `featureSetCombinations` list in the `UE-NR-Capability` IE. The UE does not include this field if the UE capability is requested by E-UTRAN and the network request includes the field `eutra-nr-only` [10].

---

**RF-ParametersMRDC**

The IE `RF-ParametersMRDC` is used to convey RF related capabilities for MR-DC.

**RF-ParametersMRDC information element**

```asn1
RF-ParametersMRDC ::= SEQUENCE {
  supportedBandCombinationList            BandCombinationList        OPTIONAL,
  appliedFreqBandListFilter               FreqBandList                OPTIONAL,
  ...,
  [[[ srs-SwitchingTimeRequested          ENUMERATED {true}               OPTIONAL,
    supportedBandCombinationList-v1540    BandCombinationList-v1540     OPTIONAL,
  ]],
  [[[ supportedBandCombinationList-v1550  BandCombinationList-v1550     OPTIONAL,
  ]],
  [[[ supportedBandCombinationList-v1560  BandCombinationList-v1560     OPTIONAL,
    supportedBandCombinationListNEDC-Only BandCombinationList           OPTIONAL,
  ]],
  [[[ supportedBandCombinationList-v1570  BandCombinationList-v1570     OPTIONAL,
  ]],
  [[[ supportedBandCombinationList-v1580  BandCombinationList-v1580     OPTIONAL,
  ]],
...}
```
appliedFreqBandListFilter
In this field the UE mirrors the FreqBandList that the NW provided in the capability enquiry, if any. The UE filtered the band combinations in the supportedBandCombinationList in accordance with this appliedFreqBandListFilter.

supportedBandCombinationList
A list of band combinations that the UE supports for (NG)EN-DC, or both (NG)EN-DC and NE-DC. The FeatureSetCombinationId:s in this list refer to the FeatureSetCombination entries in the featureSetCombinations list in the UE-MRDC-Capability IE.

supportedBandCombinationListNEDC-Only, supportedBandCombinationListNEDC-Only-v1610
A list of band combinations that the UE supports only for NE-DC. The FeatureSetCombinationId:s in this list refer to the FeatureSetCombination entries in the featureSetCombinations list in the UE-MRDC-Capability IE.

supportedBandCombinationListUplinkTxSwitch
A list of band combinations that the UE supports dynamic UL Tx switching for (NG)EN-DC. The FeatureSetCombinationId:s in this list refer to the FeatureSetCombination entries in the featureSetCombinations list in the UE-MRDC-Capability IE.

---

RLC-Parameters
The IE RLC-Parameters is used to convey capabilities related to RLC.

RLC-Parameters information element

---
-- TAG-RLC-PARAMETERS-START

RLC-Parameters ::= SEQUENCE {
    am-WithShortSN                  ENUMERATED {supported}  OPTIONAL,
    um-WithShortSN                  ENUMERATED {supported}  OPTIONAL,
    um-WithLongSN                   ENUMERATED {supported}  OPTIONAL,
    ...,
    extendedT-PollRetransmit-r16    ENUMERATED {supported}  OPTIONAL,
    extendedT-StatusProhibit-r16    ENUMERATED {supported}  OPTIONAL
}

-- TAG-RLC-PARAMETERS-STOP

-- TAG-SDAP-PARAMETERS-START

SDAP-Parameters ::= SEQUENCE {
    as-ReflectiveQoS                 ENUMERATED {true}               OPTIONAL,
    ...,
    sdap-QOS-IAB-r16                 ENUMERATED {supported}       OPTIONAL,
    sdapHeaderIAB-r16                ENUMERATED {supported}       OPTIONAL
}

-- TAG-SDAP-PARAMETERS-STOP

-- TAG-SIDELINKPARAMETERS-START

SidelinkParameters-r16 ::=    SEQUENCE {

-- TAG-SIDELINKPARAMETERS-STOP

-- TAG-SDAP-PARAMETERS-START

SDAP-Parameters

The IE SDAP-Parameters is used to convey capabilities related to SDAP.

SDAP-Parameters information element

-- TAG-SDAP-PARAMETERS-STOP

SidelinkParameters

The IE SidelinkParameters is used to convey capabilities related to NR and E-UTRA sidelink communications.

SidelinkParameters information element
SidelinkParametersNR-r16 ::= SEQUENCE {
  rl-C-ParametersSidelink-r16  RLC-ParametersSidelink-r16  OPTIONAL,
  mac-ParametersSidelink-r16   MAC-ParametersSidelink-r16   OPTIONAL,
  fdd-Add-UE-Sidelink-Capabilities-r16  UE-SidelinkCapabilityAddXDD-Mode-r16  OPTIONAL,
  tdd-Add-UE-Sidelink-Capabilities-r16  UE-SidelinkCapabilityAddXDD-Mode-r16  OPTIONAL,
  supportedBandListSidelink-r16  SEQUENCE (SIZE (1..maxBands)) OF BandSidelink-r16  OPTIONAL,
  ...
}

SidelinkParametersEUTRA-r16 ::= SEQUENCE {
  sl-ParametersEUTRA1-r16  OCTET STRING  OPTIONAL,
  sl-ParametersEUTRA2-r16  OCTET STRING  OPTIONAL,
  sl-ParametersEUTRA3-r16  OCTET STRING  OPTIONAL,
  supportedBandListSidelinkEUTRA-r16  SEQUENCE (SIZE (1..maxBandsEUTRA)) OF BandSidelinkEUTRA-r16  OPTIONAL,
  ...
}

RLC-ParametersSidelink-r16 ::= SEQUENCE {
  am-WithLongSN-Sidelink-r16  ENUMERATED {supported}  OPTIONAL,
  um-WithLongSN-Sidelink-r16  ENUMERATED {supported}  OPTIONAL,
  ...
}

MAC-ParametersSidelink-r16 ::= SEQUENCE {
  mac-ParametersSidelinkCommon-r16  MAC-ParametersSidelinkCommon-r16  OPTIONAL,
  mac-ParametersSidelinkXDD-Diff-r16  MAC-ParametersSidelinkXDD-Diff-r16  OPTIONAL,
  ...
}

UE-SidelinkCapabilityAddXDD-Mode-r16 ::= SEQUENCE {
  mac-ParametersSidelinkXDD-Diff-r16  MAC-ParametersSidelinkXDD-Diff-r16  OPTIONAL,
}

MAC-ParametersSidelinkCommon-r16 ::= SEQUENCE {
  lcp-RestrictionSidelink-r16  ENUMERATED {supported}  OPTIONAL,
  multipleConfiguredGrantsSidelink-r16  ENUMERATED {supported}  OPTIONAL,
  ...
}

MAC-ParametersSidelinkXDD-Diff-r16 ::= SEQUENCE {
  multipleSR-ConfigurationsSidelink-r16  ENUMERATED {supported}  OPTIONAL,
  logicalChannelSR-DelayTimerSidelink-r16  ENUMERATED {supported}  OPTIONAL,
  ...
}

BandSidelinkEUTRA-r16 ::= SEQUENCE {
  freqBandSidelinkEUTRA-r16  FreqBandIndicatorEUTRA,  -- R1 15-7: Transmitting LTE sidelink mode 3 scheduled by NR Uu
  gnb-ScheduledMode3SidelinkEUTRA-r16  SEQUENCE {  -- ETSI TS 138 331 V16.3.1 (2021-01)
    gnb-ScheduledMode3DelaySidelinkEUTRA-r16  ENUMERATED (ms0, ms0dot25, ms0dot5, ms0dot625, ms0dot75, ms1,  

    ETSI
BandSidelink-r16 ::= SEQUENCE {
freqBandSidelink-r16                              FreqBandIndicatorNR,  
  --15-1  
  sl-Reception-r16                                 SEQUENCE {
    harq-RxProcessSidetlink-r16                     ENUMERATED {n16, n24, n32, n48, n64},
    psch-RxSidetlink-r16                            ENUMERATED {value1, value2},
    scs-CP-PatternRxSidetlink-r16                  CHOICE {
      fr1-r16                                       SEQUENCE {
        scs-15kHz-r16                                 BIT STRING (SIZE (16)) OPTIONAL,  
        scs-30kHz-r16                                 BIT STRING (SIZE (16)) OPTIONAL,  
        scs-60kHz-r16                                 BIT STRING (SIZE (16)) OPTIONAL  
      },  
      fr2-r16                                       SEQUENCE {
        scs-60kHz-r16                                 BIT STRING (SIZE (16)) OPTIONAL,  
        scs-120kHz-r16                                BIT STRING (SIZE (16)) OPTIONAL  
      }  
    },  
    extendedCP-RxSidetlink-r16                     ENUMERATED {supported} OPTIONAL,  
    --15-2  
    sl-TransmissionMode1-r16                       SEQUENCE {
      harq-TxProcessModeOneSidetlink-r16            ENUMERATED {n8, n16},
      scs-CP-PatternTxSidetlinkModeOne-r16          CHOICE {
        fr1-r16                                       SEQUENCE {
          scs-15kHz-r16                                 BIT STRING (SIZE (16)) OPTIONAL,  
          scs-30kHz-r16                                 BIT STRING (SIZE (16)) OPTIONAL,  
          scs-60kHz-r16                                 BIT STRING (SIZE (16)) OPTIONAL  
        },  
        fr2-r16                                       SEQUENCE {
          scs-60kHz-r16                                 BIT STRING (SIZE (16)) OPTIONAL,  
          scs-120kHz-r16                                BIT STRING (SIZE (16)) OPTIONAL  
        }  
      },  
      extendedCP-TxSidetlink-r16                    ENUMERATED {supported} OPTIONAL,  
      harq-ReportOnPUCCH-r16                        ENUMERATED {supported} OPTIONAL,  
      --15-4  
      sync-Sidelink-r16                             ENUMERATED {supported},  
      gNB-Sync-r16                                  ENUMERATED {supported},  
      gNB-GNSS-UE-SyncWithPriorityOnGNB-ENB-r16     ENUMERATED {supported},  
      gNB-GNSS-UE-SyncWithPriorityOnGNSS-r16        ENUMERATED {supported}  
    },  
    --15-10  
    sl-Tx-256QAM-r16                               ENUMERATED {supported} OPTIONAL,  
    --15-11  
    psfch-FormatZeroSidetlink-r16                  ENUMERATED {n5, n15, n25, n32, n35, n45, n50, n64},  
    psfch-RxNumber                                ENUMERATED {supported} OPTIONAL,  
  }
}
psfch-TxNumber ENUMERATED {n4, n8, n16} OPTIONAL,
--15-12
lowSE-64QAM-MCS-TableSidelink-r16 ENUMERATED (supported) OPTIONAL,
--15-15
enb-sync-Sidelink-r16 ENUMERATED (supported) OPTIONAL,
...
[ [ [ [ [--15-3
sl-TransmissionMode2-r16 SEQUENCE {
harq-TxProcessModeTwoSidelink-r16 ENUMERATED {n8, n16},
acs-CP-PatternTXSidelinkModeTwo-r16 ENUMERATED {supported} OPTIONAL,
dl-openLoopPC-Sidelink-r16 ENUMERATED {supported} OPTIONAL,
} OPTIONAL,
--15-5
congestionControlSidelink-r16 SEQUENCE {
cbr-ReportSidelink-r16 ENUMERATED {supported} OPTIONAL,
cbr-CR-TimeLimitSidelink-r16 ENUMERATED {time1, time2} OPTIONAL,
} OPTIONAL,
--15-22
fewerSymbolSlotSidelink-r16 ENUMERATED (supported) OPTIONAL,
--15-23
sl-openLoopPC-RSRP-ReportSidelink-r16 ENUMERATED (supported) OPTIONAL,
--13-1
sl-Rx-256QAM-r16 ENUMERATED (supported) OPTIONAL
}]]
-- TAG-SIDELINKPARAMETERS-STOP
-- ASN1STOP

SidelinkParametersEUTRA field descriptions

This field includes IE of SL-Parameters-v1430 (where v2x-eNB-Scheduled-r14 and V2X-SupportedBandCombination-r14 shall not be included), SL-Parameters-v1530 (where V2X-SupportedBandCombination-r1530 shall not be included) and SL-Parameters-v1540 respectively defined in 36.331 [10]. It is used for reporting the per-UE capability for V2X sidelink communication.

SON-Parameters

The IE SON-Parameters contains SON related parameters.

SON-Parameters information element

-- ASN1START
-- TAG-SON-PARAMETERS-START

SON-Parameters-r16 ::= SEQUENCE {
rach-Report-r16 ENUMERATED {supported} OPTIONAL,
...
SpatialRelationsSRS-Pos

The IE SpatialRelationsSRS-Pos is used to convey spatial relation for SRS for positioning related parameters.

SpatialRelationsSRS-Pos information element

SRS-SwitchingTimeNR

The IE SRS-SwitchingTimeNR is used to indicate the SRS carrier switching time supported by the UE for one NR band pair.

SRS-SwitchingTimeNR information element
The IE \textit{SRS-SwitchingTimeEUTRA} is used to indicate the SRS carrier switching time supported by the UE for one E-UTRA band pair.

\textbf{SRS-SwitchingTimeEUTRA information element}

\begin{verbatim}
-- ASN1START
-- TAG-SRS-SWITCHINGTIMEEUTRA-START
SRS-SwitchingTimeEUTRA ::= SEQUENCE {
  switchingTimeDL            ENUMERATED {n0, n0dot5, n1, n1dot5, n2, n2dot5, n3, n3dot5, n4, n4dot5, n5, n5dot5, n6, n6dot5, n7} OPTIONAL,
  switchingTimeUL            ENUMERATED {n0, n0dot5, n1, n1dot5, n2, n2dot5, n3, n3dot5, n4, n4dot5, n5, n5dot5, n6, n6dot5, n7} OPTIONAL
}
-- TAG-SRS-SWITCHINGTIMEEUTRA-STOP
-- ASN1STOP
\end{verbatim}

\textbf{SupportedBandwidth}

The IE \textit{SupportedBandwidth} is used to indicate the maximum channel bandwidth supported by the UE on one carrier of a band of a band combination.

\textbf{SupportedBandwidth information element}

\begin{verbatim}
-- ASN1START
-- TAG-SUPPORTEDBANDWIDTH-START
SupportedBandwidth ::=      CHOICE {
  fr1                        ENUMERATED {mhz5, mhz10, mhz15, mhz20, mhz25, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100},
  fr2                        ENUMERATED {mhz50, mhz100, mhz200, mhz400}
}
-- TAG-SUPPORTEDBANDWIDTH-STOP
-- ASN1STOP
\end{verbatim}

\textbf{UE-BasedPerfMeas-Parameters}

The IE \textit{UE-BasedPerfMeas-Parameters} contains UE-based performance measurement parameters.

\textbf{UE-BasedPerfMeas-Parameters information element}

\begin{verbatim}
-- ASN1START
-- TAG-UE-BASEDPERFMEAS-PARAMETERS-START
UE-BasedPerfMeas-Parameters-r16 ::= SEQUENCE {
  barometerMeasReport-r16      ENUMERATED {supported} OPTIONAL,
}
-- TAG-UE-BASEDPERFMEAS-PARAMETERS-STOP
-- ASN1STOP
\end{verbatim}
The IE `UE-CapabilityRAT-ContainerList` contains a list of radio access technology specific capability containers.

**UE-CapabilityRAT-ContainerList information element**

```
UE-CapabilityRAT-ContainerList ::= SEQUENCE (SIZE (0..maxRAT-CapabilityContainers)) OF UE-CapabilityRAT-Container

UE-CapabilityRAT-Container ::= SEQUENCE {
  rat-Type                              RAT-Type,
  ue-CapabilityRAT-Container            OCTET STRING
}
```

**UE-CapabilityRAT-ContainerList field descriptions**

- `UE-CapabilityRAT-Container`
  - Container for the UE capabilities of the indicated RAT. The encoding is defined in the specification of each RAT:
    - For `rat-Type` set to `nr`: the encoding of UE capabilities is defined in `UE-NR-Capability`.
    - For `rat-Type` set to `eutra-nr`: the encoding of UE capabilities is defined in `UE-MRDC-Capability`.
    - For `rat-Type` set to `eutra`: the encoding of UE capabilities is defined in `UE-EUTRA-Capability` specified in TS 36.331 [10].
    - For `rat-Type` set to `utra-fdd`: the octet string contains the INTER RAT HANDOVER INFO message defined in TS 25.331 [45].

The IE `UE-CapabilityRAT-RequestList` is used to request UE capabilities for one or more RATs from the UE.
**UE-CapabilityRAT-RequestList** information element

```
UE-CapabilityRAT-RequestList ::=        SEQUENCE (SIZE (1..maxRAT-CapabilityContainers)) OF UE-CapabilityRAT-Request
```

**UE-CapabilityRAT-Request** field descriptions

- **capabilityRequestFilter**
  Information by which the network requests the UE to filter the UE capabilities.

  For `rat-Type` set to **nr** or **eutra-nr**: the encoding of the `capabilityRequestFilter` is defined in **UE-CapabilityRequestFilterNR**.

  For `rat-Type` set to **eutra**: the encoding of the `capabilityRequestFilter` is defined by **UECapabilityEnquiry** message defined in TS36.331 [10], in which `RAT-Type` in **UE-CapabilityRequest** includes only **eutra**.

- **rat-Type**
  The RAT type for which the NW requests UE capabilities.

---

**UE-CapabilityRequestFilterCommon**

The IE **UE-CapabilityRequestFilterCommon** is used to request filtered UE capabilities. The filter is common for all capability containers that are requested.

**UE-CapabilityRequestFilterCommon** information element

```
UE-CapabilityRequestFilterCommon ::=            SEQUENCE {
  mrdc-Request                                SEQUENCE {
    omitEN-DC                                   ENUMERATED {true}                      OPTIONAL,    -- Need N
    includeNR-DC                                ENUMERATED {true}                      OPTIONAL,    -- Need N
    includeNE-DC                                ENUMERATED {true}                      OPTIONAL,    -- Need N
  }                                                                                  OPTIONAL,        -- Need N
  ...,
  [][
    codebookTypeRequest-r16        SEQUENCE {
      type1-SinglePanel-r16          ENUMERATED {true}                                    OPTIONAL,    -- Need N
      type1-MultiPanel-r16           ENUMERATED {true}                                    OPTIONAL,    -- Need N
      type2-r16                      ENUMERATED {true}                                    OPTIONAL,    -- Need N
      type2-PortSelection-r16       ENUMERATED {true}                                    OPTIONAL,    -- Need N
      ...,
    }
  }
}
### UE-CapabilityRequestFilterCommon field descriptions

#### codebookTypeRequest
Only if this field is present, the UE includes `SupportedCSI-RS-Resource` supported for the codebook type(s) requested within this field (i.e. type I single/multi-panel, type II and type II port selection) into `codebookVariantsList`, `codebookParametersPerBand` and `codebookParametersPerBC`. If this field is present and none of the codebook types is requested within this field (i.e. empty field), the UE includes `SupportedCSI-RS-Resource` supported for all codebook types into `codebookVariantsList`, `codebookParametersPerBand` and `codebookParametersPerBC`.

#### IncludeNE-DC
Only if this field is present, the UE supporting NE-DC shall indicate support for NE-DC in band combinations and include feature set combinations which are applicable to NE-DC. Band combinations supporting both NE-DC and (NG)EN-DC shall be included in `supportedBandCombinationList`, band combinations supporting only NE-DC shall be included in `supportedBandCombinationListNEDC-Only`.

#### includeNR-DC
Only if this field is present, the UE supporting NR-DC shall indicate support for NR-DC in band combinations and include feature set combinations which are applicable to NR-DC.

#### omitEN-DC
Only if this field is present, the UE shall omit band combinations and feature set combinations which are only applicable to (NG)EN-DC.

#### uplinkTxSwitchRequest
Only if this field is present, the UE supporting dynamic UL Tx switching shall indicate support for UL Tx switching in band combinations which are applicable to inter-band UL CA, SUL and (NG)EN-DC.

---

### UE-CapabilityRequestFilterNR

The IE `UE-CapabilityRequestFilterNR` is used to request filtered UE capabilities.

#### UE-CapabilityRequestFilterNR information element

```plaintext
UE-CapabilityRequestFilterNR ::=            SEQUENCE {  
  frequencyBandListFilter                     FreqBandList                          OPTIONAL,   -- Need N  
  nonCriticalExtension                        UE-CapabilityRequestFilterNR-v1540    OPTIONAL  
}  

UE-CapabilityRequestFilterNR-v1540 ::=      SEQUENCE {  
  srs-SwitchingTimeRequest                    ENUMERATED {true}                     OPTIONAL,  -- Need N  
  nonCriticalExtension                        SEQUENCE {}                           OPTIONAL  
}  
```

---
UE-MRDC-Capability

The IE UE-MRDC-Capability is used to convey the UE Radio Access Capability Parameters for MR-DC, see TS 38.306 [26].

**UE-MRDC-Capability information element**

```asn1
UE-MRDC-Capability ::= SEQUENCE {
  measAndMobParametersMRDC            MeasAndMobParametersMRDC                                                        OPTIONAL,
  phy-ParametersMRDC-v1530            Phy-ParametersMRDC                                                              OPTIONAL,
  rf-ParametersMRDC                   RF-ParametersMRDC,
  generalParametersMRDC               GeneralParametersMRDC-XDD-Diff                                                  OPTIONAL,
  tdd-Add-UE-MRDC-Capabilities        UE-MRDC-CapabilityAddXDD-Mode                                                   OPTIONAL,
  fr1-Add-UE-MRDC-Capabilities        UE-MRDC-CapabilityAddXDD-Mode                                                   OPTIONAL,
  fr2-Add-UE-MRDC-Capabilities        UE-MRDC-CapabilityAddXDD-Mode                                                   OPTIONAL,
  featureSetCombinations              SEQUENCE (SIZE (1..maxFeatureSetCombinations)) OF FeatureSetCombination         OPTIONAL,
  pdcp-ParametersMRDC-v1530           PDCP-ParametersMRDC                                                             OPTIONAL,
  lateNonCriticalExtension            OCTET STRING                                                                    OPTIONAL,
  nonCriticalExtension                UE-MRDC-Capability-v1560                                                        OPTIONAL
}

UE-MRDC-Capability-v1560 ::= SEQUENCE {
  receivedFilters                     OCTET STRING (CONTAINING UECapabilityEnquiry-v1560-IEs)                         OPTIONAL,
  measAndMobParametersMRDC-v1560      MeasAndMobParametersMRDC-v1560                                                  OPTIONAL,
  fdd-Add-UE-MRDC-Capabilities-v1560  UE-MRDC-CapabilityAddXDD-Mode-v1560                                             OPTIONAL,
  nonCriticalExtension                UE-MRDC-Capability-v1610                                                        OPTIONAL
}

UE-MRDC-CapabilityAddXDD-Mode ::= SEQUENCE {
  generalParametersMRDC-XDD-Diff      GeneralParametersMRDC-XDD-Diff                                                  OPTIONAL,
}

UE-MRDC-CapabilityAddXDD-Mode-v1560 ::=    SEQUENCE {
  generalParametersMRDC-XDD-Diff-v1560    GeneralParametersMRDC-XDD-Diff-v1560                                  OPTIONAL
}

UE-MRDC-CapabilityAddFRX-Mode ::= SEQUENCE {
  measAndMobParametersMRDC-FRX-Diff    MeasAndMobParametersMRDC-FRX-Diff
}
```
UE-MRDC-Capability field descriptions

A list of FeatureSetCombination:s for supportedBandCombinationList and supportedBandCombinationListNEDC-Only in UE-MRDC-Capability. The FeatureSetDownlinks and FeatureSetUplinks referred to from these FeatureSetCombination:s are defined in the featureSets list in UE-NR-Capability.

---

UE-NR-Capability

The IE UE-NR-Capability is used to convey the NR UE Radio Access Capability Parameters, see TS 38.306 [26].

---

UE-NR-Capability information element

---

UE-MRDC-Capability ::= SEQUENCE {
    GeneralParametersMRDC-XDD-Diff ::= SEQUENCE {
        splitSRB-WithOneUL-Path ENUMERATED {supported} OPTIONAL,
        splitDRB-withUL-Both-MCG-SCG ENUMERATED {supported} OPTIONAL,
        srb3 ENUMERATED {supported} OPTIONAL,
        v2x-EUTRA ENUMERATED {supported} OPTIONAL,
        ...
    }
    GeneralParametersMRDC-v1610 ::= SEQUENCE {
        f1c-OverEUTRA-r16 ENUMERATED {supported} OPTIONAL
    }
}
3GPP TS 38.331 version 16.3.1 Release 16

ETSI TS 138 331 V16.3.1 (2021-01)

-- Regular non-critical extensions:

UE-NR-Capability-v1530 ::= SEQUENCE {
  fdd-Add-UE-NR-Capabilities-v1530  UE-NR-CapabilityAddXDD-Mode-v1530  OPTIONAL,
  tdd-Add-UE-NR-Capabilities-v1530  UE-NR-CapabilityAddXDD-Mode-v1530  OPTIONAL,
  dummy                             ENUMERATED {supported}           OPTIONAL,
  interRAT-Parameters              InterRAT-Parameters              OPTIONAL,
  inactiveState                    ENUMERATED {supported}           OPTIONAL,
  delayBudgetReporting             ENUMERATED {supported}           OPTIONAL,
  nonCriticalExtension             UE-NR-Capability-v1540           OPTIONAL
}

UE-NR-Capability-v1540 ::= SEQUENCE {
  sdap-Parameters                  SDAP-Parameters                 OPTIONAL,
  overheatingInd                   ENUMERATED {supported}           OPTIONAL,
  ims-Parameters                   IMS-Parameters                  OPTIONAL,
  fr1-Add-UE-NR-Capabilities-v1540  UE-NR-CapabilityAddFRX-Mode-v1540  OPTIONAL,
  fr2-Add-UE-NR-Capabilities-v1540  UE-NR-CapabilityAddFRX-Mode-v1540  OPTIONAL,
  fr1-fr2-Add-UE-NR-Capabilities   UE-NR-CapabilityAddFRX-Mode       OPTIONAL,
  nonCriticalExtension             UE-NR-Capability-v1550           OPTIONAL
}

UE-NR-Capability-v1550 ::= SEQUENCE {
  reducedCP-Latency                ENUMERATED {supported}           OPTIONAL,
  nonCriticalExtension             UE-NR-Capability-v1560           OPTIONAL
}

UE-NR-Capability-v1560 ::= SEQUENCE {
  nrdc-Parameters                  NRDC-Parameters                OPTIONAL,
  receivedFilters                  OCTET STRING (CONTAINING UECapabilityEnquiry-v1560-IEs) OPTIONAL,
  nonCriticalExtension             UE-NR-Capability-v1570           OPTIONAL
}

UE-NR-Capability-v1570 ::= SEQUENCE {
  nrdc-Parameters-v1570            NRDC-Parameters-v1570          OPTIONAL,
  nonCriticalExtension             UE-NR-Capability-v1610          OPTIONAL
}

-- Late non-critical extensions:

UE-NR-Capability-v15c0 ::= SEQUENCE {
  nrdc-Parameters-v15c0            NRDC-Parameters-v15c0          OPTIONAL,
  partialFP2-FallbackRX-Req        ENUMERATED {true}                  OPTIONAL,
  nonCriticalExtension             SEQUENCE {}                      OPTIONAL
}

-- Regular non-critical extensions:

UE-NR-Capability-v1610 ::= SEQUENCE {
  inDeviceCoexInd-r16              ENUMERATED {supported}           OPTIONAL,
  dl-DedicatedMessageSegmentation-r16 ENUMERATED {supported}           OPTIONAL,
  nrdc-Parameters-r16              NRDC-Parameters-v1610          OPTIONAL,
  powSav-Parameters-r16            PowSav-Parameters-r16          OPTIONAL,
  fr1-Add-UE-NR-Capabilities-v1610 UE-NR-CapabilityAddFRX-Mode-v1610  OPTIONAL,
  fr2-Add-UE-NR-Capabilities-v1610 UE-NR-CapabilityAddFRX-Mode-v1610  OPTIONAL,
  bh-RLF-Indication-r16            ENUMERATED {supported}           OPTIONAL
}
directSN-AdditionFirstRRC-IAB-r16 := ENUMERATED {supported} OPTIONAL,
bap-Parameters-r16 := BAP-Parameters-r16 OPTIONAL,
referenceTimeProvision-r16 := ENUMERATED {supported} OPTIONAL,
sidelinkParameters-r16 := SidelinkParameters-r16 OPTIONAL,
highSpeedParameters-r16 := HighSpeedParameters-r16 OPTIONAL,
mac-Parameters-v1610 := MAC-Parameters-v1610 OPTIONAL,
mcgRLF-RecoveryViaSCG-r16 := ENUMERATED {supported} OPTIONAL,
resumeWithStoredMCG-SCells-r16 := ENUMERATED {supported} OPTIONAL,
resumeWithStoredSCG-r16 := ENUMERATED {supported} OPTIONAL,
resumeWithSCG-Config-r16 := ENUMERATED {supported} OPTIONAL,
ue-BasedPerfMeas-Parameters-r16 := UE-BasedPerfMeas-Parameters-r16 OPTIONAL,
on-Parameters-r16 := SON-Parameters-r16 OPTIONAL,
onDemandSIB-Connected-r16 := ENUMERATED {supported} OPTIONAL,
nonCriticalExtension := SEQUENCE {} OPTIONAL

UE-NR-CapabilityAddXDD-Mode ::= SEQUENCE {
  phy-ParametersXDD-Diff := Phy-ParametersXDD-Diff OPTIONAL,
  mac-ParametersXDD-Diff := MAC-ParametersXDD-Diff OPTIONAL,
  measAndMobParametersXDD-Diff := MeasAndMobParametersXDD-Diff OPTIONAL
}

UE-NR-CapabilityAddXDD-Mode-v1530 ::= SEQUENCE {
  eutra-ParametersXDD-Diff := EUTRA-ParametersXDD-Diff
}

UE-NR-CapabilityAddFRX-Mode ::= SEQUENCE {
  phy-ParametersFRX-Diff := Phy-ParametersFRX-Diff OPTIONAL,
  measAndMobParametersFRX-Diff := MeasAndMobParametersFRX-Diff OPTIONAL
}

UE-NR-CapabilityAddFRX-Mode-v1540 ::= SEQUENCE {
  ims-ParametersFRX-Diff := IMS-ParametersFRX-Diff OPTIONAL
}

UE-NR-CapabilityAddFRX-Mode-v1610 ::= SEQUENCE {
  powSav-ParametersFRX-Diff-r16 := PowSav-ParametersFRX-Diff-r16 OPTIONAL,
  mac-ParametersFRX-Diff-r16 := MAC-ParametersFRX-Diff-r16 OPTIONAL
}

BAP-Parameters-r16 ::= SEQUENCE {
  flowControlBH-RLC-ChannelBased-r16 := ENUMERATED {supported} OPTIONAL,
  flowControlRouting-ID-Based-r16 := ENUMERATED {supported} OPTIONAL
}

-- TAG-UE-NR-CAPABILITY-STOP
-- ASN1STOP
**UE-NR-Capability field descriptions**

**featureSetCombinations**
A list of FeatureSetCombination:s for supportedBandCombinationList in UE-NR-Capability. The FeatureSetDownlink:s and FeatureSetUplink:s referred to from these FeatureSetCombination:s are defined in the featureSets list in UE-NR-Capability.

**UE-NR-Capability-v1540 field descriptions**

**fr1-fr2-Add-UE-NR-Capabilities**
This instance of UE-NR-CapabilityAddFRX-Mode does not include any other fields than csi-RS-IM-ReceptionForFeedback/ csi-RS-ProcFrameworkForSRS/ csi-ReportFramework.

---

**SharedSpectrumChAccessParamsPerBand**

The IE SharedSpectrumChAccessParamsPerBand is used to convey shared channel access related parameters specific for a certain frequency band (not per feature set or band combination).

**SharedSpectrumChAccessParamsPerBand information element**

```
SharedSpectrumChAccessParamsPerBand-v16 ::= SEQUENCE {
  -- R1 10-1: UL channel access for dynamic channel access mode
  ul-DynamicChAccess-r16             ENUMERATED (supported)  OPTIONAL,
  -- R1 10-1a: UL channel access for semi-static channel access mode
  ul-Semi-StaticChAccess-r16         ENUMERATED (supported)  OPTIONAL,
  -- R1 10-2: SSB-based RRM for dynamic channel access mode
  ssb-RRM-DynamicChAccess-r16       ENUMERATED (supported)  OPTIONAL,
  -- R1 10-2a: SSB-based RRM for semi-static channel access mode
  ssb-RRM-Semi-StaticChAccess-r16    ENUMERATED (supported)  OPTIONAL,
  -- R1 10-2b: MIB reading on unlicensed cell
  mib-Acquisition-r16               ENUMERATED (supported)  OPTIONAL,
  -- R1 10-2c: SSB-based RLM for dynamic channel access mode
  ssb-RLM-DynamicChAccess-r16       ENUMERATED (supported)  OPTIONAL,
  -- R1 10-2d: SSB-based RLM for semi-static channel access mode
  ssb-RLM-Semi-StaticChAccess-r16    ENUMERATED (supported)  OPTIONAL,
  -- R1 10-2e: SIB1 reception on unlicensed cell
  sib1-Acquisition-r16              ENUMERATED (supported)  OPTIONAL,
  -- R1 10-2f: Support monitoring of extended RAR window
  extRA-ResponseWindow-r16          ENUMERATED (supported)  OPTIONAL,
  -- R1 10-2g: SSB-based BFD/CBD for dynamic channel access mode
  ssb-BFD-CBD-dynamicChAccess-r16   ENUMERATED (supported)  OPTIONAL,
  -- R1 10-2h: SSB-based BFD/CBD for semi-static channel access mode
  ssb-BFD-CBD-semiStaticChAccess-r16 ENUMERATED (supported)  OPTIONAL,
  -- R1 10-2i: CSI-RS-based BFD/CBD for NR-U
  csi-RS-BFD-CBD-r16                ENUMERATED (supported)  OPTIONAL,
  -- R1 10-7: UL channel access for 10 MHz SCell
  ul-ChannelBW-SCell-10mhz-r16      ENUMERATED (supported)  OPTIONAL,
}
```
-- R1 10-10: RSSI and channel occupancy measurement and reporting
  rssi-ChannelOccupancyReporting-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-11: RKG starting position at any OFDM symbol in a slot
  srs-StartAnyOFDM-Symbol-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-20: Support search space set configuration with freqMonitorLocation-r16
  searchSpaceFreqMonitorLocation-r16 INTEGER (1..5) OPTIONAL,
-- R1 10-20a: Support coreset configuration with rb-Offset
  coreset-RB-Offset-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-23: CGI reading on unlicensed cell for ANR functionality
  cgi-Acquisition-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-25: Enable configured UL transmissions when DCI 2_0 is configured but not detected
  configuredUL-Tx-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-27: Wideband PRACH
  prach-Wideband-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-29: Support available RB set indicator field in DCI 2_0
  dci-AvailableRB-Set-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-30: Support channel occupancy duration indicator field in DCI 2_0
  dci-ChOccupancyDuration-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-8: Type B PDSCH length {3, 5, 6, 8, 9, 10, 11, 12, 13} without DMRS shift due to CRS collision
  typeB-PDSCH-length-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-9: Search space set group switching with explicit DCI 2_0 bit field trigger or with implicit PDCCH decoding with DCI 2_0 monitoring
  searchSpaceSetGroupSwitchingwithDCI-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-9b: Search space set group switching with implicit PDCCH decoding without DCI 2_0 monitoring
  searchSpaceSetGroupSwitchingwithoutDCI-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-10: Search space set group switching capability 2
  searchSpaceSetGroupSwitchingcapability2-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-14: Non-numerical PDSCH to HARQ-ACK timing
  non-numericalPDSCH-HARQ-timing-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-15: Enhanced dynamic HARQ codebook
  enhancedDynamicHARQ-codebook-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-16: One-shot HARQ ACK feedback
  oneShotHARQ-feedback-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-17: Multi-PUSCH UL grant
  multiPUSCH-UL-grant-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-20: CSI-RS based RLM for NR-U
  csi-RS-RLM-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-26: CSI-RS based RRM for NR-U
  csi-RS-RRM-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-31: Support of P/SP-CSI-RS reception with CSI-RS-ValidationWith-DCI-r16 configured
  periodicAndSemi-PersistentCSI-RS-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-3: PRB interlace mapping for PUSCH
  pushc-PRB-interlace-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-3a: PRB interlace mapping for PUCCH
  pushc-F0-F1-PRB-Interlace-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-10: OCC for PRB interlace mapping for PF2 and PF3
  occ-PRB-PF2-PF3-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-13a: Extended CP range of more than one symbol for CG-PUSCH
  extCP-rangeCG-PUSCH-r16 ENUMERATED {supported} OPTIONAL,
-- R1 10-18: Configured grant with retransmission in CG resources
  configuredGrantWithReTx-r16 ENUMERATED {supported} OPTIONAL,
6.3.4 Other information elements

- **AbsoluteTimeInfo**

  The IE *AbsoluteTimeInfo* indicates an absolute time in a format YY-MM-DD HH:MM:SS and using BCD encoding. The first/ leftmost bit of the bit string contains the most significant bit of the most significant digit of the year and so on.

  **AbsoluteTimeInfo information element**

  -- ASN1START
  -- TAG-ABSOLUTETIMEINFO-START
  AbsoluteTimeInfo-r16 ::= BIT STRING (SIZE (48))
  -- TAG-ABSOLUTETIMEINFO-STOP
  -- ASN1STOP

- **AreaConfiguration**

  The *AreaConfiguration* indicates area for which UE is requested to perform measurement logging. If not configured, measurement logging is not restricted to specific cells or tracking areas but applies as long as the RPLMN is contained in *plmn-IdentityList* stored in *VarLogMeasReport*.

  **AreaConfiguration information element**

  -- ASN1START
  -- TAG-AREACONFIGURATION-START
  AreaConfiguration-r16 ::= SEQUENCE {
    areaConfig-r16                    AreaConfig-r16,  
    interFreqTargetList-r16           SEQUENCE(SIZE (1..maxFreq)) OF InterFreqTargetInfo-r16  OPTIONAL  -- Need R
  }
  -- TAG-AREACONFIGURATION-STOP
AreaConfig-r16 ::= CHOICE {
   cellGlobalIdList-r16             CellGlobalIdList-r16,
   trackingAreaCodeList-r16         TrackingAreaCodeList-r16,
   trackingAreaIdentityList-r16     TrackingAreaIdentityList-r16
}

InterFreqTargetInfo-r16 ::= SEQUENCE {
   dl-CarrierFreq                 ARFCN-ValueNR,
   cellList                         SEQUENCE (SIZE (1..32)) OF  PhysCellId  OPTIONAL
}

CellGlobalIdList-r16 ::=         SEQUENCE (SIZE (1..32)) OF CGI-Info-Logging-r16

TrackingAreaCodeList-r16 ::=     SEQUENCE (SIZE (1..8)) OF TrackingAreaCode

TrackingAreaIdentityList-r16 ::= SEQUENCE (SIZE (1..8)) OF TrackingAreaIdentity-r16

TrackingAreaIdentity-r16 ::=     SEQUENCE {
   plmn-Identity-r16                PLMN-Identity,
   trackingAreaCode-r16             TrackingAreaCode
}

-- TAG-AREACONFIGURATION-STOP
-- ASN1STOP

---

**AreaConfiguration field descriptions**

**InterFreqTargetInfo**

If configured, it indicates the frequency for which UE is requested to perform measurement logging for neighbour cells. UE should perform measurement logging for the frequency in SIB4 of the current serving cell whose DL-carrierfrequency is included in the InterFreqTargetList. If not configured, the UE should perform measurement logging for all the neighbour cells.

---

**BT-NameList**

The IE **BT-NameList** is used to indicate the names of the Bluetooth beacon which the UE is configured to measure.

**BT-NameList information element**

---

---

ETSI
**BT-NameList field descriptions**

**bt-Name**
If configured, the UE only performs Bluetooth measurements according to the names identified. For each name, it refers to LOCAL NAME defined in Bluetooth specification [51].

---

**EUTRA-AllowedMeasBandwidth**

The IE **EUTRA-AllowedMeasBandwidth** is used to indicate the maximum allowed measurement bandwidth on a carrier frequency as defined by the parameter Transmission Bandwidth Configuration “Nrrb” in TS 36.104 [33]. The values mbw6, mbw15, mbw25, mbw50, mbw75, mbw100 indicate 6, 15, 25, 50, 75 and 100 resource blocks, respectively.

**EUTRA-AllowedMeasBandwidth information element**

```asn1
EUTRA-AllowedMeasBandwidth ::= ENUMERATED {mbw6, mbw15, mbw25, mbw50, mbw75, mbw100}
```

---

**EUTRA-MBSFN-SubframeConfigList**

The IE **EUTRA-MBSFN-SubframeConfigList** is used to define an E-UTRA MBSFN subframe pattern (for the purpose of NR rate matching).

**EUTRA-MBSFN-SubframeConfigList information element**

```asn1
EUTRA-MBSFN-SubframeConfig ::= SEQUENCE {radioframeAllocationPeriod ENUMERATED {n1, n2, n4, n8, n16, n32}, radioframeAllocationOffset INTEGER (0..7), subframeAllocation1 CHOICE {oneFrame BIT STRING (SIZE(6)), fourFrames BIT STRING (SIZE(24))}, subframeAllocation2 CHOICE {oneFrame BIT STRING (SIZE(2)), fourFrames BIT STRING (SIZE(8))}} OPTIONAL, -- Need R...
```
**EUTRA-MBSFN-SubframeConfig field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>radioframeAllocationOffset</td>
<td>Field as defined in MBSFN-SubframeConfig in TS 36.331 [10].</td>
</tr>
<tr>
<td>radioframeAllocationPeriod</td>
<td>Field as defined in MBSFN-SubframeConfig in TS 36.331 [10], where SFN refers to the SFN of the NR serving cell.</td>
</tr>
<tr>
<td>subframeAllocation1</td>
<td>Field as defined in MBSFN-SubframeConfig in TS 36.331 [10], where the UE assumes the duplex mode (FDD or TDD) of the NR cell for which the E-UTRA-MBSFN-SubframeConfig is provided.</td>
</tr>
<tr>
<td>subframeAllocation2</td>
<td>Field as defined in MBSFN-SubframeConfig-v1430 in TS 36.331 [10], where the UE assumes the duplex mode (FDD or TDD) of the NR cell for which the E-UTRA-MBSFN-SubframeConfig is provided.</td>
</tr>
</tbody>
</table>

-- EUTRA-MultiBandInfoList

The IE EUTRA-MultiBandInfoList indicates the list of frequency bands in addition to the band represented by CarrierFreq for which cell reselection parameters are common, and a list of additionalPmax and additionalSpectrumEmission.

**EUTRA-MultiBandInfoList information element**

```
EUTRA-MultiBandInfoList ::=     SEQUENCE (SIZE (1..maxMultiBands)) OF EUTRA-MultiBandInfo
EUTRA-MultiBandInfo ::=         SEQUENCE {
  eutra-FreqBandIndicator         FreqBandIndicatorEUTRA,  
  eutra-NS-PmaxList               EUTRA-NS-PmaxList                           OPTIONAL    -- Need R
}
```

-- EUTRA-NS-PmaxList

The IE EUTRA-NS-PmaxList concerns a list of additionalPmax and additionalSpectrumEmission, as defined in TS 36.101 [22], table 6.2.4-1 for UEs neither in CE nor BL UEs and TS 36.101 [22], table 6.2.4E-1 for UEs in CE or BL UEs, for a given frequency band.

**EUTRA-NS-PmaxList information element**

```
EUTRA-NS-PmaxList ::=     SEQUENCE (SIZE (1..maxMultiBands)) OF EUTRA-NS-Pmax
EUTRA-NS-Pmax ::=         SEQUENCE {
  eutra-Pmax                     INTEGER,  
  eutra-SpectrumEmission         ENUMERATED {  }
}
```
EUTRA-PhysCellId

The IE EUTRA-PhysCellId is used to indicate the physical layer identity of the cell, as defined in TS 36.211 [31].

**EUTRA-PhysCellId information element**

-- ASN1START
-- TAG-EUTRA-PHYSCELLID-START
EUTRA-PhysCellId ::= INTEGER (0..503)
-- TAG-EUTRA-PHYSCELLID-STOP
-- ASN1STOP

—

EUTRA-PhysCellIdRange

The IE EUTRA-PhysCellIdRange is used to encode either a single or a range of physical cell identities. The range is encoded by using a start value and by indicating the number of consecutive physical cell identities (including start) in the range. For fields comprising multiple occurrences of EUTRA-PhysCellIdRange, NW may configure overlapping ranges of physical cell identities.

**EUTRA-PhysCellIdRange information element**

-- ASN1START
-- TAG-EUTRA-PHYSCELLIDRANGE-START
EUTRA-PhysCellIdRange ::= SEQUENCE {
    start   EUTRA-PhysCellId,
    range   ENUMERATED {n4, n8, n12, n16, n24, n32, n48, n64, n84, n96,
                        n128, n168, n252, n504, spare2, spare1} OPTIONAL -- Need N
}  
-- TAG-EUTRA-PHYSCELLIDRANGE-STOP
-- ASN1STOP
The IE EUTRA-PresenceAntennaPort1 is used to indicate whether all the neighbouring cells use Antenna Port 1. When set to true, the UE may assume that at least two cell-specific antenna ports are used in all neighbouring cells.

**EUTRA-PresenceAntennaPort1 information element**

```asn1
EUTRA-PresenceAntennaPort1 ::= BOOLEAN
```

The IE EUTRA-Q-OffsetRange is used to indicate a cell, or frequency specific offset to be applied when evaluating triggering conditions for measurement reporting. The value in dB. Value dB-24 corresponds to -24 dB, value dB-22 corresponds to -22 dB and so on.

**EUTRA-Q-OffsetRange information element**

```asn1
EUTRA-Q-OffsetRange ::= ENUMERATED {
  dB-24, dB-22, dB-20, dB-18, dB-16, dB-14,
  dB-12, dB-10, dB-8, dB-6, dB-5, dB-4, dB-3,
  dB-2, dB-1, dB0, dB1, dB2, dB3, dB4, dB5,
  dB6, dB8, dB10, dB12, dB14, dB16, dB18,
  dB20, dB22, dB24
}
```

The IE IAB-IP-Address is used to indicate the IP address/prefix.

**IAB-IP-Address information element**

```asn1
IAB-IP-Address-r16 ::= CHOICE {
  IPv4-Address-r16                BIT STRING (SIZE(32)),
}
```
---

**IAB-IP-Address field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IPv4-Address</strong></td>
<td>This field is used to provide the allocated IPv4 address.</td>
</tr>
<tr>
<td><strong>IPv6-Address</strong></td>
<td>This field is used to provide the allocated IPv6 address.</td>
</tr>
<tr>
<td><strong>IPv6-Prefix</strong></td>
<td>This field is used to provide the allocated IPv6 prefix.</td>
</tr>
</tbody>
</table>

---

**IAB-IP-AddressIndex**

The IE **IAB-IP-AddressIndex** is used to identify a configuration of an IP address.

**IAB-IP-AddressIndex information element**

---

**IAB-IP-Usage**

The IE **IAB-IP-Usage** is used to indicate the usage of the assigned IP address/prefix.

**IAB-IP-Usage information element**

---
LoggingDuration

The `LoggingDuration` indicates the duration for which UE is requested to perform measurement logging. Value min10 corresponds to 10 minutes, value min20 corresponds to 20 minutes and so on.

### LoggingDuration information element

```asn1
LoggingDuration-r16 ::= ENUMERATED {
    min10, min20, min40, min60, min90, min120, spare2, spare1}
```

---

LoggingInterval

The `LoggingInterval` indicates the periodicity for logging measurement results. Value ms1280 corresponds to 1.28s, value ms2560 corresponds to 2.56s and so on. Value infinity means it is equal to the configured value of the `LoggingDuration` IE.

### LoggingInterval information element

```asn1
LoggingInterval-r16 ::= ENUMERATED {
    ms320, ms640, ms1280, ms2560, ms5120, ms10240, ms20480, 
    ms30720, ms40960, ms61440, infinity}
```

---

LogMeasResultListBT

The IE `LogMeasResultListBT` covers measured results for Bluetooth.

### LogMeasResultListBT information element

```asn1
LogMeasResultListBT-r16 ::= SEQUENCE (SIZE (1..maxBT-IdReport-r16)) OF LogMeasResultBT-r16
LogMeasResultBT-r16 ::= SEQUENCE {
    bt-Addr-r16             BIT STRING (SIZE (48)),
```
LogMeasResultListBT field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bt-Addr</td>
<td>This field indicates the Bluetooth public address of the Bluetooth beacon as defined in TS 37.355 [49].</td>
</tr>
<tr>
<td>rssi-BT</td>
<td>This field provides the beacon received signal strength indicator (RSSI) in dBm as defined in TS 37.355 [49].</td>
</tr>
</tbody>
</table>

LogMeasResultListWLAN

The IE LogMeasResultListWLAN covers measured results for WLAN.

LogMeasResultListWLAN information element

```
LogMeasResultListWLAN-r16 ::= SEQUENCE {SIZE (1..maxWLAN-Id-Report-r16)} OF LogMeasResultWLAN-r16

LogMeasResultWLAN-r16 ::= SEQUENCE {
  wlan-Identifiers-r16  WLAN-Identifiers-r16,
  rssiWLAN-r16          WLAN-RSSI-Range-r16 OPTIONAL,
  rtt-WLAN-r16          WLAN-RTT-r16 OPTIONAL,
  ...                   ...
}

WLAN-Identifiers-r16 ::= SEQUENCE {
  ssid-r16  OCTET STRING (SIZE (1..32)) OPTIONAL,
  bssid-r16 OCTET STRING (SIZE (6)) OPTIONAL,
  hessid-r16 OCTET STRING (SIZE (6)) OPTIONAL,
  ...       ...
}

WLAN-RSSI-Range-r16 ::= INTEGER(0..141)

WLAN-RTT-r16 ::= SEQUENCE {
  rttValue-r16  INTEGER (0..16777215),
  rttUnits-r16  ENUMERATED {
    microseconds, hundredsofnanoseconds, tensofnanoseconds, nanoseconds, tenthsfornanoseconds, ...},
```
LogMeasResultListWLAN field descriptions

**Bssid**
Basic Service Set Identifier (BSSID) defined in IEEE 802.11-2012 [50].

**Hessid**
Homogenous Extended Service Set Identifier (HESSID) defined in IEEE 802.11-2012 [50].

**rssiWLAN**
Measured WLAN RSSI result in dBm. The IE WLAN-RSSI-Range specifies the value range used in WLAN RSSI measurements and thresholds. Integer value for WLAN RSSI measurements is according to mapping table in TS 36.133 [40]. Value 0 corresponds to –infinity, value 1 to -100dBm, value 2 to -99dBm, and so on (i.e. in steps of 1dBm) until value 140, which corresponds to 39dBm, while value 141 corresponds to +infinity.

**rtt-WLAN**
This field provides the measured roundtrip time between the target device and WLAN AP and optionally the accuracy expressed as the standard deviation of the delay. Units for each of these are 1000ns, 100ns, 10ns, 1ns, and 0.1ns as defined in TS 37.355 [49].

**rttValue**
This field specifies the Round Trip Time (RTT) measurement between the target device and WLAN AP in units given by the field rttUnits as defined in TS 37.355 [49].

**rttUnits**
This field specifies the Units for the fields rttValue and rttAccuracy. The available Units are 1000ns, 100ns, 10ns, 1ns, and 0.1ns as defined in TS 37.355 [49].

**rttAccuracy**
This field provides the estimated accuracy of the provided rttValue expressed as the standard deviation in units given by the field rttUnits as defined in TS 37.355 [49].

**Ssid**
Service Set Identifier (SSID) defined in IEEE 802.11-2012 [50].

**Wlan-Identifiers**
Indicates the WLAN parameters used for identification of the WLAN for which the measurement results are applicable.

---

**OtherConfig**

The IE *OtherConfig* contains configuration related to miscellaneous other configurations.

---

**OtherConfig** information element

```asn1
OtherConfig ::= SEQUENCE {
    delayBudgetReportingConfig CHOICE {
        release NULL,
        setup SEQUENCE {
            delayBudgetReportingProhibitTimer ENUMERATED {s0, s0dot4, s0dot8, s1dot6, s3, s6, s12, s30}
        }
    }
} OPTIONAL
```
OtherConfig-v1540 ::= \n  \n  \nOtherConfig-v1610 ::= \n  \nOverheatingAssistanceConfig ::= \n  \nIDC-AssistanceConfig-r16 ::= \n  \nDRX-PreferenceConfig-r16 ::= \n  \nMaxBW-PreferenceConfig-r16 ::= \n  \nMaxCC-PreferenceConfig-r16 ::= \n  \nMaxMIMO-LayerPreferenceConfig-r16 ::= \n  \nOtherConfig-v1540 ::= SEQUENCE {\n  overheatingAssistanceConfig SetupRelease (OverheatingAssistanceConfig) \n  OPTIONAL, -- Need M\n  ...\n}  
CandidateServingFreqListNR-r16 ::= SEQUENCE {SIZE (1..maxFreqIDC-r16)} OF ARFCN-ValueNR

OtherConfig-v1610 ::= SEQUENCE {\n  idc-AssistanceConfig-r16                     SetupRelease {IDC-AssistanceConfig-r16}                       OPTIONAL, -- Need M\n  drx-PreferenceConfig-r16                   SetupRelease {DRX-PreferenceConfig-r16}                       OPTIONAL, -- Need M\n  maxBW-PreferenceConfig-r16                 SetupRelease {MaxBW-PreferenceConfig-r16}                     OPTIONAL, -- Need M\n  maxCC-PreferenceConfig-r16                 SetupRelease {MaxCC-PreferenceConfig-r16}                     OPTIONAL, -- Need M\n  maxMIMO-LayerPreferenceConfig-r16          SetupRelease {MaxMIMO-LayerPreferenceConfig-r16}               OPTIONAL, -- Need M\n  minSchedulingOffsetPreferenceConfig-r16    SetupRelease {MinSchedulingOffsetPreferenceConfig-r16}          OPTIONAL, -- Need M\n  releasePreferenceConfig-r16               SetupRelease {ReleasePreferenceConfig-r16}                    OPTIONAL, -- Need M\n  referenceTimePreferenceReporting-r16      ENUMERATED {true}                                             OPTIONAL, -- Need R\n  btNameList-r16                            SetupRelease {BT-NameList-r16}                                OPTIONAL, -- Need M\n  wlanNameList-r16                         SetupRelease {WLAN-NameList-r16}                              OPTIONAL, -- Need M\n  sensorNameList-r16                        SetupRelease {Sensor-NameList-r16}                            OPTIONAL, -- Need M\n  obtainCommonLocation-r16                 ENUMERATED {true}                                             OPTIONAL, -- Need R\n  s1-AssistanceConfigNR-r16                 ENUMERATED {true}                                             OPTIONAL, -- Need R\n}  
OverheatingAssistanceConfig ::= SEQUENCE {\n  overheatingIndicationProhibitTimer        ENUMERATED {s0, s0dot5, s1, s2, s5, s10, s20, s30,\n                                           s60, s90, s120, s300, s600, spare3, spare2, spare1}\n}  
IDC-AssistanceConfig-r16 ::= SEQUENCE {\n  candidateServingFreqListNR-r16 CandidateServingFreqListNR-r16 \n  OPTIONAL, -- Need R\n  ...\n}  
DRX-PreferenceConfig-r16 ::= SEQUENCE {\n  drx-PreferenceProhibitTimer-r16            ENUMERATED {s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,\n                                           s8, s9, s10, s20, s30, spare2, spare1}\n}  
MaxBW-PreferenceConfig-r16 ::= SEQUENCE {\n  maxBW-PreferenceProhibitTimer-r16          ENUMERATED {s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,\n                                           s8, s9, s10, s20, s30, spare2, spare1}\n}  
MaxCC-PreferenceConfig-r16 ::= SEQUENCE {\n  maxCC-PreferenceProhibitTimer-r16          ENUMERATED {s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,\n                                           s8, s9, s10, s20, s30, spare2, spare1}\n}  
MaxMIMO-LayerPreferenceConfig-r16 ::= SEQUENCE {\n  maxMIMO-LayerPreferenceProhibitTimer-r16   ENUMERATED {s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,\n                                           s8, s9, s10, s20, s30, spare2, spare1}\n}
MinSchedulingOffsetPreferenceConfig-r16 ::= SEQUENCE {
    minSchedulingOffsetPreferenceProhibitTimer-r16 ENUMERATED {
        s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,
        s8, s9, s10, s20, s30, spare2, spare1}
}

ReleasePreferenceConfig-r16 ::= SEQUENCE {
    releasePreferenceProhibitTimer-r16 ENUMERATED {
        s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,
        s8, s9, s10, s20, s30, infinity, spare1},
    connectedReporting ENUMERATED {true} OPTIONAL -- Need R
}

-- TAG-OTHERCONFIG-STOP
-- ASN1STOP
<table>
<thead>
<tr>
<th><strong>OtherConfig field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>candidateServingFreqListNR</strong></td>
</tr>
<tr>
<td>Indicates for each candidate NR serving cells, the center frequency around which UE is requested to report IDC issues.</td>
</tr>
<tr>
<td><strong>connectedReporting</strong></td>
</tr>
<tr>
<td>Indicates that the UE can report a preference to remain in RRC_CONNECTED state following a report to leave RRC_CONNECTED state. If absent, the UE cannot report a preference to stay in RRC_CONNECTED state.</td>
</tr>
<tr>
<td><strong>delayBudgetReportingProhibitTimer</strong></td>
</tr>
<tr>
<td>Prohibit timer for delay budget reporting. Value in seconds. Value $s0$ means prohibit timer is set to 0 seconds, value $s0dot4$ means prohibit timer is set to 0.4 seconds, and so on.</td>
</tr>
<tr>
<td><strong>drx-PreferenceConfig</strong></td>
</tr>
<tr>
<td>Prohibit timer for DRX preferences assistance information reporting. Value in seconds. Value $s0$ means prohibit timer is set to 0 seconds, value $s0dot5$ means prohibit timer is set to 0.5 seconds, value $s1$ means prohibit timer is set to 1 second and so on.</td>
</tr>
<tr>
<td><strong>idc-AssistanceConfig</strong></td>
</tr>
<tr>
<td>Configuration for the UE to report assistance information to inform the gNB about UE detected IDC problem.</td>
</tr>
<tr>
<td><strong>maxBW-PreferenceConfig</strong></td>
</tr>
<tr>
<td>Configuration for the UE to report assistance information to inform the gNB about the UE’s preferred bandwidth for power saving.</td>
</tr>
<tr>
<td><strong>maxBW-PreferenceProhibitTimer</strong></td>
</tr>
<tr>
<td>Prohibit timer for preferred bandwidth assistance information reporting. Value in seconds. Value $s0$ means prohibit timer is set to 0 seconds, value $s0dot5$ means prohibit timer is set to 0.5 seconds, value $s1$ means prohibit timer is set to 1 second and so on.</td>
</tr>
<tr>
<td><strong>maxCC-PreferenceConfig</strong></td>
</tr>
<tr>
<td>Configuration for the UE to report assistance information to inform the gNB about the UE’s preferred number of carriers for power saving.</td>
</tr>
<tr>
<td><strong>maxCC-PreferenceProhibitTimer</strong></td>
</tr>
<tr>
<td>Prohibit timer for preferred number of carriers assistance information reporting. Value in seconds. Value $s0$ means prohibit timer is set to 0 seconds, value $s0dot5$ means prohibit timer is set to 0.5 seconds, value $s1$ means prohibit timer is set to 1 second and so on.</td>
</tr>
<tr>
<td><strong>maxMIMO-LayerPreferenceConfig</strong></td>
</tr>
<tr>
<td>Configuration for the UE to report assistance information to inform the gNB about the UE’s preferred number of MIMO layers for power saving.</td>
</tr>
<tr>
<td><strong>maxMIMO-LayerPreferenceProhibitTimer</strong></td>
</tr>
<tr>
<td>Prohibit timer for preferred number of MIMO layers assistance information reporting. Value in seconds. Value $s0$ means prohibit timer is set to 0 seconds, value $s0dot5$ means prohibit timer is set to 0.5 seconds, value $s1$ means prohibit timer is set to 1 second and so on.</td>
</tr>
<tr>
<td><strong>minSchedulingOffsetPreferenceReporting</strong></td>
</tr>
<tr>
<td>If present, the field indicates the UE is configured to provide reference time assistance information.</td>
</tr>
</tbody>
</table>
### releasePreferenceConfig
Configuration for the UE to report assistance information to inform the gNB about the UE’s preference to leave RRC_CONNECTED state.

### releasePreferenceProhibitTimer
Prohibit timer for release preference assistance information reporting. Value in seconds. Value $s0$ means prohibit timer is set to 0 seconds, value $s0dot5$ means prohibit timer is set to 0.5 seconds, value $s1$ means prohibit timer is set to 1 second and so on. Value $infinity$ means that once a UE has reported a release preference, the UE cannot report a release preference again during the RRC connection.

### sensorNameList
Configuration for the UE to report measurements from specific sensors.

### sl-AssistanceConfigNR
Indicate whether UE is configured to provide configured grant assistance information for NR sidelink communication.

---

**PhysCellIdUTRA-FDD**

The IE *PhysCellIdUTRA-FDD* is used to indicate the physical layer identity of the cell, i.e. the primary scrambling code, as defined in TS 25.331 [45].

**PhysCellIdUTRA-FDD information element**

```asn1
PhysCellIdUTRA-FDD-r16 ::= INTEGER (0..511)
```

---

**RRC-TransactionIdentifier**

The IE *RRC-TransactionIdentifier* is used, together with the message type, for the identification of an RRC procedure (transaction).

**RRC-TransactionIdentifier information element**

```asn1
RRC-TransactionIdentifier ::= INTEGER (0..3)
```

---

**Sensor-NameList**

The IE *Sensor-NameList* is used to indicate the names of the sensors which the UE is configured to measure.
Sensor-NameList information element

```
Sensor-NameList-r16 ::= SEQUENCE {
  measUncomBarPre-r16     ENUMERATED {true}            OPTIONAL,  -- Need R
  measUeSpeed             ENUMERATED {true}            OPTIONAL,  -- Need R
  measUeOrientation       ENUMERATED {true}            OPTIONAL   -- Need R
}
```

Sensor-NameList field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>measUncomBarPre</td>
<td>If configured, the UE reports the uncompensated Barometeric pressure measurement as defined in TS 37.355 [49].</td>
</tr>
<tr>
<td>measUeSpeed</td>
<td>If configured, the UE reports the UE speed measurement as defined in TS 37.355 [49].</td>
</tr>
<tr>
<td>measUeOrientation</td>
<td>If configured, the UE reports the UE orientation information as defined in TS 37.355 [49].</td>
</tr>
</tbody>
</table>

TraceReference

The TraceReference contains parameter Trace Reference as defined in TS 32.422 [52].

TraceReference information element

```
TraceReference-r16 ::= SEQUENCE {
  plmn-Identity-r16      PLMN-Identity,
  traceId-r16            OCTET STRING (SIZE (3))
}
```

UE-MeasurementsAvailable

The IE UE-MeasurementsAvailable is used to indicate all relevant available indicators for UE measurements.
**UE-MeasurementsAvailable** information element

```asn1
-- TAG-UE-MeasurementsAvailable-START
UE-MeasurementsAvailable-r16 ::= SEQUENCE {
  logMeasAvailable-r16                         ENUMERATED {true} OPTIONAL,
  logMeasAvailableBT-r16                       ENUMERATED {true} OPTIONAL,
  logMeasAvailableWLAN-r16                     ENUMERATED {true} OPTIONAL,
  connEstFailInfoAvailable-r16                 ENUMERATED {true} OPTIONAL,
  rlf-InfoAvailable-r16                        ENUMERATED {true} OPTIONAL,
  ...                                         
}
-- TAG-UE-MeasurementsAvailable-STOP
-- ASN1STOP
```

**UTRA-FDD-Q-OffsetRange**

The IE **UTRA-FDD-Q-OffsetRange** is used to indicate a frequency specific offset to be applied when evaluating triggering conditions for measurement reporting. The value is in dB. Value **dB-24** corresponds to -24 dB, value **dB-22** corresponds to -22 dB and so on.

```asn1
-- TAG-UTRA-FDD-Q-OFFSETRANGE-START
UTRA-FDD-Q-OffsetRange-r16 ::= ENUMERATED {
  dB-24, dB-22, dB-20, dB-18, dB-16, dB-14,
  dB-12, dB-10, dB-8, dB-6, dB-5, dB-4, dB-3,
  dB-2, dB-1, dB0, dB1, dB2, dB3, dB4, dB5,
  dB6, dB8, dB10, dB12, dB14, dB16, dB18,
  dB20, dB22, dB24
}
-- TAG-UTRA-FDD-Q-OFFSETRANGE-STOP
-- ASN1STOP
```

**VisitedCellInfoList**

The IE **VisitedCellInfoList** includes the mobility history information of maximum of 16 most recently visited cells or time spent in any cell selection state and/or camped on any cell state in NR or E-UTRA. The most recently visited cell is stored first in the list. The list includes cells visited in RRC_IDLE, RRC_INACTIVE and RRC_CONNECTED states for NR and RRC_IDLE and RRC_CONNECTED for E-UTRA.

```asn1
-- TAG-VISITEDCELLINFOLIST-START
VisitedCellInfoList
-- ASN1STOP
```
VisitedCellInfoList-r16 ::= SEQUENCE (SIZE {1..maxCellHistory-r16}) OF VisitedCellInfo-r16

VisitedCellInfo-r16 ::= SEQUENCE {
  visitedCellId-r16    CHOICE {
    nr-CellId-r16       CHOICE {
      cgi-info           CGI-Info-Logging-r16,
      pci-arfcn-r16      SEQUENCE {
        physCellId-r16    PhysCellId,
        carrierFreq-r16   ARFCN-ValueNR
      }
    },
    eutra-CellId-r16    CHOICE {
      cellGlobalId-r16   CGI-InfoEUTRA,
      pci-arfcn-r16      SEQUENCE {
        physCellId-r16    EUTRA-PhysCellId,
        carrierFreq-r16   ARFCN-ValueEUTRA
      }
    }
  } OPTIONAL,
  timeSpent-r16       INTEGER (0..4095),
  ... }
6.3.5 Sidelink information elements

— **SL-BWP-Config**

The IE *SL-BWP-Config* is used to configure the UE specific NR sidelink communication on one particular sidelink bandwidth part.

### SL-BWP-Config information element

```asn1
-- ASN1START
-- TAG-SL-BWP-CONFIG-START

SL-BWP-Config-r16 ::= SEQUENCE {
  sl-BWP-Id                                BWP-Id,     
  sl-BWP-Generic-r16                       SL-BWP-Generic-r16                       OPTIONAL, -- Need M
  sl-BWP-PoolConfig-r16                    SL-BWP-PoolConfig-r16                                OPTIONAL, -- Need M
  ...
}

SL-BWP-Generic-r16 ::= SEQUENCE {
  sl-BWP-r16                               BWP                                                                OPTIONAL, -- Need M
  sl-StartSymbol-r16                       ENUMERATED {sym0, sym1, sym2, sym3, sym4, sym5, sym6, sym7}        OPTIONAL, -- Need M
  sl-PSBCH-Config-r16                      SetupRelease {SL-PSBCH-Config-r16}                                 OPTIONAL, -- Need M
  sl-TxDirectCurrentLocation-r16           INTEGER (0..3301)                                                  OPTIONAL, -- Need M
  ...
}

-- TAG-SL-BWP-CONFIG-STOP
-- ASN1STOP
```

### SL-BWP-Config field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>sl-BWP-Id</strong></td>
<td>Indicates the configured sidelink BWP.</td>
</tr>
<tr>
<td><strong>sl-BWP-Generic</strong></td>
<td>Indicates the generic parameters on the configured sidelink BWP.</td>
</tr>
<tr>
<td><strong>sl-BWP-PoolConfig</strong></td>
<td>Indicates the resource pool configurations on the configured sidelink BWP.</td>
</tr>
</tbody>
</table>
**SL-BWP-ConfigCommon**

The IE **SL-BWP-ConfigCommon** is used to configure the cell-specific configuration information on one particular sidelink bandwidth part.

**SL-BWP-ConfigCommon information element**

```asciidoc
-- ASN1START
-- TAG-SL-BWP-CONFIGCOMMON-START

SL-BWP-ConfigCommon-r16 ::= SEQUENCE {
  sl-BWP-Generic-r16  SL-BWP-Generic-r16  OPTIONAL,  -- Need R
  sl-BWP-PoolConfigCommon-r16  SL-BWP-PoolConfigCommon-r16  OPTIONAL,  -- Need R
  ...  }

-- TAG-SL-BWP-CONFIGCOMMON-STOP
-- ASN1STOP
```

**SL-BWP-ConfigCommon field descriptions**

- **sl-BWP-Generic**
  This field indicates the generic parameters on the configured sidelink BWP.

- **sl-BWP-PoolConfigCommon**
  This field indicates the resource pool configurations on the configured sidelink BWP.

-- **SL-BWP-PoolConfig**

The IE **SL-BWP-PoolConfig** is used to configure NR sidelink communication resource pool.

**SL-BWP-PoolConfig information element**

```asciidoc
-- ASN1START
-- TAG-SL-BWP-POOLCONFIG-START

SL-BWP-PoolConfig-r16 ::= SEQUENCE {
  ...  }

-- TAG-SL-BWP-POOLCONFIG-STOP
-- ASN1STOP
```
3GPP TS 38.331 version 16.3.1 Release 16

**SL-BWP-PoolConfig field descriptions**

**sl-RxPool**
Indicates the receiving resource pool on the configured BWP. For the PSFCH related configuration, if configured, will be used for PSFCH transmission/reception. If the field is included, it replaces any previous list, i.e. all the entries of the list are replaced and each of the SL-ResourcePool entries is considered to be newly created.

**sl-TxPoolExceptional**
Indicates the resources by which the UE is allowed to transmit NR sidelink communication in exceptional conditions on the configured BWP. For the PSFCH related configuration, if configured, will be used for PSFCH transmission/reception.

**sl-TxPoolScheduling**
Indicates the resources by which the UE is allowed to transmit NR sidelink communication based on network scheduling on the configured BWP. For the PSFCH related configuration, if configured, will be used for PSFCH transmission/reception.

**sl-TxPoolSelectedNormal**
Indicates the resources by which the UE is allowed to transmit NR sidelink communication by UE autonomous resource selection on the configured BWP. For the PSFCH related configuration, if configured, will be used for PSFCH transmission/reception.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HO</td>
<td>This field is optionally present, need M, in an RRCReconfiguration message including reconfigurationWithSync; otherwise it is absent, Need M.</td>
</tr>
</tbody>
</table>

---

**SL-BWP-PoolConfigCommon**

The IE **SL-BWP-PoolConfigCommon** is used to configure the cell-specific NR sidelink communication resource pool.

**SL-BWP-PoolConfigCommon information element**
The IE SL-CBR-PriorityTxConfigList indicates the mapping between PSSCH transmission parameter (such as MCS, PRB number, retransmission number, CR limit) sets by using the indexes of the configurations provided in sl-CBR-PSSCH-TxConfigList, CBR ranges by an index to the entry of the CBR range configuration in sl-CBR-RangeConfigList, and priority ranges. It also indicates the default PSSCH transmission parameters to be used when CBR measurement results are not available.

**SL-CBR-PriorityTxConfigList information element**

```asn1
SL-CBR-PriorityTxConfigList-r16 ::= SEQUENCE { 
  sl-PriorityTxConfigIndexList-r16 SEQUENCE (SIZE (1..8)) OF SL-TxConfigIndex-r16 OPTIONAL -- Need M, 
  sl-CBR-ConfigIndexList-r16 SEQUENCE (SIZE (1..maxCBR-Level-1-r16)) OF SL-ConfigIndex-r16 OPTIONAL -- Need M, 
  sl-CBR-DefaultTxConfigIndex-r16 INTEGER (0..maxCBR-Config1-r16) OPTIONAL -- Need M, 
  sl-PriorityThreshold-r16 INTEGER (1..8) OPTIONAL -- Need M, 
} 
```

**SL-CBR-PriorityTxConfigList field descriptions**

**sl-CBR-ConfigIndex**
- Indicates the CBR ranges to be used by an index to the entry of the CBR range configuration in sl-CBR-RangeConfigList.

**sl-DefaultTxConfigIndex**
- Indicates the PSSCH transmission parameters to be used by the UEs which do not have available CBR measurement results, by means of an index to the corresponding entry in tx-ConfigIndexList. Value 0 indicates the first entry in tx-ConfigIndexList. The field is ignored if the UE has available CBR measurement results.

**sl-PriorityThreshold**
- Indicates the upper bound of priority range which is associated with the configurations in sl-CBR-ConfigIndex and in sl-Tx-ConfigIndexList. The upper bounds of the priority ranges are configured in ascending order for consecutive entries of SL-Priority-TxConfigIndex in SL-CBR-PriorityTxConfigList. For the first entry of SL-Priority-TxConfigIndex, the lower bound of the priority range is 1.
The IE `SL-CBR-CommonTxConfigList` indicates the list of PSSCH transmission parameters (such as MCS, sub-channel number, retransmission number, CR limit) in `sl-CBR-PSSCH-TxConfigList`, and the list of CBR ranges in `sl-CBR-RangeConfigList`, to configure congestion control to the UE for sidelink communication.

**SL-CBR-CommonTxConfigList**

- **sl-CBR-RangeConfigList**
  Indicates the list of CBR ranges. Each entry of the list indicates in `SL-CBR-LevelsConfig` the upper bound of the CBR range for the respective entry. The upper bounds of the CBR ranges are configured in ascending order for consecutive entries of `sl-CBR-RangeConfigList`. For the first entry of `sl-CBR-RangeConfigList` the lower bound of the CBR range is 0. Value 0 corresponds to 0, value 1 to 0.01, value 2 to 0.02, and so on.

- **sl-CR-Limit**
  Indicates the maximum limit on the occupancy ratio. Value 0 corresponds to 0, value 1 to 0.0001, value 2 to 0.0002, and so on (i.e. in steps of 0.0001) until value 10000, which corresponds to 1.

- **sl-CBR-PSSCH-TxConfigList**
  Indicates the list of available PSSCH transmission parameters (such as MCS, sub-channel number, retransmission number and CR limit) configurations.

- **sl-TxParameters**
  Indicates PSSCH transmission parameters.

---

**SL-CBR-CommonTxConfigList field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-CBR-RangeConfigList</td>
<td>Indicates the list of CBR ranges. Each entry of the list indicates in <code>SL-CBR-LevelsConfig</code> the upper bound of the CBR range for the respective entry. The upper bounds of the CBR ranges are configured in ascending order for consecutive entries of <code>sl-CBR-RangeConfigList</code>. For the first entry of <code>sl-CBR-RangeConfigList</code> the lower bound of the CBR range is 0. Value 0 corresponds to 0, value 1 to 0.01, value 2 to 0.02, and so on.</td>
</tr>
<tr>
<td>sl-CR-Limit</td>
<td>Indicates the maximum limit on the occupancy ratio. Value 0 corresponds to 0, value 1 to 0.0001, value 2 to 0.0002, and so on (i.e. in steps of 0.0001) until value 10000, which corresponds to 1.</td>
</tr>
<tr>
<td>sl-CBR-PSSCH-TxConfigList</td>
<td>Indicates the list of available PSSCH transmission parameters (such as MCS, sub-channel number, retransmission number and CR limit) configurations.</td>
</tr>
<tr>
<td>sl-TxParameters</td>
<td>Indicates PSSCH transmission parameters.</td>
</tr>
</tbody>
</table>
The IE \textit{SL-ConfigDedicatedNR} specifies the dedicated configuration information for NR sidelink communication.

\textit{SL-ConfigDedicatedNR} information element

```plaintext
-- ASN1START
-- TAG-SL-CONFIGDEDICATEDNR-START

SL-ConfigDedicatedNR-r16 ::= SEQUENCE {
  sl-PHY-MAC-RLC-Config-r16 SL-PHY-MAC-RLC-Config-r16 OPTIONAL, -- Need M
  sl-RadioBearerToReleaseList-r16 SEQUENCE (SIZE (1..maxNrofSLRB-r16)) OF SLRB-Uu-ConfigIndex-r16 OPTIONAL, -- Need N
  sl-RadioBearerToAddModList-r16 SEQUENCE (SIZE (1..maxNrofSLRB-r16)) OF SL-RadioBearerConfig-r16 OPTIONAL, -- Need N
  sl-MeasConfigInfoToReleaseList-r16 SEQUENCE (SIZE (1..maxNrofSL-Dest-r16)) OF SL-DestinationIndex-r16 OPTIONAL, -- Need N
  sl-MeasConfigInfoToAddModList-r16 SEQUENCE (SIZE (1..maxNrofSL-Dest-r16)) OF SL-MeasConfigInfo-r16 OPTIONAL, -- Need M
  t400-r16 ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000} OPTIONAL, -- Need M
  ...
}

SL-DestinationIndex-r16 ::= INTEGER (0..maxNrofSL-Dest-1-r16)

SL-PHY-MAC-RLC-Config-r16 ::= SEQUENCE {
  sl-ScheduledConfig-r16 SetupRelease { SL-ScheduledConfig-r16 } OPTIONAL, -- Need M
  sl-UE-SelectedConfig-r16 SetupRelease { SL-UE-SelectedConfig-r16 } OPTIONAL, -- Need M
  sl-FreqInfoToReleaseList-r16 SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF SL-Freq-Id-r16 OPTIONAL, -- Need N
  sl-FreqInfoToAddModList-r16 SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF SL-FreqConfig-r16 OPTIONAL, -- Need N
  sl-RLC-BearerToReleaseList-r16 SEQUENCE (SIZE (1..maxSL-LCID-r16)) OF SL-RLC-BearerConfigIndex-r16 OPTIONAL, -- Need N
  sl-RLC-BearerToAddModList-r16 SEQUENCE (SIZE (1..maxSL-LCID-r16)) OF SL-RLC-BearerConfig-r16 OPTIONAL, -- Need N
  sl-MaxNumConsecutiveDTX-r16 ENUMERATED {n1, n2, n3, n4, n6, n8, n16, n32} OPTIONAL, -- Need M
  sl-CSI-Acquisition-r16 ENUMERATED {enabled} OPTIONAL, -- Need R
  sl-CSISchedulingRequestId-r16 SetupRelease { SchedulingRequestId } OPTIONAL, -- Need M
  sl-SSB-PriorityNR-r16 INTEGER (1..8) OPTIONAL, -- Need R
  networkControlledSyncTx-r16 ENUMERATED {on, off} OPTIONAL -- Need M
}

-- TAG-SL-CONFIGDEDICATEDNR-STOP
-- ASN1STOP
```
### SL-ConfigDedicatedNR field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-MeasConfigInfoToAddModList</td>
<td>This field indicates the RSRP measurement configurations for unicast destinations to add and/or modify.</td>
</tr>
<tr>
<td>sl-MeasConfigInfoToReleaseList</td>
<td>This field indicates the RSRP measurement configurations for unicast destinations to remove.</td>
</tr>
<tr>
<td>sl-PHY-MAC-RLC-Config</td>
<td>This field indicates the lower layer sidelink radio bearer configurations.</td>
</tr>
<tr>
<td>sl-RadioBearerToAddModList</td>
<td>This field indicates one or multiple sidelink radio bearer configurations to add and/or modify.</td>
</tr>
<tr>
<td>sl-RadioBearerToReleaseList</td>
<td>This field indicates one or multiple sidelink radio bearer configurations to remove.</td>
</tr>
</tbody>
</table>

### SL-PHY-MAC-RLC-Config field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>networkControlledSyncTx</td>
<td>This field indicates whether the UE shall transmit synchronisation information (i.e. become synchronisation source). Value on indicates the UE to transmit synchronisation information while value off indicates the UE to not transmit such information.</td>
</tr>
<tr>
<td>sl-MaxNumConsecutiveDTX</td>
<td>This field indicates the maximum number of consecutive HARQ DTX before triggering sidelink RLF. Value n1 corresponds to 1, value n2 corresponds to 2, and so on.</td>
</tr>
<tr>
<td>sl-FreqInfoToAddModList</td>
<td>This field indicates the NR sidelink communication configuration on some carrier frequency (ies) to add and/or modify. In this release, only one entry can be configured in the list.</td>
</tr>
<tr>
<td>sl-FreqInfoToReleaseList</td>
<td>This field indicates the NR sidelink communication configuration on some carrier frequency (ies) to remove. In this release, only one entry can be configured in the list.</td>
</tr>
<tr>
<td>sl-RLC-BearerToAddModList</td>
<td>This field indicates one or multiple sidelink RLC bearer configurations to add and/or modify.</td>
</tr>
<tr>
<td>sl-RLC-BearerToReleaseList</td>
<td>This field indicates one or multiple sidelink RLC bearer configurations to remove.</td>
</tr>
<tr>
<td>sl-ScheduledConfig</td>
<td>Indicates the configuration for UE to transmit NR sidelink communication based on network scheduling. This field is not configured simultaneously with sl-UE-SelectedConfig.</td>
</tr>
<tr>
<td>sl-UE-SelectedConfig</td>
<td>Indicates the configuration used for UE autonomous resource selection. This field is not configured simultaneously with sl-ScheduledConfig.</td>
</tr>
<tr>
<td>sl-CSI-Acquisition</td>
<td>Indicates whether CSI reporting is enabled in sidelink unicast. If the field is absent, sidelink CSI reporting is disabled.</td>
</tr>
<tr>
<td>sl-CSI-SchedulingRequestd</td>
<td>If present, it indicates the scheduling request configuration applicable for sidelink CSI report MAC CE, as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td>sl-SSB-PriorityNR</td>
<td>This field indicates the priority of NR sidelink SSB transmission and reception.</td>
</tr>
</tbody>
</table>
**SL-ConfiguredGrantConfig**

The IE **SL-ConfiguredGrantConfig** specifies the configured grant configuration information for NR sidelink communication.

**SL-ConfiguredGrantConfig** information element

```asn1
-- ASN1START
-- TAG=SL-CONFIGUREDGRANTCONFIG-START
SL-ConfiguredGrantConfig-r16 ::= SEQUENCE {
  sl-ConfigIndexCG-r16,  -- Need M
  sl-PeriodCG-r16,        -- Need M
  sl-HoDRHARQ-Processes-r16,  -- Need M
  sl-HARQ-ProcID-offset-r16,  -- Need M
  sl-CG-MaxTransNumList-r16,  -- Need M
  rrc-ConfiguredSidelinkGrant-r16 SEQUENCE {
    sl-TimeResourceCG-Type1-r16,  -- Need M
    sl-StartSubchannelCG-Type1-r16,  -- Need M
    sl-FreqResourceCG-Type1-r16,  -- Need M
    sl-TimeOffsetCG-Type1-r16,  -- Need M
    sl-P1PUCCH-AN-r16,  -- Need M
    sl-PSFCH-ToPUCCH-CG-Type1-r16,  -- Need M
    sl-RessourcePoolID-r16,  -- Need M
    sl-TimeReferenceSFN-Type1-r16,  -- Need M
  }
  ... }  -- TAG=SL-CONFIGUREDGRANTCONFIG-STOP
-- ASN1STOP
```

**sl-ConfigIndexCG-r16** ::= INTEGER (1..maxNrofCG-SL-r16)

**SL-CG-MaxTransNumList-r16** ::= SEQUENCE {SIZE (1..8)} OF SL-CG-MaxTransNum-r16

**SL-CG-MaxTransNum-r16** ::= SEQUENCE {
  sl-Priority-r16,  -- Need M
  sl-MaxTransNum-r16,  -- Need M
}

**SL-PeriodCG-r16** ::= CHOICE{
  sl-PeriodCG1-r16 ENUMERATED {ms100, ms200, ms300, ms400, ms500, ms600, ms700, ms800, ms900, ms1000, spare6, spare5, spare4, spare3, spare2, spare1},  -- Need M
  sl-PeriodCG2-r16 INTEGER (1..99),  -- Need M
}

-- ASN1START
-- TAG=SL-CONFIGUREDGRANTCONFIG-STOP
-- ASN1STOP

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>sl-ConfigIndexCG</strong></td>
<td>This field indicates the ID to identify configured grant for sidelink.</td>
</tr>
<tr>
<td><strong>sl-CG-MaxTransNumList</strong></td>
<td>This field indicates the maximum number of times that a TB can be transmitted using the resources provided by the configured grant. <strong>sl-Priority</strong> corresponds to the logical channel priority.</td>
</tr>
<tr>
<td><strong>sl-FreqResourceCG-Type1</strong></td>
<td>Indicates the frequency resource location of sidelink configured grant type 1. An index giving valid combinations of one or two starting sub-channel and length (jointly encoded) as resource indicator (RIV), as defined in TS 38.214 [19].</td>
</tr>
<tr>
<td><strong>sl-N1PUCCH-AN</strong></td>
<td>This field indicates the HARQ resource for PUCCH for sidelink configured grant type 1. The actual PUCCH-Resource is configured in sl-PUCCH-Config and referred to by its ID.</td>
</tr>
<tr>
<td><strong>sl-NrOfHARQ-Processes</strong></td>
<td>This field indicates the number of HARQ processes configured for a specific configured grant. It applies for both Type 1 and Type 2.</td>
</tr>
<tr>
<td><strong>sl-PeriodCG</strong></td>
<td>This field indicates the period of sidelink configured grant in the unit of ms.</td>
</tr>
<tr>
<td><strong>sl-PSFCH-ToPUCCH-CG-Type1</strong></td>
<td>This field, for configured grant type 1, indicates slot offset between the PSFCH associated with the last PSSCH resource of each period and the PUCCH occasion used for reporting sidelink HARQ.</td>
</tr>
<tr>
<td><strong>sl-ResourcePoolID</strong></td>
<td>Indicates the resource pool in which the configured sidelink grant Type 1 is applied.</td>
</tr>
<tr>
<td><strong>sl-StartSubchannelCG-Type1</strong></td>
<td>This field indicates the starting sub-channel of sidelink configured grant Type 1. An index giving valid sub-channel index.</td>
</tr>
<tr>
<td><strong>sl-TimeOffsetCG-Type1</strong></td>
<td>This field indicates the time offset related to SFN= <strong>sl-TimeReferenceSFN-Type1</strong>, as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>sl-TimeReferenceSFN-Type1</strong></td>
<td>Indicates SFN used for determination of the offset of a resource in time domain. If it is present, the UE uses the closest SFN with the indicated number preceding the reception of the sidelink configured grant configuration Type 1, see TS 38.321 [3], clause 5.8.3. If it is not present, the reference SFN is 0.</td>
</tr>
<tr>
<td><strong>sl-TimeResourceCG-Type1</strong></td>
<td>This field indicates the time resource location of sidelink configured grant Type 1. An index giving valid combinations of up to two slot positions (jointly encoded) as time resource indicator (TRIV), as defined in TS 38.212 [17].</td>
</tr>
</tbody>
</table>

---

**SL-DestinationIdentity**

The IE **SL-DestinationIdentity** is used to identify a destination of a NR sidelink communication.

**SL-DestinationIdentity** information element

```plaintext
-- ASN1START
-- TAG=SL-DESTINATIONIDENTITY-START

SL-DestinationIdentity-r16 ::= BIT STRING (SIZE (24))

-- TAG=SL-DESTINATIONIDENTITY-STOP
-- ASN1STOP
```
The IE **SL-FreqConfig** specifies the dedicated configuration information on one particular carrier frequency for NR sidelink communication.

**SL-FreqConfig** information element

```asn1
SL-FreqConfig-r16 ::= SEQUENCE {
  sl-Freq-Id-r16                      SL-Freq-Id-r16,
  sl-SCS-SpecificCarrierList-r16     SEQUENCE {SIZE (1..maxSCSs)} OF SCS-SpecificCarrier,  OPTIONAL, -- Need M
  sl-AbsoluteFrequencyPointA-r16     ARFCN-ValueNR  OPTIONAL, -- Need R
  sl-AbsoluteFrequencySSB-r16       ARFCN-ValueNR  OPTIONAL, -- Cond V2X-SL-Shared
  frequencyShift7p5khzSL-r16       ENUMERATED {true}  OPTIONAL, -- Cond V2X-SL-Shared
  sl-SWP-ToReleaseList-r16          SEQUENCE (SIZE (1..maxNrofSL-BWPs-r16)) OF BWP-Id   OPTIONAL, -- Need N
  sl-SWP-ToAddModList-r16           SEQUENCE (SIZE (1..maxNrofSL-BWPs-r16)) OF SL-BWP-Config-r16 OPTIONAL, -- Need M
  sl-SyncConfigList-r16             SL-SyncConfigList-r16 OPTIONAL, -- Need M
  sl-SyncPriority-r16               ENUMERATED {gnss, gnbEnb} OPTIONAL -- Need M
}
SL-Freq-Id-r16 ::=                     INTEGER (1.. maxNrofFreqSL-r16)
```

-- ASN1START
-- TAG-SL-FREQCONFIG-START

---

---

-- ASN1STOP
-- TAG-SL-FREQCONFIG-STOP

---

---
**SL-FreqConfig field descriptions**

**frequencyShift7p5khzSL**
Enable the NR SL transmission with a 7.5 kHz shift to the LTE raster. If the field is absent, the frequency shift is disabled.

**sl-AbsoluteFrequencyPointA**
Absolute frequency of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A.

**sl-AbsoluteFrequencySSB**
Indicates the frequency location of sidelink SSB. The transmission bandwidth for sidelink SSB is within the bandwidth of this sidelink BWP.

**sl-BWP-ToAddModList**
This field indicates the list of sidelink BWP(s) on which the NR sidelink communication configuration is to be added or reconfigured. In this release, only one BWP is allowed to be configured for NR sidelink communication.

**sl-BWP-ToReleaseList**
This field indicates the list of sidelink BWP(s) on which the NR sidelink communication configuration is to be released.

**sl-Freq-Id**
This field indicates the identity of the dedicated configuration information on the carrier frequency for NR sidelink communication.

**sl-SCS-SpecificCarrierList**
A set of UE specific channel bandwidth and location configurations for different subcarrier spacings (numerologies). Defined in relation to Point A. The UE uses the configuration provided in this field only for the purpose of channel bandwidth and location determination. In this release, only one SCS-SpecificCarrier is allowed to be configured for NR sidelink communication.

**sl-SyncPriority**
This field indicates synchronization priority order, as specified in sub-clause 5.8.6.

**valueN**
Indicate the NR SL transmission with a valueN *5kHz shift to the LTE raster. (see [TS 38.101-1 [15]], clause X.X.X).

---

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2X-SL-Shared</td>
<td>This field is mandatory present if the carrier frequency configured for NR sidelink communication is shared by V2X sidelink communication. It is absent, Need R, otherwise.</td>
</tr>
</tbody>
</table>

---

**SL-FreqConfigCommon**

The IE FreqConfigCommon specifies the cell-specific configuration information on one particular carrier frequency for NR sidelink communication.

**SL-FreqConfigCommon information element**

```asn1
SL-FreqConfigCommon-r16 ::= SEQUENCE {  sl-SCS-SpecificCarrierList-r16  SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier,  sl-AbsoluteFrequencyPointA-r16  ARFCN-ValueNR,  sl-AbsoluteFrequencySSB-r16  ARFCN-ValueNR,  frequencyShift7p5khzSL-r16  ENUMERATED {true} OPTIONAL, -- Cond V2X-SL-Shared  valueN-r16  INTEGER {-1..1},  sl-BWP-List-r16  SEQUENCE (SIZE (1..maxNrofSL-BWPs-r16)) OF SL-BWP-ConfigCommon-r16 OPTIONAL, -- Need R  sl-SyncPriority-r16  ENUMERATED {gnss, gnbEnb} OPTIONAL, -- Need R  sl-NbAsSync-r16  BOOLEAN OPTIONAL, -- Need R
}
```
--- TAG-SL-FREQCONFIGCOMM-STOP
--- ASN1STOP

### SL-FreqConfigCommon field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>frequencyShift7p5khzSL</td>
<td>Enable the NR SL transmission with a 7.5 kHz shift to the LTE raster. If the field is absent, the frequency shift is disabled.</td>
</tr>
<tr>
<td>sl-AbsoluteFrequencyPointA</td>
<td>Absolute frequency of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A.</td>
</tr>
<tr>
<td>sl-AbsoluteFrequencySSB</td>
<td>Indicates the frequency location of sidelink SSB. The transmission bandwidth for sidelink SSB is within the bandwidth of this sidelink BWP.</td>
</tr>
<tr>
<td>sl-BWP-List</td>
<td>This field indicates the list of sidelink BWP(s) on which the NR sidelink communication configuration. In this release, only one BWP is allowed to be configured for NR sidelink communication.</td>
</tr>
<tr>
<td>sl-NbAsSync</td>
<td>This field indicates whether the network can be selected as synchronization reference directly/indirectly only, if sl-SyncPriority is set to gnss. If this filed is set to TRUE, the network is enabled to be selected as synchronization reference directly/indirectly. The field is only present in SidelinkPreconfigNR. Otherwise it is absent.</td>
</tr>
<tr>
<td>sl-SyncPriority</td>
<td>This field indicates synchronization priority order, as specified in sub-clause 5.8.6.</td>
</tr>
<tr>
<td>sl-SyncConfigList</td>
<td>This field indicates the configuration by which the UE is allowed to receive and transmit synchronisation information for NR sidelink communication. Network configures sl-SyncConfig including txParameters when configuring UEs to transmit synchronisation information.</td>
</tr>
<tr>
<td>valueN</td>
<td>Indicate the NR SL transmission with a valueN *5kHz shift to the LTE raster (see [TS 38.101-1 [15]], clause X.X.X).</td>
</tr>
</tbody>
</table>

---

### V2X-SL-Shared

**Conditional Presence** | **Explanation**
---|---
V2X-SL-Shared | This field is mandatory present if the carrier frequency configured for NR sidelink communication is shared by V2X sidelink communication. It is absent, Need R, otherwise.

---

---

### SL-LogicalChannelConfig

The IE SL-LogicalChannelConfig is used to configure the sidelink logical channel parameters.

---

### SL-LogicalChannelConfig information element

```
-- ASN1START
-- TAG-SL-LOGICALCHANNELCONFIG-START

SL-LogicalChannelConfig-r16 ::= SEQUENCE {
    sl-Priority-r16                  INTEGER (1..8),
    sl-PrioritisedBitRate-r16       ENUMERATED {kBps0, kBps8, kBps16, kBps32, kBps64, kBps128, kBps256, kBps512,
                                              kBps1024, kBps2048, kBps4096, kBps8192, kBps16384, kBps32768, kBps65536, infinity},

---

ETSI```
sl-BucketSizeDuration-r16 ENUMERATED {ms5, ms10, ms20, ms50, ms100, ms150, ms300, ms500, ms1000, spare7, spare6, spare5, spare4, spare3, spare2, spare1}, OPTIONAL, -- Need R
sl-ConfiguredGrantTypeAllowed-r16 ENUMERATED {true} OPTIONAL, -- Need R
sl-HARQ-FeedbackEnabled-r16 ENUMERATED {enabled, disabled} OPTIONAL, -- Need R
sl-AllowedCG-List-r16 SEQUENCE (SIZE (0.. maxNrofCG-SL-r16-1)) OF SL-ConfigIndexCG-r16 OPTIONAL, -- Need R
sl-AllowedSCS-List-r16 SEQUENCE (SIZE (1..maxSCSs)) OF SubcarrierSpacing OPTIONAL, -- Need R
sl-MaxPUSCH-Duration-r16 ENUMERATED {ms0p02, ms0p04, ms0p0625, ms0p125, ms0p25, ms0p5, spare2, spare1} OPTIONAL, -- Need R
sl-LogicalChannelGroup-r16 INTEGER (0..maxLCG-ID) OPTIONAL, -- Need R
sl-SchedulingRequestId-r16 SchedulingRequestId OPTIONAL, -- Need R
sl-LogicalChannelSR-DelayTimerApplied-r16 BOOLEAN OPTIONAL, -- Need R

} -- TAG-SL-LOGICALCHANNELCONFIG-STOP
-- ASN1STOP
### SL-LogicalChannelConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>sl-AllowedCG-List</strong></td>
<td>This restriction applies only when the SL grant is a configured grant. If present, SL MAC SDUs from this logical channel can only be mapped to the indicated configured grant configuration. If the size of the sequence is zero, then UL MAC SDUs from this logical channel cannot be mapped to any configured grant configurations. If the field is not present, UL MAC SDUs from this logical channel can be mapped to any configured grant configurations. Corresponds to “sl-AllowedCG-List” as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>sl-AllowedSCS-List</strong></td>
<td>If present, indicate the numerology of UL-SCH resources that this sidelink logical channel is mapped to, when checking the SR trigger condition. Corresponds to ‘sl-AllowedSCS-List’ in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>sl-BucketSizeDuration</strong></td>
<td>Value in ms. ms5 corresponds to 5 ms, value ms10 corresponds to 10 ms, and so on.</td>
</tr>
<tr>
<td><strong>sl-ConfiguredGrantType1Allowed</strong></td>
<td>If present, SL MAC SDUs from this sidelink logical channel can be transmitted on a sidelink configured grant type 1. Corresponds to 'sl-configuredGrantType1Allowed' in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>sl-HARQ-FeedbackEnabled</strong></td>
<td>If present, indicate the HARQ feedback enabled/disabled restriction in LCP for this sidelink logical channel. If set to enabled, the sidelink logical channel will be multiplexed only with a logical channel which enabling the HARQ feedback. If set to disabled, the sidelink logical channel cannot be multiplexed with a logical channel which enabling the HARQ feedback. Corresponds to 'sl-HARQ-FeedbackEnabled' in TS 38.321 [3]. If this field of at least one sidelink logical channel for the UE is set to enabled, sl-PSFCH-Config should be mandatory present in at least one of the SL-ResourcePool.</td>
</tr>
<tr>
<td><strong>sl-LogicalChannelGroup</strong></td>
<td>ID of the sidelink logical channel group, as specified in TS 38.321 [3], which the sidelink logical channel belongs to.</td>
</tr>
<tr>
<td><strong>sl-LogicalChannelSR-DelayTimerApplied</strong></td>
<td>Indicates whether to apply the delay timer for SR transmission for this sidelink logical channel. Set to false if logicalChannelSR-DelayTimer is not included in sl-BSR-Config.</td>
</tr>
<tr>
<td><strong>sl-MaxPUSCH-Duration</strong></td>
<td>If present, indicate the maximum PUSCH duration of UL-SCH resources that this sidelink logical channel is mapped to, when checking the SR trigger condition. Corresponds to &quot;sl-MaxPUSCH-Duration&quot; in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>sl-PrioritisedBitRate</strong></td>
<td>Value in kiloBytes/s. Value kBps0 corresponds to 0 kiloBytes/s, value kBps8 corresponds to 8 kiloBytes/s, value kBps16 corresponds to 16 kiloBytes/s, and so on.</td>
</tr>
<tr>
<td><strong>sl-Priority</strong></td>
<td>Sidelink logical channel priority, as specified in TS 38.321 [3].</td>
</tr>
<tr>
<td><strong>sl-SchedulingRequestId</strong></td>
<td>If present, it indicates the scheduling request configuration applicable for this sidelink logical channel, as specified in TS 38.321 [3].</td>
</tr>
</tbody>
</table>

---

### SL-MeasConfigCommon

The IE **SL-MeasConfigCommon** is used to set the cell specific SL RSRP measurement configurations for unicast destinations.

**SL-MeasConfigCommon** information element

```asn1
SL-MeasConfigCommon-r16 ::=     SEQUENCE {
  sl-MeasObjectListCommon-r16  SL-MeasObjectList-r16 OPTIONAL, -- Need R
  sl-MeasIdListCommon-r16      SL-MeasIdList-r16             OPTIONAL, -- Need R
  sl-QuantityConfigCommon-r16  SL-QuantityConfig-r16         OPTIONAL, -- Need R
}
```
---

**SL-MeasConfigCommon field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-MeasIdListCommon</td>
<td>List of sidelink measurement identities</td>
</tr>
<tr>
<td>sl-MeasObjectListCommon</td>
<td>List of sidelink measurement objects</td>
</tr>
<tr>
<td>sl-QuantityConfigCommon</td>
<td>Indicates the layer 3 filtering coefficient for sidelink measurement</td>
</tr>
<tr>
<td>sl-ReportConfigListCommon</td>
<td>List of sidelink measurement reporting configurations</td>
</tr>
</tbody>
</table>

---

**SL-MeasConfigInfo**

The IE **SL-MeasConfigInfo** is used to set RSRP measurement configurations for unicast destinations.

---

**SL-MeasConfigInfo information element**

---

**ETSI**
SL-MeasConfigInfo field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-MeasIdToAddModList</td>
</tr>
<tr>
<td>List of sidelink measurement identities to add and/or</td>
</tr>
<tr>
<td>modify.</td>
</tr>
<tr>
<td>sl-MeasIdToRemoveList</td>
</tr>
<tr>
<td>List of sidelink measurement identities to remove.</td>
</tr>
<tr>
<td>sl-MeasObjectToAddModList</td>
</tr>
<tr>
<td>List of sidelink measurement objects to add and/or</td>
</tr>
<tr>
<td>modify.</td>
</tr>
<tr>
<td>sl-MeasObjectToRemoveList</td>
</tr>
<tr>
<td>List of sidelink measurement objects to remove.</td>
</tr>
<tr>
<td>sl-QuantityConfig</td>
</tr>
<tr>
<td>Indicates the layer 3 filtering coefficient for</td>
</tr>
<tr>
<td>sidelink measurement.</td>
</tr>
<tr>
<td>sl-ReportConfigToAddModList</td>
</tr>
<tr>
<td>List of sidelink measurement reporting configurations</td>
</tr>
<tr>
<td>to add and/or modify.</td>
</tr>
<tr>
<td>sl-ReportConfigToRemoveList</td>
</tr>
<tr>
<td>List of sidelink measurement reporting configurations</td>
</tr>
<tr>
<td>to remove.</td>
</tr>
</tbody>
</table>

---

SL-MeasIdList

The IE SL-MeasIdList concerns a list of SL measurement identities to add or modify for a destination, with for each entry the sl-MeasId, the associated sl-MeasObjectId and the associated sl-ReportConfigId.

SL-MeasIdList information element

```asn1
SL-MeasIdList-r16 ::= SEQUENCE (SIZE (1..maxNrofSL-MeasId-r16)) OF SL-MeasInfo-r16

SL-MeasInfo-r16 ::= SEQUENCE {  sl-MeasId-r16             SL-MeasId-r16,  sl-MeasObjectId-r16  SL-MeasObjectId-r16,  sl-ReportConfigId-r16  SL-ReportConfigId-r16,  ...  }

SL-MeasId-r16 ::= INTEGER (1..maxNrofSL-MeasId-r16)
```
The IE **SL-MeasObjectList** concerns a list of SL measurement objects to add or modify for a destination.

**SL-MeasObjectList** information element

---

**SL-MeasObjectList** field descriptions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>sl-MeasObjectId</code></td>
<td>It is used to identify a sidelink measurement object configuration.</td>
</tr>
<tr>
<td><code>sl-MeasObject</code></td>
<td>It specifies information applicable for sidelink DMRS measurement.</td>
</tr>
</tbody>
</table>

---

**SL-PDCP-Config**

The IE **SL-PDCP-Config** is used to set the configurable PDCP parameters for a sidelink radio bearer.

**SL-PDCP-Config** information element

---

```asn1
-- ASN1START
-- TAG-SL-PDCP-CONFIG-START

SL-PDCP-Config-r16 ::=       SEQUENCE {
  sl-DiscardTimer-r16          ENUMERATED {ms3, ms10, ms20, ms25, ms30, ms40, ms50, ms60, ms75, ms100, ms150, ms200,
                                           ms250, ms300, ms500, ms750, ms1500, infinity}                                           OPTIONAL, -- Cond Setup
  sl-PDCP-SN-Size-r16          ENUMERATED {len12bits, len18bits}                                                       OPTIONAL, -- Cond Setup2
  sl-OutOfOrderDelivery        ENUMERATED { true }                                                                     OPTIONAL,    -- Need R

-- TAG-SL-PDCP-CONFIG-STOP
-- ASN1STOP
```
SL-PDCP-Config field descriptions

**sl-DiscardTimer**
Value in ms of `discardTimer` specified in TS 38.323 [5]. Value `ms50` corresponds to 50 ms, value `ms100` corresponds to 100 ms and so on.

**sl-OutOfOrderDelivery**
Indicates whether or not `outOfOrderDelivery` specified in TS 38.323 [5] is configured. This field should be either always present or always absent, after the radio bearer is established.

**sl-PDCP-SN-Size**
PDCP sequence number size for unicast NR sidelink communication, 12 or 18 bits, as specified in TS 38.323 [5]. For groupcast and broadcast NR sidelink communication, only 12 bits is applicable, as specified in 9.1.1.5.

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Setup</strong></td>
<td>The field is mandatory present in case of sidelink DRB setup via dedicated signaling and in case of sidelink DRB configuration via system information and pre-configuration; otherwise the field is optionally present, need M.</td>
</tr>
<tr>
<td><strong>Setup2</strong></td>
<td>The field is mandatory present in case of sidelink DRB setup via dedicated signaling and in case of sidelink DRB configuration via system information and pre-configuration for RLC-AM and RLC-UM for unicast NR sidelink communication; otherwise the field is not present, Need M.</td>
</tr>
</tbody>
</table>

---

**SL-PSBCH-Config**

The IE `SL-PSBCH-Config` indicates PSBCH transmission parameters on each sidelink bandwidth part.

**SL-PSBCH-Config** information element

```
SL-PSBCH-Config-r16 ::= SEQUENCE {  
    dl-P0-PSBCH-r16            INTEGER {-16..15} OPTIONAL,   -- Need M  
    dl-Alpha-PSBCH-r16        ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alphal} OPTIONAL,   -- Need M  
    ...                     
}
```

---
### SL-PSBCH-Config field descriptions

- **dl-Alpha-PSBCH**
  Indicates alpha value for DL pathloss based power control for PSBCH. When the field is absent the UE applies the value 1

- **dl-P0-PSBCH**
  Indicates P0 value for DL pathloss based power control for PSBCH. If not configured, DL pathloss based power control is disabled for PSBCH.

---

### SL-PSSCH-TxConfigList

The IE SL-PSSCH-TxConfigList indicates PSSCH transmission parameters. When lower layers select parameters from the range indicated in IE SL-PSSCH-TxConfigList, the UE considers both configurations in IE SL-PSSCH-TxConfigList and the CBR-dependent configurations represented in IE SL-CBR-PriorityTxConfigList. Only one IE SL-PSSCH-TxConfig is provided per SL-TypeTxSync.

**SL-PSSCH-TxConfigList information element**

```plaintext
-- ASN1START
-- TAG-SL-PSSCH-TXCONFIGLIST-START

SL-PSSCH-TxConfigList-r16 ::= SEQUENCE (SIZE (1..maxPSSCH-TxConfig-r16)) OF SL-PSSCH-TxConfig-r16

SL-PSSCH-TxConfig-r16 ::= SEQUENCE {
  sl-TypeTxSync-r16       SL-TypeTxSync-r16                                   OPTIONAL, -- Need R
  sl-ThresUE-Speed-r16    ENUMERATED {kmph60, kmph80, kmph100, kmph120, kmph140, kmph160, kmph180, kmph200},
  sl-ParametersAboveThres-r16       SL-PSSCH-TxParameters-r16,
  sl-ParametersBelowThres-r16      SL-PSSCH-TxParameters-r16,
  ...
}

SL-PSSCH-TxParameters-r16 ::= SEQUENCE {
  sl-MinMCS-PSSCH-r16        INTEGER (0..27),
  sl-MaxMCS-PSSCH-r16        INTEGER (0..31),
  sl-MinSubChannelNumPSSCH-r16 INTEGER (1..27),
  sl-MaxSubchannelNumPSSCH-r16 INTEGER (1..27),
  sl-MaxTxTransNumPSSCH-r16  INTEGER (1..32),
  sl-MaxTxPower-r16          SL-TxPower-r16                                      OPTIONAL    -- Cond CBR
}

-- TAG-SL-PSSCH-TXCONFIGLIST-STOP
-- ASN1STOP

```
### SL-PSSCH-TxConfigList field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>si-MaxTxTransNumPSSCH</strong></td>
<td>Indicates the maximum transmission number (including new transmission and retransmission) for PSSCH.</td>
</tr>
<tr>
<td><strong>si-MaxTxPower</strong></td>
<td>This field indicates the maximum transmission power for transmission on PSSCH and PSCCH.</td>
</tr>
<tr>
<td><strong>si-MinMCS-PSSCH, si-MaxMCS-PSSCH</strong></td>
<td>This field indicates the minimum and maximum MCS values used for transmissions on PSSCH.</td>
</tr>
<tr>
<td><strong>si-MinSubChannelNumPSSCH, si-MaxSubChannelNumPSSCH</strong></td>
<td>This field indicates the minimum and maximum number of sub-channels which may be used for transmissions on PSSCH.</td>
</tr>
<tr>
<td><strong>si-TypeTxSync</strong></td>
<td>This field indicates the synchronization reference type. For configurations by the eNB/gNB, only gnbEnb can be configured; and for pre-configuration or when this field is absent, the configuration is applicable for all synchronization reference types.</td>
</tr>
<tr>
<td><strong>si-ThresUE-Speed</strong></td>
<td>This field indicates a UE absolute speed threshold.</td>
</tr>
</tbody>
</table>

#### Conditional Presence

| CBR | The field is optionally present. Need R, when the IE SL-PSSCH-TxParameters is present in SL-CBR-CommonTxConfigList, SL-UE-SelectedConfig, SIB12 or SidelinkPreconfigNR; otherwise the field is not present, need R. |

---

### SL-QoS-FlowIdentity

The IE **SL-QoS-FlowIdentity** is used to identify a sidelink QoS flow.

#### SL-QoS-FlowIdentity information element

```asn1
-- ASN1START
-- TAG-SL-QOS-FLOWIDENTITY-START
SL-QoS-FlowIdentity-r16 ::= INTEGER {1..maxNrofSL-QFIs-r16}
-- TAG-SL-QOS-FLOWIDENTITY-STOP
-- ASN1STOP
```

---

### SL-QoS-Profile

The IE **SL-QoS-Profile** is used to give the QoS parameters for a sidelink QoS flow. Need codes or conditions specified for **SL-QoS-Profile** do not apply, in case **SL-QoS-Profile** is included in SidelinkUEInformationNR.

#### SL-QoS-Profile information element

```asn1
-- ASN1START
-- TAG-SL-QOS-PROFILE-START
```
SL-QoS-Profile-r16 ::= SEQUENCE {
  sl-PQI-r16  SL-PQI-r16 OPTIONAL, -- Need R
  sl-GFBR-r16 INTEGER (0..4000000000) OPTIONAL, -- Need R
  sl-MFBR-r16 INTEGER (0..4000000000) OPTIONAL, -- Need R
  sl-Range-r16 INTEGER (1..1000) OPTIONAL, -- Need R
  ...
}

SL-PQI-r16 ::= CHOICE {
  sl-StandardizedPQI-r16 INTEGER (0..255),
  sl-Non-StandardizedPQI-r16 SEQUENCE {
    sl-ResourceType-r16 ENUMERATED {gbr, non-GBR, delayCriticalGBR, spare1} OPTIONAL, -- Need R
    sl-PriorityLevel-r16 INTEGER (1..8) OPTIONAL, -- Need R
    sl-PacketDelayBudget-r16 INTEGER (0..1023) OPTIONAL, -- Need R
    sl-PacketErrorRate-r16 INTEGER (0..9) OPTIONAL, -- Need R
    sl-AveragingWindow-r16 INTEGER (0..4095) OPTIONAL, -- Need R
    sl-MaxDataBurstVolume-r16 INTEGER (0..4095) OPTIONAL, -- Need R
    ...
  }
}

--- TAG-SL-QOS-PROFILE-STOP
--- ASN1STOP

--- SL-QoS-Profile field descriptions ---

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-GFBR</td>
<td>Indicate the guaranteed bit rate for a GBR QoS flow. The unit is: Kbit/s</td>
</tr>
<tr>
<td>sl-MFBR</td>
<td>Indicate the maximum bit rate for a GBR QoS flow. The unit is: Kbit/s</td>
</tr>
<tr>
<td>sl-PQI</td>
<td>This field indicates either the PQI for standardized PQI or non-standardized QoS parameters.</td>
</tr>
<tr>
<td>sl-Range</td>
<td>This field indicates the range parameter of the Qos flow, as defined in clause 5.4.1.1.1, TS 23.287 [55]. It is present only for groupcast. The unit is meter.</td>
</tr>
</tbody>
</table>

--- SL-PQI field descriptions ---

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-AveragingWindow</td>
<td>Indicates the Averaging Window for a QoS flow, and applies to GBR QoS flows only. Unit: ms. The default value of the IE is 2000ms.</td>
</tr>
<tr>
<td>sl-MaxDataBurstVolume</td>
<td>Indicates the Maximum Data Burst Volume for a QoS flow, and applies to delay critical GBR QoS flows only. Unit: byte.</td>
</tr>
<tr>
<td>sl-PacketDelayBudget</td>
<td>Indicates the Packet Delay Budget for a QoS flow. Upper bound value for the delay that a packet may experience expressed in unit of 0.5ms.</td>
</tr>
<tr>
<td>sl-PacketErrorRate</td>
<td>Indicates the Packet Error Rate for a QoS flow. The packet error rate is expressed as Scalar x 10-k where k is the Exponent.</td>
</tr>
<tr>
<td>sl-PriorityLevel</td>
<td>Indicates the Priority Level for a QoS flow. Values ordered in decreasing order of priority, i.e. with 1 as the highest priority and 8 as the lowest priority.</td>
</tr>
<tr>
<td>sl-StandardizedPQI</td>
<td>Indicate the PQI for standardized PQI.</td>
</tr>
</tbody>
</table>
The IE `SL-QuantityConfig` specifies the layer 3 filtering coefficients for NR SL RSRP measurement for a destination.

**SL-QuantityConfig** field descriptions

**sl-FilterCoefficientDMRS**
DMRS based L3 filter configuration:
Specifies L3 filter configuration for sidelink RSRP measurement result from the L1 filter(s), as defined in TS 38.215 [9].

The IE `SL-RadioBearerConfig` specifies the sidelink DRB configuration information for NR sidelink communication.

**SL-RadioBearerConfig** field descriptions

**slb-Uu-ConfigIndex**
SLRB-Uu-ConfigIndex

**sl-SDAP-Config**
SL-SDAP-Config

**sl-PDCP-Config**
SL-PDCP-Config

**sl-TransRange**
ENUMERATED {m20, m50, m80, m100, m120, m150, m180, m200, m220, m250, m300, m350, m370, m400, m420, m450, m480, m500, m550, m600, m700, m1000, spare9, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1}
### SL-RadioBearerConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>sl-PDCP-Config</strong></td>
<td>This field indicates the PDCP parameters for the sidelink DRB.</td>
</tr>
<tr>
<td><strong>sl-SDAP-Config</strong></td>
<td>This field indicates how to map sidelink QoS flows to sidelink DRB.</td>
</tr>
<tr>
<td><strong>slr-Uu-ConfigIndex</strong></td>
<td>This field indicates the index of sidelink DRB configuration.</td>
</tr>
<tr>
<td><strong>sl-TransRange</strong></td>
<td>This field indicates the transmission range of the sidelink DRB. The unit is meter.</td>
</tr>
</tbody>
</table>

### Conditional Presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-RBSetup</td>
<td>The field is mandatory present in case of sidelink DRB setup via the dedicated signalling and in case of sidelink DRB configuration via system information and pre-configuration; otherwise the field is optionally present, need M.</td>
</tr>
</tbody>
</table>

### SL-ReportConfigList

The IE `SL-ReportConfigList` concerns a list of SL measurement reporting configurations to add or modify for a destination.

### SL-ReportConfigList information element

```
-- ASN1START
-- TAG-SL-REPORTCONFIGLIST-START

SL-ReportConfigList-r16 ::= SEQUENCE (SIZE (1..maxNrofSL-ReportConfigId-r16)) OF SL-ReportConfigInfo-r16

SL-ReportConfigInfo-r16 ::= SEQUENCE {
  sl-ReportConfigId-r16             SL-ReportConfigId-r16,
  sl-ReportConfig-r16               SL-ReportConfig-r16,
  ...                               ...
}

SL-ReportConfigId-r16 ::= INTEGER (1..maxNrofSL-ReportConfigId-r16)

SL-ReportConfig-r16 ::= SEQUENCE {
  sl-ReportType-r16                 CHOICE {
    sl-Periodical-r16               SL-PeriodicalReportConfig-r16,
    sl-EventTriggered-r16           SL-EventTriggerConfig-r16,
    ...                               ...
  },                               ...
}

SL-PeriodicalReportConfig-r16 ::= SEQUENCE {
  sl-ReportInterval-r16            ReportInterval,
  sl-ReportAmount-r16              ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
  sl-ReportQuantity-r16            SL-MeasReportQuantity-r16,
  sl-RS-Type-r16                   SL-RS-Type-r16,
}  ```
SL-EventTriggerConfig-r16 ::= SEQUENCE {
  sl-EventId-r16               CHOICE {
    eventS1-r16                 SEQUENCE {
      s1-Threshold-r16           SL-MeasTriggerQuantity-r16,
      sl-ReportOnLeave-r16       BOOLEAN,
      sl-Hysteresis-r16          Hysteresis,
      sl-TimeToTrigger-r16       TimeToTrigger,
      ...
    },
    eventS2-r16                 SEQUENCE {
      s2-Threshold-r16           SL-MeasTriggerQuantity-r16,
      sl-ReportOnLeave-r16       BOOLEAN,
      sl-Hysteresis-r16          Hysteresis,
      sl-TimeToTrigger-r16       TimeToTrigger,
      ...
    },
    ...
  },
  sl-ReportInterval-r16       ReportInterval,
  sl-ReportAmount-r16         ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
  sl-ReportQuantity-r16       SL-MeasReportQuantity-r16,
  sl-RS-Type-r16              SL-RS-Type-r16,
  ...
}

SL-MeasReportQuantity-r16 ::= CHOICE {
  sl-RSRP-r16                 BOOLEAN,
  ...
}

SL-MeasTriggerQuantity-r16 ::= CHOICE {
  sl-RSRP-r16                 RSRP-Range,
  ...
}

SL-RS-Type-r16 ::= ENUMERATED {dmrs, spare3, spare2, spare1}

-- TAG-SL-REPORTCONFIGLIST-STOP
-- ASN1STOP

**SL-ReportConfig field descriptions**

| **sl-ReportType** | Type of the configured sidelink measurement report. |
SL-EventTriggerConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-EventId</td>
<td>Choice of sidelink measurement event triggered reporting criteria.</td>
</tr>
<tr>
<td>sl-ReportAmount</td>
<td>Number of sidelink measurement reports applicable for sl-EventTriggered report type.</td>
</tr>
<tr>
<td>sl-ReportInterval</td>
<td>Indicates the interval between periodical reports (i.e., when sl-ReportAmount exceeds 1) for sl-EventTriggered report type.</td>
</tr>
<tr>
<td>sl-ReportOnLeave</td>
<td>indicates whether or not the UE shall initiate the sidelink measurement reporting procedure when the leaving condition is met for a frequency in sl-FrequencyTriggeredList, as specified in 5.8.10.4.1.</td>
</tr>
<tr>
<td>sl-ReportQuantity</td>
<td>The sidelink measurement quantities to be included in the sidelink measurement report.</td>
</tr>
<tr>
<td>sl-TimeToTrigger</td>
<td>Time during which specific criteria for the event needs to be met in order to trigger a sidelink measurement report.</td>
</tr>
<tr>
<td>sl-Threshold</td>
<td>Threshold used for events S1 and S2 specified in subclauses 5.8.10.4.2 and 5.8.10.4.3, respectively.</td>
</tr>
</tbody>
</table>

SL-PeriodicalReportConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-ReportAmount</td>
<td>Number of sidelink measurement reports applicable for sl-Periodical report type.</td>
</tr>
<tr>
<td>sl-ReportInterval</td>
<td>Indicates the interval between periodical reports (i.e., when sl-ReportAmount exceeds 1) for sl-Periodical report type.</td>
</tr>
<tr>
<td>sl-ReportQuantity</td>
<td>The sidelink measurement quantities to be included in the sidelink measurement report.</td>
</tr>
</tbody>
</table>

SL-ResourcePool

The IE SL-ResourcePool specifies the configuration information for NR sidelink communication resource pool.

SL-ResourcePool information element

```asn1
SL-ResourcePool-r16 ::= SEQUENCE {
    sl-PSCCH-Config-r16      SetupRelease { SL-PSCCH-Config-r16 } OPTIONAL, -- Need M
    sl-PSSCH-Config-r16      SetupRelease { SL-PSSCH-Config-r16 } OPTIONAL, -- Need M
    sl-PSFCH-Config-r16      SetupRelease { SL-PSFCH-Config-r16 } OPTIONAL, -- Need M
    sl-SyncAllowed-r16       SL-SyncAllowed-r16 OPTIONAL, -- Need M
    sl-SubchannelSize-r16    ENUMERATED {n10, n12, n15, n20, n25, n50, n75, n100} OPTIONAL, -- Need M
    dummy                    INTEGER (10..160) OPTIONAL, -- Need M
    sl-StartRB-Subchannel-r16 INTEGER (0..265) OPTIONAL, -- Need M
    sl-NumSubchannel-r16     INTEGER (1..27) OPTIONAL, -- Need M
    sl-Additional-MCS-Table-r16 ENUMERATED (qam256, qam64LowSE, qam256-qam64LowSE ) OPTIONAL, -- Need M
    sl-ThreshS-RSSI-CBR-r16   INTEGER (0..45) OPTIONAL, -- Need M
    sl-TimeWindowSizeCBR-r16  ENUMERATED (ms100, slot100) OPTIONAL, -- Need M
}
```
sl-TimeWindowSizeCR-r16 ENUMERATED {ms1000, slot1000} OPTIONAL, -- Need M
sl-PTRS-Config-r16 SL-PTRS-Config-r16 OPTIONAL, -- Need M
sl-UE-SelectedConfigRP-r16 SL-UE-SelectedConfigRP-r16 OPTIONAL, -- Need M
sl-RxParametersNcell-r16 SEQUENCE {
  sl-TDD-Configuration-r16 TDD-UL-DL-ConfigCommon OPTIONAL, -- Need M
  sl-SyncConfigIndex-r16 INTEGER (0..15) OPTIONAL, -- Need M
}
sl-ZoneConfigMCR-List-r16 SEQUENCE (SIZE (16)) OF SL-ZoneConfigMCR-r16 OPTIONAL, -- Need M
sl-FilterCoefficient-r16 FilterCoefficient OPTIONAL, -- Need M
sl-RB-Number-r16 INTEGER (10..275) OPTIONAL, -- Need M
sl-PreemptionEnable-r16 ENUMERATED {enabled, pl1, pl2, pl3, pl4, pl5, pl6, pl7, pl8} OPTIONAL, -- Need R
sl-PriorityThreshold-UL-URLLC-r16 INTEGER (1..9) OPTIONAL, -- Need M
sl-X-Overhead-r16 ENUMERATED {n0,n3, n6, n9} OPTIONAL, -- Need S
sl-PowerControl-r16 SL-PowerControl-r16 OPTIONAL, -- Need M
sl-TxPercentageList-r16 SL-TxPercentageList-r16 OPTIONAL, -- Need M
sl-MinMaxMCS-List-r16 SL-MinMaxMCS-List-r16 OPTIONAL, -- Need M
...,
[
  sl-TimeResource-r16 BIT STRING (SIZE (10..160)) OPTIONAL -- Need M
]
]

SL-ZoneConfigMCR-r16 ::= SEQUENCE {
  sl-ZoneConfigMCR-Index-r16 INTEGER (0..15),
  sl-TransRange-r16 ENUMERATED {m20, m50, m80, m100, m120, m150, m180, m200, m220, m250, m270, m300, m350, m370, m400, m420, m450, m480, m500, m550, m600, m700, m1000, spare9, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1} OPTIONAL, -- Need S
  sl-ZoneConfig-r16 SL-ZoneConfig-r16 OPTIONAL, -- Need M
...)

SL-SyncAllowed-r16 ::= SEQUENCE {
  gnss-Sync-r16 ENUMERATED (true) OPTIONAL, -- Need R
  gnbEnb-Sync-r16 ENUMERATED (true) OPTIONAL, -- Need R
  ue-Sync-r16 ENUMERATED (true) OPTIONAL, -- Need R
}

SL-PSCCH-Config-r16 ::= SEQUENCE {
  sl-TimeResourcePSCCH-r16 ENUMERATED (n2, n3) OPTIONAL, -- Need M
  sl-FreqResourcePSCCH-r16 ENUMERATED (n10,n12, n15, n20, n25) OPTIONAL, -- Need M
  sl-DMRS-ScrambleID-r16 INTEGER (0..65535) OPTIONAL, -- Need M
  sl-NumReservedBits-r16 INTEGER (2..4) OPTIONAL, -- Need M
...)

SL-PSSCH-Config-r16 ::= SEQUENCE {
  sl-PSSCH-DMRS-TimePatternList-r16 SEQUENCE (SIZE (1..3)) OF INTEGER (2..4) OPTIONAL, -- Need M
  sl-BetaOffsets2ndSCI-r16 SEQUENCE (SIZE (4)) OF SL-BetaOffsets-r16 OPTIONAL, -- Need M
  sl-Scaling-r16 ENUMERATED {f0p5, f0p65, f0p8, f1} OPTIONAL, -- Need M
...)

SL-PSFCH-Config-r16 ::= SEQUENCE {
  sl-PSFCH-Period-r16            ENUMERATED {s10, s11, s12, s14} OPTIONAL, -- Need M
  sl-PSFCH-RB-Set-r16            BIT STRING (SIZE (10..275)) OPTIONAL, -- Need M
  sl-PSFCH-NumMaxCS-Pair-r16     ENUMERATED {n1, n2, n3, n6} OPTIONAL, -- Need M
  sl-MinTimeGapPSFCH-r16         ENUMERATED {s12, s13} OPTIONAL, -- Need M
  sl-PSFCH-HopID-r16             INTEGER (0..1023) OPTIONAL, -- Need M
  sl-PSFCH-CandidateResourceType-r16 ENUMERATED {startSubCH, allocSubCH} OPTIONAL, -- Need M
  ...
}
SL-PTRS-Config-r16 ::= SEQUENCE {
  sl-PTRS-FreqDensity-r16        SEQUENCE (SIZE (2)) OF INTEGER (1..276) OPTIONAL, -- Need M
  sl-PTRS-TimeDensity-r16        SEQUENCE (SIZE (3)) OF INTEGER (0..29) OPTIONAL, -- Need M
  sl-PTRS-RE-Offset-r16          ENUMERATED {offset01, offset10, offset11} OPTIONAL, -- Need M
  ...
}
SL-UE-SelectedConfigRP-r16 ::= SEQUENCE {
  sl-CBR-PriorityTxConfigList-r16 SL-CBR-PriorityTxConfigList-r16 OPTIONAL, -- Need M
  sl-ThresPSSCH-RSRP-List-r16    SL-ThresPSSCH-RSRP-List-r16 OPTIONAL, -- Need M
  sl-MultiReserveResource-r16    ENUMERATED {enabled} OPTIONAL, -- Need M
  sl-MaxNumPerReserve-r16        ENUMERATED {n2, n3} OPTIONAL, -- Need M
  sl-SensingWindow-r16           ENUMERATED {ms100, ms1100} OPTIONAL, -- Need M
  sl-SelectionWindowList-r16     SL-SelectionWindowList-r16 OPTIONAL, -- Need M
  sl-ResourceReservePeriodList-r16 SEQUENCE (SIZE (1..16)) OF SL-ResourceReservePeriod-r16 OPTIONAL, -- Need M
  sl-RS-ForSensing-r16           ENUMERATED {pscch, pssch},
  ...
}
SL-ResourceReservePeriod-r16 ::= CHOICE {
  sl-ResourceReservePeriod1-r16  ENUMERATED {ms0, ms100, ms200, ms300, ms400, ms500, ms600, ms700, ms800, ms900, ms1000},
  sl-ResourceReservePeriod2-r16  INTEGER (1..99)
}
SL-SelectionWindowList-r16 ::= SEQUENCE (SIZE (8)) OF SL-SelectionWindowConfig-r16
SL-SelectionWindowConfig-r16 ::= SEQUENCE {
  sl-Priority-r16                INTEGER (1..8),
  sl-SelectionWindow-r16         ENUMERATED {n1, n5, n10, n20}
}
SL-TxPercentageList-r16 ::= SEQUENCE (SIZE (8)) OF SL-TxPercentageConfig-r16
SL-TxPercentageConfig-r16 ::= SEQUENCE {
  sl-Priority-r16                INTEGER (1..8),
  sl-TxPercentage-r16            ENUMERATED {p20, p35, p50}
}
SL-MinMaxMCS-List-r16 ::= SEQUENCE (SIZE (1..3)) OF SL-MinMaxMCS-Config-r16
SL-MinMaxMCS-Config-r16 ::= SEQUENCE {
  sl-MCS-Table-r16               ENUMERATED {qam64, qam256, qam64LowSE},
  sl-MinMCS-PSSCH-r16             INTEGER (0..27),
  sl-MaxMCS-PSSCH-r16             INTEGER (0..31)
}
SL-BetaOffsets-r16 ::= INTEGER (0..31)

SL-PowerControl-r16 ::= SEQUENCE {
   sl-MaxTransPower-r16 INTEGER (-30..33),
   sl-Alpha-PSSCH-PSCCH-r16 ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1} OPTIONAL, -- Need M
   dl-Alpha-PSSCH-PSCCH-r16 ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1} OPTIONAL, -- Need S
   sl-P0-PSSCH-PSCCH-r16 INTEGER (-16..15) OPTIONAL, -- Need S
   dl-P0-PSSCH-PSCCH-r16 INTEGER (-16..15) OPTIONAL, -- Need M
   dl-Alpha-PSFCH-r16 ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1} OPTIONAL, -- Need S
   dl-P0-PSFCH-r16 INTEGER (-16..15) OPTIONAL, -- Need M
   ...
}

-- TAG-SL-RESOURCEPOOL-STOP
-- ASN1STOP

### SL-ZoneConfigMCR field descriptions

**sl-TransRange**
Indicates the communication range requirement for the corresponding *sl-ZoneConfigMCR-Index*.

**sl-ZoneConfig**
Indicates the zone configuration for the corresponding *sl-ZoneConfigMCR-Index*.

**sl-ZoneConfigMCR-Index**
Indicates the codepoint of the communication range requirement field in SCI.
**SL-ResourcePool field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dummy</td>
<td>This field is not used in the specification. If received it shall be ignored by the UE.</td>
</tr>
<tr>
<td>sl-FilterCoefficient</td>
<td>This field indicates the filtering coefficient for long-term measurement and reference signal power derivation used for sidelink open-loop power control.</td>
</tr>
<tr>
<td>sl-Additional-MCS-Table</td>
<td>Indicates the MCS table(s) additionally used in the resource pool. 64QAM table is (pre-)configured as default. Zero, one or two can be additionally (pre-)configured using the 256QAM and/or low-SE MCS tables</td>
</tr>
<tr>
<td>sl-NumSubchannel</td>
<td>Indicates the number of subchannels in the corresponding resource pool, which consists of contiguous PRBs only.</td>
</tr>
<tr>
<td>sl-PreemptionEnable</td>
<td>Indicates whether pre-emption is disabled or enabled in a resource pool. If enabled, a priority level p_preemption can be optionally configured. If the pre-emption is enabled but p_preemption is not configured, pre-emption is applicable to all levels.</td>
</tr>
<tr>
<td>sl-PriorityThreshold-UL-URLLC</td>
<td>Indicates the threshold used to determine whether NR sidelink transmission is prioritized over uplink transmission of priority index 1 as specified in TS 38.213[13], clause 16.2.4.3, or whether PUCCH transmission carrying SL HARQ is prioritized over PUCCH transmission carrying UCI of priority index 1 if they overlap in time as specified in TS 38.213[13], clause 9.2.5.0.</td>
</tr>
<tr>
<td>sl-PriorityThreshold</td>
<td>Indicates the threshold used to determine whether NR sidelink transmission is prioritized over uplink transmission of priority index 0 as specified in TS 38.213[13], clause 16.2.4.3, or whether PUCCH transmission carrying SL HARQ is prioritized over PUCCH transmission carrying UCI of priority index 0 if they overlap in time as specified in TS 38.213[13], clause 9.2.5.0.</td>
</tr>
<tr>
<td>sl-RB-Number</td>
<td>Indicates the number of PRBs in the corresponding resource pool, which consists of contiguous PRBs only. The remaining RB cannot be used (See TS 38.214[19], clause 8).</td>
</tr>
<tr>
<td>sl-StartRB-Subchannel</td>
<td>Indicates the lowest RB index of the subchannel with the lowest index in the resource pool with respect to the lowest RB index of a SL BWP.</td>
</tr>
<tr>
<td>sl-SubchannelSize</td>
<td>Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB.</td>
</tr>
<tr>
<td>sl-SyncAllowed</td>
<td>Indicates the allowed synchronization reference(s) which is (are) allowed to use the configured resource pool.</td>
</tr>
<tr>
<td>sl-SyncConfigIndex</td>
<td>Indicates the synchronisation configuration that is associated with a reception pool, by means of an index to the corresponding entry SL-SyncConfigList of in SIB12 for NR sidelink communication.</td>
</tr>
<tr>
<td>sl-TDD-Configuration</td>
<td>Indicates the TDD configuration associated with the reception pool of the cell indicated by sl-SyncConfigIndex.</td>
</tr>
<tr>
<td>sl-ThreshS-RSSI-CBR</td>
<td>Indicates the S-RSSI threshold for determining the contribution of a sub-channel to the CBR measurement. Value 0 corresponds to -112 dBm, value 1 to -110 dBm, value n to (-112 + n*2) dBm, and so on.</td>
</tr>
<tr>
<td>sl-TimeResource</td>
<td>Indicates the bitmap of the resource pool, which is defined by repeating the bitmap with a periodicity during a SFN or DFN cycle.</td>
</tr>
<tr>
<td>sl-TimeWindowSizeCBR</td>
<td>Indicates the time window size for CBR measurement.</td>
</tr>
<tr>
<td>sl-TimeWindowSizeCR</td>
<td>Indicates the time window size for CR evaluation.</td>
</tr>
<tr>
<td>sl-TxPercentageList</td>
<td>Indicates the portion of candidate single-slot PSSCH resources over the total resources. Value p20 corresponds to 20%, and so on.</td>
</tr>
</tbody>
</table>
### sl-X-Overhead
Accounts for overhead from CSI-RS, PT-RS. If the field is absent, the UE applies value \( n_0 \) (see TS 38.214 [19], clause 5.1.3.2).

### SL-SyncAllowed field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>gnbEnb-Sync</td>
<td>If configured, the (pre-) configured resources can be used if the UE is directly or indirectly synchronized to eNB or gNB.</td>
</tr>
<tr>
<td>gnss-Sync</td>
<td>If configured, the (pre-) configured resources can be used if the UE is directly or indirectly synchronized to GNSS.</td>
</tr>
<tr>
<td>ue-Sync</td>
<td>If configured, the (pre-) configured resources can be used if the UE is directly or indirectly synchronized to a reference UE.</td>
</tr>
</tbody>
</table>

### SL-PSCCH-Config field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-FreqResourcePSCCH</td>
<td>Indicates the number of PRBs for PSCCH in a resource pool where it is not greater than the number PRBs of the subchannel.</td>
</tr>
<tr>
<td>sl-DMRS-ScrambleID</td>
<td>Indicates the initialization value for PSCCH DMRS scrambling.</td>
</tr>
<tr>
<td>sl-NumReservedBits</td>
<td>Indicates the number of reserved bits in first stage SCI.</td>
</tr>
<tr>
<td>sl-TimeResourcePSCCH</td>
<td>Indicates the number of symbols of PSCCH in a resource pool.</td>
</tr>
</tbody>
</table>

### SL-PSSCH-Config field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-BetaOffsets2ndSCI</td>
<td>Indicates candidates of beta-offset values to determine the number of coded modulation symbols for second stage SCI. The value indicates the index of Table 9.3-2 of TS 38.213 [13].</td>
</tr>
<tr>
<td>sl-PSSCH-DMRS-TimePatternList</td>
<td>Indicates the set of PSSCH DMRS time domain patterns in terms of PSSCH DMRS symbols in a slot that can be used in the resource pool.</td>
</tr>
<tr>
<td>sl-Scaling</td>
<td>Indicates a scaling factor to limit the number of resource elements assigned to the second stage SCI on PSSCH. Value ( f0p5 ) corresponds to 0.5, value ( f0p65 ) corresponds to 0.65, and so on.</td>
</tr>
</tbody>
</table>
### SL-PSFCH-Config field descriptions

**sl-PSFCH-CandidateResourceType**  
Indicates the number of PSFCH resources available for multiplexing HARQ-ACK information in a PSFCH transmission (see TS 38.213 [13], clause 16.3).

**sl-PSFCH-Period**  
Indicates the period of PSFCH resource in the unit of slots within this resource pool. If set to **sl0**, no resource for PSFCH, and HARQ feedback for all transmissions in the resource pool is disabled.

**sl-PSFCH-RB-Set**  
Indicates the set of PRBs that are actually used for PSFCH transmission and reception. The leftmost bit of the bitmap refers to the lowest RB index in the resource pool, and so on.

### SL-UE-SelectedConfigRP field descriptions

**sl-MaxNumPerReserve**  
Indicates the maximum number of reserved PSCCH/PSSCH resources that can be indicated by an SCI.

**sl-MultiReserveResource**  
Indicates if it is allowed to reserve a sidelink resource for an initial transmission of a TB by an SCI associated with a different TB, based on sensing and resource selection procedure.

**sl-ResourceReservePeriodList**  
Set of possible resource reservation period allowed in the resource pool in the unit of ms. Up to 16 values can be configured per resource pool.

**sl-RS-ForSensing**  
Indicates whether DMRS of PSCCH or PSSCH is used for L1 RSRP measurement in the sensing operation.

**sl-SensingWindow**  
Parameter that indicates the start of the sensing window.

**sl-SelectionWindowList**  
Parameter that determines the end of the selection window in the resource selection for a TB with respect to priority indicated in SCI. Value n1 corresponds to $1 \times 2^\mu$, value n5 corresponds to $5 \times 2^\mu$, and so on, where $\mu = 0,1,2,3$ refers to SCS 15,30,60,120 kHz respectively.

**sl-ThresPSSCH-RSRP-List**  
Indicates a list of 64 thresholds, and the threshold should be selected based on the priority in the decoded SCI and the priority in the SCI to be transmitted. A resource is excluded if it is indicated or reserved by a decoded SCI and PSSCH RSRP in the associated data resource is above a threshold.
<table>
<thead>
<tr>
<th><strong>SL-PowerControl field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>sl-MaxTransPower</strong></td>
</tr>
<tr>
<td>Indicates the maximum value of the UE's sidelink transmission power on this resource pool. The unit is dBm.</td>
</tr>
<tr>
<td><strong>sl-Alpha-PSSCH-PSCCH</strong></td>
</tr>
<tr>
<td>Indicates alpha value for sidelink pathloss based power control for PSCCH/PSSCH when sl-P0-PSSCH is configured. When the field is absent the UE applies the value 1.</td>
</tr>
<tr>
<td><strong>sl-P0-PSSCH-PSCCH</strong></td>
</tr>
<tr>
<td>Indicates P0 value for sidelink pathloss based power control for PSCCH/PSSCH. If not configured, sidelink pathloss based power control is disabled for PSCCH/PSSCH.</td>
</tr>
<tr>
<td><strong>sl-Alpha-PSSCH-PSCCH</strong></td>
</tr>
<tr>
<td>Indicates alpha value for downlink pathloss based power control for PSCCH/PSSCH when dl-P0-PSSCH is configured. When the field is absent the UE applies the value 1.</td>
</tr>
<tr>
<td><strong>dl-P0-PSSCH-PSCCH</strong></td>
</tr>
<tr>
<td>Indicates P0 value for downlink pathloss based power control for PSCCH/PSSCH. If not configured, downlink pathloss based power control is disabled for PSCCH/PSSCH.</td>
</tr>
<tr>
<td><strong>dl-Alpha-PSSCH-PSCCH</strong></td>
</tr>
<tr>
<td>Indicates alpha value for downlink pathloss based power control for PSCCH/PSSCH when dl-P0-PSFCH is configured. When the field is absent the UE applies the value 1.</td>
</tr>
<tr>
<td><strong>dl-P0-PSFCH</strong></td>
</tr>
<tr>
<td>Indicates P0 value for downlink pathloss based power control for PSFCH. If not configured, downlink pathloss based power control is disabled for PSFCH.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SL-MinMaxMCS-Config field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>sl-MaxMCS-PSSCH</strong></td>
</tr>
<tr>
<td>Indicates the maximum MCS value used for Mode 1 configured and dynamic grants when using the associated MCS table. If no MCS is configured, UE autonomously selects MCS from the full range of values.</td>
</tr>
<tr>
<td><strong>sl-MinMCS-PSSCH</strong></td>
</tr>
<tr>
<td>Indicates the minimum MCS value for Mode 1 configured and dynamic grants when using the associated MCS table. If no MCS is configured, UE autonomously selects MCS from the full range of values.</td>
</tr>
</tbody>
</table>

---

**SL-RLC-BearerConfig**

The IE **SL-RLC-BearerConfig** specifies the SL RLC bearer configuration information for NR sidelink communication.

**SL-RLC-BearerConfig information element**

```
-- ASN1START
-- TAG-SL-RLC-BEARERCONFIG-START

SL-RLC-BearerConfig-r16 ::= SEQUENCE {
  sl-ServedRadioBearer-r16               SLRB-Uu-ConfigIndex-r16, OPTIONAL, -- Cond LCH-SetupOnly
  sl-RLC-Config-r16                     SL-RLC-Config-r16, OPTIONAL, -- Cond LCH-Setup
  sl-MAC-LogicalChannelConfig-r16       SL-LogicalChannelConfig-r16, OPTIONAL, -- Cond LCH-Setup
  ...                                    ...
}
-- TAG-SL-RLC-BEARERCONFIG-STOP
-- ASN1STOP
```

---

ETS1
**SL-RLC-BearerConfig** field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>sl-MAC-LogicalChannelConfig</strong></td>
<td>The field is used to configure MAC SL logical channel parameters.</td>
</tr>
<tr>
<td><strong>sl-RLC-BearerConfigIndex</strong></td>
<td>The index of the RLC bearer configuration.</td>
</tr>
<tr>
<td><strong>sl-RLC-Config</strong></td>
<td>Determines the RLC mode (UM, AM) and provides corresponding parameters.</td>
</tr>
<tr>
<td><strong>sl-ServedRadioBearer</strong></td>
<td>Associates the sidelink RLC Bearer with a sidelink DRB. It indicates the index of SL radio bearer configuration, which is corresponding to the RLC bearer configuration.</td>
</tr>
</tbody>
</table>

---

### Conditional Presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LCH-Setup</strong></td>
<td>The field is mandatory present upon creation of a new sidelink logical channel via the dedicated signalling and in case of sidelink DRB configuration via system information and pre-configuration; otherwise the field is optionally present, Need M.</td>
</tr>
<tr>
<td><strong>LCH-SetupOnly</strong></td>
<td>This field is mandatory present upon creation of a new sidelink logical channel via the dedicated signalling and in case of sidelink DRB configuration via system information and pre-configuration. Otherwise, it is absent, Need M.</td>
</tr>
</tbody>
</table>

---

### SL-RLC-BearerConfigIndex

The field is used to identify a SL RLC bearer configuration.

**SL-RadioBearerConfigIndex** information element

```asn1
-- ASN1START
-- TAG-SL-RLC-BEARERCONFIGINDEX-START

SL-RadioBearerConfigIndex-r16 ::= INTEGER (1..maxSL-LCID-r16)

-- TAG-RLC-BEARERCONFIGINDEX-STOP
-- ASN1STOP
```

---

### SL-RLC-Config

The field is used to specify the RLC configuration of sidelink DRB. RLC AM configuration is only applicable to the unicast NR sidelink communication.

**SL-RLC-Config** information element

```asn1
-- ASN1START
-- TAG-SL-RLC-CONFIG-START

SL-RLC-Config-r16 ::= CHOICE {
  sl-AM-RLC-r16
  SEQUENCE {
    sl-SN-FieldLengthAM-r16                  SN-FieldLengthAM OPTIONAL, -- Cond SLRBSetup
    sl-T-PollRetransmit-r16                  T-PollRetransmit,
    sl-PollPDU-r16                           PollPDU,
  }
  ...                                }
### SL-RLC-Config field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>sl-MaxRetxThreshold</strong></td>
<td>Parameter for RLC AM for NR sidelink communications, see TS 38.322 [4]. Value t1 corresponds to 1 retransmission, value t2 corresponds to 2 retransmissions and so on.</td>
</tr>
<tr>
<td><strong>sl-PollByte</strong></td>
<td>Parameter for RLC AM for NR sidelink communications, see TS 38.322 [4]. Value kB25 corresponds to 25 kBytes, value kB50 corresponds to 50 kBytes and so on. infinity corresponds to an infinite amount of kBytes.</td>
</tr>
<tr>
<td><strong>sl-PollPDU</strong></td>
<td>Parameter for RLC AM for NR sidelink communications, see TS 38.322 [4]. Value p4 corresponds to 4 PDUs, value p8 corresponds to 8 PDUs and so on. infinity corresponds to an infinite number of PDUs.</td>
</tr>
<tr>
<td><strong>sl-SN-FieldLength</strong></td>
<td>This field indicates the RLC SN field size for NR sidelink communication, see TS 38.322 [4]. For groupcast and broadcast, only value size6 (6 bits) is configured for the field sl-SN-FieldLengthUM.</td>
</tr>
<tr>
<td><strong>sl-T-PollRetransmit</strong></td>
<td>Timer for RLC AM for NR sidelink communications, see TS 38.322 [4], in milliseconds. Value ms5 means 5 ms, value ms10 means 10 ms and so on.</td>
</tr>
</tbody>
</table>

---

**SL-ScheduledConfig**

The IE **SL-ScheduledConfig** specifies sidelink communication configurations used for network scheduled NR sidelink communication.

### SL-ScheduledConfig information element
ETSI TS 138 331 V16.3.1 (2021-01)

**MAC-MainConfigSL-r16** ::= SEQUENCE {
  sl-BSR-Config-r16              BSR-Config                                           OPTIONAL, -- Need M
  sl-PrioritizationThres-r16     INTEGER (1..16)                                      OPTIONAL, -- Need M
  ul-PrioritizationThres-r16     INTEGER (1..8)                                       OPTIONAL, -- Need M
  ...,
}

**SL-ConfiguredGrantConfigList-r16** ::=       SEQUENCE {
  sl-ConfiguredGrantConfigToReleaseList-r16  SEQUENCE (SIZE (1..maxNrofCG-SL-r16)) OF SL-ConfigIndexCG-r16         OPTIONAL, -- Need N
  sl-ConfiguredGrantConfigToAddModList-r16   SEQUENCE (SIZE (1..maxNrofCG-SL-r16)) OF SL-ConfiguredGrantConfig-r16 OPTIONAL  -- Need N
}

---

**SL-ScheduledConfig field descriptions**

**sl-CS-RNTI**
Indicate the RNTI used to scramble CRC of DCI format 3_0, see TS 38.321 [3].

**sl-DCI-ToSL-Trans**
Indicate the time gap between DCI reception and the first sidelink transmission scheduled by the DCI (see TS 38.214 [19], clause 8.1.2.1). Value 1 included in this field corresponds to 1 slot, value 2 corresponds to 2 slots and so on, based on the numerology of sidelink BWP.

**sl-PSFCH-ToPUCCH**
For dynamic grant and configured grant type 2, this field configures the values of the PSFCH to PUCCH gap. The field PSFCH-to-HARQ_feedback timing indicator in DCI format 3_0 selects one of the configured values of the PSFCH to PUCCH gap.

**sl-RNTI**
Indicate the C-RNTI used for monitoring the network scheduling to transmit NR sidelink communication (i.e. the mode 1).

---

**MAC-MainConfigSL field descriptions**

**sl-BSR-Config**
This field is to configure the sidelink buffer status report.

**sl-PrioritizationThres**
Indicates the SL priority threshold, which is used to determine whether SL TX is prioritized over UL TX, as specified in TS 38.321 [3]. Network does not configure the **sl-PrioritizationThres** and the **ul-PrioritizationThres** to the UE separately.

**ul-PrioritizationThres**
Indicates the UL priority threshold, which is used to determine whether SL TX is prioritized over UL TX, as specified in TS 38.321 [3]. Network does not configure the **sl-PrioritizationThres** and the **ul-PrioritizationThres** to the UE separately.
-- SL-SDAP-Config

The IE SL-SDAP-Config is used to set the configurable SDAP parameters for a Sidelink DRB.

**SL-SDAP-Config information element**

```
-- ASN1START
-- TAG-SL-SDAP-CONFIG-START

SL-SDAP-Config-r16 ::=                  SEQUENCE {
  sl-SDAP-Header-r16                      ENUMERATED {present, absent},
  sl-DefaultRB-r16                        BOOLEAN,
  sl-MappedQoS-Flows-r16                  CHOICE {
    sl-MappedQoS-FlowsList-r16              SEQUENCE (SIZE (1..maxNrofSL-QFIs-r16)) OF SL-QoS-Profile-r16,
    sl-MappedQoS-FlowsListDedicated-r16     SL-MappedQoS-FlowsListDedicated-r16  OPTIONAL,   -- Need M
  }
  sl-CastType-r16                        ENUMERATED {broadcast, groupcast, unicast, spare1}                   OPTIONAL,   -- Need M
...

SL-MappedQoS-FlowsListDedicated-r16 ::= SEQUENCE {
  sl-MappedQoS-FlowsToAddList-r16         SEQUENCE (SIZE (1..maxNrofSL-QFIs-r16)) OF SL-QoS-FlowIdentity-r16  OPTIONAL,    -- Need N
  sl-MappedQoS-FlowsToReleaseList-r16     SEQUENCE (SIZE (1..maxNrofSL-QFIs-r16)) OF SL-QoS-FlowIdentity-r16  OPTIONAL     -- Need N
}

-- TAG-SL-SDAP-CONFIG-STOP
-- ASN1STOP
```

**SL-SDAP-Config field descriptions**

**sl-DefaultRB**
Indicates whether or not this is the default sidelink DRB for this NR sidelink communication transmission destination. Among all configured instances of SL-SDAP-Config for this destination, this field shall be set to **true** in at most one instance of SL-SDAP-Config and to **false** in all other instances.

**sl-MappedQoS-Flows**
Indicates QoS flows to be mapped to the sidelink DRB. If the field is included in dedicated signalling, it is set to **sl-MappedQoS-FlowsListDedicated**; otherwise, it is set to **sl-MappedQoS-FlowsList**.

**sl-MappedQoS-FlowsList**
Indicates the list of QoS profiles of the NR sidelink communication transmission destination mapped to this sidelink DRB.

**sl-MappedQoS-FlowsToAddList**
Indicates the list of SL QoS flows ID of the NR sidelink communication transmission destination to be additionally mapped to this sidelink DRB.

**sl-MappedQoS-FlowsToReleaseList**
Indicates the list of SL QoS flows ID of the NR sidelink communication transmission destination to be released from existing QoS flow to SLRB mapping of this sidelink DRB.

**sl-SDAP-Header**
Indicates whether or not a SDAP header is present on this sidelink DRB. The field cannot be changed after a sidelink DRB is established. This field is set to present if the field **sl-DefaultRB** is set to **true**.
SL-SyncConfig

The IE SL-SyncConfig specifies the configuration information concerning reception of synchronisation signals from neighbouring cells as well as concerning the transmission of synchronisation signals for sidelink communication.

---

**SL-SyncConfig** information element

```asn1
-- ASN1START
-- TAG-SL-SYNCCONFIG-START

SL-SyncConfigList-r16 ::= SEQUENCE {SIZE (1..maxSL-SyncConfig-r16)} OF SL-SyncConfig-r16

SL-SyncConfig-r16 ::= SEQUENCE {
  sl-SyncRefMinHyst-r16                ENUMERATED {dB0, dB3, dB6, dB9, dB12} OPTIONAL, -- Need R
  sl-SyncRefDiffHyst-r16               ENUMERATED {dB0, dB3, dB6, dB9, dB12, dBinf} OPTIONAL, -- Need R
  sl-filterCoefficient-r16            FilterCoefficient OPTIONAL, -- Need R
  sl-SSB-TimeAllocation1-r16          SL-SSB-TimeAllocation-r16 OPTIONAL, -- Need R
  sl-SSB-TimeAllocation2-r16          SL-SSB-TimeAllocation-r16 OPTIONAL, -- Need R
  sl-SSB-TimeAllocation3-r16          SL-SSB-TimeAllocation-r16 OPTIONAL, -- Need R
  sl-SSID-r16                        INTEGER (0..671) OPTIONAL, -- Need R
  txParameters-r16                   SEQUENCE {
    syncTxThreshIC-r16                 SL-RSRP-Range-r16 OPTIONAL, -- Need R
    syncTxThreshOoC-r16                SL-RSRP-Range-r16 OPTIONAL, -- Need R
    syncInfoReserved-r16               BIT STRING (SIZE (2)) OPTIONAL -- Need R
  },
  gnss-Sync-r16                      ENUMERATED {true} OPTIONAL, -- Need R
}

SL-RSRP-Range-r16 ::= INTEGER (0..13)

SL-SSB-TimeAllocation-r16 ::= SEQUENCE {
  sl-NumSSB-WithinPeriod-r16          ENUMERATED {n1, n2, n4, n8, n16, n32, n64} OPTIONAL, -- Need R
  sl-TimeOffsetSSB-r16                INTEGER (0..1279) OPTIONAL, -- Need R
  sl-TimeInterval-r16                 INTEGER (0..639) OPTIONAL -- Need R
}

-- TAG-SL-SYNCCONFIG-STOP
-- ASN1STOP
```
### SL-SyncConfig field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>gnss-Sync</strong></td>
<td>If configured, the synchronization configuration is used for SLSS transmission/reception when the UE is synchronized to GNSS. If not configured, the synchronization configuration is used for SLSS transmission/reception when the UE is synchronized to eNB/gNB.</td>
</tr>
<tr>
<td><strong>si-SyncRefMinHyst</strong></td>
<td>Hysteresis when evaluating a SyncRef UE using absolute comparison.</td>
</tr>
<tr>
<td><strong>si-SyncRefDiffHyst</strong></td>
<td>Hysteresis when evaluating a SyncRef UE using relative comparison.</td>
</tr>
</tbody>
</table>
| **si-NumSSB-WithinPeriod** | Indicates the number of sidelink SSB transmissions within one sidelink SSB period. The applicable values are related to the subcarrier spacing and frequency as follows:  
FR1, SCS = 15 kHz: 1  
FR1, SCS = 30 kHz: 1, 2  
FR1, SCS = 60 kHz: 1, 2, 4  
FR2, SCS = 60 kHz: 1, 2, 4, 8, 16, 32  
FR2, SCS = 120 kHz: 1, 2, 4, 8, 16, 32, 64 |
| **si-TimeOffsetSSB** | Indicates the slot offset from the start of sidelink SSB period to the first sidelink SSB.                                                  |
| **si-TimeInterval** | Indicates the slot interval between neighboring sidelink SSBs. This value is applicable when there are more than one sidelink SSBs within one sidelink SSB period. |
| **si-SSID**         | Indicates the ID of sidelink synchronization signal associated with different synchronization priorities.                                     |
| **si-RSRP-Range**   | Value 0 corresponds to -infinity, value 1 to -115dBm, value 2 to -110dBm, and so on (i.e. in steps of 5dBm) until value 12, which corresponds to -60dBm, while value 13 corresponds to +infinity. |
| **syncInfoReserved** | Reserved for future use.                                                                                                                |

---

### SL-ThresPSSCH-RSRP-List

IE **SL-ThresPSSCH-RSRP-List** indicates a threshold used for sensing based UE autonomous resource selection (see TS 38.215 [9]). A resource is excluded if it is indicated or reserved by a decoded SCI and PSSCH RSRP in the associated data resource is above the threshold defined by IE **SL-ThresPSSCH-RSRP-List**.

#### SL-ThresPSSCH-RSRP-List information element

```
--- ASN1START
--- TAG-SL-THRESPSSCH-RSRP-LIST-START

SL-ThresPSSCH-RSRP-List-r16 ::= SEQUENCE (SIZE (64)) OF SL-ThresPSSCH-RSRP-r16

SL-ThresPSSCH-RSRP-r16 ::= INTEGER (0..66)

--- TAG-SL-THRESPSSCH-RSRP-LIST-STOP
--- ASN1STOP
```
### SL-ThresPSSCH-RSRP-List field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SL-ThresPSSCH-RSRP</strong></td>
<td>Value 0 corresponds to minus infinity dBm, value 1 corresponds to -128dBm, value 2 corresponds to -126dBm, value n corresponds to (-128 + (n-1)*2) dBm and so on, value 66 corresponds to infinity dBm.</td>
</tr>
</tbody>
</table>

---

### SL-TxPower

The IE **SL-TxPower** is used to limit the UE's sidelink transmission power on a carrier frequency. The unit is dBm. Value minusinfinity corresponds to –infinity.

#### SL-TxPower information element

```
-- ASN1START
-- TAG-SL-TXPOWER-START
SL-TxPower-r16 ::=                    CHOICE{
   minusinfinity-r16                     NULL,
   txPower-r16                           INTEGER (-30..33)
}
-- TAG-SL-TXPOWER-STOP
-- ASN1STOP
```

---

### SL-TypeTxSync

The IE **SL-TypeTxSync** indicates the synchronization reference type.

#### SL-TypeTxSync information element

```
-- ASN1START
-- TAG-SL-TYPETXSYNC-START
SL-TypeTxSync-r16 ::=                     ENUMERATED {gnss, gnbEnb, ue}
-- TAG-SL-TYPETXSYNC-STOP
-- ASN1STOP
```

---

### SL-UE-SelectedConfig

IE **SL-UE-SelectedConfig** specifies sidelink communication configurations used for UE autonomous resource selection.

#### SL-UE-SelectedConfig information element

```
-- ASN1START
-- TAG-SL-UE-SELECTEDCONFIG-START
```
SL-UE-SelectedConfig-r16 ::= SEQUENCE {
  sl-PSSCH-TxConfigList-r16  OPTIONAL, -- Need R
  sl-ProbResourceKeep-r16     ENUMERATED {v0, v0dot2, v0dot4, v0dot6, v0dot8} OPTIONAL, -- Need R
  sl-ReselectAfter-r16       ENUMERATED {n1, n2, n3, n4, n5, n6, n7, n8, n9} OPTIONAL, -- Need R
  sl-CBR-CommonTxConfigList-r16  OPTIONAL, -- Need R
  ul-PrioritizationThres-r16  INTEGER (1..16) OPTIONAL, -- Need R
  sl-PrioritizationThres-r16  INTEGER (1..8) OPTIONAL, -- Need R
  ...}

-- TAG-SL-UE-SELECTEDCONFIG-STOP
-- ASN1STOP

--- SL-UE-SelectedConfig field descriptions ---

<table>
<thead>
<tr>
<th>Field Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>sl-PrioritizationThres</strong></td>
</tr>
<tr>
<td>Indicates the SL priority threshold, which is used to determine whether SL TX is prioritized over UL TX, as specified in TS 38.321 [3]. Network does not configure the sl-PrioritizationThres and the ul-PrioritizationThres to the UE separately.</td>
</tr>
<tr>
<td><strong>sl-ProbResourceKeep</strong></td>
</tr>
<tr>
<td>Indicates the probability with which the UE keeps the current resource when the resource reselection counter reaches zero for sensing based UE autonomous resource selection (see TS 38.321 [3]).</td>
</tr>
<tr>
<td><strong>sl-PSSCH-TxConfigList</strong></td>
</tr>
<tr>
<td>Indicates PSSCH TX parameters such as MCS, sub-channel number, retransmission number, associated to different UE absolute speeds and different synchronization reference types for UE autonomous resource selection.</td>
</tr>
<tr>
<td><strong>sl-ReselectAfter</strong></td>
</tr>
<tr>
<td>Indicates the number of consecutive skipped transmissions before triggering resource reselection for sidelink communication (see TS 38.321 [3]).</td>
</tr>
<tr>
<td><strong>ul-PrioritizationThres</strong></td>
</tr>
<tr>
<td>Indicates the UL priority threshold, which is used to determine whether SL TX is prioritized over UL TX, as specified in TS 38.321 [3]. Network does not configure the sl-PrioritizationThres and the ul-PrioritizationThres to the UE separately.</td>
</tr>
</tbody>
</table>

---

**SL-ZoneConfig**

The IE **SL-ZoneConfig** is used to configure the zone ID related parameters.

---

**SL-ZoneConfig information element**

---

---

---
SL-ZoneConfig field descriptions

sl-ZoneLength
Indicates the length of each geographic zone.

---

SLRB-Uu-ConfigIndex

The IE SLRB-Uu-ConfigIndex is used to identify a sidelink DRB configuration from the network side.

SLRB-Uu-ConfigIndex information element

---

6.4 RRC multiplicity and type constraint values

---

Multiplicity and type constraint definitions

---

maxAI-DCI-PayloadSize-r16  INTEGER ::= 128  --Maximum size of the DCI payload scrambled with ai-RNTI
maxAI-DCI-PayloadSize-r16-1 INTEGER ::= 127  --Maximum size of the DCI payload scrambled with ai-RNTI minus 1
maxBandComb               INTEGER ::= 65536  -- Maximum number of DL band combinations
maxBH-RLC-ChannelID-r16   INTEGER ::= 65536  -- Maximum value of BH RLC Channel ID
maxBT-IdReport-r16        INTEGER ::= 32    -- Maximum number of Bluetooth IDs to report
maxBT-Name-r16            INTEGER ::= 4     -- Maximum number of Bluetooth name
maxCAG-Cell-r16           INTEGER ::= 16    -- Maximum number of NR CAG cell ranges in SIB3, SIB4
maxCBR-Config-r16         INTEGER ::= 8     -- Maximum number of CBR range configurations for sidelink communication
maxCBR-Config-1-r16       INTEGER ::= 7     -- Maximum number of CBR range configurations for sidelink communication
maxCBR-Level-r16          INTEGER ::= 16    -- Maximum number of CBR levels
maxCBR-Level-1-r16        INTEGER ::= 15    -- Maximum number of CBR levels minus 1
maxCellBlack              INTEGER ::= 16    -- Maximum number of NR blacklisted cell ranges in SIB3, SIB4
maxCellHistory-r16        INTEGER ::= 16    -- Maximum number of visited cells reported
maxCellInter              INTEGER ::= 16    -- Maximum number of inter-Freq cells listed in SIB4
maxCellIntra              INTEGER ::= 16    -- Maximum number of intra-Freq cells listed in SIB3
maxCellMeasEUTRA          INTEGER ::= 32    -- Maximum number of cells in E-UTRAN
maxCellMeasIdle-r16       INTEGER ::= 8     -- Maximum number of cells per carrier for idle/inactive measurements
maxCellMeasUTRA-FDD-r16   INTEGER ::= 32    -- Maximum number of cells in FDD UTRAN
maxCellWhite INTEGER ::= 16 -- Maximum number of NR whitelisted cell ranges in SIB3, SIB4
maxEARFCN INTEGER ::= 262143 -- Maximum value of E-UTRA carrier frequency
maxEUTRA-CellBlack INTEGER ::= 16 -- Maximum number of E-UTRA blacklisted physical cell identity ranges in SIB5
maxEUTRA-NS-Pmax INTEGER ::= 8 -- Maximum number of NS and P-Max values per band
maxLogMeasReport-r16 INTEGER ::= 520 -- Maximum number of entries for logged measurements
maxMultIbands INTEGER ::= 8 -- Maximum number of additional frequency bands that a cell belongs to
maxNRAPCN INTEGER ::= 3279165 -- Maximum value of NR carrier frequency
maxNR-NS-Pmax INTEGER ::= 8 -- Maximum number of NS and P-Max values per band
maxFreqIdle-r16 INTEGER ::= 8 -- Maximum number of carrier frequencies for idle/inactive measurements
maxNrofServingCells INTEGER ::= 16 -- Maximum number of serving cells (SpCells + SCells) per cell group
maxNrofDOUCells-r16 INTEGER ::= 512 -- Maximum number of cells configured on the collocated IAB-DU
maxNrofAvailabilityCombinationsPerSet-r16 INTEGER ::= 512 -- Max number of AvailabilityCombinationId used in the DCI format 2.5
maxNrofAvailabilityCombinationsPerSet-r16-1 INTEGER ::= 511 -- Max number of AvailabilityCombinationId used in the DCI format 2.5 minus 1
maxNrofScells INTEGER ::= 32 -- Max number of secondary serving cells per cell group
maxNrofCG-SL-r16 INTEGER ::= 8 -- Max number of sidelink configured grant
maxNrofCG-SL-r16-1 INTEGER ::= 7 -- Max number of sidelink configured grant minus 1
maxNrofSS-BlocksToAverage INTEGER ::= 16 -- Max number for the (max) number of SS blocks to average to determine cell measurement
maxNrofCondCells-r16 INTEGER ::= 8 -- Max number of conditional candidate SpCells
maxNrofCSIS-RS-ResourcesToAverage INTEGER ::= 16 -- Max number for the (max) number of CSI-RS to average to determine cell measurement
maxNrofDL-Allocations INTEGER ::= 16 -- Max number of PDSCH time domain resource allocations
maxNrofSR-ConfigPerCellGroup INTEGER ::= 8 -- Max number of SR configurations per cell group
maxLCG-ID INTEGER ::= 32 -- Max value of Logical Channel ID
maxLC-ID INTEGER ::= 65535 -- Max value of BH Logical Channel ID extension
maxLTE-CRS-Patterns INTEGER ::= 3 -- Max number of additional LTE CRS rate matching patterns
maxNrofTAGs INTEGER ::= 4 -- Max number of Timing Advance Groups minus 1
maxNrofTAGs-1 INTEGER ::= 3 -- Max number of Timing Advance Groups
maxNrofBWPs INTEGER ::= 4 -- Max number of BWPs per serving cell
maxNrofCombIDC INTEGER ::= 128 -- Max number of reported MR-DC combinations for IDC
maxNrofSymbols-1 INTEGER ::= 13 -- Max number of symbols in a slot (14 symbols, indexed from 0..13)
maxNrofSlots INTEGER ::= 320 -- Max number of slots in a 10 ms period
maxNrofPhysicalResourceBlocks INTEGER ::= 275 -- Max number of PRBs
maxNrofPhysicalResourceBlocks-1 INTEGER ::= 274 -- Max number of PRBs minus 1
maxNrofPhysicalResourceBlocksPlus1 INTEGER ::= 276 -- Max number of PRBs plus 1
maxNrofControlResourceSets INTEGER ::= 12 -- Max number of CoReSets configurable on a serving cell
maxNrofControlResourceSets-1 INTEGER ::= 11 -- Max number of CoReSets configurable on a serving cell minus 1
maxNrofControlResourceSets-1-r16 INTEGER ::= 15 -- Max number of CoReSets configurable on a serving cell extended in minus 1
maxNrofCoresetPools-r16 INTEGER ::= 2 -- Max number of CORESET pools
maxNrofRateMatchPatterns INTEGER ::= 3 -- Max number of OFDM symbols in a control resource set
maxNrofSearchSpaces-r16 INTEGER ::= 39 -- Max number of Search Spaces minus 1
maxNrofRateMatchPatterns-1 INTEGER ::= 3 -- Max number of rate matching patterns that may be configured minus 1
maxSFI-DCI-PayloadSize-1 INTEGER ::= 127 -- Max number payload of a DCI scrambled with SFI-RNTI minus 1
maxSFI-DCI-PayloadSize INTEGER ::= 128 -- Max number payload of a DCI scrambled with SFI-RNTI
maxIAB-IP-Address-r16 INTEGER ::= 32 -- Max number of assigned IP addresses
maxINT-DCI-PayloadSize INTEGER ::= 126 -- Max number payload of a DCI scrambled with INT-RNTI minus 1
maxINT-DCI-PayloadSize-1 INTEGER ::= 125 -- Max number payload of a DCI scrambled with INT-RNTI
<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxNrofRateMatchPatternsPerGroup</td>
<td>8</td>
</tr>
<tr>
<td>maxNrofCSI-ReportConfigurations</td>
<td>48</td>
</tr>
<tr>
<td>maxNrofCSI-ReportConfigurations-1</td>
<td>47</td>
</tr>
<tr>
<td>maxNrofCSI-ReportConfigurations-2</td>
<td>112</td>
</tr>
<tr>
<td>maxNrofCSI-ReportConfigurations-3</td>
<td>111</td>
</tr>
<tr>
<td>maxNrofAP-CI-CSI-RS-ResourcesPerSet</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofCSI-AperiodicTriggers</td>
<td>128</td>
</tr>
<tr>
<td>maxNrofReportConfigPerAperiodicTrigger</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofNZP-CSI-RS-Resources</td>
<td>192</td>
</tr>
<tr>
<td>maxNrofNZP-CSI-RS-Resources-1</td>
<td>191</td>
</tr>
<tr>
<td>maxNrofNZP-CSI-RS-ResourcesPerSet</td>
<td>64</td>
</tr>
<tr>
<td>maxNrofNZP-CSI-RS-ResourcesSets</td>
<td>64</td>
</tr>
<tr>
<td>maxNrofNZP-CSI-RS-ResourcesSets-1</td>
<td>63</td>
</tr>
<tr>
<td>maxNrofNZP-CSI-RS-ResourcesSetsPerConfig</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofNZP-CSI-RS-ResourcesPerConfig</td>
<td>128</td>
</tr>
<tr>
<td>maxNrofCSI-IM-Resources</td>
<td>32</td>
</tr>
<tr>
<td>maxNrofCSI-IM-Resources-1</td>
<td>32</td>
</tr>
<tr>
<td>maxNrofCSI-IM-ResourcesPerSet</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofCSI-IM-ResourcesSets</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofCSI-IM-ResourcesSetsPerConfig</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofCSI-SSB-ResourcesPerSet</td>
<td>64</td>
</tr>
<tr>
<td>maxNrofCSI-SSB-ResourcesPerConfig</td>
<td>64</td>
</tr>
<tr>
<td>maxNrofCSI-SSB-ResourcesPerConfig-1</td>
<td>63</td>
</tr>
<tr>
<td>maxNrofCSI-SSB-ResourcesPerConfig-2</td>
<td>15</td>
</tr>
<tr>
<td>maxNrofFailureDetectionResources</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofFailureDetectionResources-1</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofFailureDetectionResources-2</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofFreqSL-r16</td>
<td>8</td>
</tr>
<tr>
<td>maxNrofSL-BWP-r16</td>
<td>4</td>
</tr>
<tr>
<td>maxFreqSL-EUTRA-r16</td>
<td>8</td>
</tr>
<tr>
<td>maxFreqSL-MeasId-r16</td>
<td>64</td>
</tr>
<tr>
<td>maxFreqSL-ObjectId-r16</td>
<td>64</td>
</tr>
<tr>
<td>maxFreqSL-ReportConfigId-r16</td>
<td>64</td>
</tr>
<tr>
<td>maxFreqSL-PoolToMeasureNR-r16</td>
<td>8</td>
</tr>
<tr>
<td>maxFreqSL-NR-r16</td>
<td>8</td>
</tr>
<tr>
<td>maxNrofSL-QFIs-r16</td>
<td>8</td>
</tr>
<tr>
<td>maxNrofSL-QFIsPerDest-r16</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofObject1d</td>
<td>2048</td>
</tr>
<tr>
<td>maxNrofPageRec</td>
<td>64</td>
</tr>
<tr>
<td>maxNrofPCI-Ranges</td>
<td>9</td>
</tr>
<tr>
<td>maxPLMN</td>
<td>12</td>
</tr>
<tr>
<td>maxNrofCSI-RS-ResourcesRRM</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofCSI-RS-ResourcesRRM-1</td>
<td>16</td>
</tr>
<tr>
<td>maxNrofMeas1d</td>
<td>64</td>
</tr>
<tr>
<td>maxNrofQuantityConfig</td>
<td>2</td>
</tr>
<tr>
<td>maxNrofCSI-RS-CellsNR/rmm</td>
<td>96</td>
</tr>
<tr>
<td>maxNrofCSI-RS-CellsNR/rmm-1</td>
<td>96</td>
</tr>
<tr>
<td>maxNrofCSI-RS-CellsNR/rmm-2</td>
<td>32</td>
</tr>
<tr>
<td>maxNrofCSI-RS-CellsNR/rmm-3</td>
<td>31</td>
</tr>
</tbody>
</table>

---

**Notes:**
- maxNrofRateMatchPatternsPerGroup: Maximum number of rate matching patterns that may be configured in one group.
- maxNrofCSI-ReportConfigurations: Maximum number of report configurations.
- maxNrofCSI-ReportConfigurations-1: Maximum number of report configurations minus 1.
- maxNrofCSI-ReportConfigurations-2: Maximum number of resource configurations.
- maxNrofCSI-ReportConfigurations-3: Maximum number of resource configurations minus 1.
- maxNrofAP-CI-CSI-RS-ResourcesPerSet: Maximum number of resource sets per resource configuration.
- maxNrofCSI-AperiodicTriggers: Maximum number of triggers for aperiodic CSI reporting.
- maxNrofReportConfigPerAperiodicTrigger: Maximum number of triggers for aperiodic reporting.
- maxNrofNZP-CSI-RS-Resources: Maximum number of Non-Zero-Power (NZP) CSI-RS resources.
- maxNrofNZP-CSI-RS-ResourcesPerSet: Maximum number of NZP CSI-RS resources per resource set.
- maxNrofNZP-CSI-RS-ResourcesSets: Maximum number of NZP CSI-RS resources per cell.
- maxNrofNZP-CSI-RS-ResourcesSets-1: Maximum number of NZP CSI-RS resources per cell minus 1.
- maxNrofNZP-CSI-RS-ResourcesSetsPerConfig: Maximum number of resource sets per resource configuration.
- maxNrofCSI-IM-Resources: Maximum number of CSI-IM resources. See CSI-IM-ResourceMax in 38.214.
- maxNrofCSI-IM-Resources-1: Maximum number of CSI-IM resources minus 1. See CSI-IM-ResourceMax in 38.214.
- maxNrofCSI-IM-ResourcesPerSet: Maximum number of CSI-IM resources per set. See CSI-IM-ResourcePerSetMax in 38.214.
- maxNrofCSI-IM-ResourcesSets: Maximum number of NZP CSI-IM resources per cell.
- maxNrofCSI-IM-ResourcesSets-1: Maximum number of NZP CSI-IM resources per cell minus 1.
- maxNrofCSI-IM-ResourcesSetsPerConfig: Maximum number of CSI IM resource sets per resource configuration.
- maxNrofCSI-SSB-ResourcesPerSet: Maximum number of SSB resources per resource set.
- maxNrofCSI-SSB-ResourcesPerSet: Maximum number of SSB resources per cell.
- maxNrofCSI-SSB-ResourceSets: Maximum number of SSB resources per cell.
- maxNrofCSI-SSB-ResourceSets-1: Maximum number of SSB resource sets per resource configuration.
- maxNrofCSI-SSB-ResourceSetsPerConfig: Maximum number of SSB resource sets per resource configuration.
- maxNrofFailureDetectionResources: Maximum number of failure detection resources per cell.
- maxNrofFailureDetectionResources-1: Maximum number of failure detection resources minus 1.
- maxNrofFreqSL-r16: Maximum number of carrier frequency for NR sidelink communication.
- maxNrofSL-BWP-r16: Maximum number of BWP for for NR sidelink communication.
- maxFreqSL-EUTRA-r16: Maximum number of EUTRA anchor carrier frequency for NR sidelink communication.
- maxFreqSL-MeasId-r16: Maximum number of sidelink measurement identity (RSRP) per destination.
- maxFreqSL-ObjectId-r16: Maximum number of sidelink measurement objects (RSRP) per destination.
- maxFreqSL-ReportConfigId-r16: Maximum number of sidelink measurement reporting configuration (RSRP) per destination.
- maxFreqSL-PoolToMeasureNR-r16: Maximum number of resource pool for NR sidelink measurement to measure for each measurement object (for CBR).
- maxFreqSL-NR-r16: Maximum number of NR anchor carrier frequency for NR sidelink communication.
- maxNrofSL-QFIs-r16: Maximum number of QoS flow for NR sidelink communication per UE.
- maxNrofSL-QFIsPerDest-r16: Maximum number of QoS flow per destination for NR sidelink communication.
- maxNrofObject1d: Maximum number of objects.
- maxNrofPageRec: Maximum number of page records.
- maxNrofPCI-Ranges: Maximum number of PCI ranges.
- maxPLMN: Maximum number of PLMNs broadcast and reported by UE at establishment.
- maxNrofCSI-RS-ResourcesRRM: Maximum number of CSI-RS broadcast and reported for an RRM measurement object.
- maxNrofCSI-RS-ResourcesRRM-1: Maximum number of CSI-RS resources per cell for an RRM measurement object.
- maxNrofMeas1d: Maximum number of measurements.
- maxNrofQuantityConfig: Maximum number of quantity configurations.
- maxNrofCSI-RS-CellsNR/rmm: Maximum number of cells with CSI-RS resources for an RRM measurement object.
- maxNrofCSI-RS-CellsNR/rmm-1: Maximum number of destination for NR sidelink communication.
- maxNrofCSI-RS-CellsNR/rmm-2: Maximum number of destination for NR sidelink communication.
- maxNrofCSI-RS-CellsNR/rmm-3: Maximum number of destination for NR sidelink communication.
maxNrofSLAB-r16 INTEGER ::= 512 -- Maximum number of radio bearer for NR sidelink communication per UE
maxNrofSL-CLC-r16 INTEGER ::= 512 -- Maximum number of RLC bearer for NR sidelink communication per UE
maxNrofSL-SyncConfig-r16 INTEGER ::= 16 -- Maximum number of sidelink Sync configurations
maxNrofRXPool-r16 INTEGER ::= 16 -- Maximum number of Rx resource pool for NR sidelink communication
maxNrofTXPool-r16 INTEGER ::= 8  -- Maximum number of Tx resource pool for NR sidelink communication
maxNrofPoolID-r16 INTEGER ::= 16 -- Maximum index of resource pool for NR sidelink communication
maxNrofSRSS-PathlossReferenceRS-r16 INTEGER ::= 64 -- Maximum number of RSs used as pathloss reference for SRSS power control.
maxNrofSRSS-PathlossReferenceRS-1-r16 INTEGER ::= 63 -- Maximum number of RSs used as pathloss reference for SRSS power control-1.
maxNrofSRSS-ResourceSets INTEGER ::= 16 -- Maximum number of SRSS resource sets in a BWP.
maxNrofSRSS-ResourceSets-1 INTEGER ::= 15 -- Maximum number of SRSS resource sets in a BWP minus 1.
maxNrofSRSS-PosResourceSets-r16 INTEGER ::= 16 -- Maximum number of SRSS Positioning resource sets in a BWP.
maxNrofSRSS-PosResourceSets-1-r16 INTEGER ::= 15 -- Maximum number of SRSS Positioning resource sets in a BWP minus 1.
maxNrofSRSS-Resources INTEGER ::= 64 -- Maximum number of SRSS resources.
maxNrofSRSS-Resources-1 INTEGER ::= 63 -- Maximum number of SRSS resources minus 1.
maxNrofSRSS-PosResources-r16 INTEGER ::= 64 -- Maximum number of SRSS Positioning resources.
maxNrofSRSS-PosResources-1-r16 INTEGER ::= 63 -- Maximum number of SRSS Positioning resources in an SRSS Positioning resource set minus 1.
maxNrofSRSS-ResourcesPerSet INTEGER ::= 16 -- Maximum number of SRSS resources in an SRSS resource set
maxNrofSRSS-ResourcesPerSet-1 INTEGER ::= 15 -- Maximum number of SRSS trigger states minus 1. i.e., the largest code point.
maxNrofSLAB TriggerStates INTEGER ::= 2 -- Maximum number of SRSS trigger states minus 2.
maxNrofSRSS-TriggerStates INTEGER ::= 8 -- Maximum number of interworking RAT containers (incl NR and MRDC)
maxNrofSRSS-TriggerStates-1 INTEGER ::= 7 -- Maximum number of simultaneously aggregated bands
maxNrofSlotFormatCombinationsPerSet INTEGER ::= 512 -- Maximum number of Slot Format Combinations in a SF-Set.
maxNrofSlotFormatCombinationsPerSet-1 INTEGER ::= 511 -- Maximum number of Slot Format Combinations in a SF-Set minus 1.
maxNrofTrafficPattern-r16 INTEGER ::= 128 -- Maximum number of Traffic Pattern for NR sidelink communication.
maxNrofPUCCH-Resources INTEGER ::= 128
maxNrofPUCCH-Resources-1 INTEGER ::= 127
maxNrofPUCCH-ResourceSets INTEGER ::= 4 -- Maximum number of PUCCH Resource Sets
maxNrofPUCCH-ResourceSets-1 INTEGER ::= 3 -- Maximum number of PUCCH Resource Sets minus 1.
maxNrofPUCCH-ResourcesPerSet INTEGER ::= 32 -- Maximum number of PUCCH Resources per PUCCH-ResourceSet
maxNrofPUCCH-P0-PerSet INTEGER ::= 8 -- Maximum number of P0-pucch present in a p0-pucch set
maxNrofPUCCH-PathlossReferenceRSs INTEGER ::= 4 -- Maximum number of RSs used as pathloss reference for PUCCH power control.
maxNrofPUCCH-PathlossReferenceRSs-1 INTEGER ::= 3 -- Maximum number of RSs used as pathloss reference for PUCCH power control minus 1.
maxNrofPUCCH-PathlossReferenceRSs-r16 INTEGER ::= 64 -- Maximum number of RSs used as pathloss reference for PUCCH power control extended.
maxNrofPUCCH-PathlossReferenceRSs-1-r16 INTEGER ::= 63 -- Maximum number of RSs used as pathloss reference for PUCCH power control minus 1 extended.
maxNrofPUCCH-PathlossReferenceRSsDiff-r16 INTEGER ::= 60 -- Difference between the extended maximum and the non-extended maximum.
maxNrofPUCCH-ResourceGroups-r16 INTEGER ::= 4 -- Maximum number of PUCCH resources groups.
maxNrofPUCCH-ResourcesPerGroup-r16 INTEGER ::= 128 -- Maximum number of PUCCH resources in a PUCCH group.
maxNrofPUSCH-PathlossReferenceRSs INTEGER ::= 4 -- Maximum number of multiple PUSCHs in PUSCH TORA list
maxNrofPUSCH-PathlossReferenceRSs-1 INTEGER ::= 3 -- Maximum number of PUSCH resources in PUSCH TORA list minus 1 (see 38,213, clause 7.1)
maxNrofPUSCH-PathlossReferenceRSs-r16 INTEGER ::= 64 -- Maximum number of RSs used as pathloss reference for PUSCH power control.
maxNrofPUSCH-PathlossReferenceRSs-1-r16 INTEGER ::= 63 -- Maximum number of RSs used as pathloss reference for PUSCH power control minus 1.
maxNrofPUSCH-PathlossReferenceRSsDiff-r16 INTEGER ::= 60 -- Difference between maxNrofPUSCH-PathlossReferenceRSs-r16 and maxNrofPUSCH-PathlossReferenceRSs-1-r16.
maxNrofNAICS-Entries INTEGER ::= 8 -- Maximum number of supported NAICS capability set
maxBands INTEGER ::= 1024 -- Maximum number of supported bands in UE capability.
maxBandsMRDC INTEGER ::= 1280
maxBandsEUTRA INTEGER ::= 256
maxCellReport INTEGER ::= 8 -- Maximum number of DRBs (that can be added in DRB-ToAddModLIst).
maxDRB    INTEGER ::= 29 -- Maximum number of DRBs.
maxFreq   INTEGER ::= 8 -- Max number of frequencies.
maxFreqLayers INTEGER ::= 4 -- Max number of frequency layers.
maxFreqIDC-r16 INTEGER ::= 128 -- Max number of frequencies for IDC indication.
maxCombIDC-r16 INTEGER ::= 128 -- Max number of reported UL CA for IDC indication.
maxFreqIDC-MRC INTEGER ::= 32 -- Maximum number of candidate NR frequencies for MR-DC IDC indication.
maxNrofCandidateBeams INTEGER ::= 16 -- Max number of PRACH-ResourceDedicatedBFR that in BFR config.
maxNrofCandidateBeams-r16 INTEGER ::= 64 -- Max number of candidate beam resources in BFR config.
maxNrofCandidateBeamsExt-r16 INTEGER ::= 48 -- Max number of PRACH-ResourceDedicatedBFR in the CandidateBeamRSListExt
maxNrofPCIsPerSMTC INTEGER ::= 64 -- Max number of PCIs per SMTC.
maxNrofQFIs INTEGER ::= 64
maxNrofResourceAvailabilityPerCombination-r16 INTEGER ::= 256
maxNrofSemiPersistentPUSCH-Triggers INTEGER ::= 64 -- Maximum number of triggers for semi persistent reporting on PUSCH
maxNrofSR-Resources INTEGER ::= 8 -- Maximum number of SR resources per BWP in a cell.
maxNrofSlotFormatsPerCombination INTEGER ::= 256
maxNrofSpatialRelationInfos INTEGER ::= 8
maxNrofSpatialRelationInfos-plus-1 INTEGER ::= 9
maxNrofSpatialRelationInfos-r16 INTEGER ::= 64
maxNrofSpatialRelationInfosDiff-r16 INTEGER ::= 56 -- Difference between maxNrofSpatialRelationInfos-r16 and maxNrofSpatialRelationInfos
maxNrofIndexesToReport INTEGER ::= 32
maxNrofIndexesToReport2 INTEGER ::= 64
maxNrofSSBs-r16 INTEGER ::= 64 -- Maximum number of SSB resources in a resource set.
maxNrofSSBs-1 INTEGER ::= 63 -- Maximum number of SSB resources in a resource set minus 1.
maxNrofS-NSSAI INTEGER ::= 8 -- Maximum number of S-NSSAI.
maxNrofTCI-StatesPDCCH INTEGER ::= 64 -- Maximum number of TCI states.
maxNrofTCI-States INTEGER ::= 128 -- Maximum number of TCI states minus 1.
maxNrofTCI-States-1 INTEGER ::= 127 -- Maximum number of TCI states minus 1.
maxNrofUL-Allocations INTEGER ::= 16 -- Maximum number of PUSCH time domain resource allocations.
maxQFI INTEGER ::= 63
maxRA-CI-SRS-Resources INTEGER ::= 96 -- Maximum number of RA occasions for one CSI-RS
maxRA-OccasionsPerCSI-RS INTEGER ::= 64 -- Maximum number of RA occasions in the system
maxRA-Occasions-1 INTEGER ::= 511 -- Maximum number of RA occasions in the system
maxRA-SIBs INTEGER ::= 64
maxSCSs INTEGER ::= 5
maxSecondaryCellGroups INTEGER ::= 3
maxNrofServingCellsEUTRA INTEGER ::= 32
maxMBSFN-Allocations INTEGER ::= 8
maxNrofMultiBands INTEGER ::= 8 -- Maximum number of cells for SFTD reporting
maxCellSFTD INTEGER ::= 3
maxReportConfigId INTEGER ::= 64 -- Maximum number of codebooks supported by the UE
maxNrofCodebooks INTEGER ::= 16
maxNrofCSI-RS-ResourcesExt-r16 INTEGER ::= 16 -- Maximum number of codebook resources supported by the UE for eType2/Codebook combo
maxNrofCSI-RS-Resources INTEGER ::= 7 -- Maximum number of codebook resources supported by the UE
maxNrofCSI-RS-ResourcesAlt-r16 INTEGER ::= 512 -- Maximum number of alternative codebook resources supported by the UE
maxNrofCSI-RS-ResourcesAlt-1-r16 INTEGER ::= 511 -- Maximum number of alternative codebook resources supported by the UE minus 1
maxNrofSRI-PUSCH-Mappings INTEGER ::= 16
maxNrofSRI-PUSCH-Mappings-1 INTEGER ::= 15
maxSIB INTEGER ::= 32 -- Maximum number of SIBs
maxS1-Message INTEGER ::= 32 -- Maximum number of S1 messages
maxPO-perPF INTEGER ::= 4 -- Maximum number of paging occasion per paging frame
maxAccessCat-1 INTEGER ::= 63 -- Maximum number of Access Categories minus 1
maxBarringInfoSet INTEGER ::= 8 -- Maximum number of Access Categories
maxCellEUTRA INTEGER ::= 8 -- Maximum number of E-UTRA cells in SIB list
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxEUTRA-Carrier</td>
<td>8</td>
<td>Maximum number of E-UTRA carriers in SIB list</td>
</tr>
<tr>
<td>maxPLMNIdentities</td>
<td>8</td>
<td>Maximum number of PLMN identities in RAN area configurations</td>
</tr>
<tr>
<td>maxDownlinkFeatureSets</td>
<td>1024</td>
<td>(for NR DL) Total number of FeatureSets (size of the pool)</td>
</tr>
<tr>
<td>maxUplinkFeatureSets</td>
<td>1024</td>
<td>(for NR UL) Total number of FeatureSets (size of the pool)</td>
</tr>
<tr>
<td>maxEUTRA-DL-FeatureSets</td>
<td>256</td>
<td>(for E-UTRA) Total number of FeatureSets (size of the pool)</td>
</tr>
<tr>
<td>maxEUTRA-UL-FeatureSets</td>
<td>256</td>
<td>(for E-UTRA) Total number of FeatureSets (size of the pool)</td>
</tr>
<tr>
<td>maxFeatureSetsPerBand</td>
<td>128</td>
<td>(for NR) The number of feature sets associated with one band.</td>
</tr>
<tr>
<td>maxPerCC-FeatureSets</td>
<td>1024</td>
<td>(for NR) Total number of CC-specific FeatureSets (size of the pool)</td>
</tr>
<tr>
<td>maxFeatureSetCombinations</td>
<td>1024</td>
<td>(for NR-DC/NR) Total number of Feature set combinations (size of the pool)</td>
</tr>
<tr>
<td>maxInterRAT-RSTD-Freq</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>maxHRNN-Len-r16</td>
<td>48</td>
<td>Maximum length of HRNNs</td>
</tr>
<tr>
<td>maxNPN-r16</td>
<td>12</td>
<td>Maximum number of NPNs broadcast and reported by UE at establishment</td>
</tr>
<tr>
<td>maxOfminSchedulingOffsetValues-r16</td>
<td>2</td>
<td>Maximum number of min. scheduling offset (K0/K2) configurations</td>
</tr>
<tr>
<td>maxK0-SchedulingOffset-r16</td>
<td>16</td>
<td>Maximum number of slots configured as min. scheduling offset (K0)</td>
</tr>
<tr>
<td>maxK2-SchedulingOffset-r16</td>
<td>16</td>
<td>Maximum number of slots configured as min. scheduling offset (K2)</td>
</tr>
<tr>
<td>maxDCI-2-6-Size-r16</td>
<td>140</td>
<td>Maximum size of DCI format 2-6</td>
</tr>
<tr>
<td>maxDCI-2-6-Size-1-r16</td>
<td>139</td>
<td>Maximum DCI format 2-6 size minus 1</td>
</tr>
<tr>
<td>maxNrOfUL-Allocations-r16</td>
<td>64</td>
<td>Maximum number of PUSCH time domain resource allocations</td>
</tr>
<tr>
<td>maxNrofPO-PUSCH-Set-r16</td>
<td>2</td>
<td>Maximum number of PO PUSCH set(s)</td>
</tr>
<tr>
<td>maxOnDemandSIB-r16</td>
<td>8</td>
<td>Maximum number of SIB(s) that can be requested on-demand</td>
</tr>
<tr>
<td>maxOnDemandPosSIB-r16</td>
<td>32</td>
<td>Maximum number of posSIB(s) that can be requested on-demand</td>
</tr>
<tr>
<td>maxCI-DCI-PayloadSize-r16</td>
<td>126</td>
<td>Maximum number of the DCI size for CI</td>
</tr>
<tr>
<td>maxWLAN-Id-Report-r16</td>
<td>32</td>
<td>Maximum number of WLAN IDs to report</td>
</tr>
<tr>
<td>maxWLAN-Name-r16</td>
<td>4</td>
<td>Maximum number of WLAN name</td>
</tr>
<tr>
<td>maxRAReport-r16</td>
<td>8</td>
<td>Maximum number of RA procedures information to be included in the RA report</td>
</tr>
<tr>
<td>maxTxConfig-1-r16</td>
<td>64</td>
<td>Maximum number of sidelink transmission parameters configurations minus 1</td>
</tr>
<tr>
<td>maxTxConfig-2-6-Size-r16</td>
<td>63</td>
<td>Maximum number of sidelink transmission parameters configurations</td>
</tr>
<tr>
<td>maxPSSCH-TxConfig-r16</td>
<td>16</td>
<td>Maximum number of PSSCH TX configurations</td>
</tr>
<tr>
<td>maxNrofCLI-RSSI-Resources-r16</td>
<td>64</td>
<td>Maximum number of CLI-RSSI resources for UE</td>
</tr>
<tr>
<td>maxNrofCLI-RSSI-Resources-r16-1</td>
<td>63</td>
<td>Maximum number of CLI-RSSI resources for UE minus 1</td>
</tr>
<tr>
<td>maxNrofCLI-SRS-Resources-r16</td>
<td>32</td>
<td>Maximum number of SRS resources for CLI measurement for UE</td>
</tr>
<tr>
<td>maxCLI-Report-r16</td>
<td>8</td>
<td>Maximum number of configured grant configurations per BWP</td>
</tr>
<tr>
<td>maxNrofConfiguredGrantConfig-r16</td>
<td>12</td>
<td>Maximum number of configured grant configurations per BWP</td>
</tr>
<tr>
<td>maxNrofConfiguredGrantConfig-r16-1</td>
<td>11</td>
<td>Maximum number of configured grant configurations per BWP minus 1</td>
</tr>
<tr>
<td>maxNrofCG-Type2DeactivationState</td>
<td>16</td>
<td>Maximum number of deactivation state for type 2 configured grants per BWP</td>
</tr>
<tr>
<td>maxNrofConfiguredGrantConfigMAC-r16</td>
<td>32</td>
<td>Maximum number of configured grant configurations per MAC entity</td>
</tr>
<tr>
<td>maxNrofConfiguredGrantConfigMAC-r16-1</td>
<td>31</td>
<td>Maximum number of configured grant configurations per MAC entity minus 1</td>
</tr>
<tr>
<td>maxNrofSPS-Config-r16</td>
<td>8</td>
<td>Maximum number of SPS configurations per BWP</td>
</tr>
<tr>
<td>maxNrofSPS-Config-r16-1</td>
<td>7</td>
<td>Maximum number of SPS configurations per BWP minus 1</td>
</tr>
<tr>
<td>maxNrofDeactivationState</td>
<td>16</td>
<td>Maximum number of deactivation state for SPS per BWP</td>
</tr>
<tr>
<td>maxNrofDormancyGroups</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>maxNrofPUSCH-ResourceGroups-1-r16</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>maxNrofServingCellsTCI-r16</td>
<td>32</td>
<td>Maximum number of serving cells in simultaneousTCI-UpdateList</td>
</tr>
</tbody>
</table>

--- TAG-MULTIPLICITY-AND-TYPE-CONSTRAINT-DEFINITIONS-STOP
--- ASN1STOP

--- End of NR-RRC-Definitions
--- ASN1START
6.5 Short Message

Short Messages can be transmitted on PDCCH using P-RNTI with or without associated Paging message using Short Message field in DCI format 1_0 (see TS 38.212 [17], clause 7.3.1.2.1).

Table 6.5-1 defines Short Messages. Bit 1 is the most significant bit.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Short Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>systemInfoModification</td>
</tr>
<tr>
<td></td>
<td>If set to 1: indication of a BCCH modification other than SIB6, SIB7 and SIB8.</td>
</tr>
<tr>
<td>2</td>
<td>etwsAndCmasIndication</td>
</tr>
<tr>
<td></td>
<td>If set to 1: indication of an ETWS primary notification and/or an ETWS secondary notification and/or a CMAS notification.</td>
</tr>
<tr>
<td>3</td>
<td>stopPagingMonitoring</td>
</tr>
<tr>
<td></td>
<td>This bit can be used for only operation with shared spectrum channel access and if nrofPDCCH-MonitoringOccasionPerSSB-InPO is present.</td>
</tr>
<tr>
<td></td>
<td>If set to 1: indication that the UE may stop monitoring PDCCH occasion(s) for paging in this Paging Occasion as specified in TS 38.304 [20], clause 7.1.</td>
</tr>
<tr>
<td>4 – 8</td>
<td>Not used in this release of the specification, and shall be ignored by UE if received.</td>
</tr>
</tbody>
</table>

6.6 PC5 RRC messages

6.6.1 General message structure

– PC5-RRC-Definitions

This ASN.1 segment is the start of the PC5 RRC PDU definitions.

--- ASN1START
--- TAG-PC5-RRC-DEFINITIONS-START

PC5-RRC-Definitions DEFINITIONS AUTOMATIC TAGS ::= BEGIN

IMPORTS
  SetupRelease,
  RRC-TransactionIdentifier,
  SN-FieldLengthAM,
The **SBCCH-SL-BCH-Message** class is the set of RRC messages that may be sent from the UE to the UE via SL-BCH on the SBCCH logical channel.

```plaintext
-- TAG-SCCH-MESSAGE-START
SCCH-Message ::= SEQUENCE { 
    message       SCCH-MessageType } 
```

**SCCH-Message** class is the set of RRC messages that may be sent from the UE to the UE for unicast of NR sidelink communication on SCCH logical channel.

```plaintext
-- TAG-SCCH-MESSAGE-START
```
6.6.2 Message definitions

– MasterInformationBlockSidelink

The MasterInformationBlockSidelink includes the system information transmitted by a UE via SL-BCH.

Signalling radio bearer: N/A
RLC-SAP: TM
Logical channel: SBCCH
Direction: UE to UE

MasterInformationBlockSidelink
MasterInformationBlockSidelink field descriptions

- directFrameNumber
  Indicates the frame number in which S-SSB transmitted.

- inCoverage
  Value true indicates that the UE transmitting the MasterInformationBlockSidelink is in network coverage, or UE selects GNSS timing as the synchronization reference source.

- slotIndex
  Indicates the slot index in which S-SSB transmitted.

---

MeasurementsReportSidelink

The MeasurementsReportSidelink message is used for the indication of measurement results of NR sidelink.

Signalling radio bearer: SL-SRB3

RLC-SAP: AM

Logical channel: SCCH

Direction: UE to UE

---

MeasurementsReportSidelink message

```plaintext
MeasurementsReportSidelink ::= SEQUENCE {
  criticalExtensions
    CHOICE {
      measurementReportSidelink-r16               MeasurementReportSidelink-IEs-r16,
      criticalExtensionsFuture                  SEQUENCE {}  
    }
}

MeasurementReportSidelink-IEs-r16 ::= SEQUENCE {
  sl-measResults-r16                           SL-MeasResults-r16,
  lateNonCriticalExtension                   OCTET STRING OPTIONAL,
  nonCriticalExtension                       SEQUENCE{} OPTIONAL  
}

SL-MeasResults-r16 ::= SEQUENCE {
  sl-MeasId-r16                               SL-MeasId-r16,
  sl-MeasResult-r16                           SL-MeasResult-r16,  
  ...  
}
```
ETSI TS 138 331 V16.3.1 (2021-01)

---

**MeasurementReportSidelink field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-MeasId</td>
<td>Identifies the sidelink measurement identity for which the reporting is being performed.</td>
</tr>
<tr>
<td>sl-MeasResult</td>
<td>Measured RSRP results of a unicast destination.</td>
</tr>
</tbody>
</table>

---

**RRCReconfigurationSidelink**

The **RRCReconfigurationSidelink** message is the command to AS configuration of the PC5 RRC connection. It is only applied to unicast of NR sidelink communication.

- Signalling radio bearer: SL-SRB3
- RLC-SAP: AM
- Logical channel: SCCH
- Direction: UE to UE

---

**RRCReconfigurationSidelink message**

---

---

---

---
ETSI

3GPP TS 38.331 version 16.3.1 Release 16

ETSI TS 138 331 V16.3.1 (2021-01)

801

sl-CI-RS-Config-r16 SetupRelease {SL-CI-RS-Config-r16} OPTIONAL, -- Need M
sl-ResetConfig-r16 ENUMERATED {true} OPTIONAL, -- Need N
sl-LatencyBoundCSI-Report-r16 INTEGER (3..160) OPTIONAL, -- Need M
lateNonCriticalExtension OCTET STRING OPTIONAL, -- Need M
nonCriticalExtension SEQUENCE {} OPTIONAL,

SLRB-Config-r16 ::= SEQUENCE {
  slrb-PC5-ConfigIndex-r16 SLRB-PC5-ConfigIndex-r16,
  sl-SDAP-ConfigPC5-r16 SL-SDAP-ConfigPC5-r16 OPTIONAL, -- Need M
  sl-PDCP-ConfigPC5-r16 SL-PDCP-ConfigPC5-r16 OPTIONAL, -- Need M
  sl-RLC-ConfigPC5-r16 SL-RLC-ConfigPC5-r16 OPTIONAL, -- Need M
  sl-MAC-LogicalChannelConfigPC5-r16 SL-MAC-LogicalChannelConfigPC5-r16 OPTIONAL, -- Need M
...
}

SLRB-PC5-ConfigIndex-r16 ::= INTEGER (1..maxNrofSLRB-r16)

SL-SDAP-ConfigPC5-r16 ::= SEQUENCE {
  sl-MappedQoS-FlowsToAddList-r16 SEQUENCE (SIZE (1.. maxNrofSL-QFIsPerDest-r16)) OF SL-PQFI-r16 OPTIONAL, -- Need N
  sl-MappedQoS-FlowsToReleaseList-r16 SEQUENCE (SIZE (1.. maxNrofSL-QFIsPerDest-r16)) OF SL-PQFI-r16 OPTIONAL, -- Need N
  sl-SDAP-Header-r16 ENUMERATED {present, absent},
...
}

SL-PDCP-ConfigPC5-r16 ::= SEQUENCE {
  sl-PDCP-SN-Size-r16 ENUMERATED {len12bits, len18bits} OPTIONAL, -- Need M
  sl-OutOfOrderDelivery-r16 ENUMERATED {true} OPTIONAL, -- Need R
...
}

SL-RLC-ConfigPC5-r16 ::= CHOICE {
  sl-AM-RLC-r16 SEQUENCE {
    sl-SN-FieldLengthAM-r16 SN-FieldLengthAM OPTIONAL, -- Need M
  },
  sl-UM-Bi-Directional-RLC-r16 SEQUENCE {
    sl-SN-FieldLengthUM-r16 SN-FieldLengthUM OPTIONAL, -- Need M
  },
  sl-UM-Uni-Directional-RLC-r16 SEQUENCE {
    sl-SN-FieldLengthUM-r16 SN-FieldLengthUM OPTIONAL, -- Need M
  }
...
}

SL-LogicalChannelConfigPC5-r16 ::= SEQUENCE {
  sl-LogicalChannelIdentity-r16 LogicalChannelIdentity,
...
}

SL-PQFI-r16 ::= INTEGER (1..64)

SL-CI-RS-Config-r16 ::= SEQUENCE {


**RRCReconfigurationSidetlink field descriptions**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sl-CSI-RS-FreqAllocation</td>
<td>Indicates the frequency domain position for sidelink CSI-RS.</td>
</tr>
<tr>
<td>sl-CSI-RS-FirstSymbol</td>
<td>Indicates the position of first symbol of sidelink CSI-RS.</td>
</tr>
<tr>
<td>sl-Resetconfig</td>
<td>Indicates that the full configuration should be applicable for the RRCReconfigurationSidetlink message.</td>
</tr>
<tr>
<td>sl-LatencyBoundCSI-Report</td>
<td>Indicate the latency bound of SL CSI report from the associated SL CSI triggering in terms of number of slots.</td>
</tr>
<tr>
<td>sl-LogicalChannelIdentity</td>
<td>Indicates the identity of the sidelink logical channel.</td>
</tr>
<tr>
<td>sl-MappedQoS-FlowsToAddList</td>
<td>Indicate the QoS flows to be mapped to the configured sidelink DRB. Each entry is indicated by the SL-PQFI, which is used between UEs, as defined in TS 23.287 [55].</td>
</tr>
<tr>
<td>sl-MappedQoS-FlowsToReleaseList</td>
<td>Indicate the QoS flows to be released from the configured sidelink DRB. Each entry is indicated by the SL-PQFI, which is used between UEs, as defined in TS 23.287 [55].</td>
</tr>
<tr>
<td>sl-MeasConfig</td>
<td>Indicates the sidelink measurement configuration for the unicast destination.</td>
</tr>
<tr>
<td>sl-OutOfOrderDelivery</td>
<td>Indicates whether or not outOfOrderDelivery specified in TS 38.323 [5] is configured. This field should be either always present or always absent, after the sidelink radio bearer is established.</td>
</tr>
<tr>
<td>sl-PDCP-SN-Size</td>
<td>Indicates the PDCP SN size of the configured sidelink DRB.</td>
</tr>
<tr>
<td>sl-SDAP-Header</td>
<td>Indicates whether or not a SDAP header is present on this sidelink DRB.</td>
</tr>
</tbody>
</table>

---

**RRCReconfigurationCompleteSidetlink**

The **RRCReconfigurationCompleteSidetlink** message is used to confirm the successful completion of a PC5 RRC AS reconfiguration. It is only applied to unicast of NR sidelink communication.

Signalling radio bearer: SL-SRB3

RLC-SAP: AM
Logical channel: SCCH
Direction: UE to UE

---

**RRCReconfigurationCompleteSidelink message**

```asn1
RRCReconfigurationCompleteSidelink ::= SEQUENCE {
  rrc-TransactionIdentifier-r16                  RRC-TransactionIdentifier,
  criticalExtensions                             CHOICE {
    rrcReconfigurationCompleteSidelink-r16         RRCReconfigurationCompleteSidelink-IEs-r16,
    criticalExtensionsFuture                       SEQUENCE {}
  }
}
```

---

**RRCReconfigurationFailureSidelink**

The **RRCReconfigurationFailureSidelink** message is used to indicate the failure of a PC5 RRC AS reconfiguration. It is only applied to unicast of NR sidelink communication.

Signalling radio bearer: SL-SRB3
RLC-SAP: AM
Logical channel: SCCH
Direction: UE to UE

---

**RRCReconfigurationFailureSidelink message**

```asn1
RRCReconfigurationFailureSidelink ::= SEQUENCE {
  rrc-TransactionIdentifier-r16                 RRC-TransactionIdentifier,
  criticalExtensions                            CHOICE {
    rrcReconfigurationFailureSidelink-r16        RRCReconfigurationFailureSidelink-IEs-r16,
    criticalExtensionsFuture                     SEQUENCE {}
  }
}
```
The **UECapabilityEnquirySidelink** message is used to request UE sidelink capabilities. It is only applied to unicast of NR sidelink communication.

Signalling radio bearer: SL-SRB3

RLC-SAP: AM

Logical channel: SCCH

Direction: UE to UE

**UECapabilityEnquirySidelink** information element

```asn1
UECapabilityEnquirySidelink ::= SEQUENCE {
  rrc-TransactionIdentifier-r16 RRC-TransactionIdentifier,
  criticalExtensions CHOICE {
    ueCapabilityEnquirySidelink-r16 UECapabilityEnquirySidelink-IEs-r16,
    criticalExtensionsFuture SEQUENCE{}
  }
}
```

```asn1
UECapabilityEnquirySidelink-IEs-r16 ::= SEQUENCE {
  frequencyBandListFilterSidelink-r16 FreqBandList Optional, -- Need N
  ue-CapabilityInformationSidelink-r16 OCTET STRING Optional,
  lateNonCriticalExtension OCTET STRING Optional,
  nonCriticalExtension SEQUENCE{}
}
```
**frequencyBandListFilterSidelink**

This field is used to indicate frequency bands for which the peer UE is requested to provide supported bands and band combinations for NR sidelink communications. The UE always provides this field.

**ue-CapabilityInformationSidelink**

This field indicates the UECapabilityInformationSidelink message to provide the UE sidelink capability, which can be optionally sent together with UECapabilityEnquirySidelink.

---

**UECapabilityInformationSidelink**

The UECapabilityInformationSidelink message is used to transfer UE radio access capabilities. It is only applied to unicast of NR sidelink communication.

- Signalling radio bearer: SL-SRB3
- RLC-SAP: AM
- Logical channel: SCCH
- Direction: UE to UE

**UECapabilityInformationSidelink** information element

```asn1
UECapabilityInformationSidelink ::= SEQUENCE {  
  rrc-TransactionIdentifier-r16               RRC-TransactionIdentifier,  
  criticalExtensions                          CHOICE {  
    ueCapabilityInformationSidelink-r16         UECapabilityInformationSidelink-IEs-r16,  
    criticalExtensionsFuture                    SEQUENCE {}  
  }  
}
```

```asn1
UECapabilityInformationSidelink-IEs-r16 ::= SEQUENCE {  
  accessStratumReleaseSidelink-r16            AccessStratumReleaseSidelink-r16,  
  pdcp-ParametersSidelink-r16                 PDCP-ParametersSidelink-r16                                             OPTIONAL,  
  rlc-ParametersSidelink-r16                  RLC-ParametersSidelink-r16                                             OPTIONAL,  
  supportedBandCombinationListSidelinkNR-r16  BandCombinationListSidelinkNR-r16                                      OPTIONAL,  
  supportedBandListSidelink-r16               BandCombinationListSidelink-r16                                      OPTIONAL,  
  appliedFreqBandListFilter-r16               FreqBandList                                             OPTIONAL,  
  lateNonCriticalExtension                    OCTET STRING                                                            OPTIONAL,  
  nonCriticalExtension                        SEQUENCE{}                                                              OPTIONAL  
}
```

```asn1
AccessStratumReleaseSidelink-r16 ::= ENUMERATED { rel16, spare7, spare6, spare5, spare4, spare3, spare2, spare1, ... }
```

```asn1
PDCP-ParametersSidelink-r16 ::= SEQUENCE {  
  outOfOrderDeliverySidelink-r16              ENUMERATED {supported}      OPTIONAL,  
  ...  
}
```
BandCombinationListSidelinkNR-r16 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationParametersSidelinkNR-r16

BandCombinationParametersSidelinkNR-r16 ::= SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParametersSidelink-r16

BandSidelinkPC5-r16 ::=  SEQUENCE {
  freqBandSidelink-r16                     FreqBandIndicatorNR,
  sl-Reception-r16                         SEQUENCE {
    harq-RxProcessSidelink-r16             ENUMERATED {n16, n24, n32, n64},
    pscch-RxSidelink-r16                   ENUMERATED {value1, value2},
    scs-CP-PatternRxSidelink-r16          CHOICE {
      fr1-r16                              SEQUENCE {
        scs-15kHz-r16                        BIT STRING (SIZE (16)) OPTIONAL,
        scs-30kHz-r16                        BIT STRING (SIZE (16)) OPTIONAL,
        scs-60kHz-r16                        BIT STRING (SIZE (16)) OPTIONAL,
      },
      fr2-r16                              SEQUENCE {
        scs-60kHz-r16                        BIT STRING (SIZE (16)) OPTIONAL,
        scs-120kHz-r16                       BIT STRING (SIZE (16)) OPTIONAL
      }
    } OPTIONAL,
    extendedCP-RxSidelink-r16              ENUMERATED {supported} OPTIONAL,
  } OPTIONAL,
  --15-10
  sl-Tx-256QAM-r16                        ENUMERATED {supported} OPTIONAL,
  --15-12
  lowSE-64QAM-MCS-TableSidelink-r16      ENUMERATED {supported} OPTIONAL,
  ...,
  [][--15-14
  csi-ReportSidelink-r16                  SEQUENCE {
    csi-RS-PortsSidelink-r16              ENUMERATED {p1, p2}
  } OPTIONAL,
  --15-19
  rankTwoReception-r16                   ENUMERATED {supported} OPTIONAL,
  --15-23
  sl-openLoopPC-RSRP-ReportSidelink-r16  ENUMERATED {supported} OPTIONAL,
  --13-1
  sl-Rx-256QAM-r16                       ENUMERATED {supported} OPTIONAL
}]

-- TAG-UECAPABILITYINFORMATIONSIDELINK-STOP
-- ASN1STOP

--- End of PC5-RRC-Definitions

-- ASN1START

END
7 Variables and constants

7.1 Timers

7.1.1 Timers (Informative)
<table>
<thead>
<tr>
<th>Timer</th>
<th>Start</th>
<th>Stop</th>
<th>At expiry</th>
</tr>
</thead>
<tbody>
<tr>
<td>T300</td>
<td>Upon transmission of RRCSetupRequest.</td>
<td>Upon reception of RRCSetup or RRCReject message, cell re-selection and upon abortion of connection establishment by upper layers.</td>
<td>Perform the actions as specified in 5.3.3.7.</td>
</tr>
<tr>
<td>T301</td>
<td>Upon transmission of RRCReestablishmentRequest</td>
<td>Upon reception of RRCReestablishment or RRCSetup message as well as when the selected cell becomes unsuitable</td>
<td>Go to RRC_IDLE</td>
</tr>
<tr>
<td>T302</td>
<td>Upon reception of RRCReject while performing RRC connection establishment or resume, upon reception of RRCRelease with waitTime.</td>
<td>Upon entering RRC_CONNECTED or RRC_IDLE, upon cell re-selection and upon reception of RRCReject message.</td>
<td>Inform upper layers about barring alleviation as specified in 5.3.14.4</td>
</tr>
<tr>
<td>T304</td>
<td>Upon reception of RRCReconfiguration message including reconfigurationWithSync or upon conditional reconfiguration execution i.e. when applying a stored RRCReconfiguration message including reconfigurationWithSync.</td>
<td>Upon successful completion of random access on the corresponding SpCell For T304 of SCG, upon SCG release</td>
<td>For T304 of MCG, in case of the handover from NR or intra-NR handover, initiate the RRC re-establishment procedure; In case of handover to NR, perform the actions defined in the specifications applicable for the source RAT. If any DAPS bearer is configured and if there is no RLF in source PCell, initiate the failure information procedure. For T304 of SCG, inform network about the reconfiguration with sync failure by initiating the SCG failure information procedure as specified in 5.7.3.</td>
</tr>
</tbody>
</table>
### Timer Start Stop At expiry

<table>
<thead>
<tr>
<th>Timer</th>
<th>Start</th>
<th>Stop</th>
<th>At expiry</th>
</tr>
</thead>
<tbody>
<tr>
<td>T310</td>
<td>Upon detecting physical layer problems for the SpCell i.e. upon receiving N310 consecutive out-of-sync indications from lower layers.</td>
<td>Upon receiving N311 consecutive in-sync indications from lower layers for the SpCell, upon receiving RRCReconfiguration with reconfigurationWithSync for that cell group, upon reception of MobilityFromNRCommand, upon the reconfiguration of rlf-TimersAndConstant, upon initiating the connection re-establishment procedure, upon conditional reconfiguration execution i.e. when applying a stored RRCReconfiguration message including reconfigurationWithSync for that cell group, and upon initiating the MCG failure information procedure. Upon SCG release, if the T310 is kept in SCG.</td>
<td>If the T310 is kept in MCG: If AS security is not activated: go to RRC_IDLE else: initiate the MCG failure information procedure as specified in 5.7.3b or the connection re-establishment procedure as specified in 5.3.7 or the procedure as specified in 5.3.10.3 if any DAPS bearer is configured. If the T310 is kept in SCG, Inform E-UTRAN/NR about the SCG radio link failure by initiating the SCG failure information procedure as specified in 5.7.3.</td>
</tr>
<tr>
<td>T311</td>
<td>Upon initiating the RRC connection re-establishment procedure</td>
<td>Upon selection of a suitable NR cell or a cell using another RAT.</td>
<td>Enter RRC_IDLE</td>
</tr>
<tr>
<td>Timer</td>
<td>Start</td>
<td>Stop</td>
<td>At expiry</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>T312</td>
<td>If T312 is configured in MCG: Upon triggering a measurement report for a measurement identity for which T312 has been configured and useT312 has been set to true, while T310 in PCell is running. If T312 is configured in SCG and useT312 has been set to true: Upon triggering a measurement report for a measurement identity for which T312 has been configured, while T310 in PSCell is running. Upon receiving N311 consecutive in-sync indications from lower layers for the SpCell, receiving RRCReconfiguration with reconfigurationWithSync for that cell group, upon reception of MobilityFromNRCommand, upon initiating the connection re-establishment procedure, upon the reconfiguration of rlf-TimersAndConstant, upon initiating the MCG failure information procedure, upon conditional reconfiguration execution i.e. when applying a stored RRCReconfiguration message including reconfigurationWithSync for that cell group, and upon the expiry of T310 in corresponding SpCell. Upon SCG release, if the T312 is kept in SCG.</td>
<td>If the T312 is kept in MCG initiate the MCG failure information procedure as specified in 5.7.3b or the connection re-establishment procedure. If the T312 is kept in SCG, Inform E-UTRAN/NR about the SCG radio link failure by initiating the SCG failure information procedure as specified in 5.7.3.</td>
<td></td>
</tr>
<tr>
<td>T316</td>
<td>Upon transmission of the MCGFailureInformation message</td>
<td>Upon receiving RRCRelease, RRCReconfiguration with reconfigurationWithSync for the PCell, MobilityFromNRCommand, or upon initiating the re-establishment procedure</td>
<td>Perform the actions as specified in 5.7.3b.5.</td>
</tr>
<tr>
<td>T319</td>
<td>Upon transmission of RRCResumeRequest or RRCResumeRequest1.</td>
<td>Upon reception of RRCResume, RRCSetup, RRCRelease, RRCRelease with suspendConfig or RRCReject message, cell re-selection and upon abortion of connection establishment by upper layers.</td>
<td>Perform the actions as specified in 5.3.13.5.</td>
</tr>
<tr>
<td>Timer</td>
<td>Start</td>
<td>Stop</td>
<td>At expiry</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>------</td>
<td>----------</td>
</tr>
<tr>
<td>T320</td>
<td>Upon reception of t320 or upon cell (re)selection to NR from another RAT with validity time configured for dedicated priorities (in which case the remaining validity time is applied).</td>
<td>Upon entering RRC_CONNECTED, upon reception of RRCRelease, when PLMN selection is performed on request by NAS, when the UE enters RRC_IDLE from RRC_INACTIVE, or upon cell (re)selection to another RAT (in which case the timer is carried on to the other RAT).</td>
<td>Discard the cell reselection priority information provided by dedicated signalling.</td>
</tr>
<tr>
<td>T321</td>
<td>Upon receiving <code>measConfig</code> including a <code>reportConfig</code> with the purpose set to <code>reportCGI</code>.</td>
<td>Upon acquiring the information needed to set all fields of <code>cgi-info</code>, upon receiving <code>measConfig</code> that includes removal of the <code>reportConfig</code> with the purpose set to <code>reportCGI</code> and upon detecting that a cell is not broadcasting SIB1.</td>
<td>Initiate the measurement reporting procedure, stop performing the related measurements.</td>
</tr>
<tr>
<td>T322</td>
<td>Upon receiving <code>measConfig</code> including <code>reportConfigNR</code> with the purpose set to <code>reportSFTD</code> and <code>drx-SFTD-NeighMeas</code> is set to <code>true</code>.</td>
<td>Upon acquiring the SFTD measurement results, upon receiving <code>measConfig</code> that includes removal of the <code>reportConfig</code> with the purpose set to <code>reportSFTD</code>.</td>
<td>Initiate the measurement reporting procedure, stop performing the related measurements.</td>
</tr>
<tr>
<td>T325</td>
<td>Upon reception of RRCRelease message with deprioritisationTimer.</td>
<td></td>
<td>Stop deprioritisation of all frequencies or NR signalled by RRCRelease.</td>
</tr>
<tr>
<td>T330</td>
<td>Upon receiving <code>LoggedMeasurementConfiguration</code> message</td>
<td>Upon log volume exceeding the suitable UE memory, upon initiating the release of <code>LoggedMeasurementConfiguration</code> procedure</td>
<td>Perform the actions specified in 5.5a.1.4</td>
</tr>
<tr>
<td>T331</td>
<td>Upon receiving <code>RRCRelease</code> message with <code>measIdleDuration</code></td>
<td>Upon receiving <code>RRCSetup</code>, <code>RRCResume</code>, <code>RRCRelease</code> with idle/inactive measurement configuration, upon cell selection/reselection to a cell that does not belong to the validityArea (if configured), or upon cell re-selection to another RAT.</td>
<td>Perform the actions as specified in 5.7.8.3.</td>
</tr>
<tr>
<td>Timer</td>
<td>Start</td>
<td>Stop</td>
<td>At expiry</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>T342</td>
<td>Upon transmitting <strong>UEAssistanceInformation</strong> message with <strong>DelayBudgetReport</strong>.</td>
<td>Upon releasing <strong>delayBudgetReportingConfig</strong> during the connection re-establishment/resume procedures, and upon receiving <strong>delayBudgetReportingConfig</strong> set to release.</td>
<td>No action.</td>
</tr>
<tr>
<td>T345</td>
<td>Upon transmitting <strong>UEAssistanceInformation</strong> message with <strong>overheatingAssistance</strong></td>
<td>Upon releasing <strong>overheatingAssistance</strong> during the connection re-establishment procedure, upon initiating the connection resumption procedure, and upon receiving <strong>overheatingAssistanceConfig</strong> set to release.</td>
<td>No action.</td>
</tr>
<tr>
<td>T346a</td>
<td>(The UE maintains one instance of this timer per cell group)</td>
<td>Upon transmitting <strong>UEAssistanceInformation</strong> message with <strong>drx-Preference</strong>.</td>
<td>No action.</td>
</tr>
<tr>
<td></td>
<td>Upon releasing <strong>drx-PreferenceConfig</strong> during the connection re-establishment/resume procedures, upon receiving <strong>drx-PreferenceConfig</strong> set to release, or upon performing MR-DC release.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T346b</td>
<td>(The UE maintains one instance of this timer per cell group)</td>
<td>Upon transmitting <strong>UEAssistanceInformation</strong> message with <strong>maxBW-Preference</strong>.</td>
<td>No action.</td>
</tr>
<tr>
<td></td>
<td>Upon releasing <strong>maxBW-PreferenceConfig</strong> during the connection re-establishment/resume procedures, upon receiving <strong>maxBW-PreferenceConfig</strong> set to release, or upon performing MR-DC release.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T346c</td>
<td>(The UE maintains one instance of this timer per cell group)</td>
<td>Upon transmitting <strong>UEAssistanceInformation</strong> message with <strong>maxCC-Preference</strong>.</td>
<td>No action.</td>
</tr>
<tr>
<td></td>
<td>Upon releasing <strong>maxCC-PreferenceConfig</strong> during the connection re-establishment/resume procedures, upon receiving <strong>maxCC-PreferenceConfig</strong> set to release, or upon performing MR-DC release.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timer</td>
<td>Start</td>
<td>Stop</td>
<td>At expiry</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>------</td>
<td>-----------</td>
</tr>
<tr>
<td>T346d (The UE maintains one instance of this timer per cell group)</td>
<td>Upon transmitting UEAssistanceInformation message with maxMIMO-LayerPreference.</td>
<td>Upon releasing maxMIMO-LayerPreferenceConfig during the connection re-establishment/resume procedures, upon receiving maxMIMO-LayerPreferenceConfig set to release, or upon performing MR-DC release.</td>
<td>No action.</td>
</tr>
<tr>
<td>T346e (The UE maintains one instance of this timer per cell group)</td>
<td>Upon transmitting UEAssistanceInformation message with minSchedulingOffsetPreference.</td>
<td>Upon releasing minSchedulingOffsetPreferenceConfig during the connection re-establishment/resume procedures, upon receiving minSchedulingOffsetPreferenceConfig set to release, or upon performing MR-DC release.</td>
<td>No action.</td>
</tr>
<tr>
<td>T346f</td>
<td>Upon transmitting UEAssistanceInformation message with releasePreference.</td>
<td>Upon releasing releasePreferenceConfig during the connection re-establishment/resume procedures, or upon receiving releasePreferenceConfig set to release.</td>
<td>No action.</td>
</tr>
<tr>
<td>T350</td>
<td>Upon transmitting DedicatedSIBRequest message with requestedSIB-List and/or requestedPosSIB-List.</td>
<td>Upon acquiring the requested SIB(s) or posSIB(s), upon releasing onDemandSIB-Request during the connection re-establishment procedures, upon receiving onDemandSIB-Request set to release, or upon successful change of PCell while in RRC_CONNECTED.</td>
<td>No action.</td>
</tr>
<tr>
<td>T380</td>
<td>Upon reception of t380 in RRCRelease.</td>
<td>Upon reception of RRCResume, RRCSetup or RRCRelease.</td>
<td>Perform the actions as specified in 5.3.13.</td>
</tr>
<tr>
<td>T390</td>
<td>When access attempt is barred at access barring check for an Access Category. The UE maintains one instance of this timer per Access Category.</td>
<td>Upon cell (re)selection, upon entering RRC_CONNECTED, upon reception of RRCReconfiguration including reconfigurationWithSync, upon change of PCell while in RRC_CONNECTED, upon reception of MobilityFromNRCommand, or upon reception of RRCRelease.</td>
<td>Perform the actions as specified in 5.3.14.4.</td>
</tr>
</tbody>
</table>
### 7.1.2 Timer handling

When the UE applies zero value for a timer, the timer shall be started and immediately expire unless explicitly stated otherwise.

### 7.2 Counters

<table>
<thead>
<tr>
<th>Counter</th>
<th>Reset</th>
<th>Incremented</th>
<th>When reaching max value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N310</td>
<td>Upon reception of &quot;in-sync&quot; indication from lower layers; upon receiving <code>RRCReconfigurationWithSync</code> for that cell group; upon initiating the connection re-establishment procedure.</td>
<td>Upon reception of &quot;out-of-sync&quot; from lower layer while the timer T310 is stopped.</td>
<td>Start timer T310</td>
</tr>
<tr>
<td>N311</td>
<td>Upon reception of &quot;out-of-sync&quot; indication from lower layers; upon receiving <code>RRCReconfigurationWithSync</code> for that cell group; upon initiating the connection re-establishment procedure.</td>
<td>Upon reception of the &quot;in-sync&quot; from lower layer while the timer T310 is running.</td>
<td>Stop the timer T310.</td>
</tr>
</tbody>
</table>
7.3 Constants

<table>
<thead>
<tr>
<th>Constant</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>N310</td>
<td>Maximum number of consecutive “out-of-sync” indications for the SpCell received from lower layers</td>
</tr>
<tr>
<td>N311</td>
<td>Maximum number of consecutive “in-sync” indications for the SpCell received from lower layers</td>
</tr>
</tbody>
</table>

7.4 UE variables

**NOTE:** To facilitate the specification of the UE behavioural requirements, UE variables are represented using ASN.1. Unless explicitly specified otherwise, it is however up to UE implementation how to store the variables. The optionality of the IEs in ASN.1 is used only to indicate that the values may not always be available.

---

**NR-UE-Variables**

This ASN.1 segment is the start of the NR UE variable definitions.

---

```asn1
-- NR-UE-VARIABLES-START

NR-UE-Variables DEFINITIONS AUTOMATIC TAGS ::= BEGIN

IMPORTS

ARFCN-ValueNR,
CellIdentity,
EUTRA-PhysCellId,
MeasId,
MeasIdToAddModList,
MeasIdleCarrierEUTRA-r16,
MeasIdleCarrierNR-r16,
MeasResultIdleEUTRA-r16,
MeasResultIdleNR-r16,
MeasObjectToAddModList,
PhysCellId,
RNTI-Value,
ReportConfigToAddModList,
RSRP-Range,
SL-MeasId-r16,
SL-MeasIdList-r16,
SL-MeasObjectList-r16,
SL-ReportConfigList-r16,
SL-QuantityConfig-r16,
Tx-PoolMeasList-r16,
QuantityConfig,
maxNrofCellMeas,
```

---
FROM NR-RRC-Definitions;

-- NR-UE-VARIABLES-STOP
-- ASN1STOP

--- VarConditionalReconfig

The UE variable `VarConditionalReconfig` includes the accumulated configuration of the conditional handover or conditional PSCell change configurations including the pointers to conditional handover or conditional PSCell change execution condition (associated `measId(s)`) and the stored target candidate SpCell `RRCReconfiguration`.

`VarConditionalReconfig` UE variable

-- ASN1START
-- TAG-CONDRECONFIG-START

VarConditionalReconfig ::= SEQUENCE {
    condReconfigList  CondReconfigToAddModList-r16  OPTIONAL
}
The UE variable \textit{VarConnEstFailReport} includes the connection establishment failure and connection resume failure information.

\textbf{VarConnEstFailReport UE variable}

\begin{verbatim}
VarConnEstFailReport-r16 ::= SEQUENCE {
  connEstFailReport-r16    ConnEstFailReport-r16,     
  plmn-Identity-r16       PLMN-Identity
}
\end{verbatim}

The UE variable \textit{VarLogMeasConfig} includes the configuration of the logging of measurements to be performed by the UE while in RRC_IDLE, RRC_INACTIVE, covering intra-frequency, inter-frequency and inter-RAT mobility related measurements. The UE performs logging of measurements only while in RRC_IDLE and RRC_INACTIVE.

\textbf{VarLogMeasConfig UE variable}

\begin{verbatim}
VarLogMeasConfig-r16-IEs ::= SEQUENCE {
  areaConfiguration-r16  AreaConfiguration-r16 OPTIONAL,  
  bt-NameList-r16        BT-NameList-r16 OPTIONAL,         
  wlan-NameList-r16     WLAN-NameList-r16 OPTIONAL,        
  sensor-NameList-r16   Sensor-NameList-r16 OPTIONAL,       
  loggingDuration-r16   LoggingDuration-r16, 
  reportType            CHOICE {                          
    periodical           LoggedPeriodicalReportConfig-r16, 
    eventTriggered       LoggedEventTriggerConfig-r16
  }
}
\end{verbatim}
The UE variable `VarLogMeasReport` includes the logged measurements information.

```asn1
VarLogMeasReport ::= 
  SEQUENCE {
    absoluteTimeInfo-r16         AbsoluteTimeInfo-r16,     
    traceReference-r16           TraceReference-r16,     
    traceRecordingSessionRef-r16 OCTET STRING (SIZE (2)), 
    tce-Id-r16                   OCTET STRING (SIZE (1)), 
    logMeasInfoList-r16          LogMeasInfoList-r16, 
    plmn-IdentityList-r16        PLMN-IdentityList2-r16
  }
```

The UE variable `VarMeasConfig` includes the accumulated configuration of the measurements to be performed by the UE, covering intra-frequency, inter-frequency and inter-RAT mobility related measurements.

```asn1
VarMeasConfig ::= 
  SEQUENCE {
    measIdList                          MeasIdToAddModList                  OPTIONAL, 
    measObjectList                      MeasObjectToAddModList              OPTIONAL, 
    reportConfigList                    ReportConfigToAddModList            OPTIONAL, 
    quantityConfig                      QuantityConfig                      OPTIONAL, 
    s-MeasureConfig                         CHOICE {         ssb-RSRP                                RSRP-Range,         csi-RSRP                                RSRP-Range 
    }
  }
```
---

VarMeasConfigSL

The UE variable VarMeasConfigSL includes the accumulated configuration of the NR sidelink measurements to be performed by the UE of unicast destination.

**VarMeasConfigSL UE variable**

```
-- ASN1START
-- TAG-VARMEASCONFIGSL-START

VarMeasConfigSL-r16 ::=                        SEQUENCE {
  -- NR sidelink measurement identities
  sl-MeasIdList-r16                              SL-MeasIdList-r16                          OPTIONAL,
  -- NR sidelink measurement objects     sl-MeasObjectList-r16                          SL-MeasObjectList-r16                      OPTIONAL,
  -- NR sidelink reporting configurations     sl-reportConfigList-r16                        SL-ReportConfigList-r16                    OPTIONAL,
  -- Other parameters     sl-QuantityConfig-r16                          SL-QuantityConfig-r16                      OPTIONAL
}

-- TAG-VARMEASCONFIGSL-STOP
-- ASN1STOP
```

---

VarMeasIdleConfig

The UE variable VarMeasIdleConfig includes the configuration of the measurements to be performed by the UE while in RRC_IDLE or RRC_INACTIVE for NR inter-frequency and inter-RAT (i.e. EUTRA) measurements.

**VarMeasIdleConfig UE variable**

```
-- ASN1START
-- TAG-VARMEASIDLECONFIG-START

VarMeasIdleConfig-r16 ::=     SEQUENCE {
  measIdleCarrierListNR-r16     SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierNR-r16                  OPTIONAL,
  measIdleCarrierListEUTRA-r16  SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierEUTRA-r16               OPTIONAL,
  measIdleDuration-r16          ENUMERATED {sec10, sec30, sec60, sec120, sec180, sec240, sec300, spare},
  validityAreaList-r16          ValidityAreaList-r16                                                           OPTIONAL
}

-- TAG-VARMEASIDLECONFIG-STOP
-- ASN1STOP
```
VarMeasIdleReport

The UE variable VarMeasIdleReport includes the logged measurements information.

VarMeasIdleReport UE variable

```
-- ASN1START
-- TAG-VARMEASIDLEREPORT-START

VarMeasIdleReport-r16 ::=    SEQUENCE {
    measReportIdleNR-r16         MeasResultIdleNR-r16                     OPTIONAL,
    measReportIdleEUTRA-r16      MeasResultIdleEUTRA-r16                  OPTIONAL
}

-- TAG-VARMEASIDLEREPORT-STOP
-- ASN1STOP
```

VarMeasReportList

The UE variable VarMeasReportList includes information about the measurements for which the triggering conditions have been met.

VarMeasReportList UE variable

```
-- ASN1START
-- TAG-VARMEASREPORTLIST-START

VarMeasReportList ::=               SEQUENCE (SIZE (1..maxNrofMeasId)) OF VarMeasReport

VarMeasReport ::=                   SEQUENCE {
    -- List of measurements that have been triggered
    measId                              MeasId,     cellsTriggeredList                  CellsTriggeredList              OPTIONAL,
    numberOfReportsSent                 INTEGER,     cli-TriggeredList-r16               CLI-TriggeredList-r16           OPTIONAL,
    tx-PoolMeasToAddModListNR-r16       Tx-PoolMeasList-r16             OPTIONAL
}

CellsTriggeredList ::=              SEQUENCE (SIZE (1..maxNrofCellMeas)) OF CHOICE {
    physCellId                          PhysCellId,     physCellIdEUTRA                     EUTRA-PhysCellId,
    physCellIdUTRA-FDD-r16              PhysCellIdUTRA-FDD-r16
}

CLI-TriggeredList-r16 ::=           CHOICE {
    srs-RSRP-TriggeredList-r16          SRS-RSRP-TriggeredList-r16,
    cli-RSSI-TriggeredList-r16          CLI-RSSI-TriggeredList-r16
}

SRS-RSRP-TriggeredList-r16 ::=      SEQUENCE (SIZE (1.. maxNrofCLI-SRS-Resources-r16)) OF SRS-ResourceId
```
--- VarMeasReportListSL

The UE variable `VarMeasReportListSL` includes information about the NR sidelink measurements for which the triggering conditions have been met.

```
VarMeasReportListSL UE variable
```

--- VarMobilityHistoryReport

The UE variable `VarMobilityHistoryReport` includes the mobility history information.

```
VarMobilityHistoryReport UE variable
```

--- VarPendingRNA-Update

The UE variable `VarPendingRNA-Update` indicates whether there is a pending RNA update procedure or not. The setting of this BOOLEAN variable to `true` means that there is a pending RNA Update procedure.
VarPendingRNA-Update UE variable

```
VarPendingRNA-Update ::=                     SEQUENCE {
  pendingRNA-Update                   BOOLEAN                             OPTIONAL
}
```

VarRA-Report

The UE variable VarRA-Report includes the random-access related information.

```
VarRA-Report-r16 ::=      SEQUENCE {
}
PLMN-IdentityList-r16 ::= SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity
```

VarResumeMAC-Input

The UE variable VarResumeMAC-Input specifies the input used to generate the resumeMAC-I during RRC Connection Resume procedure.

```
VarResumeMAC-Input  ::=     SEQUENCE {
  sourcePhysCellId                        PhysCellId,     targetCellIdentity                      CellIdentity,
  source-c-RNTI                           RNTI-Value
}
```
VarResumeMAC-Input field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>targetCellIdentity</td>
<td>An input variable used to calculate the resumeMAC-I. Set to the cellIdentity of the first PLMN-Identity included in the PLMN-IdentityInfoList broadcasted in SIB1 of the target cell.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>source-c-RNTI</td>
<td>Set to C-RNTI that the UE had in the PCell it was connected to prior to suspension of the RRC connection.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sourcePhysCellId</td>
<td>Set to the physical cell identity of the PCell the UE was connected to prior to suspension of the RRC connection.</td>
</tr>
</tbody>
</table>

--- VarRLF-Report

The UE variable VarRLF-Report includes the radio link failure information or handover failure information.

VarRLF-Report UE variable

--- VarShortMAC-Input

The UE variable VarShortMAC-Input specifies the input used to generate the shortMAC-I during RRC Connection Reestablishment procedure.

VarShortMAC-Input variable
**VarShortMAC-Input field descriptions**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>targetCellIdentity</strong></td>
<td>An input variable used to calculate the shortMAC-I. Set to the cellIdentity of the first PLMN-Identity in the PLMN-IdentityInfoList broadcasted in SIB1 of the target cell i.e. the cell the UE is trying to reestablish the connection.</td>
</tr>
<tr>
<td><strong>source-c-RNTI</strong></td>
<td>Set to C-RNTI that the UE had in the PCell it was connected to prior to the reestablishment.</td>
</tr>
<tr>
<td><strong>sourcePhysCellId</strong></td>
<td>Set to the physical cell identity of the PCell the UE was connected to prior to the reestablishment.</td>
</tr>
</tbody>
</table>

---

End of **NR-UE-Variables**
8 Protocol data unit abstract syntax

8.1 General

The RRC PDU contents in clause 6 and clause 10 are described using abstract syntax notation one (ASN.1) as specified in ITU-T Rec. X.680 [6] and X.681 [7]. Transfer syntax for RRC PDUs is derived from their ASN.1 definitions by use of Packed Encoding Rules, unaligned as specified in ITU-T Rec. X.691 [8].

The following encoding rules apply in addition to what has been specified in X.691:

- When a bit string value is placed in a bit-field as specified in 15.6 to 15.11 in X.691, the leading bit of the bit string value shall be placed in the leading bit of the bit-field, and the trailing bit of the bit string value shall be placed in the trailing bit of the bit-field;

NOTE: The terms 'leading bit' and 'trailing bit' are defined in ITU-T Rec. X.680. When using the 'bstring' notation, the leading bit of the bit string value is on the left, and the trailing bit of the bit string value is on the right.

- When decoding types constrained with the ASN.1 Contents Constraint ("CONTAINING"), automatic decoding of the contained type should not be performed because errors in the decoding of the contained type should not cause the decoding of the entire RRC message PDU to fail. It is recommended that the decoder first decodes the outer PDU type that contains the OCTET STRING or BIT STRING with the Contents Constraint, and then decodes the contained type that is nested within the OCTET STRING or BIT STRING as a separate step;

- When decoding a) RRC message PDUs, b) BIT STRING constrained with a Contents Constraint, or c) OCTET STRING constrained with a Contents Constraint, PER decoders are required to never report an error if there are extraneous zero or non-zero bits at the end of the encoded RRC message PDU, BIT STRING or OCTET STRING.

8.2 Structure of encoded RRC messages

An RRC PDU, which is the bit string that is exchanged between peer entities/across the radio interface contains the basic production as defined in X.691.

RRC PDUs shall be mapped to and from PDCP SDUs (in case of DCCH) or RLC SDUs (in case of PCCH, BCCH or CCCH) upon transmission and reception as follows:

- when delivering an RRC PDU as an PDCP SDU to the PDCP layer for transmission, the first bit of the RRC PDU shall be represented as the first bit in the PDCP SDU and onwards; and

- when delivering an RRC PDU as an RLC SDU to the RLC layer for transmission, the first bit of the RRC PDU shall be represented as the first bit in the RLC SDU and onwards; and

- upon reception of an PDCP SDU from the PDCP layer, the first bit of the PDCP SDU shall represent the first bit of the RRC PDU and onwards; and

- upon reception of an RLC SDU from the RLC layer, the first bit of the RLC SDU shall represent the first bit of the RRC PDU and onwards.

8.3 Basic production

The 'basic production' is obtained by applying UNALIGNED PER to the abstract syntax value (the ASN.1 description) as specified in X.691. It always contains a multiple of 8 bits.

8.4 Extension

The following rules apply with respect to the use of protocol extensions:
- A transmitter compliant with this version of the specification shall, unless explicitly indicated otherwise on a PDU type basis, set the extension part empty. Transmitters compliant with a later version may send non-empty extensions;
- A transmitter compliant with this version of the specification shall set spare bits to zero.

### 8.5 Padding

If the encoded RRC message does not fill a transport block, the RRC layer shall add padding bits. This applies to PCCH and BCCH.

Padding bits shall be set to 0 and the number of padding bits is a multiple of 8.

![Figure 8.5-1: RRC level padding](image_url)

### 9 Specified and default radio configurations

Specified and default configurations are configurations of which the details are specified in the standard. Specified configurations are fixed while default configurations can be modified using dedicated signalling. The default value for the parameters not listed in following subclauses shall be set such as the corresponding features are not configured, i.e. \textit{release} or \textit{false} unless explicitly stated otherwise.

\textbf{NOTE:} The UE applies the default values specified in the field description of ASN.1 parameters only when the parent IE is present. Hence, the UE does not apply all default values in field descriptions when it applies the "default radio configuration" in accordance with this clause.

#### 9.1 Specified configurations

##### 9.1.1 Logical channel configurations

##### 9.1.1.1 BCCH configuration

Parameters


### 9.1.1.2 CCCH configuration

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Semantics description</th>
<th>Ver</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDAP configuration</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDCP configuration</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLC configuration</td>
<td>TM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logical channel configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;priority</td>
<td>1</td>
<td>Highest priority</td>
<td></td>
</tr>
<tr>
<td>&gt;prioritisedBitRate</td>
<td>infinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;bucketSizeDuration</td>
<td>ms1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;logicalChannelGroup</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** RRC will perform padding, if required due to the granularity of the TF signalling, as defined in 8.5.

### 9.1.1.3 PCCH configuration

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Semantics description</th>
<th>Ver</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDAP configuration</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDCP configuration</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLC configuration</td>
<td>TM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logical channel configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** RRC will perform padding, if required due to the granularity of the TF signalling, as defined in 8.5.

### 9.1.1.4 SCCH configuration

Parameters that are specified for unicast of NR sidelink communication, which is used for the sidelink signalling radio bearer of PC5-RRC message. The SL-SRB using this SCCH configuration is named as SL-SRB3.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Semantics description</th>
<th>Ver</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDCP configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;t-Reordering</td>
<td>Undefined</td>
<td>Selected by the receiving UE, up to UE implementation</td>
<td></td>
</tr>
<tr>
<td>&gt;pdcp-SN-Size</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLC configuration</td>
<td>AM RLC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;sn-FieldLength</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;t-Reassembly</td>
<td>Undefined</td>
<td>Selected by the receiving UE, up to UE implementation</td>
<td></td>
</tr>
<tr>
<td>&gt;logicalChannelIdentity</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAC configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;priority</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;prioritisedBitRate</td>
<td>infinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;logicalChannelGroup</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;schedulingRequestId</td>
<td>0</td>
<td>The scheduling request configuration with this value is applicable for this SCCH if configured by the network.</td>
<td></td>
</tr>
</tbody>
</table>
Parameters that are specified of NR sidelink communication, which is used for the sidelink signalling radio bearer of unprotected PC5-S message (e.g. Direct Link Establishment Request, TS 24.587 [57]). The SL-SRB using this SCCH configuration is named as SL-SRB0.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Semantics description</th>
<th>Ver</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDCP configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;t-Reordering</td>
<td>Undefined</td>
<td>Selected by the receiving UE, up to UE implementation</td>
<td></td>
</tr>
<tr>
<td>&gt;pdcp-SN-Size</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLC configuration</td>
<td></td>
<td>UM RLC</td>
<td></td>
</tr>
<tr>
<td>&gt;sn-FieldLength</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;t-Reassembly</td>
<td>Undefined</td>
<td>Selected by the receiving UE, up to UE implementation</td>
<td></td>
</tr>
<tr>
<td>&gt;logicalChannelIdentity</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAC configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;priority</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;prioritisedBitRate</td>
<td>infinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;logicalChannelGroup</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;schedulingRequestId</td>
<td>0</td>
<td>The scheduling request configuration with this value is applicable for this SCCH if configured by the network.</td>
<td></td>
</tr>
</tbody>
</table>

Parameters that are specified for unicast of NR sidelink communication, which is used for the sidelink signalling radio bearer of PC5-S message establishing PC5-S security (e.g. Direct Link Security Mode Command and Direct Link Security Mode Complete, TS 24.587 [57]). The SL-SRB using this SCCH configuration is named as SL-SRB1.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Semantics description</th>
<th>Ver</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDCP configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;t-Reordering</td>
<td>Undefined</td>
<td>Selected by the receiving UE, up to UE implementation</td>
<td></td>
</tr>
<tr>
<td>&gt;pdcp-SN-Size</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLC configuration</td>
<td></td>
<td>AM RLC</td>
<td></td>
</tr>
<tr>
<td>&gt;sn-FieldLength</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;t-Reassembly</td>
<td>Undefined</td>
<td>Selected by the receiving UE, up to UE implementation</td>
<td></td>
</tr>
<tr>
<td>&gt;logicalChannelIdentity</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAC configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;priority</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;prioritisedBitRate</td>
<td>infinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;logicalChannelGroup</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;schedulingRequestId</td>
<td>0</td>
<td>The scheduling request configuration with this value is applicable for this SCCH if configured by the network.</td>
<td></td>
</tr>
</tbody>
</table>

Parameters that are specified for unicast of NR sidelink communication, which is used for the sidelink signalling radio bearer of protected PC5-S message except Direct Link Security Mode Complete. The SL-SRB using this SCCH configuration is named as SL-SRB2.
<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Semantics description</th>
<th>Ver</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDCP configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; t-Reordering</td>
<td>Undefined</td>
<td>Selected by the receiving UE, up to UE implementation</td>
<td></td>
</tr>
<tr>
<td>&gt; pdcp-SN-Size</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLC configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; sn-FieldLength</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; t-Reassembly</td>
<td>Undefined</td>
<td>Selected by the receiving UE, up to UE implementation</td>
<td></td>
</tr>
<tr>
<td>&gt; logicalChannelIdentity</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAC configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; priority</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; prioritisedBitRate</td>
<td>infinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; logicalChannelGroup</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; schedulingRequestId</td>
<td>0</td>
<td>The scheduling request configuration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>with this value is applicable for this SCCH if configured</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>by the network.</td>
<td></td>
</tr>
</tbody>
</table>

9.1.1.5 STCH configuration

Parameters that are specified for NR sidelink communication, which is used for the sidelink data radio bearer.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Semantics description</th>
<th>Ver</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDCP configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; t-Reordering</td>
<td>Undefined</td>
<td>Selected by the receiving UE, up to UE implementation</td>
<td></td>
</tr>
<tr>
<td>&gt; pdcp-SN-Size</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLC configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; sn-FieldLength</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; t-Reassembly</td>
<td>Undefined</td>
<td>Selected by the receiving UE, up to UE implementation</td>
<td></td>
</tr>
<tr>
<td>&gt; logicalChannelIdentity</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; schedulingRequestId</td>
<td>0</td>
<td>The scheduling request configuration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>with this value is applicable for this SCCH if configured</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>by the network.</td>
<td></td>
</tr>
</tbody>
</table>

9.1.2 Void

9.2 Default radio configurations

The following clauses only list default values for REL-15 parameters included in protocol version v15.3.0. For all fields introduced in a later protocol version, the default value is "released" or "false" unless explicitly specified otherwise. If the UE is to apply default configuration while it is configured with some critically extended fields, the UE shall apply the original version of those fields with only default values.

NOTE 1: In general, the signalling should preferably support a "release" option for fields introduced after v15.3.0. The "value not applicable" should be used restrictively, mainly limited to for fields which value is relevant only if another field is set to a value other than its default.

NOTE 2: For parameters in ServingCellConfig, the default values are specified in the corresponding specification.
### 9.2.1 Default SRB configurations

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Semantics description</th>
<th>Ver</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDCP-Config</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;t-Reordering</td>
<td>infinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RLC-Config CHOICE</td>
<td>Am</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ul-AM-RLC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;sn-FieldLength</td>
<td>size12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;t-PollRetransmit</td>
<td>ms45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;pollPDU</td>
<td>infinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;pollByte</td>
<td>infinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;maxRetxThreshold</td>
<td>t8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dl-AM-RLC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;sn-FieldLength</td>
<td>size12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;t-Reassembly</td>
<td>ms35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;t-StatusProhibit</td>
<td>ms0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>logicalChannelIdentity</td>
<td>1 2 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LogicalChannelConfig</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;priority</td>
<td>1 3 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;prioritisedBitRate</td>
<td>infinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;logicalChannelGroup</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.2 Default MAC Cell Group configuration

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Semantics description</th>
<th>Ver</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAC Cell Group config</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bsr-Config</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;periodicBSR-Timer</td>
<td>sf10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;retxBSR-Timer</td>
<td>sf80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>phr-Config</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;phr-PeriodicTimer</td>
<td>sf10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;phr-ProhibitTimer</td>
<td>sf10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;phr-Tx-PowerFactorChange</td>
<td>dB1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.3 Default values timers and constants

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Semantics description</th>
<th>Ver</th>
</tr>
</thead>
<tbody>
<tr>
<td>t310</td>
<td>ms1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n310</td>
<td></td>
<td></td>
<td>n1</td>
</tr>
<tr>
<td>t311</td>
<td></td>
<td></td>
<td>ms30000</td>
</tr>
<tr>
<td>n311</td>
<td></td>
<td></td>
<td>n1</td>
</tr>
</tbody>
</table>
9.3 Sidelink pre-configured parameters

This ASN.1 segment is the start of the NR definitions of pre-configured sidelink parameters.

-- NR-Sidelink-Preconf

-- ASN1START
-- TAG-NR-SIDELINK-PRECONF-DEFINITIONS-START

NR-Sidelink-Preconf DEFINITIONS AUTOMATIC TAGS ::= BEGIN

IMPORTS
SL-CBR-CommonTxConfigList-r16,
SL-FreqConfigCommon-r16,
SL-RadioBearerConfig-r16,
SL-RLC-BearerConfig-r16,
SL-EUTRA-AnchorCarrierFreqList-r16,
SL-NR-AnchorCarrierFreqList-r16,
SL-MeasConfigCommon-r16,
SL-UE-SelectedConfig-r16,
TDD-UL-DL-ConfigCommon,
maxNrofFreqSL-r16,
maxNrofSLRB-r16,
maxSL-LCID-r16
FROM NR-RRC-Definitions;

-- TAG-NR-SIDELINK-PRECONF-DEFINITIONS-STOP
-- ASN1STOP

-- SL-PreconfigurationNR

The IE SL-PreconfigurationNR includes the sidelink pre-configured parameters used for NR sidelink communication. Need codes or conditions specified for subfields in SL-PreconfigurationNR do not apply.

SL-PreconfigurationNR information elements

-- ASN1START
-- TAG-SL-PRECONFIGURATIONNR-START

SL-PreconfigurationNR-r16 ::= SEQUENCE {
sidelinkPreconfigNR-r16 SidelinkPreconfigNR-r16,
...
}

ETSI
SL-PreconfigGeneral-r16 ::= SEQUENCE {
  sl-TDD-Configuration-r16  TDD-UL-DL-ConfigCommon OPTIONAL,
  reservedBits-r16           BIT STRING (SIZE (2)) OPTIONAL,
  ...                       
}

SL-RoHC-Profiles-r16 ::= SEQUENCE {
  profile0x0001-r16         BOOLEAN,
  profile0x0002-r16         BOOLEAN,
  profile0x0003-r16         BOOLEAN,
  profile0x0004-r16         BOOLEAN,
  profile0x0006-r16         BOOLEAN,
  profile0x0101-r16         BOOLEAN,
  profile0x0102-r16         BOOLEAN,
  profile0x0103-r16         BOOLEAN,
  profile0x0104-r16         BOOLEAN,
  ...                       
}

-- TAG-SL-PRECONFIGURATIONNR-STOP
-- ASN1STOP
### SL-PreconfigurationNR field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>sl-OffsetDFN</strong></td>
</tr>
<tr>
<td>Indicates the timing offset for the UE to determine DFN timing when GNSS is used for timing reference. Value 1 corresponds to 0.001 milliseconds, value 2 corresponds to 0.002 milliseconds, and so on. If the field is absent, no offset is applied.</td>
</tr>
<tr>
<td><strong>sl-PreconfigEUTRA-AnchorCarrierFreqList</strong></td>
</tr>
<tr>
<td>This field indicates the EUTRA anchor carrier frequency list, which can provide the NR sidelink communication configuration.</td>
</tr>
<tr>
<td><strong>sl-PreconfigFreqInfoList</strong></td>
</tr>
<tr>
<td>This field indicates the NR sidelink communication configuration some carrier frequency(ies). In this release, only one SL-FreqConfig can be configured in the list.</td>
</tr>
<tr>
<td><strong>sl-PreconfigNR-AnchorCarrierFreqList</strong></td>
</tr>
<tr>
<td>This field indicates the NR anchor carrier frequency list, which can provide the NR sidelink communication configuration.</td>
</tr>
<tr>
<td><strong>sl-RadioBearerPreConfigList</strong></td>
</tr>
<tr>
<td>This field indicates one or multiple sidelink radio bearer configurations.</td>
</tr>
<tr>
<td><strong>sl-RLC-BearerPreConfigList</strong></td>
</tr>
<tr>
<td>This field indicates one or multiple sidelink RLC bearer configurations.</td>
</tr>
<tr>
<td><strong>sl-RoHC-Profiles</strong></td>
</tr>
<tr>
<td>This field indicates the supported RoHC profiles for NR sidelink communications.</td>
</tr>
<tr>
<td><strong>sl-SSB-PriorityNR</strong></td>
</tr>
<tr>
<td>This field indicates the priority of NR sidelink SSB transmission and reception.</td>
</tr>
</tbody>
</table>

---

End of NR-Sidelink-Preconf

---

---

---

---

---
10  Generic error handling

10.1  General

The generic error handling defined in the subsequent sub-clauses applies unless explicitly specified otherwise e.g. within the procedure specific error handling.

The UE shall consider a value as not comprehended when it is set:

- to an extended value that is not defined in the version of the transfer syntax supported by the UE;
- to a spare or reserved value unless the specification defines specific behaviour that the UE shall apply upon receiving the concerned spare/reserved value.

The UE shall consider a field as not comprehended when it is defined:

- as spare or reserved unless the specification defines specific behaviour that the UE shall apply upon receiving the concerned spare/reserved field.

10.2  ASN.1 violation or encoding error

The UE shall:

1> when receiving an RRC message on the BCCH, CCCH or PCCH for which the abstract syntax is invalid [6]:
2> ignore the message.

NOTE: This clause applies in case one or more fields is set to a value, other than a spare, reserved or extended value, not defined in this version of the transfer syntax. E.g. in the case the UE receives value 12 for a field defined as INTEGER (1..11). In cases like this, it may not be possible to reliably detect which field is in the error hence the error handling is at the message level.

10.3  Field set to a not comprehended value

The UE shall, when receiving an RRC message on any logical channel:

1> if the message includes a field that has a value that the UE does not comprehend:
2> if a default value is defined for this field:
3> treat the message while using the default value defined for this field;
2> else if the concerned field is optional:
3> treat the message as if the field were absent and in accordance with the need code for absence of the concerned field;
2> else:
3> treat the message as if the field were absent and in accordance with sub-clause 10.4.

10.4  Mandatory field missing

The UE shall:

1> if the message includes a field that is mandatory to include in the message (e.g. because conditions for mandatory presence are fulfilled) and that field is absent or treated as absent:
2> if the RRC message was not received on DCCH or CCCH:
3> if the field concerns a (sub-field of) an entry of a list (i.e. a SEQUENCE OF):
4> treat the list as if the entry including the missing or not comprehended field was absent;
3> else if the field concerns a sub-field of another field, referred to as the 'parent' field i.e. the field that is one
nesting level up compared to the erroneous field:
4> consider the 'parent' field to be set to a not comprehended value;
4> apply the generic error handling to the subsequent 'parent' field(s), until reaching the top nesting level
i.e. the message level;
3> else (field at message level):
4> ignore the message.

NOTE 1: The error handling defined in these sub-clauses implies that the UE ignores a message with the message
type or version set to a not comprehended value.

NOTE 2: The nested error handling for messages received on logical channels other than DCCH and CCCH applies
for errors in extensions also, even for errors that can be regarded as invalid network operation e.g. the
network not observing conditional presence.

NOTE 3: UE behaviour on receipt of an RRC message on DCCH or CCCH that does not include a field that is
mandatory (e.g. because conditions for mandatory presence are fulfilled) is unspecified.

The following ASN.1 further clarifies the levels applicable in case of nested error handling for errors in extension
fields.

```asn1
ItemInfoList ::=                    SEQUENCE (SIZE (1..max)) OF ItemInfo

ItemInfo ::=                        SEQUENCE {
  itemIdentity                        INTEGER (1..max),
  field1                              Field1,
  field2                              Field2                  OPTIONAL,           -- Need N
  ... [
    field3-r9                       Field3-r9               OPTIONAL,              -- Cond Cond1
    field4-r9                       Field4-r9               OPTIONAL               -- Need N
  ]
}

BroadcastInfoBlock1 ::=             SEQUENCE {
  itemIdentity                        INTEGER (1..max),
  field1                              Field1,
  field2                              Field2                  OPTIONAL,           -- Need N
  nonCriticalExtension                BroadcastInfoBlock1-v940-IEs    OPTIONAL
}

BroadcastInfoBlock1-v940-IEs::= SEQUENCE {
  field3-r9                           Field3-r9               OPTIONAL,           -- Cond Cond1
  field4-r9                           Field4-r9               OPTIONAL,           -- Need N
  nonCriticalExtension                SEQUENCE {}             OPTIONAL            -- Need S
}
```

The UE shall, apply the following principles regarding the levels applicable in case of nested error handling:

- an extension addition group is not regarded as a level on its own. E.g. in the ASN.1 extract in the previous, a error
  regarding the conditionality of field3 would result in the entire itemInfo entry to be ignored (rather than just the
  extension addition group containing field3 and field4);
- a traditional nonCriticalExtension is not regarded as a level on its own. E.g. in the ASN.1 extract in the previous, an error regarding the conditionality of field3 would result in the entire BroadcastInfoBlock1 to be ignored (rather than just the non-critical extension containing field3 and field4).

10.5 Not comprehended field

The UE shall, when receiving an RRC message on any logical channel:

1> if the message includes a field that the UE does not comprehend:
   2> treat the rest of the message as if the field was absent.

NOTE: This clause does not apply to the case of an extension to the value range of a field. Such cases are addressed instead by the requirements in clause 10.3.
11 Radio information related interactions between network nodes

11.1 General

This clause specifies RRC messages that are transferred between network nodes. These RRC messages may be transferred to or from the UE via another Radio Access Technology. Consequently, these messages have similar characteristics as the RRC messages that are transferred across the NR radio interface, i.e. the same transfer syntax and protocol extension mechanisms apply.

11.2 Inter-node RRC messages

11.2.1 General

This clause specifies RRC messages that are sent either across the X2-, Xn- or the NG-interface, either to or from the gNB, i.e. a single 'logical channel' is used for all RRC messages transferred across network nodes. The information could originate from or be destined for another RAT.

```asn1
BEGIN NR-InterNodeDefinitions DEFINITIONS AUTOMATIC TAGS ::= IMPORTS
ARFCN-ValueNR,
ARFCN-ValueEUTRA,
CellIdentity,
CGI-InfoEUTRA,
CGI-InfoNR,
CSI-RS-Index,
CSI-RS-CellMobility,
DRX-Config,
EUTRA-PhysCellId,
FreqBandIndicatorNR,
GapConfig,
maxBandComb,
maxBands,
maxCellSFTD,
maxFeatureSetsPerBand,
maxFreqIDC-MRDC,
maxNrofCombIDC,
maxNrofSCells,
maxNrofServingCells,
maxNrofServingCells-1,
maxNrofServingCellsEUTRA,
```
11.2.2 Message definitions

– **HandoverCommand**

This message is used to transfer the handover command as generated by the target gNB.

Direction: target gNB to source gNB/source RAN.

**HandoverCommand message**

```plaintext
HandoverCommand ::= SEQUENCE {
  maxNrofIndexesToReport,
  maxSimultaneousBands,
  MeasQuantityResults,
  MeasResultCellListSFTD-EUTRA,
  MeasResultCellListSFTD-NR,
  MeasResultList2NR,
  NeedForGapsInfoNR-r16,
  OverheatingAssistance,
  P-Max,
  PhysCellId,
  RadioBearerConfig,
  RAN-NotificationAreaInfo,
  RRCReconfiguration,
  ServCellIndex,
  SetupRelease,
  SSB-Index,
  SSB-MTC,
  SSB-ToMeasure,
  SS-RSSI-Measurement,
  ShortMAC-I,
  SubcarrierSpacing,
  UEAssistanceInformation,
  UE-CapabilityRAT-ContainerList,
  maxNrofCLI-RSSI-Resources-r16,
  maxNrofCLI-SRS-Resources-r16,
  SRS-ResourceId-r16,
  SidelinkUEInformationNR-r16,
  SRS-ResourceId
FROM NR-RRC-Definitions;
```
criticalExtensions
   CHOICE {
      c1
         CHOICE {
            handoverCommand         HandoverCommand-IEs,
            spare3 NULL, spare2 NULL, spare1 NULL
         },
         criticalExtensionsFuture  SEQUENCE {}
   }

HandoverCommand-IEs ::=  SEQUENCE {
   handoverCommandMessage  OCTET STRING (CONTAINING RRCReconfiguration),
   nonCriticalExtension    SEQUENCE {} OPTIONAL
}

-- TAG-HANDOVER-COMMAND-STOP
-- ASN1STOP

**HandoverCommand field descriptions**

**handoverCommandMessage**

Contains the *RRC*Reconfiguration message used to perform handover within NR or handover to NR, as generated (entirely) by the target gNB.

---

**HandoverPreparationInformation**

This message is used to transfer the NR RRC information used by the target gNB during handover preparation or UE context retrieval, e.g. in case of resume or re-establishment, including UE capability information. This message is also used for transferring the information between the CU and DU.

Direction: source gNB/source RAN to target gNB or CU to DU.

**HandoverPreparationInformation message**

---

HandoverPreparationInformation ::=  SEQUENCE {
   criticalExtensions         CHOICE {
      c1
         CHOICE {
            handoverPreparationInformation  HandoverPreparationInformation-IEs,
            spare3 NULL, spare2 NULL, spare1 NULL
         },
         criticalExtensionsFuture  SEQUENCE {}
   }
}

HandoverPreparationInformation-IEs ::=  SEQUENCE {
   ue-CapabilityRAT-List       UE-CapabilityRAT-ContainerList,
   sourceConfig                AS-Config OPTIONAL, -- Cond HO
   rrm-Config                  RRM-Config OPTIONAL,
   as-Context                  AS-Context OPTIONAL,
   nonCriticalExtension       SEQUENCE {} OPTIONAL
}
AS-Config ::= SEQUENCE {
  rrcReconfiguration OCTET STRING (CONTAINING RRCReconfiguration),
  ...,
  [[
    sourceRR-SN-Config OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL,
    sourceSCG-NR-Config OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL,
    sourceSCG-EUTRA-Config OCTET STRING OPTIONAL
  ]],
  [[
    sourceSCG-Configured ENUMERATED {true} OPTIONAL
  ]]
}

AS-Context ::= SEQUENCE {
  reestablishmentInfo ReestablishmentInfo OPTIONAL,
  configRestrictInfo ConfigRestrictInfo SCG OPTIONAL,
  ...,
  [[ ran-NotificationAreaInfo RAN-NotificationAreaInfo OPTIONAL ]],
  [[ ueAssistanceInformation OCTET STRING (CONTAINING UEAssistanceInformation) OPTIONAL -- Cond HO2 ]],
  [[ selectedBandCombinationSN BandCombinationInfoSN OPTIONAL ]],
  [[ configRestrictInfoDAPS-r16 ConfigRestrictInfoDAPS-r16 OPTIONAL, sidelinkUEInformationNR-r16 OCTET STRING OPTIONAL, sidelinkUEInformationEUTRA-r16 OCTET STRING OPTIONAL, ueAssistanceInformationEUTRA-r16 OCTET STRING (CONTAINING UEAssistanceInformation) OPTIONAL, needForGapsInfoNR-r16 NeedForGapsInfoNR-r16 OPTIONAL ]]
}

ConfigRestrictInfoDAPS-r16 ::= SEQUENCE {
  powerCoordination-r16 SEQUENCE {
    p-DAPS-Source-r16 P-Max,
    p-DAPS-Target-r16 P-Max,
    uplinkPowerSharingDAPS-Mode-r16 ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic } OPTIONAL
  } }
HandoverPreparationInformation field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>as-Context</td>
<td>Local RAN context required by the target gNB or DU.</td>
</tr>
<tr>
<td>rrm-Config</td>
<td>Local RAN context used mainly for RRM purposes.</td>
</tr>
<tr>
<td>sourceConfig</td>
<td>The radio resource configuration as used in the source cell.</td>
</tr>
<tr>
<td>ue-CapabilityRAT-List</td>
<td>The UE radio access related capabilities concerning RATs supported by the UE. A gNB that retrieves MRDC related capability containers ensures that the set of included MRDC containers is consistent w.r.t. the feature set related information.</td>
</tr>
<tr>
<td>ue-InactiveTime</td>
<td>Duration while UE has not received or transmitted any user data. Thus the timer is still running in case e.g., UE measures the neighbour cells for the HO purpose. Value s1 corresponds to 1 second, s2 corresponds to 2 seconds and so on. Value min1 corresponds to 1 minute, value min1s20 corresponds to 1 minute and 20 seconds, value min1s40 corresponds to 1 minute and 40 seconds and so on. Value hr1 corresponds to 1 hour, hr1min30 corresponds to 1 hour and 30 minutes and so on.</td>
</tr>
</tbody>
</table>
### AS-Config field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>rrcReconfiguration</td>
<td>Contains the RRCReconfiguration configuration as generated entirely by the MN.</td>
</tr>
<tr>
<td>sourceRB-SN-Config</td>
<td>Contains the IE RadioBearerConfig as generated entirely by the SN. This field is only used when the UE is configured with SN terminated RB(s).</td>
</tr>
<tr>
<td>sourceSCG-Configured</td>
<td>Value true indicates that the UE is configured with NR or EUTRA SCG in source configuration. The field is only used in NR-DC and NE-DC and is included only if the fields sourceSCG-NR-Config and sourceSCG-EUTRA-Config are absent.</td>
</tr>
<tr>
<td>sourceSCG-EUTRA-Config</td>
<td>Contains the current dedicated SCG configuration in RRCConnectionReconfiguration message as specified in TS 36.331 [10] and generated entirely by the SN. In this version of the specification, the E-UTRA RRCConnectionReconfiguration message can only include the field scg-Configuration. This field is only used in NE-DC.</td>
</tr>
<tr>
<td>sourceSCG-NR-Config</td>
<td>Contains the current dedicated SCG configuration in RRCReconfiguration message as generated entirely by the SN. In this version of the specification, the RRCReconfiguration message can only include fields secondaryCellGroup and measConfig. This field is only used in NR-DC.</td>
</tr>
</tbody>
</table>

### AS-Context field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>configRestrictInfoDAPS</td>
<td>Includes fields for which source cell explicitly indicates the restriction to be observed by target cell during DAPS handover.</td>
</tr>
<tr>
<td>needForGapsInfoNR</td>
<td>Includes measurement gap requirement information of the UE for NR target bands.</td>
</tr>
<tr>
<td>selectedBandCombinationSN</td>
<td>Indicates the band combination selected by SN in (NG)EN-DC, NE-DC, and NR-DC.</td>
</tr>
<tr>
<td>sidelinkUEInformationEUTRA</td>
<td>This field includes SidelinkUEInformation IE as specified in TS 36.331 [10].</td>
</tr>
<tr>
<td>sidelinkUEInformationNR</td>
<td>This field includes SidelinkUEInformationNR IE.</td>
</tr>
<tr>
<td>ueAssistanceInformation</td>
<td>Includes for each UE assistance feature the information last reported by the UE, if any.</td>
</tr>
<tr>
<td>ueAssistanceInformationSCG</td>
<td>Includes for each UE assistance feature associated with the SCG, the information last reported by the UE in the NR UEAssistanceInformation message for the SCG, if any.</td>
</tr>
</tbody>
</table>

### RRM-Config field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>candidateCellInfoList</td>
<td>A list of the best cells on each frequency for which measurement information was available.</td>
</tr>
<tr>
<td>candidateCellInfoListSN-EUTRA</td>
<td>A list of EUTRA cells including serving cells and best neighbour cells on each serving frequency, for which measurement results were available. This field is only used in NE-DC.</td>
</tr>
</tbody>
</table>

### Conditional Presence

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HO</td>
<td>The field is mandatory present in case of handover within NR or UE context retrieval, e.g. in case of resume or re-establishment. The field is optionally present in case of handover from E-UTRA/5GC. Otherwise the field is absent.</td>
</tr>
<tr>
<td>HO2</td>
<td>The field is optionally present in case of handover within NR; otherwise the field is absent.</td>
</tr>
</tbody>
</table>
NOTE 1: The following table indicates per source RAT whether RAT capabilities are included or not:

<table>
<thead>
<tr>
<th>Source RAT</th>
<th>NR capabilities</th>
<th>E-UTRA capabilities</th>
<th>MR-DC capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>May be included if UE Radio Capability ID as specified in 23.502 [43] is used for the UE. Included otherwise.</td>
<td>May be included</td>
<td>May be included</td>
</tr>
<tr>
<td>E-UTRAN</td>
<td>May be included if UE Radio Capability ID as specified in 23.502 [43] is used for the UE. Included otherwise.</td>
<td>May be included</td>
<td>May be included</td>
</tr>
</tbody>
</table>

NOTE 2: The following table indicates, in case of inter-RAT handover from E-UTRA, which additional IEs are included or not:

<table>
<thead>
<tr>
<th>Source system</th>
<th>sourceConfig</th>
<th>rrm-Config</th>
<th>as-Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-UTRA/EPC</td>
<td>Not included</td>
<td>May be included</td>
<td>Not included</td>
</tr>
<tr>
<td>E-UTRA/5GC</td>
<td>May be included, but only radioBearerConfig is included in the RRCReconfiguration.</td>
<td>May be included</td>
<td>Not included</td>
</tr>
</tbody>
</table>

---

**CG-Config**

This message is used to transfer the SCG radio configuration as generated by the SgNB or SeNB. It can also be used by a CU to request a DU to perform certain actions, e.g. to request the DU to perform a new lower layer configuration.

Direction: Secondary gNB or eNB to master gNB or eNB, alternatively CU to DU.

**CG-Config message**

```
-- ASN1START
-- TAG-CG-CONFIG-START
CG-Config ::= SEQUENCE {
  criticalExtensions CHOICE {
    c1 CHOICE{
      cg-Config CG-Config-IEs, spare3 NULL, spare2 NULL, spare1 NULL
    },
    criticalExtensionsFuture SEQUENCE {}}
}
CG-Config-IEs ::= SEQUENCE {
  scg-CellGroupConfig OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL,
  scg-RB-Config OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL,
  configRestrictModReq ConfigRestrictModReqSCG OPTIONAL,
  drx-InfoSCG DRX-Info OPTIONAL,
  candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,
}
```
measConfigSN                          MeasConfigSN                                      OPTIONAL,
selectedBandCombination              BandCombinationInfoSN                                OPTIONAL,
fr-InfoListSN                         FR-InfoListSN                                       OPTIONAL,
candidateServingFreqListNR            CandidateServingFreqListNR                           OPTIONAL,
nonCriticalExtension                 CG-Config-v1540-IEs                                     OPTIONAL
}

CG-Config-v1540-IEs ::=             SEQUENCE {
apSCellFrequency                     ARFCN-ValueNR                                       OPTIONAL,
reportCGI-RequestNR                 SEQUENCE {
requestedCellInfo                   SEQUENCE {
ssbFrequency                        ARFCN-ValueNR,
cellForWhichToReportCGI             PhysCellId   }
}                                                                               OPTIONAL
}                                                                                   OPTIONAL,
ph-InfoSCG                          PH-TypeListSCG                                  OPTIONAL,
nonCriticalExtension                CG-Config-v1560-IEs                                     OPTIONAL
}

CG-Config-v1560-IEs ::=             SEQUENCE {
apSCellFrequencyEUTRA                ARFCN-ValueEUTRA                                OPTIONAL, 
scc-CellGroupConfigEUTRA            OCTET STRING                                    OPTIONAL,
candidateCellInfoListSN-EUTRA       OCTET STRING                                    OPTIONAL,
candidateServingFreqListEUTRA       CandidateServingFreqListEUTRA                   OPTIONAL, 
needForGaps                         ENUMERATED {true}                               OPTIONAL, 
drx-ConfigSCG                        DRA-Config                                       OPTIONAL, 
reportCGI-RequestEUTRA              SEQUENCE {
requestedCellInfoEUTRA              SEQUENCE {
eutraFrequency                             ARFCN-ValueEUTRA,
cellForWhichToReportCGI-EUTRA              EUTRA-PhysCellId   }
}                                                                               OPTIONAL
}                                                                                   OPTIONAL,
nonCriticalExtension                CG-Config-v1590-IEs                                     OPTIONAL
}

CG-Config-v1590-IEs ::=             SEQUENCE {
sccellFrequenciesSN-NR             SEQUENCE (SIZE (1.. maxNrofServingCells-1)) OF ARFCN-ValueNR    OPTIONAL,
sccellFrequenciesSN-EUTRA            SEQUENCE (SIZE (1.. maxNrofServingCells-1)) OF ARFCN-ValueEUTRA    OPTIONAL,
nonCriticalExtension                CG-Config-v1610-IEs                                                    OPTIONAL
}

CG-Config-v1610-IEs ::=             SEQUENCE {
drx-InfoSCG2                        DRX-Info2                                      OPTIONAL, 
nonCriticalExtension                CG-Config-v1620-IEs                                     OPTIONAL
}

CG-Config-v1620-IEs ::=             SEQUENCE {
ueAssistanceInformationSCG-r16      OCTET STRING (CONTAINING UEAssistanceInformation) OPTIONAL,
nonCriticalExtension                CG-Config-v1630-IEs                                     OPTIONAL
}

CG-Config-v1630-IEs ::=             SEQUENCE {
selectedToffset-r16                 T-Offset-r16                                        OPTIONAL,
nonCriticalExtension                SEQUENCE {}                                        OPTIONAL
}
PH-TypeListSCG ::=  SEQUENCE {SIZE (1..maxNrofServingCells)} OF PH-InfoSCG

PH-InfoSCG ::=  SEQUENCE {
    servCellIndex       ServCellIndex,
    ph-Uplink           PH-UplinkCarrierSCG,
    ph-SupplementaryUplink PH-UplinkCarrierSCG OPTIONAL,
    ...
}

PH-UplinkCarrierSCG ::=  SEQUENCE{
    ph-Type1or3         ENUMERATED {type1, type3},
    ...
}

MeasConfigSN ::=  SEQUENCE {
    measuredFrequenciesSN SEQUENCE {SIZE (1..maxMeasFreqsSN)} OF NR-FreqInfo OPTIONAL,
    ...
}

NR-FreqInfo ::=  SEQUENCE {
    measuredFrequency    ARFCN-ValueNR OPTIONAL,
    ...
}

ConfigRestrictModReqSCG ::=  SEQUENCE {
    requestedBC-MRDC     BandCombinationInfoSN OPTIONAL,
    requestedP-MaxFR1    P-Max OPTIONAL,
    ...
    [
        requestedPDCCH-BlindDetectionSCG INTEGER (1..15) OPTIONAL,
        requestedP-MaxEUTRA     P-Max OPTIONAL
    ],
    [
        requestedP-MaxFR2-r16   P-Max OPTIONAL,
        requestedMaxInterFreqMeasIdSCG-r16 INTEGER (1..maxMeasIdentitiesMN) OPTIONAL,
        requestedMaxIntraFreqMeasIdSCG-r16 INTEGER (1..maxMeasIdentitiesMN) OPTIONAL,
        requestedToffset-r16    T-Offset-r16 OPTIONAL
    ]
}

BandCombinationIndex ::= INTEGER (1..maxBandComb)

BandCombinationInfoSN ::=  SEQUENCE {
    bandCombinationIndex    BandCombinationIndex,
    requestedFeatureSets    FeatureSetEntryIndex
}

FR-InfoList ::=  SEQUENCE {SIZE (1..maxNrofServingCells-1)} OF FR-Info

FR-Info ::=  SEQUENCE {
    servCellIndex       ServCellIndex,
    fr-Type             ENUMERATED {fr1, fr2}
CandidateServingFreqListNR ::= SEQUENCE (SIZE (1.. maxFreqIDC-MRDC)) OF ARFCN-ValueNR

CandidateServingFreqListEUTRA ::= SEQUENCE (SIZE (1.. maxFreqIDC-MRDC)) OF ARFCN-ValueEUTRA

T-Offset-r16 ::= ENUMERATED {ms0dot5, ms0dot75, ms1, ms1dot5, ms2, ms2dot5, ms3, spare1}
<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>candidateCellInfoListSN</strong></td>
<td>Contains information regarding cells that the source secondary node suggests the target secondary gNB to consider configuring.</td>
</tr>
<tr>
<td><strong>candidateCellInfoListSN-EUTRA</strong></td>
<td>Includes the <code>MeasResultList3EUTRA</code> as specified in TS 36.331 [10]. Contains information regarding cells that the source secondary node suggests the target secondary eNB to consider configuring. This field is only used in NE-DC.</td>
</tr>
<tr>
<td><strong>candidateServingFreqListNR, candidateServingFreqListEUTRA</strong></td>
<td>Indicates frequencies of candidate serving cells for In-Device Co-existence Indication (see TS 36.331 [10]).</td>
</tr>
<tr>
<td><strong>configRestrictModReq</strong></td>
<td>Used by SN to request changes to SCG configuration restrictions previously set by MN to ensure UE capabilities are respected. E.g. can be used to request configuring an NR band combination whose use MN has previously forbidden.</td>
</tr>
<tr>
<td><strong>drx-ConfigSCG</strong></td>
<td>This field contains the complete DRX configuration of the SCG. This field is only used in NR-DC.</td>
</tr>
<tr>
<td><strong>drx-InfoSCG</strong></td>
<td>This field contains the DRX long and short cycle configuration of the SCG. This field is used in (NG)EN-DC and NE-DC.</td>
</tr>
<tr>
<td><strong>drx-InfoSCG2</strong></td>
<td>This field contains the <code>drx-onDurationTimer</code> configuration of the SCG. This field is only used in (NG)EN-DC.</td>
</tr>
<tr>
<td><strong>fr-InfoListSCG</strong></td>
<td>Contains information of FR information of serving cells that include PScell and SCells configured in SCG.</td>
</tr>
<tr>
<td><strong>measuredFrequenciesSN</strong></td>
<td>Used by SN to indicate a list of frequencies measured by the UE.</td>
</tr>
<tr>
<td><strong>needForGaps</strong></td>
<td>In NE-DC, indicates whether the SN requests gNB to configure measurements gaps.</td>
</tr>
<tr>
<td><strong>ph-InfoSCG</strong></td>
<td>Power headroom information in SCG that is needed in the reception of PHR MAC CE of MCG</td>
</tr>
<tr>
<td><strong>ph-SupplementaryUplink</strong></td>
<td>Power headroom information for supplementary uplink. In the case of (NG)EN-DC and NR-DC, this field is only present when two UL carriers are configured for a serving cell and one UL carrier reports type 1 PH while the other reports type 3 PH.</td>
</tr>
<tr>
<td><strong>ph-Type1or3</strong></td>
<td>Type of power headroom for a certain serving cell in SCG (PSCell and activated SCells). Value <code>type1</code> refers to type 1 power headroom, value <code>type3</code> refers to type 3 power headroom. (See TS 38.321 [3]).</td>
</tr>
<tr>
<td><strong>ph-Uplink</strong></td>
<td>Power headroom information for uplink.</td>
</tr>
<tr>
<td><strong>pSCellFrequency, pSCellFrequencyEUTRA</strong></td>
<td>Indicates the frequency of PSCell in NR (i.e., <code>pSCellFrequency</code>) or E-UTRA (i.e., <code>pSCellFrequencyEUTRA</code>). In this version of the specification, <code>pSCellFrequency</code> is not used in NE-DC whereas <code>pSCellFrequencyEUTRA</code> is only used in NE-DC.</td>
</tr>
<tr>
<td><strong>reportCGI-RequestNR, reportCGI-RequestEUTRA</strong></td>
<td>Used by SN to indicate to MN about configuring reportCGI procedure. The request may optionally contain information about the cell for which SN intends to configure reportCGI procedure. In this version of the specification, the <code>reportCGI-RequestNR</code> is used in (NG)EN-DC and NR-DC whereas <code>reportCGI-RequestEUTRA</code> is used only for NE-DC.</td>
</tr>
<tr>
<td><strong>requestedBC-MRDC</strong></td>
<td>Used to request configuring a band combination and corresponding feature sets which are forbidden to use by MN (i.e. outside of the <code>allowedBC-ListMRDC</code>) to allow renegotiation of the UE capabilities for SCG configuration.</td>
</tr>
<tr>
<td><strong>requestedMaxInterFreqMeasIdSCG</strong></td>
<td>Used to request the maximum number of allowed measurement identities to configure for inter-frequency measurement. This field is only used in NR-DC.</td>
</tr>
</tbody>
</table>
### requestedMaxIntraFreqMeasIdSCG
Used to request the maximum number of allowed measurement identities to configure for intra-frequency measurement on each serving frequency.

### requestedPDCCH-BlindDetectionSCG
Requested value of the reference number of cells for PDCCH blind detection allowed to be configured for the SCG.

### requestedP-MaxEUTRA
Requested value for the maximum power for the serving cells the UE can use in E-UTRA SCG. This field is only used in NE-DC.

### requestedP-MaxFR1
Requested value for the maximum power for the serving cells on frequency range 1 (FR1) in this secondary cell group (see TS 38.104 [12]) the UE can use in NR SCG.

### requestedP-MaxFR2
Requested value for the maximum power for the serving cells on frequency range 2 (FR2) in this secondary cell group the UE can use in NR SCG. This field is only used in NR-DC.

### requestedToffset
Requests the new value for the time offset restriction used by the SN for scheduling SCG transmissions (i.e. $T_{\text{max}}^\text{SCG}$, see TS 38.213 [13]). This field is used in NR-DC only when the fields nrdc-PC-mode-FR1-r16 or nrdc-PC-mode-FR2-r16 are set to dynamic. Value ms0.5 corresponds to 0.5 ms, value ms0.75 corresponds to 0.75 ms, value ms1 corresponds to 1 ms and so on.

### scellFrequenciesSN-EUTRA, scellFrequenciesSN-NR
Indicates the frequency of all SCells configured in SCG. The field scellFrequenciesSN-EUTRA is used in NE-DC; the field scellFrequenciesSN-NR is used in (NG)EN-DC and NR-DC. In (NG)EN-DC, the field is optionally provided to the MN.

### scg-CellGroupConfig
Contains the RRCReconfiguration message (containing only secondaryCellGroup and/or measConfig and/or otherConfig and/or conditionalReconfiguration and/or bap-Config and/or lab-IP-AddressConfigurationList):
- to be sent to the UE, used upon SCG establishment or modification, as generated (entirely) by the (target) SgNB. In this case, the SN sets the RRCReconfiguration message in accordance with clause 6 e.g. regarding the "Need" or "Cond" statements.

  or

- including the current SCG configuration of the UE, when provided in response to a query from MN, or in SN triggered SN change in order to enable delta signaling by the target SN. In this case, the SN sets the RRCReconfiguration message in accordance with clause 11.2.3.

The field is absent if neither SCG (re)configuration nor SCG configuration query nor SN triggered SN change is performed, e.g. at inter-node capability/configuration coordination which does not result in SCG (re)configuration towards the UE. This field is not applicable in NE-DC.

### scg-CellGroupConfigEUTRA
Includes the E-UTRA RRCConnectionReconfiguration message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field scg-Configuration:
- to be sent to the UE, used to (re-)configure the SCG configuration upon SCG establishment or modification, as generated (entirely) by the (target) SeNB. In this case, the SN sets the scg-Configuration within the EUTRA RRCConnectionReconfiguration message in accordance with clause 6 in TS 36.331 [10] e.g. regarding the "Need" or "Cond" statements.

  or

- including the current SCG configuration of the UE, when provided in response to a query from MN, or in SN triggered SN change in order to enable delta signalling by the target SN.

The field is absent if neither SCG (re)configuration nor SCG configuration query nor SN triggered SN change is performed, e.g. at inter-node capability/configuration coordination which does not result in SCG (re)configuration towards the UE. This field is only used in NE-DC.
**scg-RB-Config**
Contains the IE `RadioBearerConfig`:
- to be sent to the UE, used to (re-)configure the SCG RB configuration upon SCG establishment or modification, as generated (entirely) by the (target) SgNB or SeNB. In this case, the SN sets the `RadioBearerConfig` in accordance with clause 6, e.g. regarding the “Need” or “Cond” statements.

or

- including the current SCG RB configuration of the UE, when provided in response to a query from MN or in SN triggered SN change or in SN triggered SN release or bearer type change between SN terminated bearer to MN terminated bearer in order to enable delta signaling by the MN or target SN. In this case, the SN sets the `RadioBearerConfig` in accordance with clause 11.2.3.

The field is absent if neither SCG (re)configuration nor SCG configuration query nor SN triggered SN change nor SN triggered SN release is performed, e.g. at inter-node capability/configuration coordination which does not result in SCG RB (re)configuration.

**selectedBandCombination**
Indicates the band combination selected by SN in (NG)EN-DC, NE-DC, and NR-DC. The SN should inform the MN with this field whenever the band combination and/or feature set it selected for the SCG changes (i.e. even if the new selection concerns a band combination and/or feature set that is allowed by the `allowedBC-List(MRDC)`).

**selectedToffset**
Indicates the value used by the SN for scheduling SCG transmissions (i.e. $T_{\text{max}}^{\text{SCG}}$, see TS 38.213 [13]). This field is used in NR-DC only when the fields `nrdc-PC-mode-FR1-r16` or `nrdc-PC-mode-FR2-r16` are set to dynamic. The SN can only indicate a value that is less than or equal to $T_{\text{max}}$Toffset received from MN. This field is used in NR-DC only when MN has included the field $T_{\text{max}}$Toffset in `CG-ConfigInfo`. Value `ms0dot5` corresponds to 0.5 ms, value `ms0dot75` corresponds to 0.75 ms, value `ms1` corresponds to 1 ms and so on.

**ueAssistanceInformationSCG**
Includes for each UE assistance feature associated with the SCG, the information last reported by the UE in the NR `UEAssistanceInformation` message for the SCG, if any.

<table>
<thead>
<tr>
<th>BandCombinationInfoSN field descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bandCombinationIndex</strong></td>
</tr>
</tbody>
</table>
| In case of NR-DC, this field indicates the position of a band combination in the `supportedBandCombinationList`. In case of NE-DC, this field indicates the position of a band combination in the `supportedBandCombinationList` and/or `supportedBandCombinationListNEDC-Only`. In case of (NG)EN-DC, this field indicates the position of a band combination in the `supportedBandCombinationList` and/or `supportedBandCombinationList-UplinkTxSwitch`. Band combination entries in `supportedBandCombinationList` are referred by an index which corresponds to the position of a band combination in the `supportedBandCombinationList`. Band combination entries in `supportedBandCombinationListNEDC-Only` are referred by an index which corresponds to the position of a band combination in the `supportedBandCombinationListNEDC-Only` increased by the number of entries in `supportedBandCombinationList`. Band combination entries in `supportedBandCombinationList-UplinkTxSwitch` are referred by an index which corresponds to the position of a band combination in the `supportedBandCombinationList-UplinkTxSwitch` increased by the number of entries in `supportedBandCombinationList`.

| **requestedFeatureSets**                 |
| The position in the `FeatureSetCombination` which identifies one `FeatureSetUplink/Downlink` for each band entry in the associated band combination |

---

**CG-ConfigInfo**
This message is used by master eNB or gNB to request the SgNB or SeNB to perform certain actions e.g. to establish, modify or release an SCG. The message may include additional information e.g. to assist the SgNB or SeNB to set the SCG configuration. It can also be used by a CU to request a DU to perform certain actions, e.g. to establish, or modify an MCG or SCG.

Direction: Master eNB or gNB to secondary gNB or eNB, alternatively CU to DU.
**CG-ConfigInfo message**

```plaintext
CG-ConfigInfo ::= SEQUENCE {
  criticalExtensions CHOICE {
    ci CHOICE{
      cg-ConfigInfo CG-ConfigInfo-IEs,
      spare3 NULL, spare2 NULL, spare1 NULL
    },
    criticalExtensionsFuture SEQUENCE {}
  }
}

CG-ConfigInfo-IEs ::= SEQUENCE {
  ue-CapabilityInfo OCTET STRING (CONTAINING UE-CapabilityRAT-ContainerList) OPTIONAL,
  candidateCellInfoListMN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,
  candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,
  measResultCellListSFTD-NR OCTET STRING (CONTAINING MeasResultCellListSFTD-NR) OPTIONAL,
  scgFailureInfo SEQUENCE {
    failureType ENUMERATED { t310-Expiry, randomAccessProblem,
      rlc-MaxNumRetx, synchReconfigFailure-SCG,
      scg-reconfigFailure, sr3-IntegrityFailure },
    measResultSCG OCTET STRING (CONTAINING MeasResultSCG-Failure) OPTIONAL,
  } OPTIONAL,
  configRestrictInfo ConfigRestrictInfoSCG OPTIONAL,
  drx-InfoMCG DRX-Info OPTIONAL,
  measConfigMN MeasConfigMN OPTIONAL,
  sourceConfigSCG OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL,
  scg-RB-Config OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL,
  mrgc-AssistanceInfo MRDC-AssistanceInfo OPTIONAL,
  nonCriticalExtension CG-ConfigInfo-v1540-IEs OPTIONAL
}

CG-ConfigInfo-v1540-IEs ::= SEQUENCE {
  ph-InfoMCG PH-TypeListMCG OPTIONAL,
  measResultReportCGI SEQUENCE {
    ssbFrequency ARFCN-ValueNR OPTIONAL,
    cellForWhichToReportCGI PhysCellId OPTIONAL,
  } OPTIONAL,
  nonCriticalExtension CG-ConfigInfo-v1560-IEs OPTIONAL
}

CG-ConfigInfo-v1560-IEs ::= SEQUENCE {
  candidateCellInfoListMN-EUTRA OCTET STRING OPTIONAL,
  candidateCellInfoListSN-EUTRA OCTET STRING OPTIONAL,
  sourceConfigSCG-EUTRA OCTET STRING OPTIONAL,
  scgFailureInfoEUTRA SEQUENCE {
    failureTypeEUTRA ENUMERATED { t313-Expiry, randomAccessProblem,
      rlc-MaxNumRetx, scg-ChangeFailure },
  } OPTIONAL
}
```

---

ETSI
measResultSCG-EUTRA \hspace{1cm} \text{OCTET STRING} \hspace{1cm} \text{OPTIONAL},

drx-ConfigMCG \hspace{1cm} \text{DRX-Config} \hspace{1cm} \text{OPTIONAL},

measResultReportCGI-EUTRA \hspace{1cm} \text{SEQUENCE} \hspace{1cm} \text{OPTIONAL},

eutraFrequency \hspace{1cm} \text{ARFCN-ValueEUTRA},
cellForWhichToReportCGI-EUTRA \hspace{1cm} \text{EUTRA-PhysCellId},
cgi-InfoEUTRA \hspace{1cm} \text{CGI-InfoEUTRA}

measResultCellListSFTD-EUTRA \hspace{1cm} \text{MeasResultCellListSFTD-EUTRA} \hspace{1cm} \text{OPTIONAL},

fr-InfoListMCG \hspace{1cm} \text{FR-InfoList} \hspace{1cm} \text{OPTIONAL},
nonCriticalExtension \hspace{1cm} \text{CG-ConfigInfo-v1570-IEs} \hspace{1cm} \text{OPTIONAL}

CG-ConfigInfo-v1570-IEs ::= \text{SEQUENCE} \\
\text{sftdFrequencyList-NR} \hspace{1cm} \text{SFTD-FrequencyList-NR} \hspace{1cm} \text{OPTIONAL},
\text{sftdFrequencyList-EUTRA} \hspace{1cm} \text{SFTD-FrequencyList-EUTRA} \hspace{1cm} \text{OPTIONAL},
nonCriticalExtension \hspace{1cm} \text{CG-ConfigInfo-v1590-IEs} \hspace{1cm} \text{OPTIONAL}

CG-ConfigInfo-v1590-IEs ::= \text{SEQUENCE} \\
\text{servFrequenciesMN-NR} \hspace{1cm} \text{SEQUENCE} \{\text{SIZE (1.. maxNrofServingCells-1)}\} \hspace{1cm} \text{OF ARFCN-ValueNR} \hspace{1cm} \text{OPTIONAL},
nonCriticalExtension \hspace{1cm} \text{CG-ConfigInfo-v1610-IEs} \hspace{1cm} \text{OPTIONAL}

CG-ConfigInfo-v1610-IEs ::= \text{SEQUENCE} \\
drx-InfoMCG2 \hspace{1cm} \text{DRX-Info2} \hspace{1cm} \text{OPTIONAL},
alignedDRX-Indication \hspace{1cm} \text{ENUMERATED} \{\text{true}\} \hspace{1cm} \text{OPTIONAL},
scgFailureInfo-r16 \hspace{1cm} \text{SEQUENCE} \hspace{1cm} \text{OPTIONAL},
\text{failureType-r16} \hspace{1cm} \text{ENUMERATED} \{\text{scg-1btFailure-r16, beamFailureRecoveryFailure-r16, t312-Expiry-r16, bh-RLF-r16, spare4, spare3, spare2, spare1}\},
\text{measResultSCG-r16} \hspace{1cm} \text{OCTET STRING} \hspace{1cm} \text{(CONTAINING MeasResultSCG-Failure)}

scgFailureInfoEUTRA-r16 \hspace{1cm} \text{SEQUENCE} \hspace{1cm} \text{OPTIONAL},
\text{failureTypeEUTRA-r16} \hspace{1cm} \text{ENUMERATED} \{\text{scg-1btFailure-r16, beamFailureRecoveryFailure-r16, t312-Expiry-r16, bh-RLF-r16, spare4, spare3, spare2, spare1}\},
\text{measResultSCG-EUTRA-r16} \hspace{1cm} \text{OCTET STRING} \hspace{1cm} \text{(OPTIONAL),}

sidelinkUEInformationNR-r16 \hspace{1cm} \text{OCTET STRING} \hspace{1cm} \text{(OPTIONAL),}
sidelinkUEInformationEUTRA-r16 \hspace{1cm} \text{OCTET STRING} \hspace{1cm} \text{(OPTIONAL),}
nonCriticalExtension \hspace{1cm} \text{CG-ConfigInfo-v1620-IEs} \hspace{1cm} \text{OPTIONAL}

CG-ConfigInfo-v1620-IEs ::= \text{SEQUENCE} \\
\text{ueAssistanceInformationSourceSCG-r16} \hspace{1cm} \text{OCTET STRING} \hspace{1cm} \text{(OPTIONAL),}
nonCriticalExtension \hspace{1cm} \text{SEQUENCE} \{\text{OPTIONAL}

SFTD-FrequencyList-NR ::= \text{SEQUENCE} \{\text{SIZE (1..maxCellSFTD)}\} \hspace{1cm} \text{OF ARFCN-ValueNR}

SFTD-FrequencyList-EUTRA ::= \text{SEQUENCE} \{\text{SIZE (1..maxCellSFTD)}\} \hspace{1cm} \text{OF ARFCN-ValueEUTRA}

ConfigRestrictInfoSCG ::= \text{SEQUENCE} \{
allowedBC-ListMRDC  BandCombinationInfoList  OPTIONAL,

powerCoordination-FR1  
  SEQUENCE { 
    p-maxNR-FR1  P-Max  OPTIONAL, 
    p-maxLTE-TA  P-Max  OPTIONAL, 
    p-maxUE-FR1  P-Max  OPTIONAL, 
  }  OPTIONAL, 

servCellIndexRangeSCG  SEQUENCE { 
  lowBound  ServCellIndex, 
  upBound  ServCellIndex 
}  OPTIONAL, -- Cond SN-AddMod 

maxMeasFreqsSCG  INTEGER(1..maxMeasFreqsMN)  OPTIONAL, 
dummy  INTEGER(1..maxMeasIdentitiesMN)  OPTIONAL, 
...,

selectedBandEntriesMNList  SEQUENCE (SIZE (1..maxBandComb)) OF SelectedBandEntriesMN  OPTIONAL, 
pdcch-BlindDetectionSCG  INTEGER (1..15)  OPTIONAL, 
maxNumberROHC-ContextSessionsSN  INTEGER(0..16384)  OPTIONAL, 
[[], 
  maxIntraFreqMeasIdentitiesSCG  INTEGER(1..maxMeasIdentitiesMN)  OPTIONAL, 
  maxInterFreqMeasIdentitiesSCG  INTEGER(1..maxMeasIdentitiesMN)  OPTIONAL, 
],
[[], 
  p-maxNR-FR1-MCG-r16  P-Max  OPTIONAL, 
powerCoordination-FR2-r16  SEQUENCE { 
  p-maxNR-FR2-MCG-r16  P-Max  OPTIONAL, 
  p-maxNR-FR2-SCG-r16  P-Max  OPTIONAL, 
  p-maxUE-FR2-r16  P-Max  OPTIONAL, 
}  OPTIONAL, 

nrdc-PC-mode-FR1-r16  ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic}  OPTIONAL, 
nrdc-PC-mode-FR2-r16  ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic}  OPTIONAL, 
maxMeasSRS-ResourceSCG-r16  INTEGER (0..maxNrofSRS-Resources-r16)  OPTIONAL, 
maxMeasCLI-ResourceSCG-r16  INTEGER (0..maxNrofCLI-RSSI-Resources-r16)  OPTIONAL, 
maxNumberEHC-ContextsSN-r16  INTEGER (0..65536)  OPTIONAL, 
allowedReducedConfigForOverheating-r16  OverheatingAssistance  OPTIONAL, 
maxToffset-r16  T-Offset-r16  OPTIONAL, 
}

SelectedBandEntriesMN ::=  SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandEntryIndex 

BandEntryIndex ::=  INTEGER (0..maxNrofServingCells) 

PH-TypeListMCG ::=  SEQUENCE (SIZE (1..maxNrofServingCells)) OF PH-InfoMCG 

PH-InfoMCG ::=  SEQUENCE { 
  servCellIndex  ServCellIndex, 
  ph-Uplink  PH-UplinkCarrierMCG, 
  ph-SupplementaryUplink  PH-UplinkCarrierMCG 
  
}  OPTIONAL, 

PH-UplinkCarrierMCG ::=  SEQUENCE{ 
  ph-Typeor3  ENUMERATED {type1, type3}, 

}
BandCombinationInfoList ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationInfo

BandCombinationInfo ::= SEQUENCE {
  bandCombinationIndex  BandCombinationIndex,
  allowedFeatureSetsList SEQUENCE (SIZE (1..maxFeatureSetsPerBand)) OF FeatureSetEntryIndex
}

FeatureSetEntryIndex ::= INTEGER (1..maxFeatureSetsPerBand)

DRX-Info ::= SEQUENCE {
  drx-LongCycleStartOffset  CHOICE {
    ms10  INTEGER (0..9),
    ms20  INTEGER (0..19),
    ms32  INTEGER (0..31),
    ms40  INTEGER (0..39),
    ms60  INTEGER (0..59),
    ms64  INTEGER (0..63),
    ms70  INTEGER (0..69),
    ms80  INTEGER (0..79),
    ms128 INTEGER (0..127),
    ms160 INTEGER (0..159),
    ms256 INTEGER (0..255),
    ms320 INTEGER (0..319),
    ms512 INTEGER (0..511),
    ms640 INTEGER (0..639),
    ms1024 INTEGER (0..1023),
    ms1280 INTEGER (0..1279),
    ms2048 INTEGER (0..2047),
    ms2560 INTEGER (0..2559),
    ms5120 INTEGER (0..5119),
    ms10240 INTEGER (0..10239)
  },
  shortDRX  SEQUENCE {
    drx-ShortCycle ENUMERATED  {
      ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms14, ms16, ms20, ms30, ms32,
      ms35, ms40, ms64, ms80, ms128, ms160, ms256, ms320, ms512, ms640, spares9,
      spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 },
    drx-ShortCycleTimer INTEGER (1..16)
  }
}

DRX-Info2 ::= SEQUENCE {
  drx-onDurationTimer  CHOICE {
    subMilliSeconds  INTEGER (1..31),
    milliSeconds ENUMERATED {
      ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60,
      ms80, ms100, ms200, ms300, ms400, ms500, ms600, ms800, ms1000, ms1200,
      ms1600, spares8, spares7, spares6, spares5, spares4, spares3, spares2, spares1 }
  }
}
MeasConfigMN ::= SEQUENCE {
  measuredFrequenciesMN SEQUENCE (SIZE (1..maxMeasFreqsMN)) OF NR-FreqInfo OPTIONAL,
  measGapConfig SetupRelease { GapConfig } OPTIONAL,
  gapPurpose ENUMERATED {perUE, perFR1} OPTIONAL,
  ...
  measGapConfigFR2 SetupRelease { GapConfig } OPTIONAL
}

MRDC-AssistanceInfo ::= SEQUENCE {
  affectedCarrierFreqCombInfoListMRDC SEQUENCE (SIZE (1..maxNrofCombIDC)) OF AffectedCarrierFreqCombInfoMRDC,
  ...
  overheatingAssistanceSCG-r16 OCTET STRING (CONTAINING OverheatingAssistance) OPTIONAL
}

AffectedCarrierFreqCombInfoMRDC ::= SEQUENCE {
  victimSystemType VictimSystemType,
  interferenceDirectionMRDC ENUMERATED {eutra-nr, nr, other, utra-nr-other, nr-other, spare3, spare2, spare1},
  affectedCarrierFreqCombMRDC SEQUENCE {
    affectedCarrierFreqCombEUTRA AffectedCarrierFreqCombEUTRA OPTIONAL,
    affectedCarrierFreqCombNR AffectedCarrierFreqCombNR OPTIONAL
  }
}

VictimSystemType ::= SEQUENCE {
  gps ENUMERATED {true} OPTIONAL,
  glonass ENUMERATED {true} OPTIONAL,
  bds ENUMERATED {true} OPTIONAL,
  galileo ENUMERATED {true} OPTIONAL,
  wlan ENUMERATED {true} OPTIONAL,
  bluetooth ENUMERATED {true} OPTIONAL
}

AffectedCarrierFreqCombEUTRA ::= SEQUENCE (SIZE (1..maxNrofServingCellsEUTRA)) OF ARFCN-ValueEUTRA

AffectedCarrierFreqCombNR ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF ARFCN-ValueNR

-- TAG-CG-CONFIG-INFO-STOP
-- ASN1STOP
This field is signalled upon MN triggered CGI reporting by the UE that requires aligned DRX configurations between the MCG and the SCG (i.e. same DRX cycle and on-duration configured by MN completely contains on-duration configured by SN).

- A list of indices referring to band combinations in MR-DC capabilities from which SN is allowed to select the SCG band combination. Each entry refers to:
  - a band combination numbered according to supportedBandCombinationList and supportedBandCombinationList-UplinkTxSwitch in the UE-MRDC-Capability (in case of (NG)EN-DC), or according to supportedBandCombinationList and supportedBandCombinationList-EN-DC-Only in the UE-MRDC-Capability (in case of NE-DC), or according to supportedBandCombinationList in the UE-NR-Capability (in case of NR-DC),
  - and the Feature Sets allowed for each band entry. All MR-DC band combinations indicated by this field comprise the MCG band combination, which is a superset of the MCG band(s) selected by MN.

Indicates the reduced configuration that the SCG is allowed to configure.

- reducedMaxCCs in allowedReducedConfigForOverheating indicates the maximum number of downlink/uplink PSCell/SCells that the SCG is allowed to configure. This field is used in (NG)EN-DC and NR-DC.
- reducedMaxBW-FR1 and reducedMaxBW-FR2 in allowedReducedConfigForOverheating indicates the maximum aggregated bandwidth across all downlink/uplink carriers of FR1 and FR2, respectively that the SCG is allowed to configure. This field is only used in NR-DC.
- reducedMaxMIMO-LayersFR1 and reducedMaxMIMO-LayersFR2 in allowedReducedConfigForOverheating indicates the maximum number of downlink/uplink MIMO layers of each serving cell operating on FR1 and FR2, respectively that the SCG is allowed to configure. This field is only used in NR-DC.

Contains information regarding cells that the master node or the source node suggests the target gNB or DU to consider configuring.

For (NG)EN-DC, including CSI-RS measurement results in candidateCellInfoListMN is not supported in this version of the specification. For NR-DC, including SSB and/or CSI-RS measurement results in candidateCellInfoListMN is supported.

Includes the MeasResultList3EUTRA as specified in TS 36.331 [10]. Contains information regarding cells that the master node or the source node suggests the target secondary eNB to consider configuring. These fields are only used in NE-DC.

Includes fields for which SgNB is explicitly indicated to observe a configuration restriction.

This field contains the complete DRX configuration of the MCG. This field is only used in NR-DC.

This field contains the DRX long and short cycle configuration of the MCG. This field is used in (NG)EN-DC and NE-DC.

This field contains the drx-onDurationTimer configuration of the MCG and a DRX alignment indication. This field is only used in (NG)EN-DC.

Contains information of FR information of serving cells that include PCell and SCell(s) configured in MCG.

This field is not used in the specification and SN ignores the received value.

Indicates the maximum number of allowed measurement identities that the SCG is allowed to configure for inter-frequency measurement. The maximum value for this field is 10. If the field is absent, the SCG is allowed to configure inter-frequency measurements up to the maximum value. This field is only used in NR-DC.

Indicates the maximum number of allowed measurement identities that the SCG is allowed to configure for intra-frequency measurement on each serving frequency. The maximum value for this field is 9 (in case of (NG)EN-DC or NR-DC) or 10 (in case of NE-DC). If the field is absent, the SCG is allowed to configure intra-frequency measurements up to the maximum value on each serving frequency.

Indicates the maximum number of CLI RSSI resources that the SCG is allowed to configure.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxMeasFREQsSCG</td>
<td>Indicates the maximum number of NR inter-frequency carriers the SN is allowed to configure with PScell for measurements.</td>
</tr>
<tr>
<td>maxMeasRES-RSCResourceSCG</td>
<td>Indicates the maximum number of SRS resources that the SCG is allowed to configure for CLI measurement.</td>
</tr>
<tr>
<td>maxNumberROHC-ContextSessionsSN</td>
<td>Indicates the maximum number of ROHC context sessions allowed to SN terminated bearer, excluding context sessions that leave all headers uncompressed.</td>
</tr>
<tr>
<td>maxNumberEHC-ContextsSN</td>
<td>Indicates the maximum number of EHC contexts allowed to the SN terminated bearer. The field indicates the number of contexts in addition to CID = &quot;all zeros&quot;, as specified in TS 38.323 [5].</td>
</tr>
<tr>
<td>maxTofset</td>
<td>Indicates the maximum Tofset value the SN is allowed to use for scheduling SCG transmissions (see TS 38.213 [13]). This field is used in NR-DC only when the fields nrdc-PC-mode-FR1-r16 or nrdc-PC-mode-FR2-r16 are set to dynamic. Value ms0dot5 corresponds to 0.5 ms, value ms0dot75 corresponds to 0.75 ms, value ms1 corresponds to 1 ms and so on.</td>
</tr>
<tr>
<td>measuredFrequenciesMN</td>
<td>Used by MN to indicate a list of frequencies measured by the UE.</td>
</tr>
<tr>
<td>measGapConfig</td>
<td>Indicates the FR1 and perUE measurement gap configuration configured by MN.</td>
</tr>
<tr>
<td>measGapConfigFR2</td>
<td>Indicates the FR2 measurement gap configuration configured by MN.</td>
</tr>
<tr>
<td>mcg-RB-Config</td>
<td>Contains all of the fields in the IE RadioBearerConfig used in MCG, used by the SN to support delta configuration to UE, for bearer type change between MN terminated bearer with NR PDCP to SN terminated bearer. It is also used to indicate the PDCP duplication related information for MN terminated split bearer (whether duplication is configured and if so, whether it is initially activated) in SN Addition/Modification procedure. Otherwise, this field is absent.</td>
</tr>
<tr>
<td>measResultReportCGI, measResultReportCGI-EUTRA</td>
<td>Used by MN to provide SN with CGI-Info for the cell as per SN's request. In this version of the specification, the measResultReportCGI is used for (NG)EN-DC and NR-DC and the measResultReportCGI-EUTRA is used only for NE-DC.</td>
</tr>
<tr>
<td>measResultSCG-EUTRA</td>
<td>This field includes the MeasResultSCG-FailureMRDC IE as specified in TS 36.331 [10]. This field is only used in NE-DC.</td>
</tr>
<tr>
<td>measResultSF-TD-EUTRA</td>
<td>SFTD measurement results between the PCell and the E-UTRA PScell in NE-DC. This field is only used in NE-DC.</td>
</tr>
<tr>
<td>nrdc-AssistanceInfo</td>
<td>Contains the IDC assistance information for MR-DC reported by the UE (see TS 36.331 [10]).</td>
</tr>
<tr>
<td>nrdc-PC-mode-FR1</td>
<td>Indicates the uplink power sharing mode that the UE uses in NR-DC FR1 (see TS 38.213 [13], clause 7.6).</td>
</tr>
<tr>
<td>nrdc-PC-mode-FR2</td>
<td>Indicates the uplink power sharing mode that the UE uses in NR-DC FR2 (see TS 38.213 [13], clause 7.6).</td>
</tr>
<tr>
<td>overheatingAssistanceSCG</td>
<td>Contains the UE's preference on reduced configuration for NR SCG to address overheating. This field is only used in (NG)EN-DC.</td>
</tr>
<tr>
<td>p-maxEUTRA</td>
<td>Indicates the maximum total transmit power to be used by the UE in the E-UTRA cell group (see TS 36.104 [33]). This field is used in (NG)EN-DC and NE-DC.</td>
</tr>
<tr>
<td>p-maxNR-FR1</td>
<td>Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 1 (FR1) (see TS 38.104 [12]). The field is used in (NG)EN-DC and NE-DC.</td>
</tr>
<tr>
<td>p-maxUE-FR1</td>
<td>Indicates the maximum total transmit power to be used by the UE across all serving cells in frequency range 1 (FR1).</td>
</tr>
</tbody>
</table>
**p-maxNR-FR1-MCG**
Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 1 (FR1) (see TS 38.104 [12]) the UE can use in NR MCG. This field is only used in NR-DC.

**p-maxNR-FR2-SCG**
Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 2 (FR2) (see TS 38.104 [12]) the UE can use in NR SCG.

**p-maxUE-FR2**
Indicates the maximum total transmit power to be used by the UE across all serving cells in frequency range 2 (FR2).

**p-maxNR-FR2-MCG**
Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 2 (FR2) (see TS 38.104 [12]) the UE can use in NR MCG.

**pdcch-BlindDetectionSCG**
Indicates the maximum value of the reference number of cells for PDCCH blind detection allowed to be configured for the SCG.

**ph-InfoMCG**
Power headroom information in MCG that is needed in the reception of PHR MAC CE in SCG.

**ph-SupplementaryUplink**
Power headroom information for supplementary uplink. For UE in (NG)EN-DC, this field is absent.

**ph-Type1or3**
Type of power headroom for a serving cell in MCG (PCell and activated SCells). *type1* refers to type 1 power headroom, *type3* refers to type 3 power headroom. (See TS 38.321 [3]).

**ph-Uplink**
Power headroom information for uplink.

**powerCoordination-FR1**
Indicates the maximum power that the UE can use in FR1.

**powerCoordination-FR2**
Indicates the maximum power that the UE can use in frequency range 2 (FR2). This field is only used in NR-DC.

**scgFailureInfo**
Contains SCG failure type and measurement results. In case the sender has no measurement results available, the sender may include one empty entry (i.e. without any optional fields present) in measResultPerMOList. This field is used in (NG)EN-DC and NR-DC.

**scgFailureInfoEUTRA**
Contains SCG failure type and measurement results of the EUTRA secondary cell group. This field is only used in NE-DC.

**scg-RB-Config**
Contains all of the fields in the IE RadioBearerConfig used in SCG, used to allow the target SN to use delta configuration to the UE, e.g. during SN change. The field is signalled upon change of SN. Otherwise, the field is absent. This field is also absent when master eNB uses full configuration option.

**selectedBandEntriesMNList**
A list of indices referring to the position of a band entry selected by the MN, in each band combination entry in allowedBC-ListMRDC IE. BandEntryIndex 0 identifies the first band in the bandList of the BandCombination, BandEntryIndex 1 identifies the second band in the bandList of the BandCombination, and so on. This selectedBandEntriesMNList includes the same number of entries, and listed in the same order as in allowedBC-ListMRDC. The SN uses this information to determine which bands out of the NR band combinations in allowedBC-ListMRDC it can configure in SCG. This field is only used in NR-DC.

**servCellIndexRangeSCG**
Range of serving cell indices that SN is allowed to configure for SCG serving cells.

**servFrequenciesMN-NR**
Indicates the frequency of all serving cells that include PCell and SCCell(s) configured in MCG. This field is only used in NR-DC.

**sftdFrequencyList-NR**
Includes a list of SSB frequencies. Each entry identifies the SSB frequency of a PSCell, which corresponds to one MeasResultCellSFTD-NR entry in the MeasResultCellListSFTD-NR.
**stdFrequencyList-EUTRA**
Includes a list of E-UTRA frequencies. Each entry identifies the carrier frequency of a PSCell, which corresponds to one *MeasResultSFTD-EUTRA* entry in the *MeasResultCellListSFTD-EUTRA*.

**sidelinkUEInformationEUTRA**
This field contains the E-UTRA *SidelinkUEInformation* message as specified in TS 36.331 [10].

**sidelinkUEInformationNR**
This field contains the NR *SidelinkUEInformationNR* message.

**sourceConfigSCG**
Includes all of the current SCG configurations used by the target SN to build delta configuration to be sent to UE, e.g. during SN change. The field contains the *RRCReconfiguration* message, i.e. including *secondaryCellGroup* and *measConfig*. The field is signalled upon change of SN, unless MN uses full configuration option. Otherwise, the field is absent.

**sourceConfigSCG-EUTRA**
Includes the E-UTRA *RRCConnectionReconfiguration* message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field *scg-Configuration*. In this version of the specification, this field is absent when master gNB uses full configuration option. This field is only used in NE-DC.

**ueAssistanceInformationSourceSCG**
Includes for each UE assistance feature associated with the SCG, the information last reported by the UE in the NR *UEAssistanceInformation* message for the source SCG, if any.

**ue-CapabilityInfo**
Contains the IE *UE-CapabilityRAT-ContainerList* supported by the UE (see NOTE 3). A gNB that retrieves MRDC related capability containers ensures that the set of included MRDC containers is consistent w.r.t. the feature set related information.

---

**BandCombinationInfo** field descriptions

**allowedFeatureSetsList**
Defines a subset of the entries in a *FeatureSetCombination*. Each index identifies a position in the *FeatureSetCombination*, which corresponds to one *FeatureSetUplink*/*Downlink* for each band entry in the associated band combination.

**bandCombinationIndex**
In case of NR-DC, this field indicates the position of a band combination in the *supportedBandCombinationList*. In case of NE-DC, this field indicates the position of a band combination in the *supportedBandCombinationList* and/or *supportedBandCombinationListNEDC-Only*. In case of (NG)EN-DC, this field indicates the position of a band combination in the *supportedBandCombinationList* and/or *supportedBandCombinationList-UplinkTxSwitch*. Band combination entries in *supportedBandCombinationList* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationList*. Band combination entries in *supportedBandCombinationListNEDC-Only* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationListNEDC-Only* increased by the number of entries in *supportedBandCombinationList*. Band combination entries in *supportedBandCombinationList-UplinkTxSwitch* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationList-UplinkTxSwitch* increased by the number of entries in *supportedBandCombinationList*.

---

<table>
<thead>
<tr>
<th>Conditional Presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SN-AddMod</td>
<td>The field is mandatory present upon SN addition and SN change. It is optionally present upon SN modification and inter-MN handover without SN change. Otherwise, the field is absent.</td>
</tr>
</tbody>
</table>

NOTE 3: The following table indicates per MN RAT and SN RAT whether RAT capabilities are included or not in *ue-CapabilityInfo*.
---

**MeasurementTimingConfiguration**

The MeasurementTimingConfiguration message is used to convey assistance information for measurement timing.

Direction: en-gNB to eNB, eNB to en-gNB, gNB to gNB, ng-eNB to gNB, gNB to ng-eNB, ng-eNB to ng-eNB, gNB DU to gNB CU, and gNB CU to gNB DU.

**MeasurementTimingConfiguration message**

```asn1
-- ASN1START
-- TAG-MEASUREMENT-TIMING-CONFIGURATION-START
MeasurementTimingConfiguration ::= SEQUENCE {
  criticalExtensions                      CHOICE {
    c1                                      CHOICE{
      measTimingConf                          MeasurementTimingConfiguration-IEs,
                                               MeasurementTimingConfiguration-v1550-IEs,
                                               MeasurementTimingConfiguration-v1610-IEs
    },
    criticalExtensionsFuture        SEQUENCE {}     }
  MeasurementTimingConfiguration-IEs ::=  SEQUENCE {
    measTiming                              MeasTimingList                                      OPTIONAL,
    nonCriticalExtension                    MeasurementTimingConfiguration-v1550-IEs            OPTIONAL
  }
  MeasurementTimingConfiguration-v1550-IEs ::= SEQUENCE {
    campOnFirstSSB                               BOOLEAN,
    psCellOnlyOnFirstSSB                         BOOLEAN,
    nonCriticalExtension                         MeasurementTimingConfiguration-v1610-IEs       OPTIONAL
  }
  MeasurementTimingConfiguration-v1610-IEs ::=  SEQUENCE {
    csi-RS-Config-r16                             SEQUENCE {
      csi-RS-SubcarrierSpacing-r16                 SubcarrierSpacing,
    }
  }
-- ASN1END
```
MeasTimingList ::= SEQUENCE (SIZE (1..maxMeasFreqsMN)) OF MeasTiming

MeasTiming ::= SEQUENCE {
  frequencyAndTiming          SEQUENCE {
    carrierFreq                  ARFCN-ValueNR,
    ssbSubcarrierSpacing         SubcarrierSpacing,
    ssb-MeasurementTimingConfig  SSB-MTC,
    ss-RSSI-Measurement          SS-RSSI-Measurement
  }
}

MeasTiming field descriptions

<table>
<thead>
<tr>
<th>field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>carrierFreq, ssbSubcarrierSpacing</td>
<td>Indicates the frequency and subcarrier spacing of the SS block of the cell for which this message is included, or of other SS blocks within the same carrier.</td>
</tr>
<tr>
<td>ssb-MeasurementTimingConfig</td>
<td>Indicates the SMTC which can be used to search for SSB of the cell for which the message is included. When the message is included in &quot;Served NR Cell Information&quot; (see TS 36.423 [37]), &quot;Served Cell Information NR&quot; (see TS 38.423 [35]), or &quot;Served Cell Information&quot; (see TS 38.473 [36]), the timing is based on the cell for which the message is included. When the message is included in &quot;NR Neighbour Information&quot; (see TS 36.423 [37]), or &quot;Served Cell Information&quot; (see TS 38.423 [35]), the timing is based on the cell indicated in the &quot;Served NR Cell Information&quot; or &quot;Served Cell Information NR&quot; with which the &quot;NR Neighbour Information&quot; or &quot;Neighbour Information NR&quot; is provided. When the message is included in &quot;CU to DU RRC Information&quot;, the timing is based on the cell indicated by SpCell ID with which the message is included.</td>
</tr>
<tr>
<td>ss-RSSI-Measurement</td>
<td>Provides the configuration which can be used for RSSI measurements of the cell for which the message is included.</td>
</tr>
</tbody>
</table>
MeasurementTimingConfiguration field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>campOnFirstSSB</td>
<td>Value <code>true</code> indicates that the SSB indicated in the first instance of <code>MeasTiming</code> in the <code>measTiming</code> list can be used for camping and for a PCell configuration (i.e. in <code>spCellConfigCommon</code> of the <code>masterCellGroup</code>).</td>
</tr>
<tr>
<td>csi-RS-CellMobility</td>
<td>Indicates the CSI-RS configuration of the cell for which this message is included. The timing of the CSI-RS resources is based on the SSB indicated by <code>refSSBFreq</code>.</td>
</tr>
<tr>
<td>csi-RS-SubcarrierSpacing</td>
<td>Indicates the subcarrier spacing of the CSI-RS resources included in <code>csi-rs-CellMobility</code>.</td>
</tr>
<tr>
<td>measTiming</td>
<td>A list of SMTC information, SSB RSSI measurement information and associated NR frequency exchanged via EN-DC X2 Setup, EN-DC Configuration Update, Xn Setup and NG-RAN Node Configuration Update procedures, or F1 messages between gNB DU and gNB CU.</td>
</tr>
<tr>
<td>physCellId</td>
<td>Physical Cell Identity of the SSB on the ARFCN indicated by <code>carrierFreq</code>.</td>
</tr>
<tr>
<td>psCellOnlyOnFirstSSB</td>
<td>Value <code>true</code> indicates that only the SSB indicated in the first instance of <code>MeasTiming</code> in the <code>measTiming</code> list can be used for a PSCell configuration (i.e. in <code>spCellConfigCommon</code> of the <code>secondaryCellGroup</code>).</td>
</tr>
<tr>
<td>ssb-ToMeasure</td>
<td>The set of SS blocks to be measured within the SMTC measurement duration (see TS 38.215 [9]).</td>
</tr>
</tbody>
</table>

---

**UERadioPagingInformation**

This message is used to transfer radio paging information, covering both upload to and download from the 5GC, and between gNBs.

Direction: gNB to/ from 5GC and gNB to/from gNB

**UERadioPagingInformation message**

```
UERadioPagingInformation ::= SEQUENCE {
    criticalExtensions                  CHOICE {
        c1                                  CHOICE{
            ueRadioPagingInformation            UERadioPagingInformation-IEs,
            spare7 NULL,
            spare6 NULL, spare5 NULL, spare4 NULL,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture            SEQUENCE {}}
}

UERadioPagingInformation-IEs ::=    SEQUENCE {     supportedBandListNRForPaging        SEQUENCE (SIZE (1..maxBands)) OF FreqBandIndicatorNR    OPTIONAL,     nonCriticalExtension                SEQUENCE {}     OPTIONAL }
```
**UERadioPagingInformation field descriptions**

**supportedBandListNRForPaging**
Indicates the UE supported NR frequency bands which are derived by the gNB from **UE-NR-Capability**.

---

**UERadioAccessCapabilityInformation**

This message is used to transfer UE radio access capability information, covering both upload to and download from the 5GC.

Direction: ng-eNB or gNB to/ from 5GC

**UERadioAccessCapabilityInformation message**

---

**UERadioAccessCapabilityInformation** ::= SEQUENCE {
  criticalExtensions                  CHOICE {
    c1                                  CHOICE{             ueRadioAccessCapabilityInformation    UERadioAccessCapabilityInformation-IEs,
    spare7 NULL,
    spare6 NULL, spare5 NULL, spare4 NULL,
    spare3 NULL, spare2 NULL, spare1 NULL
  },
  criticalExtensionsFuture            SEQUENCE {}                                                   OPTIONAL
}

**UERadioAccessCapabilityInformation-IEs** ::= SEQUENCE {
  ue-RadioAccessCapabilityInfo               OCTET STRING (CONTAINING UE-CapabilityRAT-ContainerList),
  nonCriticalExtension                       SEQUENCE {}                                                   OPTIONAL
}

---

**UERadioAccessCapabilityInformation-IEs field descriptions**

**ue-RadioAccessCapabilityInfo**
Including NR, MR-DC, E-UTRA radio access capabilities. A gNB that retrieves MRDC related capability containers ensures that the set of included MRDC containers is consistent w.r.t. the feature set related information.
11.2.3 Mandatory information in inter-node RRC messages

For the AS-Config transferred within the HandoverPreparationInformation:

- The source node shall include all fields necessary to reflect the AS configuration of the UE, except for the fields sourceSCG-NR-Config, sourceSCG-EUTRA-Config and sourceeB-RB-SN-Config, which can be omitted in case the source MN did not receive the latest configuration from the source SN. For RRCReconfiguration included in the field rrcReconfiguration, ReconfigurationWithSync is included with only the mandatory subfields (e.g. newUE-Identity and t304) and ServingCellConfigCommon;

- Need codes or conditions specified for subfields according to IEs defined in clause 6 do not apply. I.e. some fields shall be included regardless of the "Need" or "Cond" e.g. discardTimer;

- Based on the received AS configuration, the target node can indicate the delta (difference) to the UE's AS configuration (as included in HandoverCommand). The fields newUE-Identity and t304 included in ReconfigurationWithSync are not used for delta configuration purpose.

The candidateCellInfoListSN(-EUTRA) in CG-Config and the candidateCellInfoListMN(-EUTRA)/candidateCellInfoListSN(-EUTRA) in CG-ConfigInfo need not be included in procedures that do not involve a change of node.

For a field that conveys the UE configuration in CG-Config (SN initiated change of SN configuration, or SCG configuration query) and in CG-ConfigInfo upon change of SN (i.e. mcg-RB-Config, scg-RB-Config and sourceConfigSCG):

- The source node shall include all fields necessary to reflect the AS configuration of the UE, unless stated otherwise in the field description or in this sub-clause. For RRCReconfiguration included in the field scg-CellGroupConfig in CG-Config, ReconfigurationWithSync is included with only the mandatory subfields (e.g. newUE-Identity and t304) and ServingCellConfigCommon;

- Need codes or conditions specified for subfields according to IEs defined in clause 6 do not apply;

- Based on the received AS configuration, the target node can indicate the delta (difference) to the UE's AS configuration (as included in CG-Config). The fields newUE-Identity and t304 included in ReconfigurationWithSync are not used for delta configuration purpose.

For the other fields in CG-Config and CG-ConfigInfo, the sender shall always signal the appropriate value even if same as indicated in the previous RRC INM, unless explicitly stated otherwise. As an exception to this general rule, the absence of the below listed fields means that the receiver maintains the values informed via the previous message. Note that every time there is a change in the configuration covered by a listed field, the MN shall include the field and it shall provide the full configuration provided by that field. Otherwise, if there is no change, the field can be omitted:

- configRestrictInfo;
- gapPurpose;
- measGapConfig (for which delta signaling applies);
- measGapConfigFR2 (for which delta signaling applies);
- measResultCellListSFTD;
- measResultSFTD-EUTRA;
11.3 Inter-node RRC information element definitions

-  

11.4 Inter-node RRC multiplicity and type constraint values

-- ASN1START
-- TAG-NR-MULTIPLICITY-AND-CONSTRAINTS-START

maxMeasFreqsMN INTEGER ::= 32  -- Maximum number of MN-configured measurement frequencies
maxMeasFreqsSN INTEGER ::= 32  -- Maximum number of SN-configured measurement frequencies
maxMeasIdentitiesMN INTEGER ::= 62  -- Maximum number of measurement identities that a UE can be configured with
maxCellPrep INTEGER ::= 32  -- Maximum number of cells prepared for handover

-- TAG-NR-MULTIPLICITY-AND-CONSTRAINTS-STOP
-- ASN1STOP

End of NR-InterNodeDefinitions

-- ASN1START
-- TAG-NR-INTER-NODE-DEFINITIONS-END-START
END

-- TAG-NR-INTER-NODE-DEFINITIONS-END-STOP
-- ASN1STOP
12 Processing delay requirements for RRC procedures

The UE performance requirements for RRC procedures are specified in the following tables. The performance requirement is expressed as the time in [ms] from the end of reception of the network -> UE message on the UE physical layer up to when the UE shall be ready for the reception of uplink grant for the UE -> network response message with no access delay other than the TTI-alignment (e.g. excluding delays caused by scheduling, the random access procedure or physical layer synchronisation). In case the RRC procedure triggers BWP switching, the RRC procedure delay is the value defined in the following table plus the BWP switching delay defined in TS 38.133 [14], clause 8.6.3.

![Figure 12.1-1: Illustration of RRC procedure delay](image-url)
Table 12.1-1: UE performance requirements for RRC procedures for UEs
<table>
<thead>
<tr>
<th>Procedure title:</th>
<th>Network -&gt; UE</th>
<th>UE -&gt; Network</th>
<th>Value [ms]</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RRC Connection Control Procedures</strong></td>
<td>RRCReconfiguration</td>
<td>RRCReconfigurationComplete</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>RRC reconfiguration</td>
<td>RRCReconfiguration</td>
<td>RRCReconfigurationComplete</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>RRC reconfiguration (scell addition/release)</td>
<td>RRCReconfiguration</td>
<td>RRCReconfigurationComplete</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>RRC reconfiguration (SCG establishment/ modification/ release)</td>
<td>RRCReconfiguration</td>
<td>RRCReconfigurationComplete</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>RRC setup</td>
<td>RRCSetup</td>
<td>RRCSetupComplete</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>RRC Release</td>
<td>RRCRelease</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RRC re-establishment</td>
<td>RRCReestablishment</td>
<td>RRCReestablishmentComplete</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>RRC resume</td>
<td>RRCResume</td>
<td>RRCResumeComplete</td>
<td>6 or 10</td>
<td>Value=6 applies for a UE supporting reduced CP latency for the case of RRCResume message only including MAC and PHY configuration, and no DRX, SPS, configured grant, CA or MIMO re-configuration will be triggered by this message. Further, the UL grant for transmission of RRCResumeComplete and the data is transmitted over common search space with DCI format 0_0. In this scenario, the RRC procedure delay [ms] can extend beyond the reception of the UL grant, up to 7 ms. For other cases, Value = 10 applies.</td>
</tr>
<tr>
<td>RRC resume (MCG SCell addition/restoration/release)</td>
<td>RRCResume</td>
<td>RRCResumeComplete</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>RRC resume (SCG establishment/ restoration/release)</td>
<td>RRCResume</td>
<td>RRCResumeComplete</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Procedure title</td>
<td>Network -&gt; UE</td>
<td>UE -&gt; Network</td>
<td>Value [ms]</td>
<td>Notes</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------</td>
<td>---------------</td>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td>Initial AS security activation</td>
<td>SecurityModeCommand</td>
<td>SecurityModeComplete/Security ModeFailure</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Other procedures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UE assistance information</td>
<td></td>
<td>UEAssistanceInformation</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>UE capability transfer</td>
<td>UECapabilityEnquiry</td>
<td>UECapabilityInformation</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Counter check</td>
<td>CounterCheck</td>
<td>CounterCheckResponse</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>UE information</td>
<td>UEInformationRequest</td>
<td>UEInformationResponse</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>DL Information transfer MR-DC</td>
<td>DLInformationTransferMRDC</td>
<td></td>
<td>NA</td>
<td>The UE shall apply the performance requirements of the RRC message included within the DLInformationTransferMRDC message.</td>
</tr>
<tr>
<td>IAB other information</td>
<td></td>
<td>IABOtherInformation</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Sidelink UE information</td>
<td></td>
<td>SidelinkUEInformationNR</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>
Annex A (informative): Guidelines, mainly on use of ASN.1

A.1 Introduction

The following clauses contain guidelines for the specification of RRC protocol data units (PDUs) with ASN.1.

A.2 Procedural specification

A.2.1 General principles

The procedural specification provides an overall high level description regarding the UE behaviour in a particular scenario.

It should be noted that most of the UE behaviour associated with the reception of a particular field is covered by the applicable parts of the PDU specification. The procedural specification may also include specific details of the UE behaviour upon reception of a field, but typically this should be done only for cases that are not easy to capture in the PDU clause e.g. general actions, more complicated actions depending on the value of multiple fields.

Likewise, the procedural specification need not specify the UE requirements regarding the setting of fields within the messages that are sent to the network i.e. this may also be covered by the PDU specification.

A.2.2 More detailed aspects

The following more detailed conventions should be used:

- Bullets:
  - Capitals should be used in the same manner as in other parts of the procedural text i.e. in most cases no capital applies since the bullets are part of the sentence starting with ‘The UE shall:’
  - All bullets, including the last one in a sub-clause, should end with a semi-colon i.e. an ‘;’.

- Conditions:
  - Whenever multiple conditions apply, a semi-colon should be used at the end of each conditions with the exception of the last one, i.e. as in ‘if cond1, or cond2.’
A.3 PDU specification

A.3.1 General principles

A.3.1.1 ASN.1 sections

The RRC PDU contents are formally and completely described using abstract syntax notation (ASN.1), see X.680 [6], X.681 [7].

The complete ASN.1 code is divided into a number of ASN.1 sections in the specifications. In order to facilitate the extraction of the complete ASN.1 code from the specification, each ASN.1 section begins with the following:

- a first text paragraph consisting entirely of an *ASN.1 start tag*, which consists of a double hyphen followed by a single space and the text string "ASN1START" (in all upper case letters);

- a second text paragraph consisting entirely of a *block start tag* is included, which consists of a double hyphen followed by a single space and the text string "TAG-NAME-START" (in all upper case letters), where the "NAME" refers to the main name of the paragraph (in all upper-case letters).

Similarly, each ASN.1 section ends with the following:

- a first text paragraph consisting entirely of a *blockstop tag*, which consists of a double hyphen followed by a single space and the text string "TAG-NAME-STOP" (in all upper-case letters), where the "NAME" refers to the main name of the paragraph (in all upper-case letters);

- a second text paragraph consisting entirely of an *ASN.1 stop tag*, which consists of a double hyphen followed by a singlespace and the text "ASN1STOP" (in all upper case letters).

This results in the following tags:

```
-- ASN1START
-- TAG-NAME-START
-- TAG-NAME-STOP
-- ASN1STOP
```

The text paragraphs containing either of the start and stop tags should not contain any ASN.1 code significant for the complete description of the RRC PDU contents. The complete ASN.1 code may be extracted by copying all the text paragraphs between an ASN.1 start tag and the following ASN.1 stop tag in the order they appear, throughout the specification.

**NOTE:** A typical procedure for extraction of the complete ASN.1 code consists of a first step where the entire RRC PDU contents description (ultimately the entire specification) is saved into a plain text (ASCII) file format, followed by a second step where the actual extraction takes place, based on the occurrence of the ASN.1 start and stop tags.
A.3.1.2 ASN.1 identifier naming conventions

The naming of identifiers (i.e., the ASN.1 field and type identifiers) should be based on the following guidelines:

- Message (PDU) identifiers should be ordinary mixed case without hyphenation. These identifiers, e.g., the \texttt{RRConnectionModificationCommand}, should be used for reference in the procedure text. Abbreviations should be avoided in these identifiers and abbreviated forms of these identifiers should not be used.

- Type identifiers other than PDU identifiers should be ordinary mixed case, with hyphenation used to set off acronyms only where an adjacent letter is a capital, e.g., \texttt{EstablishmentCause}, \texttt{SelectedPLMN} (not \texttt{Selected-PLMN}, since the "d" in "Selected" is lowercase), \texttt{InitialUE-Identity} and \texttt{MeasSFN-SFN-TimeDifference}.

- Field identifiers shall start with a lowercase letter and use mixed case thereafter, e.g., \texttt{establishmentCause}. If a field identifier begins with an acronym (which would normally be in upper case), the entire acronym is lowercase (\texttt{plmn-Identity}, not \texttt{pLMN-Identity}). The acronym is set off with a hyphen (\texttt{ue-Identity}, not \texttt{ueIdentity}), in order to facilitate a consistent search pattern with corresponding type identifiers.

- Identifiers should convey the meaning of the identifier and should avoid adding unnecessary postfixes (e.g. abstractions like 'Info') for the name.

- Identifiers that are likely to be keywords of some language, especially widely used languages, such as C++ or Java, should be avoided to the extent possible.

- Identifiers, other than PDU identifiers, longer than 25 characters should be avoided where possible. It is recommended to use abbreviations, which should be done in a consistent manner i.e. use 'Meas' instead of 'Measurement' for all occurrences. Examples of typical abbreviations are given in table A.3.1.2.1-1 below.

- \textit{For future extension:} When an extension is introduced a suffix is added to the identifier of the concerned ASN.1 field and/or type. A suffix of the form "-rX" is used, with X indicating the release, for ASN.1 fields or types introduced in a later release (i.e. a release later than the original/first release of the protocol) as well as for ASN.1 fields or types for which a revision is introduced in a later release replacing a previous version, e.g., \texttt{Foo-r9} for the Rel-9 version of the ASN.1 type \texttt{Foo}. A suffix of the form "-rXb" is used for the first revision of a field that it appears in the same release (X) as the original version of the field, "-rXc" for a second intra-release revision and so on. A suffix of the form "-vXYZ" is used for ASN.1 fields or types that only are an extension of a corresponding earlier field or type (see sub-clause A.4), e.g., \texttt{AnElement-v10b0} for the extension of the ASN.1 type \texttt{AnElement} introduced in version 10.11.0 of the specification. A number 0...9, 10, 11, etc. is used to represent the first part of the version number, indicating the release of the protocol. Lower case letters \texttt{a}, \texttt{b}, \texttt{c}, \texttt{etc.} are used to represent the second (and third) part of the version number if they are greater than 9. In the procedural specification, in field descriptions as well as in headings suffixes are not used, unless there is a clear need to distinguish the extension from the original field.

- More generally, in case there is a need to distinguish different variants of an ASN.1 field or IE, a suffix should be added at the end of the identifiers e.g. \texttt{MeasObjectUTRA}, \texttt{ConfigCommon}. When there is no particular need to distinguish the fields (e.g. because the field is included in different IEs), a common field identifier name may be used. This may be attractive e.g. in case the procedural specification is the same for the different variants.

- It should be avoided to use field identifiers with the same name within the elements of a CHOICE, including using a CHOICE inside a SEQUENCE (to avoid certain compiler errors).
Table A.3.1.2-1: Examples of typical abbreviations used in ASN.1 identifiers

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Abbreviated word</th>
</tr>
</thead>
<tbody>
<tr>
<td>Config</td>
<td>Configuration</td>
</tr>
<tr>
<td>DL</td>
<td>Downlink</td>
</tr>
<tr>
<td>Ext</td>
<td>Extension</td>
</tr>
<tr>
<td>Freq</td>
<td>Frequency</td>
</tr>
<tr>
<td>Id</td>
<td>Identity</td>
</tr>
<tr>
<td>Ind</td>
<td>Indication</td>
</tr>
<tr>
<td>Meas</td>
<td>Measurement</td>
</tr>
<tr>
<td>MIB</td>
<td>MasterInformationBlock</td>
</tr>
<tr>
<td>Neigh</td>
<td>Neighbour(ing)</td>
</tr>
<tr>
<td>Param(s)</td>
<td>Parameter(s)</td>
</tr>
<tr>
<td>Phys</td>
<td>Physical</td>
</tr>
<tr>
<td>PCI</td>
<td>Physical Cell Id</td>
</tr>
<tr>
<td>Proc</td>
<td>Process</td>
</tr>
<tr>
<td>Reconfig</td>
<td>Reconfiguration</td>
</tr>
<tr>
<td>Reest</td>
<td>Re-establishment</td>
</tr>
<tr>
<td>Req</td>
<td>Request</td>
</tr>
<tr>
<td>Rx</td>
<td>Reception</td>
</tr>
<tr>
<td>Sched</td>
<td>Scheduling</td>
</tr>
<tr>
<td>SIB</td>
<td>SystemInformationBlock</td>
</tr>
<tr>
<td>Sync</td>
<td>Synchronisation</td>
</tr>
<tr>
<td>Thr</td>
<td>Threshold</td>
</tr>
<tr>
<td>Tx</td>
<td>Transmission</td>
</tr>
<tr>
<td>UL</td>
<td>Uplink</td>
</tr>
</tbody>
</table>

NOTE: The table A.3.1.2.1-1 is not exhaustive. Additional abbreviations may be used in ASN.1 identifiers when needed.

A.3.1.3 Text references using ASN.1 identifiers

A text reference into the RRC PDU contents description from other parts of the specification is made using the ASN.1 field identifier of the referenced type. The ASN.1 field and type identifiers used in text references should be in the italic font style. The "do not check spelling and grammar" attribute in Word should be set. Quotation marks (i.e., "") should not be used around the ASN.1 field or type identifier.

A reference to an RRC PDU should be made using the corresponding ASN.1 field identifier followed by the word "message", e.g., a reference to the RRCRelease message.

A reference to a specific part of an RRC PDU, or to a specific part of any other ASN.1 type, should be made using the corresponding ASN.1 field identifier followed by the word "field", e.g., a reference to the prioritisedBitRate field in the example below.

-- /example/ ASN1START

LogicalChannelConfig ::= SEQUENCE {
  ul-SpecificParameters SEQUENCE {
    priority Priority,
  }
...
NOTE: All the ASN.1 start tags in the ASN.1 sections, used as examples in this annex to the specification, are deliberately distorted, in order not to include them when the ASN.1 description of the RRC PDU contents is extracted from the specification.

A reference to a specific type of information element should be made using the corresponding ASN.1 type identifier preceded by the acronym "IE", e.g., a reference to the IE LogicalChannelConfig in the example above.

References to a specific type of information element should only be used when those are generic, i.e., without regard to the particular context wherein the specific type of information element is used. If the reference is related to a particular context, e.g., an RRC PDU type (message) wherein the information element is used, the corresponding field identifier in that context should be used in the text reference.

A reference to a specific value of an ASN.1 field should be made using the corresponding ASN.1 value without using quotation marks around the ASN.1 value, e.g., 'if the status field is set to value true'.

### A.3.2 High-level message structure

Within each logical channel type, the associated RRC PDU (message) types are alternatives within a CHOICE, as shown in the example below.

--- /example/ ASN1START

DL-DCCH-Message ::= SEQUENCE {
  message                 DL-DCCH-MessageType
}

DL-DCCH-MessageType ::= CHOICE {
  c1                      CHOICE {
    dlInformationTransfer                   DLInformationTransfer,
    handoverFromEUTRAPreparationRequest     HandoverFromEUTRAPreparationRequest,
    mobilityFromEUTRACommand               MobilityFromEUTRACommand,
    rrcConnectionReconfiguration           RRCConnectionReconfiguration,
    rrcConnectionRelease                  RRCConnectionRelease,
    securityModeCommand                   SecurityModeCommand,
    ueCapabilityEnquiry                   UECapabilityEnquiry,
    sparel NULL,
  },
  messageClassExtension   SEQUENCE {}
}

--- ASN1STOP
A nested two-level CHOICE structure is used, where the alternative PDU types are alternatives within the inner level c1 CHOICE.

Spare alternatives (i.e., spare1 in this case) may be included within the c1 CHOICE to facilitate future extension. The number of such spare alternatives should not extend the total number of alternatives beyond an integer-power-of-two number of alternatives (i.e., eight in this case).

Further extension of the number of alternative PDU types is facilitated using the messageClassExtension alternative in the outer level CHOICE.

### A.3.3 Message definition

Each PDU (message) type is specified in an ASN.1 section similar to the one shown in the example below.

```asn1
    RRCConnectionReconfiguration ::= SEQUENCE {
        rrConnectionTransactionIdentifier RRC-TransactionIdentifier,
        criticalExtensions CHOICE {
            c1 CHOICE {
                rrConnectionReconfiguration-r8 RRCConnectionReconfiguration-r8-IEs,
                spare3 NULL, spare2 NULL, spare1 NULL
            },
            criticalExtensionsFuture SEQUENCE {}
        }
    }
```

Hooks for critical and non-critical extension should normally be included in the PDU type specification. How these hooks are used is further described in sub-clause A.4.

Critical extensions are characterised by a redefinition of the PDU contents and need to be governed by a mechanism for protocol version agreement between the encoder and the decoder of the PDU, such that the encoder is prevented from sending a critically extended version of the PDU type, which is not comprehended by the decoder.

Critical extension of a PDU type is facilitated by a two-level CHOICE structure, where the alternative PDU contents are alternatives within the inner level c1 CHOICE. Spare alternatives (i.e., spare3 down to spare1 in this case) may be included within the c1 CHOICE. The number of spare alternatives to be included in the original PDU specification should be decided case by case, based on the expected rate of critical extension in the future releases of the protocol.

Further critical extension, when the spare alternatives from the original specifications are used up, is facilitated using the criticalExtensionsFuture in the outer level CHOICE.

In PDU types where critical extension is not expected in the future releases of the protocol, the inner level c1 CHOICE and the spare alternatives may be excluded, as shown in the example below.

```asn1
    RRCConnectionReconfiguration-r8-IEs ::= SEQUENCE {
        -- Enter the IEs here.
        ...
    }
```

---
RRCConnectionReconfigurationComplete ::= SEQUENCE {
  rrc-TransactionIdentifier      RRC-TransactionIdentifier,
  criticalExtensions             CHOICE {
    rrcConnectionReconfigurationComplete-r8
      RRCConnectionReconfigurationComplete-r8-IEs,
    criticalExtensionsFuture      SEQUENCE {}  
  }
}

RRCConnectionReconfigurationComplete-r8-IEs ::= SEQUENCE {
  -- Enter the fields here.  
  ...
}

Non-critical extensions are characterised by the addition of new information to the original specification of the PDU type. If not comprehended, a non-critical extension may be skipped by the decoder, whilst the decoder is still able to complete the decoding of the comprehended parts of the PDU contents.

Non-critical extensions at locations other than the end of the message or other than at the end of a field contained in a BIT or OCTET STRING are facilitated by use of the ASN.1 extension marker "...". The original specification of a PDU type should normally include the extension marker at the end of the sequence of information elements contained.

Non-critical extensions at the end of the message or at the end of a field that is contained in a BIT or OCTET STRING may be facilitated by use of an empty sequence that is marked OPTIONAL e.g. as shown in the following example:

```
-- /example/ ASN1START
RRCMessage-r8-IEs ::=                     SEQUENCE {
  field1                                 InformationElement1,
  field2                                 InformationElement2,
  nonCriticalExtension                   SEQUENCE {}                     OPTIONAL
}
-- ASN1STOP
```

The ASN.1 section specifying the contents of a PDU type may be followed by a field description table where a further description of, e.g., the semantic properties of the fields may be included. The general format of this table is shown in the example below. The field description table is absent in case there are no fields for which further description needs to be provided e.g. because the PDU does not include any fields, or because an IE is defined for each field while there is nothing specific regarding the use of this IE that needs to be specified.

<table>
<thead>
<tr>
<th>%field identifier%</th>
<th>field description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The field description table has one column. The header row shall contain the ASN.1 type identifier of the PDU type.

The following rows are used to provide field descriptions. Each row shall include a first paragraph with a field identifier (in bold and italic font style) referring to the part of the PDU to which it applies. The following paragraphs at the same row may include (in regular font style), e.g., semantic description, references to other specifications and/or specification of value units, which are relevant for the particular part of the PDU.

The parts of the PDU contents that do not require a field description shall be omitted from the field description table.

A.3.4 Information elements

Each IE (information element) type is specified in an ASN.1 section similar to the one shown in the example below.

```
-- /example/ ASN1START

PRACH-ConfigSIB ::=                     SEQUENCE {
    rootSequenceIndex                   INTEGER (0..1023),
    prach-ConfigInfo                    PRACH-ConfigInfo
}

PRACH-Config ::=                     SEQUENCE {
    rootSequenceIndex                   INTEGER (0..1023),
    prach-ConfigInfo                    PRACH-ConfigInfo                    OPTIONAL    -- Need N
}

PRACH-ConfigInfo ::=                SEQUENCE {
    prach-ConfigIndex                   ENUMERATED {ffs},
    highSpeedFlag                       ENUMERATED {ffs},
    zeroCorrelationZoneConfig           ENUMERATED {ffs}
}

-- ASN1STOP
```

IEs should be introduced whenever there are multiple fields for which the same set of values apply. IEs may also be defined for other reasons e.g. to break down a ASN.1 definition in to smaller pieces.

A group of closely related IE type definitions, like the IEs PRACH-ConfigSIB and PRACH-Config in this example, are preferably placed together in a common ASN.1 section. The IE type identifiers should in this case have a common base, defined as the generic type identifier. It may be complemented by a suffix to distinguish the different variants. The "PRACH-Config" is the generic type identifier in this example, and the "SIB" suffix is added to distinguish the variant. The sub-clause heading and generic references to a group of closely related IEs defined in this way should use the generic type identifier.

The same principle should apply if a new version, or an extension version, of an existing IE is created for critical or non-critical extension of the protocol (see sub-clause A.4). The new version, or the extension version, of the IE is included in the same ASN.1 section defining the original. A suffix is added to the type identifier, using the naming conventions defined in sub-clause A.3.1.2, indicating the release or version of the where the new version, or extension version, was introduced.

Local IE type definitions, like the IE PRACH-ConfigInfo in the example above, may be included in the ASN.1 section and be referenced in the other IE types defined in the same ASN.1 section. The use of locally defined IE types should be encouraged, as a tool to break up large and complex IE type definitions. It can improve the readability of the
code. There may also be a benefit for the software implementation of the protocol end-points, as these IE types are typically provided by the ASN.1 compiler as independent data elements, to be used in the software implementation.

An IE type defined in a local context, like the IE PRACH-ConfigInfo, should not be referenced directly from other ASN.1 sections in the RRC specification. An IE type which is referenced in more than one ASN.1 section should be defined in a separate sub-clause, with a separate heading and a separate ASN.1 section (possibly as one in a set of closely related IE types, like the IEs PRACH-ConfigSIB and PRACH-Config in the example above). Such IE types are also referred to as 'global IEs'.

NOTE: Referring to an IE type, that is defined as a local IE type in the context of another ASN.1 section, does not generate an ASN.1 compilation error. Nevertheless, using a locally defined IE type in that way makes the IE type definition difficult to find, as it would not be visible at an outline level of the specification. It should be avoided.

The ASN.1 section specifying the contents of one or more IE types, like in the example above, may be followed by a field description table, where a further description of, e.g., the semantic properties of the fields of the information elements may be included. This table may be absent, similar as indicated in sub-clause A.3.3 for the specification of the PDU type. The general format of the field description table is the same as shown in sub-clause A.3.3 for the specification of the PDU type.

A.3.5 Fields with optional presence

A field with optional presence may be declared with the keyword DEFAULT. It identifies a default value to be assumed, if the sender does not include a value for that field in the encoding:

```asn1
PreambleInfo ::= SEQUENCE {
  numberOfRA-Preambles INTEGER (1..64) DEFAULT 1,
  ...}
```

Alternatively, a field with optional presence may be declared with the keyword OPTIONAL. It identifies a field for which a value can be omitted. The omission carries semantics, which is different from any normal value of the field:

```asn1
PRACH-Config ::= SEQUENCE {
  rootSequenceIndex INTEGER (0..1023),
  prach-ConfigInfo PRACH-ConfigInfo OPTIONAL -- Need N}
```

The semantics of an optionally present field, in the case it is omitted, should be indicated at the end of the paragraph including the keyword OPTIONAL, using a short comment text with a need code. The need code includes the keyword "Need", followed by one of the predefined semantics tags (S, M, N or R) defined in sub-clause 6.1. If the semantics tag S is used, the semantics of the absent field are further specified either in the field description table following the ASN.1 section, or in procedure text.
The addition of OPTIONAL keywords for capability groups is based on the following guideline. If there is more than one field in the lower level IE, then OPTIONAL keyword is added at the group level. If there is only one field in the lower level IE, OPTIONAL keyword is not added at the group level.

A.3.6 Fields with conditional presence

A field with conditional presence is declared with the keyword OPTIONAL. In addition, a short comment text shall be included at the end of the paragraph including the keyword OPTIONAL. The comment text includes the keyword "Cond", followed by a condition tag associated with the field ("UL" in this example):

```
LogicalChannelConfig ::= SEQUENCE {
  ul-SpecificParameters
    SEQUENCE {
      priority
        INTEGER (0),
      ...
    } OPTIONAL_DGRAM  -- Cond UL
}
```

When conditionally present fields are included in an ASN.1 section, the field description table after the ASN.1 section shall be followed by a conditional presence table. The conditional presence table specifies the conditions for including the fields with conditional presence in the particular ASN.1 section.

<table>
<thead>
<tr>
<th>Conditional presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL</td>
<td>Specification of the conditions for including the field associated with the condition tag = &quot;UL&quot;. Semantics in case of optional presence under certain conditions may also be specified.</td>
</tr>
</tbody>
</table>

The conditional presence table has two columns. The first column (heading: "Conditional presence") contains the condition tag (in italic font style), which links the fields with a condition tag in the ASN.1 section to an entry in the table. The second column (heading: "Explanation") contains a text specification of the conditions and requirements for the presence of the field. The second column may also include semantics, in case of an optional presence of the field, under certain conditions i.e. using the same predefined tags as defined for optional fields in A.3.5.

Conditional presence should primarily be used when presence of a field depends on the presence and/or value of other fields within the same message. If the presence of a field depends on whether another feature/function has been configured, while this function can be configured independently e.g. by another message and/or at another point in time, the relation is best reflected by means of a statement in the field description table.

If the ASN.1 section does not include any fields with conditional presence, the conditional presence table shall not be included.

Whenever a field is only applicable in specific cases e.g. TDD, use of conditional presence should be considered.

A.3.7 Guidelines on use of lists with elements of SEQUENCE type

Where an information element has the form of a list (the SEQUENCE OF construct in ASN.1) with the type of the list elements being a SEQUENCE data type, an information element shall be defined for the list elements even if it would not otherwise be needed.
For example, a list of PLMN identities with reservation flags is defined as in the following example:

```asn1
PLMN-IdentityInfoList ::= SEQUENCE (SIZE (1..6)) OF PLMN-IdentityInfo

PLMN-IdentityInfo ::= SEQUENCE {
    plmn-Identity                  PLMN-Identity,
    cellReservedForOperatorUse     ENUMERATED {reserved, notReserved}
}
```

rather than as in the following (bad) example, which may cause generated code to contain types with unpredictable names:

```asn1
PLMN-IdentityList ::= SEQUENCE (SIZE (1..6)) OF SEQUENCE {
    plmn-Identity                  PLMN-Identity,
    cellReservedForOperatorUse     ENUMERATED {reserved, notReserved}
}
```

A.3.8 Guidelines on use of parameterised SetupRelease type

The usage of the parameterised `SetupRelease` type is like a function call in programming languages where the element type parameter is passed as a parameter. The parameterised type only implies a textual change in abstract syntax where all references to the parameterised type are replaced by the compiler with the release/setup choice. Two examples of the usage are shown below:

```asn1
RRCMessage-rX-IEs ::= SEQUENCE {
    field-rX               SetupRelease { IE-rX }                   OPTIONAL,  -- Need M
    ...
}

RRCMessage-rX-IEs ::= SEQUENCE {
    field-rX               SetupRelease { Element-rX }                   OPTIONAL,  -- Need M
}

Element-rX ::= SEQUENCE {
    field1-rX              IE1-rX,
    field2-rX              IE2-rX                                      OPTIONAL,  -- Need M
    ...
}
```

```asn1
-- /example/ ASN1STOP

```
The **SetupRelease** is always be used with only named IEs, i.e. the example below is not allowed:

```
-- /example/ ASN1START
RRCMessage-rX-IEs ::= SEQUENCE {
  field-rX       SetupRelease [ SEQUENCE [ -- Unnamed SEQUENCEs are not allowed!
    field1-rX                IE1-rX,  
    field2-rX                IE2-rX                        OPTIONAL        -- Need N
  ]
}
-- /example/ ASN1STOP
```

If a field defined using the parameterized SetupRelease type requires procedural text, the field is referred to using the values defined for the type itself, namely, "setup" and "release". For example, procedural text for field-rX above could be as follows:

1) if field-rX is set to "setup":
   
   2) do something;

1) else (field-rX is set to "release"):

   2) release field-rX (if appropriate).

### A.3.9 Guidelines on use of ToAddModList and ToReleaseList

In order to benefit from delta signalling when modifying lists with many and/or large elements, so-called add/mod- and release- lists should be used. Instead of a single list containing all elements of the list, the ASN.1 provides two lists. One list is used to convey the actual elements that are to be added to the list or modified in the list. The second list conveys only the identities (IDs) of the list elements that are to be released from the list. In other words, the ASN.1 defines only means to signal modifications to a list maintained in the receiver (typically the UE). An example is provided below:

```
-- /example/ ASN1START
AnExampleIE ::=         SEQUENCE {
  elementsToAddModList    SEQUENCE (SIZE (1..maxNrofElements)) OF Element                                     OPTIONAL,   --  Need N
  elementsToReleaseList   SEQUENCE (SIZE (1..maxNrofElements)) OF ElementId                                   OPTIONAL,   --  Need N
  ...
}

Element ::=             SEQUENCE {
  elementId               ElementId,
  aField                  INTEGER (0..16777215),
  anotherField            OCTET STRING,
  ...
}
-- /example/ ASN1STOP
```
As can be seen, the elements of the list must contain an identity (INTEGER) that identifies the elements unambiguously upon addition, modification and removal. It is recommended to define an IE for that identifier (here ElementId) so that it can be used both for a field inside the element as well as in the elementsToReleaseList.

Both lists should be made OPTIONAL and flagged as "Need N". The need code reflects that the UE does not maintain the received lists as such but rather updates its configuration using the information therein. In other words, it is not possible to provide via delta signalling an update to a previously signalled elementsToAddModList or elementsToReleaseList (which Need M would imply). The update is always in relation to the UE's internal configuration.

Note that the release of a field (a list element as well as any other field) releases all its sub-fields (sub-fields configured by elementsToAddModList and any other sub-field).

As per subclause 6.1.3, when using lists without the ToAddModList and ToReleaseList structure, the contents of the lists are always replaced. To illustrate this, an example is provided below:

```asn1
AnExampleIE ::= SEQUENCE {
  ElementId ::= INTEGER (0..maxNrofElements-1)
  maxNrofElements ::= INTEGER ::= 50
  maxNrofElements-1 INTEGER ::= 49
}
```

A.3.10 Guidelines on use of of lists (without ToAddModList and ToReleaseList)

As per subclause 6.1.3, when using lists without the ToAddModList and ToReleaseList structure, the contents of the lists are always replaced. To illustrate this, an example is provided below:

```asn1
AnExampleIE ::= SEQUENCE {
  ElementId ::= INTEGER (0..maxNrofElements-1)
  maxNrofElements ::= INTEGER ::= 50
  maxNrofElements-1 INTEGER ::= 49
}
```
As can be seen, the elementList list itself uses Need M, but each list entry Element contains mandatory, Need M and Need R fields. If the list is first signalled to UE with 3 entries, and subsequently again with 2 entries, UE shall retain only the latter list, i.e. the list with 2 elements will completely replace the list with 3 elements. That also means that the field aField will be treated as if it was newly created, i.e. network must include it if it wishes UE to utilize the field even if it was previously signalled. This also implies that the Need M field (aField) will be treated in the same way as the Need R field (anotherField), i.e. delta signalling is not applied and the network has to signal the field to ensure UE does not release the value (which is why Need M should not normally be used in the entries of these lists).

A.4 Extension of the PDU specifications

A.4.1 General principles to ensure compatibility

It is essential that extension of the protocol does not affect interoperability i.e. it is essential that implementations based on different versions of the RRC protocol are able to interoperate. In particular, this requirement applies for the following kind of protocol extensions:

- Introduction of new PDU types (i.e. these should not cause unexpected behaviour or damage).
- Introduction of additional fields in an extensible PDUs (i.e. it should be possible to ignore uncomprehended extensions without affecting the handling of the other parts of the message).
- Introduction of additional values of an extensible field of PDUs. If used, the behaviour upon reception of an uncomprehended value should be defined.

It should be noted that the PDU extension mechanism may depend on the logical channel used to transfer the message e.g. for some PDUs an implementation may be aware of the protocol version of the peer in which case selective ignoring of extensions may not be required.
The non-critical extension mechanism is the primary mechanism for introducing protocol extensions i.e. the critical extension mechanism is used merely when there is a need to introduce a 'clean' message version. Such a need appears when the last message version includes a large number of non-critical extensions, which results in issues like readability, overhead associated with the extension markers. The critical extension mechanism may also be considered when it is complicated to accommodate the extensions by means of non-critical extension mechanisms.

### A.4.2 Critical extension of messages and fields

The mechanisms to critically extend a message are defined in A.3.3. There are both "outer branch" and "inner branch" mechanisms available. The "outer branch" consists of a CHOICE having the name criticalExtensions, with two values, \( c1 \) and criticalExtensionsFuture. The criticalExtensionsFuture branch consists of an empty SEQUENCE, while the \( c1 \) branch contains the "inner branch" mechanism.

The "inner branch" structure is a CHOICE with values of the form "MessageName-\( rX \)-IEs" (e.g., "RRCConnectionReconfiguration-\( r8 \)-IEs") or "\( \text{spare}X \)", with the spare values having type NULL. The "-\( rX \)-IEs" structures contain the complete structure of the message IEs for the appropriate release; i.e., the critical extension branch for the Rel-10 version of a message includes all Rel-8 and Rel-9 fields (that are not obviated in the later version), rather than containing only the additional Rel-10 fields.

The following guidelines may be used when deciding which mechanism to introduce for a particular message, i.e. only an 'outer branch', or an 'outer branch' in combination with an 'inner branch' including a certain number of spares:

- For certain messages, e.g. initial uplink messages, messages transmitted on a broadcast channel, critical extension may not be applicable.
- An outer branch may be sufficient for messages not including any fields.
- The number of spares within inner branch should reflect the likelihood that the message will be critically extended in future releases (since each release with a critical extension for the message consumes one of the spare values). The estimation of the critical extension likelihood may be based on the number, size and changeability of the fields included in the message.
- In messages where an inner branch extension mechanism is available, all spare values of the inner branch should be used before any critical extensions are added using the outer branch.

The following example illustrates the use of the critical extension mechanism by showing the ASN.1 of the original and of a later release:

```
-- /example/ ASN1START

RRCMessage ::= SEQUENCE {
  rrc-TransactionIdentifier               RRC-TransactionIdentifier,
  criticalExtensions                      CHOICE {
    c1                                      CHOICE{
      rrcMessage-r8                           RRCMessage-r8-IEs,
      spare3 NULL, spare2 NULL, spare1 NULL
    },
    criticalExtensionsFuture                SEQUENCE {}
  }
}

-- ASN1STOP
```
It is important to note that critical extensions may also be used at the level of individual fields i.e. a field may be replaced by a critically extended version. When sending the extended version, the original version may also be included (e.g. original field is mandatory, E-UTRAN is unaware if UE supports the extended version). In such cases, a UE supporting both versions may be required to ignore the original field. The following example illustrates the use of the critical extension mechanism by showing the ASN.1 of the original and of a later release.

```
-- /example/ ASN1START                  -- Later release
RRCMessage ::=                      SEQUENCE {
  rrc-TransactionIdentifier        RRC-TransactionIdentifier,
  criticalExtensions               CHOICE {
    c1                              CHOICE{
      rrcMessage-r8               RRCMessage-r8-IEs,
      rrcMessage-r10              RRCMessage-r10-IEs,
      rrcMessage-r11              RRCMessage-r11-IEs,
      rrcMessage-r14              RRCMessage-r14-IEs
    },
    later                          CHOICE {
      c2                             CHOICE{
        rrcMessage-r16             RRCMessage-r16-IEs,
        spare7 NULL, spare6 NULL, spare5 NULL, spare4 NULL,
        spare3 NULL, spare2 NULL, spare1 NULL
      },
      criticalExtensionsFuture   SEQUENCE {}
    }
  }
}
-- /example/ ASN1STOP

-- /example/ ASN1START                  -- Original release
RRCMessage ::=                      SEQUENCE {
  rrc-TransactionIdentifier        RRC-TransactionIdentifier,
  criticalExtensions               CHOICE {
    c1                              CHOICE{
      rrcMessage-r8               RRCMessage-r8-IEs,
      spare3 NULL, spare2 NULL, spare1 NULL
    },
    criticalExtensionsFuture   SEQUENCE {}
  }
}

RRCMessage-rN-IEs ::= SEQUENCE {
  field1-rN                        ENUMERATED {
    value1, value2, value3, value4}  OPTIONAL, -- Need N
  field2-rN                        InformationElement2-rN    OPTIONAL, -- Need N
  nonCriticalExtension             RRCConnectionReconfiguration-vMxy-IEs  OPTIONAL
}

RRCConnectionReconfiguration-vMxy-IEs ::= SEQUENCE {
  field2-rM                        InformationElement2-rM    OPTIONAL, -- Cond NoField2rN
  nonCriticalExtension             SEQUENCE {}
}
Finally, it is noted that a critical extension may be introduced in the same release as the one in which the original field was introduced e.g. to correct an essential ASN.1 error. In such cases a UE capability may be introduced, to assist the network in deciding whether or not to use the critical extension.

## A.4.3 Non-critical extension of messages

### A.4.3.1 General principles

The mechanisms to extend a message in a non-critical manner are defined in A.3.3. W.r.t. the use of extension markers, the following additional guidelines apply:

- When further non-critical extensions are added to a message that has been critically extended, the inclusion of these non-critical extensions in earlier critical branches of the message should be avoided when possible.

- The extension marker ("...") is the primary non-critical extension mechanism that is used but empty sequences may be used if length determinant is not required.

Examples of cases where a length determinant is not required:

- at the end of a message;
- at the end of a structure contained in a BIT STRING or OCTET STRING.

- When an extension marker is available, non-critical extensions are preferably placed at the location (e.g. the IE) where the concerned parameter belongs from a logical/functional perspective (referred to as the 'default extension location').

- It is desirable to aggregate extensions of the same release or version of the specification into a group, which should be placed at the lowest possible level.

- In specific cases it may be preferable to place extensions elsewhere (referred to as the 'actual extension location') e.g. when it is possible to aggregate several extensions in a group. In such a case, the group should be placed at the lowest suitable level in the message. <TBD: ref to separate example>

- In case placement at the default extension location affects earlier critical branches of the message, locating the extension at a following higher level in the message should be considered.

- In case an extension is not placed at the default extension location, an IE should be defined. The IE's ASN.1 definition should be placed in the same ASN.1 section as the default extension location. In case there are intermediate levels in-between the actual and the default extension location, an IE may be defined for each level. Intermediate levels are primarily introduced for readability and overview. Hence intermediate levels need not always be introduced e.g. they may not be needed when the default and the actual extension location are within the same ASN.1 section. <TBD: ref to separate example>
A.4.3.2 Further guidelines

Further to the general principles defined in the previous section, the following additional guidelines apply regarding the use of extension markers:

- **Extension markers within SEQUENCE:**
  - Extension markers are primarily, but not exclusively, introduced at the higher nesting levels.
  - Extension markers are introduced for a SEQUENCE comprising several fields as well as for information elements whose extension would result in complex structures without it (e.g. re-introducing another list).
  - Extension markers are introduced to make it possible to maintain important information structures e.g. parameters relevant for one particular RAT.
  - Extension markers are also used for size critical messages (i.e. messages on BCCH, BR-BCCH, PCCH and CCCH), although introduced somewhat more carefully.
  - The extension fields introduced (or frozen) in a specific version of the specification are grouped together using double brackets.

- **Extension markers within ENUMERATED:**
  - Spare values may be used until the number of values reaches the next power of 2, while the extension marker caters for extension beyond that limit, given that the use of spare values in a later Release is possible without any error cases.
  - A suffix of the form “vXYZ” is used for the identifier of each new value, e.g. “value-vXYZ”.

- **Extension markers within CHOICE:**
  - Extension markers are introduced when extension is foreseen and when comprehension is not required by the receiver i.e. behaviour is defined for the case where the receiver cannot comprehend the extended value (e.g. ignoring an optional CHOICE field). It should be noted that defining the behaviour of a receiver upon receiving a not comprehended choice value is not required if the sender is aware whether or not the receiver supports the extended value.
  - A suffix of the form “vXYZ” is used for the identifier of each new choice value, e.g. “choice-vXYZ”.

Non-critical extensions at the end of a message/ of a field contained in an OCTET or BIT STRING:

- When a nonCriticalExtension is actually used, a "Need" code should not be provided for the field, which always is a group including at least one extension and a field facilitating further possible extensions. For simplicity, it is recommended not to provide a "Need" code when the field is not actually used either.

Further, more general, guidelines:

- In case a need code is not provided for a group, a "Need" code is provided for all individual extension fields within the group i.e. including for fields that are not marked as OPTIONAL. The latter is to clarify the action upon absence of the whole group.
A.4.3.3  Typical example of evolution of IE with local extensions

The following example illustrates the use of the extension marker for a number of elementary cases (sequence, enumerated, choice). The example also illustrates how the IE may be revised in case the critical extension mechanism is used.

NOTE  In case there is a need to support further extensions of release n while the ASN.1 of release (n+1) has been frozen, without requiring the release n receiver to support decoding of release (n+1) extensions, more advanced mechanisms are needed e.g. including multiple extension markers.

```asn1
-- /example/ ASN1START

InformationElement1 ::= SEQUENCE {
  field1                              ENUMERATED {
    value1, value2, value3, value4-v880,
    ..., value5-v960 },

  field2                              CHOICE {
    field2a                             BOOLEAN,
    field2b                             InformationElement2b,
    ...,
    field2c-v960                        InformationElement2c-r9
  },
  ...
  ...
  [ [ field3-r9 ] InformationElement3-r9 OPTIONAL -- Need R
  ]],
  [ [ field3-v9a0                      InformationElement3-v9a0 OPTIONAL, -- Need R
    field4-r9                          InformationElement4 OPTIONAL -- Need R
  ]]
}

InformationElement1-r10 ::= SEQUENCE {
  field1                              ENUMERATED {
    value1, value2, value3, value4-v880,
    value5-v960, value6-v1170, spare2, spare1, ...
  },

  field2                              CHOICE {
    field2a                             BOOLEAN,
    field2b                             InformationElement2b,
    field2c-v960                        InformationElement2c-r9,
    ...
    field2d-v12b0                       INTEGER (0..63)
  },
  field3-r9                           InformationElement3-r10 OPTIONAL -- Need R
  field4-r9                           InformationElement4 OPTIONAL -- Need R
  field5-r10                          BOOLEAN,
  field6-r10                          InformationElement6-r10 OPTIONAL -- Need R
  ...
  [ [ field3-v1170                     InformationElement3-v1170 OPTIONAL -- Need R
  ]]
}
-- ASN1STOP
```
Some remarks regarding the extensions of InformationElement1 as shown in the above example:

- The InformationElement1 is initially extended with a number of non-critical extensions. In release 10 however, a critical extension is introduced for the message using this IE. Consequently, a new version of the IE InformationElement1 (i.e. InformationElement1-r10) is defined in which the earlier non-critical extensions are incorporated by means of a revision of the original field.

- The value4-v880 is replacing a spare value defined in the original protocol version for field1. Likewise value6-v1170 replaces spare3 that was originally defined in the r10 version of field1.

- Within the critically extended release 10 version of InformationElement1, the names of the original fields/IEs are not changed, unless there is a real need to distinguish them from other fields/IEs. E.g. the field1 and InformationElement4 were defined in the original protocol version (release 8) and hence not tagged. Moreover, the field3-r9 is introduced in release 9 and not re-tagged; although, the InformationElement3 is also critically extended and therefore tagged InformationElement3-r10 in the release 10 version of InformationElement1.

A.4.3.4 Typical examples of non critical extension at the end of a message

The following example illustrates the use of non-critical extensions at the end of the message or at the end of a field that is contained in a BIT or OCTET STRING i.e. when an empty sequence is used.

```asn1
-- /example/ ASN1START
RRCMessage-r8-IEs ::=  SEQUENCE {
  field1                          InformationElement1,  OPTIONAL,   -- Need N
  field2                          InformationElement2,  OPTIONAL,
  field3                          InformationElement3                 OPTIONAL,   -- Need N
  nonCriticalExtension            RRCMessage-v860-IEs                 OPTIONAL
}

RRCMessage-v860-IEs ::=         SEQUENCE {
  field4-v860                     InformationElement4                 OPTIONAL,   -- Need S
  field5-v860                     BOOLEAN                             OPTIONAL,   -- Cond C54
  nonCriticalExtension            RRCMessage-v940-IEs                 OPTIONAL
}

RRCMessage-v940-IEs ::=         SEQUENCE {
  field6-v940                     InformationElement6-r9              OPTIONAL,   -- Need R
  nonCriticalExtensions            SEQUENCE {}                         OPTIONAL
}

-- ASN1STOP
```

Some remarks regarding the extensions shown in the above example:

- The InformationElement4 is introduced in the original version of the protocol (release 8) and hence no suffix is used.
A.4.3.5 Examples of non-critical extensions not placed at the default extension location

The following example illustrates the use of non-critical extensions in case an extension is not placed at the default extension location.

– **ParentIE-WithEM**

The IE `ParentIE-WithEM` is an example of a high level IE including the extension marker (EM). The root encoding of this IE includes two lower level IEs `ChildIE1-WithoutEM` and `ChildIE2-WithoutEM` which do not include the extension marker. Consequently, non-critical extensions of the Child-IEs have to be included at the level of the Parent-IE.

The example illustrates how the two extension IEs `ChildIE1-WithoutEM-vNx0` and `ChildIE2-WithoutEM-vNx0` (both in release N) are used to connect non-critical extensions with a default extension location in the lower level IEs to the actual extension location in this IE.

**ParentIE-WithEM** information element

```asn1
ParentIE-WithEM ::= SEQUENCE {
  -- Root encoding, including:
  childIE1-WithoutEM                  ChildIE1-WithoutEM              OPTIONAL, -- Need N
  childIE2-WithoutEM                  ChildIE2-WithoutEM              OPTIONAL, -- Need N
  ...,
  [[
    childIE1-WithoutEM-vNx0             ChildIE1-WithoutEM-vNx0     OPTIONAL, -- Need N
    childIE2-WithoutEM-vNx0             ChildIE2-WithoutEM-vNx0     OPTIONAL        -- Need N
  ]]
}
```

Some remarks regarding the extensions shown in the above example:

– The fields `childIEx-WithoutEM-vNx0` may not really need to be optional (depends on what is defined at the next lower level).
– In general, especially when there are several nesting levels, fields should be marked as optional only when there is a clear reason.

– **ChildIE1-WithoutEM**

The IE `ChildIE1-WithoutEM` is an example of a lower level IE, used to control certain radio configurations including a configurable feature which can be setup or released using the local IE `ChIE1-ConfigurableFeature`. The example illustrates how the new field `chIE1-NewField` is added in release N to the configuration of the configurable feature. The example is based on the following assumptions:

– When initially configuring as well as when modifying the new field, the original fields of the configurable feature have to be provided also i.e. as if the extended ones were present within the setup branch of this feature.
– When the configurable feature is released, the new field should be released also.
When omitting the original fields of the configurable feature the UE continues using the existing values (which is used to optimise the signalling for features that typically continue unchanged upon handover).

When omitting the new field of the configurable feature the UE releases the existing values and discontinues the associated functionality (which may be used to support release of unsupported functionality upon handover to an eNB supporting an earlier protocol version).

The above assumptions, which affect the use of conditions and need codes, may not always apply. Hence, the example should not be re-used blindly.

**ChildIE1-WithoutEM information element**

```
ChildIE1-WithoutEM ::= SEQUENCE {
    -- Root encoding, including:
    chIE1-ConfigurableFeature          ChIE1-ConfigurableFeature       OPTIONAL        -- Need N
}
```

```
ChildIE1-WithoutEM-vNx0 ::=     SEQUENCE {
    chIE1-ConfigurableFeature-vNx0      ChIE1-ConfigurableFeature-vNx0  OPTIONAL    -- Cond ConfigF
}
```

```
ChIE1-ConfigurableFeature ::=       CHOICE {
    release                             NULL,
    setup                               SEQUENCE {
        -- Root encoding
    }
}
```

```
ChIE1-ConfigurableFeature-vNx0 ::=  SEQUENCE {
    chIE1-NewField-rN                   INTEGER (0..31)
}
```

**Conditional presence**

<table>
<thead>
<tr>
<th>ConfigF</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The field is optional present, need R, in case of chIE1-ConfigurableFeature is included and set to “setup”; otherwise the field is absent and the UE shall delete any existing value for this field.</td>
</tr>
</tbody>
</table>

**ChildIE2-WithoutEM**

The IE **ChildIE2-WithoutEM** is an example of a lower level IE, typically used to control certain radio configurations. The example illustrates how the new field **chIE1-NewField** is added in release N to the configuration of the configurable feature.

**ChildIE2-WithoutEM information element**

```
ChildIE2-WithoutEM ::= SEQUENCE {
}
```
A.5 Guidelines regarding inclusion of transaction identifiers in RRC messages

The following rules provide guidance on which messages should include a Transaction identifier:

1: DL messages on CCCH that move UE to RRC-Idle should not include the RRC transaction identifier.
2: All network initiated DL messages by default should include the RRC transaction identifier.
3: All UL messages that are direct response to a DL message with an RRC Transaction identifier should include the RRC Transaction identifier.
4: All UL messages that require a direct DL response message should include an RRC transaction identifier.
5: All UL messages that are not in response to a DL message nor require a corresponding response from the network should not include the RRC Transaction identifier.

A.6 Guidelines regarding use of need codes

The following rule provides guidance for determining need codes for optional downlink fields:

- if the field needs to be stored by the UE (i.e. maintained) when absent:
  - use Need M (=Maintain);
- else, if the field needs to be released by the UE when absent:
  - use Need R (=Release);
- else, if UE shall take no action when the field is absent (i.e. UE does not even need to maintain any existing value of the field):
  - use Need N (=None);
- else (UE behaviour upon absence does not fit any of the above conditions):
  - use Need S (=Specified);
  - specify the UE behaviour upon absence of the field in the procedural text or in the field description table.

### A.7 Guidelines regarding use of conditions

Conditions are primarily used to specify network restrictions, for which the following types can be distinguished:

- Message Contents related constraints e.g. that a field B is mandatory present if the same message includes field A and when it is set value X.
- Configuration Constraints e.g. that a field D can only be signalled if field C is configured and set to value Y. (i.e. regardless of whether field C is present in the same message or previously configured).

The use of these conditions is illustrated by an example.

```-- /example/ ASN1START
RRCMessage-IEs ::= SEQUENCE {
  fieldA                          FieldA                  OPTIONAL,   -- Need M
  fieldB                          FieldB                  OPTIONAL,   -- Cond FieldAsetToX
  fieldC                          FieldC                  OPTIONAL,   -- Need M
  fieldD                          FieldD                  OPTIONAL,   -- Cond FieldCsetToY
  nonCriticalExtension            SEQUENCE {}             OPTIONAL
}
-- /example/ ASN1STOP```

<table>
<thead>
<tr>
<th>Conditional presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FieldAsetToX</td>
<td>The field is mandatory present if fieldA is included and set to valueX. Otherwise the field is optionally present, need R.</td>
</tr>
<tr>
<td>FieldCsetToY</td>
<td>The field is optionally present, need M, if fieldC is configured and set to valueY. Otherwise the field is absent and the UE does not maintain the value</td>
</tr>
</tbody>
</table>

### A.8 Miscellaneous

The following miscellaneous convention should be used:
- UE capabilities: TS 38.306 [26] specifies that the network should in general respect the UE's capabilities. Hence there is no need to include statement clarifying that the network, when setting the value of a certain configuration field, shall respect the related UE capabilities unless there is a particular need e.g. particularly complicated cases.
Annex B (informative): RRC Information

B.1 Protection of RRC messages

The following list provides information which messages can be sent (unprotected) prior to AS security activation and which messages can be sent unprotected after AS security activation. Those messages indicated "-" in "P" column should never be sent unprotected by gNB or UE. Further requirements are defined in the procedural text.

P…Messages that can be sent (unprotected) prior to AS security activation
A – I…Messages that can be sent without integrity protection after AS security activation
A – C…Messages that can be sent unciphered after AS security activation
NA… Message can never be sent after AS security activation
<table>
<thead>
<tr>
<th>Message</th>
<th>P</th>
<th>A-I</th>
<th>A-C</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CounterCheck</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CounterCheckResponse</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>DedicatedSIBRequest</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>DLMessageSegment</td>
<td>NOTE 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DLInformationTransfer</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>DLInformationTransferMRDC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>FailureInformation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>LocationMeasurementIndication</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>MCGFailureInformation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>MIB</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>MeasurementReport</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Measurement configuration may be sent prior to AS security activation. But: In order to protect privacy of UEs, MeasurementReport is only sent from the UE after successful AS security activation.</td>
</tr>
<tr>
<td>MobilityFromNRCommand</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Paging</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>RRCReconfiguration</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>The message shall not be sent unprotected before AS security activation if it is used to perform handover or to establish SRB2 and DRBs.</td>
</tr>
<tr>
<td>RRCReconfigurationComplete</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>Unprotected, if sent as response to RRCReconfiguration which was sent before AS security activation.</td>
</tr>
<tr>
<td>RRCReestablishment</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>Integrity protection applied, but no ciphering.</td>
</tr>
<tr>
<td>RRCReestablishmentComplete</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>RRCReestablishmentRequest</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>This message is not protected by PDCP operation. However, a shortMAC-I is included.</td>
</tr>
<tr>
<td>RRCReject</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Justification for A-I and A-C: the message can be sent in SRB0 in RRC_INACTIVE state, after the AS security is activated.</td>
</tr>
<tr>
<td>RRCRelease</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>Justification for P: If the RRC connection only for signalling not requiring DRBs or ciphered messages, or the signalling connection has to be released prematurely, this message is sent as unprotected. RRCRelease message sent before AS security activation cannot include deprioritisationReq, suspendConfig, redirectedCarrierInfo, cellReselectionPriorities information fields.</td>
</tr>
<tr>
<td>RRCResume</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>RRCResumeComplete</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>RRCResumeRequest</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>This message is not protected by PDCP operation. However, a resumeMAC-I is included.</td>
</tr>
<tr>
<td>RRCResumeRequest1</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>This message is not protected by PDCP operation. However, a resumeMAC-I is included.</td>
</tr>
<tr>
<td>RRCSetup</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Justification for A-I and A-C: the message can be sent in SRB0 in RRC_INACTIVE or RRC_CONNECTED states, after the AS security is activated.</td>
</tr>
<tr>
<td>RRCSetupComplete</td>
<td>+</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>RRCSetupRequest</td>
<td>+</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>RRCSystemInfoRequest</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Justification for A-I and A-C: the message can be sent in SRB0 in RRC_INACTIVE state, after the AS security is activated.</td>
</tr>
<tr>
<td>SIB1</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>SCGFailureInformation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>SCGFailureInformationEUTRA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>SecurityModeCommand</td>
<td>+</td>
<td>NA</td>
<td>NA</td>
<td>Integrity protection applied, but no ciphering (integrity verification done after the message received by RRC).</td>
</tr>
<tr>
<td>SecurityModeComplete</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>The message is sent after AS security activation. Integrity protection applied, but no ciphering. Ciphering is applied after completing the procedure.</td>
</tr>
<tr>
<td>SecurityModeFailure</td>
<td>+</td>
<td>NA</td>
<td>NA</td>
<td>Neither integrity protection nor ciphering applied.</td>
</tr>
</tbody>
</table>
### B.2 Description of BWP configuration options

There are two possible ways to configure BWP#0 (i.e. the initial BWP) for a UE:

1) Configure **BWP-DownlinkCommon** and **BWP-UplinkCommon** in **ServingCellConfigCommon**, but do not configure dedicated configurations in **BWP-DownlinkDedicated** or **BWP-UplinkDedicated** in **ServingCellConfig**.

2) Configure both **BWP-DownlinkCommon** and **BWP-UplinkCommon** in **ServingCellConfigCommon** and configure dedicated configurations in at least one of **BWP-DownlinkDedicated** or **BWP-UplinkDedicated** in **ServingCellConfig**.

The same way of configuration is used for UL BWP#0 and DL BWP#0 if both are configured.

With the first option (illustrated by figure B2-1 below), the BWP#0 is not considered to be an RRC-configured BWP, i.e. UE only supporting one BWP can still be configured with BWP#1 in addition to BWP#0 when using this configuration. The BWP#0 can still be used even if it does not have the dedicated configuration, albeit in a more limited manner since only the SIB1-defined configurations are available. For example, only DCI format 1_0 can be used with BWP#0 without dedicated configuration, so changing to another BWP requires RRCReconfiguration since DCI format 1_0 doesn't support DCI-based switching.

![Figure B2-1: BWP#0 configuration without dedicated configuration](image)
With the second option (illustrated by figure B2-2 below), the BWP#0 is considered to be an RRC-configured BWP, i.e. UE only supporting one BWP cannot be configured with BWP#1 in addition to BWP#0 when using this configuration. However, UE supporting more than one BWP can still switch to and from BWP#0 e.g. via DCI normally, and there are no explicit limitations to using the BWP#0 (compared to the first option).

![Figure B2-2: BWP#0 configuration with dedicated configuration](image)

For BWP#0, the $BWP-\text{DownlinkCommon}$ and $BWP-\text{UplinkCommon}$ in $\text{ServingCellConfigCommon}$ should match the parameters configured by MIB and SIB1 (if provided) in the corresponding serving cell.
Annex C (normative): List of CRs Containing Early Implementable Features and Corrections

This annex lists the Change Requests (CRs) whose changes may be implemented by a UE of an earlier release than which the CR was approved in (i.e. CRs that contain on their coversheets the sentence "Implementation of this CR from Rel-N will not cause interoperability issues").

Table C-1: List of CRs Containing Early Implementable Features and Corrections

<table>
<thead>
<tr>
<th>TDoc Number (RP-xxxxxx): CR Title</th>
<th>CR Number(s)</th>
<th>CR Revision Number(s)</th>
<th>Earliest Implementable Release</th>
<th>Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP-200335: Correction on usage of access category 2 for UAC for RNA update</td>
<td>1141</td>
<td>2</td>
<td>Release 15</td>
<td></td>
</tr>
<tr>
<td>RP-201185: Introduction of signalling for high-speed train scenarios</td>
<td>1464</td>
<td>5</td>
<td>Release 15</td>
<td></td>
</tr>
<tr>
<td>RP-201216: Release-16 UE capabilities based on RAN1, RAN4 feature lists and RAN2</td>
<td>1665</td>
<td>2</td>
<td>Release 15</td>
<td>Early implementation part is referring to the aspect covered by R2-2006203: Extension of CSI-RS capabilities per codebook type</td>
</tr>
<tr>
<td>RP-202768: UE behaviour when UL 7.5KHz shift is not supported</td>
<td>2107</td>
<td>2</td>
<td>Release 15</td>
<td></td>
</tr>
<tr>
<td>RP-202790: Correction on uac-AccessCategory1-SelectionAssistanceInfo</td>
<td>2130</td>
<td>1</td>
<td>Release 15</td>
<td></td>
</tr>
</tbody>
</table>
Annex D (normative): UE requirements on ASN.1 comprehension

This clause specifies UE requirements regarding the ASN.1 transfer syntax support, i.e. the ASN.1 definitions to be comprehended by the UE.

A UE that indicates release X in field `accessStratumRelease` shall comprehend the entire transfer syntax (ASN.1) of release X, in particular at least the first version upon ASN.1 freeze. The UE is however not required to support dedicated signalling related transfer syntax associated with optional features it does not support.

In case a UE that indicates release X in field `accessStratumRelease` supports a feature specified in release Y, which is later than release X, (i.e. early UE implementation) additional requirements apply. The UE obviously also has to support the ASN.1 parts related to indicating support of the feature (in UE capabilities).

Critical extensions (dedicated signaling)

If the early implemented feature involves one or more critical extensions in dedicated signalling, the UE shall comprehend the parts of the transfer syntax (ASN.1) of release Y that are related to the feature implemented early. This, in particular, concerns the ASN.1 parts related to configuration of the feature.

If configuration of an early implemented feature introduced in release Y involves a message or field that has been critically extended, the UE shall support configuration of all features supported by the UE that are associated with sub-fields of this critical extension. Apart from the early implemented feature(s), the UE needs, however, not to support functionality beyond what is defined in the release the UE indicates in access stratum release.

Let's consider the example of a UE indicating value X in field `accessStratumRelease` that supports the features A1, A3, and A5, associated with fields `fieldA1`, `fieldA3` and `fieldA5` of `InformationElementA` (see ASN.1 below).

The feature A5 implemented early is associated with `fieldA5`, and can only be configured by the –rY version of `InformationElementA`. In such case, the UE should support configuration of all the features A1, A3 and A5 associated with fields `fieldA1`, `fieldA3` and `fieldA5` by the –rY version of `InformationElementA`.

If, however, one of the features was modified, e.g. the feature A3 associated with `fieldA3`, the network should assume the UE only supports the feature A3 according to the release it indicated in field `accessStratumRelease` (i.e. X).

The UE is neither required to support the additional code-point (n80-vY0) nor the additional sub-field (fieldA3c-rY).

```asn1
InformationElementA-rX ::= SEQUENCE {
  fieldA1-rX             InformationElementA1-rX OPTIONAL, -- Need N
  fieldA2-rX             InformationElementA2-rX OPTIONAL, -- Need R
  fieldA3-rX             InformationElementA3-rX OPTIONAL
}

InformationElementA-rY ::= SEQUENCE {
  fieldA1-rY             InformationElementA1-rX OPTIONAL, -- Need N
  fieldA2-rY             InformationElementA2-rX OPTIONAL, -- Need R
  fieldA3-rY             InformationElementA3-rY OPTIONAL, -- Need R
  fieldA4-rY             InformationElementA4-rY OPTIONAL, -- Need R
  fieldA5-rY             InformationElementA5-rY OPTIONAL
}

InformationElementA3-rX ::= SEQUENCE {
  fieldA3a-rX           InformationElementA3a-rX OPTIONAL, -- Need N
}
```
Non-critical extensions (dedicated and broadcast signaling)

If the early implemented feature involves one or more non-critical extensions, the UE shall comprehend the parts of the transfer syntax (ASN.1) of release Y that are related to the feature implemented early.

If the early implemented feature involves one or more non-critical extensions in dedicated signaling, the network does not include extensions introduced after the release X that are not the parts related to the feature which the UE indicates early support of in UE capabilities. The UE shall anyway comprehend the parts of the transfer syntax (ASN.1) which indicate absence of such extensions.

If the early implemented feature involves one or more non-critical extensions in system information, the SIB(s) containing the release Y fields related to the early implemented features may also include other extensions introduced after the release X that are not the parts related to the feature which the UE supports. The UE shall comprehend such intermediate fields (but again is not required to support the functionality associated with these intermediate fields, in case this concerns optional features not supported by the UE).
## Annex E (informative):

### Change history

<table>
<thead>
<tr>
<th>Date</th>
<th>Meeting</th>
<th>TDoc</th>
<th>CR</th>
<th>Subject/Comment</th>
<th>New version</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/2017</td>
<td>RAN2 #97bis</td>
<td>R2-1703395</td>
<td></td>
<td></td>
<td>0.0.1</td>
</tr>
<tr>
<td>04/2017</td>
<td>RAN2 #97bis</td>
<td>R2-1703922</td>
<td></td>
<td></td>
<td>0.0.2</td>
</tr>
<tr>
<td>05/2017</td>
<td>RAN2 #98</td>
<td>R2-1705815</td>
<td></td>
<td></td>
<td>0.0.3</td>
</tr>
<tr>
<td>06/2017</td>
<td>RAN2 #NR2</td>
<td>R2-1707187</td>
<td></td>
<td></td>
<td>0.0.4</td>
</tr>
<tr>
<td>08/2017</td>
<td>RAN2 #99</td>
<td>R2-1708468</td>
<td></td>
<td></td>
<td>0.0.5</td>
</tr>
<tr>
<td>09/2017</td>
<td>RAN2 #99bis</td>
<td>R2-1710557</td>
<td></td>
<td></td>
<td>0.1.0</td>
</tr>
<tr>
<td>11/2017</td>
<td>RAN2 #100</td>
<td>R2-1713629</td>
<td></td>
<td></td>
<td>0.2.0</td>
</tr>
<tr>
<td>11/2017</td>
<td>RAN2 #100</td>
<td>R2-1714126</td>
<td></td>
<td></td>
<td>0.3.0</td>
</tr>
<tr>
<td>12/2017</td>
<td>RAN2 #100</td>
<td>R2-1714259</td>
<td></td>
<td></td>
<td>0.4.0</td>
</tr>
<tr>
<td>12/2017</td>
<td>RP#7</td>
<td>RP-172570</td>
<td></td>
<td>Submitted for Approval in RAN#78</td>
<td>1.0.0</td>
</tr>
<tr>
<td>12/2017</td>
<td>RP#7</td>
<td>RP-172570</td>
<td></td>
<td>Upgraded to Rel-15 (MCC)</td>
<td>15.0.0</td>
</tr>
<tr>
<td>03/2018</td>
<td>RP#7</td>
<td>RP-180479</td>
<td>0008</td>
<td>F Corrections for EN-DC (Note: the clause numbering between 15.0.0 and 15.1.0 has changed in some cases).</td>
<td>15.1.0</td>
</tr>
<tr>
<td>06/2018</td>
<td>RP-80</td>
<td>RP-181326</td>
<td>0042</td>
<td>F Miscellaneous EN-DC corrections</td>
<td>15.2.0</td>
</tr>
<tr>
<td></td>
<td>RP-80</td>
<td>RP-181326</td>
<td>0042</td>
<td>F Correction: Duplicate Foreword clause removed &amp; ASN.1 clauses touched up</td>
<td>15.2.1</td>
</tr>
<tr>
<td>09/2018</td>
<td>RP#8</td>
<td>RP-181942</td>
<td>0100</td>
<td>F Introduction of SA</td>
<td>15.3.0</td>
</tr>
<tr>
<td>12/2018</td>
<td>RP-82</td>
<td>RP-182656</td>
<td>0179</td>
<td>F Handling of Resume Failure</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182656</td>
<td>0179</td>
<td>F Clarification on the presence of ra-ResponseWindow</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182656</td>
<td>0188</td>
<td>F Addition of RAN specific Access Category</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182653</td>
<td>0199</td>
<td>F CR for TS38.331 on MIB</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182653</td>
<td>0200</td>
<td>F CR for TS38.331 on PDCCH-ConfigGB</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182661</td>
<td>0202</td>
<td>F Handling Cell Reselection during SI Request</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182649</td>
<td>0213</td>
<td>F Corrections on security field descriptions</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182649</td>
<td>0216</td>
<td>F Remain issue for T302</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182649</td>
<td>0219</td>
<td>F (C204) Handling of timer T380</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182655</td>
<td>0229</td>
<td>F Clarification on configured grant timer in 38.331</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182663</td>
<td>0232</td>
<td>F CR for ServingCellConfigCommon in 38.331</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182659</td>
<td>0234</td>
<td>F Introduction of cell level rate matching parameters in ServingCellConfig</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182650</td>
<td>0235</td>
<td>F CR for introducing PSCell frequency in CG-Config</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182650</td>
<td>0236</td>
<td>F CR for security handling for eLTE in 38.331</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182650</td>
<td>0237</td>
<td>F Handling on simultaneously triggered NAS&amp;AS events (I770)</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182650</td>
<td>0238</td>
<td>F Handling on security keys for resume procedure (I774)</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182664</td>
<td>0239</td>
<td>F RIL 1556, 1557, 1558 on RB handling when resuming</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182650</td>
<td>0242</td>
<td>F Security for RRC connection release</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182650</td>
<td>0243</td>
<td>F Corrections on reestablishment and security procedures</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182650</td>
<td>0244</td>
<td>F RIL 1118 on release case to upper layers for CN paging for a UE in RRC INACTIVE</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182650</td>
<td>0246</td>
<td>F CR on SI request procedure in TS38.331</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182650</td>
<td>0248</td>
<td>F CR to 38331 on ul-DataSplitThreshold for SRB</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182652</td>
<td>0249</td>
<td>F Clarification of guami-Type</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182652</td>
<td>0252</td>
<td>F CR to 38331 on Protection of RRC messages Table</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182663</td>
<td>0254</td>
<td>F Access barring check after handover</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182663</td>
<td>0259</td>
<td>F Stop of T390 and related UE actions</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182667</td>
<td>0260</td>
<td>F Corrections for handover between NR and E-UTRA</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182728</td>
<td>0267</td>
<td>F CR on sub-ToMeasure in MeasurementTimingConfiguration</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182659</td>
<td>0269</td>
<td>F Clarification of the applicability of 38.331 to EN-DC</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182654</td>
<td>0270</td>
<td>F Clarification on the smtc signalled for intra-NR handover, PCell change or SCell addition</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182654</td>
<td>0273</td>
<td>F CR on fallback to the setup procedure</td>
<td>15.4.0</td>
</tr>
<tr>
<td></td>
<td>RP-82</td>
<td>RP-182654</td>
<td>0275</td>
<td>F Correction on cell sorting for periodical measurement reporting</td>
<td>15.4.0</td>
</tr>
</tbody>
</table>
Correction to full configuration
Correction on the allowedBC-ListMRDC
Corrections on P-Max description
Resume/Reestablishment MAC-I calculation
Correction to missing field descriptions of PLMN Identity
PDCCH Monitoring Occasions in SI Window
Corrections to the field descriptions of System Information
SRB3 integrity protection failure handling
Correction to commonControlResourceSet
Clarification for the implementation of UE feature list item 6-1 (BWP op1)
Missing optionality bit in CG-ConfigInfo
Clarifications on RNA update and CN registration (N023)
Miscellaneous minor corrections
Correction on CN type indication for Redirection from NR to E-UTRA
Procedures for full config at RRCResume
Clarification on paging in connected mode
Corrections to PowerControl-related issues
SI reception in RRC Connected mode (RIL#II611)
A3 and A5 corrections – neighbouring cell definition
On RRM procedures related procedural text corrections
Update of L1/RF capabilities
Additional UE capabilities for NR standalone
CR on CGI reporting
CR to avoid unnecessary L3 filtered beam measurements
CR on to avoid unnecessary L3 filtered beam measurements
TestCorrection to pendingRnaUpdate setting
Correction to full configuration
Correction on the Support of the Delay Budget Report in NR
CR on the Clarification for the Support of the Delay Budget Report in NR
Correction to missing field descriptions of System Information
Correction to CN type indication for Redirection from NR to E-UTRA
Correction to commonControlResourceSet
Correction to SIB1 reception during handover to NR
Clarification on counter check procedure
Correction to commonControlResourceSet
Correction to commonControlResourceSet
Correction to commonControlResourceSet
Correction to commonControlResourceSet
Clarification on counter check procedure
Clarification on counter check procedure
 Clarification on counter check procedure
Clarification on counter check procedure
3GPP TS 38.331 version 16.3.1 Release 16

RP-82 RP-182663
RP-82 RP-182661
RP-82 RP-182663

0506
0509
0510

1
2
1

F
F
F

RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82

RP-182663
RP-182649
RP-182661
RP-182662
RP-182662
RP-182665
RP-182664
RP-182660
RP-182649
RP-182649

0514
0515
0516
0518
0520
0522
0524
0539
0541
0542

2
1
1
1
1
2
1
-

F
F
F
F
F
F
F
F
F
F

RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82

RP-182664
RP-182661
RP-182659
RP-182659
RP-182665
RP-182663
RP-182650
RP-182661
RP-182650
RP-182650
RP-182660
RP-182663
RP-182664
RP-182660
RP-182661
RP-182659
RP-182667
RP-182664
RP-182659
RP-182667
RP-182667
RP-182659
RP-182657
RP-182657
RP-182657
RP-182663
RP-182663
RP-182663
RP-182840
RP-182666

0543
0545
0552
0554
0558
0560
0562
0567
0569
0570
0571
0572
0575
0577
0578
0580
0582
0587
0591
0594
0600
0601
0602
0603
0604
0616
0617
0618
0620
0624

2
1
1
1
1
1
1
1
1
1
1
2
1
2
1
1
2
5
1
1
1
2
1
1
1
3
2

F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F
F

RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82

RP-182665
RP-182662
RP-182665
RP-182664
RP-182659
RP-182739
RP-182665
RP-182662

0627
0638
0640
0643
0646
0647
0649
0654

2
1
2
1
1
3
2
1

F
F
F
F
F
F
F
F

RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82
RP-82

RP-182664
RP-182659
RP-182663
RP-182662
RP-182663
RP-182662
RP-182667
RP-182661
RP-182653
RP-182654
RP-182658
RP-182654
RP-182661
RP-182665
RP-182661
RP-182654

0655
0656
0660
0664
0665
0670
0673
0680
0682
0683
0684
0686
0687
0688
0689
0692

1
1
1
1
1
1
3
1
2
1
3
1
-

F
F
C
F
F
F
F
F
F
F
F
F
F
F
F
F

904

ETSI TS 138 331 V16.3.1 (2021-01)

Correction on the behaviors with cell reselection while T302 is running
Correction on SDAP reconfiguration handling
Clarification for the UE behaviour in camped normally and camped on any
cell states
Correction to description of parameter Ns nAndPagingFrameOffset
Correction to description of parameter Ns
CR on UE behaviour after SI Acquisition Failure
CR on PUCCH-ConfigCommon
Clarifications on receiving RRCReject without wait timer
CR on powerControlOffset
Correction to configuration of firstPDCCH-MonitoringOccasionOfPO
R on PCCH-Config
Clarification to no barring configuration for Implicit UAC
Correction to Access Category and barring config determination for implicit
access barring
Per serving cell MIMO layer configuration
Correction to reconfiguration with sync
Correction for SSB power
Corrections on SearchSpace configuration
Correction for TCI state in ControlResourceSet
CR for the optional configuration of subbandSize
Correction on ShortMAC-I description in 38.331
CR to the field descriptions of System Information
Clarification on SRB3 release
Avoiding security risk for RLC UM bearers during termination point change
MO configuration with SSB SCS for a given SSB frequency
Barring alleviation for emergency service
Corrections for security configurations during setup of SRB1
Clarification of UE behaviour when frequencyBandList is absent in SIB4
Handling of missing fields in SIB1
Correction to ControlResourceSetZero
Full configuration for inter-RAT handover
Corrections on number of RadioLinkMonitoringRS condifuration
Clarification on phr-Type2OtherCell
Addition of PCI in MeasTiming
Clarifications to SIBs requiring request procedure
Correction for support of initial downlink BWP
Miscellaneous corrections related to idle mode SIBs
Correction for missing fields in SIB2 and SIB4
Correction to Q-QualMin value range
Clarification of cell reselection during resume procedure
Determination of Access Identities for RRC-triggered Access Attempts
CR to 38.331 on stopping of timer T390 upon reception of RRCRelease
CR on MN/SN coordination for report CGI procedure
CR to 38.331 on aligning I-RNTI terminology in paging and SuspendConfig
(Alt.2)
CR to 38.331 on IRAT Cell reselection in RRC_INACTIVE
CR for pendingRnaUpdate set
Corrections on BWP ID
Inter-frequency handover capability
Search space configuration for DCI format 2_0 monitoring
Correction on power headroom configuration exchange
UE capability on PA architecture
CR on pdsch-TimeDomainAllocationList and puschTimeDomainAllocationList
Correction on the SSB based RACH configuration
CR on starting bit of Format 2-3
CR on wait timer in RRC release
SCell release at RRC Reestablishment
Clean up of SRB1 terminology
Correction on the size of PUCCH resource ID
CR to 38.331 on Integrity Check failure at RRC Reestablishment
Correction on SI message acquisition timing
Add t-ReselectionNR-SF in SIB2
freqBandIndicatorNR correction in MultiFrequencyBandListNR-SIB
Corrections to CellSelectionInfo in SIB1 and SIB4
Correction on the field description of DRX timers
Correction on DC subcarrier usage in SetupComplete message
Various carrier frequency definiton corrections
CR on signaling contiguous and non-contiguous EN-DC capability
Update of the usage of QCL type-C

ETSI

15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0
15.4.0


<p>| RP-82 | RP-182659 | 0694 | 1 | F | Cleanup of references to L1 specifications | 15.4.0 |
| RP-82 | RP-182660 | 0695 | 1 | F | Correction of MeasResultEUTRA | 15.4.0 |
| RP-82 | RP-182660 | 0696 | 1 | F | Missing need code for relReqCSI-RS | 15.4.0 |
| RP-82 | RP-182661 | 0697 | 2 | F | Missing procedure text in RRC Reconfiguration | 15.4.0 |
| RP-82 | RP-182781 | 0700 | 3 | F | Correction to UE capability procedures in 38.331 | 15.4.0 |
| RP-82 | RP-182667 | 0701 | 1 | F | Correction to aperiodicTriggeringOffset | 15.4.0 |
| RP-82 | RP-182664 | 0709 | 1 | F | CR to 38.331 on including serving cell measurements | 15.4.0 |
| RP-82 | RP-182660 | 0711 | 1 | F | CR to 38.331 on associatedSSB | 15.4.0 |
| RP-82 | RP-182662 | 0714 | 1 | F | CR on 38.331 for RRCResumeRequest and RRCResumeRequest1 and protection of RRCResumeRequest1 | 15.4.0 |
| RP-82 | RP-182667 | 0715 | 2 | F | Correction for reporting of NR serving cell measurements when rsType is missing | 15.4.0 |
| RP-82 | RP-182656 | 0719 | 1 | F | Clarification of the values for RangeToBestCell | 15.4.0 |
| RP-82 | RP-182668 | 0721 | 2 | F | CR on handling of timer T380 | 15.4.0 |
| RP-82 | RP-182662 | 0723 | 2 | F | CR on supporting signalling only connection | 15.4.0 |
| RP-82 | RP-182838 | 0725 | 3 | F | Signalling introduction of SRS switching capability | 15.4.0 |
| RP-82 | RP-182667 | 0729 | 3 | B | CR on signalling introduction of UE overheating support in NR SA scenario | 15.4.0 |
| RP-82 | RP-182856 | 0730 | 4 | F | CR on SRS antenna switching | 15.4.0 |
| RP-82 | RP-182660 | 0731 | 1 | F | Correction to offsetToPointA | 15.4.0 |
| RP-82 | RP-182655 | 0732 | - | F | Correction to cell selection parameters | 15.4.0 |
| RP-82 | RP-182665 | 0746 | 2 | F | CR to 38.331 on stopping T302 and UE related actions | 15.4.0 |
| RP-82 | RP-182666 | 0750 | 2 | F | Correction on indication for user plane resource release | 15.4.0 |
| RP-82 | RP-182662 | 0767 | 1 | F | Correction on the terminology scg-ChangeFailure | 15.4.0 |
| RP-82 | RP-182661 | 0768 | 1 | F | Correction on default configuration | 15.4.0 |
| RP-82 | RP-182660 | 0772 | 1 | F | Clarification of measurement object for beam reporting for NR cells | 15.4.0 |
| RP-82 | RP-182667 | 0773 | 3 | F | CR to 38.331 on UE AS Context definition – Include suspendConfig | 15.4.0 |
| RP-82 | RP-182661 | 0778 | 1 | F | CR to 38.331 on HO support in Setup Procedure | 15.4.0 |
| RP-82 | RP-182656 | 0781 | - | F | CR on description of k0 | 15.4.0 |
| RP-82 | RP-182666 | 0783 | 2 | F | CR to 38.331 on removing FFS of locationInfo | 15.4.0 |
| RP-82 | RP-182661 | 0787 | - | F | Clarification on MIB Acquisition | 15.4.0 |
| RP-82 | RP-182662 | 0788 | - | F | CR to 38331 on release after completion of inter-RAT HO | 15.4.0 |
| RP-82 | RP-182662 | 0789 | - | F | CR to 38.331 on rbg-Size in PDSCH-Config, PUSCH-Config and ConfiguredGrantConfig | 15.4.0 |
| RP-82 | RP-182657 | 0790 | - | F | Advanced processing time configuration for PDSCH and PUSCH | 15.4.0 |
| RP-82 | RP-182896 | 0791 | 2 | F | UE specific channel bandwidth signaling | 15.4.0 |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>RP-83</th>
<th>RP-190541</th>
<th>Feature/Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/2019</td>
<td>RP-190541</td>
<td>0416</td>
<td>F Clarification on hopping parameters for PUSCH</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0593</td>
<td>F Removal of creation of MCG MAC entity</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190633</td>
<td>0792</td>
<td>1 F Capability for aperiodic CSI-RS triggering with different numerology between PDCH and CSI-RS</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0796</td>
<td>2 F Correction on Mapping between SSBs and PDCCH Monitoring Occasions in SI Window</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0797</td>
<td>2 F Correction to SI Request Procedure</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190546</td>
<td>0798</td>
<td>2 F CR to 38.331 on clarification of reportCGI</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0799</td>
<td>2 F Describing mandatory/optional information in inter-node RRC messages</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0800</td>
<td>1 F Search space configuration for cross carrier scheduling</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190542</td>
<td>0803</td>
<td>1 F Clarification on FeatureSetCombinationId zero value</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190546</td>
<td>0805</td>
<td>2 F Clarification on UE Capability Request Filtering</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190545</td>
<td>0807</td>
<td>3 F Miscellaneous non-controversial corrections</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0808</td>
<td>2 F CR to 38.331 on MAC configuration</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190543</td>
<td>0810</td>
<td>2 F Correction to SCG failure</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190540</td>
<td>0811</td>
<td>1 F Clarifying handling of parent and child IE need nodes</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190544</td>
<td>0812</td>
<td>2 F Clarification to channel bandwidth signalling</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0813</td>
<td>1 F Clarifications to BWP configuration options</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190543</td>
<td>0822</td>
<td>2 F Correction to EUTRA-MBSFN-SubframeConfig</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190545</td>
<td>0823</td>
<td>2 F Clarification on dedicated serving cell configuration in Re-establishment</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0828</td>
<td>2 F Clarification on the BWP id configuration</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0836</td>
<td>1 F Upon entering a new PLMN which is in the list of EPLMNs in RRC INACTIVE state</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190546</td>
<td>0843</td>
<td>1 F EUTRA UE capability filtering in NR UE capability enquiry</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190543</td>
<td>0847</td>
<td>2 F Correction to SIB transmission during handover</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190545</td>
<td>0850</td>
<td>2 F Clarification to monitoring occasion of PWS notification</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0853</td>
<td>1 F HandoverPreparationInformation for CU/DU</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190542</td>
<td>0855</td>
<td>1 F CR to introduce simultaneousRxDataSSB-DiffNumerology for NR SA</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190550</td>
<td>0858</td>
<td>- F Condition on integrity protection for DRB</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190544</td>
<td>0860</td>
<td>2 F Handling on UE Inactive AS context upon resume</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190542</td>
<td>0861</td>
<td>1 F Miscellaneous Corrections for INACTIVE</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190542</td>
<td>0864</td>
<td>1 F Correction on RRC processing delay</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190540</td>
<td>0865</td>
<td>1 F Dummy the ue-RRCControlPlaneFunction IE</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190545</td>
<td>0866</td>
<td>2 F Further update of Need codes</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190547</td>
<td>0867</td>
<td>1 F Corrections to reestablishment procedure</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190545</td>
<td>0868</td>
<td>2 F CR on use of positioning measurement gaps for subframe and slot timing detection towards E-UTRA</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190542</td>
<td>0876</td>
<td>2 F Barring alleviation when T302 or T390 is stopped</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190544</td>
<td>0877</td>
<td>2 F Correction on smtc configuration in NR SCell addition procedure</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190543</td>
<td>0884</td>
<td>2 F Correction on the configuration for transform preceding of PUSCH</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190543</td>
<td>0896</td>
<td>2 F Correction to Need Codes in system information</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0897</td>
<td>1 F Corrections on drb-ContinueROHC</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0898</td>
<td>1 F Correction on outOfOrderDelivery</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190542</td>
<td>0902</td>
<td>1 F Corrections on radio link failure related actions</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0904</td>
<td>1 F Clarification for SIB validity</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190540</td>
<td>0905</td>
<td>- F Corrections to MFBI</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190542</td>
<td>0912</td>
<td>1 F CR on clarification on the description of NIA0</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190542</td>
<td>0913</td>
<td>1 F CR on the number of bits of downlink NAS COUNT value</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0920</td>
<td>1 F CR to 38.331 for not supporting different quantities for thresholds in Event A5 and B2</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190544</td>
<td>0922</td>
<td>2 F CR on SSB type indication</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190545</td>
<td>0923</td>
<td>2 F Correction for measurements of serving cells without SSB or without CSI-RS</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190540</td>
<td>0930</td>
<td>- F CR on introduction of UE assistance information in inter-node message</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190540</td>
<td>0931</td>
<td>- F CR on description of SRS carrier switching</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190542</td>
<td>0932</td>
<td>1 F Clarification on the relation between CA configuration and supported featureset combination. Option1</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190545</td>
<td>0935</td>
<td>2 F Unification of EN-DC terminology</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190550</td>
<td>0938</td>
<td>- F PDCP re-establishment during SRB modification for EUTRA/5GC</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0939</td>
<td>1 F The support of drb-ContinueROHC</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0948</td>
<td>1 F Correction on PTRS port index</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0956</td>
<td>1 F CR on the supplementaryUplink and uplinkConfig</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190545</td>
<td>0963</td>
<td>2 F Correction on MIB acquisition upon Reconfiguration with Sync</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190542</td>
<td>0967</td>
<td>2 F Offset for inter-RAT cell reselection</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190541</td>
<td>0975</td>
<td>1 F Correction on SI scheduling</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190543</td>
<td>0976</td>
<td>2 F Correction of uac-AccessCategory1-SelectionAssistanceInfo field description</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190546</td>
<td>0978</td>
<td>3 F Correction on going to RRC_IDLE upon inter-RAT cell reselection in RRC INACTIVE.</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190543</td>
<td>0981</td>
<td>2 F Clarification on nrofSS-BlocksToAverage and absThreshSS-BlocksConsolidation</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190543</td>
<td>0984</td>
<td>3 F Correction on compilation of featureSets for NR container</td>
</tr>
<tr>
<td>RP-83</td>
<td>RP-190540</td>
<td>0985</td>
<td>- F Enable and disable of security at DRB setup</td>
</tr>
</tbody>
</table>
Correction on BWP configuration
Correction on Measurement Report Triggering for Periodical Report
Correction to the description of subcarrier spacing usage in CR to 38.331 on Measurement Timing Configuration
Correction on the issue with NCP and ECP for RateMatchPattern
Correction to barring alleviation
Ignore additional fields in RRC Release message before security activation
Correction on use of Null algorithm for DRBs during emergency calls in LSM
RRC processing delay for UE capability transfer
Coordination of ROHC capability for MR-DC
Correction on bar indication of emergency service (access category 2)
Correction on UE configuration for RRC Resume procedure
RRC release with suspend configuration and inter-RAT redirection
RRC Reconfiguration via SRB3 in EN-DC
 Corrections on RLC bearer setup
Correction to Permitted MaxGID for ROHC and Uplink-Only ROHC
Coordination of ROHC capability for MR-DC
Correction on the rtmInSyncOutOfSyncThreshold
Correction on description of tci-PresentInDCI
RRC processing delay for UE capability transfer
Handling of SMTC configuration
Clarification on filters used to generate FeatureSets (38.331)
Correction of behavior for eutra-nr-only
Clarification on CSI-RS resource configuration in MO
Update on usage of Need codes
Ignore additional fields in RRC Release message before security activation
Correction on use of Null algorithm for DRBs during emergency calls in LSM
NR changes for FullConfig for Inter-RAT intra-system HO
Monitoring of short messages with multi-beams
Clarification of commonControlResourceSet frequency reference point
CR on capability of maxUplinkDutyCycle for FR2
Correction on transferring common configuration during handover and SN change
Correction to barring alleviation
Correction on UE behaviour on the cell without TAC
Correction to RRC resume
Corrections to inter-node messages
Clarification on mandatory information in inter node RRC messages
Correction to PWS reception
Serving cell measurement handling with different rType configuration scenarios
On CGI reporting contents
CR for 38.331 on security related corrections to UE and Network initiated RRC procedures to increase user's security and privacy
Correction on the issue with NCP and ECP for RateMatchPattern
Security protection of RRC messages
Introduction of a new NR band for LTE/NR spectrum sharing in Band 41/n41
Stop of T302 and T390 at reception of RRCRelease with waitTime
Restriction of piggybacking of NAS PDUs
Correction on intra-band fallback behavior with FeatureSetsPerCC
Removal of spurious requirement on consistency of feature set combination IDs
Miscellaneous non-controversial corrections Set II
Correction to configuration of security in RadioBearerConfig
CR to 38.331 on MeasurementTimingConfiguration
Correction to the description of subcarrierspacing usage in ServingCellConfigCommon
Clarification on multiple TA capabilities
Set beamCorrespondenceCA dummy
Correction on Measurement Report Triggering for Periodical Report
Correction on PDCP duplication configuration
Correction on BWP configuration
| RP-84  | RP-191377 | 1097 | 1 | F | Correction on configuration of pucch-ResourceCommon | 15.6.0 |
| RP-84  | RP-191376 | 1098 | 1 | F | Clarification of PUCCH reconfiguration on NR UL and SUL | 15.6.0 |
| RP-84  | RP-191375 | 1100 | 1 | F | Correction on initial BWP configuration in DownlinkConfigCommon and UplinkConfigCommon | 15.6.0 |
| RP-84  | RP-191377 | 1101 | 1 | F | Correction on PUCCH cell | 15.6.0 |
| RP-84  | RP-191377 | 1103 | 1 | F | Correction on the dpdc-Config | 15.6.0 |
| RP-84  | RP-191379 | 1104 | 2 | F | Correction on pathlossReferenceLinking | 15.6.0 |
| RP-84  | RP-191381 | 1106 | 2 | F | Clarification of dedicated priority handling from RRC_INACTIVE to RRC_IDLE | 15.6.0 |
| RP-84  | RP-191375 | 1110 | - | F | Clarification on sending condition for mcg-RB-Config | 15.6.0 |
| RP-84  | RP-191375 | 1111 | - | F | Clarification of timing reference for CSI-RS resources | 15.6.0 |
| RP-84  | RP-191376 | 1113 | - | F | Setting of resumeCause for NAS triggered event | 15.6.0 |
| RP-84  | RP-191376 | 1114 | - | F | UE capability signalling for FD-MIMO processing capabilities for EN-DC | 15.6.0 |
| RP-84  | RP-191376 | 1115 | - | F | Modified UE capability on different numerologies within the same PUCCH group | 15.6.0 |
| RP-84  | RP-191478 | 1116 | 2 | F | Clarification to commonSearchSpaceList in PDCCH-ConfigCommon | 15.6.0 |
| RP-84  | RP-191589 | 1117 | 1 | F | Removal of "Capability for aperiodic CSI-RS triggering with different numerology between PDCCH and CSI-RS" | 15.6.0 |

### Additional capability signalling for 1024QAM support

**09/2019**

| RP-85 | RP-192196 | 1120 | 1 | C | Additional capability signalling for 1024QAM support | 15.7.0 |
| RP-85 | RP-192191 | 1121 | 1 | F | Correction on TDD-UL-DL-Config | 15.7.0 |
| RP-85 | RP-192191 | 1122 | 1 | F | Correction of the secondHopPrb Parameter | 15.7.0 |
| RP-85 | RP-192190 | 1123 | - | F | RSRP reporting of SFTD measurement in NR-DC | 15.7.0 |
| RP-85 | RP-192191 | 1124 | 1 | F | Small Corrections for System Information | 15.7.0 |
| RP-85 | RP-192194 | 1125 | - | F | Corrections for Inter-node Messages | 15.7.0 |
| RP-85 | RP-192191 | 1126 | 1 | F | Clarification of Layer 3 Filtering for E-UTRA | 15.7.0 |
| RP-85 | RP-192191 | 1127 | 1 | F | Clarification on FailureInformation report for NE-DC | 15.7.0 |
| RP-85 | RP-192191 | 1136 | 1 | F | Clarification to fullConfig in NR | 15.7.0 |
| RP-85 | RP-192190 | 1137 | - | F | Updates for positioning measurement gaps for subframe and slot timing detection towards E-UTRA | 15.7.0 |
| RP-85 | RP-192191 | 1138 | 1 | F | Clarification for enabling of configured PUSCH frequency hopping | 15.7.0 |
| RP-85 | RP-192191 | 1139 | 1 | B | Introduction of SFTD measurement to neighbour cells for NR SA | 15.7.0 |
| RP-85 | RP-192192 | 1144 | 1 | F | Corrections to 38.331 on SI-schedulingInfo | 15.7.0 |
| RP-85 | RP-192193 | 1148 | 2 | F | Clarification on SRB2 and DRB configuration | 15.7.0 |
| RP-85 | RP-192191 | 1151 | 2 | F | PDU session release indication to upper layers during Full Configuration | 15.7.0 |
| RP-85 | RP-192191 | 1160 | 1 | F | Clarification on max payload of PUCCH-ResourceSet | 15.7.0 |
| RP-85 | RP-192191 | 1161 | 1 | F | Clarification on PUSCH configuration | 15.7.0 |
| RP-85 | RP-192192 | 1167 | 1 | F | Correction of condition HO-toNR and HO-Conn | 15.7.0 |
| RP-85 | RP-192192 | 1172 | 1 | F | Clarifying UE capability freqHoppingPUCCH-F0-2 and freqHoppingPUCCH-F1-3-4 | 15.7.0 |
| RP-85 | RP-192190 | 1173 | 1 | F | Clarification on selectedBandCombination | 15.7.0 |
| RP-85 | RP-192193 | 1174 | 2 | F | Clarifying handling of information elements on the F1 interface | 15.7.0 |
| RP-85 | RP-192192 | 1178 | 1 | F | Correction of field descriptions in UE-CapabilityRequestFilterCommon (38.331) | 15.7.0 |
| RP-85 | RP-192190 | 1179 | - | F | Clarification of ca-ParametersNR-forDC (38.331) | 15.7.0 |
| RP-85 | RP-192193 | 1183 | 2 | F | Correction on reestablishRLC | 15.7.0 |
| RP-85 | RP-192191 | 1185 | 1 | F | Correction on SFTD measurement configuration | 15.7.0 |
| RP-85 | RP-192192 | 1191 | 1 | F | Handling of embedded RRC message in RRCReconfiguration procedure | 15.7.0 |
| RP-85 | RP-192192 | 1201 | 2 | F | Clarification on definition of PUSCH-Less SCell | 15.7.0 |
| RP-85 | RP-192192 | 1204 | - | F | Correction on non-critical extension for NRDC-Parameters | 15.7.0 |
| RP-85 | RP-192191 | 1208 | 1 | F | Correction on UE actions upon going to RRC_IDLE | 15.7.0 |
| RP-85 | RP-192192 | 1211 | 1 | F | Correction on the acquisition of MiB and SIB1 for re-establishment | 15.7.0 |
| RP-85 | RP-192192 | 1212 | 1 | F | Correction on band selection in SIB1 | 15.7.0 |
| RP-85 | RP-192193 | 1213 | 2 | F | Correction on the actions upon reception of SIB2 and SIB4 | 15.7.0 |
| RP-85 | RP-192193 | 1219 | 3 | F | Miscellaneous non-controversial corrections Set III | 15.7.0 |
| RP-85 | RP-192194 | 1220 | 3 | F | Channel Bandwidth validation upon SIB1 acquisition | 15.7.0 |
| RP-85 | RP-192193 | 1224 | 1 | F | Correction of presence conditions for common PCell parameters | 15.7.0 |
| RP-85 | RP-192190 | 1226 | - | F | Release of unnecessary power restrictions upon RRC connection re-establishment in NE-DC and NR-DC | 15.7.0 |
| RP-85 | RP-192193 | 1232 | 2 | F | Correction of field inclusion for inter-node message | 15.7.0 |
|RP-85 | RP-192192 | 1234 | 1 | F | SFTD measurement information in CG-ConfigInfo | 15.7.0 |
|RP-85 | RP-192192 | 1235 | 1 | F | Correction for UE context retrieval | 15.7.0 |
|RP-85 | RP-192190 | 1226 | 1 | F | Correction on CQI measurements | 15.7.0 |
|RP-85 | RP-192191 | 1237 | 1 | F | Corrections to SIB8 for CMAS geo-fencing | 15.7.0 |
|RP-85 | RP-192194 | 1242 | 3 | F | Correction on the condition of RBTermChange | 15.7.0 |
| RP-85 | RP-192192 | 1243 | 1 | F | CR on clarification of aggregated bandwidth for overheating | 15.7.0 |
| RP-85 | RP-192190 | 1244 | - | F | Clarification on the selectedBandEntriesMN - Understanding 1 | 15.7.0 |
| RP-85 | RP-192194 | 1253 | 1 | F | Correction on RRC connection release indication after handover | 15.7.0 |
| RP-85 | RP-192193 | 1254 | 2 | F | Corrections on SIB1 configuration | 15.7.0 |
| RP-85 | RP-192191 | 1256 | 1 | F | Correction on inter-RAT cell re-selection when UE is in RRC_IDLE | 15.7.0 |
| RP-85 | RP-192193 | 1257 | 2 | F | maxMIMO-Layers for the normal uplink and the supplementary uplink_Option 1 | 15.7.0 |
Table 10.1: ETSI TS 138 331 V16.3.1 (2021-01) - Page 909

<table>
<thead>
<tr>
<th>RP</th>
<th>3GPP TS 38.331 Version 16.3.1 Release 16</th>
<th>12/2019</th>
<th>3GPP TS 38.331 Version 16.3.1 Release 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP</td>
<td>85</td>
<td>1261</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>85</td>
<td>1262</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>85</td>
<td>1263</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>85</td>
<td>1267</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1273</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1274</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1278</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1293</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1292</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1296</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1300</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1301</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1305</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1308</td>
<td>3</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1309</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1323</td>
<td>3</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1325</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1332</td>
<td>4</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1333</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1335</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1337</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1341</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1351</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1358</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1362</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1368</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1369</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1375</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1378</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1379</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1381</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1383</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1385</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1387</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1389</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1402</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1403</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1405</td>
<td>2</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1406</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>86</td>
<td>1421</td>
<td>1</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200335</td>
<td>1272</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200334</td>
<td>1409</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200334</td>
<td>1410</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200335</td>
<td>1440</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200334</td>
<td>1444</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200334</td>
<td>1450</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200344</td>
<td>1454</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200334</td>
<td>1455</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200334</td>
<td>1460</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200344</td>
<td>1461</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200335</td>
<td>1472</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200335</td>
<td>1475</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200335</td>
<td>1483</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200334</td>
<td>1484</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200334</td>
<td>1496</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200335</td>
<td>1501</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200335</td>
<td>1511</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200344</td>
<td>1499</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200344</td>
<td>1529</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200344</td>
<td>1152</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200357</td>
<td>1168</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200357</td>
<td>1218</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200358</td>
<td>1312</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200358</td>
<td>1535</td>
</tr>
<tr>
<td>RP</td>
<td>87</td>
<td>200358</td>
<td>1433</td>
</tr>
<tr>
<td>RP</td>
<td>Document Number</td>
<td>Reason</td>
<td>Version</td>
</tr>
<tr>
<td>------</td>
<td>-----------------</td>
<td>----------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200355</td>
<td>Introducing autonomous gap in CGI reporting</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200351</td>
<td>Introducing of UECapabilityInformation segmentation in TS38.331</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200358</td>
<td>Introducing of NR IDC solution</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200350</td>
<td>Introducing of SRVCC from 5G to 3G</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200341</td>
<td>Introducing of on-demand SI procedure in RRC CONNECTED</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200358</td>
<td>Introducing of DL RRC segmentation</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200353</td>
<td>Introducing the support of Non-Public Networks</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200344</td>
<td>CR for 38.331 for Power Savings</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200349</td>
<td>CR on Integrated Access and Backhaul for NR</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200348</td>
<td>CR for 38.331 for CA&amp;DC enh.</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200341</td>
<td>Introduction of NR mobility enhancement</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200347</td>
<td>Introduction of NR mobility enhancement</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200335</td>
<td>Introduction of additional RACH configurations for TDD FR1</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200343</td>
<td>Introduction of NR eURLLC</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200354</td>
<td>CR for introducing MDT and SON</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200357</td>
<td>CR to 38.331 on DRX coordination</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200346</td>
<td>Introduction of 5G V2X with NR sidelink</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200340</td>
<td>Introduction of CI handling and RIM in TS38.331</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200352</td>
<td>Introduction of NR IoT</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200342</td>
<td>Introduction of 2-step RA</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200339</td>
<td>Introduction of MIMO enhancements</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200359</td>
<td>Recommended Bit Rate/Query for FLUS and MTSI</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200345</td>
<td>Introduction of NR positioning</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-87</td>
<td>RP-200358</td>
<td>Support of inter-RAT handover from NR to EN-DC in TS 38.331</td>
<td>16.0.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201191</td>
<td>Missing report/AdjNeighMeas in periodic measurement reporting</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201166</td>
<td>Introduction of NeedForGap capability for NR measurement</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201185</td>
<td>Introduction of signalling adaptation for high-speed train scenarios</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201191</td>
<td>Corrections to PRACH prioritization procedure for MPS and MCS</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201182</td>
<td>Finalization of the support of Non-Public Networks</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201172</td>
<td>Miscellaneous corrections for NR-U</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201174</td>
<td>CR for 38.331 for Power Savings</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201180</td>
<td>Correction to transfer of UE capabilities at HO for RACS and minor ASN.1 correction (38.331)</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201161</td>
<td>Clarification on avoiding keystream repeat due to COUNT reuse</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201178</td>
<td>CR for 38.331 on CA/DC Enhancements</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201160</td>
<td>SRS Capability report for SRS only Scell</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201160</td>
<td>Correction to RequestedCapabilityCommon</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201187</td>
<td>R on introduction of BCS to asymmetric channel bandwidths (38.331)</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201159</td>
<td>Correction on PUCCH configuration</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201176</td>
<td>Correction to 38.331 for V2X</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201160</td>
<td>Correction on the need for reconfiguration with sync in (NG)EN-DC, NR-DC and NE-DC</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201160</td>
<td>CR on inter-RAT SFT measurements</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201160</td>
<td>Clarification on pdcp-Duplication at RRC Reconfiguration</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201188</td>
<td>Correction to RRC spec for eURLLC</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201179</td>
<td>Corrections to 38.331 for supporting IAB in NPN</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201177</td>
<td>Corrections on NR mobility enhancements</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201175</td>
<td>Introduction of RRC Positioning</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201166</td>
<td>Band combination list for NE-DC (Cat-F)</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201159</td>
<td>Avoiding security risk for RLC AM bearers during termination point change</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201161</td>
<td>CR on SRS-CarrierSwitching</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201164</td>
<td>CR on introduction of extended capabilities for NR-DC only BCS</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201165</td>
<td>Clarification on the presence of ssb-pERACH-Occasion for the CSI-RS based CFRA</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201163</td>
<td>Clarification on the maxPUSCH-Duration for LCP Restriction</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201159</td>
<td>Clarification for SIB6, SIB7 and SIB8 acquisition during measurement gap</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201198</td>
<td>Introduction of secondary DRX group CR 38.331</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201164</td>
<td>Correction to CORESET and PDCCCH TCI state release</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201181</td>
<td>Correction of NR IloT</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201162</td>
<td>Clarification on release and addition of the uplink for SCell</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201189</td>
<td>CR on 38.331 for SRVCC from 5G to 3G</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201159</td>
<td>Ambiguity in fr1-fr2-Add-UE-NR-Capabilities parameter</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201162</td>
<td>Correction to measurement coordination in MR-DC</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201176</td>
<td>Introduction of on-demand SIB(s) procedure in CONNECTED</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201164</td>
<td>TS10 handling during MobilityFromNR</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201173</td>
<td>Corrections for 2-step Random Access Type</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201216</td>
<td>Release-16 UE capabilities based on RAN1, RAN4 feature lists and RAN2</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201191</td>
<td>Miscellaneous ASN.1 review corrections</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201166</td>
<td>Miscellaneous non-controversial corrections Set V</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201184</td>
<td>Corrections on MDT and SON in NR</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201190</td>
<td>Introduction of eCall over IMS for NR</td>
<td>16.1.0</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201191</td>
<td>1671</td>
<td>1</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201186</td>
<td>1673</td>
<td>1</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201164</td>
<td>1682</td>
<td>1</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201161</td>
<td>1683</td>
<td>1</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201164</td>
<td>1687</td>
<td>1</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201170</td>
<td>1696</td>
<td>4</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201166</td>
<td>1697</td>
<td>-</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201171</td>
<td>1700</td>
<td>-</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201191</td>
<td>1703</td>
<td>1</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201163</td>
<td>1707</td>
<td>-</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201165</td>
<td>1711</td>
<td>1</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201191</td>
<td>1716</td>
<td>-</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201166</td>
<td>1717</td>
<td>1</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201179</td>
<td>1718</td>
<td>1</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201183</td>
<td>1719</td>
<td>-</td>
</tr>
<tr>
<td>RP-88</td>
<td>RP-201183</td>
<td>1720</td>
<td>-</td>
</tr>
</tbody>
</table>
Correction on field description of mrdc-SecondaryCellGroup in NR-DC
Reconfiguring RoHC and setting the drb-ContinueRoHC simultaneously
Miscellaneous corrections for NR-U
CR on drb-ContinueRoHC for DAPS
Correction on SearchSpace configuration for IAB
Corrections on F1-C transfer path
Correction on HO from NR to EN-DC
Correction on NR CHO
Miscellaneous corrections for NR IIoT
SCGFailureInformation
Introduction of MPE reporting
Remaining ASN.1 review issues
RLF in source cell during DAPS handover
Clarification on TS38.331 for DAPS
Correction to field condition on refFR2ServCellAsyncCA
Redundant procedural text of on demand SIB in CONNECTED
Corrections to handing posSIB-MappingInfo in SIB1
Correction on beamSwitchTiming values of 224 and 336
Miscellaneous correction regarding on demand SIB in CONNECTED
Redundant procedural text of on demand SIB in CONNECTED
Correction to field condition on refFR2ServCellAsyncCA
 Corrections to Conditional Reconfiguration triggering
Adding enableDefaultBeamForCCS for cross-carrier scheduling with different SCS
Correction on cross-RAT V2X functionality in TS 38.331
Time misalignment in DAPS DRB configuration (Alt.2)
Correction on the Cross Carrier Scheduling Configuration
Correction on the Configuration of sCellState for 38.331
Correction on the Cross Carrier Scheduling Configuration
CR to clarify UE behaviour after TAT expiry due to reconfigurationWithSync
Miscellaneous corrections for NR IIoT
CR on the BandCombination (RT6)
Correction on T312 handling during Mobility from NR
Correction on the RLFF for NR DAPS
Correction on RLF in source cell during DAPS handover
Miscellaneous eMIMO corrections
Missing fields for Toffset coordination in INM
Miscellaneous corrections for NR-U
Correction on T38.331 for DAPS
Correction on the Configuration of sCellState for 38.331
Correction on the Configuration of sCellState for 38.331
Miscellaneous corrections for NR IIoT
Correction on UE assistance information transmission for handover case
Correction on the UE Capability presence upon SN addition and SN change
Correction on msgA-PUSCH-Config
Correction on handling of reconfigurationWithSync
Introduction of PRS measurement gap
Correction on the IAB-MT TDD resource configuration
CR for Early Implementation in NR
CR on UE behavior with E-UTRA cell selection upon mobility from NR failure for enhanced EPS voice fallback
Correction on the SRB configuration for fullConfig during RRC Resume procedure
Correction on field description of mrdc-SecondaryCellGroup in NR-DC
Correction on RRC parameters for 5G V2X with NR sidelink
Correction on HARQ ACK spatial bundling configurations for secondary PUCCH group
Update to IAB-MT capabilities
Adding notes for joint success and failure in crossRAT SL
Corrections on RAN1 related clarifications
Editorial corrections on MDT and SON in NR
Correction to MIB and SIB1
Support of Rel-16 features for SCG in EN-DC and NR-DC
Clarification on SRVCC handover
Correction on acquisition of MIB and SIB1
Corrections for NPNs
Clarification on UL and SL priority thresholds
Miscellaneous IAB Corrections
Miscellaneous corrections on UL Tx switching
Configuration for uplink power boosting via suspended IEBE requirements
NR-DC UE capabilities
Correction on the calculation of CG occasion
NR CA additional spectrum emission requirements
12/2020
Correction on HARQ processing for CGs
Corrections to 2-Step RA
Correction on RRC state preference
configuredGrantConfigType2DeactivationStateList
Correction on uac-AccessCategory1-SelectionAssistanceInfo
Corrections on RLF cause determination
Corrections on BH RLC channel
Correction on non-DRB for IAB-MT
Miscellaneous corrections for NR-U
UE assistance information for DRX preference
Miscellaneous corrections for NR-U
Correction on C-RNTI
Correction on field description for ra-ResponseWindow
Correction on HARQ process sharing for CGs
Corrections to 2-Step RA
Correction on RRC state preference
Clarifications for the common search space on the active BWP
Corrections to 2-Step RA
Discarding of stored DL RRC message segments when UE transitions to RRC_IDLE
Correction on field description of configuredGrantConfigType2DeactivationStateList
Miscellaneous corrections on UL Tx switching
Correction on BFD resource on SCell
Misc corrections for Rel-16 DCCA
Missing fields for Toffset coordination
Processing delay requirements for DLInformationTransferMRDC
Correction regarding reconfigure EHC
Processing delay requirements for RRC resume
Correction for fast MCG link recovery in (NG)EN-DC
Correction on HARQ ACK/NACK feedback configuration
Correction on slot based repetition
Correction on RRC Miscellaneous Corrections
Support of Rel-16 features for SCG in EN-DC and NR-DC
Correction on acquisition of MIB and SIB1
Correction on posSIB broadcastStatus
Clarification on SRVCC handover
Miscellaneous corrections on TS 38.331
CR for CSI-RS-ResourceConfigMobility
Correction on T321 for autonomous gap based CSI in FR2
Transmission suspension on BH RLC channel upon IAB-MT failure
CR on TS 38.331 for LCP restriction of configured grant type 1
Correction on RRC parameters for NR SL communication
Introduction of capability bit for multi-CC simultaneous TCI activation with multi-TRP
Clarification on referenceTimePreferenceReporting in RRC Recomfiguration Procedure
| RP-90 | RP-202771 | 2277 | 1 | F | Selecting index for PLMN, SNPN and UAC parameters | 16.3.0 |
| RP-90 | RP-202775 | 2278 | - | F | Positioning RRC updates for posSIB validity check and field description correction | 16.3.0 |
| RP-90 | RP-202774 | 2280 | - | F | Miscellaneous corrections for conditional reconfiguration | 16.3.0 |
| RP-90 | RP-202774 | 2282 | - | F | Miscellaneous corrections for DAPS (NR) | 16.3.0 |
| RP-90 | RP-202773 | 2284 | 1 | F | Corrections for PDCP duplication introduced in IIoT | 16.3.0 |
| RP-90 | RP-202769 | 2285 | - | F | Corrections on sidelink related RRC procedures | 16.3.0 |
| RP-90 | RP-202770 | 2287 | - | A | Dummify UE capability of crossCarrierScheduling-OtherSCS | 16.3.0 |
| RP-90 | RP-202776 | 2293 | - | F | HRC corrections on NR SCN and MDT | 16.3.0 |
| RP-90 | RP-202770 | 2294 | - | F | CR for Unaligned CA signalling in TS 38.331 | 16.3.0 |
| RP-90 | RP-202767 | 2295 | - | F | Name change of the UE capability for the extended RAR window monitoring | 16.3.0 |
| RP-90 | RP-202884 | 2297 | - | A | CR to 38.331 on handling of fallbacks for FR2 CA | 16.3.0 |

01/2021 | RP-90 | | | | Corrected the extension marker in type PosSchedulingInfo-r16 so that it passes ASN.1 syntax check | 16.3.1 |
## History

<table>
<thead>
<tr>
<th>Document history</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>V16.1.0</td>
<td>July 2020</td>
</tr>
<tr>
<td>V16.2.0</td>
<td>November 2020</td>
</tr>
<tr>
<td>V16.3.1</td>
<td>January 2021</td>
</tr>
</tbody>
</table>