



**5G;  
NR;  
Radio Resource Control (RRC);  
Protocol specification  
(3GPP TS 38.331 version 15.6.0 Release 15)**



---

ReferenceRTS/TSGR-0238331vf60

---

Keywords

---

5G

---

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

---

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

---

**Important notice**

---

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at [www.etsi.org/deliver](http://www.etsi.org/deliver).

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

---

**Copyright Notification**

---

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2019.

All rights reserved.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members.

**3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

**oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners.

**GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

---

# 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.

# Contents

|                                                                                        |    |
|----------------------------------------------------------------------------------------|----|
| Intellectual Property Rights .....                                                     | 2  |
| Legal Notice .....                                                                     | 2  |
| Modal verbs terminology.....                                                           | 2  |
| Foreword.....                                                                          | 15 |
| 1 Scope .....                                                                          | 16 |
| 2 References .....                                                                     | 16 |
| 3 Definitions, symbols and abbreviations .....                                         | 18 |
| 3.1 Definitions .....                                                                  | 18 |
| 3.2 Abbreviations .....                                                                | 18 |
| 4 General .....                                                                        | 20 |
| 4.1 Introduction .....                                                                 | 20 |
| 4.2 Architecture .....                                                                 | 20 |
| 4.2.1 UE states and state transitions including inter RAT .....                        | 20 |
| 4.2.2 Signalling radio bearers .....                                                   | 22 |
| 4.3 Services .....                                                                     | 23 |
| 4.3.1 Services provided to upper layers.....                                           | 23 |
| 4.3.2 Services expected from lower layers .....                                        | 23 |
| 4.4 Functions .....                                                                    | 23 |
| 5 Procedures .....                                                                     | 24 |
| 5.1 General .....                                                                      | 24 |
| 5.1.1 Introduction.....                                                                | 24 |
| 5.1.2 General requirements.....                                                        | 24 |
| 5.1.3 Requirements for UE in MR-DC .....                                               | 25 |
| 5.2 System information .....                                                           | 25 |
| 5.2.1 Introduction.....                                                                | 25 |
| 5.2.2 System information acquisition .....                                             | 26 |
| 5.2.2.1 General UE requirements.....                                                   | 26 |
| 5.2.2.2 SIB validity and need to (re)-acquire SIB .....                                | 27 |
| 5.2.2.2.1 SIB validity.....                                                            | 27 |
| 5.2.2.2.2 SI change indication and PWS notification .....                              | 27 |
| 5.2.2.3 Acquisition of System Information .....                                        | 28 |
| 5.2.2.3.1 Acquisition of <i>MIB</i> and <i>SIB1</i> .....                              | 28 |
| 5.2.2.3.2 Acquisition of an SI message .....                                           | 29 |
| 5.2.2.3.3 Request for on demand system information .....                               | 29 |
| 5.2.2.3.4 Actions related to transmission of <i>RRCSystemInfoRequest</i> message ..... | 30 |
| 5.2.2.4 Actions upon receipt of System Information .....                               | 30 |
| 5.2.2.4.1 Actions upon reception of the <i>MIB</i> .....                               | 30 |
| 5.2.2.4.2 Actions upon reception of the <i>SIB1</i> .....                              | 31 |
| 5.2.2.4.3 Actions upon reception of <i>SIB2</i> .....                                  | 33 |
| 5.2.2.4.4 Actions upon reception of <i>SIB3</i> .....                                  | 33 |
| 5.2.2.4.5 Actions upon reception of <i>SIB4</i> .....                                  | 33 |
| 5.2.2.4.6 Actions upon reception of <i>SIB5</i> .....                                  | 34 |
| 5.2.2.4.7 Actions upon reception of <i>SIB6</i> .....                                  | 34 |
| 5.2.2.4.8 Actions upon reception of <i>SIB7</i> .....                                  | 34 |
| 5.2.2.4.9 Actions upon reception of <i>SIB8</i> .....                                  | 35 |
| 5.2.2.4.10 Actions upon reception of <i>SIB9</i> .....                                 | 35 |
| 5.2.2.5 Essential system information missing .....                                     | 36 |
| 5.3 Connection control .....                                                           | 36 |
| 5.3.1 Introduction.....                                                                | 36 |
| 5.3.1.1 RRC connection control .....                                                   | 36 |
| 5.3.1.2 AS Security .....                                                              | 37 |
| 5.3.2 Paging .....                                                                     | 38 |
| 5.3.2.1 General .....                                                                  | 38 |

|           |                                                                                                |    |
|-----------|------------------------------------------------------------------------------------------------|----|
| 5.3.2.2   | Initiation.....                                                                                | 38 |
| 5.3.2.3   | Reception of the <i>Paging message</i> by the UE .....                                         | 38 |
| 5.3.3     | RRC connection establishment .....                                                             | 39 |
| 5.3.3.1   | General .....                                                                                  | 39 |
| 5.3.3.2   | Initiation.....                                                                                | 39 |
| 5.3.3.3   | Actions related to transmission of <i>RRCSetupRequest</i> message.....                         | 40 |
| 5.3.3.4   | Reception of the <i>RRCSetup</i> by the UE .....                                               | 40 |
| 5.3.3.5   | Reception of the <i>RRCReject</i> by the UE.....                                               | 41 |
| 5.3.3.6   | Cell re-selection or cell selection while T390, T300 or T302 is running (UE in RRC_IDLE) ..... | 42 |
| 5.3.3.7   | T300 expiry .....                                                                              | 42 |
| 5.3.3.8   | Abortion of RRC connection establishment.....                                                  | 42 |
| 5.3.4     | Initial AS security activation .....                                                           | 42 |
| 5.3.4.1   | General .....                                                                                  | 42 |
| 5.3.4.2   | Initiation.....                                                                                | 43 |
| 5.3.4.3   | Reception of the <i>SecurityModeCommand</i> by the UE.....                                     | 43 |
| 5.3.5     | RRC reconfiguration.....                                                                       | 44 |
| 5.3.5.1   | General .....                                                                                  | 44 |
| 5.3.5.2   | Initiation.....                                                                                | 44 |
| 5.3.5.3   | Reception of an <i>RRCReconfiguration</i> by the UE .....                                      | 45 |
| 5.3.5.4   | Secondary cell group release.....                                                              | 47 |
| 5.3.5.5   | Cell Group configuration .....                                                                 | 48 |
| 5.3.5.5.1 | General .....                                                                                  | 48 |
| 5.3.5.5.2 | Reconfiguration with sync.....                                                                 | 48 |
| 5.3.5.5.3 | RLC bearer release .....                                                                       | 49 |
| 5.3.5.5.4 | RLC bearer addition/modification.....                                                          | 49 |
| 5.3.5.5.5 | MAC entity configuration .....                                                                 | 50 |
| 5.3.5.5.6 | RLF Timers & Constants configuration.....                                                      | 50 |
| 5.3.5.5.7 | SpCell Configuration.....                                                                      | 51 |
| 5.3.5.5.8 | SCell Release.....                                                                             | 51 |
| 5.3.5.5.9 | SCell Addition/Modification.....                                                               | 51 |
| 5.3.5.6   | Radio Bearer configuration .....                                                               | 52 |
| 5.3.5.6.1 | General .....                                                                                  | 52 |
| 5.3.5.6.2 | SRB release .....                                                                              | 52 |
| 5.3.5.6.3 | SRB addition/modification.....                                                                 | 52 |
| 5.3.5.6.4 | DRB release.....                                                                               | 54 |
| 5.3.5.6.5 | DRB addition/modification .....                                                                | 54 |
| 5.3.5.7   | AS Security key update.....                                                                    | 56 |
| 5.3.5.8   | Reconfiguration failure .....                                                                  | 57 |
| 5.3.5.8.1 | Void.....                                                                                      | 57 |
| 5.3.5.8.2 | Inability to comply with <i>RRCReconfiguration</i> .....                                       | 57 |
| 5.3.5.8.3 | T304 expiry (Reconfiguration with sync Failure) .....                                          | 58 |
| 5.3.5.9   | Other configuration .....                                                                      | 59 |
| 5.3.5.10  | MR-DC release .....                                                                            | 59 |
| 5.3.5.11  | Full configuration.....                                                                        | 59 |
| 5.3.6     | Counter check .....                                                                            | 61 |
| 5.3.6.1   | General .....                                                                                  | 61 |
| 5.3.6.2   | Initiation.....                                                                                | 61 |
| 5.3.6.3   | Reception of the <i>CounterCheck</i> message by the UE .....                                   | 61 |
| 5.3.7     | RRC connection re-establishment.....                                                           | 62 |
| 5.3.7.1   | General .....                                                                                  | 62 |
| 5.3.7.2   | Initiation.....                                                                                | 62 |
| 5.3.7.3   | Actions following cell selection while T311 is running.....                                    | 63 |
| 5.3.7.4   | Actions related to transmission of <i>RRCReestablishmentRequest</i> message .....              | 64 |
| 5.3.7.5   | Reception of the <i>RRCReestablishment</i> by the UE.....                                      | 64 |
| 5.3.7.6   | T311 expiry .....                                                                              | 65 |
| 5.3.7.7   | T301 expiry or selected cell no longer suitable.....                                           | 65 |
| 5.3.7.8   | Reception of the <i>RRCSetup</i> by the UE .....                                               | 65 |
| 5.3.8     | RRC connection release .....                                                                   | 65 |
| 5.3.8.1   | General .....                                                                                  | 65 |
| 5.3.8.2   | Initiation.....                                                                                | 66 |
| 5.3.8.3   | Reception of the <i>RRCRelease</i> by the UE .....                                             | 66 |
| 5.3.8.4   | T320 expiry .....                                                                              | 67 |

|           |                                                                                                      |    |
|-----------|------------------------------------------------------------------------------------------------------|----|
| 5.3.8.5   | UE actions upon the expiry of <i>DataInactivityTimer</i> .....                                       | 68 |
| 5.3.9     | RRC connection release requested by upper layers .....                                               | 68 |
| 5.3.9.1   | General .....                                                                                        | 68 |
| 5.3.9.2   | Initiation .....                                                                                     | 68 |
| 5.3.10    | Radio link failure related actions .....                                                             | 68 |
| 5.3.10.1  | Detection of physical layer problems in RRC_CONNECTED .....                                          | 68 |
| 5.3.10.2  | Recovery of physical layer problems .....                                                            | 68 |
| 5.3.10.3  | Detection of radio link failure .....                                                                | 68 |
| 5.3.11    | UE actions upon going to RRC_IDLE .....                                                              | 69 |
| 5.3.12    | UE actions upon PUCCH/SRS release request .....                                                      | 70 |
| 5.3.13    | RRC connection resume .....                                                                          | 70 |
| 5.3.13.1  | General .....                                                                                        | 70 |
| 5.3.13.2  | Initiation .....                                                                                     | 71 |
| 5.3.13.3  | Actions related to transmission of <i>RRCResumeRequest</i> or <i>RRCResumeRequest1</i> message ..... | 73 |
| 5.3.13.4  | Reception of the <i>RRCResume</i> by the UE .....                                                    | 74 |
| 5.3.13.5  | T319 expiry or Integrity check failure from lower layers while T319 is running .....                 | 75 |
| 5.3.13.6  | Cell re-selection or cell selection while T390, T319 or T302 is running (UE in RRC_INACTIVE) .....   | 75 |
| 5.3.13.7  | Reception of the <i>RRCSetup</i> by the UE .....                                                     | 75 |
| 5.3.13.8  | RNA update .....                                                                                     | 75 |
| 5.3.13.9  | Reception of the <i>RRCRelease</i> by the UE .....                                                   | 76 |
| 5.3.13.10 | Reception of the <i>RRCReject</i> by the UE .....                                                    | 76 |
| 5.3.13.11 | Inability to comply with <i>RRCResume</i> .....                                                      | 76 |
| 5.3.13.12 | Inter RAT cell reselection .....                                                                     | 76 |
| 5.3.14    | Unified Access Control .....                                                                         | 76 |
| 5.3.14.1  | General .....                                                                                        | 76 |
| 5.3.14.2  | Initiation .....                                                                                     | 76 |
| 5.3.14.3  | Void .....                                                                                           | 78 |
| 5.3.14.4  | T302, T390 expiry or stop (Barring alleviation) .....                                                | 78 |
| 5.3.14.5  | Access barring check .....                                                                           | 79 |
| 5.3.15    | RRC connection reject .....                                                                          | 79 |
| 5.3.15.1  | Initiation .....                                                                                     | 79 |
| 5.3.15.2  | Reception of the <i>RRCReject</i> by the UE .....                                                    | 79 |
| 5.4       | Inter-RAT mobility .....                                                                             | 80 |
| 5.4.1     | Introduction .....                                                                                   | 80 |
| 5.4.2     | Handover to NR .....                                                                                 | 80 |
| 5.4.2.1   | General .....                                                                                        | 80 |
| 5.4.2.2   | Initiation .....                                                                                     | 80 |
| 5.4.2.3   | Reception of the <i>RRCReconfiguration</i> by the UE .....                                           | 81 |
| 5.4.3     | Mobility from NR .....                                                                               | 81 |
| 5.4.3.1   | General .....                                                                                        | 81 |
| 5.4.3.2   | Initiation .....                                                                                     | 81 |
| 5.4.3.3   | Reception of the <i>MobilityFromNRCommand</i> by the UE .....                                        | 81 |
| 5.4.3.4   | Successful completion of the mobility from NR .....                                                  | 82 |
| 5.4.3.5   | Mobility from NR failure .....                                                                       | 82 |
| 5.5       | Measurements .....                                                                                   | 82 |
| 5.5.1     | Introduction .....                                                                                   | 82 |
| 5.5.2     | Measurement configuration .....                                                                      | 84 |
| 5.5.2.1   | General .....                                                                                        | 84 |
| 5.5.2.2   | Measurement identity removal .....                                                                   | 85 |
| 5.5.2.3   | Measurement identity addition/modification .....                                                     | 86 |
| 5.5.2.4   | Measurement object removal .....                                                                     | 86 |
| 5.5.2.5   | Measurement object addition/modification .....                                                       | 87 |
| 5.5.2.6   | Reporting configuration removal .....                                                                | 88 |
| 5.5.2.7   | Reporting configuration addition/modification .....                                                  | 88 |
| 5.5.2.8   | Quantity configuration .....                                                                         | 89 |
| 5.5.2.9   | Measurement gap configuration .....                                                                  | 89 |
| 5.5.2.10  | Reference signal measurement timing configuration .....                                              | 90 |
| 5.5.2.11  | Measurement gap sharing configuration .....                                                          | 90 |
| 5.5.3     | Performing measurements .....                                                                        | 91 |
| 5.5.3.1   | General .....                                                                                        | 91 |
| 5.5.3.2   | Layer 3 filtering .....                                                                              | 93 |

|          |                                                                                                             |     |
|----------|-------------------------------------------------------------------------------------------------------------|-----|
| 5.5.3.3  | Derivation of cell measurement results .....                                                                | 94  |
| 5.5.3.3a | Derivation of layer 3 beam filtered measurement .....                                                       | 95  |
| 5.5.4    | Measurement report triggering .....                                                                         | 95  |
| 5.5.4.1  | General .....                                                                                               | 95  |
| 5.5.4.2  | Event A1 (Serving becomes better than threshold) .....                                                      | 97  |
| 5.5.4.3  | Event A2 (Serving becomes worse than threshold) .....                                                       | 98  |
| 5.5.4.4  | Event A3 (Neighbour becomes offset better than SpCell) .....                                                | 98  |
| 5.5.4.5  | Event A4 (Neighbour becomes better than threshold) .....                                                    | 99  |
| 5.5.4.6  | Event A5 (SpCell becomes worse than threshold1 and neighbour becomes better than threshold2) .....          | 100 |
| 5.5.4.7  | Event A6 (Neighbour becomes offset better than SCell) .....                                                 | 100 |
| 5.5.4.8  | Event B1 (Inter RAT neighbour becomes better than threshold) .....                                          | 101 |
| 5.5.4.9  | Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) ..... | 102 |
| 5.5.5    | Measurement reporting .....                                                                                 | 103 |
| 5.5.5.1  | General .....                                                                                               | 103 |
| 5.5.5.2  | Reporting of beam measurement information .....                                                             | 108 |
| 5.5.5.3  | Sorting of cell measurement results .....                                                                   | 108 |
| 5.5.6    | Location measurement indication .....                                                                       | 109 |
| 5.5.6.1  | General .....                                                                                               | 109 |
| 5.5.6.2  | Initiation .....                                                                                            | 109 |
| 5.5.6.3  | Actions related to transmission of <i>LocationMeasurementIndication</i> message .....                       | 109 |
| 5.6      | UE capabilities .....                                                                                       | 110 |
| 5.6.1    | UE capability transfer .....                                                                                | 110 |
| 5.6.1.1  | General .....                                                                                               | 110 |
| 5.6.1.2  | Initiation .....                                                                                            | 110 |
| 5.6.1.3  | Reception of the <i>UECapabilityEnquiry</i> by the UE .....                                                 | 110 |
| 5.6.1.4  | Setting band combinations, feature set combinations and feature sets supported by the UE .....              | 111 |
| 5.6.1.5  | Void .....                                                                                                  | 113 |
| 5.7      | Other .....                                                                                                 | 113 |
| 5.7.1    | DL information transfer .....                                                                               | 113 |
| 5.7.1.1  | General .....                                                                                               | 113 |
| 5.7.1.2  | Initiation .....                                                                                            | 113 |
| 5.7.1.3  | Reception of the <i>DLInformationTransfer</i> by the UE .....                                               | 113 |
| 5.7.2    | UL information transfer .....                                                                               | 114 |
| 5.7.2.1  | General .....                                                                                               | 114 |
| 5.7.2.2  | Initiation .....                                                                                            | 114 |
| 5.7.2.3  | Actions related to transmission of <i>ULInformationTransfer</i> message .....                               | 114 |
| 5.7.2.4  | Failure to deliver <i>ULInformationTransfer</i> message .....                                               | 114 |
| 5.7.2a   | UL information transfer for MR-DC .....                                                                     | 114 |
| 5.7.2a.1 | General .....                                                                                               | 114 |
| 5.7.2a.2 | Initiation .....                                                                                            | 115 |
| 5.7.2a.3 | Actions related to transmission of <i>ULInformationTransferMRDC</i> message .....                           | 115 |
| 5.7.3    | SCG failure information .....                                                                               | 115 |
| 5.7.3.1  | General .....                                                                                               | 115 |
| 5.7.3.2  | Initiation .....                                                                                            | 115 |
| 5.7.3.3  | Failure type determination for (NG)EN-DC .....                                                              | 116 |
| 5.7.3.4  | Setting the contents of <i>MeasResultSCG-Failure</i> .....                                                  | 116 |
| 5.7.3.5  | Actions related to transmission of <i>SCGFailureInformation</i> message .....                               | 117 |
| 5.7.3a   | EUTRA SCG failure information .....                                                                         | 118 |
| 5.7.3a.1 | General .....                                                                                               | 118 |
| 5.7.3a.2 | Initiation .....                                                                                            | 118 |
| 5.7.3a.3 | Actions related to transmission of <i>SCGFailureInformationEUTRA</i> message .....                          | 118 |
| 5.7.4    | UE Assistance Information .....                                                                             | 119 |
| 5.7.4.1  | General .....                                                                                               | 119 |
| 5.7.4.2  | Initiation .....                                                                                            | 119 |
| 5.7.4.3  | Actions related to transmission of <i>UEAssistanceInformation</i> message .....                             | 119 |
| 5.7.5    | Failure information .....                                                                                   | 121 |
| 5.7.5.1  | General .....                                                                                               | 121 |
| 5.7.5.2  | Initiation .....                                                                                            | 121 |
| 5.7.5.3  | Actions related to transmission of <i>FailureInformation</i> message .....                                  | 121 |

|       |                                                        |     |
|-------|--------------------------------------------------------|-----|
| 6     | Protocol data units, formats and parameters (ASN.1)    | 122 |
| 6.1   | General                                                | 122 |
| 6.1.1 | Introduction                                           | 122 |
| 6.1.2 | Need codes and conditions for optional downlink fields | 122 |
| 6.1.3 | General rules                                          | 125 |
| 6.2   | RRC messages                                           | 125 |
| 6.2.1 | General message structure                              | 125 |
| –     | NR-RRC-Definitions                                     | 125 |
| –     | BCCH-BCH-Message                                       | 125 |
| –     | BCCH-DL-SCH-Message                                    | 126 |
| –     | DL-CCCH-Message                                        | 126 |
| –     | DL-DCCH-Message                                        | 127 |
| –     | PCCH-Message                                           | 127 |
| –     | UL-CCCH-Message                                        | 128 |
| –     | UL-CCCH1-Message                                       | 128 |
| –     | UL-DCCH-Message                                        | 129 |
| 6.2.2 | Message definitions                                    | 130 |
| –     | CounterCheck                                           | 130 |
| –     | CounterCheckResponse                                   | 131 |
| –     | DLInformationTransfer                                  | 132 |
| –     | FailureInformation                                     | 133 |
| –     | LocationMeasurementIndication                          | 133 |
| –     | MeasurementReport                                      | 134 |
| –     | MIB                                                    | 135 |
| –     | MobilityFromNRCommand                                  | 136 |
| –     | Paging                                                 | 137 |
| –     | RRCReestablishment                                     | 138 |
| –     | RRCReestablishmentComplete                             | 139 |
| –     | RRCReestablishmentRequest                              | 140 |
| –     | RRCReconfiguration                                     | 141 |
| –     | RRCReconfigurationComplete                             | 144 |
| –     | RRCReject                                              | 145 |
| –     | RRCRelease                                             | 146 |
| –     | RRCResume                                              | 149 |
| –     | RRCResumeComplete                                      | 151 |
| –     | RRCResumeRequest                                       | 152 |
| –     | RRCResumeRequest1                                      | 153 |
| –     | RRCSetup                                               | 153 |
| –     | RRCSetupComplete                                       | 154 |
| –     | RRCSetupRequest                                        | 156 |
| –     | RRCSystemInfoRequest                                   | 157 |
| –     | SCGFailureInformation                                  | 158 |
| –     | SCGFailureInformationEUTRA                             | 159 |
| –     | SecurityModeCommand                                    | 160 |
| –     | SecurityModeComplete                                   | 161 |
| –     | SecurityModeFailure                                    | 161 |
| –     | SIB1                                                   | 162 |
| –     | SystemInformation                                      | 164 |
| –     | UEAssistanceInformation                                | 165 |
| –     | UECapabilityEnquiry                                    | 168 |
| –     | UECapabilityInformation                                | 168 |
| –     | ULInformationTransfer                                  | 169 |
| –     | ULInformationTransferMRDC                              | 170 |
| 6.3   | RRC information elements                               | 171 |
| 6.3.0 | Parameterized types                                    | 171 |
| –     | SetupRelease                                           | 171 |
| 6.3.1 | System information blocks                              | 171 |
| –     | SIB2                                                   | 171 |
| –     | SIB3                                                   | 174 |
| –     | SIB4                                                   | 175 |
| –     | SIB5                                                   | 178 |
| –     | SIB6                                                   | 180 |

|       |                                                   |     |
|-------|---------------------------------------------------|-----|
| –     | SIB7.....                                         | 181 |
| –     | SIB8.....                                         | 182 |
| –     | SIB9.....                                         | 183 |
| 6.3.2 | Radio resource control information elements ..... | 184 |
| –     | AdditionalSpectrumEmission .....                  | 184 |
| –     | Alpha .....                                       | 184 |
| –     | AMF-Identifier .....                              | 185 |
| –     | ARFCN-ValueEUTRA.....                             | 185 |
| –     | ARFCN-ValueNR .....                               | 185 |
| –     | BeamFailureRecoveryConfig .....                   | 186 |
| –     | BSR-Config.....                                   | 188 |
| –     | BWP .....                                         | 188 |
| –     | BWP-Downlink.....                                 | 189 |
| –     | BWP-DownlinkCommon .....                          | 190 |
| –     | BWP-DownlinkDedicated .....                       | 190 |
| –     | BWP-Id.....                                       | 191 |
| –     | BWP-Uplink .....                                  | 191 |
| –     | BWP-UplinkCommon .....                            | 192 |
| –     | BWP-UplinkDedicated .....                         | 193 |
| –     | CellAccessRelatedInfo.....                        | 194 |
| –     | CellAccessRelatedInfo-EUTRA-5GC .....             | 195 |
| –     | CellAccessRelatedInfo-EUTRA-EPC .....             | 195 |
| –     | CellGroupConfig.....                              | 196 |
| –     | CellGroupId .....                                 | 199 |
| –     | CellIdentity.....                                 | 199 |
| –     | CellReselectionPriority .....                     | 200 |
| –     | CellReselectionSubPriority .....                  | 200 |
| –     | CGI-InfoEUTRA.....                                | 200 |
| –     | CGI-InfoNR.....                                   | 201 |
| –     | CodebookConfig.....                               | 201 |
| –     | ConfiguredGrantConfig .....                       | 204 |
| –     | ConnEstFailureControl.....                        | 207 |
| –     | ControlResourceSet.....                           | 208 |
| –     | ControlResourceSetId .....                        | 209 |
| –     | ControlResourceSetZero .....                      | 210 |
| –     | CrossCarrierSchedulingConfig .....                | 210 |
| –     | CSI-AperiodicTriggerStateList.....                | 211 |
| –     | CSI-FrequencyOccupation.....                      | 212 |
| –     | CSI-IM-Resource .....                             | 213 |
| –     | CSI-IM-ResourceId .....                           | 214 |
| –     | CSI-IM-ResourceSet.....                           | 214 |
| –     | CSI-IM-ResourceSetId .....                        | 215 |
| –     | CSI-MeasConfig .....                              | 215 |
| –     | CSI-ReportConfig.....                             | 217 |
| –     | CSI-ReportConfigId .....                          | 222 |
| –     | CSI-ResourceConfig.....                           | 222 |
| –     | CSI-ResourceConfigId .....                        | 223 |
| –     | CSI-ResourcePeriodicityAndOffset .....            | 223 |
| –     | CSI-RS-ResourceConfigMobility .....               | 224 |
| –     | CSI-RS-ResourceMapping .....                      | 226 |
| –     | CSI-SemiPersistentOnPUSCH-TriggerStateList.....   | 227 |
| –     | CSI-SSB-ResourceSet.....                          | 228 |
| –     | CSI-SSB-ResourceSetId.....                        | 228 |
| –     | DedicatedNAS-Message .....                        | 228 |
| –     | DMRS-DownlinkConfig .....                         | 229 |
| –     | DMRS-UplinkConfig .....                           | 230 |
| –     | DownlinkConfigCommon .....                        | 231 |
| –     | DownlinkConfigCommonSIB .....                     | 232 |
| –     | DownlinkPreemption.....                           | 234 |
| –     | DRB-Identity .....                                | 235 |
| –     | DRX-Config.....                                   | 235 |
| –     | FilterCoefficient.....                            | 237 |

|   |                                                     |     |
|---|-----------------------------------------------------|-----|
| – | <i>FreqBandIndicatorNR</i> .....                    | 237 |
| – | <i>FrequencyInfoDL</i> .....                        | 238 |
| – | <i>FrequencyInfoDL-SIB</i> .....                    | 239 |
| – | <i>FrequencyInfoUL</i> .....                        | 239 |
| – | <i>FrequencyInfoUL-SIB</i> .....                    | 240 |
| – | <i>Hysteresis</i> .....                             | 241 |
| – | <i>I-RNTI-Value</i> .....                           | 242 |
| – | <i>LocationMeasurementInfo</i> .....                | 242 |
| – | <i>LogicalChannelConfig</i> .....                   | 243 |
| – | <i>LogicalChannelIdentity</i> .....                 | 244 |
| – | <i>MAC-CellGroupConfig</i> .....                    | 245 |
| – | <i>MeasConfig</i> .....                             | 246 |
| – | <i>MeasGapConfig</i> .....                          | 247 |
| – | <i>MeasGapSharingConfig</i> .....                   | 249 |
| – | <i>MeasId</i> .....                                 | 249 |
| – | <i>MeasIdToAddModList</i> .....                     | 250 |
| – | <i>MeasObjectEUTRA</i> .....                        | 250 |
| – | <i>MeasObjectId</i> .....                           | 252 |
| – | <i>MeasObjectNR</i> .....                           | 252 |
| – | <i>MeasObjectToAddModList</i> .....                 | 256 |
| – | <i>MeasResultCellListSFTD-NR</i> .....              | 257 |
| – | <i>MeasResultCellListSFTD-EUTRA</i> .....           | 257 |
| – | <i>MeasResults</i> .....                            | 258 |
| – | <i>MeasResult2EUTRA</i> .....                       | 261 |
| – | <i>MeasResult2NR</i> .....                          | 262 |
| – | <i>MeasResultSCG-Failure</i> .....                  | 262 |
| – | <i>MobilityStateParameters</i> .....                | 262 |
| – | <i>MultiFrequencyBandListNR</i> .....               | 263 |
| – | <i>MultiFrequencyBandListNR-SIB</i> .....           | 263 |
| – | <i>NextHopChainingCount</i> .....                   | 264 |
| – | <i>NG-5G-S-TMSI</i> .....                           | 264 |
| – | <i>NR-NS-PmaxList</i> .....                         | 265 |
| – | <i>NZP-CSI-RS-Resource</i> .....                    | 265 |
| – | <i>NZP-CSI-RS-ResourceId</i> .....                  | 266 |
| – | <i>NZP-CSI-RS-ResourceSet</i> .....                 | 267 |
| – | <i>NZP-CSI-RS-ResourceSetId</i> .....               | 267 |
| – | <i>P-Max</i> .....                                  | 268 |
| – | <i>PCI-List</i> .....                               | 268 |
| – | <i>PCI-Range</i> .....                              | 268 |
| – | <i>PCI-RangeElement</i> .....                       | 269 |
| – | <i>PCI-RangeIndex</i> .....                         | 269 |
| – | <i>PCI-RangeIndexList</i> .....                     | 270 |
| – | <i>PDCCCH-Config</i> .....                          | 270 |
| – | <i>PDCCCH-ConfigCommon</i> .....                    | 271 |
| – | <i>PDCCCH-ConfigSIB1</i> .....                      | 273 |
| – | <i>PDCCCH-ServingCellConfig</i> .....               | 273 |
| – | <i>PDCCP-Config</i> .....                           | 274 |
| – | <i>PDSCH-Config</i> .....                           | 277 |
| – | <i>PDSCH-ConfigCommon</i> .....                     | 280 |
| – | <i>PDSCH-ServingCellConfig</i> .....                | 280 |
| – | <i>PDSCH-TimeDomainResourceAllocationList</i> ..... | 282 |
| – | <i>PHR-Config</i> .....                             | 282 |
| – | <i>PhysCellId</i> .....                             | 283 |
| – | <i>PhysicalCellGroupConfig</i> .....                | 284 |
| – | <i>PLMN-Identity</i> .....                          | 285 |
| – | <i>PLMN-IdentityInfoList</i> .....                  | 286 |
| – | <i>PRB-Id</i> .....                                 | 287 |
| – | <i>PTRS-DownlinkConfig</i> .....                    | 287 |
| – | <i>PTRS-UplinkConfig</i> .....                      | 288 |
| – | <i>PUCCH-Config</i> .....                           | 289 |
| – | <i>PUCCH-ConfigCommon</i> .....                     | 293 |
| – | <i>PUCCH-PathlossReferenceRS-Id</i> .....           | 294 |

|   |                                              |     |
|---|----------------------------------------------|-----|
| – | PUCCH-PowerControl .....                     | 294 |
| – | PUCCH-SpatialRelationInfo .....              | 295 |
| – | PUCCH-TPC-CommandConfig .....                | 296 |
| – | PUSCH-Config .....                           | 297 |
| – | PUSCH-ConfigCommon .....                     | 300 |
| – | PUSCH-PowerControl .....                     | 300 |
| – | PUSCH-ServingCellConfig .....                | 303 |
| – | PUSCH-TimeDomainResourceAllocationList ..... | 304 |
| – | PUSCH-TPC-CommandConfig .....                | 305 |
| – | Q-OffsetRange .....                          | 306 |
| – | Q-QualMin .....                              | 306 |
| – | Q-RxLevMin .....                             | 307 |
| – | QuantityConfig .....                         | 307 |
| – | RACH-ConfigCommon .....                      | 308 |
| – | RACH-ConfigDedicated .....                   | 311 |
| – | RACH-ConfigGeneric .....                     | 313 |
| – | RA-Prioritization .....                      | 314 |
| – | RadioBearerConfig .....                      | 315 |
| – | RadioLinkMonitoringConfig .....              | 317 |
| – | RadioLinkMonitoringRS-Id .....               | 318 |
| – | RAN-AreaCode .....                           | 319 |
| – | RateMatchPattern .....                       | 319 |
| – | RateMatchPatternId .....                     | 320 |
| – | RateMatchPatternLTE-CRS .....                | 321 |
| – | RejectWaitTime .....                         | 322 |
| – | ReportConfigId .....                         | 322 |
| – | ReportConfigInterRAT .....                   | 322 |
| – | ReportConfigNR .....                         | 325 |
| – | ReportConfigToAddModList .....               | 329 |
| – | ReportInterval .....                         | 330 |
| – | ReselectionThreshold .....                   | 330 |
| – | ReselectionThresholdQ .....                  | 330 |
| – | ResumeCause .....                            | 331 |
| – | RLC-BearerConfig .....                       | 331 |
| – | RLC-Config .....                             | 332 |
| – | RLF-TimersAndConstants .....                 | 335 |
| – | RNTI-Value .....                             | 335 |
| – | RSRP-Range .....                             | 336 |
| – | RSRQ-Range .....                             | 336 |
| – | SCellIndex .....                             | 336 |
| – | SchedulingRequestConfig .....                | 337 |
| – | SchedulingRequestId .....                    | 338 |
| – | SchedulingRequestResourceConfig .....        | 338 |
| – | SchedulingRequestResourceId .....            | 339 |
| – | ScramblingId .....                           | 339 |
| – | SCS-SpecificCarrier .....                    | 340 |
| – | SDAP-Config .....                            | 340 |
| – | SearchSpace .....                            | 341 |
| – | SearchSpaceId .....                          | 345 |
| – | SearchSpaceZero .....                        | 345 |
| – | SecurityAlgorithmConfig .....                | 346 |
| – | ServCellIndex .....                          | 346 |
| – | ServingCellConfig .....                      | 347 |
| – | ServingCellConfigCommon .....                | 351 |
| – | ServingCellConfigCommonSIB .....             | 353 |
| – | ShortI-RNTI-Value .....                      | 354 |
| – | ShortMAC-I .....                             | 354 |
| – | SINR-Range .....                             | 355 |
| – | SI-SchedulingInfo .....                      | 355 |
| – | SK-Counter .....                             | 358 |
| – | SlotFormatCombinationsPerCell .....          | 358 |
| – | SlotFormatIndicator .....                    | 359 |

|       |                                          |     |
|-------|------------------------------------------|-----|
| –     | S-NSSAI .....                            | 360 |
| –     | SpeedStateScaleFactors .....             | 360 |
| –     | SPS-Config .....                         | 361 |
| –     | SRB-Identity .....                       | 362 |
| –     | SRS-CarrierSwitching .....               | 362 |
| –     | SRS-Config .....                         | 363 |
| –     | SRS-TPC-CommandConfig .....              | 368 |
| –     | SSB-Index .....                          | 369 |
| –     | SSB-MTC .....                            | 369 |
| –     | SSB-ToMeasure .....                      | 370 |
| –     | SS-RSSI-Measurement .....                | 371 |
| –     | SubcarrierSpacing .....                  | 371 |
| –     | TAG-Config .....                         | 372 |
| –     | TCI-State .....                          | 372 |
| –     | TCI-StateId .....                        | 373 |
| –     | TDD-UL-DL-Config .....                   | 374 |
| –     | TrackingAreaCode .....                   | 376 |
| –     | T-Reselection .....                      | 376 |
| –     | TimeToTrigger .....                      | 377 |
| –     | UAC-BarringInfoSetIndex .....            | 377 |
| –     | UAC-BarringInfoSetList .....             | 377 |
| –     | UAC-BarringPerCatList .....              | 378 |
| –     | UAC-BarringPerPLMN-List .....            | 379 |
| –     | UE-TimersAndConstants .....              | 379 |
| –     | UplinkConfigCommon .....                 | 380 |
| –     | UplinkConfigCommonSIB .....              | 380 |
| –     | UplinkTxDirectCurrentList .....          | 381 |
| –     | ZP-CSI-RS-Resource .....                 | 382 |
| –     | ZP-CSI-RS-ResourceSet .....              | 383 |
| –     | ZP-CSI-RS-ResourceSetId .....            | 383 |
| 6.3.3 | UE capability information elements ..... | 384 |
| –     | AccessStratumRelease .....               | 384 |
| –     | BandCombinationList .....                | 384 |
| –     | CA-BandwidthClassEUTRA .....             | 386 |
| –     | CA-BandwidthClassNR .....                | 387 |
| –     | CA-ParametersEUTRA .....                 | 387 |
| –     | CA-ParametersNR .....                    | 387 |
| –     | CA-ParametersNRDC .....                  | 389 |
| –     | CodebookParameters .....                 | 390 |
| –     | FeatureSetCombination .....              | 390 |
| –     | FeatureSetCombinationId .....            | 392 |
| –     | FeatureSetDownlink .....                 | 392 |
| –     | FeatureSetDownlinkId .....               | 395 |
| –     | FeatureSetDownlinkPerCC .....            | 395 |
| –     | FeatureSetDownlinkPerCC-Id .....         | 395 |
| –     | FeatureSetEUTRA-DownlinkId .....         | 396 |
| –     | FeatureSetEUTRA-UplinkId .....           | 396 |
| –     | FeatureSets .....                        | 396 |
| –     | FeatureSetUplink .....                   | 397 |
| –     | FeatureSetUplinkId .....                 | 399 |
| –     | FeatureSetUplinkPerCC .....              | 399 |
| –     | FeatureSetUplinkPerCC-Id .....           | 400 |
| –     | FreqBandIndicatorEUTRA .....             | 400 |
| –     | FreqBandList .....                       | 400 |
| –     | FreqSeparationClass .....                | 401 |
| –     | IMS-Parameters .....                     | 401 |
| –     | InterRAT-Parameters .....                | 402 |
| –     | MAC-Parameters .....                     | 403 |
| –     | MeasAndMobParameters .....               | 404 |
| –     | MeasAndMobParametersMRDC .....           | 405 |
| –     | MIMO-Layers .....                        | 406 |
| –     | MIMO-ParametersPerBand .....             | 406 |

|       |                                                    |     |
|-------|----------------------------------------------------|-----|
| –     | ModulationOrder .....                              | 410 |
| –     | MRDC-Parameters .....                              | 410 |
| –     | NRDC-Parameters .....                              | 410 |
| –     | PDCCP-Parameters .....                             | 411 |
| –     | PDCCP-ParametersMRDC .....                         | 412 |
| –     | Phy-Parameters .....                               | 412 |
| –     | Phy-ParametersMRDC .....                           | 415 |
| –     | ProcessingParameters .....                         | 416 |
| –     | RAT-Type .....                                     | 416 |
| –     | RF-Parameters .....                                | 417 |
| –     | RF-ParametersMRDC .....                            | 419 |
| –     | RLC-Parameters .....                               | 419 |
| –     | SDAP-Parameters .....                              | 420 |
| –     | SRS-SwitchingTimeNR .....                          | 420 |
| –     | SRS-SwitchingTimeEUTRA .....                       | 421 |
| –     | SupportedBandwidth .....                           | 421 |
| –     | UE-CapabilityRAT-ContainerList .....               | 421 |
| –     | UE-CapabilityRAT-RequestList .....                 | 422 |
| –     | UE-CapabilityRequestFilterCommon .....             | 423 |
| –     | UE-CapabilityRequestFilterNR .....                 | 423 |
| –     | UE-MRDC-Capability .....                           | 424 |
| –     | UE-NR-Capability .....                             | 425 |
| 6.3.4 | Other information elements .....                   | 427 |
| –     | EUTRA-AllowedMeasBandwidth .....                   | 427 |
| –     | EUTRA-MBSFN-SubframeConfigList .....               | 427 |
| –     | EUTRA-MultiBandInfoList .....                      | 428 |
| –     | EUTRA-NS-PmaxList .....                            | 428 |
| –     | EUTRA-PhysCellId .....                             | 429 |
| –     | EUTRA-PhysCellIdRange .....                        | 429 |
| –     | EUTRA-PresenceAntennaPort1 .....                   | 430 |
| –     | EUTRA-Q-OffsetRange .....                          | 430 |
| –     | OtherConfig .....                                  | 430 |
| –     | RRC-TransactionIdentifier .....                    | 431 |
| 6.4   | RRC multiplicity and type constraint values .....  | 432 |
| –     | Multiplicity and type constraint definitions ..... | 432 |
| –     | End of NR-RRC-Definitions .....                    | 435 |
| 6.5   | Short Message .....                                | 435 |
| 7     | Variables and constants .....                      | 437 |
| 7.1   | Timers .....                                       | 437 |
| 7.1.1 | Timers (Informative) .....                         | 437 |
| 7.1.2 | Timer handling .....                               | 440 |
| 7.2   | Counters .....                                     | 440 |
| 7.3   | Constants .....                                    | 441 |
| 7.4   | UE variables .....                                 | 441 |
| –     | NR-UE-Variables .....                              | 441 |
| –     | VarPendingRNA-Update .....                         | 442 |
| –     | VarMeasConfig .....                                | 442 |
| –     | VarMeasReportList .....                            | 443 |
| –     | VarResumeMAC-Input .....                           | 443 |
| –     | VarShortMAC-Input .....                            | 444 |
| –     | End of NR-UE-Variables .....                       | 444 |
| 8     | Protocol data unit abstract syntax .....           | 445 |
| 8.1   | General .....                                      | 445 |
| 8.2   | Structure of encoded RRC messages .....            | 445 |
| 8.3   | Basic production .....                             | 445 |
| 8.4   | Extension .....                                    | 445 |
| 8.5   | Padding .....                                      | 446 |
| 9     | Specified and default radio configurations .....   | 446 |
| 9.1   | Specified configurations .....                     | 446 |
| 9.1.1 | Logical channel configurations .....               | 446 |