

ETSI TS 136 133 V18.12.0 (2026-03)



TECHNICAL SPECIFICATION

**LTE;
Evolved Universal Terrestrial Radio Access (E-UTRA);
Requirements for support of radio resource management
(3GPP TS 36.133 version 18.12.0 Release 18)**

get full document from standards.iteh.ai



ReferenceRTS/TSGR-0436133vic0

KeywordsLTE

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 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from the
[ETSI Search & Browse Standards](#) application.

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 on [ETSI deliver](#) repository.

Users should be aware that the present document may be revised or have its status changed, this information is available in the [Milestones listing](#).

If you find errors in the present document, please send your comments to the relevant service listed under [Committee Support Staff](#).

If you find a security vulnerability in the present document, please report it through our [Coordinated Vulnerability Disclosure \(CVD\)](#) program.

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

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 2026.
All rights reserved.

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are 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 IPR online database](#).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, 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.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™**, **LTE™** and **5G™** logo 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.

Legal Notice

This Technical Specification (TS) has been produced by the 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 at [3GPP to ETSI numbering cross-referencing](#).

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..... | 106 |
| 1 Scope | 108 |
| 2 References | 108 |
| 3 Definitions, symbols and abbreviations | 110 |
| 3.1 Definitions | 110 |
| 3.2 Symbols..... | 112 |
| 3.3 Abbreviations | 113 |
| 3.4 Test tolerances..... | 116 |
| 3.5 Additional notation..... | 116 |
| 3.5.1 Groups of bands..... | 116 |
| 3.5.1A Groups of bands for satellite access..... | 118 |
| 3.6 General | 119 |
| 3.6.1 Applicability of requirements in this specification version | 119 |
| 3.6.1.1 Applicability of requirements for UE capable of network-based CRS interference mitigation | 125 |
| 3.6.1.2 Applicability of requirements with CRS muting for category M1 UE capable of CRS muting..... | 127 |
| 3.6.1.3 Applicability of requirements with CRS muting for category M2 UE capable of CRS muting..... | 128 |
| 3.6.2 Applicability of requirements for EN-DC operation | 129 |
| 3.6.3 Applicability of requirements for NE-DC operation | 130 |
| 3.6.4 Applicability of requirements for NGEN-DC operation..... | 131 |
| 3.6.5 Applicability of 2-step RA and 4-step RA in RRM requirements | 131 |
| 3.6.6 Void | 131 |
| 3.6.7 Applicability of NB-IoT inband operation in NTN NR..... | 131 |
| Rel-18 UEs supporting only standalone operation do not need to be tested for in-band operation with NR over NTN. In-band operation with NR NTN is not supported in Rel-17. | 131 |
| 4 E-UTRAN RRC_IDLE state mobility..... | 131 |
| 4.1 Cell Selection | 131 |
| 4.2 Cell Re-selection | 132 |
| 4.2.1 Introduction..... | 132 |
| 4.2.2 Requirements | 132 |
| 4.2.2.1 Measurement and evaluation of serving cell..... | 133 |
| 4.2.2.2 Void..... | 134 |
| 4.2.2.3 Measurements of intra-frequency E-UTRAN cells | 134 |
| 4.2.2.4 Measurements of inter-frequency E-UTRAN cells | 136 |
| 4.2.2.5 Measurements of inter-RAT cells | 138 |
| 4.2.2.5.1 Measurements of UTRAN FDD cells..... | 138 |
| 4.2.2.5.2 Measurements of UTRAN TDD cells | 140 |
| 4.2.2.5.3 Measurements of GSM cells..... | 141 |
| 4.2.2.5.4 Measurements of HRPD cells..... | 142 |
| 4.2.2.5.5 Measurements of cdma2000 1X | 143 |
| 4.2.2.5.6 Measurements of NR cells..... | 144 |
| 4.2.2.5.7 Measurements of NR cells subject to CCA | 147 |
| 4.2.2.5.8 Measurements of NR cells for RedCap | 149 |
| 4.2.2.6 Evaluation of cell re-selection criteria..... | 151 |
| 4.2.2.7 Maximum interruption in paging reception..... | 151 |
| 4.2.2.8 void | 152 |
| 4.2.2.9 UE measurement capability | 152 |
| 4.2.2.9a UE measurement capability (Increased UE carrier monitoring) | 153 |
| 4.2.2.10 Reselection to CSG cells | 153 |
| 4.2.2.10.1 Reselection from a non CSG to an inter-frequency CSG cell..... | 153 |
| 4.2.2.10.2 Reselection from a non CSG to an inter-RAT UTRAN FDD CSG cell..... | 154 |
| 4.2.2.11 Void..... | 155 |

| | | |
|-----------|---------------------------------------------------------------------------------------------------------------------------------|-----|
| 4.2.2.12 | Void..... | 155 |
| 4.2.2.13 | Void..... | 155 |
| 4.2.2.14 | UE measurement capability for RedCap | 155 |
| 4.3 | Minimization of Drive Tests (MDT) | 155 |
| 4.3.1 | Introduction..... | 155 |
| 4.3.2 | Measurements | 156 |
| 4.3.2.1 | Requirements | 156 |
| 4.3.3 | Relative Time Stamp Accuracy | 156 |
| 4.3.3.1 | Requirements | 156 |
| 4.3.4 | Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting | 156 |
| 4.3.4.1 | Requirements | 156 |
| 4.3.5 | Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting..... | 156 |
| 4.3.5.1 | Requirements for <i>timeSinceFailure</i> | 156 |
| 4.4 | MBSFN Measurements | 157 |
| 4.4.1 | Introduction..... | 157 |
| 4.4.2 | MBSFN RSRP measurements | 157 |
| 4.4.3 | MBSFN RSRQ measurements..... | 157 |
| 4.4.4 | MCH BLER measurements | 157 |
| 4.5 | Proximity-based Services | 158 |
| 4.5.1 | Introduction..... | 158 |
| 4.5.2 | Requirements | 158 |
| 4.5.2.1 | Interruptions with ProSe Direct Discovery | 158 |
| 4.5.2.2 | Interruptions with ProSe Direct Communication | 158 |
| 4.5.2.3 | Initiation/Cease of SLSS transmissions with ProSe Direct Discovery..... | 158 |
| 4.5.2.4 | Initiation/Cease of SLSS transmissions with ProSe Direct Communication | 159 |
| 4.6 | Cell Selection and Re-selection Requirements for UE category NB1 | 159 |
| 4.6.1 | Cell Selection..... | 159 |
| 4.6.2 | Cell Re-selection..... | 159 |
| 4.6.2.1 | Measurement and evaluation of serving NB-IoT cell for UE category NB1 in normal coverage..... | 159 |
| 4.6.2.1A | Measurement and evaluation of serving NB-IoT cell for HD-FDD UE category NB1 in normal coverage when configured with WUS..... | 161 |
| 4.6.2.2 | Measurements of intra-frequency NB-IoT cells for UE category NB1 in normal coverage | 162 |
| 4.6.2.3 | Measurement and evaluation of serving NB-IoT cell for UE category NB1 in enhanced coverage ... | 163 |
| 4.6.2.3A | Measurement and evaluation of serving NB-IoT cell for HD-FDD UE category NB1 in enhanced coverage when configured with WUS..... | 164 |
| 4.6.2.4 | Measurements of intra-frequency NB-IoT cells for UE category NB1 in enhanced coverage | 165 |
| 4.6.2.5 | Measurements of inter-frequency NB cells for UE category NB1 in normal coverage | 167 |
| 4.6.2.6 | Measurements of inter-frequency NB-IoT cells for UE category NB1 in enhanced coverage | 168 |
| 4.6.2.7 | Maximum interruption in paging reception in normal coverage | 169 |
| 4.6.2.7A | Maximum interruption in paging reception in enhanced coverage | 169 |
| 4.6.2.8 | UE measurement capability | 169 |
| 4.6.2.9 | WUS receptions for NB1 | 170 |
| 4.6.3 | Requirements for transmission using preconfigured uplink resources for UE category NB1 | 170 |
| 4.6.3.1 | Introduction..... | 170 |
| 4.6.3.2 | Requirements on UE synchronization for transmission using PUR..... | 170 |
| 4.6.3.3 | Requirements on TA validation for transmission using PUR | 170 |
| 4.6A | Cell Selection and Re-selection Requirements for UE category NB-IoT for Satellite Access..... | 171 |
| 4.6A.1 | Cell Selection..... | 171 |
| 4.6A.2 | Cell Re-selection for UE category NB-IoT for Satellite Access..... | 171 |
| 4.6A.2.1 | Measurement and evaluation of serving NB-IoT cell for UE category NB1 in normal coverage..... | 172 |
| 4.6A.2.1A | Measurement and evaluation of serving NB-IoT cell for HD-FDD UE category NB1 in normal coverage when configured with WUS..... | 173 |
| 4.6A.2.2 | Measurements of intra-frequency NB-IoT cells for UE category NB1 in normal coverage | 174 |
| 4.6A.2.3 | Measurement and evaluation of serving NB-IoT cell for UE category NB1 in enhanced coverage ... | 176 |
| 4.6A.2.3A | Measurement and evaluation of serving NB-IoT cell for HD-FDD UE category NB1 in enhanced coverage when configured with WUS..... | 178 |
| 4.6A.2.4 | Measurements of intra-frequency NB-IoT cells for UE category NB1 in enhanced coverage | 179 |
| 4.6A.2.5 | Measurements of inter-frequency NB cells for UE category NB1 in normal coverage | 181 |
| 4.6A.2.6 | Measurements of inter-frequency NB-IoT cells for UE category NB1 in enhanced coverage | 183 |
| 4.6A.2.7 | Maximum interruption in paging reception in normal coverage | 185 |
| 4.6A.2.7A | Maximum interruption in paging reception in enhanced coverage | 185 |
| 4.6A.2.8 | UE measurement capability | 186 |

| | | |
|-------------|----------------------------------------------------------------------------------------------------------------------|-----|
| 4.6A.2.9 | WUS receptions for NB1 | 186 |
| 4.6A.3 | Requirements for transmission using preconfigured uplink resources for UE category NB-IoT for Satellite Access | 186 |
| 4.6A.3.1 | Introduction | 186 |
| 4.6A.3.2 | Requirements on UE synchronization for transmission using PUR | 186 |
| 4.6A.3.3 | Requirements on TA validation for transmission using PUR | 187 |
| 4.7 | Cell Selection and Re-selection Requirements for UE category M1 | 187 |
| 4.7.1 | Cell Selection | 187 |
| 4.7.2 | Cell Re-selection | 187 |
| 4.7.2.1 | Cell Re-selection requirements for UE category M1 in normal coverage | 187 |
| 4.7.2.1.1 | Measurement and evaluation of serving cell for UE category M1 in normal coverage | 187 |
| 4.7.2.1.1A | Relaxed measurement and evaluation of serving cell for UE category M1 in normal coverage ... | 188 |
| 4.7.2.1.2 | Measurements of intra-frequency cells for UE category M1 in normal coverage | 189 |
| 4.7.2.1.3 | Measurements of inter-frequency cells for UE category M1 in normal coverage | 190 |
| 4.7.2.1.4 | Maximum allowed layers for multiple monitoring for UE category M1 in normal coverage | 192 |
| 4.7.2.1.5 | Maximum interruption in paging reception for Category M1 UEs in normal coverage | 192 |
| 4.7.2.2 | Cell Re-selection requirements for UE category M1 in enhanced coverage | 193 |
| 4.7.2.2.1 | Measurement and evaluation of serving cell for UE category M1 in enhanced coverage | 193 |
| 4.7.2.2.1A | Relaxed measurement and evaluation of serving cell for UE category M1 in enhanced coverage | 194 |
| 4.7.2.2.2 | Measurements of intra-frequency cells for UE category M1 in enhanced coverage | 195 |
| 4.7.2.2.3 | Measurements of inter-frequency cells for UE category M1 in enhanced coverage | 197 |
| 4.7.2.2.4 | Maximum allowed layers for multiple monitoring for UE category M1 in enhanced coverage ... | 199 |
| 4.7.2.2.5 | Maximum interruption in paging reception for Category M1 UEs in enhanced coverage | 199 |
| 4.7.2.3 | WUS receptions for UE category M1 | 200 |
| 4.7.3 | Channel quality report for UE Category M1 in idle mode | 200 |
| 4.7.4 | Requirements for transmission using preconfigured uplink resources for UE category M1 | 201 |
| 4.7.4.1 | Introduction | 201 |
| 4.7.4.2 | Requirements on UE synchronization for transmission using PUR | 201 |
| 4.7.4.3 | Requirements on TA validation for transmission using PUR | 201 |
| 4.7A | Cell Selection and Re-selection Requirements for UE category M1 for Satellite Access | 202 |
| 4.7A.1 | Cell Selection | 202 |
| 4.7A.2 | Cell Re-selection for UE category M1 for Satellite Access | 202 |
| 4.7A.2.1 | Cell Re-selection requirements for UE category M1 in normal coverage | 203 |
| 4.7A.2.1.1 | Measurement and evaluation of serving cell for UE category M1 in normal coverage | 203 |
| 4.7A.2.1.1A | Relaxed measurement and evaluation of serving cell for UE category M1 in normal coverage ... | 205 |
| 4.7A.2.1.2 | Measurements of intra-frequency cells for UE category M1 in normal coverage | 206 |
| 4.7A.2.1.3 | Measurements of inter-frequency cells for UE category M1 in normal coverage | 209 |
| 4.7A.2.1.4 | Maximum allowed layers for multiple monitoring for UE category M1 in normal coverage | 211 |
| 4.7A.2.1.5 | Maximum interruption in paging reception for Category M1 UEs in normal coverage | 211 |
| 4.7A.2.2 | Cell Re-selection requirements for UE category M1 in enhanced coverage | 212 |
| 4.7A.2.2.1 | Measurement and evaluation of serving cell for UE category M1 in enhanced coverage | 212 |
| 4.7A.2.2.1A | Relaxed measurement and evaluation of serving cell for UE category M1 in enhanced coverage | 213 |
| 4.7A.2.2.2 | Measurements of intra-frequency cells for UE category M1 in enhanced coverage | 215 |
| 4.7A.2.2.3 | Measurements of inter-frequency cells for UE category M1 in enhanced coverage | 217 |
| 4.7A.2.2.4 | Maximum allowed layers for multiple monitoring for UE category M1 in enhanced coverage ... | 220 |
| 4.7A.2.2.5 | Maximum interruption in paging reception for Category M1 UEs in enhanced coverage | 220 |
| 4.7A.2.3 | WUS receptions for UE category M1 | 221 |
| 4.7A.3 | Channel quality report for UE Category M1 in idle mode for Satellite Access | 221 |
| 4.7A.4 | Requirements for transmission using preconfigured uplink resources for UE category M1 for Satellite Access | 222 |
| 4.7A.4.1 | Introduction | 222 |
| 4.7A.4.2 | Requirements on UE synchronization for transmission using PUR | 222 |
| 4.7A.4.3 | Requirements on TA validation for transmission using PUR | 222 |
| 4.8 | Idle State Positioning Measurement Requirements for UE category NB1 | 222 |
| 4.8.1 | OTDOA Intra-Frequency RSTD Measurements for UE category NB1 for normal coverage | 222 |
| 4.8.1.1 | RSTD Measurement Reporting Delay | 224 |
| 4.8.2 | OTDOA Intra-Frequency RSTD Measurements for UE category NB1 for enhanced coverage | 224 |
| 4.8.2.1 | RSTD Measurement Reporting Delay | 225 |
| 4.8.3 | OTDOA Inter-Frequency RSTD Measurements for UE category NB1 for normal coverage | 226 |
| 4.8.3.1 | RSTD Measurement Reporting Delay | 227 |

| | | |
|------------|----------------------------------------------------------------------------------------------------|-----|
| 4.8.4 | OTDOA Inter-Frequency RSTD Measurements for UE category NB1 for enhanced coverage | 228 |
| 4.8.4.1 | RSTD Measurement Reporting Delay | 229 |
| 4.8.5 | Intra-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for normal coverage..... | 229 |
| 4.8.5.1 | Measurement Reporting Delay..... | 230 |
| 4.8.6 | Intra-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for enhanced coverage | 231 |
| 4.8.6.1 | Measurement Reporting Delay..... | 232 |
| 4.8.7 | Inter-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for normal coverage..... | 232 |
| 4.8.7.1 | Measurement Reporting Delay..... | 233 |
| 4.8.8 | Inter-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for enhanced coverage..... | 234 |
| 4.8.8.1 | Measurement Reporting Delay..... | 235 |
| 4.9 | Idle Mode CA Measurement | 235 |
| 4.9.1 | Introduction..... | 235 |
| 4.9.2 | Requirement..... | 236 |
| 4.9.2.1 | Detected cell requirement during state transition and Idle mode | 236 |
| 4.9.2.2 | Measurements of inter-frequency CA candidate cells..... | 236 |
| 4.9.2.3 | Measurements on serving cell..... | 237 |
| 4A | E-UTRAN RRC_INACTIVE state mobility..... | 238 |
| 4A.1 | Cell Re-selection | 238 |
| 4A.1.1 | Introduction..... | 238 |
| 4A.1.2 | Requirements | 238 |
| 4A.1.2.1 | UE measurement capability | 238 |
| 4A.1.2.2 | Measurement and evaluation of serving cell..... | 238 |
| 4A.1.2.3 | Measurements of intra-frequency E-UTRAN cells..... | 238 |
| 4A.1.2.4 | Measurements of inter-frequency E-UTRAN cells..... | 239 |
| 4A.1.2.5 | Evaluation of cell re-selection criteria..... | 239 |
| 4A.1.2.6 | Maximum interruption in paging reception..... | 239 |
| 4A.1.2.7 | Measurements of inter-RAT NR cells..... | 239 |
| 4A.1.2.8 | UE measurement capability for RedCap..... | 239 |
| 4A.1.2.9 | Measurements of inter-RAT NR cells for RedCap | 239 |
| 4A.2 | Requirements for UE Category M1 | 240 |
| 4A.2.1 | Introduction..... | 240 |
| 4A.2.2 | Cell Selection..... | 240 |
| 4A.2.3 | Cell Reselection | 240 |
| 4A.2.3.1 | Cell Re-selection requirements for UE category M1 in normal coverage..... | 240 |
| 4A.2.3.1.1 | Measurement and evaluation of serving cell for UE category M1 in normal coverage..... | 240 |
| 4A.2.3.1.2 | Measurements of intra-frequency cells for UE category M1 in normal coverage | 240 |
| 4A.2.3.1.3 | Measurements of inter-frequency cells for UE category M1 in normal coverage | 241 |
| 4A.2.3.1.4 | Maximum allowed layers for multiple monitoring for UE category M1 in normal coverage | 241 |
| 4A.2.3.1.5 | Maximum interruption in paging reception for Category M1 UEs in normal coverage..... | 241 |
| 4A.2.4 | Channel quality report for UE Category M1 in idle mode..... | 243 |
| 5 | E-UTRAN RRC_CONNECTED state mobility | 243 |
| 5.1 | E-UTRAN Handover..... | 243 |
| 5.1.1 | Introduction..... | 243 |
| 5.1.2 | Requirements | 243 |
| 5.1.2.1 | E-UTRAN FDD – FDD | 243 |
| 5.1.2.1.1 | Handover delay..... | 243 |
| 5.1.2.1.2 | Interruption time..... | 244 |
| 5.1.2.2 | E-UTRAN FDD – TDD | 245 |
| 5.1.2.2.1 | (Void) | 245 |
| 5.1.2.2.2 | (Void) | 245 |
| 5.1.2.3 | E-UTRAN TDD – FDD | 245 |
| 5.1.2.3.1 | (Void) | 245 |
| 5.1.2.3.2 | (Void) | 245 |
| 5.1.2.4 | E-UTRAN TDD – TDD..... | 245 |
| 5.1.2.4.1 | Handover delay | 245 |
| 5.1.2.4.2 | Interruption time | 246 |

| | | |
|-----------|----------------------------------------------------------|-----|
| 5.1.2.5 | E-UTRAN HD–FDD | 247 |
| 5.1.2.5.1 | Handover delay..... | 247 |
| 5.1.2.5.2 | Interruption time | 248 |
| 5.1.2.6 | E-UTRAN FDD – FDD conditional handover..... | 249 |
| 5.1.2.6.1 | Handover delay..... | 249 |
| 5.1.2.6.2 | Measurement time | 249 |
| 5.1.2.6.3 | Preparation time..... | 250 |
| 5.1.2.6.4 | Interruption time | 250 |
| 5.1.2.7 | E-UTRAN FDD – TDD conditional handover | 250 |
| 5.1.2.8 | E-UTRAN TDD – FDD conditional handover | 250 |
| 5.1.2.9 | E-UTRAN TDD – TDD conditional handover | 250 |
| 5.2 | Void..... | 250 |
| 5.3 | Handover to other RATs | 250 |
| 5.3.1 | E-UTRAN - UTRAN FDD Handover | 250 |
| 5.3.1.1 | Introduction..... | 250 |
| 5.3.1.1.1 | Handover delay..... | 251 |
| 5.3.1.1.2 | Interruption time | 251 |
| 5.3.2 | E-UTRAN - UTRAN TDD Handover | 251 |
| 5.3.2.1 | Introduction..... | 251 |
| 5.3.2.2 | Requirements | 251 |
| 5.3.2.2.1 | Handover delay..... | 252 |
| 5.3.2.2.2 | Interruption time | 252 |
| 5.3.3 | E-UTRAN - GSM Handover | 252 |
| 5.3.3.1 | Introduction..... | 252 |
| 5.3.3.2 | Requirements | 252 |
| 5.3.3.2.1 | Handover delay..... | 252 |
| 5.3.3.2.2 | Interruption time | 253 |
| 5.3.4 | E-UTRAN - NR FR1 Handover | 253 |
| 5.3.4.1 | Introduction..... | 253 |
| 5.3.4.2 | Handover delay | 253 |
| 5.3.4.3 | Interruption time | 253 |
| 5.3.4A | E-UTRAN - NR FR1 Handover to target cell using CCA | 254 |
| 5.3.4A.1 | Introduction..... | 254 |
| 5.3.4A.2 | Handover delay | 254 |
| 5.3.4A.3 | Interruption time | 254 |
| 5.3.4B | E-UTRAN - NR FR1 Handover for RedCap | 255 |
| 5.3.4B.1 | Introduction..... | 255 |
| 5.3.4B.2 | Requirements | 255 |
| 5.3.5 | E-UTRAN - NR FR2 Handover | 255 |
| 5.3.5.1 | Introduction..... | 255 |
| 5.3.5.2 | Handover delay | 255 |
| 5.3.5.3 | Interruption time | 256 |
| 5.4 | Handover to Non-3GPP RATs | 256 |
| 5.4.1 | E-UTRAN – HRPD Handover..... | 256 |
| 5.4.1.1 | Introduction | 256 |
| 5.4.1.1.1 | Handover delay..... | 257 |
| 5.4.1.1.2 | Interruption time | 257 |
| 5.4.2 | E-UTRAN – cdma2000 1X Handover..... | 257 |
| 5.4.2.1 | Introduction | 257 |
| 5.4.2.1.1 | Handover delay..... | 257 |
| 5.4.2.1.2 | Interruption time | 257 |
| 5.5 | E-UTRAN Handover for Cat-M1 UEs..... | 258 |
| 5.5.1 | Introduction..... | 258 |
| 5.5.2 | Requirements in CEModeA..... | 258 |
| 5.5.2.1 | E-UTRAN FDD – FDD for Cat-M1 FDD UEs | 258 |
| 5.5.2.1.1 | Handover delay..... | 258 |
| 5.5.2.1.2 | Interruption time | 258 |
| 5.5.2.2 | E-UTRAN FDD – FDD for Cat-M1 HD – FDD UEs..... | 259 |
| 5.5.2.3 | E-UTRAN TDD – TDD for Cat-M1 TDD UEs | 259 |
| 5.5.2.3.1 | Void..... | 259 |
| 5.5.2.3.2 | Void..... | 259 |
| 5.5.3 | Requirements in CEModeB | 259 |

| | | |
|------------|-----------------------------------------------------------------------------|-----|
| 5.5.3.1 | E-UTRAN FDD – FDD for Cat-M1 FDD UEs | 259 |
| 5.5.3.1.1 | Handover delay..... | 259 |
| 5.5.3.1.2 | Interruption time | 260 |
| 5.5.3.2 | E-UTRAN FDD – FDD for Cat-M1 HD – FDD UEs..... | 260 |
| 5.5.3.3 | E-UTRAN TDD – TDD for Cat-M1 TDD UEs..... | 260 |
| 5.5A | E-UTRAN Handover for Cat-M1 UEs for Satellite Access | 260 |
| 5.5A.1 | Introduction..... | 260 |
| 5.5A.2 | Requirements in CEModeA..... | 261 |
| 5.5A.2.1 | E-UTRAN FDD – FDD HO for Cat-M1 FDD UEs..... | 261 |
| 5.5A.2.1.1 | Handover delay..... | 261 |
| 5.5A.2.1.2 | Interruption time | 261 |
| 5.5A.2.2 | E-UTRAN FDD – FDD HO for Cat-M1 HD – FDD UEs | 262 |
| 5.5A.2.3 | E-UTRAN FDD – FDD conditional HO for Cat-M1 FDD UEs..... | 262 |
| 5.5A.2.3.1 | Handover delay..... | 262 |
| 5.5A.2.3.2 | Measurement time | 262 |
| 5.5A.2.3.3 | Preparation time..... | 264 |
| 5.5A.2.3.4 | Interruption time | 264 |
| 5.5A.2.4 | E-UTRAN FDD – FDD conditional HO for Cat-M1 HD – FDD UEs | 264 |
| 5.5A.3 | Requirements in CEModeB | 265 |
| 5.5A.3.1 | E-UTRAN FDD – FDD HO for Cat-M1 FDD UEs..... | 265 |
| 5.5A.3.1.1 | Handover delay..... | 265 |
| 5.5A.3.1.2 | Interruption time | 265 |
| 5.5A.3.2 | E-UTRAN FDD – FDD HO for Cat-M1 HD – FDD UEs | 266 |
| 5.5A.3.3 | E-UTRAN FDD – FDD conditional HO for Cat-M1 FDD UEs | 266 |
| 5.5A.3.3.1 | Handover delay..... | 266 |
| 5.5A.3.3.2 | Measurement time | 266 |
| 5.5A.3.3.3 | Preparation time..... | 268 |
| 5.5A.3.3.4 | Interruption time | 268 |
| 5.5A.3.4 | E-UTRAN FDD – FDD conditional HO for Cat-M1 HD – FDD UEs | 268 |
| 5.6 | Void..... | 269 |
| 5.7 | E-UTRAN DAPS Handover..... | 269 |
| 5.7.1 | Introduction..... | 269 |
| 5.7.2 | Requirements | 269 |
| 5.7.2.1 | E-UTRAN FDD – FDD | 269 |
| 5.7.2.1.1 | DAPS Handover delay | 269 |
| 5.7.2.1.2 | Interruption time | 270 |
| 5.7.2.2 | E-UTRAN FDD – TDD | 270 |
| 5.7.2.3 | E-UTRAN TDD – FDD | 270 |
| 5.7.2.4 | E-UTRAN TDD – TDD..... | 270 |
| 5.8 | EN-DC Handover with PSCell..... | 271 |
| 5.8.1 | Introduction..... | 271 |
| 5.8.1.1 | Handover with PSCell Interruption time..... | 271 |
| 5.8.1.2 | Handover with PSCell - NR PSCell Change Delay requirements..... | 271 |
| 5.9 | EN-DC Handover with PSCell using CCA | 272 |
| 5.9.1 | Introduction..... | 272 |
| 5.9.1.1 | Handover with PSCell – E-UTRA HO Interruption time..... | 272 |
| 5.9.1.2 | Handover with PSCell - NR PSCell Change Delay requirements..... | 273 |
| 6 | RRC Connection Mobility Control | 274 |
| 6.1 | RRC Re-establishment | 274 |
| 6.1.1 | Introduction..... | 274 |
| 6.1.2 | Requirements | 274 |
| 6.1.2.1 | UE Re-establishment delay requirement..... | 274 |
| 6.2 | Random Access..... | 275 |
| 6.2.1 | Introduction..... | 275 |
| 6.2.2 | Requirements | 275 |
| 6.2.2.1 | Contention based random access..... | 275 |
| 6.2.2.1.1 | Correct behaviour when receiving Random Access Response reception | 275 |
| 6.2.2.1.2 | Correct behaviour when not receiving Random Access Response reception | 275 |
| 6.2.2.1.3 | Correct behaviour when receiving a NACK on msg3 | 275 |
| 6.2.2.1.4 | Void..... | 275 |
| 6.2.2.1.5 | Correct behaviour when receiving a message over Temporary C-RNTI..... | 275 |

| | | |
|-----------|----------------------------------------------------------------------------|-----|
| 6.2.2.1.6 | Correct behaviour when contention Resolution timer expires..... | 275 |
| 6.2.2.2 | Non-Contention based random access | 276 |
| 6.2.2.2.1 | Correct behaviour when receiving Random Access Response..... | 276 |
| 6.2.2.2.2 | Correct behaviour when not receiving Random Access Response..... | 276 |
| 6.2.3 | Requirements for Cat-M1 UEs | 276 |
| 6.2.3A | Random Access Requirements for Cat-M1 UEs for Satellite Access..... | 276 |
| 6.3 | RRC Connection Release with Redirection..... | 276 |
| 6.3.1 | Introduction..... | 276 |
| 6.3.2 | Requirements | 277 |
| 6.3.2.1 | RRC connection release with redirection to UTRAN FDD | 277 |
| 6.3.2.2 | RRC connection release with redirection to GERAN | 277 |
| 6.3.2.3 | RRC connection release with redirection to UTRAN TDD..... | 277 |
| 6.3.2.4 | RRC connection release with redirection to NR | 278 |
| 6.3.2.5 | RRC connection release with redirection to NR carrier subject to CCA..... | 279 |
| 6.3.2.6 | RRC connection release with redirection to NR Redcap | 280 |
| 6.4 | CSG Proximity Indication for E-UTRAN and UTRAN..... | 281 |
| 6.4.1 | Introduction..... | 281 |
| 6.4.2 | Requirements | 281 |
| 6.5 | RRC Re-establishment for NB-IoT UEs | 281 |
| 6.5.1 | Introduction..... | 281 |
| 6.5.2 | Requirements | 281 |
| 6.5.2.1 | UE Re-establishment delay requirement in normal coverage | 282 |
| 6.5.2.2 | UE Re-establishment delay requirement in enhanced coverage..... | 282 |
| 6.5A | RRC Re-establishment for NB-IoT UEs for Satellite Access | 283 |
| 6.5A.1 | Introduction..... | 283 |
| 6.5A.2 | Requirements | 283 |
| 6.5A.2.1 | UE Re-establishment delay requirement in normal coverage | 283 |
| 6.5A.2.2 | UE Re-establishment delay requirement in enhanced coverage..... | 284 |
| 6.6 | Random Access for UE category NB1 | 284 |
| 6.6.1 | Introduction..... | 284 |
| 6.6.2 | Requirements | 284 |
| 6.6.2.1 | Correct behaviour when receiving Random Access Response reception..... | 285 |
| 6.6.2.2 | Correct behaviour when not receiving Random Access Response reception..... | 285 |
| 6.6.2.3 | Correct behaviour when receiving a NACK on msg3..... | 285 |
| 6.6.2.4 | Correct behaviour when receiving a message over Temporary C-RNTI | 285 |
| 6.6.2.5 | Correct behaviour when contention Resolution timer expires | 285 |
| 6.6.2.6 | MSG3-based channel quality report for UE Category NB1 | 285 |
| 6.6.3 | Requirements for NPRACH configuration..... | 286 |
| 6.6A | Random Access for UE category NB-IoT for Satellite Access | 286 |
| 6.6A.1 | Introduction..... | 286 |
| 6.6A.2 | Requirements | 286 |
| 6.6A.2.1 | Correct behaviour when receiving Random Access Response reception..... | 286 |
| 6.6A.2.2 | Correct behaviour when not receiving Random Access Response reception..... | 287 |
| 6.6A.2.3 | Correct behaviour when receiving a NACK on msg3..... | 287 |
| 6.6A.2.4 | Correct behaviour when receiving a message over Temporary C-RNTI | 287 |
| 6.6A.2.5 | Correct behaviour when contention Resolution timer expires | 287 |
| 6.6A.2.6 | MSG3-based channel quality report for UE Category NB1 | 287 |
| 6.6A.3 | Requirements for NPRACH configuration..... | 288 |
| 6.7 | RRC Re-establishment for Cat-M1 UEs | 288 |
| 6.7.1 | Introduction..... | 288 |
| 6.7.2 | Requirements | 288 |
| 6.7.2.1 | UE Re-establishment delay requirement for CEModeA | 288 |
| 6.7.2.2 | UE Re-establishment delay requirement for CEModeB | 289 |
| 6.7A | RRC Re-establishment for Cat-M1 UEs for Satellite Access..... | 289 |
| 6.7A.1 | Introduction..... | 289 |
| 6.7A.2 | Requirements | 290 |
| 6.7A.2.1 | UE Re-establishment delay requirement for CEModeA | 290 |
| 6.7A.2.2 | UE Re-establishment delay requirement for CEModeB | 290 |
| 6.8 | RRC Connection Release with Redirection for Cat-M1 UEs..... | 291 |
| 6.8.1 | Introduction..... | 291 |
| 6.8.2 | Requirements | 291 |
| 6.8.2.1 | RRC connection release with redirection to E-UTRAN with CE Mode A | 291 |

| | | |
|----------|----------------------------------------------------------------------------------------------------------------------|-----|
| 6.8A | RRC Connection Release with Redirection for UE Category M1 for Satellite Access..... | 292 |
| 6.8A.1 | Introduction..... | 292 |
| 6.8A.2 | Requirements | 292 |
| 6.8A.2.1 | RRC connection release with redirection to E-UTRAN with CE Mode A | 292 |
| 6.9 | RRC Connection Redirection to Non-anchor Carrier in NB-IoT | 293 |
| 6.9.1 | Introduction..... | 293 |
| 6.9.2 | Requirements | 293 |
| 6.9A | RRC Connection Redirection to Non-anchor Carrier in NB-IoT for Satellite Access | 294 |
| 6.9A.1 | Introduction..... | 294 |
| 7 | Timing and signalling characteristics..... | 295 |
| 7.1 | UE transmit timing | 295 |
| 7.1.1 | Introduction..... | 295 |
| 7.1.2 | Requirements | 295 |
| 7.2 | UE timer accuracy | 296 |
| 7.2.1 | Introduction..... | 296 |
| 7.2.2 | Requirements | 296 |
| 7.3 | Timing Advance | 297 |
| 7.3.1 | Introduction..... | 297 |
| 7.3.2 | Requirements | 297 |
| 7.3.2.1 | Timing Advance adjustment delay..... | 297 |
| 7.3.2.2 | Timing Advance adjustment accuracy | 297 |
| 7.4 | Cell phase synchronization accuracy (TDD)..... | 297 |
| 7.4.1 | Definition..... | 297 |
| 7.4.2 | Minimum requirements..... | 298 |
| 7.5 | Synchronization Requirements for E-UTRAN to 1xRTT and HRPD Handovers..... | 298 |
| 7.5.1 | Introduction..... | 298 |
| 7.5.2 | eNodeB Synchronization Requirements | 298 |
| 7.5.2.1 | Synchronized E-UTRAN | 298 |
| 7.5.2.2 | Non-Synchronized E-UTRAN | 299 |
| 7.6 | Radio Link Monitoring..... | 299 |
| 7.6.1 | Introduction..... | 299 |
| 7.6.2 | Requirements | 300 |
| 7.6.2.1 | Minimum requirement when no DRX is used..... | 300 |
| 7.6.2.2 | Minimum requirement when DRX is used..... | 301 |
| 7.6.2.3 | Minimum requirement at transitions | 302 |
| 7.6.2.4 | Minimum requirement during SI Acquisition with autonomous gaps | 302 |
| 7.6.2.5 | Minimum requirement under IDC Interference | 303 |
| 7.7 | SCell Activation and Deactivation Delay for E-UTRA Carrier Aggregation | 303 |
| 7.7.1 | Introduction..... | 303 |
| 7.7.2 | SCell Activation Delay Requirement for Deactivated SCell | 303 |
| 7.7.3 | SCell Deactivation Delay Requirement for Activated SCell | 304 |
| 7.7.4 | SCell Activation Delay Requirement for Deactivated SCell with Multiple Downlink SCells | 305 |
| 7.7.5 | SCell Deactivation Delay Requirement for Activated SCell with Multiple Downlink SCells | 307 |
| 7.7.6 | SCell Activation Delay Requirement for Deactivated PUCCH SCell | 308 |
| 7.7.7 | SCell Activation Delay Requirement for Deactivated PUCCH SCell with Multiple SCells | 308 |
| 7.7.8 | SCell Deactivation Delay Requirement for Activated PUCCH SCell | 309 |
| 7.7.9 | SCell Deactivation Delay Requirement for Activated PUCCH SCell with Multiple SCells | 309 |
| 7.7.10 | SCell Activation Delay Requirement for Deactivated SCell under Frame Structure 3..... | 309 |
| 7.7.11 | SCell Deactivation Delay Requirement for Activated SCell under Frame Structure 3..... | 311 |
| 7.7.12 | SCell Activation Delay Requirement for Deactivated SCell with Multiple Downlink SCells under Frame Structure 3 | 311 |
| 7.7.13 | SCell Deactivation Delay Requirement for Activated SCell with Multiple Downlink SCells under Frame Structure 3 | 312 |
| 7.7.14 | SCell Activation Delay Requirement for Dormant SCell | 313 |
| 7.7.15 | SCell Hibernation Delay Requirement for Activated SCell..... | 314 |
| 7.7.16 | SCell Hibernation Delay Requirement for Deactivated SCell | 315 |
| 7.7.17 | SCell Deactivation Delay Requirement for Dormant SCell..... | 316 |
| 7.7.18 | Direct SCell Activation and Hibernation Delay Requirement | 316 |
| 7.7.19 | Direct SCell Activation and Hibernation Delay Requirement at RRC Reconfiguration during Handover | 318 |
| 7.8 | Interruptions with Carrier Aggregation | 320 |

| | | |
|----------|-----------------------------------------------------------------------------------------------|-----|
| 7.8.1 | Introduction..... | 320 |
| 7.8.2 | Requirements | 321 |
| 7.8.2.1 | Interruptions at SCell addition/release for intra-band CA..... | 321 |
| 7.8.2.2 | Interruptions at SCell addition/release for inter-band CA..... | 321 |
| 7.8.2.3 | Interruptions at SCell activation/deactivation for intra-band CA..... | 321 |
| 7.8.2.4 | Interruptions at SCell activation/deactivation for inter-band CA..... | 321 |
| 7.8.2.5 | Interruptions during measurements on SCC for intra-band CA | 321 |
| 7.8.2.6 | Interruptions during measurements on SCC for inter-band CA | 321 |
| 7.8.2.7 | Interruptions at SCell addition/release with multiple downlink SCells..... | 322 |
| 7.8.2.8 | Interruptions at SCell activation/deactivation with multiple downlink SCells..... | 322 |
| 7.8.2.9 | Interruptions during measurements on SCC with multiple downlink SCells..... | 322 |
| 7.8.2.10 | Interruptions at overlapping addition/release/activation/deactivation of SCells | 323 |
| 7.8.2.11 | Interruptions during RSSI measurements on one SCC under Frame Structure 3..... | 323 |
| 7.8.2.12 | Interruptions during RSSI measurements on multiple SCCs under Frame Structure 3..... | 324 |
| 7.8.2.13 | Interruptions at SRS carrier based switching | 324 |
| 7.8.2.14 | Interruptions at SCell activation and deactivation of dormant SCell for intra-band CA..... | 325 |
| 7.8.2.15 | Interruptions at SCell activation and deactivation of dormant SCell for inter-band CA..... | 325 |
| 7.8.2.16 | Interruptions at SCell activation and deactivation of multiple dormant SCells | 325 |
| 7.8.2.17 | Interruptions during CQI measurement on dormant SCell..... | 326 |
| 7.8.2.18 | Interruptions during RRM measurement on dormant SCell for intra-band CA | 326 |
| 7.8.2.19 | Interruptions during RRM measurement on dormant SCell for inter-band CA | 326 |
| 7.8.2.20 | Interruptions at SCell hibernation | 326 |
| 7.8.2.21 | Interruptions at direct SCell activation and hibernation..... | 327 |
| 7.8.2.22 | Interruptions during inter-RAT NR measurements without measurement gap..... | 327 |
| 7.9 | Maximum Transmission Timing Difference in Carrier Aggregation..... | 328 |
| 7.9.1 | Introduction..... | 328 |
| 7.9.2 | Minimum Requirements for Interband Carrier Aggregation | 328 |
| 7.9.3 | Minimum Requirements for Intra-band non-contiguous Carrier Aggregation..... | 328 |
| 7.9.4 | Minimum Requirements for Inter-Band Carrier Aggregation under Frame Structure 3..... | 329 |
| 7.10 | Interruptions with RSTD Measurements with Carrier Aggregation..... | 329 |
| 7.10.1 | Introduction..... | 329 |
| 7.10.2 | Requirements | 329 |
| 7.10.2.1 | Interruptions during RSTD measurements on SCC for intra-band CA with one downlink SCell | 329 |
| 7.10.2.2 | Interruptions during RSTD measurements on SCC for inter-band CA with one downlink SCell | 329 |
| 7.10.2.3 | Interruptions during RSTD measurements on SCC with multiple downlink SCells..... | 330 |
| 7.10.2.4 | Interruptions at overlapping RSTD and inter-frequency measurements | 330 |
| 7.11 | Radio Link Monitoring for UE Category 0 | 331 |
| 7.11.1 | Introduction..... | 331 |
| 7.11.2 | Requirements for FD-FDD and TDD | 332 |
| 7.11.2.1 | Minimum requirement when no DRX is used..... | 332 |
| 7.11.2.2 | Minimum requirement when DRX is used..... | 332 |
| 7.11.2.3 | Minimum requirement at transitions | 333 |
| 7.11.3 | Requirements for HD-FDD | 333 |
| 7.11.3.1 | Minimum requirement when no DRX is used..... | 333 |
| 7.11.3.2 | Minimum requirement when DRX is used..... | 333 |
| 7.11.3.3 | Minimum requirement at transitions | 334 |
| 7.12 | Interruptions with Dual Connectivity..... | 334 |
| 7.12.1 | Introduction..... | 334 |
| 7.12.2 | Requirements | 334 |
| 7.12.2.1 | Interruptions at PSCell addition/release | 334 |
| 7.12.2.2 | Interruptions at transitions between active and non-active during DRX..... | 335 |
| 7.12.2.3 | Interruptions at transitions from non-DRX to DRX..... | 335 |
| 7.12.2.4 | Interruptions at SCell addition/release | 335 |
| 7.12.2.5 | Interruptions at SCell activation/deactivation | 335 |
| 7.12.2.6 | Interruptions during measurements on SCC | 336 |
| 7.12.2.7 | Interruptions at SRS carrier based switching | 336 |
| 7.13 | Cell phase synchronization accuracy (Synchronized mode of dual connectivity)..... | 337 |
| 7.13.1 | Definition..... | 337 |
| 7.13.2 | Minimum requirements..... | 337 |
| 7.14 | PSCell Addition and Release Delay for E-UTRA Dual Connectivity..... | 337 |
| 7.14.1 | Introduction..... | 337 |
| 7.14.2 | PSCell Addition Delay Requirement | 337 |

| | | |
|------------|--------------------------------------------------------------------------------------------------|-----|
| 7.14.3 | PSCell Release Delay Requirement..... | 338 |
| 7.15 | Maximum Receive Timing Difference in Dual Connectivity | 338 |
| 7.15.1 | Introduction..... | 338 |
| 7.15.2 | Minimum Requirements for Inter-band Dual Connectivity | 338 |
| 7.16 | Proximity-based Services | 339 |
| 7.16.1 | Introduction..... | 339 |
| 7.16.2 | Requirements | 339 |
| 7.16.2.1 | ProSe UE transmission timing | 339 |
| 7.16.2.1.1 | Serving cell or PCell as timing reference | 339 |
| 7.16.2.1.2 | SCell or non-serving cell as timing reference..... | 339 |
| 7.16.3 | Interruptions with ProSe | 339 |
| 7.16.3.1 | Interruptions at ProSe Direct Discovery configuration | 340 |
| 7.16.3.2 | Interruptions at ProSe Direct Communication configuration..... | 340 |
| 7.16.3.3 | Interruptions during ProSe Direct Discovery | 340 |
| 7.16.3.4 | Interruptions during ProSe Direct Discovery with discovery gaps | 340 |
| 7.16.3.5 | Interruptions during ProSe Direct Communication..... | 341 |
| 7.16.4 | Cell reselection for ProSe Direct Discovery on non-serving frequency | 341 |
| 7.16.4.1 | Measurement and evaluation of selected cell..... | 341 |
| 7.16.4.2 | Measurement of intra-frequency E-UTRAN cells | 341 |
| 7.16.5 | Selection / Reselection of ProSe relay UE..... | 342 |
| 7.16.6 | ProSe operation under deactivated SCell..... | 342 |
| 7.17 | Maximum Transmission Timing Difference in Dual Connectivity | 343 |
| 7.17.1 | Introduction..... | 343 |
| 7.17.2 | Minimum Requirements for maximum transmission timing difference Inter-band Dual Connectivity ... | 343 |
| 7.18.1 | Introduction..... | 343 |
| 7.18.2 | SCell Activation Delay Requirement for Deactivated SCell | 343 |
| 7.18.3 | SCell Deactivation Delay Requirement for Activated SCell | 343 |
| 7.19 | Radio Link Monitoring for UE Category M1 | 343 |
| 7.19.1 | Introduction..... | 343 |
| 7.19.2 | Requirements for FD-FDD and TDD CE mode A..... | 344 |
| 7.19.2.1 | Minimum requirement when no DRX is used..... | 345 |
| 7.19.2.2 | Minimum requirement when DRX is used..... | 346 |
| 7.19.2.3 | Minimum requirement at transitions | 347 |
| 7.19.3 | Requirements for HD-FDD with CE mode A..... | 348 |
| 7.19.3.1 | Minimum requirement when no DRX is used..... | 348 |
| 7.19.3.2 | Minimum requirement when DRX is used..... | 348 |
| 7.19.3.3 | Minimum requirement at transitions | 349 |
| 7.19.4 | Requirements for FD-FDD and TDD with CE mode B..... | 349 |
| 7.19.4.1 | Minimum requirement when no DRX is used..... | 351 |
| 7.19.4.2 | Minimum requirement when DRX is used..... | 352 |
| 7.19.4.3 | Minimum requirement at transitions | 353 |
| 7.19.5 | Requirements for HD-FDD with CE mode B | 353 |
| 7.19.5.1 | Minimum requirement when no DRX is used..... | 353 |
| 7.19.5.2 | Minimum requirement when DRX is used..... | 353 |
| 7.19.5.3 | Minimum requirement at transitions | 354 |
| 7.19A | Radio Link Monitoring for UE Category M1 for Satellite Access | 355 |
| 7.19A.1 | Introduction..... | 355 |
| 7.19A.2 | Requirements for FD-FDD and CE mode A..... | 355 |
| 7.19A.2.1 | Minimum requirement when no DRX is used..... | 356 |
| 7.19A.2.2 | Minimum requirement when DRX is used..... | 357 |
| 7.19A.2.3 | Minimum requirement at transitions | 359 |
| 7.19A.3 | Requirements for HD-FDD with CE mode A..... | 359 |
| 7.19A.3.1 | Minimum requirement when no DRX is used..... | 359 |
| 7.19A.3.2 | Minimum requirement when DRX is used..... | 359 |
| 7.19A.3.3 | Minimum requirement at transitions | 360 |
| 7.19A.4 | Requirements for HD-FDD with CE mode B | 360 |
| 7.19A.4.1 | Minimum requirement when no DRX is used..... | 360 |
| 7.19A.4.2 | Minimum requirement when DRX is used..... | 361 |
| 7.19A.4.3 | Minimum requirement at transitions | 362 |
| 7.20 | UE transmit timing for NB-IoT | 362 |
| 7.20.1 | Introduction..... | 362 |
| 7.20.2 | Requirements | 362 |

| | | |
|-----------|-------------------------------------------------------------------------|-----|
| 7.20A | UE transmit timing for NB-IoT for Satellite Access | 363 |
| 7.20A.1 | Introduction..... | 363 |
| 7.20A.2 | Requirements | 363 |
| 7.21 | UE timer accuracy for NB-IoT..... | 364 |
| 7.21.1 | Introduction..... | 364 |
| 7.21.2 | Requirements | 364 |
| 7.21A | UE timer accuracy for NB-IoT for Satellite Access | 364 |
| 7.21A.1 | Introduction..... | 364 |
| 7.21A.2 | Requirements | 364 |
| 7.22 | Timing Advance for NB-IoT..... | 365 |
| 7.22.1 | Introduction..... | 365 |
| 7.22.2 | Requirements | 365 |
| 7.22.2.1 | Timing Advance adjustment delay..... | 365 |
| 7.22.2.2 | Timing Advance adjustment accuracy | 365 |
| 7.22A | Timing Advance for NB-IoT for Satellite Access | 365 |
| 7.22A.1 | Introduction..... | 365 |
| 7.22A.2 | Requirements | 365 |
| 7.22A.2.1 | Timing Advance adjustment delay..... | 365 |
| 7.22A.2.2 | Timing Advance adjustment accuracy | 365 |
| 7.23 | Radio Link Monitoring for Category NB1 UE..... | 365 |
| 7.23.1 | Introduction..... | 365 |
| 7.23.2 | Requirements for Category NB1 UE | 365 |
| 7.23.2.1 | Minimum requirement when no DRX is used..... | 366 |
| 7.23.2.2 | Minimum requirement when DRX is used..... | 366 |
| 7.23.2.3 | Minimum requirement at transitions | 367 |
| 7.23A | Radio Link Monitoring for Category NB-IoT UE for Satellite Access | 367 |
| 7.23A.1 | Introduction..... | 367 |
| 7.23A.2 | Requirements for Category NB1 UE..... | 367 |
| 7.23A.2.1 | Minimum requirement when no DRX is used..... | 368 |
| 7.23A.2.2 | Minimum requirement when DRX is used..... | 368 |
| 7.23A.2.3 | Minimum requirement at transitions | 369 |
| 7.24 | UE transmit timing for Category M1 | 369 |
| 7.24.1 | Introduction..... | 369 |
| 7.24.2 | Requirements | 369 |
| 7.24A | UE transmit timing for Category M1 for Satellite Access..... | 370 |
| 7.24A.1 | Introduction..... | 370 |
| 7.24A.2 | Requirements | 370 |
| 7.25 | Cell phase synchronization accuracy for MBMS services (FDD)..... | 371 |
| 7.25.1 | Definition..... | 371 |
| 7.25.2 | Minimum requirements..... | 371 |
| 7.26 | UE transmit timing for Category M2 | 372 |
| 7.26.1 | Introduction..... | 372 |
| 7.26.2 | Requirements | 372 |
| 7.27 | UE timer accuracy for category M1 | 372 |
| 7.27.1 | Introduction..... | 372 |
| 7.27.2 | Requirements | 372 |
| 7.27A | UE timer accuracy for category M1 for Satellite Access | 373 |
| 7.27A.1 | Introduction..... | 373 |
| 7.27A.2 | Requirements | 373 |
| 7.28 | Timing Advance for Category M1 | 373 |
| 7.28.1 | Introduction..... | 373 |
| 7.28.2 | Requirements | 373 |
| 7.28A | Timing Advance for Category M1 for Satellite Access | 373 |
| 7.28A.1 | Introduction..... | 373 |
| 7.28A.2 | Requirements | 373 |
| 7.28A.2.1 | Timing Advance adjustment delay..... | 373 |
| 7.28A.2.2 | Timing Advance adjustment accuracy | 373 |
| 7.29 | Interruptions requirements with FeMBMS..... | 373 |
| 7.29.1 | Introduction..... | 373 |
| 7.29.2 | Requirements | 374 |
| 7.30 | Numerology switching delay requirements with FeMBMS | 374 |
| 7.30.1 | Introduction..... | 374 |

| | | |
|-------------|-----------------------------------------------------------------------------------------------------------------------------|-----|
| 7.30.2 | Requirements | 374 |
| 7.31 | NR PSCell Addition and Release Delay for E-UTRA - NR Dual Connectivity | 374 |
| 7.31.1 | Introduction..... | 374 |
| 7.31.2 | NR PSCell Addition Delay Requirement..... | 374 |
| 7.31.3 | NR PSCell Release Delay Requirement | 375 |
| 7.31A | Addition and Release Delay of NR PSCell Operating with CCA for E-UTRA - NR Dual Connectivity | 375 |
| 7.31A.1 | Introduction..... | 375 |
| 7.31A.2 | NR PSCell Addition Delay Requirement..... | 375 |
| 7.31A.3 | NR PSCell Release Delay Requirement | 376 |
| 7.32 | Interruptions with EN-DC | 377 |
| 7.32.1 | Introduction..... | 377 |
| 7.32.2 | Requirements | 377 |
| 7.32.2.1 | Interruptions at PSCell addition/release | 377 |
| 7.32.2.2 | Interruptions at transitions between active and non-active during DRX..... | 378 |
| 7.32.2.3 | Interruptions at transitions from non-DRX to DRX..... | 378 |
| 7.32.2.4 | Interruptions at SCell addition/release | 378 |
| 7.32.2.5 | Interruptions at SCell activation/deactivation | 378 |
| 7.32.2.6 | Interruptions during measurements on SCC | 379 |
| 7.32.2.6.1 | Interruptions during measurements on deactivated NR SCC | 379 |
| 7.32.2.6.2 | Interruptions during measurements on deactivated E-UTRA SCC | 379 |
| 7.32.2.6.3 | Interruptions during CQI measurements on dormant E-UTRA SCell..... | 379 |
| 7.32.2.6.4 | Interruptions during RRM measurements on dormant E-UTRA SCC | 379 |
| 7.32.2.7 | Interruptions at active BWP switching..... | 379 |
| 7.32.2.8 | Interruptions at SCell activation and deactivation of dormant SCell | 380 |
| 7.32.2.9 | Interruptions at SCell activation and deactivation of multiple dormant SCell..... | 380 |
| 7.32.2.10 | Interruptions at SCell hibernation | 380 |
| 7.32.2.11 | Interruptions at direct SCell activation and hibernation..... | 380 |
| 7.32.2.12 | DL Interruptions at UE switching between two uplink carriers | 381 |
| 7.32.2.13 | Interruptions at NR SRS carrier based switching..... | 381 |
| 7.32.2.14 | Interruptions at NR SCell dormancy | 382 |
| 7.32.2.14.1 | Interruptions due to NR SCell dormancy switch..... | 382 |
| 7.32.2.14.2 | Interruptions due to CSI and RRM measurements during SCell dormancy | 382 |
| 7.32.2.15 | Interruption during NR measurement with autonomous gaps..... | 382 |
| 7.32.2.16 | Interruptions at SRS carrier based switching | 383 |
| 7.32.2.17 | Interruptions at SCG activation/deactivation | 383 |
| 7.32.2.18 | Interruptions due to NR SRS antenna port switching | 383 |
| 7.32.2.19 | Interruptions at fast SCell activation/deactivation | 384 |
| 7.32.2.20 | Interruptions due to RRM measurements on deactivated NR SCG | 384 |
| 7.32.2.21 | Interruptions during RLM/BFD measurements on deactivated PSCell | 385 |
| 7.33 | Maximum Transmit/Receive Timing Difference in Carrier Aggregation for sTTI and 1ms-TTI with 3 subframe HARQ processing..... | 385 |
| 7.33.1 | Introduction..... | 385 |
| 7.33.2 | Requirements | 385 |
| 7.34 | Void..... | 385 |
| 7.35 | Interruptions with SFTD measurements | 385 |
| 7.35.1 | Introduction..... | 385 |
| 7.35.2 | Requirements | 385 |
| 7.36 | Interruptions with NE-DC | 386 |
| 7.36.1 | Introduction..... | 386 |
| 7.36.2 | Requirements | 386 |
| 7.36.2.1 | Interruptions at transitions between active and non-active during DRX..... | 386 |
| 7.36.2.2 | Interruptions at transitions from non-DRX to DRX..... | 386 |
| 7.36.2.3 | Interruptions at SCell addition/release | 386 |
| 7.36.2.4 | Interruptions at SCell activation/deactivation | 387 |
| 7.36.2.5 | Interruptions during measurements on SCC | 387 |
| 7.36.2.5.1 | Interruptions during measurements on deactivated NR SCC | 387 |
| 7.36.2.5.2 | Interruptions during measurements on deactivated E-UTRA SCC | 387 |
| 7.36.2.5.3 | Interruptions during CQI measurements on dormant E-UTRA SCell..... | 388 |
| 7.36.2.5.4 | Interruptions during RRM measurements on dormant E-UTRA SCC | 388 |
| 7.36.2.6 | Interruptions at active BWP switching..... | 388 |
| 7.36.2.7 | Interruptions at SCell activation and deactivation of dormant SCell | 389 |
| 7.36.2.8 | Interruptions at SCell activation and deactivation of multiple dormant SCell..... | 389 |