

# ETSI TS 138 300 V18.9.0 (2026-04)



TECHNICAL SPECIFICATION

**5G;  
NR;  
NR and NG-RAN Overall description;  
Stage-2  
(3GPP TS 38.300 version 18.9.0 Release 18)**



---

**Reference**

RTS/TSGR-0238300vi90

---

**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 - 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 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.....	13
1 Scope .....	14
2 References .....	14
3 Abbreviations and Definitions.....	16
3.1 Abbreviations .....	16
3.2 Definitions .....	20
4 Overall Architecture and Functional Split.....	24
4.1 Overall Architecture .....	24
4.2 Functional Split .....	25
4.3 Network Interfaces .....	27
4.3.1 NG Interface .....	27
4.3.1.1 NG User Plane .....	27
4.3.1.2 NG Control Plane.....	28
4.3.2 Xn Interface .....	28
4.3.2.1 Xn User Plane .....	28
4.3.2.2 Xn Control Plane.....	29
4.4 Radio Protocol Architecture .....	30
4.4.1 User Plane.....	30
4.4.2 Control Plane .....	30
4.5 Multi-Radio Dual Connectivity.....	30
4.6 Radio Access Network Sharing.....	31
4.7 Integrated Access and Backhaul.....	31
4.7.1 Architecture .....	31
4.7.2 Protocol Stacks .....	32
4.7.3 User-plane Aspects .....	33
4.7.3.1 Backhaul transport .....	33
4.7.3.2 Flow and Congestion Control .....	34
4.7.3.3 Uplink Scheduling Latency.....	34
4.7.4 Signalling procedures .....	34
4.7.4.1 IAB-node Integration .....	34
4.7.4.2 IAB-node Migration.....	35
4.7.4.3 Topological Redundancy .....	35
4.7.4.4 Backhaul RLF Recovery .....	35
4.7.4.5 OTA timing synchronization.....	35
4.7.4.6 Inter node discovery.....	36
4.7.5 Mobile IAB .....	36
4.7.5.1 General .....	36
4.7.5.2 Void.....	36
4.8 Non-Public Networks .....	36
4.9 Network-Controlled Repeaters .....	37
4.9.1 Architecture .....	37
4.9.2 Capabilities .....	37
4.9.3 Signalling procedures .....	37
4.9.4 OAM aspects .....	38
4.9.5 Network-controlled repeater management.....	38
5 Physical Layer .....	39
5.1 Waveform, numerology and frame structure.....	39
5.2 Downlink.....	40
5.2.1 Downlink transmission scheme .....	40
5.2.2 Physical-layer processing for physical downlink shared channel .....	40

5.2.3	Physical downlink control channels.....	41
5.2.4	Synchronization signal and PBCH block.....	42
5.2.5	Physical layer procedures .....	43
5.2.5.1	Link adaptation .....	43
5.2.5.2	Power Control .....	43
5.2.5.3	Cell search.....	43
5.2.5.4	HARQ .....	44
5.2.5.5	Reception of SIB1 .....	44
5.2.6	Downlink Reference Signals and Measurements for Positioning.....	44
5.3	Uplink.....	44
5.3.1	Uplink transmission scheme .....	44
5.3.2	Physical-layer processing for physical uplink shared channel.....	45
5.3.3	Physical uplink control channel.....	45
5.3.4	Random access.....	46
5.3.5	Physical layer procedures .....	47
5.3.5.1	Link adaptation .....	47
5.3.5.2	Uplink Power control .....	47
5.3.5.3	Uplink timing control.....	47
5.3.5.4	HARQ .....	48
5.3.5.5	Prioritization of overlapping transmissions.....	48
5.3.6	Uplink Reference Signals and Measurements for Positioning.....	48
5.4	Carrier aggregation.....	48
5.4.1	Carrier aggregation .....	48
5.4.2	Supplementary Uplink .....	48
5.4.3	Uplink Tx switching .....	49
5.5	Transport Channels.....	49
5.6	Access to Shared Spectrum .....	50
5.6.1	Overview .....	50
5.6.2	Channel Access Priority Classes.....	50
5.7	Sidelink .....	51
5.7.1	General.....	51
5.7.2	Sidelink resource allocation modes/schemes .....	51
5.7.3	Physical sidelink channels and signals.....	51
5.7.4	Physical layer procedures for sidelink .....	51
5.7.4.1	HARQ feedback.....	51
5.7.4.2	Power Control .....	52
5.7.4.3	CSI report.....	52
5.7.5	Physical layer measurement definition .....	52
5.7.6	Sidelink Reference Signal and Measurements for Positioning .....	52
6	Layer 2.....	52
6.1	Overview .....	52
6.2	MAC Sublayer.....	56
6.2.1	Services and Functions .....	56
6.2.2	Logical Channels .....	57
6.2.3	Mapping to Transport Channels.....	57
6.2.4	HARQ.....	57
6.3	RLC Sublayer .....	57
6.3.1	Transmission Modes .....	57
6.3.2	Services and Functions .....	58
6.3.3	ARQ.....	58
6.4	PDCP Sublayer.....	58
6.4.1	Services and Functions .....	58
6.5	SDAP Sublayer .....	59
6.6	L2 Data Flow.....	59
6.7	Carrier Aggregation.....	59
6.8	Dual Connectivity.....	61
6.9	Supplementary Uplink.....	61
6.10	Bandwidth Adaptation.....	61
6.11	Backhaul Adaptation Protocol Sublayer.....	62
6.11.1	Services and Functions .....	62
6.11.2	Traffic Mapping from Upper Layers to Layer-2.....	62

6.11.3	Routing, BAP Header Rewriting and BH-RLC-channel Mapping on BAP sublayer .....	63
6.12	Multiple Transmit/Receive Point Operation .....	65
7	<b>RRC</b> .....	65
7.1	Services and Functions .....	65
7.2	Protocol States .....	66
7.3	System Information Handling .....	67
7.3.1	Overview .....	67
7.3.2	Scheduling .....	69
7.3.3	SI Modification .....	69
7.4	Access Control .....	70
7.5	UE Capability Retrieval framework .....	70
7.6	Transport of NAS Messages .....	70
7.7	Carrier Aggregation .....	71
7.8	Bandwidth Adaptation .....	71
7.9	UE Assistance Information .....	71
7.10	Segmentation of RRC messages .....	72
8	<b>NG Identities</b> .....	72
8.1	UE Identities .....	72
8.2	Network Identities .....	73
8.3	User Data Transport on the CN-RAN Interface .....	74
8.4	NR sidelink communication, V2X sidelink communication and Ranging/Sidelink positioning related identities .....	74
9	<b>Mobility and State Transitions</b> .....	75
9.1	Overview .....	75
9.2	Intra-NR .....	76
9.2.1	Mobility in RRC_IDLE .....	76
9.2.1.1	Cell Selection .....	76
9.2.1.2	Cell Reselection .....	77
9.2.1.3	State Transitions .....	77
9.2.2	Mobility in RRC_INACTIVE .....	79
9.2.2.1	Overview .....	79
9.2.2.2	Cell Reselection .....	80
9.2.2.3	RAN-Based Notification Area .....	80
9.2.2.4	State Transitions .....	81
9.2.2.4.1	UE triggered transition from RRC_INACTIVE to RRC_CONNECTED .....	81
9.2.2.4.2	Network triggered transition from RRC_INACTIVE to RRC_CONNECTED .....	83
9.2.2.5	RNA update .....	83
9.2.2.6	Resume request responded with Release with Redirect, with UE context relocation .....	86
9.2.3	Mobility in RRC_CONNECTED .....	87
9.2.3.1	Overview .....	87
9.2.3.2	Handover .....	89
9.2.3.2.1	C-Plane Handling .....	89
9.2.3.2.2	U-Plane Handling .....	92
9.2.3.2.3	Data Forwarding .....	94
9.2.3.3	Re-establishment procedure .....	96
9.2.3.4	Conditional Handover .....	97
9.2.3.4.1	General .....	97
9.2.3.4.2	C-plane handling .....	97
9.2.3.4.3	U-plane handling .....	99
9.2.3.4.4	Data Forwarding .....	99
9.2.3.5	L1/L2 Triggered Mobility .....	99
9.2.3.5.1	General .....	99
9.2.3.5.2	C-Plane Handling .....	100
9.2.3.5.3	U-Plane Handling .....	102
9.2.3.6	RACH-less handover .....	102
9.2.4	Measurements .....	102
9.2.5	Paging .....	105
9.2.6	Random Access Procedure .....	108
9.2.7	Radio Link Failure .....	111
9.2.8	Beam failure detection and recovery .....	113

9.2.9	Timing Advance .....	114
9.2.10	Extended DRX for RRC_IDLE and RRC_INACTIVE.....	114
9.3	Inter RAT .....	115
9.3.1	NR-E-UTRA mobility: Intra 5GC .....	115
9.3.1.1	Cell Reselection .....	115
9.3.1.2	Handover.....	115
9.3.1.3	Measurements .....	115
9.3.2	NR-E-UTRA mobility: From 5GC to EPC.....	116
9.3.2.1	Cell Reselection .....	116
9.3.2.2	Handover and redirection.....	116
9.3.2.3	Measurements .....	116
9.3.2.4	Data Forwarding for the Control Plane .....	116
9.3.2.5	Data Forwarding for the User Plane.....	117
9.3.3	NR-E-UTRA mobility: From EPC to 5GC.....	117
9.3.3.1	Data Forwarding for the Control Plane .....	117
9.3.3.2	Data Forwarding for the User Plane.....	118
9.3.4	NR-UTRA mobility .....	118
9.3.4.1	Handover with SRVCC operation.....	118
9.3.4.2	Measurements .....	119
9.4	Roaming and Access Restrictions .....	119
10	Scheduling.....	120
10.1	Basic Scheduler Operation .....	120
10.2	Downlink Scheduling.....	120
10.3	Uplink Scheduling.....	121
10.4	Measurements to Support Scheduler Operation .....	122
10.5	Rate Control .....	122
10.5.1	Downlink .....	122
10.5.2	Uplink .....	122
10.6	Activation/Deactivation Mechanism .....	123
10.7	E-UTRA-NR Cell Resource Coordination.....	124
10.8	Cross Carrier Scheduling.....	124
10.9	IAB Resource Configuration.....	124
10.10	Autonomous Denial for IDC .....	125
10.11	Multi-cell scheduling by a single DCI.....	125
11	UE Power Saving .....	125
12	QoS.....	127
12.1	Overview .....	127
12.2	Explicit Congestion Notification.....	130
13	Security.....	130
13.1	Overview and Principles .....	130
13.2	Security Termination Points .....	132
13.3	State Transitions and Mobility .....	132
14	UE Capabilities .....	132
15	Self-Configuration and Self-Optimisation .....	134
15.1	Definitions .....	134
15.2	Void.....	134
15.3	Self-configuration.....	134
15.3.1	Dynamic configuration of the NG-C interface.....	134
15.3.1.1	Prerequisites .....	134
15.3.1.2	SCTP initialization .....	134
15.3.1.3	Application layer initialization.....	134
15.3.2	Dynamic Configuration of the Xn interface .....	135
15.3.2.1	Prerequisites .....	135
15.3.2.2	SCTP initialization .....	135
15.3.2.3	Application layer initialization.....	135
15.3.3	Automatic Neighbour Cell Relation Function .....	135
15.3.3.1	General .....	135
15.3.3.2	Intra-system Automatic Neighbour Cell Relation Function.....	136

15.3.3.3	Void.....	137
15.3.3.4	Void.....	137
15.3.3.5	Inter-system Automatic Neighbour Cell Relation Function.....	137
15.3.4	Xn-C TNL address discovery .....	138
15.4	Support for Energy Saving .....	139
15.4.1	General.....	139
15.4.2	Solution description .....	139
15.4.2.1	Intra-system energy saving .....	139
15.4.2.2	Inter-system energy saving .....	139
15.4.2.3	Cell DTX/DRX .....	140
15.4.2.4	Conditional Handover .....	140
15.4.2.5	Camping Restrictions.....	140
15.4.2.6	SSB-less SCell .....	140
15.4.2.7	Spatial and power domain adaptation .....	140
15.4.3	O&M requirements .....	141
15.5	Self-optimisation .....	141
15.5.1	Support for Mobility Load Balancing.....	141
15.5.1.1	General .....	141
15.5.1.2	Load reporting for intra-RAT and intra-system inter-RAT load balancing.....	141
15.5.1.3	Load balancing action based on handovers .....	142
15.5.1.4	Adapting handover and/or reselection configuration .....	142
15.5.1.5	Load reporting for inter-system load balancing .....	142
15.5.2	Support for Mobility Robustness Optimization .....	142
15.5.2.1	General .....	142
15.5.2.2	Connection failure.....	143
15.5.2.2.1	General .....	143
15.5.2.2.2	Connection failure due to intra-system mobility .....	143
15.5.2.2.3	Connection failure due to inter-system mobility .....	145
15.5.2.3	Inter-system Unnecessary HO.....	146
15.5.2.4	Inter-system Ping-pong .....	146
15.5.2.5	O&M Requirements .....	147
15.5.2.6	PSCell addition/change failure.....	147
15.5.2.7	Successful HO.....	147
15.5.2.8	Successful PSCell Addition/Change Report .....	147
15.5.3	Support for RACH Optimization.....	148
15.5.4	UE History Information .....	148
15.5.5	Support for Coverage and Capacity Optimisation .....	148
15.5.5.1	General .....	148
15.5.5.2	OAM requirements.....	149
15.5.5.3	Dynamic coverage configuration changes .....	149
15.5.6	Support for PCI Optimisation .....	149
15.5.6.1	Centralized PCI Assignment .....	149
15.5.6.2	Distributed PCI Assignment .....	149
16	Verticals Support.....	149
16.1	URLLC.....	149
16.1.1	Overview .....	149
16.1.2	LCP Restrictions.....	149
16.1.3	Packet Duplication.....	150
16.1.4	CQI and MCS .....	151
16.1.5	DCI formats .....	151
16.1.6	Higher layer multi-connectivity.....	151
16.1.6.1	Redundant user plane paths based on dual connectivity .....	151
16.1.6.2	Redundant data transmission via single UPF and single RAN node.....	151
16.1.7	URLLC in Unlicensed Controlled Environment.....	151
16.1.8	PUCCH cell switching for TDD cells.....	152
16.2	IMS Voice .....	152
16.2.0	Support for IMS voice .....	152
16.2.1	Support for MMTEL IMS voice and video enhancements .....	152
16.2.1.1	RAN-assisted codec adaptation.....	152
16.2.1.2	MMTEL voice quality/coverage enhancements.....	153
16.3	Network Slicing.....	153

16.3.1	General Principles and Requirements .....	153
16.3.2	AMF and NW Slice Selection.....	155
16.3.2.1	CN-RAN interaction and internal RAN aspects.....	155
16.3.2.2	Radio Interface Aspects .....	155
16.3.3	Resource Isolation and Management .....	156
16.3.3.1	General .....	156
16.3.3.2	Handling of Slice Resources .....	156
16.3.3a	Slice-based cell reselection .....	156
16.3.4	Signalling Aspects .....	156
16.3.4.1	General .....	156
16.3.4.2	AMF and NW Slice Selection.....	157
16.3.4.3	UE Context Handling.....	157
16.3.4.4	PDU Session Setup Handling.....	158
16.3.4.5	Mobility.....	158
16.4	Public Warning System.....	159
16.5	Emergency Services .....	160
16.5.1	Overview .....	160
16.5.2	IMS Emergency call .....	160
16.5.3	eCall over IMS.....	160
16.5.4	Fallback .....	160
16.5.5	Barring exemption for emergency calls .....	160
16.6	Stand-Alone NPN.....	160
16.6.1	General.....	160
16.6.2	Mobility .....	161
16.6.2.1	General .....	161
16.6.2.2	Inactive Mode .....	161
16.6.2.3	Connected Mode .....	161
16.6.3	Self-Configuration for SNPN .....	161
16.6.4	Access Control.....	161
16.6.5	Access with subscription/credentials owned by a Credentials Holder.....	161
16.6.6	Support of UE onboarding and remote provisioning .....	162
16.7	Public Network Integrated NPN.....	162
16.7.1	General.....	162
16.7.2	Mobility .....	162
16.7.2.1	General .....	162
16.7.2.2	Inactive Mode .....	163
16.7.2.3	Connected Mode .....	163
16.7.3	Self-Configuration for PNI-NPN .....	163
16.7.4	Access Control.....	163
16.7.5	Paging .....	163
16.8	Support for Time Sensitive Communications.....	163
16.8.1	General.....	163
16.8.2	Network timing synchronization status monitoring.....	165
16.8.2.1	General .....	165
16.8.2.2	Network timing synchronization status monitoring towards CN .....	165
16.8.2.3	Network timing synchronization status monitoring towards UE .....	165
16.8.3	RAN feedback for adaptation of Burst Arrival Time and Periodicity .....	166
16.9	Sidelink .....	167
16.9.1	General.....	167
16.9.2	Radio Protocol Architecture for NR sidelink communication .....	168
16.9.2.1	Overview.....	168
16.9.2.2	MAC .....	169
16.9.2.3	RLC.....	170
16.9.2.4	PDCP.....	170
16.9.2.5	SDAP .....	170
16.9.2.6	RRC.....	170
16.9.3	Radio Resource Allocation .....	170
16.9.3.1	General .....	170
16.9.3.2	Scheduled Resource Allocation .....	171
16.9.3.3	UE Autonomous Resource Selection .....	171
16.9.3.4	LTE and NR Sidelink co-channel coexistence .....	171
16.9.4	Uu Control .....	171

16.9.4.1	General .....	171
16.9.4.2	Control of connected UEs .....	172
16.9.4.3	Control of idle/inactive UEs.....	172
16.9.5	Sidelink Discovery.....	173
16.9.6	SL DRX .....	173
16.9.6.1	General .....	173
16.9.6.2	Unicast .....	173
16.9.6.3	Groupcast/Broadcast .....	174
16.9.6.4	Alignment between Uu DRX and SL DRX .....	174
16.9.7	Power Savings Resource Allocation .....	175
16.9.8	Inter-UE Coordination (IUC).....	175
16.9.9	Sidelink in Shared Spectrum (SL-U) .....	175
16.9.9.1	Overview.....	175
16.9.9.2	Channel Access Priority Classes for Sidelink (SL-CAPC) .....	176
16.9.9.3	Sidelink Specific Consistent LBT Failure.....	176
16.9.9.4	COT Sharing .....	176
16.9.9.5	Resource Allocation .....	177
16.9.10	Sidelink CA .....	177
16.10	Multicast and Broadcast Services.....	178
16.10.1	General.....	178
16.10.2	Network Architecture .....	178
16.10.3	Protocol Architecture.....	178
16.10.4	Group Scheduling .....	180
16.10.5	Multicast Handling .....	181
16.10.5.1	Session Management.....	181
16.10.5.2	Configuration .....	181
16.10.5.3	Service Continuity.....	182
16.10.5.3.1	General .....	182
16.10.5.3.2	Handover between Multicast supporting cells.....	183
16.10.5.3.3	Handover between Multicast-supporting cell and Multicast non-supporting cell .....	183
16.10.5.3.4	MRB reconfiguration.....	184
16.10.5.3.5	Service Continuity in RRC_INACTIVE .....	184
16.10.5.4	Reception of MBS Multicast data .....	184
16.10.5.5	Support of CA .....	185
16.10.5.6	DRX .....	185
16.10.5.7	Physical Layer.....	185
16.10.6	Broadcast Handling.....	185
16.10.6.1	Session Management.....	185
16.10.6.2	Configuration .....	185
16.10.6.3	Support of CA .....	186
16.10.6.4	DRX .....	186
16.10.6.5	Service Continuity.....	186
16.10.6.5.0	General .....	186
16.10.6.5.1	Service Continuity in RRC_IDLE or RRC_INACTIVE .....	186
16.10.6.5.2	Service Continuity in RRC_CONNECTED .....	187
16.10.6.5A	Reception of MBS Broadcast data .....	187
16.10.6.6	Physical Layer.....	187
16.10.6.7	Shared processing for MBS broadcast and unicast reception.....	187
16.10.6.8	Support of Resource Sharing across multiple Broadcast MBS sessions in RAN Sharing Scenario ...	188
16.11	Minimization of Service Interruption .....	188
16.12	Sidelink Relay .....	188
16.12.1	General.....	188
16.12.2	Protocol Architecture.....	189
16.12.2.1	L2 UE-to-Network Relay .....	189
16.12.2.2	L2 UE-to-UE Relay.....	191
16.12.3	Relay Discovery.....	192
16.12.4	Relay Selection/Reselection.....	194
16.12.5	Control plane procedures for L2 U2N Relay .....	195
16.12.5.1	RRC Connection Management.....	195
16.12.5.2	Radio Link Failure .....	197
16.12.5.3	RRC Connection Re-establishment.....	197
16.12.5.4	RRC Connection Resume .....	197

16.12.5.5	System Information .....	197
16.12.5.6	Paging .....	198
16.12.5.7	Access Control .....	198
16.12.5.8	Mobility Registration Update and RAN Area Update.....	198
16.12.6	Service Continuity for L2 U2N relay.....	198
16.12.6.0	General .....	198
16.12.6.1	Switching from indirect to direct path.....	198
16.12.6.2	Switching from direct to indirect path.....	201
16.12.6.3	Switching from indirect to indirect path.....	203
16.12.7	Control plane procedures for L2 U2U Relay .....	206
16.13	Support of Reduced Capability (RedCap) and enhanced Reduced Capability (eRedCap) NR devices .....	208
16.13.1	Introduction.....	208
16.13.2	Capabilities .....	208
16.13.3	Identification, access and camping restrictions.....	208
16.13.4	RRM measurement relaxations.....	209
16.13.5	BWP operation.....	209
16.14	Non-Terrestrial Networks.....	209
16.14.1	Overview .....	209
16.14.2	Timing and Synchronization.....	211
16.14.2.1	Scheduling and Timing .....	211
16.14.2.2	Timing Advance and Frequency Pre-compensation.....	212
16.14.3	Mobility and State transition.....	213
16.14.3.1	Mobility in RRC_IDLE and RRC_INACTIVE .....	213
16.14.3.2	Mobility in RRC_CONNECTED.....	213
16.14.3.2.1	Handover .....	213
16.14.3.2.2	Conditional Handover .....	213
16.14.3.2.3	Satellite switch with re-synchronization.....	214
16.14.3.3	Measurements .....	214
16.14.4	Switchover .....	215
16.14.4.1	Definitions.....	215
16.14.4.2	Assumptions.....	215
16.14.4.3	Procedures.....	215
16.14.5	NG-RAN signalling .....	215
16.14.6	AMF (Re-)Selection .....	216
16.14.7	O&M Requirements.....	216
16.14.8	Coarse UE location reporting.....	217
16.14.9	Support for NR NTN coverage enhancements.....	217
16.14.10	Verification of UE location.....	217
16.15	eXtended Reality Services.....	217
16.15.1	General.....	217
16.15.2	Awareness.....	217
16.15.3	Power Saving .....	218
16.15.4	Capacity .....	219
16.15.4.1	Physical Layer Enhancements.....	219
16.15.4.2	Layer 2 Enhancements .....	219
16.15.4.2.1	Assistance Information .....	219
16.15.4.2.2	Discard.....	219
16.15.5	Non-Homogeneous support of PDU set based handling in NG-RAN .....	220
16.16	ECN marking for L4S and congestion information exposure .....	220
16.17	Support for TSN enabled Transport Network .....	220
16.18	Support for Aerial UE Communication.....	220
16.18.1	General.....	220
16.18.2	Subscription-based Identification of Aerial UE.....	221
16.18.3	Altitude-based Reporting for Aerial UE Communication.....	221
16.18.4	Altitude-dependent Configurations for Aerial UE Communication .....	221
16.18.5	Interference Detection and Mitigation for Aerial UE Communication.....	221
16.18.6	Flight Path Information Reporting for Aerial UE Communication .....	222
16.18.7	Location Reporting for Aerial UE Communication.....	222
16.18.8	BRID and DAA Support via A2X Communication.....	222
16.19	Support for Air to Ground Networks.....	222
16.19.1	Overview .....	222
16.19.2	Timing and Synchronization.....	222

16.19.2.1	Scheduling and Timing .....	222
16.19.2.2	Timing Advance .....	222
16.19.3	Mobility .....	223
16.19.3.1	Mobility in RRC_IDLE and RRC_INACTIVE .....	223
16.19.3.2	Mobility in RRC_CONNECTED .....	223
16.19.3.2.1	Handover .....	223
16.19.3.2.2	Conditional Handover .....	223
16.20	Support of AI/ML for NG-RAN .....	223
16.20.1	General .....	223
16.20.2	Principles .....	223
16.20.3	Data Collection and Reporting .....	224
16.20.4	OAM Requirements .....	224
16.21	Multi-path Relay .....	224
16.21.1	General .....	224
16.21.2	Protocol Architecture .....	225
16.21.2.1	L2 MP Relay using SL indirect path .....	225
16.21.2.2	L2 MP Relay using N3C indirect path .....	226
16.21.3	Control plane procedure for multi-path relaying .....	227
16.21.3.1	Path Management .....	227
16.21.3.2	Path Failure Report .....	233
16.21.3.3	System Information .....	233
16.22	Support of 2Rx XR devices .....	233
16.22.1	Introduction .....	233
16.22.2	Identification, access and camping restrictions .....	233
17	Interference Management .....	233
17.1	Remote Interference Management .....	233
17.2	Cross-Link Interference Management .....	234
18	Small Data Transmission .....	234
18.0	General .....	234
18.1	Support of SDT procedure over RACH .....	236
18.2	SDT with UE context relocation .....	236
18.3	SDT without UE context relocation .....	238
18.4	MT-SDT with/without UE context relocation .....	239
19	Support for NR coverage enhancements .....	240
20	Support for Multi-USIM devices .....	241
20.1	General .....	241
20.2	Paging Collision Avoidance .....	241
20.3	UE notification on Network Switching .....	242
20.4	Temporary UE capability restriction and removal of restriction .....	242
21	Application Layer Measurement Collection .....	243
21.1	Overview .....	243
21.2	QoE Measurement Configuration .....	243
21.2.1	QoE Measurement Collection Activation and Reporting .....	243
21.2.2	QoE Measurement Collection Deactivation .....	244
21.2.3	Handling of QMC during RAN Overload .....	244
21.2.4	QoE Measurement Handling in RRC_IDLE and RRC_INACTIVE States .....	244
21.2.5	Per-slice QoE Measurement .....	245
21.3	QoE Measurement Continuity for Mobility .....	245
21.4	RAN Visible QoE Measurements .....	246
21.5	Alignment of MDT and QoE Measurements .....	247
21.6	QoE Measurement Collection in High Mobility Scenarios .....	247
21.7	Void .....	247
<b>Annex A (informative): QoS Handling in RAN .....</b>		<b>248</b>
A.1	PDU Session Establishment .....	248
A.2	New QoS Flow with RQoS .....	248
A.3	New QoS Flow with Explicit RRC Signalling .....	249

A.4	New QoS Flow with Explicit NAS Signalling .....	250
A.5	Release of QoS Flow with Explicit Signalling.....	251
A.6	UE Initiated UL QoS Flow.....	251
<b>Annex B (informative): Deployment Scenarios .....</b>		<b>253</b>
B.1	Supplementary Uplink.....	253
B.2	Multiple SSBs in a carrier .....	253
B.3	NR Operation with Shared Spectrum.....	254
B.4	Example implementation of Non-Terrestrial Networks .....	254
<b>Annex C (informative): I-RNTI Reference Profiles .....</b>		<b>257</b>
<b>Annex D (informative): SPID ranges and mapping of SPID values to cell reselection and inter-RAT/inter frequency handover priorities.....</b>		<b>258</b>
<b>Annex E (informative): NG-RAN Architecture for Radio Access Network Sharing with multiple cell ID broadcast .....</b>		<b>259</b>
<b>Annex F (normative): Use and structure of the I-RNTI .....</b>		<b>260</b>
<b>Annex G (informative): Components of Mobility Latency .....</b>		<b>261</b>
<b>Annex H (informative): Change history .....</b>		<b>263</b>
History .....		273

Sample Document

get full document from [standards.iteh.ai](https://standards.iteh.ai)

---

# Foreword

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

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

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

# Sample Document

get full document from [standards.iteh.ai](https://standards.iteh.ai)

---

# 1 Scope

The present document provides an overview and overall description of the NG-RAN and focuses on the radio interface protocol architecture of NR connected to 5GC (E-UTRA connected to 5GC is covered in the 36 series). Details of the radio interface protocols are specified in companion specifications of the 38 series.

---

# 2 References

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

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

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".
- [3] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".
- [4] 3GPP TS 38.401: "NG-RAN; Architecture description".
- [5] 3GPP TS 33.501: "Security Architecture and Procedures for 5G System".
- [6] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".
- [7] 3GPP TS 38.322: "NR; Radio Link Control (RLC) protocol specification".
- [8] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".
- [9] 3GPP TS 37.324: "E-UTRA and NR; Service Data Adaptation Protocol (SDAP) specification".
- [10] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in Idle mode and RRC Inactive state".
- [11] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".
- [12] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".
- [13] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".
- [14] 3GPP TS 22.168: "Earthquake and Tsunami Warning System (ETWS) requirements; Stage 1".
- [15] 3GPP TS 22.268: "Public Warning System (PWS) Requirements".
- [16] 3GPP TS 38.410: "NG-RAN; NG general aspects and principles".
- [17] 3GPP TS 38.420: "NG-RAN; Xn general aspects and principles".
- [18] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".
- [19] 3GPP TS 22.261: "Service requirements for next generation new services and markets".
- [20] 3GPP TS 38.202: "NR; Physical layer services provided by the physical layer"
- [21] 3GPP TS 37.340: "NR; Multi-connectivity; Overall description; Stage-2".