

3GPP TR 36.912 V9.1.0 (2009-12)

Technical Report

**3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
Feasibility study for
Further Advancements for E-UTRA (LTE-Advanced)
(Release 9)**



The present document has been developed within the 3rd Generation Partnership Project (3GPP™) and may be further elaborated for the purposes of 3GPP.

The present document has not been subject to any approval process by the 3GPP Organizational Partners and shall not be implemented.

Keywords

LTE, Radio

3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

<http://www.3gpp.org>

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© 2009, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TTA, TTC).
All rights reserved.

UMTS™ is a Trade Mark of ETSI registered for the benefit of its members
3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners
LTE™ is a Trade Mark of ETSI currently being registered for the benefit of its Members and of the 3GPP Organizational Partners
GSM® and the GSM logo are registered and owned by the GSM Association

Contents

Foreword	6
1 Scope	7
2 References	7
3 Definitions, symbols and abbreviations	8
3.1 Definitions	8
3.2 Symbols	8
3.3 Abbreviations.....	8
4 Introduction	8
5 Support of wider bandwidth.....	8
5.1 General.....	8
5.1A Physical layer.....	9
5.1A.1 DL control signalling	9
5.1A.2 UL control signalling.....	9
5.2 User Plane.....	10
5.2.1 Structure	10
5.2.2 MAC	11
5.2.3 RLC.....	11
5.2.4 PDCP.....	11
5.3 Control plane	11
5.3.1 Structure	11
5.3.2 RRC procedures	12
5.3.2.1 System Information	12
5.3.2.2 Connection Control	12
5.3.2.3 Measurements.....	12
5.3.3 Idle mode procedures	12
6 Uplink transmission scheme.....	12
6.1 Uplink spatial multiplexing.....	12
6.1A Uplink transmit diversity	14
6.1A.1 Transmit Diversity for Uplink Control Channel	14
6.2 Uplink multiple access.....	14
6.3 Uplink reference signals	15
6.4 Uplink power control.....	15
7 Downlink transmission scheme.....	15
7.0 Physical channel mapping.....	15
7.1 Downlink spatial multiplexing.....	15
7.1.1 Feedback in support of downlink spatial multiplexing	16
7.2 Downlink reference signals.....	16
7.3 Downlink transmit diversity	17
8 Coordinated multiple point transmission and reception	17
8.1 Downlink coordinated multi-point transmission.....	17
8.2 Uplink coordinated multi-point reception.....	17
9 Relaying	17
9.1 General.....	17
9.2 Architecture	18
9.3 Relay-eNodeB link	18
9.3.1 Resource partitioning for relay-eNodeB link	18
9.3.2 Backward compatible backhaul partitioning	19
9.3.3 Backhaul resource assignment	19
10 Improvement for latency	20
10.1 Improvement for C-Plane latency.....	20
10.2 Improvement for U-Plane latency.....	20

11	Radio transmission and reception	21
11.1	RF scenarios.....	21
11.1.1	Deployment scenarios	21
11.2	Common requirements for UE and BS	21
11.2.1	Carrier Aggregation.....	21
11.2.1.1	Bandwidth configuration of component carriers	21
11.2.1.2	Carrier spacing between component carriers.....	21
11.2.2	Operating bands	21
11.3	UE RF requirements	22
11.3.1	General.....	22
11.3.2	Transmitter characteristics	23
11.3.2.1	Transmitter architecture	23
11.3.2.2	Transmit power	24
11.3.2.3	Output power dynamics	24
11.3.2.4	Transmit signal quality	25
11.3.2.5	Output RF spectrum emissions.....	25
11.3.2.5.1	Adjacent Channel Leakage ratio	25
11.3.2.5.2	Spurious emission (UE to UE co-existence)	25
11.3.2.6	Transmit intermodulation.....	25
11.3.3	Receiver characteristics.....	25
11.3.3.1	Receiver architecture	26
11.3.3.2	Receiver Sensitivity.....	26
11.3.3.3	Selectivity.....	26
11.3.3.4	Blocking performance	27
11.3.3.5	Spurious response.....	27
11.3.3.6	Intermodulation performance	27
11.3.3.7	Spurious emission	27
11.4	BS RF requirements.....	27
11.4.1	General.....	27
11.4.2	Transmitter characteristics	28
11.4.2.1	Base Station output power.....	28
11.4.2.2	Transmitted signal quality	28
11.4.2.3	Unwanted emissions.....	28
11.4.2.4	Transmitter spurious emissions	28
11.4.3	Receiver characteristics.....	29
11.4.3.1	Reference sensitivity level.....	29
11.4.3.2	Adjacent Channel Selectivity (ACS), narrow-band blocking, Blocking, Receiver intermodulation	29
11.4.3.3	Performance requirements.....	29
12	Mobility enhancements	29
13	TS 36.133 [17] requirements enhancements	30
14	MBMS Enhancements.....	30
15	SON Enhancements.....	30
16	Self-Evaluation Report on "LTE Release 10 and beyond (LTE-Advanced)"	30
16.1	Peak spectral efficiency	31
16.2	C-plane latency	32
16.2.1	Idle to Connected	32
16.2.2	Dormant to Active.....	33
16.3	U-Plane latency.....	34
16.4	Spectral efficiency and user throughput.....	34
16.4.1	Cell spectral efficiency and cell-edge spectral efficiency	34
16.4.1.1	Indoor	34
16.4.1.2	Microcellular	35
16.4.1.3	Base coverage urban.....	36
16.4.1.4	High speed.....	37
16.4.2	Number of supported VoIP users	39
16.4.3	Mobility traffic channel link data rates	39
16.5	Handover Performance	40
16.5.1	Intra-frequency handover interruption time	42

16.5.2	Inter-frequency handover interruption time within a spectrum band	42
16.5.3	Inter-frequency handover interruption time between spectrum bands	42
16.6	Spectrum and bandwidth	42
16.6.1	Deployment in IMT bands	42
16.6.2	Bandwidth and channel bandwidth scalability	42
16.7	Services	42
16.8	Conclusions of the Self-Evaluation	43
Annex A: Simulation model		44
A.1	General assumption	44
A.2	CoMP assumption for evaluation	46
A.3	Detailed simulation results	46
Annex B: Latency performance of Rel-8		47
B.1	C-plane latency	47
B.1.1	Transition IDLE to CONNECTED	47
B.1.1.1	FDD frame structure	47
B.1.1.2	TDD frame structure	48
B.1.2	Transition Dormant to Active	49
B.1.2.1	FDD frame structure	50
B.1.2.1.1	Uplink initiated transition, synchronized	50
B.1.2.1.2	Uplink initiated transition, unsynchronized	50
B.1.2.1.3	Downlink initiated transition, synchronized	50
B.1.2.1.4	Downlink initiated transition, unsynchronized	50
B.1.2.2	TDD frame structure	51
B.1.2.2.1	Uplink initiated transition, synchronized	51
B.1.2.2.2	Uplink initiated transition, unsynchronized	51
B.1.2.2.3	Downlink initiated transition, synchronized	52
B.1.2.2.4	Downlink initiated transition, unsynchronized	52
B.2	U-plane latency	53
B.2.1	FDD frame structure	53
B.2.2	TDD frame structure	54
Annex C: ITU-R Submission Templates		57
C.1	Description template – characteristics (4.2.3.2)	57
C.2	Description template – link budget (4.2.3.3)	57
C.3	Compliance templates for services (4.2.4.1), for spectrum (4.2.4.2), technical performance (4.2.4.3)	57
Annex D: Change history		58

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.