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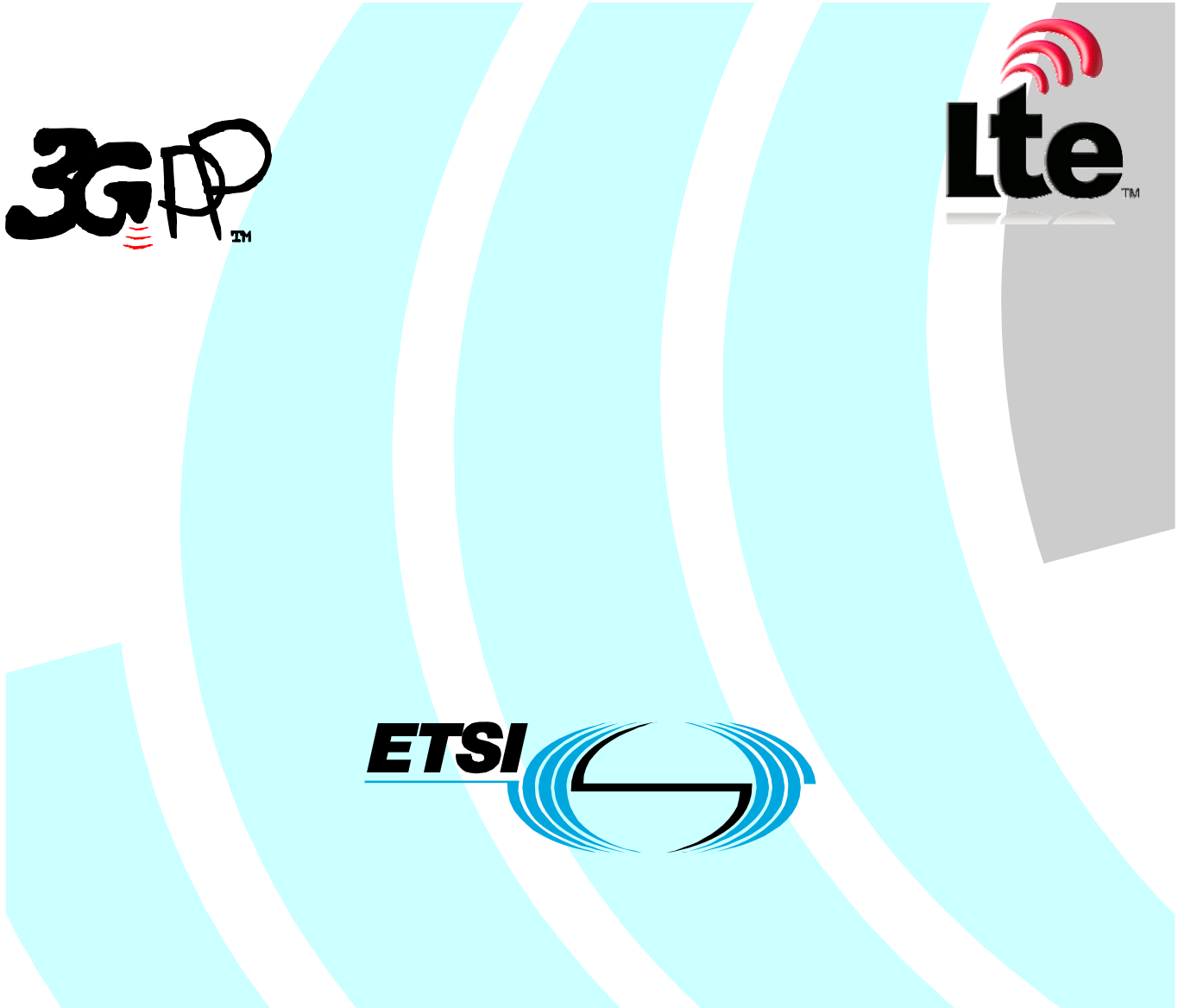
Technical Specification

LTE;
Evolved Universal Terrestrial Radio Access Network (E-UTRAN);
Layer 2 - Measurements
(3GPP TS 36.314 version 8.0.1 Release 8)



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Foreword

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, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

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

Contents

Foreword

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

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

Version x.y.z

where:

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

1 Scope

The present document contains the description and definition of the measurements performed by E-UTRAN that are transferred over the standardised interfaces in order to support E-UTRA radio link operations, radio resource management (RRM), network operations and maintenance (OAM), and self-organising networks (SON).

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 TR 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA) Medium Access Control (MAC) protocol specification ".

[3] 3GPP TR 36.322: "Evolved Universal Terrestrial Radio Access (E-UTRA) Radio Link Control (RLC) protocol specification".

[4] 3GPP TR 36.323: "Evolved Universal Terrestrial Radio Access (E-UTRA); Packet Data Convergence Protocol (PDCP) specification".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

3.2 Symbols

For the purposes of the present document, the following symbols apply:

(void)

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

(void)

4 Layer 2 measurements

4.1 E-UTRAN measurements

4.1.1 PRB usage

The objective of the PRB usage measurements is to measure usage of time and frequency resources. A use case is cell load balancing, where PRB usage is used for information signalled across the X2 interface. Another use-case is OAM performance observability.

4.1.1.1 UL and DL Total PRB usage

Protocol Layer: MAC

Definition	Total PRB usage. The reference point is the Service Access Point between MAC and L1. The measurement is done separately for: - DL - UL Detailed Definitions: NOTE: Detail definition is FFS

4.1.1.2 UL and DL PRB usage per traffic class

Protocol Layer: MAC

Definition

PRB usage per traffic class. This measurement is an aggregate for all UEs in a cell, and is applicable to Dedicated Traffic Channels (DTCH). The reference point is the Service Access Point between MAC and L1. The measurement is done separately for:
- DL DTCH, for each QCI.
- UL DTCH, for each CQI

Detailed Definitions:

$$M1(qci,T) = \sum_{\forall t} N(t) * X(t) * \frac{B(t,qci)}{B(t)}$$, where

$M1(qci,T)$	Absolute PRB usage per traffic class. A count of full or partial physical resource blocks.
T	The time period during which the measurement is performed (in TTIs)
t	A transport block in time period T that contain DTCH data. Initial transmissions and HARQ retransmissions shall be counted.
$N(t)$	The number of physical resource blocks used for transmission of transport block t.
$B(t,qci)$	The total number of DTCH bits for DTCHs with QCI = qci, carried in transport block t
$B(t)$	The total number of DTCH and DCCH bits carried in transport block t.
$X(t)$	If concatenation is taken into account: $X(t)=1$ always. If concatenation is not taken into account: $X(t)=1$ if transport block t carries data corresponding to only one QCI and: $X(t)=0$ otherwise. It is up to implementation if to take concatenation into account or not.

$$M(qci) = \left\lfloor \frac{M1(qci,T)}{P(T)} * 100 \right\rfloor$$, where

$M(qci)$	PRB usage per traffic class. Percentage of PRBs used for a certain qci. Value range: 0-100%
$P(T)$	Total number of PRBs available during time period T.

4.1.1.3 UL and DL PRB usage for SRB

Protocol Layer: MAC

Definition

PRB usage for SRB. This measurement is applicable to Dedicated Control Channels (DCCH). The reference point is the Service Access Point between MAC and L1. The measurement is done separately for:
- DL DCCH
- UL DCCH

It is FFS whether SRB0 (CCCH) should be included or not.

Detailed Definitions:

$$M1(srb,T) = \sum_{\forall t} N(t) * X(t) * \frac{B(t,srb)}{B(t)}$$, where

$M1(srb,T)$	Absolute PRB usage per SRBs. A count of full or partial physical resource blocks.
T	The time period during which the measurement is performed (in TTIs)
t	A transport block in time period T that contain DCCH data. Initial transmissions and HARQ retransmissions shall be counted.
$N(t)$	The number of physical resource blocks used for transmission of transport block t.
$B(t,srb)$	The total number of DCCH bits carried in transport block t
$B(t)$	The total number of DTCH and DCCH bits carried in transport block t.
$X(t)$	If concatenation is taken into account: $X(t)=1$ always. If concatenation is not taken into account: $X(t)=1$ if transport block t carries data corresponding to only DCCH and: $X(t)=0$ otherwise. It is up to implementation if to take concatenation into account or not.

$$M(srb) = \left\lfloor \frac{M1(srb,T)}{P(T)} * 100 \right\rfloor$$, where

$M(srb)$	PRB usage per SRB. Percentage of PRBs used for SRBs. Value range: 0-100%
$P(T)$	Total number of PRBs available during time period T.

4.1.1.4 DL PRB usage for Common Control Channels

Protocol Layer: MAC

Definition	DL PRB usage for Common Control Channels. This measurement is applicable to Broadcast Control Channel (BCCH) and Paging Control Channel (PCCH). The reference point is the Service Access Point between MAC and L1. Detailed Definitions: $M1(T) = \sum_{\forall t1} N1(t1) + \sum_{\forall t2} N2(t2)$, where $M1(T)$ — Absolute DL PRB usage for Common Control Channels. An integer count of physical resource blocks T — The time period during which the measurement is performed. $t1$ — A transport block in time period T that contain BCCH data. Initial transmissions and repetitions shall be counted. $t2$ — A transport block in time period T that contain PCCH data. Initial transmissions and repetitions shall be counted. $N1(t1)$ — The number of physical resource blocks used for transmission of transport block $t1$. $N2(t2)$ — The number of physical resource blocks used for transmission of transport block $t2$. $M = \left\lfloor \frac{M1(T)}{P(T)} * 100 \right\rfloor$, where M — DL PRB usage for Common Control Channels. Percentage of PRBs used for Common Control Channels. Value range: 0-100%. $P(T)$ — Total number of PRBs available during time period T . Value of measurement time period T shall be supported in the FFS range.

4.1.1.5 UL PRB usage for Common Control Channels

Protocol Layer: L2 or L3

Definition	UL PRB usage for Common Control Channels. This measurement is applicable to Random Access Channel (RACH) and Physical Uplink Control Channel (PUCCH). Detailed Definitions: $M1(T) = N_{RACH}(T) + N_{PUCCH}(T)$, where $M1(T)$ Absolute UL PRB usage for Common Control Channels. An integer count of physical resource blocks. T The time period during which the measurement is performed. $N_{RACH}(T)$ The number of physical resource blocks allocated for RACH during time period T . $N_{PUCCH}(T)$ The number of physical resource blocks allocated for PUCCH during time period T . $M = \left\lfloor \frac{M1(T)}{P(T)} * 100 \right\rfloor$, where M UL PRB usage for Common Control Channels. Percentage of PRBs used for Common Control Channels. Value range: 0-100% . $P(T)$ Total number of PRBs available during time period T . Value of measurement time period T shall be supported in the FFS range.

4.1.2 Received Random Access Preambles

A use case for this measurement is RACH configuration optimization, where Received Random Access Preambles is signaled across an OAM interface.

Protocol Layer: MAC

Definition	Received Random Access Preambles. This measurement is applicable to PRACH. The reference point is the Service Access Point between MAC and L1. The measured quantity is the number of received Random Access preambles during a time period over all PRACHs configured in a cell. The measurement is done separately for: - Dedicated preambles - Randomly selected preambles in the low range - Randomly selected preambles in the high range. The unit of the measured value is [/s].

NOTE: Confirmation on the need for this measurement is still required from SA5.

4.1.3 Number of active UEs

The objective of the measurement is to measure number of active UEs per QCI for OAM performance observability. It is intended to be part of a calculation to determine the bitrate UEs achieve when they are active, i.e. when applications are transmitting and receiving data.

4.1.3.1 Average number of Active UEs in the DL per QCI

Protocol Layer: MAC, RLC, PDCP

Definition

Average number of Active UEs in the DL per QCI. This measurement refers to UEs for which there is buffered data for the DL for DRBs. The measurement is done separately per QCI.

Detailed Definition:

$$M(T,qci,p) = \left\lfloor \frac{\sum_{\forall i} N(i,qci)}{I(T,p)} \right\rfloor$$,where

$M(T,qci,p)$	Average number of Active UEs in the DL per QCI. Unit: Integer.
$N(i,qci)$	Number of UEs for which there is buffered data for the DL in MAC, RLC or PDCP protocol layers for a Data Radio Bearer of traffic class with QCI = qci at sampling occasion i. In RLC and PDCP layers, buffered data corresponds to *data available for transmission* according to the definitions in TS 36.322 and TS 36.323. Buffered data includes data for which HARQ transmission has not yet terminated.
i	Sampling occasion during time period T. A sampling occasion shall occur once every p seconds.
p	Sampling period length. Unit: second. The following values shall be supported: [0.1s, 0.2s, 0.5s, 1.0s, 2.0s, 3.0s, 5.0s, 10.0s]
$I(T,p)$	Total number of sampling occasions during time period T.
T	Time Period during which the measurement is performed, Unit: second.

4.1.3.2 Average number of Active UEs in the UL per QCI

Protocol Layer: MAC

Definition	Average number of Active UEs in the UL per QCI. This measurement refers to UEs for which there is buffered data for the UL for DRBs. The measurement is done separately per QCI. Detailed Definition: $M(T,qci,p)=\left\lfloor \frac{\sum_{\forall i} N(i,qci)}{I(T,p)} \right\rfloor$,where $M(T,qci,p)$ — Average number of Active UEs in the UL per QCI. Unit: Integer. $N(i,qci)$ — Number of UEs for which there is buffered data for the UL in MAC, RLC or PDCP protocol layers for a Data Radio Bearer of traffic class with QCI = qci at sampling occasion i. This is a Node B estimation that is expected to be based on Buffer Status Reporting, analysis of received data and progress of ongoing HARQ transmissions. Buffered data includes data for which HARQ transmission has not yet terminated. When QCI cannot be determined at the time of the sampling occasion, it is expected that QCI is determined after successful reception of data. i — Sampling occasion during time period T. A sampling occasion shall occur once every p seconds. p — Sampling period length. Unit: second. The following values shall be supported: [0.1s, 0.2s, 0.5s, 1.0s, 2.0s, 3.0s, 5.0s, 10.0s] $I(T,p)$ — Total number of sampling occasions during time period T. T — Time Period during which the measurement is performed, Unit: second.

NOTE: For this measurement, the expected accuracy is dependent on application scenario, cell load and UE configuration.

4.1.4 Packet Delay

4.1.4.1 Average Packet Delay in the DL per QCI

The objective of this measurement is to measure L2 Packet Delay for OAM performance observability.

Protocol Layer: MAC, RLC, PDCP

Definition	Average Packet Delay in the DL per QCI. This measurement refers to packet delay for DRBs. For arrival of packets the reference point is PDCP upper SAP. For successful reception the reference point is MAC lower SAP. The measurement is done separately per QCI. Detailed Definition: $M(T,qci) = \left\lfloor \frac{\sum_{\forall i} tArriv(i) - tAck(i)}{I(T)} \right\rfloor$,where $M(T,qci)$ Average Packet Delay in the DL per QCI. Unit: Integer ms. $tArriv(i)$ The point in time when PDCP SDU i arrives. $tAck(i)$ The point in time when HARQ acknowledgement for the last piece of PDCP SDU i has been received. i A PDCP SDU that arrives at the PDCP upper SAP during time period T. PDCP SDU for which HARQ acknowledgement is not received for all parts shall not be included in the calculation. $I(T)$ Total number of PDCP SDUs i . T Time Period during which the measurement is performed

4.1.5 Data Loss

4.1.5.1 Average Packet Discard Rate in the DL per QCI

The objective of this measurement is to measure packets that are dropped due to congestion, traffic management etc, for OAM performance observability.

Protocol Layer: MAC, RLC, PDCP

Definition	Average Packet Discard Rate in the DL per QCI. This measurement refers to discard for DRBs. One packet corresponds to one PDCP SDU. The reference point is PDCP upper SAP. The measurement is done separately per QCI. Detailed Definition: $M(T,qci) = \left\lfloor \frac{Ddisc(T,qci)*1000000}{N(T,qci)} \right\rfloor$,where $M(T,qci)$ — Average Packet Discard Rate in the DL per QCI. Unit: number of discarded packets per received packets * 10^6, Integer. $Ddisc(T,qci)$ — Number of DL packets, for which no part has been transmitted over the air, of a data radio bearer with QCI = qci , that are discarded during time period T in the PDCP, RLC or MAC layers due to reasons other than hand-over. $N(T,qci)$ — Number of DL packets of bearer with QCI = qci that has entered PDCP upper SAP during time period T (NOTE). T — Time Period during which the measurement is performed, Unit: minutes, where the lowest value is 5 minutes (NOTE).

NOTE: Packet loss is expected to be small or very small The statistical accuracy of an individual discard rate measurement result is dependent on how many packets has been received, and thus the time for the measurement.

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2008-12	RP-42	RP-081034	-	-	v1.0.0 was approved as v8.0.0 and put under CR control	1.0.0	8.0.0
2009-01					Keywords added, white space trimmed, file properties set	8.0.0	8.0.1

History

Document history		
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