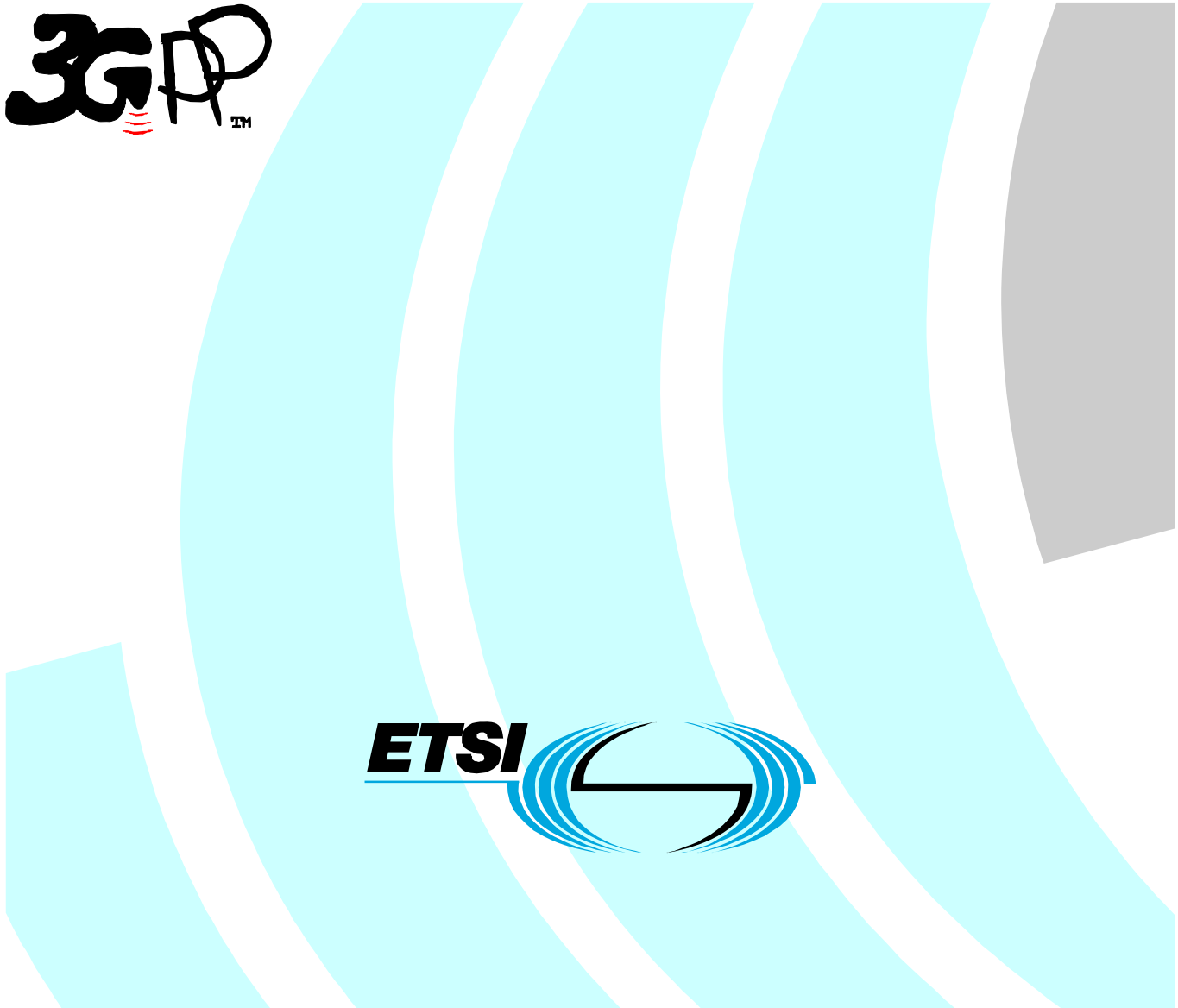
ETSI TS 125 215 V8.3.0 (2009-03)

Technical Specification

Universal Mobile Telecommunications System (UMTS);
Physical layer;
Measurements (FDD)
(3GPP TS 25.215 version 8.3.0 Release 8)



Reference
RTS/TSGR-0125215v830

Keywords
UMTS

ETSI

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Foreword

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Contents

Foreword

This Technical Specification (TS) 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:

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1 Scope

The present document contains the description and definition of the measurements for FDD done at the UE and network in order to support operation in idle mode and connected mode.

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 TS 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)".

[2] 3GPP TS 25.212: "Multiplexing and channel coding (FDD)".

[3] 3GPP TS 25.213: "Spreading and modulation (FDD)".

[4] 3GPP TS 25.214: "Physical layer procedures (FDD)".

[5] 3GPP TS 25.215: "Physical layer - Measurements (FDD)".

[6] 3GPP TS 25.221: "Physical channels and mapping of transport channels onto physical channels (TDD)".

[7] 3GPP TS 25.222: "Multiplexing and channel coding (TDD)".

[8] 3GPP TS 25.223: "Spreading and modulation (TDD)".

[9] 3GPP TS 25.224: "Physical layer procedures (TDD)".

[10] 3GPP TS 25.301: "Radio Interface Protocol Architecture".

[11] 3GPP TS 25.302: "Services provided by the Physical layer".

[12] 3GPP TS 25.303: "UE functions and interlayer procedures in connected mode".

[13] 3GPP TS 25.304: "UE procedures in idle mode".

[14] 3GPP TS 25.331: "RRC Protocol Specification".

[15] 3GPP TR 25.922: "Radio Resource Management Strategies".

[16] 3GPP TR 25.923: "Report on Location Services (LCS)".

[17] 3GPP TR 25.401: "UTRAN Overall Description".

[18] 3GPP TS 25.101: "UE Radio transmission and Reception (FDD)".

[19] 3GPP TS 25.104: "UTRA (BS) FDD; Radio transmission and Reception".

[20] 3GPP TS 25.133: " Requirements for Support of Radio Resource Management (FDD)"

[21] 3GPP TS 25.225: " Physical layer – Measurements (TDD)".

[22] 3GPP TS 25.321: "Medium Access Control (MAC) protocol specification"

[23] 3GPP TS 36.211: "E-UTRA; Physical Channels and Modulation"

[24] 3GPP TS 36.214: "E-UTRA; Physical layer – Measurements"

3 Definitions and Abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

cell portion: A geographical part of a cell for which a Node B measurement can be reported to the RNC. A cell portion is semi-static, and identical for both the UL and the DL. Within a cell, a cell portion is uniquely identified by a cell portion ID.

Note 1: a cell portion is not necessarily analogous to actual beams used for transmission and/or reception of e.g. a DPCH at the Node B.
Note 2: RNC may associate physical channels with cell portions.

3.2 Abbreviations

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

BER	Bit Error Rate
BLER	Block Error Rate
Ec/No	Received energy per chip divided by the power density in the band
E-UTRA	Evolved Universal Terrestrial Radio Access
F-DPCH	Fractional Dedicated Physical Channel
GANSS	Galileo and Additional Navigation Satellite Systems
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ISCP	Interference Signal Code Power
RL	Radio Link
RSCP	Received Signal Code Power
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
RSSI	Received Signal Strength Indicator
SIR	Signal to Interference Ratio

4 Control of UE/UTRAN measurements

In this chapter the general measurement control concept of the higher layers is briefly described to provide an understanding on how L1 measurements are initiated and controlled by higher layers.

L1 provides with the measurement specifications a toolbox of measurement abilities for the UE and the UTRAN. These measurements can be differentiated in different reported measurement types: intra-frequency, inter-frequency, inter-system, traffic volume, quality and UE internal measurements (see [14]).

In the L1 measurement specifications the measurements, see chapter 5, are distinguished between measurements in the UE (the messages will be described in the RRC Protocol or MAC Protocol [22]) and measurements in the UTRAN (the messages will be described in the NBAP and the Frame Protocol).

To initiate a specific measurement the UTRAN transmits a 'measurement control message' to the UE including a measurement ID and type, a command (setup, modify, release), the measurement objects and quantity, the reporting quantities, criteria (periodical/event-triggered) and mode (acknowledged/unacknowledged), see [14].

When the reporting criteria is fulfilled the UE shall answer with a 'measurement report message' to the UTRAN including the measurement ID and the results.

In idle mode the measurement control message is broadcast in a System Information.

Intra-frequency reporting events, traffic volume reporting events and UE internal measurement reporting events described in [14] define events which trigger the UE to send a report to the UTRAN. This defines a toolbox from which the UTRAN can choose the needed reporting events.

5 Measurement abilities for UTRA FDD

In this chapter the physical layer measurements reported to higher layers are defined. The GSM measurements are required only from the GSM capable terminals. The TDD measurements are required only from the terminals that are capable to operate in TDD mode.

5.1 UE measurement abilities

The structure of the table defining a UE measurement quantity is shown below.

Column field	Comment
Definition	Contains the definition of the measurement.
Applicable for	States in which RRC state according to [14] a measurement shall be possible to perform. For RRC connected mode states information is also given on the possibility to perform the measurement on intra-frequency and/or inter-frequency. The following terms are used in the tables: Idle = Shall be possible to perform in idle mode; URA_PCH = Shall be possible to perform in URA_PCH; CELL_PCH = Shall be possible to perform in CELL_PCH; CELL_FACH = Shall be possible to perform in CELL_FACH; CELL_DCH = Shall be possible to perform in CELL_DCH; For all RRC connected mode states i.e. URA_PCH, CELL_PCH, CELL_FACH and CELL_DCH Intra appended to the RRC state = Shall be possible to perform in the corresponding RRC state on an intra-frequency cell; Inter appended to the RRC state = Shall be possible to perform in the corresponding RRC state on an inter-frequency cell. Inter-RAT appended to the RRC state = Shall be possible to perform in the corresponding RRC state on an inter-RAT cell.

The term "antenna connector of the UE" used in this sub-clause to define the reference point for the UE measurements is defined in [18]. Performance and reporting requirements for the UE measurements are defined in [20].

5.1.1 CPICH RSCP

Definition	Received Signal Code Power, the received power on one code measured on the Primary CPICH. The reference point for the RSCP shall be the antenna connector of the UE. If Tx diversity is applied on the Primary CPICH the received code power from each antenna shall be separately measured and summed together in [W] to a total received code power on the Primary CPICH. If receiver diversity is in use by the UE, the measured CPICH RSCP value shall not be lower than the corresponding CPICH RSCP of any of the individual receive antenna branches.
Applicable for	Idle, URA_PCH intra, URA_PCH inter, CELL_PCH intra, CELL_PCH inter, CELL_FACH intra, CELL_FACH inter, CELL_DCH intra, CELL_DCH inter

5.1.2 PCCPCH RSCP

Definition	Received Signal Code Power, the received power on one code measured on the PCCPCH from a TDD cell. The reference point for the RSCP shall be the antenna connector of the UE. See [21] for further details on this measurement.
Applicable for	Idle, URA_PCH inter, CELL_PCH inter, CELL_FACH inter, CELL_DCH inter

5.1.3 UTRA carrier RSSI

Definition	The received wide band power, including thermal noise and noise generated in the receiver, within the bandwidth defined by the receiver pulse shaping filter. The reference point for the measurement shall be the antenna connector of the UE. If receiver diversity is in use by the UE, the measured UTRA carrier RSSI value shall not be lower than the corresponding UTRA carrier RSSI of any of the individual receive antenna branches.
Applicable for	CELL_DCH intra, CELL_DCH inter

5.1.4 GSM carrier RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the relevant channel bandwidth. Measurement shall be performed on a GSM BCCH carrier. The reference point for the RSSI shall be the antenna connector of the UE.
Applicable for	Idle, URA_PCH inter-RAT CELL_PCH inter-RAT CELL_FACH inter-RAT CELL_DCH inter-RAT

5.1.5 CPICH Ec/No

Definition	The received energy per chip divided by the power density in the band. If receiver diversity is not in use by the UE, the CPICH Ec/No is identical to CPICH RSCP/UTRA Carrier RSSI. Measurement shall be performed on the Primary CPICH. The reference point for the CPICH Ec/No shall be the antenna connector of the UE. If Tx diversity is applied on the Primary CPICH the received energy per chip (Ec) from each antenna shall be separately measured and summed together in [Ws] to a total received chip energy per chip on the Primary CPICH, before calculating the Ec/No. If receiver diversity is in use by the UE the measured CPICH Ec/No value shall not be lower than the corresponding CPICH $RSCP_i$/UTRA Carrier $RSSI_i$ of receive antenna branch i.
Applicable for	Idle, URA_PCH intra, URA_PCH inter, CELL_PCH intra, CELL_PCH inter, CELL_FACH intra, CELL_FACH inter, CELL_DCH intra, CELL_DCH inter

5.1.6 Transport channel BLER

Definition	Estimation of the transport channel block error rate (BLER). The BLER estimation shall be based on evaluating the CRC of each transport block associated with the measured transport channel after RL combination. The BLER shall be computed over the measurement period as the ratio between the number of received transport blocks resulting in a CRC error and the number of received transport blocks. When either TFCI or guided detection is used, the measurement 'Transport channel BLER' may only be requested for a transport channel when the associated CRC size is non zero and at least one transport format in the associated transport format set includes at least one transport block. When neither TFCI nor guided detection is used, the measurement 'Transport channel BLER' may only be requested for a transport channel when the associated CRC size is non zero and all transport formats in the associated transport format set include at least one transport block. The measurement 'Transport channel BLER' does not apply to transport channels mapped on a P-CCPCH and a S-CCPCH. The UE shall be able to perform the measurement 'Transport channel BLER' on any transport channel configured such that the measurement 'Transport channel BLER' can be requested as defined in this section.
Applicable for	CELL_DCH intra

5.1.7 UE transmitted power

Definition	The total UE transmitted power on one carrier. The reference point for the UE transmitted power shall be the antenna connector of the UE.
Applicable for	CELL_FACH intra, CELL_DCH intra

5.1.8 SFN-CFN observed time difference

Definition	The SFN-CFN observed time difference to cell is defined as: OFF×38400+ T_m, where: T_m= (T_{UETx}-T_0) - T_{RxSFN}, given in chip units with the range [0, 1, …, 38399] chips T_{UETx} is the time when the UE transmits an uplink DPCCH frame. T_0 is defined in [1]. T_{RxSFN} is the time at the beginning of the neighbouring P-CCPCH frame received most recent in time before the time instant T_{UETx}-T_0in the UE. If the beginning of the neighbouring P-CCPCH frame is received exactly at T_{UETx}-T_0 then T_{RxSFN}=T_{UETx}-T_0 (which leads to T_m=0). and OFF=(SFN-CFN_{Tx}) mod 256, given in number of frames with the range [0, 1, …, 255] frames CFN_{Tx} is the connection frame number for the UE transmission of an uplink DPCCH frame at the time T_{UETx}. SFN is the system frame number for the neighbouring P-CCPCH frame received in the UE at the time T_{RxSFN}. The reference point for the SFN-CFN observed time difference shall be the antenna connector of the UE. In case the inter-frequency measurement is done with compressed mode, the UE is not required to read the cell SFN of the target inter-frequency neighbour cell and the value for the parameter OFF is always reported to be 0. In case that the SFN measurement indicator indicates that the UE does not need to read cell SFN of the target neighbour cell, the value of the parameter OFF is always be set to 0.
Applicable for	CELL_DCH intra, CELL_DCH inter

5.1.9 SFN-SFN observed time difference

Definition	**Type 1:** The SFN-SFN observed time difference to cell is defined as: OFF×38400+ T_m, where: T_m= T_{RxSFNj} - T_{RxSFNi}, given in chip units with the range [0, 1, …, 38399] chips T_{RxSFNj} is the time at the beginning of a received neighbouring P-CCPCH frame from cell j. T_{RxSFNi} is the time at the beginning of the P-CCPCH frame from serving cell i of most recent in time before the time instant T_{RxSFNj} in the UE. If the next neighbouring P-CCPCH frame is exactly at T_{RxSFNj} then T_{RxSFNj}= T_{RxSFNi} (which leads to T_m=0). and OFF=(SFN_i- SFN_j) mod 256, given in number of frames with the range [0, 1, …, 255] frames SFN_j is the system frame number for downlink P-CCPCH frame from cell j in the UE at the time T_{RxSFNj}. SFN_i is the system frame number for the P-CCPCH frame from serving cell i in the UE at the time T_{RxSFNi}. The reference point for the SFN-SFN observed time difference type 1 shall be the antenna connector of the UE. **Type 2:** The relative timing difference between cell j and cell i, defined as $T_{CPICHRxj}$ - $T_{CPICHRxi}$, where: $T_{CPICHRxj}$ is the time when the UE receives one Primary CPICH slot from cell j $T_{CPICHRxi}$ is the time when the UE receives the Primary CPICH slot from cell i that is closest in time to the Primary CPICH slot received from cell j. The reference point for the SFN-SFN observed time difference type 2 shall be the antenna connector of the UE.
Applicable for	**Type 1:** Idle, URA_PCH intra, CELL_PCH intra, CELL_FACH intra **Type 2:** URA_PCH intra, URA_PCH inter, CELL_PCH intra, CELL_PCH inter, CELL_FACH intra, CELL_FACH inter CELL_DCH intra, CELL_DCH inter

5.1.10 UE Rx-Tx time difference

Definition	The difference in time between the UE uplink DPCCH frame transmission and the first detected path (in time), of the downlink DPCH or F-DPCH frame from the measured radio link. Type 1 and Type 2 are defined. For Type 1, the reference Rx path shall be the first detected path (in time) amongst the paths (from the measured radio link) used in the demodulation process. For Type 2, the reference Rx path shall be the first detected path (in time) amongst all paths (from the measured radio link) detected by the UE. The reference path used for the measurement may therefore be different for Type 1 and Type 2. The reference point for the UE Rx-Tx time difference shall be the antenna connector of the UE. Measurement shall be made for each cell included in the active set.
Applicable for	CELL_DCH intra

5.1.11 Void

5.1.12 UE GPS Timing of Cell Frames for UE positioning

Definition	The timing between cell j and GPS Time Of Week. $T_{UE\text{-}GPSj}$ is defined as the time of occurrence of a specified UTRAN event according to GPS time. The specified UTRAN event is the beginning of a particular frame (identified through its SFN) in the first detected path (in time) of the cell j CPICH, where cell j is a cell chosen by the UE. The reference point for $T_{UE\text{-}GPSj}$ shall be the antenna connector of the UE.
Applicable for	CELL_FACH intra, CELL_DCH intra

5.1.13 UE GPS code phase

Definition	The whole and fractional phase of the spreading code of the i^{th} GPS satellite signal. The reference point for the GPS code phase shall be the antenna connector of the UE.
Applicable for	Void (this measurement is not related to UTRAN/GSM signals; its applicability is therefore independent of the UE RRC state)

5.1.14 UE transmission power headroom

Definition	UE transmission power headroom (UPH) is the ratio of the maximum UE transmission power and the corresponding DPCCH code power, and shall be calculated as following: $UPH = P_{\max,tx} / P_{DPCCH}$ where: $P_{max,tx}$ = min {*Maximum allowed UL TX Power*, P_{max}} is the UE maximum transmission power; *Maximum allowed UL TX Power* is set by UTRAN and defined in [14]; P_{max} is the UE nominal maximum output power according to the UE power class and specified in [18] table 6.1; P_{DPCCH} is the transmitted code power on DPCCH. The reference point for the UE transmission power headroom shall be the antenna connector of the UE.
Applicable for	CELL_FACH intra, CELL_DCH intra

5.1.15 UE GANSS Timing of Cell Frames for UE positioning

Definition	The timing between cell j and GANSS Time Of Day for a given GANSS system. $T_{UE\text{-}GANSS}$ is defined as the time of occurrence of a specified UTRAN event according to GANSS time for a given GANSS Id. The specified UTRAN event is the beginning of a particular frame (identified through its SFN) in the first detected path (in time) of the cell j CPICH, where cell j is a cell chosen by the UE. The reference point for $T_{UE\text{-}GANSSj}$ shall be the antenna connector of the UE.
Applicable for	CELL_FACH intra, CELL_DCH intra

5.1.16 UE GANSS code measurements

Definition	The GANSS code phase and GANSS Integer code phase of the spreading code of the i^{th} GANSS satellite signal. The reference point for the GANSS code phase shall be the antenna connector of the UE.
Applicable for	Void (this measurement is not related to UTRAN/GSM signals; its applicability is therefore independent of the UE RRC state)

5.1.17 E-UTRA RSRP

Definition	Reference signal received power (RSRP), is defined as the linear average over the power contributions (in [W]) of the resource elements that carry cell-specific reference signals within the considered measurement frequency bandwidth. For RSRP determination the cell-specific reference signals R_0 according to TS 36.211 [23] shall be used. If the UE can reliably detect that R_1 is available it may use R_1 in addition to R_0 to determine RSRP. If receiver diversity is in use by the UE, the reported value shall not be lower than the corresponding RSRP of any of the individual diversity branches.
Applicable for	Idle, URA_PCH inter-RAT CELL_PCH inter-RAT CELL_DCH inter-RAT

NOTE 1: The number of resource elements within the considered measurement frequency bandwidth and within the measurement period that are used by the UE to determine RSRP is left up to the UE implementation with the limitation that corresponding measurement accuracy requirements have to be fulfilled.

NOTE 2: The power per resource element is determined from the energy received during the useful part of the symbol, excluding the CP.

5.1.18 Void

5.1.19 E-UTRA RSRQ

Definition	Reference Signal Received Quality (RSRQ) is defined as the ratio *N*×RSRP/(E-UTRA carrier RSSI), where *N* is the number of resource blocks of the E-UTRA carrier RSSI measurement bandwidth. The measurements in the numerator and denominator shall be made over the same set of resource blocks. E-UTRA Carrier Received Signal Strength Indicator (RSSI), comprises the linear average of the total received power (in [W]) observed only in OFDM symbols containing reference symbols for antenna port 0, in the measurement bandwidth, over *N* number of resource blocks by the UE from all sources, including co-channel serving and non-serving cells, adjacent channel interference, thermal noise etc. If receiver diversity is in use by the UE, the reported value shall not be lower than the corresponding RSRQ of any of the individual diversity branches.
Applicable for	CELL_DCH inter-RAT

5.2 UTRAN measurement abilities

The structure of the table defining a UTRAN measurement quantity is shown below.

Column field	Comment
Definition	Contains the definition of the measurement.

The term "antenna connector" used in this sub-clause to define the reference point for the UTRAN measurements refers to the "BS antenna connector" test port A and test port B as described in [19]. The term "antenna connector" refers to Rx or Tx antenna connector as described in the respective measurement definitions.

5.2.1 Received total wide band power

Definition	The received wide band power, including noise generated in the receiver, within the bandwidth defined by the receiver pulse shaping filter. The reference point for the measurement shall be the Rx antenna connector. In case of receiver diversity the reported value shall be linear average of the power in the diversity branches. When cell portions are defined in the cell, the total received wideband power shall be measured for each cell portion.

5.2.2 SIR

Definition	Type 1: Signal to Interference Ratio, is defined as: (RSCP/ISCP)×SF. The measurement shall be performed on the DPCCH of a Radio Link Set. In compressed mode the SIR shall not be measured in the transmission gap. The reference point for the SIR measurements shall be the Rx antenna connector. If the radio link set contains more than one radio link, the reported value shall be the linear summation of the SIR from each radio link of the radio link set. If Rx diversity is used in the Node B for a cell, the SIR for a radio link shall be the linear summation of the SIR from each Rx antenna for that radio link. When cell portions are defined in the cell, the SIR measurement shall be possible in each cell portion. where: RSCP = Received Signal Code Power, unbiased measurement of the received power on one code. ISCP = Interference Signal Code Power, the interference on the received signal. SF=The spreading factor used on the DPCCH. Type 2: Signal to Interference Ratio, is defined as: (RSCP/ISCP)×SF. The measurement shall be performed on the PRACH control part. The reference point for the SIR measurements shall be the Rx antenna connector. When cell portions are defined in the cell, the SIR measurement shall be possible in each cell portion. where: RSCP = Received Signal Code Power, unbiased measurement of the received power on the code. ISCP = Interference Signal Code Power, the interference on the received signal. SF=The spreading factor used on the control part of the PRACH.

5.2.3 SIR_{error}

Definition	SIR_{error} = SIR – SIR_{target_ave}, where: SIR = the SIR measured by UTRAN, defined in section 5.2, given in dB. SIR_{target_ave} = the SIR_{target} averaged over the same time period as the SIR used in the SIR_{error} calculation. In compressed mode SIR_{target}=SIR_{cm_target} shall be used when calculating SIR_{target_ave}. In compressed mode the SIR_{target_ave} shall not be calculated over the transmission gap. The averaging of SIR_{target} shall be made in a linear scale and SIR_{target_ave} shall be given in dB.

5.2.4 Transmitted carrier power

Definition	Transmitted carrier power, is the ratio between the total transmitted power on one DL carrier from one UTRAN access point, and the maximum transmission power possible to use on that DL carrier at this moment of time. Total transmission power is the mean power [W] on one carrier from one UTRAN access point. Maximum transmission power is the mean power [W] on one carrier from one UTRAN access point when transmitting at the configured maximum power for the cell. Measurement shall be possible on any carrier transmitted from the UTRAN access point. The reference point for the transmitted carrier power measurement shall be the Tx antenna connector. In case of Tx diversity the transmitted carrier power is the ratio between the sum of the total transmitted powers of all branches and the maximum transmission power. When cell portions are defined in the cell, the transmitted carrier power for each cell portion shall be measured and reported to higher layers.

5.2.5 Transmitted code power

Definition	Transmitted code power, is the transmitted power on one channelisation code on one given scrambling code on one given carrier. For DPCH, measurement shall be possible on the DPCCH-field of any dedicated radio link transmitted from the UTRAN access point and shall reflect the power on the pilot bits of the DPCCH-field. For F-DPCH, measurement shall be possible on the TPC-field and shall reflect the power on the TPC bits. When measuring the transmitted code power in compressed mode all slots shall be included in the measurement, e.g. also the slots in the transmission gap shall be included in the measurement. The reference point for the transmitted code power measurement shall be the Tx antenna connector. In case of Tx diversity the transmitted code power for each branch shall be measured and summed together in [W].

5.2.6 Transport channel BER

Definition	The transport channel BER is an estimation of the average bit error rate (BER) of the DPDCH data of a Radio Link Set. The transport channel (TrCH) BER is measured from the data considering only non-punctured bits at the input of the channel decoder in Node B. It shall be possible to report an estimate of the transport channel BER for a TrCH after the end of each TTI of the TrCH. The reported TrCH BER shall be an estimate of the BER during the latest TTI for that TrCH.

5.2.7 Physical channel BER

Definition	The Physical channel BER is an estimation of the average bit error rate (BER) on the DPCCH of a Radio Link Set. An estimate of the Physical channel BER shall be possible to be reported after the end of each TTI of any of the transferred TrCHs. The reported physical channel BER shall be an estimate of the BER averaged over the latest TTI of the respective TrCH.

5.2.8 Round trip time

Definition	Round trip time (RTT), is defined as RTT = $T_{RX} – T_{TX}$, where T_{TX} = The time of transmission of the beginning of a downlink DPCH or F-DPCH frame to a UE. The reference point for T_{TX} shall be the Tx antenna connector. T_{RX} = The time of reception of the beginning (the first detected path, in time) of the corresponding uplink DPCCH frame from the UE. The reference point for T_{RX} shall be the Rx antenna connector. Measurement shall be possible on DPCH or F-DPCH for each RL transmitted from an UTRAN access point and DPDCH for each RL received in the same UTRAN access point.

5.2.9 UTRAN GPS Timing of Cell Frames for UE positioning

Definition	$T_{UTRAN-GPS}$ is defined as the time of the occurrence of a specified UTRAN event according to GPS Time Of Week. The specified UTRAN event is the beginning of the transmission of a particular frame in the cell. The reference point for $T_{UTRAN-GPS}$ shall be the Tx antenna connector.

5.2.10 PRACH Propagation delay

Definition	Propagation delay is defined as one-way propagation delay as measured during PRACH access: PRACH : Propagation delay = (T_{RX} – T_{TX} – 2560)/2, where: T_{TX} = The transmission time of AICH access slot (n-2-AICH transmission timing), where 0≤(n-2-AICH Transmission Timing)≤14 and AICH_Transmission_Timing can have values 0 or 1. The reference point for T_{TX} shall be the Tx antenna connector. T_{RX} = The time of reception of the beginning (the first detected path, in time) of the PRACH message from the UE at PRACH access slot n. The reference point for T_{RX} shall be the Rx antenna connector.

5.2.11 Acknowledged PRACH preambles

Definition	The Acknowledged PRACH preambles measurement is defined as the total number of acknowledged PRACH preambles per access frame per PRACH. This is equivalent to the number of positive acquisition indicators transmitted per access frame per AICH.

5.2.12 Void

5.2.13 Void

5.2.14 SFN-SFN observed time difference

Definition	The relative timing difference between cell j and cell i, defined as $T_{CPICHRxj}$ - $T_{CPICHRxi}$, where: $T_{CPICHRxj}$ is the time when the LMU receives the beginning of one Primary CPICH frame from cell j and $T_{CPICHRxi}$ is the time when the LMU receives the beginning of the Primary CPICH frame from cell i that is closest in time to the beginning of Primary CPICH frame received from cell j. The reference point for the measurements shall be the Rx antenna connector.

5.2.15 Transmitted carrier power of all codes not used for HS-PDSCH, HS-SCCH, E-AGCH, E-RGCH or E-HICH transmission

Definition	Transmitted carrier power of all codes not used for HS-PDSCH, HS-SCCH, E-AGCH, E-RGCH or E-HICH transmission is the ratio between the total transmitted power of all codes not used for HS-PDSCH, HS-SCCH, E-AGCH, E-RGCH or E-HICH transmission on one DL carrier from one UTRAN access point, and the maximum transmission power possible to use on that DL carrier at this moment of time. Total transmission power of all codes not used for HS-PDSCH, HS-SCCH, E-AGCH, E-RGCH or E-HICH transmission is the mean power [W] of all codes not used for HS-PDSCH, HS-SCCH, E-AGCH, E-RGCH or E-HICH transmission on one carrier from one UTRAN access point. Maximum transmission power is the mean power [W] on one carrier from one UTRAN access point when transmitting at the configured maximum power for the cell. The measurement shall be possible on any carrier transmitted from the UTRAN access point. The reference point for the measurement shall be the Tx antenna connector. In case of Tx diversity the measurement is the ratio between the sum of the total transmitted powers of all codes not used for HS-PDSCH, HS-SCCH, E-AGCH, E-RGCH or E-HICH transmission of all branches and the maximum transmission power. When cell portions are defined in the cell, the measurement shall be performed and reported to higher layers for each cell portion.

5.2.16 DL Transmission Branch Load

Definition	The 'DL transmission branch load' is the maximum of the transmission branch loads calculated for each branch. A 'transmission branch load' is the ratio between the total transmitted power [W] on the considered branch and the 'maximum DL branch capability' on this branch. The 'maximum DL branch capability' defines the maximum transmission power possible to use on that branch. The reference point for the transmission branch load measurement shall be the TX antenna connector.

5.2.17 Received scheduled E-DCH power share (RSEPS)

Definition	The 'Received scheduled E-DCH power share' is defined as a report of 2 values for a considered cell: 1. RSEPS: defined as a quotient: sum of all scheduled E-DPCCH and E-DPDCH power contributions determined in the RSEPS measurement period T=t2-t1>0 for all UEs for which this cell is the serving E-DCH cell divided by the corresponding received total wideband power value determined for this cell during T. 2. RTWP*: This is the received total wideband power (RTWP) measured for this cell as defined in section 5.2.1 but determined for the same time period T starting at t1 and ending at t2 during which RSEPS is determined. The reference point for the RSEPS and RTWP* measurements shall be the Rx antenna connector. When cell portions are defined in the cell, RSEPS (and RTWP*) shall be measured for each cell portion. The sum in the numerator of RSEPS is determined under the following conditions: - The contributions are summed up TTI wise and only TTIs which are ending between the time instants t1 and t2 are considered. - In case a UE has not only a radio link to the considered cell but also other radio links to the same Node B ('softer handover'): It is allowed to take into account the power value combined for these radio links of the same Node B and divided by the number of combined radio links. Note: For improved measurement performance it is possible to consider only the power contribution determined for the considered cell.

5.2.18 UTRAN GANSS Timing of Cell Frames for UE positioning

Definition	$T_{UTRAN-GANSS}$ is defined as the time of the occurrence of a specified UTRAN event according to GANSS Time Of Day. The specified UTRAN event is the beginning of the transmission of a particular frame in the cell. The reference point for $T_{UTRAN-GANSS}$ shall be the Tx antenna connector.

6 Measurements for UTRA FDD

6.1 UE measurements

6.1.1 Compressed mode

6.1.1.1 Use of compressed mode for monitoring

On command from the UTRAN, a UE shall monitor cells on other FDD frequencies and on other modes and radio access technologies that are supported by the UE (i.e. TDD, GSM, E-UTRA). To allow the UE to perform measurements, UTRAN shall command that the UE enters in compressed mode, depending on the UE capabilities.

The UE capabilities define whether a UE requires compressed mode in order to monitor cells on other FDD frequencies and on other modes and radio access technologies. UE capabilities indicate the need for compressed mode separately for the uplink and downlink and for each mode, radio access technology and frequency band.

A UE shall support compressed mode for all cases for which the UE indicates that compressed mode is required.

A UE does not need to support compressed mode for cases for which the UE indicates that compressed mode is not required. For these cases, the UE shall support an alternative means of making the measurements.

The UE shall support one single measurement purpose for one transmission gap pattern sequence. The measurement purpose of the transmission gap pattern sequence is signalled by higher layers.

The following subclause provides rules to parameterise the compressed mode.

6.1.1.2 Parameterisation of the compressed mode

In response to a request from higher layers, the UTRAN shall signal to the UE the compressed mode parameters.

A transmission gap pattern sequence consists of consecutive occurrences of transmission gap pattern 1, where transmission gap pattern 1 consists of one or two transmission gaps. See figure 1.

The following parameters characterise a transmission gap pattern:

- TGSN (Transmission Gap Starting Slot Number): A transmission gap pattern begins in a radio frame, henceforward called first radio frame of the transmission gap pattern, containing at least one transmission gap slot. TGSN is the slot number of the first transmission gap slot within the first radio frame of the transmission gap pattern;

- TGL1 (Transmission Gap Length 1): This is the duration of the first transmission gap within the transmission gap pattern, expressed in number of slots;

- TGL2 (Transmission Gap Length 2): This is the duration of the second transmission gap within the transmission gap pattern, expressed in number of slots. If this parameter is not explicitly set by higher layers, then TGL2 = TGL1;

- TGD (Transmission Gap start Distance): This is the duration between the starting slots of two consecutive transmission gaps within a transmission gap pattern, expressed in number of slots. The resulting position of the second transmission gap within its radio frame(s) shall comply with the limitations of [2]. If this parameter is not set by higher layers, then there is only one transmission gap in the transmission gap pattern;

- TGPL1 (Transmission Gap Pattern Length): This is the duration of transmission gap pattern 1, expressed in number of frames;

The following parameters control the transmission gap pattern sequence start and repetition:

- TGPRC (Transmission Gap Pattern Repetition Count): This is the number of transmission gap patterns within the transmission gap pattern sequence;

- TGCFN (Transmission Gap Connection Frame Number): This is the CFN of the first radio frame of the first pattern 1 within the transmission gap pattern sequence.

In addition to the parameters defining the positions of transmission gaps, each transmission gap pattern sequence is characterised by:

- UL/DL compressed mode selection: This parameter specifies whether compressed mode is used in UL only, DL only or both UL and DL;

- UL compressed mode method: The methods for generating the uplink compressed mode gap are spreading factor division by two or higher layer scheduling and are described in [2];

- DL compressed mode method: The methods for generating the downlink compressed mode gap are spreading factor division by two or higher layer scheduling and are described in [2];

- downlink frame type: This parameter defines if frame structure type 'A' or 'B' shall be used in downlink compressed mode. The frame structures are defined in [2];

- scrambling code change: This parameter indicates whether the alternative scrambling code is used for compressed mode method 'SF/2'. Alternative scrambling codes are described in [3];

- RPP: Recovery Period Power control mode specifies the uplink power control algorithm applied during recovery period after each transmission gap in compressed mode. RPP can take 2 values (0 or 1). The different power control modes are described in [4];

- ITP: Initial Transmit Power mode selects the uplink power control method to calculate the initial transmit power after the gap. ITP can take two values (0 or 1) and is described in [4].

The UE shall support simultaneous compressed mode pattern sequences which can be used for different measurements. The following measurement purposes can be signalled from higher layers:

- FDD

- TDD

- GSM carrier RSSI measurement

- Initial BSIC identification

- BSIC re-confirmation

- E-UTRA.

The UE shall support one compressed mode pattern sequence for each measurement purpose while operating in FDD mode, assuming the UE needs compressed mode to perform the respective measurement. In case the UE supports several of the measurement purposes, it shall support in parallel one compressed mode pattern sequence for each supported measurement purpose where the UE needs compressed mode to perform the measurement. The capability of the UE to operate in compressed mode in uplink and downlink is given from the UE capabilities.

The GSM measurements Initial BSIC identification and BSIC re-confirmation are defined in [20].

Higher layers will ensure that the compressed mode gaps do not overlap and are not scheduled to overlap the same frame. The behaviour when an overlap occurs is described in [11]. UE is not required to support two compressed mode gaps in a frame.

In all cases, higher layers have control of individual UE parameters. Any pattern sequence can be stopped on higher layers' command.

The parameters TGSN, TGL1, TGL2, TGD, TGPL1, TGPRC and TGCFN shall all be integers.

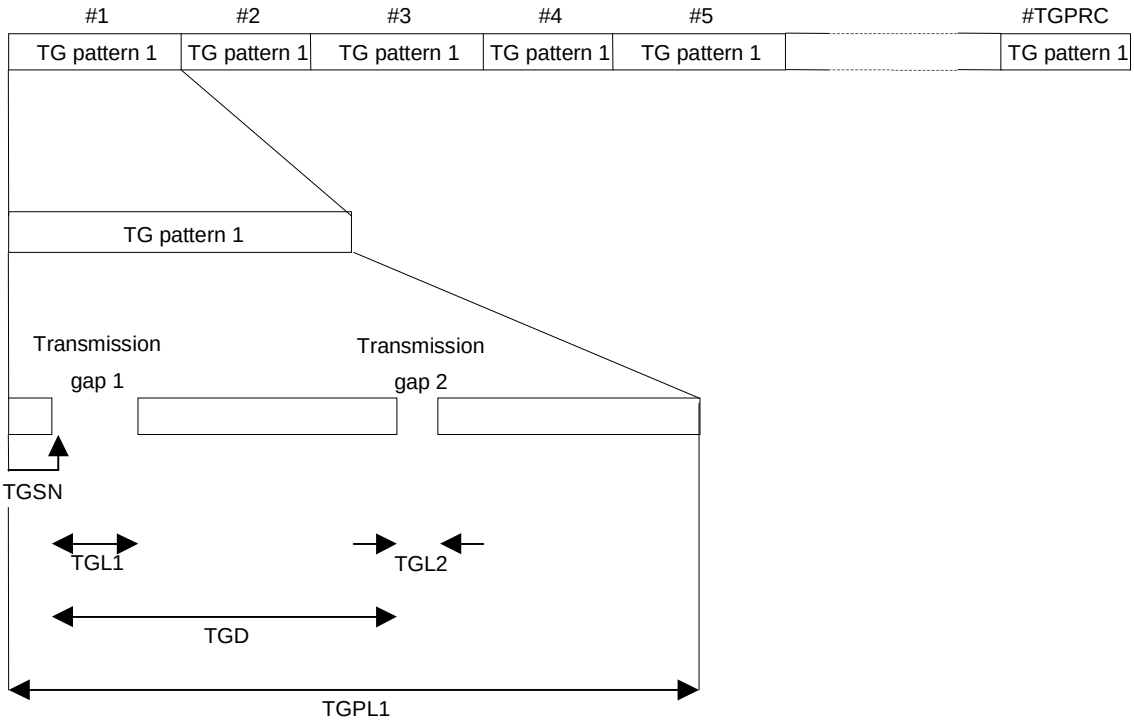

Figure 1: Illustration of compressed mode pattern parameters

Annex A (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
14/01/00	RAN_05	RP-99590	-		Approved at TSG RAN #5 and placed under Change Control	-	3.0.0
14/01/00	RAN_06	RP-99688	001	3	Clarifications for compressed mode parameters	3.0.0	3.1.0
14/01/00	RAN_06	RP-99689	002	-	Definition of PCCPCH RSCP	3.0.0	3.1.0
14/01/00	RAN_06	RP-99689	003	-	Definition of observed time difference to GSM cell	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	004	-	Measurements are done on Primary CPICH	3.0.0	3.1.0
14/01/00	RAN_06	RP-99689	005	1	Physical channel BER on DPCCH	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	006	-	Definition of SIR measurement	3.0.0	3.1.0
14/01/00	RAN_06	RP-99689	007	2	Ranges and resolution of timing measurements	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	009	2	Range and resolution for RF related measurements	3.0.0	3.1.0
14/01/00	RAN_06	RP-99689	010	2	New subclauses: 5.1.15 - UE GPS Timing of Cell Frames for LCS; 5.2.8 UTRAN GPS Timing of Cell Frames for LCS	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	011	-	Removal of Annex A from TS 25.215	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	013	-	Definition of Transmitted code power	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	014	2	Range and resolution of BLER measurements	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	015	2	Range and resolution of BER measurements	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	020	-	Correction of SFN-SFN observed time difference	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	021	1	CFN-SFN measurement with compressed mode	3.0.0	3.1.0
14/01/00	-	-	-		Change history was added by the editor	3.1.0	3.1.1
31/03/00	RAN_07	RP-000066	024	1	Definition of Transmitted carrier power	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	025	-	Clarification of Observed time difference to GSM cell	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	027	-	Naming of BER/BLER mapping	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	028	-	Minor corrections in TS 25.215	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	029	-	Re-definition of timing measurements	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	030	2	Mapping of timing measurements	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	031	-	Removal of note in Round trip time measurement	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	033	-	Removal of fixed gap position in 25.215	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	036	4	Corrections to 25.215 compressed mode parameter list	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	037	3	Definition and range of physical channel BER	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	040	-	Clarification of CPICH measurements in Tx diversity	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	042	1	UTRAN RSSI measurement	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	043	1	UTRAN Propagation delay	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	044	2	Correction to subclauses: 5.1.15 UE GPS Timing of Cell Frames for LCS; 5.2.8 UTRAN GPS Timing of Cell Frames for LCS, including timing mapping	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	047	-	Removal of RSCP measurement	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	048	-	UE BER measurement removal and clarification for use of uplink compressed mode	3.1.1	3.2.0
26/06/00	RAN_08	RP-000270	049	1	Propagation delay for PCPCH	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	050	1	Maximum number of simultaneous compressed mode pattern sequences	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	051	1	Clarification of Physical channel BER	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	052	-	Clarification of transmitted code power	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	053	-	Editorial correction in TS 25.215	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	055	-	Proposed CR for Measurements of RACH in FDD	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	056	-	Proposed CR for Measurements of CPCH in FDD	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	057	-	Transfer of information from TS 25.212 table 9 to TS 25.215	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	058	-	Correction to CM parameter list	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	062	-	Clarification of radio link measurements in compressed mode	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	063	-	Clarification of the Transmitted code power measurement in Tx diversity	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	064	1	Removal of Range/mapping	3.2.0	3.3.0
26/06/00	RAN_08	RP-000270	066	-	Removal of UTRAN TrCH BLER measurement	3.2.0	3.3.0
23/09/00	RAN_09	RP-000343	067	-	Insertion of UTRAN SIRerro measurement in 25.215	3.3.0	3.4.0
23/09/00	RAN_09	RP-000343	068	-	Reporting of UTRAN Transmitted carrier power	3.3.0	3.4.0
23/09/00	RAN_09	RP-000343	070	-	Clarification of UTRAN SIR measurement	3.3.0	3.4.0
23/09/00	RAN_09	RP-000343	071	-	Clarification of first significant path	3.3.0	3.4.0
23/09/00	RAN_09	RP-000343	072	-	Clarification of radio link set as the measured object	3.3.0	3.4.0
15/12/00	RAN_10	RP-000541	069	3	Support of parallel compressed mode patterns	3.4.0	3.5.0
15/12/00	RAN_10	RP-000541	074	1	Clarification of SIRerror measurement during compressed mode	3.4.0	3.5.0
15/12/00	RAN_10	RP-000541	075	2	Definition of UTRAN RSSI	3.4.0	3.5.0
15/12/00	RAN_10	RP-000541	076	1	Clarification of GPS timing measurements	3.4.0	3.5.0
15/12/00	RAN_10	RP-000541	077	2	Clarification of reference point for UE/UTRAN measurements	3.4.0	3.5.0
15/12/00	RAN_10	RP-000541	078	1	Correction to measurement "Rx-Tx time difference"	3.4.0	3.5.0

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
15/12/00	RAN_10	RP-000541	080	1	Clarifications to compressed mode usage	3.4.0	3.5.0
16/03/01	RAN_11	-	-	-	Approved as Release 4 specification (v4.0.0) at TSG RAN #11	3.5.0	4.0.0
16/03/01	RAN_11	RP-010061	079	2	Correction of the observed time difference to GSM measurement	3.5.0	3.6.0
16/03/01	RAN_11	RP-010061	081	-	Removal of UE SIR measurement	3.5.0	3.6.0
16/03/01	RAN_11	RP-010061	082	1	Correction of GSM reference	3.5.0	3.6.0
16/03/01	RAN_11	RP-010061	083	-	Correction of GPS Timing measurement	3.5.0	3.6.0
16/03/01	RAN_11	RP-010061	086	-	Correction on transport channel BLER	3.5.0	3.6.0
16/03/01	RAN_11	RP-010072	085	-	RTD measurement in UTRAN for FDD	3.5.0	4.0.0
15/06/01	RAN_12	RP-010335	088	-	Renaming of LCS measurements	4.0.0	4.1.0
15/06/01	RAN_12	RP-010456	090	2	Correction the TrCH BLER measurement	4.0.0	4.1.0
21/09/01	RAN_13	RP-010521	096	-	Removal of the BLER measurement of the BCH	4.1.0	4.2.0
14/12/01	RAN_14	RP-010740	098	-	Clarification of internal measurements	4.2.0	4.3.0
14/12/01	RAN_14	RP-010740	103	-	Clarification of P-CCPCH RSCP in 25.215	4.2.0	4.3.0
14/12/01	RAN_14	RP-010740	105	-	Revised definitions of CPICH Ec/No and UTRA carrier RSSI	4.2.0	4.3.0
14/12/01	RAN_14	RP-010745	099	2	UE GPS code phase measurement	4.2.0	4.3.0
14/12/01	RAN_14	RP-010745	106	1	UTRAN SFN-SFN observed time difference measurement	4.2.0	4.3.0
08/03/02	RAN_15	RP-020245	114	3	Clarification of UE measurements Applicability	4.3.0	4.4.0
08/03/02	RAN_15	RP-020048	116	-	Correction to the definition of UTRAN GPS timing of cell frames for UE positioning	4.3.0	4.4.0
08/03/02	RAN_15	RP-020048	117	-	Correction to the definition of UE GPS timing of cell frames for UE positioning	4.3.0	4.4.0
08/03/02	RAN_15	RP-020231	111	1	Removal of channel coding option 'no coding' for FDD	4.3.0	4.4.0
08/03/02	RAN_15	-	-	-	Raised up to v5.0.0 together with other specs.	4.4.0	5.0.0
18/09/02	RAN_17	RP-020530	119	4	Transmitted carrier power measurement correction	5.0.0	5.1.0
18/09/02	RAN_17	RP-020575	121	-	Measurements for observed time difference to GSM cell	5.0.0	5.1.0
18/09/02	RAN_17	RP-020575	130	-	Compressed mode limitation	5.0.0	5.1.0
18/09/02	RAN_17	RP-020558	128	-	Correction of UE SFN-SFN type 1 measurement	5.0.0	5.1.0
21/12/02	RAN_18	RP-020842	131	1	Received Total Wide Band Power Measurement Definition	5.1.0	5.2.0
26/03/03	RAN_19	RP-030017	133	3	Correction of UTRAN SIR measurement definition	5.2.0	5.3.0
26/03/03	RAN_19	RP-030081	134	1	Non-HSDPA power measurement	5.2.0	5.3.0
23/06/03	RAN_20	RP-030270	142	-	Correction of transmitted carrier power definition in case of Tx diversity	5.3.0	5.4.0
23/06/03	RAN_20	RP-030274	143	-	Correction of transmitted carrier power of all codes not used for HS-PDSCH or HS-SCCH transmission definition in case of Tx diversity	5.3.0	5.4.0
22/09/03	RAN_21	RP-030452	144	1	Beamforming Enhancement related measurements	5.4.0	5.5.0
07/01/04	RAN_22	-	-	-	Approved to promote to a Release 6 TS and created for M.1457 update	5.5.0	6.0.0
07/01/04	RAN_22	RP-030726	145	2	Beamforming Enhancement related measurements	5.5.0	6.0.0
13/12/04	RAN_26	RP-040449	149	1	Introduction of E-DCH	6.0.0	6.1.0
14/03/05	RAN_27	RP-050050	147	4	Introduction of "DL Transmission Branch Load" measurement	6.1.0	6.2.0
14/03/05	RAN_27	RP-050038	153	1	Removal of TGPL2	6.1.0	6.2.0
14/03/05	RAN_27	RP-050092	154	-	Clarification of the cell on SFN-SFN observed time difference	6.1.0	6.2.0
14/03/05	RAN_27	RP-050088	155	-	Introduction of F-DPCH without pilot field	6.1.0	6.2.0
16/06/05	RAN_28	RP-050250	161	-	Feature Clean Up: Removal of 'CPCH'	6.2.0	6.3.0
16/06/05	RAN_28	RP-050245	163	-	Feature Clean Up: Removal of observed time difference to GSM cell measurement	6.2.0	6.3.0
16/06/05	RAN_28	RP-050249	165	-	Feature clean up: Removal of the 'compressed mode by puncturing'	6.2.0	6.3.0
26/09/05	RAN_29	RP-050453	0166	1	UE power headroom measurement	6.3.0	6.4.0
26/09/05	RAN_29	RP-050440	0167	-	Non-HS power measurement	6.3.0	6.4.0
20/03/06	RAN_31	-	-	-	Creation of Release 7 specification (v.7.0.0) at RAN#31	6.4.0	7.0.0
29/09/06	RAN_33	RP-060495	0170	3	Introduction of a Node B measurement for E-DCH RRM	7.0.0	7.1.0
30/05/07	RAN_36	RP-070391	0172	5	Clarification of UE measurement definitions for RX diversity	7.1.0	7.2.0
11/09/07	RAN_37	RP-070648	0176	1	Adding GANSS related measurements in the FDD physical layer measurements	7.2.0	7.3.0
27/11/07	RAN_38	RP-070946	0177	-	Clarification of UE measurement definitions for RX diversity	7.3.0	7.4.0
04/03/08	RAN_39	-	-	-	Release 8 version further to RAN_39 decision	7.4.0	8.0.0
28/05/08	RAN_40	RP-080436	188	-	E-UTRA measurements for UTRA – E-UTRA interworking	8.0.0	8.1.0
09/09/08	RAN_41	RP-080672	189	-	UPH measurement support for Enhanced Uplink for CELL_FACH state	8.1.0	8.2.0
09/09/08	RAN_41	RP-080666	190	-	Modification of RSRQ and removal of RSSI	8.1.0	8.2.0
09/09/08	RAN_41	RP-080666	192	-	Modification of RSRP definition	8.1.0	8.2.0
03/03/09	RAN_43	RP-090232	194	1	RSRP and RSRQ Measurement Definitions	8.2.0	8.3.0

History

Document history		
V8.1.0	October 2008	Publication
V8.2.0	October 2008	Publication
V8.3.0	March 2009	Publication