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TECHNICAL SPECIFICATION

Universal Mobile Telecommunications System (UMTS); Universal Terrestrial Radio Access Network (UTRAN); General description; Stage 2 (3GPP TS 25.300 version 14.3.0 Release 14)

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1 Scope

The present document provides an overview and overall description of the UTRA radio interface functionalities from Release 12 onwards which are not covered by the Technical Specifications TS 25.308 [2] or TS 25.319 [3].

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.
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[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 25.308: "UTRA HSDPA: UTRAN Overall Description (Stage 2) ".

[3] 3GPP TS 25.319: "Enhanced Uplink: Overall description (Stage 2) ".

[4] 3GPP TS 24.008: "Mobile radio interface layer 3 specification, Core Network Protocols - Stage 3".

[5] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[6] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

[7] 3GPP TR 25.704: "Study on enhanced broadcast of system information".

[8] 3GPP TS 24.312: "Access Network Discovery and Selection Function (ANDSF) Management Object (MO)".

[9] 3GPP TS 25.304: "User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode".

[10] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[11] 3GPP TS 25.133: "Requirements for support of radio resource management (FDD)".

[12] 3GPP TS 25.331: "Radio Resource Control (RRC)”.

[13] 3GPP TR 25.993: "Typical examples of Radio Access Bearers (RABs) and Radio Bearers (RBs) supported by Universal Terrestrial Radio Access (UTRA)".

[14] 3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2".

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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].

Power saving mode: Mode configured and controlled by NAS that allows the UE to reduce its power consumption, as defined in TS 24.008 [4], TS 23.060 [5], TS 23.682 [6].

3.2 Symbols

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

<symbol> <Explanation>

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].

ACDC	Application specific Congestion control for Data Communication
ANDSF	Access Network Discovery and Selection Function
DPCCH2	Dedicated Physical Control Channel 2
NCL	Neighbour Cell List
OPI	Offload Preference Indicator
PSM	Power Saving Mode
QoE	Quality of Experience
WLAN	Wireless Local Area Network

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4 Heterogeneous Networks Mobility Enhancements

Neighbour Cell List (NCL) extension

- The size of the inter-frequency neighbour cell list is extended for CELL_DCH, CELL_FACH, CELL_PCH, URA_PCH states and Idle mode, so that network could configure more inter-frequency neighbour cells than 32 for UE to monitor and detect under massive small cell deployment scenario.

Change of best cell on a configured secondary downlink frequency (event 2g)

- Event 2g is an inter-frequency measurement event. It is applicable only to the secondary downlink frequency with configured HS-DSCH operation, and it can be configured on more than one secondary downlink frequency.

Enhanced Serving Cell Change for Event 1C

- The enhanced Serving Cell Change procedure could also be applied to Event 1C, which is defined in TS 25.308 [2].

5 Heterogeneous Networks Enhancements

Serving E-DCH cell decoupling

- Serving E-DCH cell decoupling is introduced in order to improve the quality of reception of the uplink E-DCH control channels and the E-DCH SI in the presence of strong uplink/downlink imbalance. The UE is configured with different serving HS-DSCH cell and serving E-DCH cell.

Radio Links without DPCH/F-DPCH

- The UE is configured with a subset of non-serving E-DCH radio links in the UE’s E-DCH active set to operate in the absence of DPCH/F-DPCH. However, a UE is allowed to only receive either E-HICH or both E-HICH and E-RGCH from these non-serving E-DCH cells to mitigate uplink interference to a cell that is unable to power control a UE in the presence of strong uplink/downlink imbalance.

DPCCH2 transmission

- In order to improve the quality of reception of the HS-DPCCH in the presence of strong uplink/imbalance, a new secondary uplink pilot channel (DPCCH2) is introduced in the serving HS-DSCH cell as the reference for the HS-DPCCH channel power.

6 DCH Enhancements (FDD only)

DCH enhancements aims at improving the link efficiency and UE battery performance for voice calls compared to R99 DCH. DCH enhancements constitutes of the following sub-features:

- DL overhead optimization
- Enhanced rate matching and transport channel multiplexing
- DL Frame Early Termination (DL FET)
- Uplink DPCCH with DL FET ACK
- Uplink DPDCH dynamic 10ms transmission

DCH enhancements supports two modes (Basic and Full). The mode choice controls how the DL Frame Early Termination sub-feature operates, as described in 6.3. All other sub-features are active in both modes.

DCH enhancements is only applicable if the TTI of all DCH transport channels on both downlink and uplink is at least 20 ms.

If a UE is configured with both CS and PS mapped to the DCH transport channel (in uplink or downlink or both), then DCH enhancements may be configured only when PS has UL:0 and DL:0kbps RAB configuration (3GPP TR 25.993 [13]).

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6.1 DL overhead optimization

This sub-feature introduces new DL DPCH slot format by removing the dedicated pilot bits from DL DPCCH and reusing them for DL DPDCH instead.

The R99 downlink physical channel (DPCH) consists of 0.66ms slots that contain 2 groups of data (DPDCH) symbols and 3 groups of control (DPCCH) symbols. The size of the groups is determined by the slot format. The control symbol groups are TPC - controlling uplink transmit power, TFCI - specifying the downlink packet type, and dedicated pilot - supporting channel estimation for DL power control and closed-loop transmit diversity. While the TFCI group may be empty in certain slot formats, the pilot and TPC are currently always non-empty. The dedicated pilot bits are used for estimation of DL SIR. With this sub-feature, new DL DPCH slot formats are introduced by removing the dedicated pilot bits and reusing the TPC bits instead for estimating the DL SIR. Correspondingly, the number of data symbols in a slot is increased leading to less control channel overhead on the downlink.

DL closed-loop transmit diversity is not supported when this sub-feature is configured.

6.2 Enhanced rate matching and transport channel multiplexing

The physical layer in R99 is designed to carry potentially a large variety of transport blocks with different sizes. The drawback for this design is the rate matching may not be efficient when some transport format combinations are not frequently used. For example, DCCH channel carries non-zero transport blocks not as often as voice DTCH channel. The enhanced rate matching and transport channel multiplexing sub-feature sets a zero rate matching attribute for DCCH, whenever DCCH channel does not carry a transport block together with DTCH channel. The DCCH bit fields are used to transmit DTCH transport channels instead. This potentially improves link efficiency due to less puncturing and better rate matching of the transport block with the available physical channel resources.

6.3 DL frame early termination (DL FET) and UL DPCCH with DL FET ACK

In a power-controlled system such as R99 DCH, inefficiencies in the power-control loop, such as limited granularity, delays and errors in the feedback, result in the presence of excess SINR at the receiver. This means that packets such as

the voice packets which have a long (20ms) transmission time interval (TTI) can often be early-decoded, i.e, decoded prior to reception of all the data symbols in a TTI by running the channel decoder at multiple time instants during the TTI instead of only once at the end of the TTI. This is referred to as Frame Early Termination (FET). As described below, DCH enhancements introduces new mechanisms to R99 DCH in order to support DL FET.

A new design of UL DPCCH is introduced to support DL FET. With the new design, TFCI information is carried in the first 10 slots of each 20ms TTI for the uplink. Sending the TFCI information early in each 20ms TTI allows sending of DL FET ACK or NACK information using the TFCI bits in remaining UL DPCCH slots that do not carry TFCI.

Furthermore, there are two modes of operation introduced with support for DL FET in DCH enhancements as described below.

6.3.1 DL FET Full mode (Mode 1)

In the Full mode of operation:

- The UE acknowledges successful early decoding of a DL packet via a DL FET ACK on the newly designed UL DPCCH channel, which then allows the NodeB to stop transmission of the packet.

- AMR Class A, B, C transport channels are concatenated on the DL which further helps in early decoding of DL DPDCH.

6.3.2 DL FET Basic mode (Mode 0)

In the Basic mode of operation:

- DL FET is achieved by applying the DL BLER target at slot 14 (10ms) in each 20ms TTI duration. The NodeB may decide to stop transmission of the DL voice packet at slot 14 provided that the Uplink is in 10ms transmission mode (see sub-clause 6.4). The UE does not indicate successful decoding of the DL packet via the DL FET ACK or NACK field in UL DPCCH.

- AMR Class A, B, C transport channels are not concatenated on the downlink.

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6.4 Uplink DPDCH dynamic 10ms transmission

The R99 DCH transport channels for a voice call are typically configured with 20ms TTI. However, the transport block sizes for a voice call could potentially be transmitted over a shorter duration. The sub-feature of uplink DPDCH dynamic 10ms transmission allows for dynamically selecting a shorter transmission time, i.e. 10ms, at the physical layer to transmit a voice packet on the uplink. The UE selects on whether to use a 10ms or 20ms transmission duration based on considerations such as the power headroom at the UE. The UE also discontinues the transmission of UL DPCCH for the remaining duration of the TTI when both UL transport block has been completed transmitted and DL has been successfully decoded early.

With 20ms TTI transmission at the physical layer, the pilot channel (UL DPCCH) is sent for the entire 20ms duration. This sub-feature potentially improves link efficiency due to reduction in UL DPCCH overhead as well as improves UE battery performance by allowing the UE to turn off its transceiver once the reception and transmission has been completed before the end of a 20ms TTI.

7 Access Control in Connected Mode (CELL_FACH, CELL_PCH and URA_PCH)

For FDD, certain categories of UEs may be configured for Access Control in connected mode. This feature allows for a network to differentiate and control accesses of UE for DTCH transmission in CELL_FACH state and for DCCH/CCCH due to uplink data transmission in CELL_PCH state or URA_PCH state, when uplink congestion is being experienced.

The network may differentiate among the UE population by assigning UEs to one of 16 defined Access Groups. The network can indicate the identity of the access group to which the UE is assigned via RRC dedicated signalling.