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TECHNICAL REPORT

Universal Mobile Telecommunications System (UMTS);
Continuous connectivity for packet data users;
1.28 Mcps TDD
(3GPP TR 25.929 version 14.0.0 Release 14)

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Reference

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Contents

Foreword

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

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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.

Introduction

Packet-oriented features like HSDPA and E-DCH in UMTS systems will promote the subscribers' desire for continuous connectivity, where the user stays connected over a long time span with only occasional active periods of data transmission, and avoiding frequent connection termination and re-establishment with its inherent overhead and delay.

This is the perceived mode a subscriber is used to in fixed broadband networks (e.g. DSL) and a precondition to attract users from fixed broadband networks.

For a high number of users in the cell it can be assumed that many users are not transmitting any user data for some time (e.g. for reading during web browsing or in between packets for periodic packet transmission such as VoIP).The corresponding overhead control channels and dedicated channels will significantly limit the number of users that can be efficiently supported.

As completely releasing dedicated channels during periods of temporary traffic inactivity would cause considerable delays for reestablishing data transmission and a corresponding bad user perception, this WI is intended to reduce the impact of control channels while maintaining the DCH state and allowing a much faster reactivation for temporarily inactive users.

1 Scope

The present document summarizes the work done under the WI "Continuous Connectivity for Packet Data Users for 1.28Mcps TDD" defined in [1] by listing technical concepts addressing the objectives of the work item (see below), analysing these technical concepts and selecting the best solution (which might be a combination of technical concepts).

The objective of this work item is to reduce the code consumption (e.g. overhead of physical control channels or related signaling messages) of packet data users for both real-time (e.g. VoIP) and non real-time services, e.g. for users which have temporarily no data transmission in either uplink or downlink. Packet data users as considered in this work item are using only HS-DSCH/E-DCH channels without UL DPCH and DL DPCH.

The aim is to increase the number of packet data users in the UMTS 1.28Mcps TDD system that can be kept efficiently in CELL_DCH state over a longer time period and that can restart transmission after a period of temporary inactivity with a much shorter delay (for example, <100ms) than would be necessary for reestablishment of a new connection.

Another aim is to reduce UE power consumption in CELL_DCH state over a long period by DTX and DRX.

The present document provides the base for the following preparation of change requests to the corresponding RAN specifications.

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 Tdoc RP- 080085: " New Work item Proposal: Continuous Connectivity for packet data users for 1.28Mcps TDD ", TSG RAN #39, Puerto Vallarta, Mexico, 04 - 07 March 2008.

[2] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

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

[4] 3GPP TS 25.222: "Multiplexing and channel coding (TDD)".

[5] 3GPP TS 25.223: "Spreading and modulation (TDD)".

[6] 3GPP TS 25.224: "Physical layer procedures (TDD)".

[7] 3GPP TS 25.225: "Physical layer – Measurements (TDD)".

[8] 3GPP TS 25.306: "UE Radio Access Capabilities".

[9] 3GPP TS 25.308: "UTRA High Speed Downlink Packet Access (HSDPA); Overall description; Stage 2".

[10] 3GPP TS 25.319: "Enhanced uplink; Overall description; Stage 2".

[11] 3GPP TS 25.321: "Medium Access Control (MAC) protocol specification".

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

[13] 3GPP TS 25.433: "UTRAN Iub Interface NBAP Signalling".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the [following] terms and definitions [given in ... and the following] apply.

example: text used to clarify abstract rules by applying them literally.

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 following abbreviations apply:

ACK	Acknowledgement
CQI	Channel Quality Indicator
CRC	Cyclic Redundancy Check
DCH	Dedicated Channel
DL	Downlink
DPCH	Dedicated Physical Channel
DTX	Discontinuous Transmission
E-DCH	Enhanced Dedicated Channel
E-AGCH	E-DCH Absolute Grant Channel
E-HICH	E-DCH HARQ Acknowledgement Indicator Channel
HSDPA	High Speed Downlink Packet Access
HS-DSCH	High Speed Downlink Shared Channel
HS-PDSCH	High Speed Physical Downlink Shared Channel
HS-SCCH	High Speed Physical Downlink Shared Control Channel
NACK	Negative Acknowledgement
P-CCPCH	Primary Common Control Physical Channel
RL	Radio Link
S-CCPCH	Secondary Common Control Physical Channel
SIR	Signal-to-Interference Ratio
TPC	Transmit Power Control
TTI	Transmission Time Interval
UE	User Equipment
UL	Uplink
UTRAN	UMTS Terrestrial Radio Access Network

4 Technical concepts

4.0 General

This clause describes and analyses the suggested technical concepts addressing the problem described by the work item "Continuous Connectivity for Packet Data Users" defined in [1].

4.1 Semi-persistent scheduling in uplink

4.1.1 Description of the concept

In TD-SCDMA HSPA plus system, CPC technique serves as a solution to data transmission for UE in CELL_DCH state, and the data transmission characteristic for such as real-time (e.g. VoIP) service would be periodicly and strictly delay sensitive. For uplink transmission, E-AGCH adds a significant overhead to each E-DCH transmission. Although this overhead is relatively small for transmission of large packets of data, such as in the presence of full-buffer type of traffic, it is considerable for IMS real-time services such as VoIP.

This concept alleviates this overhead by allowing UTRAN to allocate a kind of semi-persistent or long term resource and NodeB can adjust this resource during the transmission. When UE transmits new data using this resources it should wait for the feedback from NodeB by detection corresponding E-HICH , i.e. E-HICH for non-schedule E-DCH shall be used in case of semi-persistent/long term resource assignment.

4.1.2 Analysis of the concept

By this semi-persistent scheduling method, the control channel overhead could be reduced and the VoIP capacity could be increased. The E-AGCH channels are freed up to be used for other services and UEs.

4.1.3 Agreements

- Long term resource assignment shall be introduced in Uplink, and the assignment can be adjusted by NodeB dynamically.
- E-HICH for non-schedule E-DCH shall be used in case of long term resource assignment.
- Node B can re-assign the UE's semi-persistent resource when the UE transfers from the VoIP active period to the VoIP silence period.

4.1.4 Open issues of the concept

- The mapping relation between semi-persistent or long term assignment E-PUCH and E-HICH.
- Semi-persistent resource assignment procedure and frame structure design.
- Authorization trigger event design and authorization algorithm, NodeB data receiving information (for instance, SIR measurement or effective traffic statistics, etc) and the cell's Rot information.

4.2 Semi-persistent scheduling in downlink

4.2.1 Description of the concept

In TD-SCDMA HSPA plus system, CPC technique serves as a solution to data transmission for UE in CELL_DCH state, and the data transmission characteristic for such as real-time (e.g. VoIP) service would be periodicly and strictly delay sensitive. For downlink tranmission, HS-SCCH adds a significant overhead to each HS-DSCH transmission. Although this overhead is relatively small for transmission of large packets of data, such as in the presence of full-buffer type of traffic, it is considerable for IMS real-time services such as VoIP.

This concept alleviates this overhead by allowing UTRAN to allocate a kind of semi-persistent or long term resource. When the semi-persistent HS-DSCH resources are configured for a UE, the first HS-DSCH transmission is performed without the accompanying HS-SCCH. And HARQ retransmissions of the first HS-DSCH transmission are accompanied by a new format HS-SCCH.

4.2.2 Analysis of the concept

By this semi-persistent scheduling method, the control channel overhead could be reduced and the VoIP capacity could be increased.

4.2.3 Agreements

- When the semi-persistent HS-DSCH resources are configured for a UE, the first HS-DSCH transmission on the semi-persistent HS-DSCH resources is performed without the accompanying HS-SCCH.

- The Node B can assign and re-assign the UE's semi-persistent resource.

4.3 Uplink transmission simulation

4.3.1 Analysis of the scheme

Node B may assign semi-persistent resource for uplink VoIP transmission, and the assignment can be adjusted by Node B via E-AGCH.

When semi-persistent resource is assigned to UE, UE sends uplink data on E-PUCH in the allocated TTIs.

- VoIP active period to silent period

Node B receives the uplink data on E-PUCH and judges whether UE transits from VoIP active period to silent period. If UE transits from active period to silent period, Node B re-assigns the E-PUCH physical resource and informs UE via E-AGCH. Once UE receives the E-AGCH, UE shall send the uplink data on E-PUCH occupying the allocated physical resource in the designated TTIs by E-AGCH.

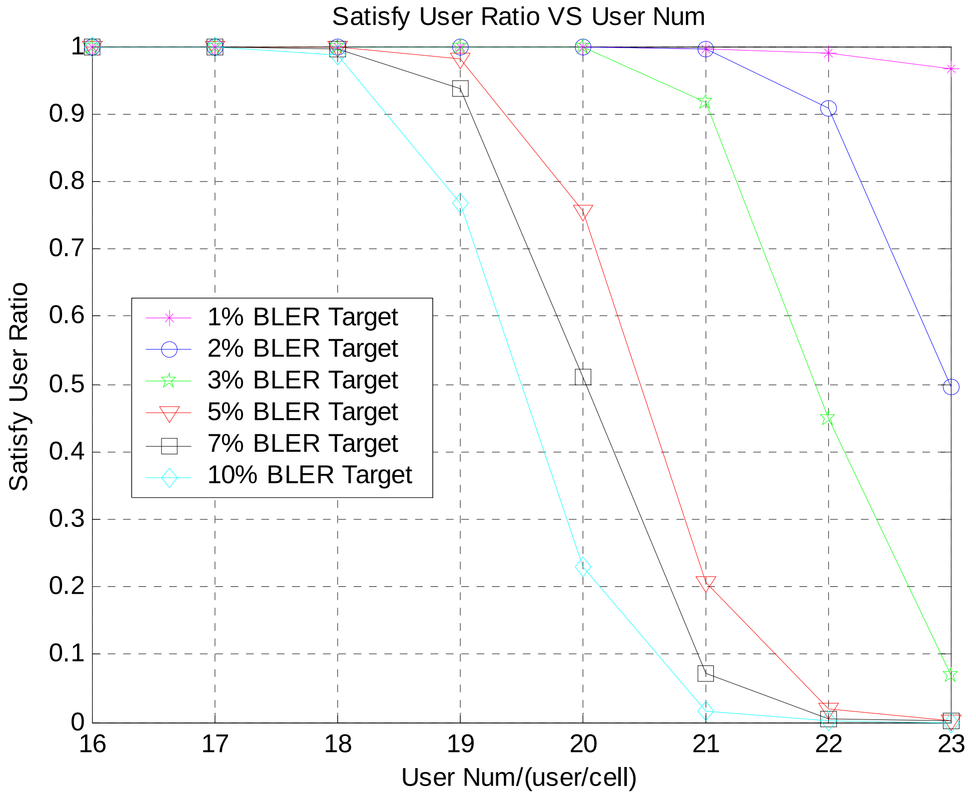
- VoIP silent period to active period

When UE transits from silent period to active period, UE shall report SI via MAC-e PDU or E-RUCCH to ask for more physical resources. Once Node B receives the request, Node B re-assigns the E-PUCH resource and informs UE via E-AGCH.

The proposed transmission scheme may improve both the physical resource efficiency and the VoIP capacity.

4.3.2 Simulation result

Based on the proposed uplink transmission scheme, the system simulation result is shown below:



With the criteria that more than 95% users should be satisfied, the VoIP capacity of a cell, namely the number of VoIP satisfied user is listed as following:

Target BLER	**1% BLER Target**	**2% BLER Target**	**3% BLER Target**	**5% BLER Target**	**7% BLER Target**	**10% BLER Target**
User Number	23	21	20	19	18	18

Simulation Assumptions

Multipath Channel Models	- PA 3Km/h - Propagation model: Cost231-Hata - Fast fading model: Jakes spectrum
Cell layout and link budget	- Number of cells: 19. - Cell Radius: 500m. - 3-sectors per cell. - Node B Tx power: 34 dBm. - Log-normal shadowing: 8 dB. - Shadow-correlation between co-located cells: 1.0.

	- Shadow-correlation between non co-located cells: 0.5. - Carrier frequency: 2 GHz. - Bandwidth: 1.6 MHz. - Number of UE antennas: 1.
Node B resource	- OVSF code used for E-PUCH: - 2 timeslots(2 SF2 OVSF codes per timeslot) - Up to 2 E-AGCH transmissions allowed.

VoIP traffic details	- AMR 12.2 kbps.
	- SID transmitted every 160 ms of silence.
	- Voice activity model:
	  - 50% voice activity.
	  - ON and OFF periods of duration exponentially distributed, of average 2 seconds.
	- 100 ms maximum delay bound with 100 ms SDU discarding at the MAC-hs.
	- Call length: 120 seconds.
	- Call Outage: VoIP calls with FER over call length greater than 5% are considered in outage.

Signalling traffic	- SRB, RTCP, and SIP not modeled.
Parameters for transmission	- TB sizes: - 2 TB sizes: 162 bits, 364 bits - 24-bit CRC overhead. - Every transport block occupies one resource block which is 8 BRU - QPSK only - At most 2 retransmissions are allowed. - No DRX or DTX. - Power control for E-PUCH modeled.

Scheduler	- Voice traffic scheduler:
	  - HARQ re-transmissions have highest priority
	    - Oldest transmissions are re-transmitted first

Feedback delays	- HARQ delay: minimum 10ms from end of a transmission to start of a re-transmission.
Error modelling	- No E-AGCH error modeled. - No E-HICH error modeled.

4.3.3 Agreements

The Node B can assign/re-assign the semi-persistent physical resources via E-AGCH.

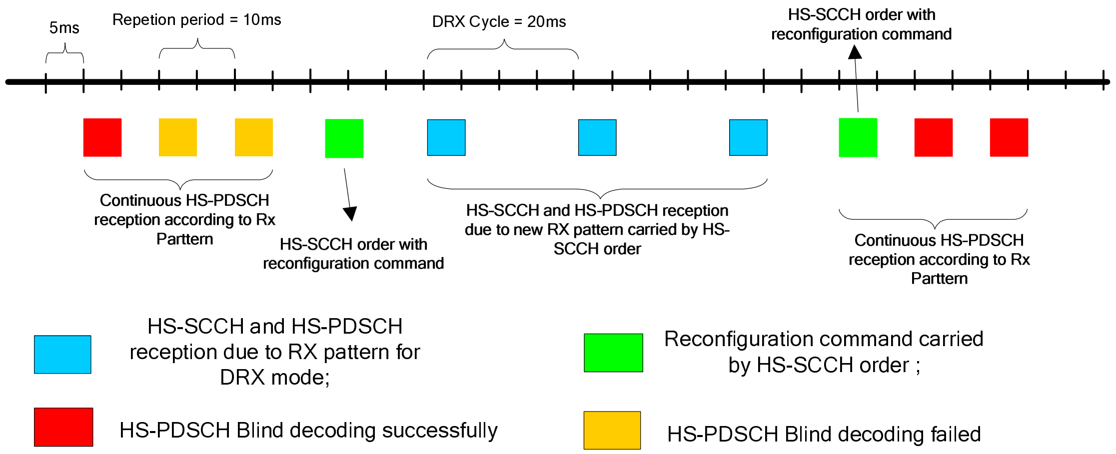
4.4 Explicit state switch mechanism

4.4.1 Analysis of the scheme

Compare to the implicit state switch mechanism, the explicit state switch mechanism use the fast reconfiguration procedure to change the physical resource for different states. In explicit state switch mechanism, no timer shall be maintained on UE side.

Downlink

For Downlink, When NodeB detects the state switch according to the buffer state. NodeB shall use the HS-SCCH order to reconfigure the physical resource of the UE. The procedure is depicted as below:

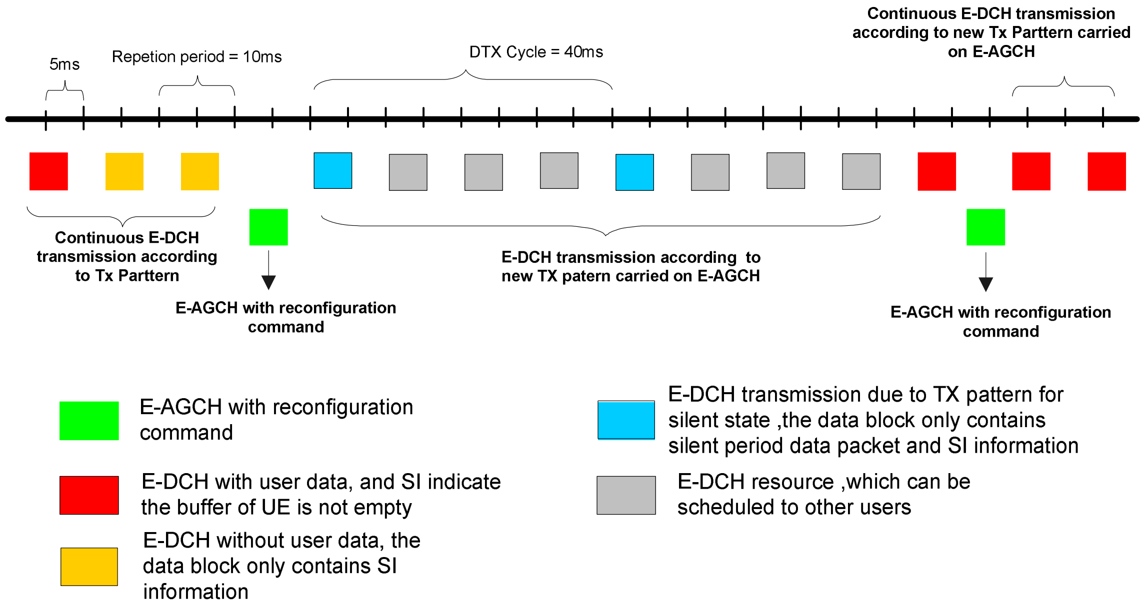


1) When NodeB detect the state switch from active to silent according to the buffer of UE, NodeB shall send reconfiguration command by HS-SCCH order to reconfigure the physical resource of UE. The physical resource include the channel code resource and Rx pattern

2) When NodeB detect the state switch from silent to active according to the buffer of UE, NodeB shall also use the HS-SCCH order to reconfigure the physical resource of UE.

Uplink

Similar to the Downlink explicit state switch mechanism, a fast reconfiguration procedure can also be used in uplink, the reconfiguration command shall be carried by E-AGCH. The procedure is depicted as below:



1. When NodeB detect the state switch from active to silent according to the buffer state in SI information, NodeB shall send reconfiguration command by E-AGCH to reconfigure the physical resource of UE. The physical resource include the channel code resource and Tx pattern

2. When NodeB detect the state switch from silent to active according to the buffer state in SI information, NodeB shall also use the E-AGCH to reconfigure the physical resource of UE.

4.4.2 Agreements

For both uplink and downlink, explicit commands will be used to reconfigure resources to handle voice traffic patterns.

5 Technical solution

This section describes which technical concepts of section 4 are selected to solve the problems in the 3GPP standard described by the work item "Continuous Connectivity for Packet Data Users for 1.28Mcps TDD" defined in [1].

5.1 Overview of the selected solution

Editor's note: A summary of which concepts are selected.

5.2 Impact on RAN1 specifications

Editor's note: Overview description of the modifications needed per affected specification, if any.

5.3 Impact on RAN2 specifications

Editor's note: Overview description of the modifications needed per affected specification, if any.

5.4 Impact on RAN3 specifications

Editor's note: Overview description of the modifications needed per affected specification, if any.

5.5 Impact on RAN4 specifications

Editor's note: Overview description of the modifications needed per affected specification, if any.

Annex A: Change history

Change history							
Date	**Meeting**	**Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2008-05	RAN1#53	R1-08XXXX	-	-	Skeleton TR	-	0.0.1
2008-10	RAN1#54bis	R1-084010	-	-	Add concept Semi-persistent Scheduling in Uplink	-0.0.1	0.1.0
2008-11	RAN1#55	R1-084147, R1-084148		-	Add agreed TP on Downlink transmission, Uplink transmission Simulation and Explicit state switch mechanism	0.1.0	0.2.0
2008-12	RAN#42	RP-080868	-	-	Update to V1.0.0	0.2.0	1.0.0
2009-05	RAN#44	RP-090582	-	-	TR is presented to RAN for approval	1.0.0	2.0.0
2009-05	RAN#44	-	-	-	Post RAN#44 decision to bring TR under change control	2.0.0	8.0.0
2009-06					Cosmetic clean up by MCC	8.0.0	8.0.1
2009-12	SP_46	-	-	-	Doc to Release 9 at SA_46	8.0.1	9.0.0
2011-03	SP_51	-	-	-	Doc to Release 10 at SA_51	9.0.0	10.0.0
2012-09	SP_57	-	-	-	Update to Rel-11 version (MCC)	10.0.0	11.0.0
2014-09	SP_65	-	-	-	Update to Rel-12 version (MCC)	11.0.0	12.0.0
2015-12	SP_70	-	-	-	Update to Rel-13 version (MCC)	12.0.0	13.0.0

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-03	SA#75	-	-	-	-	Promotion to Release 14 without technical change (MCC)	14.0.0

History

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