TSG RAN WG1#11 R1-00-0423

3G TR 25.928 V0.0.2 (2000-03)

Technical Report

3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG); Radio Access Network (RAN); 1.28Mcps UTRA TDD Physical Layer

Reference
DTS/TSGR-0125223 (25223-300.PDF)

Keywords
<keyword[, keyword]>

3GPP

Postal address

Office address

Internet
secretariat@3gpp.org
Individual copies of this deliverable
can be downloaded from
http://www.3gpp.org

Copyright Notification

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

© 1999, 3GPP Organizational Partners (ARIB, CWTS, ETSI, T1, TTA,TTC).
All rights reserved.

Contents

Foreword 7
1 Scope 8
2 References 8
3 Abbreviations 8
4 Radio Requirements 9
4.1 Radio environments 9
4.2 Services 9
4.3 Operational requirements 9
4.3.1 Deployment scenarios 9
4.4 Handover and Cell selection/reselection 9
4.5 Particular characteristics of the low chip rate TDD 9
5 High level characteristics 10
6 Physical layer - General description 11
6.1 General description of Layer 1 11
6.2 Document structure of the physical layer specification 11
7 Physical channels and mapping of transport channels onto physical channels 12
7.1 Transport channels 12
7.1.1 Transport channels 12
7.1.1.1 Dedicated transport channels 12
7.1.1.2 Common transport channels 12
7.2 Physical channels 12
7.2.1 Frame structure 12
7.2.2 Dedicated physical channel (DPCH) 12
7.2.2.1 Spreading 12
7.2.2.1.1 Spreading for Downlink Physical Channels 12
7.2.2.1.2 Spreading for Uplink Physical Channels 12
7.2.2.2 Burst Types 12
7.2.2.2.1 Transmission of TFCI 12
7.2.2.2.2 Transmission of TPC 12
7.2.2.2.3 Timeslot formats 12
7.2.2.2.3.1 Downlink timeslot formats 12
7.2.2.2.3.2 Uplink timeslot formats 12
7.2.2.3 Training sequences for spread bursts 12
7.2.2.3.1 Midamble Transmit Power 12
7.2.2.4 Beamforming and Transmit Diversity 12
7.2.3 Primary common control physical channel (P-CCPCH) 12
7.2.3.1 Primary common control physical channel (P-CCPCH) 12
7.2.3.1.1 P-CCPCH Spreading 12
7.2.3.1.2 P-CCPCH Burst Types 13
7.2.3.1.3 P-CCPCH Training sequences 13
7.2.3.1.4 Block STTD antenna diversity for P-CCPCH 13
7.2.3.2 Secondary common control physical channel (S-CCPCH) 13
7.2.3.2.1 S-CCPCH Spreading 13
7.2.3.2.2 S-CCPCH Burst Types 13
7.2.3.2.3 S-CCPCH Training sequences 13
7.2.3.3 The physical random access channel (PRACH) 13
7.2.3.3.1 PRACH Spreading 13
7.2.3.3.2 PRACH Burst Types 13
7.2.3.3.3 PRACH Training sequences 13
7.2.3.3.4 Association between Training Sequences and Channelisation Codes 13
7.2.3.4 The physical synchronisation channel (PSCH) 13

7.2.3.5 Physical Uplink Shared Channel (PUSCH) 13
7.2.3.6 Physical Downlink Shared Channel (PDSCH) 13
7.2.3.7 The Page Indicator Channel (PICH) 13
7.2.4 Beacon function of physical channels 13
7.2.4.1 Location of physical channels with beacon function 13
7.2.4.2 Physical characteristics of the beacon function 13
7.2.5 Midamble Allocation for Physical Channels 13
7.3 Mapping of transport channels to physical channels 13
7.3.1 Dedicated Transport Channels 13
7.3.2 Common Transport Channels 13
7.3.2.1 The Broadcast Channel (BCH) 13
7.3.2.2 The Paging Channel (PCH) 14
7.3.2.2 The Forward Channel (FACH) 14
7.3.2.3 The Random Access Channel (RACH) 14
7.3.2.4 The Synchronisation Channel (SCH) 14
7.3.2.5 Common Transport Channels for ODMA networks 14
7.3.2.6 The Uplink Shared Channel (USCH) 14
7.3.2.7 The Downlink Shared Channel (DSCH) 14
Annex A (Normative): Basic Midamble Codes 14
A.1 Basic Midamble Codes for Burst Type 1 and PRACH Burst Type 14
A.2 Basic Midamble Codes for Burst Type 2 14
A.3 Association between Midambles and Channelisation Codes 14
A.3.1 Association for Burst Type 1 and K=16 Midambles 14
A.3.2 Association for Burst Type 1 and K=4 Midambles 14
A.3.4 Association for Burst Type 2 and K=6 Midambles 14
A.3.5 Association for Burst Type 2 and K=3 Midambles 14
Annex B (Informative): CCPCH Multiframe Structure 14

8 Multiplexing and channel coding 16
8.1 Transport channel coding/multiplexing 16
8.1.1 Error detection 16
8.1.1.1 CRC calculation 16
8.1.1.2 Relation between input and output of the Cyclic Redundancy Check 16
8.1.2 Transport block concatenation and code block segmentation 16
8.1.2.1 Concatenation of transport blocks 16
8.1.2.2 Code block segmentation 16
8.1.3 Channel coding 16
8.1.3.1 Convolutional Coding 16
8.1.3.2 Turbo coding 16
8.1.3.2.1 Turbo coder 16
8.1.3.2.2 Trellis termination in turbo code 16
8.1.3.2.3 Turbo code internal interleaver 16
8.1.4 Radio frame size equalisation 16
8.1.5 1st interleaving 16
8.1.6 Radio frame segmentation 16
8.1.7 Rate matching 16
8.1.7.1 Determination of rate matching parameters 16
8.1.7.2 Bit separation for rate matching 16
8.1.7.3 Rate matching pattern determination 16
8.1.8 TrCH multiplexing 16
8.1.9 Physical channel segmentation 16
8.1.10 2nd interleaving 17
8.1.10.1 Frame related 2nd interleaving 17
8.1.10.2 Timeslot related 2nd interleaving 17
8.1.11 Physical channel mapping 17
8.1.11.1 Mapping scheme after frame related 2nd interleaving 17
8.1.11.2 Mapping scheme after timeslot related 2nd interleaving 17
8.1.12 Multiplexing of different transport channels onto one CCTrCH, and mapping of one CCTrCH onto physical channels 17

8.1.12.1 Allowed CCTrCH combinations for one UE 17
8.1.12.1.1 Allowed CCTrCH combinations on the uplink 17
8.1.12.1.2 Allowed CCTrCH combinations on the downlink 17
8.1.13 Transport format detection 17
8.1.13.1 Blind transport format detection 17
8.1.13.2 Explicit transport format detection based on TFCI 17
8.1.13.2.1 Transport Format Combination Indicator (TFCI) 17
8.2 Coding for layer 1 control 17
8.2.1 Coding of transport format combination indicator (TFCI) 17
8.2.1.1 Default TFCI word 17
8.2.1.2 Coding of short TFCI lengths 17
8.2.2 Coding of Paging Indicator (PI) 17
8.2.3 Coding of Transmit Power Control (TPC) 17

9 Spreading and Modulation 18
9.1 Data modulation 18
9.1.1 Symbol rate 18
9.1.2 Mapping of bits onto signal point constellation 18
9.2 Spreading modulation 18
9.2.1 Basic spreading parameters 18
9.2.2 Spreading codes 18
9.2.3 Scrambling codes 18
9.2.4 Spread and scrambled signal of data symbols and data blocks 18
9.3 Synchronisation codes 18
9.3.1 Code Generation 18
9.3.2 Code Allocation 18
9.3.2.1 Code allocation for Case 1: 18
9.3.2.2 Code allocation for Case 2: 18
9.3.2.3 Code allocation for Case 3: 18
9.3.3 Evaluation of synchronisation codes 18

10 Physical layer procedures 20
10.1 Transmitter Power Control 20
10.1.1 General Parameters 20
10.1.2 Uplink Control 20
10.1.2.1 Common Physical Channel 20
10.1.2.2 Dedicated Physical Channel 20
10.1.3 Downlink Control 20
10.1.3.1 Common Physical Channel 20
10.1.3.2 Dedicated Physical Channel 20
10.2 Timing Advance 20
10.2.1 With UL Synchronization 20
10.3 Synchronisation and Cell Search Procedures 20
10.3.1 Cell Search 20
10.4 ODMA Relay Probing 20
10.4.1 Initial Mode Probing 20
10.4.2 Idle Mode Probing 20
10.4.3 Active Mode Probing 20
10.5 Discontinuous transmission (DTX) of Radio Frames 20
10.6 Downlink Transmit Diversity 20
10.6.1 Transmit Diversity for DPCH 20
10.6.1.1 Determination of Weight Information 20
10.6.1.1.1 STD Weights 20
10.6.1.1.2 TxAA Weights 21
10.6.2 Transmit Diversity for SCH 21
10.6.2.1 SCH Transmission Scheme 21
10.6.3 Transmit Diversity for P-CCPCH 21
10.6.3.1 P-CCPCH Transmission Scheme 21
Annex A (informative): An Example for Calculating α 21
Annex B (informative): Change Request History 21

11 Physical layer measurements 22
11.1 Control of UE/UTRAN measurements 22
11.1.1 General measurement concept 22
11.1.2 Measurements for cell selection/reselection 22
11.1.3 Measurements for Handover 22
11.1.4 Measurements for DCA 22
11.1.5 Measurements for timing advance 22
11.2 Measurement abilities for UTRA TDD 22
11.2.1 UE measurement abilities 22
11.2.1.1 PCCPCH RSCP 22
11.2.1.2 CPICH RSCP 22
11.2.1.3 RSCP 22
11.2.1.4 Timeslot ISCP 22
11.2.1.5 UTRA carrier RSSI 22
11.2.1.6 GSM carrier RSSI 22
11.2.1.7 SIR 22
11.2.1.8 CPICH Ec/No 22
11.2.1.9 Physical channel BER 22
11.2.1.10 Transport channel BLER 22
11.2.1.11 UE transmitted power 22
11.2.1.12 SFN-SFN observed time difference 22
11.2.1.13 Observed time difference to GSM cell 22
11.2.2 UTRAN measurement abilities 22
11.2.2.1 RSCP 23
11.2.2.2 Timeslot ISCP 23
11.2.2.3 RSSI 23
11.2.2.4 SIR 23
11.2.2.5 Physical channel BER 23
11.2.2.6 Transport channel BLER 23
11.2.2.7 Transmitted carrier power 23
11.2.2.8 Transmitted code power 23
11.2.2.9 RX Timing Deviation 23
Annex A (informative): Monitoring GSM from TDD: Calculation Results 23
A.1 Low data rate traffic using 1 uplink and 1 downlink slot 23
A.1.1 Higher data rate traffic using more than 1 uplink and/or 1 downlink TDD timeslot 23
12 Performance analysis of the low chip rate 24
13 History 25

Foreword

This Technical Report has been produced by the 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 this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version 3.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 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 specification.

1 Scope

This Technical Report describes the 1.28Mcps UTRA TDD physical layer, identifies commonalties and explains the differences to the 3.84Mcps UTRA TDD. Suggestions for alignment will be provided too.

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.

[1] TS 25.201: “Physical Layer - General Description”

[2] TS 25.221: “Physical channels and mapping of transport channels onto physical channels (TDD)”

[3] TS 25.222: “Multiplexing and channel coding (TDD)”

[4] TS 25.223: “Spreading and modulation (TDD)”

[5] TS 25.224: “Physical layer procedures (TDD)”

[6] TS 25.225: "Physical layer – Measurements (TDD)"

3 Abbreviations

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

CDMA	Code Division Multiple Access
PN	Pseudo Noise
QPSK	Quadrature Phase Shift Keying
RACH	Random Access Channel

4 Radio Requirements

4.1 Radio environments

4.2 Services

4.3 Operational requirements

4.3.1 Deployment scenarios

4.4 Handover and Cell selection/reselection

4.5 Particular characteristics of the low chip rate TDD

5 High level characteristics

6 Physical layer - General description

6.1 General description of Layer 1

6.2 Document structure of the physical layer specification

7 Physical channels and mapping of transport channels onto physical channels

7.1 Transport channels

7.1.1 Transport channels

7.1.1.1 Dedicated transport channels

7.1.1.2 Common transport channels

7.2 Physical channels

7.2.1 Frame structure

7.2.2 Dedicated physical channel (DPCH)

7.2.2.1 Spreading

7.2.2.1.1 Spreading for Downlink Physical Channels

7.2.2.1.2 Spreading for Uplink Physical Channels

7.2.2.2 Burst Types

7.2.2.2.1 Transmission of TFCI

7.2.2.2.2 Transmission of TPC

7.2.2.2.3 Timeslot formats

7.2.2.2.3.1 Downlink timeslot formats

7.2.2.2.3.2 Uplink timeslot formats

7.2.2.3 Training sequences for spread bursts

7.2.2.3.1 Midamble Transmit Power

7.2.2.4 Beamforming and Transmit Diversity

7.2.3 Primary common control physical channel (P-CCPCH)

7.2.3.1 Primary common control physical channel (P-CCPCH)

7.2.3.1.1 P-CCPCH Spreading

7.2.3.1.2 P-CCPCH Burst Types

7.2.3.1.3 P-CCPCH Training sequences

7.2.3.1.4 Block STTD antenna diversity for P-CCPCH

7.2.3.2 Secondary common control physical channel (S-CCPCH)

7.2.3.2.1 S-CCPCH Spreading

7.2.3.2.2 S-CCPCH Burst Types

7.2.3.2.3 S-CCPCH Training sequences

7.2.3.3 The physical random access channel (PRACH)

7.2.3.3.1 PRACH Spreading

7.2.3.3.2 PRACH Burst Types

7.2.3.3.3 PRACH Training sequences

7.2.3.3.4 Association between Training Sequences and Channelisation Codes

7.2.3.4 The physical synchronisation channel (PSCH)

7.2.3.5 Physical Uplink Shared Channel (PUSCH)

7.2.3.6 Physical Downlink Shared Channel (PDSCH)

7.2.3.7 The Page Indicator Channel (PICH)

7.2.4 Beacon function of physical channels

7.2.4.1 Location of physical channels with beacon function

7.2.4.2 Physical characteristics of the beacon function

7.2.5 Midamble Allocation for Physical Channels

7.3 Mapping of transport channels to physical channels

7.3.1 Dedicated Transport Channels

7.3.2 Common Transport Channels

7.3.2.1 The Broadcast Channel (BCH)

7.3.2.2 The Paging Channel (PCH)

7.3.2.2 The Forward Channel (FACH)

7.3.2.3 The Random Access Channel (RACH)

7.3.2.4 The Synchronisation Channel (SCH)

7.3.2.5 Common Transport Channels for ODMA networks

7.3.2.6 The Uplink Shared Channel (USCH)

7.3.2.7 The Downlink Shared Channel (DSCH)

Annex A (Normative): Basic Midamble Codes

A.1 Basic Midamble Codes for Burst Type 1 and PRACH Burst Type

A.2 Basic Midamble Codes for Burst Type 2

A.3 Association between Midambles and Channelisation Codes

A.3.1 Association for Burst Type 1 and K=16 Midambles

A.3.2 Association for Burst Type 1 and K=4 Midambles

A.3.4 Association for Burst Type 2 and K=6 Midambles

A.3.5 Association for Burst Type 2 and K=3 Midambles

Annex B (Informative): CCPCH Multiframe Structure

8 Multiplexing and channel coding

8.1 Transport channel coding/multiplexing

8.1.1 Error detection

8.1.1.1 CRC calculation

8.1.1.2 Relation between input and output of the Cyclic Redundancy Check

8.1.2 Transport block concatenation and code block segmentation

8.1.2.1 Concatenation of transport blocks

8.1.2.2 Code block segmentation

8.1.3 Channel coding

8.1.3.1 Convolutional Coding

8.1.3.2 Turbo coding

8.1.3.2.1 Turbo coder

8.1.3.2.2 Trellis termination in turbo code

8.1.3.2.3 Turbo code internal interleaver

8.1.4 Radio frame size equalisation

8.1.5 1st interleaving

8.1.6 Radio frame segmentation

8.1.7 Rate matching

8.1.7.1 Determination of rate matching parameters

8.1.7.2 Bit separation for rate matching

8.1.7.3 Rate matching pattern determination

8.1.8 TrCH multiplexing

8.1.9 Physical channel segmentation

8.1.10 2nd interleaving

8.1.10.1 Frame related 2nd interleaving

8.1.10.2 Timeslot related 2nd interleaving

8.1.11 Physical channel mapping

8.1.11.1 Mapping scheme after frame related 2nd interleaving

8.1.11.2 Mapping scheme after timeslot related 2nd interleaving

8.1.12 Multiplexing of different transport channels onto one CCTrCH, and mapping of one CCTrCH onto physical channels

8.1.12.1 Allowed CCTrCH combinations for one UE

8.1.12.1.1 Allowed CCTrCH combinations on the uplink

8.1.12.1.2 Allowed CCTrCH combinations on the downlink

8.1.13 Transport format detection

8.1.13.1 Blind transport format detection

8.1.13.2 Explicit transport format detection based on TFCI

8.1.13.2.1 Transport Format Combination Indicator (TFCI)

8.2 Coding for layer 1 control

8.2.1 Coding of transport format combination indicator (TFCI)

8.2.1.1 Default TFCI word

8.2.1.2 Coding of short TFCI lengths

8.2.2 Coding of Paging Indicator (PI)

8.2.3 Coding of Transmit Power Control (TPC)

9 Spreading and Modulation

9.1 Data modulation

9.1.1 Symbol rate

9.1.2 Mapping of bits onto signal point constellation

9.2 Spreading modulation

9.2.1 Basic spreading parameters

9.2.2 Spreading codes

9.2.3 Scrambling codes

9.2.4 Spread and scrambled signal of data symbols and data blocks

9.3 Synchronisation codes

9.3.1 Code Generation

9.3.2 Code Allocation

9.3.2.1 Code allocation for Case 1:

9.3.2.2 Code allocation for Case 2:

9.3.2.3 Code allocation for Case 3:

9.3.3 Evaluation of synchronisation codes

10 Physical layer procedures

10.1 Transmitter Power Control

10.1.1 General Parameters

10.1.2 Uplink Control

10.1.2.1 Common Physical Channel

10.1.2.2 Dedicated Physical Channel

10.1.3 Downlink Control

10.1.3.1 Common Physical Channel

10.1.3.2 Dedicated Physical Channel

10.2 Timing Advance

10.2.1 With UL Synchronization

10.3 Synchronisation and Cell Search Procedures

10.3.1 Cell Search

10.4 ODMA Relay Probing

10.4.1 Initial Mode Probing

10.4.2 Idle Mode Probing

10.4.3 Active Mode Probing

10.5 Discontinuous transmission (DTX) of Radio Frames

10.6 Downlink Transmit Diversity

10.6.1 Transmit Diversity for DPCH

10.6.1.1 Determination of Weight Information

10.6.1.1.1 STD Weights

10.6.1.1.2 TxAA Weights

10.6.2 Transmit Diversity for SCH

10.6.2.1 SCH Transmission Scheme

10.6.3 Transmit Diversity for P-CCPCH

10.6.3.1 P-CCPCH Transmission Scheme

Annex A (informative): An Example for Calculating α

Annex B (informative): Change Request History

11 Physical layer measurements

11.1 Control of UE/UTRAN measurements

11.1.1 General measurement concept

11.1.2 Measurements for cell selection/reselection

11.1.3 Measurements for Handover

11.1.4 Measurements for DCA

11.1.5 Measurements for timing advance

11.2 Measurement abilities for UTRA TDD

11.2.1 UE measurement abilities

11.2.1.1 PCCPCH RSCP

11.2.1.2 CPICH RSCP

11.2.1.3 RSCP

11.2.1.4 Timeslot ISCP

11.2.1.5 UTRA carrier RSSI

11.2.1.6 GSM carrier RSSI

11.2.1.7 SIR

11.2.1.8 CPICH Ec/No

11.2.1.9 Physical channel BER

11.2.1.10 Transport channel BLER

11.2.1.11 UE transmitted power

11.2.1.12 SFN-SFN observed time difference

11.2.1.13 Observed time difference to GSM cell

11.2.2 UTRAN measurement abilities

11.2.2.1 RSCP

11.2.2.2 Timeslot ISCP

11.2.2.3 RSSI

11.2.2.4 SIR

11.2.2.5 Physical channel BER

11.2.2.6 Transport channel BLER

11.2.2.7 Transmitted carrier power

11.2.2.8 Transmitted code power

11.2.2.9 RX Timing Deviation

Annex A (informative): Monitoring GSM from TDD: Calculation Results

A.1 Low data rate traffic using 1 uplink and 1 downlink slot

A.1.1 Higher data rate traffic using more than 1 uplink and/or 1 downlink TDD timeslot

12 Performance analysis of the low chip rate

13 History

Document history		
V0.0.1	January 2000	Created in WG#10 in Beijing, Table of contents approved, R1-00-149
V0.0.2	March 2000	New structure created according to the comments at the WG1#11

Editor information:

Mirko Aksentijevic
Nokia

Email: mirko.aksentijevic@nokia.com