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Technical Specification

3rd Generation Partnership Project (3GPP);
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Low chip rate TDD Iub/Iur protocol aspects
(Release 2000)

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Foreword

This Technical Report (TR) has been produced by the 3rd Generation Partnership Project (3GPP), Technical Specification Group RAN.
The contents of this TR are subject to continuing work within 3GPP and may change following formal TSG approval. Should the TSG modify the contents of this TR, it will be re-released with an identifying change of release date and an increase in version number as follows:

Version m.t.e
where:

- m indicates [major version number]
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated into the specification.

1 Scope

The work item “Low chip rate TDD Iub/Iur protocol aspects” is a Building Block which has been agreed at TSG RAN#8 as described in contribution [1]. Its parent feature is “Low chip rate TDD” which has been agreed at TSG-RAN#6 and updated at RAN#7. The purpose of the work item “Low chip rate TDD Iub/Iur protocol aspects” is to update the Iub/Iur interface protocol specifications and related overview specifications in RAN WG3 in support of the several aspects of the feature “Low chip rate TDD”.

The purpose of the present document is to help the TSG RAN WG3 group to specify the changes to existing specifications, needed for the introduction of the low chip rate TDD option in the UTRAN for Release 2000. It is intended to gather all information in order to trace the history and the status of the Work Task in RAN WG3. It is not intended to replace contributions and Change Requests, but only to list conclusions and make reference to agreed contributions and CRs. When solutions are sufficiently stable, the CRs can be issued.

It describes agreed requirements related to the Work Task, and split the Work Task into “Study Areas” in order to group contributions in a consistent way.

It identifies the affected specifications with related Change Requests.

It also describes the schedule of the Work Task.

This document is a ‘living’ document, i.e. it is permanently updated and presented to all TSG-RAN meetings.

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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] RP-(00)0316rev, Low chip rate TDD Iub/Iur protocol aspects, Work Item Description
[2] R3(#15)-002003: LS from R1 to R2, R3, R4: Progress report of the Work Item “Low chip rate TDD, physical layer” and request for support.
[3] TR 25.928 (by RAN WG1), 1.28 Mcps functionality for UTRA TDD Physical Layer
[4] TR 25.834 (by RAN WG2), UTRA TDD Low Chip Rate Option Radio Protocol Aspects, TR 25.834 V 0.0.1 (R2-001528)
[5] TS 25.302, Services provided by the Physical Layer
[6] TS 25.420, UTRAN I_{ur} Interface: General Aspects and Principles
[7] TS 25.430, UTRAN I_{ub} Interface: General Aspects and Principles
[8] TS 25.401: UTRAN Overall Description
[9] TS 25.423, UTRAN Iur interface RNSAP signalling
[10] TS 25.425, UTRAN Iur interface user plane protocols for CCH data streams
[11] TS 25.427, UTRAN Iur and Iub interface user plane protocols for DCH data streams
[12] TS 25.433, UTRAN Iub interface NBAP signalling
[13] TS 25.435, UTRAN Iub interface user plane protocols for CCH data streams
[14] TR 25.990: Vocabulary for the UTRAN

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in [14] apply.

3.2 Symbols

3.3 Abbreviations

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

ASC	Access Service Class
BCCH	Broadcast Control Channel
BCH	Broadcast Channel
BMC	Broadcast/Multicast Control
C-	Control-
CCCH	Common Control Channel
CCH	Control Channel
CCTrCH	Coded Composite Transport Channel
CN	Core Network
CRC	Cyclic Redundancy Check
CTCH	Common Traffic Channel
DC	Dedicated Control (SAP)
DCA	Dynamic Channel Allocation
DCCH	Dedicated Control Channel
DCH	Dedicated Channel
DL	Downlink
DRNC	Drift Radio Network Controller
DSCH	Downlink Shared Channel
DTCH	Dedicated Traffic Channel
DwPTS	Downlink Pilot Timeslot
FACH	Forward Link Access Channel
FDD	Frequency Division Duplex
FPACH	Fast Physical Access Channel
GC	General Control (SAP)
GP	Guard Period
HO	Handover
ITU	International Telecommunication Union
kbps	kilo-bits per second
L1	Layer 1 (physical layer)
L2	Layer 2 (data link layer)
L3	Layer 3 (network layer)
MAC	Medium Access Control
Nt	Notification (SAP)
PCCH	Paging Control Channel
P-CCPCH	Primary Common Control Physical Channel
PCH	Paging Channel
PDCP	Packet Data Convergence Protocol
PDSCH	Physical Downlink Shared Channel

PDU	Protocol Data Unit
PHY	Physical layer
PhyCH	Physical Channels
P-RACH	Physical Random Access Channel
PU	Payload Unit
PUSCH	Physical Uplink Shared Channel
RAB	Radio Access Bearer
RACH	Random Access Channel
RB	Radio Bearer
RLC	Radio Link Control
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RNTI	Radio Network Temporary Identity
RRC	Radio Resource Control
Rx	Receive
SAP	Service Access Point
SCH	Synchronization Channel
SDU	Service Data Unit
SHCCH	Shared Channel Control Channel
SIR	Signal to Interference Ratio
SRNC	Serving Radio Network Controller
SRNS	Serving Radio Network Subsystem
TCH	Traffic Channel
TDD	Time Division Duplex
TFCI	Transport Format Combination Indicator
TFI	Transport Format Indicator
TPC	Transmit Power Control
Ts	Timeslot
Tx	Transmit
U-	User-
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunications System
UpPTS	Uplink Pilot Timeslot
URA	UTRAN Registration Area
USCH	Uplink Shared Channel
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network

4 Overview of the TDD low chip rate option

4.1 Physical layer

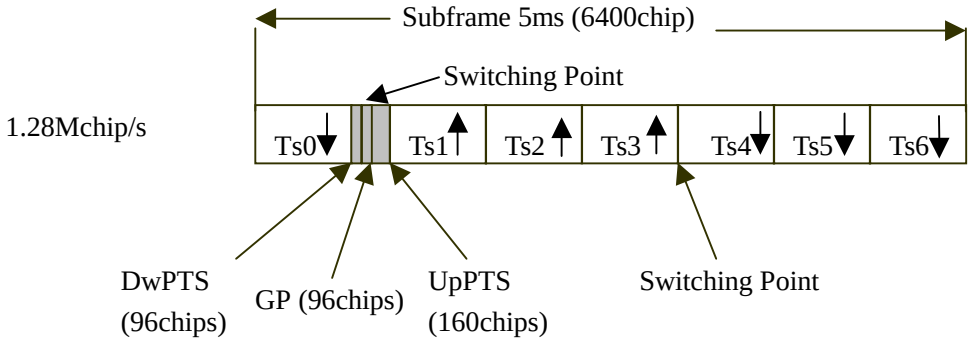
4.1.1 General

This section contains some basic information about frame and burst structure of physical layer of TDD low chip rate option. More information on physical layer characteristics of TDD low chip rate option can be found in [25928] .

4.1.2 Frame structure

For low chip rate option, the frame length is 10ms and the 10ms frame is divided into 2 sub-frames of 5ms. The frame structure for each sub-frame in the 10ms frame length is the same. The frame structure for each sub-frame is shown in Figure 1.

Figure 1 Structure of the sub-frame for TDD low chip rate option



Tsn (n from 0 to 6): the nth normal time slot, 864 chips duration;
DwPTS: downlink pilot time slot, 96 chips duration;
UpPTS: uplink pilot time slot, 160 chips duration;
GP: main guard period for TDD operation, 96 chips duration;

In Figure 1, the total number of normal traffic time slots for uplink and downlink is 7, and the length for each normal time slot is 864 chips duration. Among the 7 normal traffic time slots, Ts0 is always allocated as downlink while Ts1 is always allocated as uplink. The time slots for the uplink and the downlink are separated by a switching point. Between the downlink time slots and uplink time slots, the special period is the switching point to separate the uplink and downlink. In each sub-frame of 5ms for low chip rate option, there are two switching points (uplink to downlink and vice versa). The proposed frame structure has taken some new technologies into consideration, both the smart antenna (beam forming) technology and the uplink synchronisation will be well supported.

4.1.3 Burst Types

In correspondence to the frame structure described above, the burst structures for Tsn, DwPTS and UpPTS are proposed. The burst structure for normal time slot (Tsn) is described in Figure 2.

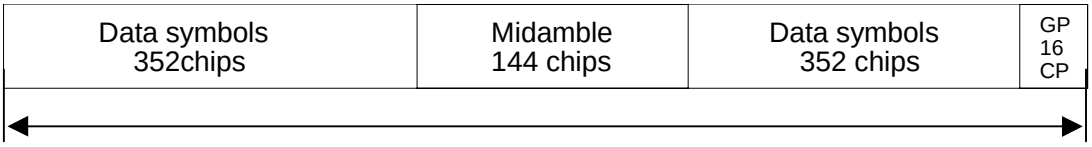


Figure 2 Burst structure for normal traffic time slot

The structure for DwPTS and UpPTS is described in Figure 3 and Figure 4.

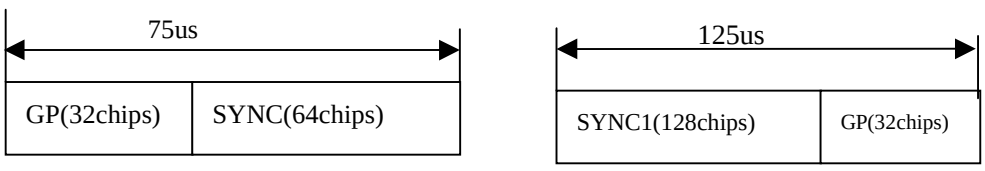


Figure 3 Structure for DwPTS *Figure 4 Structure for UpPTS*

In Figure 2, the data symbols in each side of the midamble are 352 chips. The TPC bits for power control, the TFCI bits and the additional uplink synchronization bits (synchronization shift) are included in the Data symbols fields of the burst if they are needed. The amount of TFCI bits used is depending on the service and the details for TFCI, synchronization shift and TPC bits should be provided later with service mapping. For the power control symbols, the uplink synchronization control symbols and the TFCI the symbols around the midamble are used.

The GP field in Figure 2 for each time slot is used for protection between time slots to avoid the long delay multi-path interference. It should be noted that the GP of the TS0 together with the guard period in DwPTS is 48 chips long which is different with other normal guard period of 16 chips between time slots. This 'super long' guard period can be used to avoid the interference between the last normal downlink time slot and the downlink synchronization pilot burst. Otherwise, the interference to the last downlink time slot from the strong powered pilot will be serious to the traffic; and vice versa, the interference to the downlink pilot burst from the last downlink time slot will decrease the performance on downlink synchronization and cell search. Note that if the UEs serving Node B is far away and the UE makes handover measurements it will receive the beginning of the DwPTS of a close by Node B inside these 48 chip. 48 chip corresponds to 11 km difference in distance to the Node B. If the other Node B is more distant to the serving Node B, big guard period can be used for receiving the DwPTS of the handover candidate Node B.

In DwPTS and UpPTS, the content of SYNC and SYNC1 field are used for downlink and uplink pilot. The GP fields are used to separate the downlink (uplink) pilot from the normal downlink (uplink) time slot.

It should be pointed out that the uplink synchronization burst (SYNC1) is not followed by a RACH immediately. First the UL synchronization burst UpPTS is sent by the UE. This UpPTS is used for Node B to determine the received power level and the received timing. Second, the Node B transmits timing and power control information to the UE using the FPACH (one burst message) within the next 4 frames. Then the P-RACH is transmitted. Both FPACH and P-RACH are carrying single burst messages transmitted on a normal traffic time slot (see Fig. 2).

4.2 Transport Channel and higher layer differences compared to TDD-high

For details on the higher layers of the radio protocol of the low-chip-rate TDD option see [25834]. For example there are differences with the RACH access procedure, compared to TDD-high. DSCH and USCH details may be different.

4.3 Other key features of low-chip-rate TDD

Uplink synchronisation.
Smart antenna, and baton handover.

5 Iub/Iur aspects of Low chip rate TDD radio frame structure

5.1 Introduction

This chapter includes several properties of the radio frames used in low chip rate TDD. On the Iub and Iur interface, this will imply new parameters and information elements in the radio related control plane protocols.
The following impacts have been identified in a Liaison Statement from RAN1 to RAN3 [2].

- Different frame structure than for high chiprate TDD option.
- Different basic midamble sequences, maximum channel impulse response is scalable (W=8, 9, 12, 16, 21, 32, 64), depending on number of users and environment, including the association between midambles and channelisation codes

- Use of only one burst type for physical channels except special bursts in DwPTS/UpPTS. Because there is only one burst type in low chip rate TDD option, “burst type” defined as a parameter for physical channel is not necessary.
- Support of different timeslot formats due to different number of bits and L1 control signals and midamble length
- Support of use of 8PSK for special timeslots/all timeslots per cell
- Beacon function is provided by DwPTS and P-CCPCH.

5.2 Requirements

5.3 Study areas

5.4 Agreements and associated contributions

5.5 Specification impact and associated Change Requests

It is expected that these Iub/Iur protocol aspects have impacts on the following Specifications: [12] (NBAP), [9] (RNSAP).

5.6 Open issues

6 Iub/Iur aspects of physical channel types

6.1 Introduction

6.1.1 General

6.1.2 DwPTS

6.1.3 UpPTS

6.1.4 FPACH

6.1.5 PRACH

6.2 Requirements

6.3 Study areas

6.4 Agreements and associated contributions

6.5 Specification impact and associated Change Requests

6.6 Open issues

7 Iub/Iur aspects of transport channel features

7.1 Introduction

7.1.1 General

7.1.2 Types of Transport Channels

7.1.3 System information broadcast

7.1.4 Usage of RACH

7.1.5 Common downlink channels

7.2 Requirements

7.3 Study areas

7.4 Agreements and associated contributions

7.5 Specification impact and associated Change Requests

7.6 Open issues

8 Iub/Iur aspects of Uplink synchronisation

8.1 Introduction

8.2 Requirements

8.3 Study areas

8.4 Agreements and associated contributions

8.5 Specification impact and associated Change Requests

8.6 Open issues

9 Iub/Iur aspects of RACH concept

9.1 Introduction: RACH procedure

9.2 Requirements

9.3 Study areas

9.4 Agreements and associated contributions

9.5 Specification impact and associated Change Requests

9.6 Open issues

10 Iub/Iur aspects of Measurements

10.1 Introduction

10.2 Requirements

10.3 Study areas

10.4 Agreements and associated contributions

10.5 Specification impact and associated Change Requests

10.6 Open issues

11 Project Plan

11.1 General

It is intended to focus on the basic features of low-chip-rate TDD first, and then on the advanced features.

Basic features includes:

L1 interface
primitives to MAC, RRC
uplink synchronisation
support of RACH, FACH, PCH, BCH, DCH
cell selection/reselection
handover (set of measurements)
incorporation of basic features of the smart antenna concept

Advanced features include:

Support of USCH/DSCH
Support of Iur
baton handover
extended functionality and completion of smart antenna concept
alignment with UTRA LCS concept

11.2 Schedule

Date	Meeting	Scope	[expected] Input	[expected]Output

11.3 Work Task Status

	Planned Date	Milestone	Status
1.			
2.			

12 History

Document history		
Date	**Version**	**Comment**
August 2000	0.0.1	First proposal
August 2000	0.1.0	Approved by WG3 #15
August 2000	0.1.1	Includes some input chapters approved by WG3 #15

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