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Technical Report

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3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

http://www.3gpp.org

3GPP

Contents

Foreword

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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

This clause is optional. If it exists, it is always the second unnumbered clause.

1   Scope

The present document identifies RAN2 the specifications impacted by the introduction of 7.68 Mcps TDD. It describes the various options for implementing the 7.68 Mcps TDD option in specifications and presents a brief description of the decisions and changes agreed.

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 TR 25.895 (V6.0.0): "Analysis of higher chip rates for UTRA TDD evolution (Release 6)".

[2]   3GPP TS 25.221 (V6.2.0) "Physical channels an mapping of transport channels onto physical channels (TDD)"

[3]   3GPP TS 25.xxx "7.68 Mcps TDD Option; Overall Description: Stage 2"

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.

3.2   Symbols

3.3   Abbreviations

4   Introduction and Overview

In RAN#25 plenary meeting a work item was approved for 7.68 Mcps TDD Option [1]. An analysis of the feasibility and potential benefits of higher chip rates for UTRA TDD were presented in [2]. A stage 2 technical specification will be written by RAN1, as part of the work item [3].

7.68 Mcps TDD operates at twice the chip rate of 3.84 Mcps TDD, and therefore requires carriers of 10 MHz. Many aspects will be common to 3.84 Mcps: 7.68 Mcps TDD is expected to re-use 3.84 Mcps TDD procedures/protocols as far as possible.

The areas in which 7.68 Mcps is expected to differ from 3.84 Mcps [2] that are relevant to Layer 2 and Layer 3 protocol aspects

>   Chip duration;

> > Support for SF32 on the downlink and uplink;

> > Midambles;

> > HSDPA UE capabilities;

> > Timing Advance & Rx Timing Deviation (same range in terms of time, but doubled in terms of chips);

> > Timing adjustment value – for Cell Synchronisation;

> > Physical layer parameters and measurements (e.g transmit powers, interference);

<Editors note: This Section should made consistent with the Stage 2 TS>

5 Protocol Architecture

The protocol architecture for 7.68 Mcps TDD is the same as the protocol architecture for 3.84 Mcps TDD.

6 Details of Specifications Impacted

Table 1 provides an overview of the specifications for which RAN2 has responsibility and which are impacted by the introduction of the 7.68 Mcps TDD option. The impact list all specifications and changes identified during in the TR [1]; however impact on TS 25.304 has been identified since approval of the TR.

Table 1: Specifications impacted

Spec. No.	Spec. Title	Overview of Changes
25.301	Radio Interface Protocol Architecture	editorial modifications[1]
25.302	Services provided by the physical layer	editorial modifications[1]
25.304	User Equipment procedures in idle mode and procedures for cell reselection in connected mode	editorial modifications[1]
25.305	User Equipment positioning in UTRAN; Stage 2	editorial modifications[1]
25.306	Radio Access Capabilities Definition	• extension of definition of physical channel parameters DL and UL • Capability flag • HSPDA UE categories and capabilities • editorial modifications[1]
25.321	Medium Access Control (MAC) protocol specification	• HSPDA transport block size signalling • MAC-hs (signalling on HS-SCCH and HS-SICH) • Control of RACH transmission • UL TFC selection • editorial modifications[1]
25.331	Radio Resource Control (RRC) protocol specification	• editorial modifications[1] • message and IE definitions (incl. ASN.1 changes) • power control procedures • RACH access service class • timing advance procedures • use of SIB14 (uplink and outer loop power control)

		• capability signalling • measurement capabilities • use of SF = 32 (doubling no. of channelisation codes per slot)

1   Features applicable to 3.84 Mcps TDD are also applicable to 7.68 Mcps TDD and are generally a matter of replacing "3.84 Mcps TDD" with "3.84/7.68 Mcps".

7 Discussion and Analysis

7.1 25.301 Issues

Only editorial changes are needed, to replace "3.84 Mcps TDD" with "3.84/7.68 Mcps TDD".

7.2 25.302 Issues

Only editorial changes are needed, to replace "3.84 Mcps TDD" with "3.84/7.68 Mcps TDD".

7.3 25.304 Issues

Only editorial change are needed, to replace "3.84 Mcps TDD" with "3.84/7.68 Mcps TDD".

7.4 25.305 Issues

Only editorial changes are needed, to replace "3.84 Mcps TDD" with "3.84/7.68 Mcps TDD".

7.5 25.306 Issues

7.5.1 Editorial Changes

Generally 7.68 Mcps TDD UE capabilities are as 3.84 Mcps TDD UE capabilities. Consequently a number of editorial changes are needed to replace "3.84 Mcps TDD" with "3.84 Mcps TDD and 7.68 Mcps TDD".

7.5.2 Support of SF 32

For 7.68 Mcps TDD SF 32 is supported in uplink and downlink.

7.5.3 Radio Access Capability Combinations

There is no change to the radio access capability parameter combinations (Table 5.2.2.1 of 25.306) and classes 12 kbps to 2048 kbps are still appropriate.

7.5.4 HSPDA Capabilities Doubled

Downlink resource capabilities are doubled therefore HSPDA capabilities are doubled

- the minimum category is now 2.4 Mbits/s ~~(see Table 5.1f-a of attached draft CR)~~
- the maximum category is 20.4 Mbis/s ~~(see Table 5.1f-a of attached draft CR)~~
- transport channel parameters are extended
- total buffer sizes for RLC and MAC-hs are extended ~~(see Table 5.1 and Table 5.1f-b of attached draft CR)~~

7.6   25.321 Issues

7.6.1   Editorial Changes

Generally 7.68 Mcps MAC procedures are as 3.84 Mcps TDD. Consequently a number of editorial changes are need to replace "3.84 Mcps TDD" with "3.84/7.68 Mcps TDD".

7.6.2   Max. Number of PDUs Transmitted in a single TTI

For 7.68 Mcps TDD the maximum number of PDUs transmitted in a single TTI should be 636 (for 3.84 Mcps TDD the maximum number is 318).

7.6.3   Transport Block Sizes for 7.68 Mcps TDD

Transport block sizes for 7.68 need to be generally double those of 3.84 Mcps TDD in order to take advantage of the doubling of the chip rate. A new formula and table giving transport block sizes needs to be added to Section 9.2.3 of 25.321.

7.6.4   ASC Selection

The 7.68 Mcps access service class procedure (for control of RACH transmissions) is as for 3.84 Mcps TDD.

7.7   25.331 Issues

7.7.1   Procedures applicable to 3.84 Mcps TDD are generally applicable to 7.68 Mcps TDD

A number of changes need to be made to indicate that 3.84 Mcps TDD procedures also apply to 7.68 Mcps TDD. This is achieved by replacing "3.84 Mcps TDD" with "3.84 Mcps TDD or 7.68 Mcps TDD" or with "3.84 Mcps TDD and 7.68 Mcps TDD" (as appropriate).

7.7.2   RACH

The RACH access procedure for 7.68 Mcps TDD is as 3.84 Mcps TDD and uses 8 ASCs (Access Service Classes). *No need to increase the number of ASCs or use any different access procedure has been identified.*

The 7.68 Mcps will be configured to use SF 16 or 32 for PRACH rather than SF 8 and 16 as 3.84 Mcps This has some impact on open loop power control (Section 8.5.7 of 25.331)

Because SF 32 may be used for 7.68 Mcps TDD for the PRACH then more channelisation codes are available so the bit map defined for the available channelisation codes needs to be 16 rather than 8 (3.84 Mcps TDD). A new note (Section 8.6.6.29) should be added covering the bit map for 7.68 Mcps TDD and indicating availability of up to 16 channelisation codes. A corresponding change is required to the ASC IE definition (Section 10.3.6.6 of 25.331).

7.7.3 Open Loop Power Control

For 7.68 Mcps, the cell will be configured for use of SF 16 or 32 with respect to PRACH. This impacts calculation of the uplink transmit power for PRACH (Section 8.5.7 of 25.331) and requires the UE to add 3dB to the RACH Constant Value in the equation:

$$P_{PRACH} = L_{PCCPCH} + I_{BTS} + PRACH \text{ Constant value}$$

for the case where RACH Spreading Factor = 16.

7.7.4 Capability Update Requirement

A new IE "UE radio access 7.68 Mcps TDD capability update requirement" is added to Section 8.6.3.17 of 25.331.

7.7.5 Uplink Timing Advance

The timing advance procedure is based on that of 3.84 Mcps TDD; however, 7 bits are required to signal timing advance in order to maintain the same granularity as 3.84 Mcps TDD. A number of RRC messages are impacted (Physical Channel reconfiguration complete, Radio Bearer Reconfiguration Complete, Radio Bearer Release Complete, Radio Bearer Setup Complete, Transport Channel Reconfiguration Complete) due to the use of a different Uplink Timing Advance IE for 7.68 Mcps TDD to 3.84 Mcps TDD.

7.7.6 DL Physical Channel Capability

The Physical Channel Capability is doubled for downlink relative to 3.84 Mcps TDD. For 14 timeslots in a frame we can have 448 physical channels rather than 224 (3.84 Mcps TDD) with SF 1..32 rather than 1..16 (3.84 Mcps TDD) and a maximum of 32 physical channels per timeslot rather than 16 (3.84 Mcps TDD).

7.7.7 Downlink Channelisation Codes

Up to 32 channelisation codes can be used downlink, 32/1 …..32/32, for 7.68 Mcps TDD rather than 16 (3.84 Mcps TDD). This means that a bit map of size 32, rather than 16, is needed to indicate which ones are available.

7.7.8 Burst Types and Midambles

7.68 Mcps TDD will use burst types 1 and 3 as 3.84 Mcps TDD. 7.68 Mcps TDD will use Burst Type 2 (as 3.84 Mcps TDD) with Kcell 4 or 8 instead of 3 or 6.

7.7.9 General Rules on Introducing 7.68 Mcps TDD Options and Specific 7.68 Mps TDD IEs

For Release 6 and earlier, messages and IEs have been specified either as for TDD (implying applicabillity to both 1.28 Mcps TDD and 3.84 Mcps TDD) or for 3.84 Mcps TDD or 1.28 Mcps TDD. If there is a need to have something uniquely specified for 7.68 Mcps then changes must be introduced for 7.68 Mcps TDD without impacting 1.28 Mcps TDD and 3.84 Mcps TDD implementations.

Where there is already a choice structure covering 1.28 Mcps and 3.84 Mcps options a new 7.68 Mcps TDD option can be introduced, as shown by the following example.

10.2.23 PHYSICAL CHANNEL RECONFIGURATION COMPLETE

This message is sent from the UE when a physical channel reconfiguration has been done.

RLC-SAP: AM

Logical channel: DCCH

Direction: UE → UTRAN

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		
UE information elements					
RRC transaction identifier	MP		RRC transaction identifier 10.3.3.36		
Integrity check info	CH		Integrity check info 10.3.3.16		
Uplink integrity protection activation info	OP		Integrity protection activation info 10.3.3.17		
CHOICE mode	MP				
>FDD				(no data)	
>TDD					
>>CHOICE TDD option	MP				REL-4
>>>3.84 Mcps TDD					REL-4
>>>>Uplink Timing Advance	OP		Uplink Timing Advance 10.3.6.95		
>>>7.68 Mcps TDD					REL-7
>>>>Uplink Timing Advance 7.68 Mcps TDD	OP		Uplink Timing Advance 7.68 Mcps TDD 10.3.6.95a		
>>>1.28 Mcps TDD				(no data)	REL-4
RB Information elements					
COUNT-C activation time	OP		Activation time 10.3.3.1	Used for radio bearers mapped on RLC-TM.	
Uplink counter synchronisation info	OP				
>RB with PDCP information list	OP	1 to <maxRBall RABs>			
>>RB with PDCP information	MP		RB with		

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
			PDCP information 10.3.4.22		
>START list	MP	1 to <maxCNdomains>		START [40] values for all CN domains.	
>>CN domain identity	MP		CN domain identity 10.3.1.1		
>>START	MP		START 10.3.3.38	START value to be used in this CN domain.	

Where there is no choice structure and the TDD specifice IE is optional the existing TDD option should be relabelled "1.28 Mcps TDD And 3.84 Mcps TDD" and a new optional "7.68 Mcps TDD" IE should be introduced. In some case this requires new IEs to be introduced specific for 7.68 Mcps TDD. This is illustrated by the following example.

10.3.6.44   PDSCH info

NOTE: Only for TDD.

Information Element/Group name	Need	Multi	Type and reference	Semantics description
TFCS ID	MD		Integer(1..8)	TFCS to be used. Default value is 1.
Common timeslot info	OP		Common timeslot info 10.3.6.10	
PDSCH timeslots and codes 1.28 Mcps TDD or 3.84 Mcps TDD	OP		Downlink Timeslots and Codes 10.3.6.32	Default is to use the old timeslots and codes.
PDSCH timeslots and codes 7.68 Mcps TDD	OP		Downlink Timeslots and Codes 10.3.6.32a	Default is to use the old timeslots and codes.

10.3.6.32   Downlink Timeslots and Codes

NOTE: Only for 1.28 Mcps TDD and 3.84 Mcps TDD

Information Element/Group name	Need	Multi	Type and reference	Semantics description
First Individual timeslot info	MP		Individual timeslot info 10.3.6.37	Individual timeslot info for the first timeslot used by the physical layer.
First timeslot channelisation codes	MP		Downlink channelisation codes 10.3.6.17	These codes shall be used by the physical layer in the timeslot given in First Individual timeslot info.
CHOICE more timeslots	MP			
>No more timeslots				(no data)
>Consecutive timeslots				

Information Element/Group name	Need	Multi	Type and reference	Semantics description
>>Number of additional timeslots	MP		Integer(1..maxTS-1)	The timeslots used by the physical layer shall be timeslots: N mod maxTS (N+1) mod maxTS ... (N+k) mod maxTS in that order, where N is the timeslot number in the First individual timeslot info and k the Number of additional timeslots. The additional timeslots shall use the same parameters (e.g. channelisation codes, midamble shifts etc.) as the first timeslot.
>Timeslot list				
>>Additional timeslot list	MP	1 to <maxTS-1>		The first instance of this parameter corresponds to the timeslot that shall be used second by the physical layer, the second to the timeslot that shall be used third and so on.
>>>CHOICE *parameters*	MP			
>>>>Same as last				
>>>>>Timeslot number	MP		Timeslot Number 10.3.6.84	The physical layer shall use the same parameters (e.g. channelisation codes, midamble shifts etc.) for this timeslot as for the last one.
>>>>New parameters				
>>>>>Individual timeslot info	MP		Individual timeslot info 10.3.6.37	
>>>>>Channelisation codes	MP		Downlink channelisation codes 10.3.6.17	

10.3.6.32a   Downlink Timeslots and Codes

NOTE: Only for 7.68 Mcps TDD

Information Element/Group name	Need	Multi	Type and reference	Semantics description
First Individual timeslot info	MP		Individual timeslot info 10.3.6.37	Individual timeslot info for the first timeslot used by the physical layer.
First timeslot channelisation codes 7.68 Mcps TDD	MP		Downlink channelisation codes 7.68 Mcps TDD 10.3.6.17a	These codes shall be used by the physical layer in the timeslot given in First Individual timeslot info.
CHOICE *more timeslots*	MP			
>No more timeslots				(no data)
>Consecutive timeslots				

Information Element/Group name	Need	Multi	Type and reference	Semantics description
>>Number of additional timeslots	MP		Integer(1..maxTS-1)	The timeslots used by the physical layer shall be timeslots: N mod maxTS (N+1) mod maxTS ... (N+k) mod maxTS in that order, where N is the timeslot number in the First individual timeslot info and k the Number of additional timeslots. The additional timeslots shall use the same parameters (e.g. channelisation codes, midamble shifts etc.) as the first timeslot.
>Timeslot list				
>>Additional timeslot list	MP	1 to <maxTS-1>		The first instance of this parameter corresponds to the timeslot that shall be used second by the physical layer, the second to the timeslot that shall be used third and so on.
>>>CHOICE *parameters*	MP			
>>>>Same as last				
>>>>>Timeslot number	MP		Timeslot Number 10.3.6.84	The physical layer shall use the same parameters (e.g. channelisation codes, midamble shifts etc.) for this timeslot as for the last one.
>>>>New parameters				
>>>>>Individual timeslot info	MP		Individual timeslot info 10.3.6.37	
>>>>>Channelisation codes 7.68 Mcps TDD	MP		Downlink channelisation codes 7.68 Mcps TDD 10.3.6.17a	

Annex A:
Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New