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Agenda item: Release 2000 issues / AH 21
Source: Telia
Title: New frame structure proposal for the 1.28 Mcps TDD option
Document for: Discussion & Decision

Introduction

There has been a lot of concerns expressed [1,2,3] regarding the interoperability between the existing 3.84 Mcps TDD option and the proposed 1.28 Mcps TDD option [4]. The requirements on coexistence and interworking have been clearly stated. The problem with BS to BS and UE to UE interference using unsynchronised TDD modes is well understood, and it is also clear that coexistence of TDD modes puts requirements on synchronisation. Still no work has been done by the proponents of the current 1.28 Mcps TDD option to remedy this problem, and at the last RAN meeting (number 9) it was pointed out that the TR [4] can not be considered finalised with the potential issue on the slot/frame structure.

This document outlines a new proposal for the 1.28 Mcps TDD option, living up to the requirements on coexistence and interworking with the existing 3.84 Mcps TDD. The guiding principle for defining the basic Layer 1 parameters has been to provide the best possible co-existence properties with the already existing 3.84 Mcps TDD option.

Below we first give the rationale for our choice of frame structure. Next, the basic physical parameters are given. In the last section, finally, a way forward is proposed.

Rationale for our choice of frame structure

We first note that coexistence of the two TDD options on adjacent bands in the same geographical area is an absolute requirement endorsed by 3GPP. We also note that the objective of the integration work for the 1.28 Mcps TDD option in RAN WG1, as stated in the WI -sheet [5], is to “maximise the commonality with the high chip rate TDD option”.

To live up to the requirement on coexistence, it is clear that the frame structure for the 1.28 Mcps TDD option must allows synchronisation with the existing 3.84 Mcps TDD option. Taking also the objective to maximise the commonality with the 3.84 Mcps TDD option into account, the obvious choice is to use the same frame structure as for the existing 3.84 Mcps TDD option.

On top of fulfilling the requirement on coexistence in adjacent bands in the same geographical area, this choice has a number of important benefits compared to the current proposal.

- The use of the same frame structure and switching point options will make it possible to operate the two TDD option efficiently in a wide range of operational scenarios
  - Synchronised and unsynchronised
  - In the same and in adjacent bands
  - In the same and in neighbouring geographical areas

- The commonality with the 3.84 Mcps TDD option will ease implementations and make multi mode terminals less complex and cheaper.

- The commonality with the 3.84 Mcps TDD option will also ease and speed up the standardisation work for the 1.28 Mcps TDD option.

- Less sensitive to interference in unsynchronised operation by avoiding pre-defined allocation of essential access channels to a particular time slot (the current proposal, on top of not allowing

synchronisation with the 3.84 Mcps TDD mode, is sensitive to interference in unsynchronised operation).

Synchronised operation gives a number of benefits:

- Increased capacity.
- Relaxed requirements on ACLR and ACS, resulting in more cost efficient filters.
- The level of co-ordination between operators, in terms of site location to avoid interference, is kept to a minimum.

Physical Layer

The following table outlines the major parameters. If possible the parameters are the same as for the 3.84 Mcps TDD option.

Chip rate	1.28 Mcps
Frame length	10 milliseconds (Same as for 3.84 TDD)
Number of time slots per frame	15 (Same as for 3.84 TDD)
Time slot length	10/15 milliseconds (Same as for 3.84 TDD)

Transport and physical channel definitions and mapping

It is assumed that the same physical channels and transport channels principles as for the 3.84 Mcps TDD are used, to select on what time slots the channels are allocated. The slot content is assumed to have the same structure as for the 3.84 Mcps TDD option, i.e. burst that include data part, midamble and guard period. The exact formats are to be determined.

Beamforming and related aspects

In order to support beam-forming and possibly faster power control multiple switching points could be used in order to create a 5 ms sub-frame structure. Hence, this way the flexibility for an operator increases while having better coexistence properties than the current 1.28 Mcps TDD option proposal.

Proposal

The suggested 1.28 Mcps TDD option outlined above should be included in TR [4]. The two 1.28 Mcps TDD proposals should be analysed and compared before finalising the TR [4] and the 5 working CRs. A first proposal of changes in TR [4] is presented in Annex A.

References:

[1] RAN WG1, “LS on low chip rate TDD interference/deployment scenarios,” Doc. TSGR1#12(00)0614, TSG-RAN Working Group 1 Meeting #12

[2] RAN WG4, ”LS answer on low chip rate TDD interference/deployment scenarios,” Doc. TSGR1-00-0773, TSG-RAN Working Group 1 meeting No. 13

[3] RAN WG4, Telia, NTT DoCoMo, Telenor, BT, “ Coexistence between the 3.84 Mcps TDD option and the 1.28 Mcps TDD option”, Doc. TSGR4-00-0633, TSG-RAN Working Group 4 meeting No. 1

[4] RAN WG1, 3G TR 25.928 V1.1.0 (2000-07), “1.28Mcps functionality for UTRA TDD Physical Layer”, Doc. TSGR1#14 R1-00-0960

[5] RAN, “Work Item sheets - latest situation”, *RP-000440,* Oahu, HI, USA, 20 - 22 September 2000,Meeting No. 9

Annex A

5 High level characteristics

Parameter/Feature	**Value/Expression**	**Note**	**Value/Expression New proposal**
Chip rate	1.28 Mcps		1.28 Mcps
Modulation	QPSK (8PSK)		Same as for 3.84 TDD
Spreading Factor	1/2/4/8/16		1/2/4/8/16
Nominal Channel Spacing	1.6MHz / Carrier		1.6MHz / Carrier
Burst Format	1 burst type		Same as for 3.84 TDD
Radio Frame Length	10ms (divided into 2 sub-frames)		10ms
Sub-frame length	5ms		None
Time slot number (traffic)	7		15
Time slot length (us)	675		Same as for 3.84 TDD
Downlink pilot slot (us)	75	DwPTS	None
Uplink pilot slot (us)	125	UpPTS	None
Guard Period (us)	75	GP After DwPTS	Tbd
Range of uplink slot	1 – 6		1-14 (Same as for 3.84 TDD)
Range of downlink slot	1 – 6		1-14 (Same as for 3.84 TDD)
Receiver type	Multi-user Detection (option), Rake		Same as for 3.84 TDD
Pilot aided detection	DwPTS, UpPTS, Midamble		Same as for 3.84 TDD
Synchronization aspect	Downlink and uplink synchronization		Same as for 3.84 TDD
Precision for UL sync.	1/8 chip		Same as for 3.84 TDD
Antenna processing	Smart antenna with beam forming	Option	Same as for 3.84 TDD
Switching point	Two switching points / sub-frame		Up to 14 switching points/ frame (Same as for 3.84 TDD)
Power control / rate	Open loop power control Closed loop power control / 200Hz (max rate)		Same as for 3.84 TDD
Variable bit rate service	Supported (using TFCI)		Supported
Basic resource unit	One code, one slot with Spreading factor =16 (use of same resource in both consecutive sub-frames)		Tbd
Service mapping	Multi-code, multi-slot combination (variable spreading factor)		Tbd
Interleaving period	10/20/40/80ms		Tbd
HO capability	Low chip rate TDD to High chip rate TDD, FDD, GSM, etc.		Same as for 3.84 TDD.
Tx Diversity	same capability as high chip rate TDD for DwPTS,DPCH, but not for P-CCPCH; the TxDiversity scheme used for the DPCH is used for the FPACH, as well.	Refer to sub clause 10.5 of TR	Same as for 3.84 TDD