TSG-RAN Working Group 2 (Radio layer 2 and Radio layer 3) ***TSGR2#6(99)850***
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Title: Proposal for changes in 25.302 for Timing Advance

Document for: Decision

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1. Introduction

A detailed concept for the handling of Timing Advance has been presented in [1]. Some changes to the document TS25.302, Services of the physical layer, are necessary to support timing advance. This paper presents these changes and contains a text proposal for TS25.302.

2. Summary

The following changes to TS 25.302 are proposed:

1. The possibility to perform Timing Advance in TDD mode has been added to the Uplink model of the UE.
2. The possibility to use timing advance has been added to the characteristics of the USCH and DCH transport channels.
3. The RX Timing Deviation measurement has been added as an optional parameter to the PHY-DATA-IND primitive.

3. Text Proposal

1 Scope

2 References

3 Definitions and Abbreviations

4 Interfaces to the physical layer

5 Services and functions of the physical layer

5.1 General

5.2 Overview of L1 functions

The physical layer performs the following main functions:

- FEC encoding/decoding of transport channels
- Measurements and indication to higher layers (e.g. FER, SIR, interference power, transmission power, etc...)
- Macrodiversity distribution/combining and soft handover execution
- Error detection on transport channels
- Multiplexing of transport channels and demultiplexing of coded composite transport channels
- Rate matching
- Mapping of coded composite transport channels on physical channels
- Modulation and spreading/demodulation and despreading of physical channels
- Frequency and time (chip, bit, slot, frame) synchronization
- Closed-loop power control
- Power weighting and combining of physical channels
- RF processing
- Timing advance on uplink channels

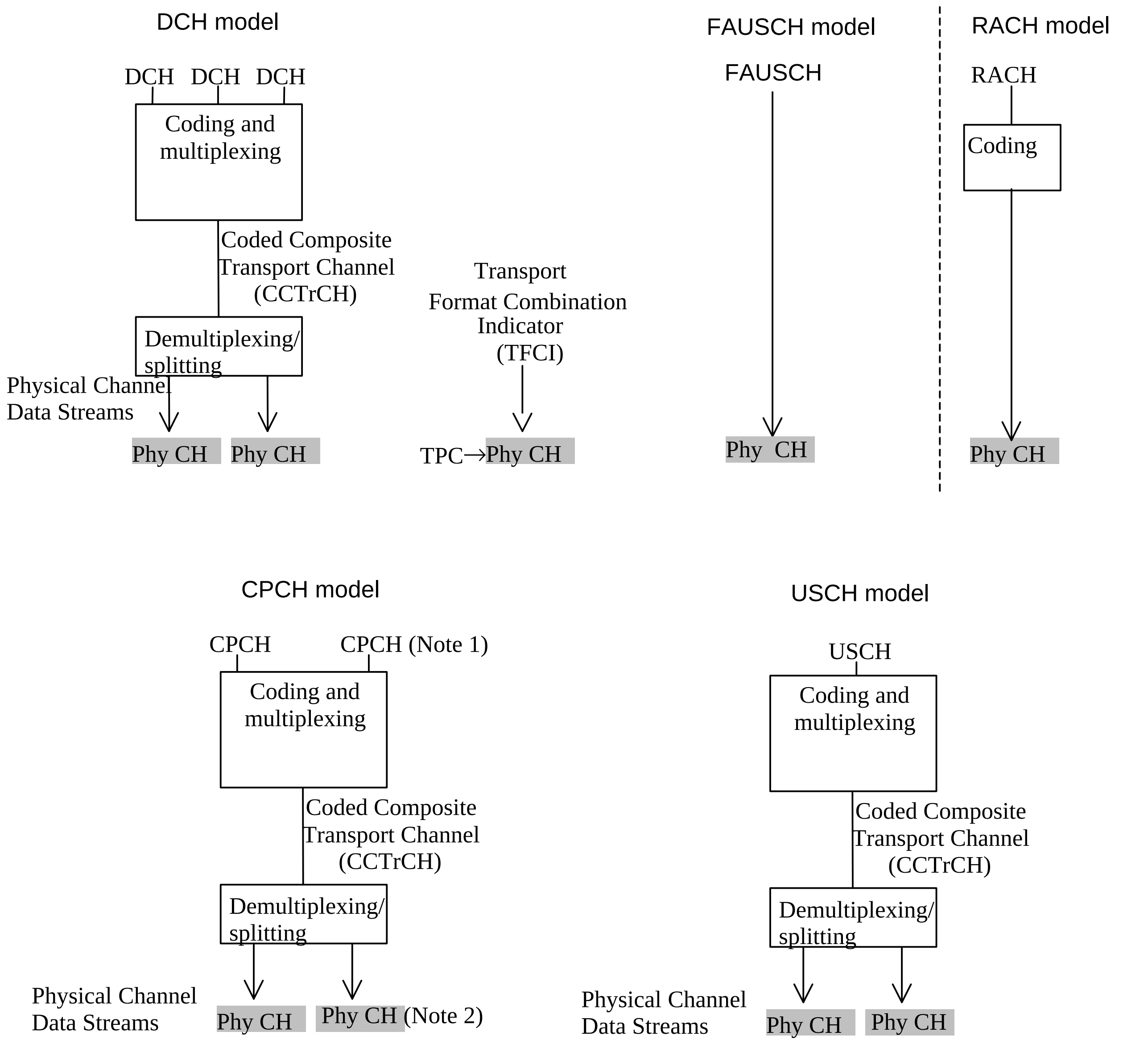
5.3 L1 interactions with L2 retransmission functionality

6 Model of physical layer of the UE

6.1 Uplink models

Figure 1Figure 1Figure 1 shows models of the UE's physical layer in the uplink for both FDD and TDD mode. It shows two models: DCH model and RACH model. Some restriction exist for the use of different types of transport channel at the same time, these restrictions are described in the chapter "UE Simultaneous Physical Channel combinations". More details can be found in [3] and [4].

Editors note: Models for uplink transport channels currently marked ffs will be necessary if these channels are included in the description.



Note 1: The need to multiplex several CPCH transport channels is FFS
Note 2: Only the data part of the CPCH can be mapped on multiple physical channels
Note 3: FAUSCH and CPCH are for FDD only.
Note 4: USCH is for TDD only.

Figure 1: Model of the UE's physical layer – uplink

The DCH model shows that one or several DCHs can be processed and multiplexed together by the same coding and multiplexing unit. The detailed functions of the coding and multiplexing unit are not defined in this document but in [3] and [4]. The single output data stream from the coding and multiplexing unit is denoted *Coded Composite Transport Channel (CCTrCH).*

The bits on a CCTrCH Data Stream can be mapped on the same Physical Channel and should have the same C/I requirement.

On the downlink, multiple CCTrCH can be used simultaneously with one UE. In the case of FDD, only one fast power control loop is necessary for these different CCtrCH, but the different CCtrCH can have different C/I requirements to provide different QoS on the mapped Transport Channels. In the case of TDD, different power control loops can be applied for different CCTrCH. One physical channel can only have bits coming from the same CCTrCH.

On the uplink and in the case of FDD, only one CCTrCH can be used simultaneously. On the uplink and in the case of TDD, multiple CCTrCH can be used simultaneously.

When multiple CCTrCH are used by one UE, one or several TFCI can be used, but each CCTrCH has only zero or one corresponding TFCI. In the case of FDD, these different words are mapped on the same DPCCH. In the case of TDD, these different TFCI can be mapped on different DPCH.

The data stream of the CCTrCH is fed to a data demultiplexing/splitting unit that demultiplexes/splits the CCTrCH's data stream onto one or several *Physical Channel Data Streams*.

Editors's note: The term "splitting" used for above function in FDD mode has been replaced by "demultiplexing/splitting". The intention of using the term splitting is to express that this function is performed on bit level not on some block level. The term demultiplexing/splitting shall cover both cases, block or bit level demultiplexing, where block lengths larger than 1 bit may be applied in the TDD mode. This needs to be confirmed by the L1 group

The current configuration of the coding and multiplexing unit is either signalled to, or optionally blindly detected by, the network for each 10 ms frame. If the configuration is signalled, it is represented by the *Transport Format Combination Indicator (TFCI)* bits. Note that the TFCI signalling only consists of pointing out the current transport format combination within the already configured transport format combination set. In the uplink there is only one TFCI representing the current transport formats on all DCHs of one CCTrCH simultaneously. In FDD mode, the physical channel data stream carrying the TFCI is mapped onto the physical channel carrying the power control bits and the pilot.

The DCH and USCH have the possibility to perform Timing Advance in TDD mode.

For the FAUSCH, there is no coding, since the FAUSCH is only used for the transmission of a reservation request by sending an up-link signalling code (USC) at the time-offset allocated for the specific UE during the 10 ms frame. Due to the fixed time-offset allotted to a specific UE, the FAUSCH is a dedicated control channel.

The model for the RACH case shows that RACH is a common type transport channel in the uplink. RACHs are always mapped one-to-one onto physical channels, i.e. there is no physical layer multiplexing of RACH. Service multiplexing is handled by the MAC layer. The CPCH which is another common type transport channel has a physical layer model as shown in the above figure.

6.2 Downlink models

6.3 Relay link Model

7 Formats and configurations for L1 data transfer

7.1 General concepts about Transport Channels

7.2 Types of Transport Channels

A general classification of transport channels is into two groups:

- common channels and
- dedicated channels (where the UEs can be unambiguously identified by the physical channel, i.e. code and frequency)

Common transport channel types are:

1. Random Access Channel(s) (RACH) characterized by:
    - existence in uplink only,
    - limited data field. The exact number of allowed bits is FFS.
    - collision risk,
    - open loop power control,

2. ODMA Random Access Channel(s) (ORACH) characterized by:
   - used in TDD mode only (FDD is for FFS)
   - existence in relay-link
   - collision risk,
   - open loop power control,
   - no timing advance control
3. Forward Access Channel(s) (FACH) characterized by:
   - existence in downlink only,
   - possibility to use beam forming,
   - possibility to use slow power control,
   - possibility to change rate fast (each 10ms),
   - lack of fast power control and
4. Broadcast Channel (BCH) characterized by:
   - existence in downlink only,
   - low fixed bit rate and
   - requirement to be broadcast in the entire coverage area of the cell.
5. Paging Channel (PCH) characterized by:
   - existence in downlink only,
   - association with a physical layer signal, the Page Indicator, to support efficient sleep mode procedures and
   - requirement to be broadcast in the entire coverage area of the cell.
6. Synchronisation channel (SCH) characterised by :
   - existence in TDD and downlink only
   - low fixed bit rate
   - requirement to be broadcast in the entire coverage area of the cell
7. Downlink Shared Channel(s) (DSCH) characterised by:
   - existence in downlink only,
   - possibility to use beamforming,
   - possibility to use slow power control,
   - possibility to use fast power control, when associated with dedicated channel(s)
   - possibility to be broadcast in the entire cell
   - always associated with another channel (DCH or DSCH Control Channel).
8. DSCH Control Channel characterised by:
   - existence in downlink only,
   - possibility to use beam forming,
   - possibility to use slow power control,
   - lack of fast power control

   Editor' s note: It is for further study whether or not the DSCH Control Channel needs to be regarded as separate transport channel type from FACH. Seen from the upper layers, the current requirements are identical to a FACH, but some extra L1 information (e.g.TPC bits) may lead to a different physical channel.
9. CPCH Channel characterised by:

- existence in FDD only,
- existence in uplink only,
- fast power control on the message part,
- possibility to use beam forming,
- possibility to change rate fast,
- collision detection,
- open loop power estimate for pre-amble power ramp-up

9. Uplink Shared channel (USCH) characterised by:
    - used in TDD only
    - existence in uplink only,
    - possibility to use beam forming,
    - possibility to use power control,
    - possibility to change rate fast
    - possibility to use timing advance

Dedicated transport channel types are:

1. Dedicated Channel (DCH) characterized by:
    - existing in uplink or downlink
    - possibility to use beam forming,
    - possibility to change rate fast (each 10ms),
    - fast power control
    - possibility to use timing advance

2. Fast Uplink Signaling Channel (FAUSCH) to allocate, in conjunction with FACH, dedicated channels; the FAUSCH is characterized by:
    - existing in uplink only,
    - inherent addressing of a UE by a unique time-offset (indicating to a UE when to send an uplink signalling code, USC) related to the beginning of the 10 ms frame,
    - allowing for a UE to notify (by sending an USC) a request for a DCH, the allocation of which is messaged via the FACH. No further information is conveyed via the FAUSCH,
    - applicability for TDD mode is FFS.

3. ODMA Dedicated Channel (ODCH) characterized by:
    - used in TDD mode only (FDD is for FFS),
    - possibility to use beam forming,
    - possibility to change rate fast (each 10ms),
    - closed loop power control,
    - closed loop timing advance control

To each transport channel (except for the FAUSCH, since it only conveys a reservation request),, there is an associated Transport Format (for transport channels with a fixed or slow changing rate) or an associated Transport Format Set (for transport channels with fast changing rate).

~~1.3~~7.3 Slotted Mode

8 UE Simultaneous Physical Channels combinations

9 Measurements provided by the physical layer

9.1 Measurements of downlink channels

9.2 Measurements on uplink channels

9.2.1 UL load

9.2.2 UE Tx Power

9.2.3 Transport CH BLER

9.2.4 Physical CH BER

9.3 Miscellaneous measurements

10 Primitives of the physical layer

10.1 10.1 Generic names of primitives between layers 1 and 2

The primitives between layer 1 and layer 2 are shown in the Table 1.

Table 1. Primitives between layer 1 and 2

Generic Name	Parameters
PHY-DATA-REQ	TFI, compressed mode type, TBS
PHY-DATA-IND	TFI, compressed mode type, TBS, CRC result, TD
PHY-STATUS-IND	Event value

~~1.1.1~~10.1.1 10.1.1 PHY-Data-REQ

The PHY-DATA primitives are used to request SDUs used for communications passed to and from the physical layer. One PHY-DATA primitive is submitted every Transmission Time Interval for each Transport Channel.

Primitive Type: request.

Parameters:

- TFI
- Type of compressed mode (e.g. uncompressed, compressed with beginning/middle/end of frame)
- Transport Block Set
- FN_{CELL}
- Page indicators (PIs) (PCH only)

10.1.2 PHY- Data-IND

The PHY-DATA primitives are used to indicate SDUs used for Layer 2 passed to and from the physical layer. One PHY-DATA primitive is submitted every Transmission Time Interval for each Transport Channel.

Primitive Type: indicate

Parameters:

- TFI
- Type of compressed mode (e.g. uncompressed, compressed with beginning/middle/end of frame)
- Transport Block Set
- CRC check result
- TD (RX Timing Deviation measurement) (optional)

10.1.3 10.1.3 PHY-Status-IND

10.2 Generic names of primitives between layers 1 and 3

10.3 Parameter definition